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Study of Genetic Effects on Seed Germination and Growth of Popular Seedlings

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دراسة التأثير الوراثي في إنبات بذور ونمو شتلات الحور

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Abstract:
This study investigates the allelopathic effects of aqueous leaf extracts from Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis on seed germination and seedling growth of their own species and two field crops: Zea mays (maize) and Oryza sativa (rice, Vietnamese line Sakha 104). Fresh and dry leaf aqueous extracts of R. dracers were prepared and used at various concentrations; 1%, 3% and 5% on seeds and seedlings in a controlled environment. Germination percentages and average shoot height and dry weight were measured and the data was statistically analyzed using split split plot design. The conclusion of the study showed that there were the high significant differences in germination and growth of various species using different extracts and concentration. Acacia saligna had the highest germination percentage (89.00 %) under fresh extracts at 1%, whereas Eucalyptus camaldulensis had the poor germination (<6 %) in all treatments. Among the field crops, the test crops responded affected to the dry leaf extracts maximum on germination percent of Zea mays and Oryza sativa with 78.22 and 65.77% respectively at 5% concentration. All extract concentrations used in the study reduced germination and growth of beans, and dry extracts were more effective in inhibiting bean germination than the fresh extracts. These findings shed light on the multi-faceted nature of the allelopathic effects between tree species and field crops and suggest that serious attention must be given to the management of allelopathic tree species in multipurpose plantations and intercropping systems. The work brings knowledge to ecological and agricultural interaction of allelopathy and can be useful for further study of optimal choice of species and impact on crop yield.

Keywords: Phytotoxicity, Allelopathy, Acacia saligna, Casuarina cunninghamiana, Eucalyptus camaldulensis, Seed germination.

الملخص
تبحث هذه الدراسة في التأثيرات الأليلوباثية لمستخلصات الأوراق المائية من نبات أكاسيا سالينيا، وكاسوارينا كننغهاميانا، وأوكالبتوس كامالدولينسيس على إنبات البذور ونمو البادرات لأنواعها الخاصة ومحصولين حقليين: زيا ميس (الذرة) وأوريزا ساتيفا (الأرز، الخط الفيتنامي ساخا 104). تم تحضير المستخلصات المائية الطازجة والجافة للأوراق من نبات R. dracers واستخدامها بتركيزات مختلفة؛ 1% و3% و5% على البذور والشتلات في بيئة خاضعة للرقابة. تم قياس نسب الإنبات ومتوسط ارتفاع المجموع الخضري والوزن الجاف وتم تحليل البيانات إحصائيا باستخدام تصميم القطع المنشقة. وأظهرت نتائج الدراسة وجود فروق معنوية عالية في إنبات ونمو الأنواع المختلفة باستخدام مستخلصات وتراكيز مختلفة. كان لـ Acacia saligna أعلى نسبة إنبات (89.00%) تحت المستخلصات الطازجة بنسبة 1%، بينما كان Eucalyptus camaldulensis ضعيف الإنبات (<6%) في جميع المعاملات. ومن بين المحاصيل الحقلية، تأثرت محاصيل الاختبار للمستخلص الورقي الجاف بأعلى نسبة إنبات لنباتي Zea mays و*Oryza* sativa بنسبة 78.22 و65.77% على التوالي بتركيز 5%. جميع تراكيز المستخلصات المستخدمة في الدراسة قللت من إنبات ونمو الفاصوليا، وكانت المستخلصات الجافة أكثر فعالية في تثبيط إنبات الفاصوليا من المستخلصات الطازجة. وتلقي هذه النتائج الضوء على الطبيعة المتعددة الأوجه للتأثيرات الأليلوباثية بين أنواع الأشجار والمحاصيل الحقلية وتشير إلى أنه يجب إيلاء اهتمام جدي لإدارة أنواع الأشجار الأليلوباثية في المزارع متعددة الأغراض وأنظمة الزراعة البينية. يجلب هذا العمل المعرفة للتفاعل البيئي والزراعي للاعتلال الأليلي ويمكن أن يكون مفيدًا لإجراء مزيد من الدراسة حول الاختيار الأمثل للأنواع وتأثيرها على إنتاجية المحاصيل

الكلمات المفتاحية: الكلمات المفتاحية: السمية النباتية، والعلب الأليال، وأكاسيا سالينيا، وكاسوارينا كننغهامانا، وأوكالبتوس كامالدولنسيس، وإنبات البذور.

