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Potential of California Variety Papaya Leaf Extract (*Carica papaya* L. California variety) As Bioherbicide of Snake Grass Weed (*Cyperus rotundus* L.)

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Abstract

Efforts to increase production yields are by controlling weeds. Weeds that often grow and we encounter in cultivated plants are weed grass (*C. rotundus*). California papaya leaves have the potential to be a bioherbicide because they contain allelochemicals that can inhibit weed growth. This study aims to determine the effect of papaya leaves (*C. papaya*) on the growth of teki grass (*C. rotundus*) and determinetheconcentration level of papaya leaf allelopathy that most effectively inhibits the growth of teki grass.The method used was a completely randomized design (CRD) with five replications and four treatmentsof0%, 30%, 50%, and 70%. For data analysis in this study using the SPSS version 25.0 program. Papaya leaf extract (*C. papaya*) is able to inhibit the growth of weed grass (*C. rotundus*). The concentration of papaya leaf extract (*C. papaya*) that most effectively inhibits the growth of weed is 50% concentration with a mortality rate (64%), for the lowest plant heightis50% concentration which is 13.84 cm, for the slowestgrowthrate is 50% concentrationwith a growthrate of -0.16 cm.

Keywords: Papaya Leaf, Bioherbicide, Tackle Weed.

INTRODUCTION

Weeds are a type of plant that can reduce the productivity of cultivated plants on agricultural land, weeds are also parasitic on other plants in taking nutrients, space, water, CO2 and light (Lestari et al., 2012). Directly or indirectly, weeds have a very bad effect on cultivated plants because weeds will become hosts for diseases (Dinarto & Astriani, 2012). The presence of weeds on agricultural land causes plants not to grow optimally and reduces agricultural production, this happens because of competition (fighting) for nutrients and water caused by these weeds. The size (degree) of weed competition with the main plant will affect the main plant's good or bad growth and, in turn, will affect the main plant's high or low yield (Harsono, 1993).

Weeds are divided into 3 groups: narrow-leaf weeds (grass), broad-leaf weeds, and sedge weeds. One of the sedge weeds is sedge weeds (*Cyperus rotundus*). C. rotundus is a weed whose presence is detrimental to other plants, *C. rotundus* is a type of weed that we often find in various agricultural cultivation areas, especially in rice fields and is dominant in rice plants. *C. rotundus* L. causes a significant decrease in production because it has parasitic properties like other weed groups. (Kristanto, 2006). Control that farmers often carry out tends to use synthetic herbicides to suppress weed populations on agricultural land, if this is done continuously it will have a bad impact which results in environmental pollution. The alternative that needs to be done is to find weed control techniques, from chemical materials to switching to environmentally friendly pesticides because they come from living organisms, often referred to as bioherbicides. Papaya plants (*Carica papaya* L.) belong to the Caricaceae family and are found in various regions in the country. Papaya leaves have an oval leaf blade outline, with finger-like veins, leaf edges with shared canes, pointed tips, heart-shaped leaf bases with irregularly curved leaf lobes, leaf blades with a diameter of about 25-75 cm, and dark green leaves, while the veins are lighter or light green (Kartasapoetra, 1996).

This study aims to determine whether the extract of papaya leaves of the California variety (*Carica papaya*) can inhibit the growth of nutsedge weeds (*Cyperus rotundus*) and to determine how much extract of papaya leaves of the California variety (*Carica papaya*) is most effective in inhibiting the growth of nutsedge weeds (*Cyperus rotundus*).

RESEARCH METHOD

This research was conducted from August to September 2022 in the research garden and integrated laboratory of the Faculty of Pharmaceutical and Health Sciences, Mathla'ul Anwar University, Banten.

The tools that will be used in this study are test tubes, analytical scales, 4000 ml glass bottles, 70 ml Vail bottles, filter paper, blender, polybags, knives, planting tubs, droppers, rotary evaporators, spatulas, macerators, 20 mesh sieves, rulers, digital scales, knives, label paper, 100 g plastic.

The materials used in this study include experimental garden soil, nutsedge (*C. rotundus* L.), California variety papaya leaves (*C. papaya* L.), distilled water and 96% ethanol.

Preparation of Planting Media

The planting media used in this study is soil. The soil is separated into two places: the planting tub and the other in a 20 cm x 20 cm polybag. The land used is the land around the Experimental Garden of Kp. Babakan Kawung, Ds. Katumbiri, Kec. Cigeulis, Kab. Pandeglang.

