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Original Paper

Growth and production of cat's whiskers plant biomass (*Orthosiphon aristatus* Bl. Miq.) In various accessions and harvest intervals

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***Abstract*— Cat's whiskers plant is an ornamental plant used as a medicinal plant. The part of the cat's whiskers plant used is leaves. Accessions and harvest intervals are essential for increasing optimal yields to plant biomass growth and results. This study aims to determine the effect of differences in accession, intervals, and interactions between accession differences and intervals on the growth and production of a cat's whiskers biomass. The design used in this study is a complete group design of being randomized with two treatment factors. The first factor has two treatment levels: white flowering accessions (A1) and purple flowering accessions (A2). The second factor is a harvest interval with four treatment levels, namely a 1-week harvest interval (P1), two weeks (P2), three weeks (P3), and six weeks (P4). The results showed that accession treatment significantly affected the number of books, number of branches, flowering ages, leaf fresh weight, leaf dry weight, and leaf simplicia yields. Harvest interval treatment significantly affects the height of the shoots, number of shoots, number of branches, number of leaves, flowering ages, leaf fresh weight, stem fresh weight, flower fresh weight, leaf dry weight, stem dry weight, flower dry weight, and leaf simplicia yield. Accession interactions with harvest intervals significantly affect the height of the shoots, number of shoots, number of branches, number of leaves, flower fresh weight, stem dry weight, and leaf simplicia yields.**

Keywords - Simplisia leaf, bioactive, medicine

I. INTRODUCTION

Cat's whiskers (*Orthosiphon aristatus* Bl. Miq.) is a plant from Family Lamiaceae which is efficacious as a medicinal plant and can grow wildly in the yard. Cat's whiskers are widely used as traditional medicine because they have various benefits. Cat's whiskers can treat kidney infections, bladder infections, stone urine, gout, and urine decay (diuretics) and eliminate heat and moisture [1]. In addition, the leaves of the cat's whiskers are also helpful for treating kidney inflammation, diabetes, albuminuria, syphilis, rheumatic disease, and reduced blood glucose levels.

Cat's whiskers are commonly used as medicinal ingredients in the form of leaves, both fresh (fresh) and dry (simplicia). Simplisia Cat's whiskers leaf has been widely used in the Indonesian Traditional Medicine Industry (Jamu) and has been an export commodity since World War II [2]. The use of simplicia cat's whiskers in large and medium industries besides the herbal medicine industry in Indonesia in 2005 is quite extensive, with as many as 20 tons. This demand shows that the potential demand for cat's whiskerss in Indonesia's herbal and industrial industry is still huge [3].

It is necessary to increase the results of the production of simplicia and its bioactive content. The growing environment affects the vegetative and generative growth of plants [4], such as plant biomass, flowering length [5], and plant bioactive content [4]. The type of plant also influences biomass production. Cat's whiskers, widely cultivated in Indonesia, is a white flowering cat's whiskers, purple flowering, and white flowering or intermediates [6]. To produce superior varieties of cat's whiskerss with high biomass required genetic material selection material with a wide variety. The results of the germplasm selection at the Research Center for Spice and Medicine Plant (Balittro) obtained two accession numbers, namely the type of purple flowering (Aksiansi A) and White Flowers (Accession B) which are relatively stable production in the lowlands and medium plants at an altitude of 240-550 m above sea level [6]. White flowering cat's whiskers have many leaves and branches, fresh and dry weight, stems, and the highest roots. Purpose White Flowering Cat's whiskers has the most extensive leaf area index [7].

In addition to the accession type, the correct cultivation technique can produce high simplicia production. Simplicia production is related to the condition of growth and harvest regulation [8]. Harvesting can be done by picking 4-10 leaves from above every 2-3 weeks to 1-2 months, depending on the state [9]. The problem encountered in the production of medicinal plants is determining harvest time and the appropriate type of plants to get the optimal amount of plant parts and bioactive compounds. Harvest time is one of the factors that can affect the quality of the harvest [10]. Suitable intervals and harvest time must be determined in order to facilitate cultivation. Harvesting intervals affect the production of fresh and dry leaves, as in cat's whiskers plants [10].