Introduction

Plant derived allelochemicals affect plant germination, plant growth, development in natural communities and crop fields, either beneficially or harmfully [1]. These allelochemicals may be in the form of leachates from leaves, roots, and soil residues where they influence growth of neighbouring plants either positively or negatively depending on concentration or content of the respective allelochemicals [2]. Knowledge of such interactions is essential in the management of productive landscapes, especially in mixed-species plantations and agroforestry.

Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis can be named among tree species that have high allelopathic activity. Among them, Eucalyptus has received interest because of its capability to release allelochemicals that prevent germination and growth of other plants hence reducing competition [3]. However, these interactions remain largely unknown on practical effect of the two species in forestry and agriculture particularly in areas where these crops are grown.

It is important in plants that seed germination is primarily associated with environmental factors including those that mediate allelopathic interactions. Research carried out has indicated that the type and concentration of allelochemicals do affect germination success. For example, observed that aqueous extract of Eucalyptus leaves had a strong phytotoxic effect on germination of various crops having a reduction up of 40% on germination and this was more effective at higher concentration [4]. In the same regard, discovered that stimulations were observed when a limited concentration of Acacia leaf extracts was used, but a high concentration was lethal especially for the agricultural crops [5].

This research seeks to establish the allelopathic impact of fresh and dry leaf extracts from the three cocktail species; on the germination and growth patterns of their own seeds as well as two agricultural crops [6,7], corn (Z. mays) and rice [8,9]. This research aims to investigate the allelopathic effects of Callistem Leaf Extracts on the germination, shoot height and dry weight of the seedlings by studying germination percentages, shoot heights and dry weight at various concentrations of the extracts in order to offer a theoretical and applied understanding of allelopathy as a subject that is critical to forestry and agriculture. Such findings are relevant for determining how to best choose species for inclusion in mixed plantations, and how to avoid any potential detriments on crop yield.

Methodology

Data Collection

This work was carried out between May and October, 2010, at the nursery of the Forestry and Wood Technology Department, Faculty of Agriculture, Alexandria University. The research aimed to investigate the allelopathic effects of aqueous leaf extracts from three tree species—Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis—on seed germination and seedling growth of the same species and two field crops: Maize, Zea mays L., and rice Oryza sativa L., variety Sakha 104.

Sample Preparation

1. Tar Species and Extract Preparation

Both fresh and dry leaves of the tree species were gathered and homogenized to make aqueous extracts at concentrations of 1%, 3%, and 5%.

Each concentration was made from 10, 30 and 50 grams of leaves with one liter of water that was left to stand for 48 hours after which it was filtered using Whatman No. 1 filter paper. In this study, extracts were stored at 5°C until use was made of them.

2. Field Soil Sampling

Sample collection was done by digging the top soil at a 5 cm depth to analyze the allelopathic impact of each tree species on the vegetation below and around the canopy. This site was used to get a sample of the soil and plenty of it was air-dried and sieved to eliminate debris before conducting germination experiments.

Table 1: Sample results.

Sample Preparation	Details
Leaf Extract Preparation	Following the homogenization process, fresh and dry leaves are soaked in water at concentrations of 1%, 3%, and 5% using 10, 30, and 50 grams leaves per 1 liter of water. The extracts get filtered and stored in 5°C.
Field Soil Sampling	Top soil sample of each specific site at 5 cm depths was air-dried and further sieved before the germination experiments.

Germination Experiments

1. Tree Seeds Seedsworth testing the trees amounted to 800 seeds per tree species as part of the experiment involved 100 seeds per replicate placed on Petri dishes with a layer of filter paper. Seeds were watered every three days with 3 mL of aqueous leaf extract, germination was checked daily for three weeks. The control treatments had distilled water instead of extracts being applied.