Seeding Preparation

The prepared soil is then put into the planting tub and used as a medium for sowing nutsedge. 90 nutsedge are to be sown. The seeding tub is watered with 200 ml of water every day, precisely in the afternoon, until it is 15 days old.

Making Papaya Leaf Extract

First of all, prepare papaya leaves (*C. papaya* L.) which will be used as a bioherbicide extract, papaya leaves (C. papaya L.) are obtained from a garden near the Labuan PLTU. After that, 9000 grams of fresh leaves are taken, then washed using clean water and rinsed with sterile distilled water, after that they are dried at room temperature until the distilled water on the surface of the leaves is dry. After that, the papaya leaves are dried in the sun until they become dry simplicia. The dried leaves are then ground using a blender, sieved using a mesh sieve no. 20, and stored in a clean, tightly closed container.

Dry leaf powder (*C. papaya* L.) was weighed as much as 500 grams and then put into a maceration container. After that, 96% ethanol solvent was added as much as 2 L, then closed and stored for 24 hours in a place protected from direct sunlight while stirring every 12 hours. Furthermore, it was filtered and separated between dregs and filtrate. The dregs were re-extracted with new ethanol with a total of 1.5 litres in the 2nd and 3rd remaceration. This was done for 3 x 24 hours. The ethanol filtrate was then collected, and the filtered liquid was evaporated with a rotary evaporator until a thick ethanol extract of Papaya leaf extract (*C. papaya* L.) was obtained.

Growth Test

The nutsedge planted for 15 days was then transferred from the planting tub into 20 polybags measuring 5 kg (diameter 20 cm, soil height 20 cm). The transfer was carried out in the afternoon. Each polybag contains 3 nutsedge plants. After that, papaya leaf extract bioherbicide was sprayed with various concentrations on the second day after being transferred from the planting tub or on the 16th. The papaya leaf extract (*C. papaya* L.) was sprayed every 2 days at 08.00 WIB until the 24th day after planting. Spraying using a dropper pipette of 10 drops on each plant.

Data Collection

Data collection was carried out while the plants were still being treated. The data in this study were the number of nutsedge weeds that died in each treatment for 24 days. The data collection was carried out every 2 days until 5 observation data were obtained. Observation activities were conducted in the morning at 07:00 WIB before watering and spraying papaya leaf extract bioherbicide.

Research Parameters

The growth parameters measured by the changes observed in this study were plant height, wet weight, dry weight, growth rate and phytotoxicity (poisoning) in nutsedge. Measurements were carried out on a scale of the nutsedge population in each polybag.

Plant Height

The height of the nutsedge is measured using a ruler from the base of the stem to the tip of the highest leaf. Measurements are taken every two days after the plant is transferred from the nursery to the polybag.

Growth Rate

The growth rate is obtained from the final height of the nutsedge (*Cyperus rotundus*) on the 26th day minus the height of the nutsedge (*Cyperus rotundus*) on the 15th day so that the growth rate is obtained for 11 days.

Phytotoxicity

Phytotoxicity in nutsedge is observed using the Truelove scoring system, namely:

- 0 = no poisoning occurs (with a poisoning level of 0-5%, the shape and colour of the leaves are abnormal)
- 1 = mild poisoning (with a poisoning level of 6-10%, abnormal leaf shape and colour)
- 2 = moderate poisoning (with a poisoning level of 11-20%, abnormal leaf shape and colour)
- 3 = severe poisoning (with a poisoning level of 21-50%, abnormal leaf shape and colour)
- 4 = very severe poisoning (with a poisoning level

>50%, abnormal leaf shape and colour, so that the leaves dry up and fall off until they die) (Lasmini and Wahid, 2008)

Wet Weight
The wet weight of the treated sedge is weighed using an analytical scale. Plant weight measurements are carried out on the 24th day after planting.

Dry Weight
The dry weight of the treated sedge is first oven-dried and then weighed using an analytical scale. Dry weight measurements are carried out on the 24th day after planting.

RESULTS AND DISCUSSION

Based on the results of the experiments that have been carried out, the potential of California papaya leaf extract (*C. papaya* L.) as a bioherbicide against sedge weeds (*C. rotundus*) in a study in polybags using 4 treatments, namely control (aquades) and using California papaya leaf extract with concentrations of 30%, 50% and 70%. Each treatment with 5 repetitions using 3 plants in each repetition studied every 2 days for 11 days gave very different results at all concentrations of California papaya leaf extract (*C. papaya* L.) that can inhibit the growth of sedge weeds (*C. rotundus* L.).