At the same time, this study aimed to determine the effect of differences in accession, intervals, and interactions between the differences in accession and intervals on the growth and production of the cat's whiskers biomass. Research needs to be carried out to find the accounts of accessions that are different from the harvest intervals of the growth of the production of the biomass and the production of the cat's whiskers.

II. Materials and Methods

A. Description of Study Area

The study was conducted at UG Technopark, Cianjur, West Java, at an altitude of 330-887 meters above sea level. The time of the research was carried out from June to August 2023. The study temperature occurred in the average range of 32.39 ° C.

B. Experimental Materials

Almighty, what is used in this research is a set of automatic drips of irrigation tools, oven, cuttings, digital scales, harvesting baskets, crop plastic, and stationery. If it is used, the cuttings of the cat's whiskers stem are white flower accession, purple flowering accessions, rootone-F, soil, cow manure, pearls of NPK fertilizer 16:16:16, polybag.

C. Experimental Design

The one used in this research was that two treatment factors randomized the complete group design. The first factor has two treatment levels: white flowering accessions (A1) and purple flowering accessions (A2). The second factor is a harvest interval with four treatment levels, namely a one-week harvest interval (P1), two weeks (P2), three weeks (P3), and six weeks (P4).

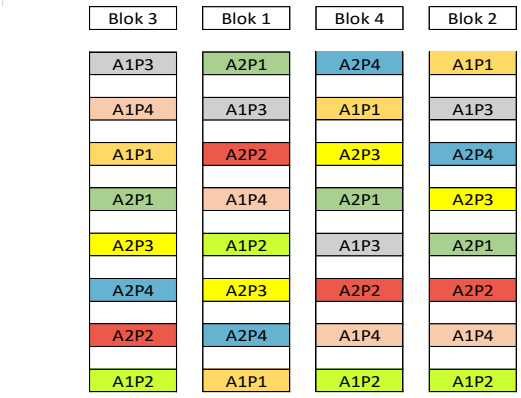

Fig. 1. Research plan in the field

Cat's whiskers plant seeds used in this study are white and purple flowering accessions. Seedlings come from stem cuttings. The seeds are used as a cat's whiskers stem cuttings, with two books (10-15 cm) and 10 DAP in the nursery. The planting media used in this research will be a mixture of red soil (laterite soil) and cow manure. The land was obtained from the UG Technopark region, Cianjur Regency, West Java—organic material by providing 15 tons of cow manure/ha. The medium of the soil manure is 1 4. The media mixture is at the same time as a polybag with a measure of 35 x 35 cm. Harvesting Cat's Whisker Plants The first period is done when the plant is 4 WAP. Harvesting is carried out by treating harvest intervals divided into four intervals for 10 WAP. Harvest intervals conducted are 1, 2, 3, and 6 weeks. The harvest is done with criteria referring to Nurhajijah [24]. The leaves are harvested by picking 3-5 strands and biomass measurements.

Growth parameters include the percentage of growing, height of the shoots, number of shoots, number of branches, number of leaves, number of books, and flowering ages. Parameters of biomass production include total fresh leaf weight each harvest interval, total dry weight of each harvest, total af dry weight of each harvest, fresh weight, dry weight, flower fresh weight, flower dry weight, and leaf simplicia yield.

D. Data Collection and Analysis

The data normality test and homogeneity were obtained in the Minitab Software Program 14 and then analyzed in SAS 9.4 progress using the Analysis of Variance (ANOVA). If f>f-table is also the test with the test with the DMRT test (Duncan's Multiple Range Test)

III. Result And Discussion

A. The Growth of Cat's whiskers

TABLE I. Shoot Height, Number Of Shoot, Number of Nodes

Treatment	Shoot Height	Number of shoot	Number of nodes
Accesions			
White (A1)	8.83a	70.25a	4.47b
Purple (A2)	9.49a	69.31a	5.20a
Harvest Interval			
P1 (1 week)	7.06c	76.75a	5.08a
P2 (2 weeks)	7.96c	70.12b	5.25a
P3 (3 weeks)	9.79b	69.12b	4.45a
P4 (6 weeks)	11.83a	63.12c	4.58a
Interaction (A*P)	*	*	ns