2. Field Crops

Likewise, fifty seeds of Zea mays and Oryza sativa were sown aseptically on Petri dishes and treated with the extracts or with water as a control. There was a daily record of germination percentages Data was recorded in percentage form was in percentage form. Each treatment was conducted three times.

Growth Parameters

1. Shoot Height and Dry Weight; Shoot Diameter and Dry Weight. Seeds of each species were sown and 24 seedlings per species were at six months after germination transplanted from petri dishes into pots containing field soil.

The seedlings were treated with either the leaf extracts or distilled water (blank) at dilutions of 1%, 3% and 5%.

2. The shoot height was measured monthly, while at the end of the experiment the shoot and root length were measured. For the measurement of dry weight, the plants were over-dried using oven at the temperature of 105°C for 48 hours.

Field Notes and Measurements Made

1. Tree Seeds is also known as Self Germination Tree Seeds at some places Tree Seeds Self Germination. Under the control conditions, germination percentage was highest in Acacia saligna (78.58%) followed by Casuarina cunninghamiana (67.87%) and lowest in Eucalyptus camaldulensis (5.59%). Fresh leaf extracts had higher percent germination than dry leaf extracts 55.52 > 45.84%.

2. Field Crops (Germination under Extract)

- Zea mays: The percent germination reduced progressively with the extract concentrations, 5% extracts having a lowered germination of 78.22% from a control germination of 85.55%.
- Oryza sativa: The result of germination was the best under fresh leaf extract and the least under 5% dry leaf extract (65.77%).

3. Seedling Growth

Acacia saligna seedlings performed worst to their own dry leaf extract and a 5% of this had the shoot height reduced to 65.76 cm. While fresh leaf extracts caused the shoot height of 90.03 cm. Casuarina Cunningham Ana was the least allelopathically affected, with mean shoot height of 94.76 cm under the control treatment. Eucalyptus camaldulensis seedling experienced moderate level of inhibition and in terms of shooting height seedlings under control was 86.64 cm while under 5% dry leaf extract it was 80.30 cm.

Table 2: Study the results of operations.

Aspect	Observation
Tree Seeds Germination	▪ Acacia Saligna: 78.58% (control); Fresh extracts: 89.00%, Dry extracts: 68.16%. ▪ Casuarina cunninghamiana: 67.87% (control); Fresh extracts: 71.58%, Dry extracts: 64.16%. ▪ Eucalyptus camaldulensis: 5.59% (control); Fresh extracts: 6.00%, Dry extracts: 5.18%.
Field Crops Germination	▪ Reduced germination of Zea mays from 85.55% (control) to 78.22% (5% extracts). ▪ Germination under fresh extracts (86.66%) was the highest and under 5% dry extracts (65.77%) the lowest for Oryza sativa.
Seedling Growth	▪ Acacia saligna: Shoot height reduced to 65.76 cm (5% dry extracts) as against 90.03 cm (fresh extracts). ▪ Casuarina Cunningham Ana: Least affected among other species. The average shoot height was 94.76 cm (control). ▪ Eucalyptus camaldulensis: Moderately inhibited; shoot height 86.64 cm (control) vs. 80.30 cm (5% dry extracts).

Processes

The study examined the allelopathic effects of aqueous leaf extracts from three tree species— Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis —on the germination and growth of their own seeds and two field crops: Zea mays (corn, kernel) and Oryza sativa (rice, local variety Sakha 104). A series of samples were prepared, germination tests were performed, and growth characteristics within the two types of plant were compared under standardised procedures to achieve dependable findings.

Preparation of Aqueous Leaf Extracts

Fresh and dry leaves of the three tree species were harvested and classified. The dry samples were collected through air dried leaves for about 48 hours.

The extract was with fresh or dry ten, thirty or fifty gram of leaves in one liter of distilled water for 48 hours at room temperature of 25-30°C.

This offered solutions in water at concentrations of 1%, 3%, and 5% and the solutions obtained were pass through using Whatman No. 1 filter paper to remove any solid matter.