The administration of papaya leaf extract (*C. papaya* L.) to sedge weeds (*Cyperus rotundus*) affected their height. The results of watering between the control and various concentrations showed differences. In terms of the height of sedge grass, various results were obtained, where the height showed the effectiveness of papaya leaf extract on the height of sedge grass.

The effect of the reaction of botanical herbicides is also seen in the phytotoxicity that occurs in nutsedge (*C. rotundus* L.). This level of phytotoxicity shows how effective the concentration of ketapang leaf extract is on the population of nutsedge. The nutsedge (*C. rotundus* L.) cells are dead and dry, so they cannot produce cell division. All physiological functions in plants have been damaged and lysed, and this causes nutsedge (*C. rotundus* L.) to wilt, dry and die.

The administration of papaya leaf extract (*C. papaya* L.) to nutsedge (*C. rotundus* L) affects nutsedge's phytotoxicity. The watering results between the control with extract concentrations of 30%, 50% and 50% showed significantly different results. After observation for 11 days, the most effective extract concentration in inhibiting the growth of nutsedge was a concentration of 50% with a mortality rate of 64%. This is believed because saponins and tannins can work more optimally when given an extract concentration of 50%. Polar solvents are often used for the extraction of a simple drug. Polar solvents such as ethanol used in the test can attract secondary metabolite compounds such as alkaloids, saponins, phenolic components, carotenoids, and tannins (Hidayati, 2012).

Table 1. Average height of nutsedge (*Cyperus rotundus* L.).

Concentration	Day 3	Day 5	Day 7	Day 9	Day 11
0%	14.40[a]	14.74[a]	15.06[a]	15.46[a]	15.94[a]
30%	14.16[ab]	14.46[a]	14.62[a]	14.56[b]	14.54[b]
50%	14.04[b]	14.00[b]	13.90[b]	13.94[b]	13.84[b]
70%	13.98[b]	13.86[b]	13.86[b]	13.90[b]	13.92[b]

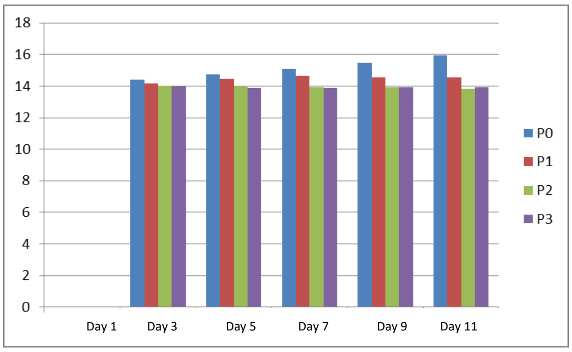

Figure 1. Graph of the average height of the nutmeg population after being treated with Ketapang leaf extract (Terminalia Catappa) at various concentrations.

Table 2. Growth Rate of Nutmeg Weed (*C. rotundus* L.).

Concentration	Wet Weight
0%	1.94[a]
30%	0.54[b]
50%	-0.16[b]
70%	-0.08[b]

Description: The letters in the same column indicate no significant difference based on the one-way anova test at a 95% confidence level.

Table 3. Phytotoxicity of nutsedge (*C. rotundus* L.).

Concentration	Day 3	Day 5	Day 7	Day 9	Day 11
0%	0.00[a]	0.00[a]	0.00[a]	0.00[a]	0.00[a]
30%	0.60[ab]	1.00[b]	1.60[b]	2.00[b]	2.20[b]
50%	0.80[ab]	1.40[b]	1.80[b]	2.20[b]	3.20[b]
70%	1.20[b]	1.80[b]	2.00[b]	2.40[b]	3.00[b]

Description: The same letters in the same column indicate no significant difference based on a way anova test at a 95% confidence level.

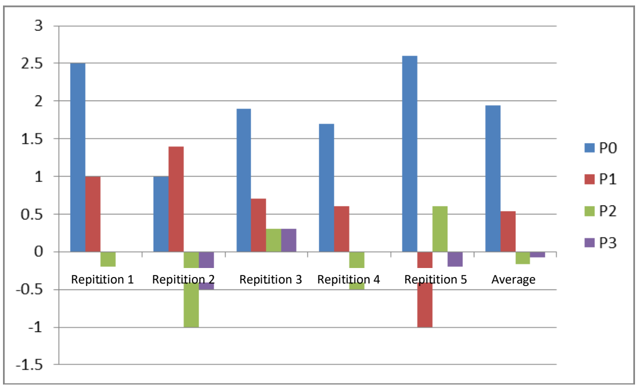

Figure 2. Graph of the Phytotoxicity of nutsedge.