Note : * = significant, ns = not significant

Accessions affect the number of nodes**.** Purple flowering accessions have an average long-cutting growth that indicates many nodes**.** The number of books is likelier to have several buds that live more [11]. More shoots require more assimilation results for the growth of the shoots. This condition shows that the more nodes on purple flowering accessions, the higher the rod length produced, and the more the resulting shoots will increase.

Harvest intervals affect the height of the shoots, the number of shoots, and the number of books. Harvest intervals every six weeks have the highest average value at the height of the shoots because at harvest intervals every six weeks that have not received harvest treatment, the shoots will grow longer and longer [12]. Plants with the most extended harvest interval of 6 weeks also grow tall every week. Harvest intervals once a week have the highest average on the number of shoots because harvest intervals are increasingly frequent, which will increase the number of shoots. This condition is caused by auxin at the leaf point, which is picked to spread to other parts and form

shoots that will grow into branches [13]. The harvest interval every two weeks has the highest average on the number of books. This condition is because it shows that the more often the harvest intensity is, the more books will increase. The increase in the number of books, the higher the cat's whiskers plants, the more books there will be. This continuous high increase explains that the growth pattern of a cat's whiskers is an indeterminate growth pattern in which plants still experience an increase in plant height in the generative phase. Interaction in the accession of purple flowering with harvest intervals every six weeks produces high growth of shoots. Interaction on white flowering accessions with harvest intervals once a week produces the higher growth of the number of shoots.

TABLE II. NUMBER OF BRANCHES AND NUMBER OF LEAVES

Treatment	Number of branches	Number of leaves
Accesions		
White (A1)	90.10a	638.4a
Purple (A2)	79.16b	624.4a
Harvest Interval		
P1 (1 week)	96.68a	524.0c
P2 (2 weeks)	90.12b	610.7b
P3 (3 weeks)	89.12b	672.0ab
P4 (6 weeks)	62.62c	719.0a
Interaction (A*P)	*	*

Note : * = significant, ns = not significant

Accessions affect the number of branches. White flowering accessions have more branches and more leaves. This condition was allegedly due to effective N absorption and photosynthate flow, which is more directed at shoots. Element N is necessary for preparing amino and essential acids for cell division and enlargement [14].

Harvest intervals affect the number of branches and number of leaves. Harvest interval once a week has the highest average value in the number of branches. This condition shows the influence of harvest intervals on branch growth because the shoots often harvest it. The number of branches is one component of growth closely related to the production of terna or leaves [15]. The growth of mini branches will be more encouraged if the branches at the top are trimmed or harvested [16]. Harvest intervals every six weeks have the highest average number of leaves. That is because the number of leaves indicates that the plant's accession has an effective N absorption and photosynthate flow, which is more directed at shoots [17]. The ability to absorb nutrients is influenced by good plant growth, so the greater the number of nutrients to be absorbed by plants, the more the number of leaves is significantly affected [18]. Interaction on white flowering accessions with harvest intervals once a week to the growth of the number of branches. Interaction on white flowering accessions with harvest intervals every six weeks to the growth of the number of leaves.

TABLE III. FLOWERING AGES

Treatment	Flowering ages
Accesions	
White (A1)	22.88b
Purple (A2)	50.21a
Harvest Interval	
P1 (1 week)	-
P2 (2 weeks)	21.58a
P3 (3 weeks)	46.18a
P4 (6 weeks)	41.86a
Interaction (A*P)	ns

Note : * = significant, ns = not significant

Accessions affect the age of flowering. White flowering accessions bloom faster than purple flowering accessions. Differences in the development phase allegedly cause the difference in flower blooming time. The buds that are formed earlier will bloom first [19]. The discouragement of flowering in every genotype is a genetic factor [20]. The planting environment influences gene activity that controls flowering time to harvest [21].