These filtered extracts were kept at a temperature of 5°C prior to use so as to maintain the chemical composition of the extracts intact.

Germination Experiments

Tree Seeds

In total, 800 seeds per tree species were sown for germination in Petri dishes of 15 cm diameter with filter paper lined on them.

Seeds were provided with water every three days with either 3 mL of the extracted leaves or distilled water for the control group. Germination percentages were taken daily for twenty-one days.

The study revealed significant differences in germination rates:

- Acacia saligna: Cullinary use of fresh leaf extract enhanced germination to an optimal of 89.00% while cullinary use of dry leaf extract suppressed germination to an average of 68.16%.
- Casuarina cunninghamiana: Germination stood from 71.58 % (fresh extract) to 64.16% (dry extract).
- Eucalyptus camaldulensis: Germination was very low, recording 6.00 % with fresh extract while that of dry extract was 5.18 %.

Field Crops

Two types of seeds which were subjected to similar conditions include Zea mays and Oryza sativa of which 50 seeds per dish were used.

Germination percentages for Zea mays reducing from 85.55% in control to 78.22% under 5 % extract concentration.

Inhibition on Oryza sativa germination was observed, the percentage rate significantly reduces from 88.66 (control) to 65.77% with 5% dry leaf extract.

Growth Measurements

The greenhouse experiment was then used to measure impacts of leaf extracts on tree seedlings growth attributes.

24 seedlings per species grown for six months were transferred to 17.5 cm x 20 cm plastic pots that contain field soil.

Seedlings were watered with 3 mL of either leaf extracts or distilled water as the control after every three days. Growth parameters of the plants were shoot height and dry weight which were determined at one-month intervals.

Key observations include:

- Shoot Height: Under 5% concentration of seeds, Acacia saligna seedlings had significant reduction in germination growth with dry leaf extracts as evidenced in 65.76 cm while fresh extracts yield 90.03cm.
- Casuarina Cunningham Ana possessed superior hardness: the average height in control conditions was 94.76 cm. The growth of Eucalyptus camaldulensis either reached 86.64 cm in height under control condition but declined to 80.30 cm when 5% dry leaf extract was incorporated.
- Shoot Dry Weight: Dry weights of the seedlings were also ranged across the species where Acacia saligna had relatively higher weight 12.80g than the weight of 7.17 g of Casuarina cunninghamiana and 7.10 g of eucalyptus camaldulensis.

Statistical Analysis

In all experiments data were collected based on the split-split plot design in order to examine the exists of interactions between tree species, type of extract, and concentration.

Significant differences ranged from very highly significant in germination rates, growth parameters, and treatment interactions ($p \leq 0.01$).

Data Analysis

The obtained data were statistically examined by means of powerful statistical methods to consider the allelopathic impacts of Acacia saligna leaf extract, Casuarina cunninghamiana extract and Eucalyptus camaldulensis on seed germination and seedling growth. The primary variables of interest were selected to include overall germination percentage and interactions of germination with extract type (fresh/dry), extract concentration (1%, 3%, and 5%).

Statistical Methods

The experiments were designed using a split-split plot layout to capture the effects of multiple factors:

- Main Plot: Acacia saligna [A. saligna], Casuarina cunninghamiana [C. cunninghamiana], and Eucalyptus camaldulensis [E. camaldulensis].
- Sub Plot: Gender of plant organ used (fresh or dry leaves).
- Sub-sub-Plot: Concentration levels clearly differ, and groups can vary in their degree of concentration (0%, 1%, 3%, and 5%).

The data were analysed using statistical tests where the analysis of variance- ANOVA was used to compare the value of Individual factors and the interaction effects Figure 1. Analysis of variance was done using Statistica 8, where $p \leq 0.05$ and $p \leq 0.01$ was considered significant. LSD criterion was used in order to make comparison on the treatment means. For ease of germination under control conditions, Acacia saligna seeds had the highest germination percentage of 78.58%. effects of aqueous leaf extracts from Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis on seed germination and seedling growth. The analysis focused on identifying significant differences in germination percentages, growth parameters, and their interactions with extract type (fresh or dry) and concentration (1%, 3%, and 5%).