One of the secondary metabolite compounds suspected of being bioherbicides is tannin, which is included in the phenolic compound group. Previous studies have shown that tannin can inhibit growth, eliminate respiration control in mitochondria and disrupt the transport of Ca+2 and PO4 3- ions. In addition, tannin compounds can also deactivate amylase, proteinase, lipase, and urease enzymes, inhibiting gibberellin hormone activity (Marisa in Senjaya 2012). In addition to tannin, secondary metabolite compounds suspected as bioherbicides are flavonoids. Flavonoids also play a role in the growth inhibition process, acting as a strong inhibitor of IAA-oxidase (Khotib, 2002). The wet weight of the nutmeg population obtained quite significant results. There is a very visible difference starting from the administration of 70% extract to 0%. Each stage of the administration of papaya leaf extract concentration (*C. papaya* L.) effectively inhibited the growth of nutmeg weeds (*Cyperus rotundus*). In the grouping in the table below, it is known that there are differences in the wet weight of each concentration. Giving 70% papaya leaf extract of ketapang leaves (*C. papaya* L.) effectively results in the growth of the wet weight of nutsedge weeds (*C. rotundus* L.).

Table 4. Wet Weight of Nutmeg Weed (*C. rotundus* L.).

Concentration	Wet Weight
0%	0.50^{a}
30%	0.80^{b}
50%	0.61^{c}
70%	0.55^{c}

Note: the same letter in the column indicates no significant difference based on the one-way Anova test at a 95% confidence level.

Table 5. Dry Weight of Nutmeg Weed (*C. rotundus* L.).

Concentration	Wet Weight
0%	0.50^{a}
30%	0.39^{b}
50%	0.32^{bc}
70%	0.29^{c}

Note: the same letter in the column indicates no significant difference based on the one-way Anova test at a 95% confidence level.

The dry weight reflects the pattern of plants accumulating products from photosynthesis and is integrated with other environmental factors. In dry weight, it is obtained after being ovened for 1 hour at a temperature of 100 c. By being ovened, all the water in the nutsedge will be lost, thus showing only the weight of the remaining organs. From the results of the table and grouping, the same results were obtained, this shows that there is no difference in the dry weight of nutsedge weeds (*C. rotundus* L.) as a control or those treated with various concentrations of ketapang leaf extract (Terminalia catappa) by ANOVA calculations. However, in descriptive analysis, dry weight has an effect, this can be seen that the dry weight value and the wet weight value are directly proportional. According to (Sumarsono, 2012), the absence of a significant difference in dry weight results indicates that the photosynthesis process in nutsedge weeds (*C. rotundus* L.) both in the control and those treated with papaya leaf extract (*C. papaya* L.) at various concentrations can still run.

By looking at the observations that occur in the results of plant height, phytotoxicity, wet weight and dry weight of the nutsedge plant (*C. rotundus* L.), it can be said that nutsedge (*C. rotundus* L.) experiences physiological process disorders (Adinugroho, 2008). According to (Doflamingo, 2013), the disruption of this physiological process, the plant responds in several forms of symptoms, including the Main Symptoms, where abnormal growth is seen, can exceed normal size or be smaller than normal size. Colour changes, both in leaves, stems, roots, fruits, and flowers, and there is also tissue death; parts of the plant become dry and are marked by wilting of parts of the plant body. Wilting events are caused by water absorption not keeping up with the plant's water evaporation rate. If this transpiration process is large enough and water absorption cannot keep up with it, the plant will experience transient wilting. At the same time, the plant will experience permanent wilting if the water condition in the soil has reached the permanent wilting percentage. Plants in this condition are difficult to cure because most of their cells have undergone plasmolysis.

CONCLUSION

Papaya leaf extract of the California variety (*C. papaya* L.) can inhibit the growth of nutsedge weeds (*C. rotundus* L.). The concentration of papaya leaf extract (*C. papaya* L.) that showed the most effective inhibition of nutsedge growth was a concentration of 50% with a mortality rate of 64%.

Competing Interests: The authors claim that there are no conflicts of interests.

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