Harvest intervals affect the age of flowering. Harvest intervals of 3 weeks have the highest average value at flowering age. However, at the harvest interval, once a week, no flower blooms. That is because, at the time of the treatment of harvest intervals, flower publishing is carried out so that the flowers will not form in the next harvest. Flowers composting is done because what is used is the leaves. The flower that grows should be completed to maximize the growth of leaves in the next harvest. There is no interaction between accession and harvest intervals of flowering age.

TABLE IV. LEAF FRESH WEIGHT, STEM FRESH WEIGHT AND FLOWER FRESH WEIGHT

Treatment	Leaf fresh weight	Stem fresh weight	Flower fresh weight
Accesions			
White (A1)	11.9a	60.4a	1.28a
Purple (A2)	8.08b	54.6a	1.63a
Harvest Interval			
P1 (1 week)	6.23c	44.7b	-
P2 (2 weeks)	9.63b	50.2b	0.83b
P3 (3 weeks)	10.03b	71.8a	1.10b
P4 (6 weeks)	13.6a	63.2a	2.42a
Interaction (A*P)	ns	ns	*

Note : * = significant, ns = not significant

Accessions affect the fresh weight of the leaf. White flowering accessions have more fresh leaves due to the ability of plant organs in each accession to have different abilities in absorbing assimilate produced from the process of photosynthesis and also absorption of water and nutrients in the soil.

Harvest intervals affect the fresh weight of the leaves, fresh weights, and fresh weight flowers. Harvest intervals every six weeks have the highest leaf fresh weight. That is because the harvest interval every six weeks has a long stem because the harvesting intensity is carried out at 10 MST, which shows that the longer the stem, the more leaves are produced [22]. Although pruning triggers the growth of lateral shoots, lateral bud growth requires time, so the harvest intervals of 1, 2, and 3 weeks show that the more often the plants are cut, the less the fresh weight of the leaves is obtained. Harvest intervals of three weeks have the highest fresh weight. This condition indicates harvest intervals that allocate assimilations longer on the stem than more frequent harvest intervals. The water content in the old harvest interval is higher than at a short harvest interval. Stem water content in harvest intervals every three weeks shows a difference between harvest intervals 1, 2, and 6 weeks, where harvest intervals of three weeks produce stems with higher water content. Harvest intervals every three weeks produce a lot of new shoots so that the tissue of crops that are harvested is still young. The longer the harvest ages, the older the plants will be, the more complicated the plant stems will become, and the heavier the weight will be [23]. The harvest interval every six weeks gives the highest flower fresh weight. The intervals 1, 2, and 3 weeks of flower powder are carried out at harvest intervals. After all, plants focus on vegetative growth. The more often the intensity of harvesting, the less flowers formed. The source that is disturbed when flowering causes flowers that will become flowers to decrease [24]. Interaction on purple flowering accessions with harvest intervals every six weeks against flower fresh weight.

TABLE V. LEAF DRY WEIGHT, STEM DRY WEIGHT, AND FLOWER DRY WEIGHT

Treatment	Leaf dry weight	Stem dry weight	Flower dry weight
Accesions			
White (A1)	1.64a	8.73a	1.31a
Purple (A2)	0.93b	8.35a	1.06b
Harvest Interval			
P1 (1 week)	0.90c	5.89b	-
P2 (2 weeks)	1.51a	8.32a	0.83b
P3 (3 weeks)	1.53a	9.60a	0.93b
P4 (6 weeks)	1.21b	10.35a	1.85a
Interaction (A*P)	ns	*	ns

Note : * = significant, ns = not significant

Accession affects the dry leaf weight. White flowering accessions have more dry weights due to the ability of plants or organs in each accession to absorb assimilates produced from photosynthesis. Plant biomass reflects the results of clean photosynthesis (net photosynthesis) associated with the availability of nutrients that plants can absorb [25]. Dry weight gain indicates plant growth because dry weight reflects the accumulation of organic compounds synthesized by plants from inorganic compounds, namely water and CO_2 [26]. Accessions affect the dry weight of flowers. White flowering accessions have the highest dry weight. The white flowering accessions bloom faster than the purple flowering accessions. Differences in the development phase allegedly cause the difference in flower blooming time. The buds that are formed earlier will bloom first [19].