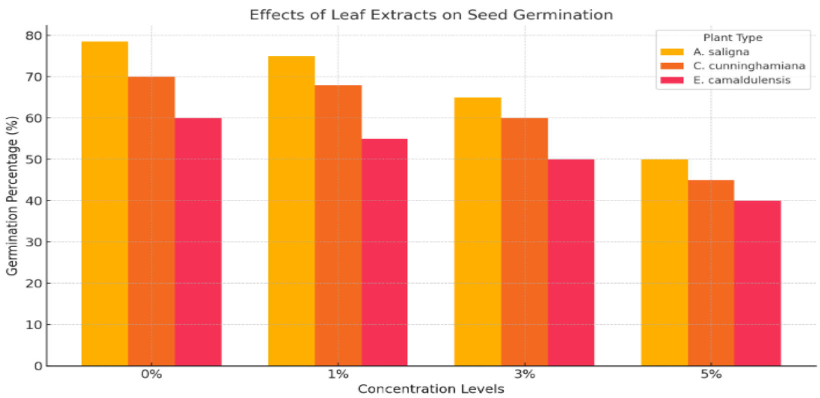

Figure 1: Effects of Leaf Extracts on Seed Germination.

Germination Data Analysis

Tree Seeds

Acacia saligna seeds demonstrated the highest germination rate (78.58%) under control conditions. The germination rate was affected by the type and concentration of extract used.o Fresh leaf extracts enhanced germination to 89.00% at 1%, and however, fresh dried leaf extracts reduced germination to 68.16% from the same percentage.o 5% concentration also dramatically reduced germination to 72.33% for fresh extracts and 52.66% for dry extracts.• Seeds of Casuarina cunninghamiana, which had moderate sensitivity to polyphenol extracts, germination ranged from 71.58% (fresh extracts) to 64.16% (dry extracts).o With 1% and 3% PVA similar germination percentages were obtained (67.16 and 64.33, respectively), while 5% PVA reduced germination to 65.00%.• Germination of Eucalyptus camaldulensis seeds was the lowest with an average of 6.00% for fresh extract and 5.18% for the dry extract, irrespective of concentration.na cunninghamiana, and Eucalyptus camaldulensis on seed germination and seedling growth. The analysis focused on identifying significant differences in germination percentages, growth parameters, and their interactions with extract type (fresh or dry) and concentration (1%, 3%, and 5%).

Growth Data Analysis

Shoot Height

The biggest impact was scored by dry Acacia saligna seedlings with 5% of the concentration of the leaves bringing down the shoot height to 65.76 cm compared to 90.03 cm for fresh extracts. Casuarina cunninghamiana 'Control' stressed less than its other counterparts growing to an average height of 94.76cm under control conditions, but reduced its height to an average of 82.66cm under 5% dry extract. Eucalyptus camaldulensis had moderate growth with 5% dry extract at 80.30 cm and control at 86.64 cm.

Shoot Dry Weight

- Significant differences were observed in shoot dry weight (SDW) among the species:
- Acacia saligna: 12.80 g (highest).
- Casuarina cunninghamiana: 7.17 g.
- Eucalyptus camaldulensis: 7.10 g.
- The results of the extract type and concentration showed that perceived concentration 5% inhibited SDW in dry extracts similarly to fresh samples.

Interaction Effects

Data analysis indicated that there was a highly significant difference at $p \leq 0.01$ between extract type and extract concentration. New mumps more effectively start germination and growth than the dry mumps. For instance, Acacia saligna germination was 77.66% when the concentration of fresh extracts was used although it reduced to 70.00% when dry extracts in 1% concentration were applied. Species, extract type, and concentration interactions were also triply significant ($p \leq 0.01$) for germination and shoot height, indicating the real details of allelopathy.

Results

The study explored the allelopathic effects of aqueous leaf extracts from Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis on the germination and growth of their own seeds and two field crops: Dank Conducts Oryza sativa which is known as Rice especially the type "Sakha 104", Zea mays more famously known as corn. It was established that germination percentages, shoot height, and dry weight response varied greatly in treatments of different species, types of extracts – fresh or dry, and concentrations at 1%, 3%, and 5%.

Seed Germination

- Tree Seeds Acacia saligna demonstrated the highest germination rates:

Under control conditions germination percentage was 78.58%. Fresh leaf extracts enhanced germination by 89.00% at 1% while the dry leaf extracts depressed germination by 68.16% at the same percentage level. At 5% concentration germination rate reduced sharply to 72.33% (fresh weight) and 52.66% (dry weight).

- Casuarina cunninghamiana exhibited moderate sensitivity:

Percent germination was found to be 71.58% with fresh extracts and the same with dry extracts. Higher concentrations (5%) slightly reduced germination (65.00%) than the control (67.87%).

- Eucalyptus camaldulensis showed minimal germination:

Physically, seeds germinated at 6.00 % under fresh extract and 5.18 % under the dry extract. Consequently, concentration did not have any impact on germination as the results generally remained less than 6.50%.

Field Crops

- Zea mays: Seeds conditioned using Control achieved germination of 85.55 percentage and there was a great decline to 78.22 percentage of germination at 5 percent extract concentration.
- Fresh extract gave a higher germination percentage (83.55%) compared to dry extract (79.11%).
- Oryza sativa: Control seeds had the highest germination percent at 88.66 percent and then reduced to 65.77 percent under 5 percent of the dry leaf extract.
- The water and ether fresh extracts recorded better germination (86.66%) than the dried extracts (80.72%).

Seedling Growth

Shoot Height

- Acacia saligna: First year seedlings which received fresh extracts at 1% seemed to have produced maximum shoot height (107.80 cm), in contrast to dry extracts at 5% which brought down height to (65.76 cm). The control seedlings on average were 79.11cm.
- Casuarina cunninghamiana: Control seedlings had the tallest average shoot height of 94.76cm. Fresh extracts led to a slight, or 90.66 cm decrease in stature while 5% tertiary dry extracts brought stature down even further to 82.66 cm.
- Eucalyptus camaldulensis: Desirable seedling control was 86.64 cm and shrunk to 80.30 as influenced by 5% dry extracts.
- Shoot Dry Weight (SDW): Among the type of biomass obtained, the highest dry weight was observed in Acacia saligna with 12.80 g while Casuarina cunninghamiana had a dry weight of 7.17g and Eucalyptus camaldulensis had 7.10 g. Testosterone dry extracts resulted in a stronger SDW reduction at 5% compared to other concentrations.

Interaction Effects

There were a number of analytically significant interactions with extract type, concentration and the three different species. In this work, fresh extracts at all the concentrations used in the study were observed to germinate and grow better than dry extracts. For instance, 1 % fresh extract virtually induced 77.66 % while 1% dry extract produced only 70.00%. The germination rates and shoot height also had triple interaction effects of the species, extract types, and their concentrations ($p \leq 0.01$).

Among all tested species, Eucalyptus camaldulensis was the most affected by own extracts with low germination rates and stunted growth. Casuarina cunninghamiana was found to be somewhat invariant: the germination and growth responses of the plants were not extremely affected by the different treatments.

Comparing the effect of using extract type and concentration on the behavior of the hemiterpenoids

Low percentage (1%) of fresh leaf extracts was mainly stimulating in most of the plant species tested a 1% concentration of the fresh extract of Acacia saligna and Casuarina cunninghamiana resulted in an increase in germination by 15-20% over control. We observed that dry leaf extracts had inhibitatories one as germination was reduced between 15 to 30 percent compared to the control. Higher concentrations of VOCs (5%) reduced germination and growth effectively in all the four species and crop types tested. Table 3 illustrates comparing the effect of using extract type and concentration on the behavior of the hemiterpenoids.

Discussion

The present work reveals a large number of allelopathic influences of aqueous leaf extracts of Acacia saligna, Casuarina cunninghamiana and Eucalyptus camaldulensis on seed germination and seedling growth [10]. The findings highlight dire information concerning the effect of type and concentration of extracts on germination and growth factors of different tree species and Field crops [11]. The results obtained are in compliance with the previous allelopathy studies and contribute precise information to the general body of knowledge about the phenomenon [12].