Harvest intervals affect the leaves' dry weight, the stem's dry weight, and the flower's dry weight. Harvest interval every three weeks has the highest dry weight of the leaf. Differences in dry weight of leaves are allegedly due to differences in the number of leaves. The number of leaves will be directly proportional to the increase in leaf dry weight. Leaves are the main organs that produce photosynthesis. The more leaves there are, the more photosynthesis will be produced on the leaves, so the dry weight of the leaves will increase [27]. The highest dry weight of the leaf at the harvest interval every three weeks is caused by the high growth of leaves provided by the active lateral shoots and high N absorption by young leaves. Harvest intervals every six weeks have the highest dry weight. The difference in stem length and diameter usually supports the dry weight of the stem obtained. This condition was in line with the results of high-rod dry weighting research supported by the length of the stem and large stem diameter [28]. Harvest intervals of 6 weeks have the highest dry weight. That is because the dense flower mass is such that the ability to photosynthesize is greater than the others. The number of leaves also influences it. Plant production is usually influenced by vegetative growth. The production will be good if the vegetative growth regarding the number of leaves [29]. Interaction on white flowering accessions with harvest intervals every six weeks against the dry weight of the stem.

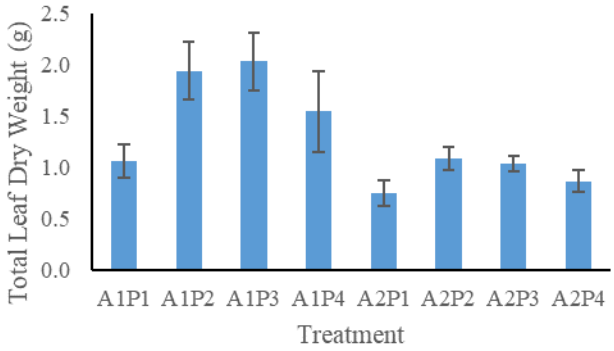

Fig. 2. Total leaf dry weight of cat's whiskers at various accessions and harvest intervals

Accessions affect the yield of leaf simplicia. White flowering accessions indicate the highest average value of 18.33% compared to purple flowering accessions of 13.22%. Harvest intervals do not significantly affect the yield of leaf simplicia. The yield can indicate the quality of the harvest obtained by comparing the dry weight produced from fresh leaves, which are the same but treated differently. The simplicia yield obtained averaged in the range of 15-16% with the lowest average yield value of harvest intervals once a week. Interaction on white flowering accessions with harvest intervals every two weeks of the leaf simplicia yield.

TABLE VI. LEAF SIMPLICIA YIELDS

Treatment	Leaf simplicia yields (%)
Accesions	
White (A1)	18.33a
Purple (A2)	13.22b
Harvest Interval	
P1 (1 week)	15.12a
P2 (2 weeks)	16.35a
P3 (3 weeks)	16.06a
P4 (6 weeks)	15.56a
Interaction (A*P)	*

Note : * = significant, ns = not significant

IV. CONCLUSION

Differences in accession significantly affect the number of books, branches, flowering ages, leaf fresh weight, leaf dry weight, and leaf simplicia yields. White flowering accessions have advantages in the number of branches, flowering ages, leaf fresh weight, leaf dry weight, and leaf simplicia yields. Purple flowering accessions have a higher number of books. Harvest intervals have a significant effect on shoot height, number of shoots, number of branches, number of leaves, flowering ages, leaf fresh weight, fresh weight, flower fresh weight, the dried weight of leaves, dry weight of stems, flower dry weight, and leaf simplicia yield. Accession interactions with harvest intervals are significantly different in high-tempered parameters, number of shoots, number of branches, number of leaves, flower fresh weight, dried weight of stems, and leaf simplicia yields.

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