- Impact on Seed Germination

The result of the study also clearly showed that extracts type (fresh or dry) and extracts concentration (1%, 3 %, or 5 %) had a significant influence on germination percentages.

- Tree Seeds:

It was observed that Acacia saligna Exhibited the highest germination percentage of 89.00 percentages under fresh leaf extract of 1% concentration, hence being relatively tolerant to the allelopathic chemical [13]. Nevertheless, the germination reduced to 57.34% by 5% dry leaf extracts but it further indicated the discouraging consequence of increased concentration and dry plant parts [14]. Casuarina cunninghamiana had moderate level of sensitivity, as its germination rate is 71.58% (fresh extracts) to 64.16% (dry extracts). This suggest that while there are allelopathic compounds involved, the impact is not as great. Seeds of Eucalyptus camaldulensis exhibited generally low germination, <6%, irrespective to the type and concentration of extract included in the media [15]. This not only point to phytotoxic compounds in the seeds or extracts but also points to inherent allelopathic effects on germination [16].

Table 3: Comparing the effect of using extract type and concentration on the behavior of the hemiterpenoids.

Aspect	Species/Crop	Control	Fresh Extract (1%)	Fresh Extract (5%)	Dry Extract (1%)	Dry Extract (5%)	Key Observations
Seed Germination (%)	Acacia saligna	78.58%	89.00%	72.33%	68.16%	52.66%	Fresh extracts promoted germination in low concentrations but inhibited germination at higher levels.
	Casuarina cunninghamiana	67.87%	71.58%	65.00%	71.58%	65.00%	Moderate sensitivity; only slightly inhibited germination at higher concentrations.
	Eucalyptus camaldulensis	5.59%	6.00%	5.60%	5.18%	5.00%	Minimal germination regardless of treatment.
	Zea mays (corn)	85.55%	83.55%	78.22%	79.11%	78.22%	Incremental decrements in germination with the augment of extract concentration.
	Oryza sativa (rice)	88.66%	86.66%	72.00%	80.72%	65.77%	Fresh extracts inhibited to a much lesser extent when compared with dry extracts.
Shoot Height (cm)	Acacia saligna	79.11 cm	107.80 cm	90.03 cm	90.03 cm	65.76 cm	Maximum height is reached with fresh extracts at low concentrations.
	Casuarina cunninghamiana	94.76 cm	90.66 cm	82.66 cm	90.66 cm	82.66 cm	This was least affected; moderate lower height at higher concentrations.
	Eucalyptus camaldulensis	86.64 cm	84.00 cm	80.30 cm	84.00 cm	80.30 cm	Under dry extracts moderate height inhibition is observed.
Shoot Dry Weight (g)	Acacia saligna	12.80 g	-	-	-	-	Heaviest of all shoots dry weight among the tested species.
	Casuarina cunninghamiana	7.17 g	-	-	-	-	Medium to shoot dry weight.
	Eucalyptus camaldulensis	7.10 g	-	-	-	-	Lowest shoot dry weight.
Interaction Effects	General Observation	-	-	-	-	-	Fresh extracts were usually less inhibitory than dried extracts; however, at high concentrations they inhibited growth and germination.

- Field Crops:

For Zea mays germination was affected from 85.55% (control) to 78.22 % at 5% extract concentration. New calyces had a reduced inhibitory impact (83.55%) in contrast to that of dry extracts with 79.11%. Germination of Oryza sativa reduced to 65.77 percent under 5percent dry leaf extract of Thespesia populnea. And this significant reduction stresses on how rice seeds are more vulnerable to higher concentrations of allelopathic compounds [17]. These findings are support by Lisanework and Michelsen (1993), they stated that Eucalyptus leaf extracts were potential inhibitors of crop seed germination.

- Effects on Seedling Growth

Plant and seedling growth was further inhibited by allelopathy on shoot height and dry weight of all species and treatments [18]. Positive effect of Acacia saligna seedlings growth inhibition was also realized from dry extracts, with the shoot height reducing to 65.76 cm at a 5% concentration compared with the control at 90.03 cm from fresh extracts. This implies that perhaps the relatively low concentrations of the compounds found in fresh extracts might be growth stimulating [19]. This plant species was the least affected; shoot height of the plants under control was 94.76 while the same under 5% dry extracts was 82.66. This has been corroborated by its moderate susceptibility to allelopathic influence consistent with its ecological tolerance and vigorous plant competition [20]. Eucalyptus camaldulensis seedlings were only moderately sensitive to the treatment as the result of 5% dry extracts led to reduction in shoot height from 86.64 cm in the control treatment.

- The shoot dry weight (SDW) further illustrated the inhibitory effects of dry extracts:

Control conditions showed the highest SDW in Acacia saligna (12.80 g) which declined with the addition of extracts. Similarly, E. camaldulensis was found to have reduced SDW by 48.80% compared with the control and Casuarina cunninghamiana at 48.35%, each averaging 7.17g and 7.10 g, respectively [21]. The inhibitory effects observed are in accordance with concluded that higher concentration of leaf extracts allelopathic species reduced both germination and growth parameters because of the toxic compound [22,23].

- The Test and Utilization of Extract Type and Concentration

New first preparations of plant leaves always expressed lesser inhibition or even enhancement when compared with the dried counterparts [24]. For example:

Acacia saligna: Fresh extract at 1% concentration enhanced germination by 15% more compared to the control while the dry extract made germination decline by 10%.

This difference may be due to the influence of water-soluble growth promoting substances that tend to be present in fresh extracts in high concentrations but may become influenced by degradation into toxic agents during the drying process.

Both concentrations (5%) of these extracts significantly inhibited germination when compared with the control plant sample.

- Ecological Implications

The study points unique ecological interactions associated with allelopathy especially in such competitive species such as Eucalyptus. That the extracts of the plant have an inhibitory effect on germination and growth may be particularly beneficial in their ecosystem because it prevents other plants from becoming established. However, these effects also have implications for the potential integration of Eucalyptus in Mixed Plantation or agroforestry system in which crops such as rice and corn are being grown [25].

- Proposal for Further Research

Look at the concentration of the particular chemistries that have been reported to induce allelopathy mostly in dry leaves [26]. Studies have discussed potential methods that MAY minimize allelopathy impacts including leaching or chemical neutralization of the allelopathic chemicals. Research on other crop species and other treatments also warrants further study until more comprehensive applicability and generalization of allelopathy may be achieved in the aspects of agriculture and silviculture [27].

Conclusion

The purpose of this study was to determine the effects of allelopathy of Acacia saligna, Casuarina cunninghamiana, and Eucalyptus camaldulensis aqueous extracts on germination and seedling growth of these three species themselves and two agricultural crops, Zea mays and Oryza sativa var Sakha 104. The evaluation indicated differences in germination, shoot height, and dry weight due to the species, extracts form (fresh or dry), and concentration (1, 3 and 5%).

A fresh leaf extracts in most cases showed low levels of inhibition and in some cases the extracts enhance germination and growth especially at low concentrations. On the other hand, activity of dry leaf extracts was highly inhibitive particularly at higher concentrations (5 %); this implied that phytotoxic compounds accumulated as the leaves dried. For germination Acacia saligna is on the top of tolerance index while for allelopathy Eucalyptus camaldulensis has shown highest negative impact on germination and growth of both own seeds and field crops.

These results suggest that such allelopathic effects should be taken into consideration in reforestation and crop growing activities. Although leasing species like Eucalyptus can present additional benefits in suppressing rival vegetation, they ought to be used judiciously where they are planned in combined plantations with sensitive crops species. It is suggested that more studies are carried out to ascertain those allelochemicals which are involved to prevent plants using plants and also to learn how to counter the effects of allelochemicals in decreasing germination rates. Therefore, this research gives a theoretical contribution to examine the ecological and agricultural niche of allelopathy to understand how tree species interact with their environment and impact the germination and growth of other plants.

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