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GROWTH AND FLAVONOID CONTENT OF *Gynura procumbens* (Lour) Merr. IN DIFFERENT SOIL WATER CONTENT

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Abstract. *Gynura procumbens contains tannins, saponins, steroids, triterpenoids, essential oils and flavonoids which have bioactivity as a medicine for various diseases. One effort to obtain the quality of medicinal plants uses management of soil water content. The optimum of soil water content will support optimal growth of a plant. Whereas in conditions of low soil water content resulted in the induction of the production of secondary metabolites as a self-defense system. This study aimed to determine the effect of soil moisture content on the growth and total content of plant flavonoids G. procumbens. This study was carried out experimentally using a one-factor complete randomized design (CRD) consisting of 4 treatments with five replications. The treatment used is the difference in soil water content of 40%, 60%, 80% and 100% field capacity. The data obtained in the form of quantitative data will be analyzed by One Way ANOVA Test. Measurement of the content of total flavonoid compounds was carried out using UV-Vis spectrophotometer analysis. The results of the study indicate the influence of soil moisture level on the growth and total content of G. procumbens. Parameter growth of fresh weight, dry weight, and root G. procumbens showed an increase in 40% soil water content. The flavonoid content showed the highest total flavonoid content 18.884 mg/g in the 40% field capacity soil water content.*

Keywords: *flavonoid, G. procumbens, soil water content*

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INTRODUCTION

Gynura procumbens (Lour) Merr. has various benefits, one of which is as a medicine. (Yam et al., 2008). Recently, herbal medicine using medicinal plants is starting to gain popularity as an alternative medicine because the price is cheaper than modern medicine and also has a potent efficacy (Chan et al., 2009).

G. procumbens (Lour) Merr. is a family of Asteraceae which is widely used by the community in Indonesia as traditional medicine, and they are mainly grown in Southeast Asian regions, such as Indonesia, Malaysia, and Thailand (Dash, 2016).

G. procumbens (Lour) Merr. commonly used as traditional medicine for inflammation, herpes, rash, rheumatism, kidney impairment, diabetes, cancer and hypertension (Dash, 2016). During *G. procumbens* (Lour) Merr cultivation. Water availability play a fundamental role in plant growth and development. The ideal water content for plant growth is in the optimum range of available soil water, ranging between 50% to 70% of available water. This differs based on the condition of field capacity (Drenovsky et al., 2004).

Water stress can occur due to a lack or an excess of water in the plant environment. Drought in plants occurs when there is a lack of water availability in the root area while at the same time there is excessive water demand by leaves due to the transpiration process (Rebey et al., 2012). The excessive water will harm plants and cause oxygen content low as soil pores to fill with water (Anggarwulan & Mudyantini, 2005). Soil water content affects plant growth in *Gynura divaricata*. The optimal plant height, number of leaves, leaf area, as well as optimal growth was found in the plant in 60% KL water content; optimal plant biomass found at 80% KL water content; the optimal number of flower as well as the optimal water transport found at 40% KL water content (Susanti & Setiari, 2009).

The effect of 60% water content within field capacity in *Sonchus arvensis* can increase the flavonoid content, 2.11% higher than the control (Chang et al., 2002). The water availability of 40-60% in *Talinum paniculatum* can increase tuber saponin levels up to 11.01% (Anggarwulan & Mudyantini, 2005). The effect of 20% drought stress on the leaves could increase the saponin content of leaves 8.42570 mg/g. While optimal biomass production showed in soil water content 40% -80% of field capacity.

The purpose of this study was to determine the accumulation of secondary metabolites in this case, the total flavonoid content and plant growth under different conditions of water availability. So it is necessary to determine the content of bioactive compound of medicinal plants in different conditions of available soil water content.

MATERIALS AND METHODS

The experimental design using a one-factor Completely Randomized Design (CRD) consisting of four treatment levels, each treatment consisting of five replications as follows: A0 = 100% field water capacity (control), A1 = 80% field capacity, A2 = 60% field water capacity, A3 = 40% field water capacity (Drenovsky, 2004).

The tools and materials used in this study included measuring glass, moppets, UV-Vis spectrophotometers, vortices, spray bottles, 10 mL volumetric flasks, 50 mL volumetric flasks, ovens, analytical scales, mashers, 60 mesh sieves, beaker cups, maceration jars, aluminum foil, glass funnel, rotary evaporator, extract glass, spatula, cuvette, poly bag, thermometer, ruler, hygrometer, ethanol 96%, standard quercetin solution, $AlCl_3$ 10%, 1 M sodium acetate, filter paper, blue tip, and aquadest.

Plant Media

The plant media used for planting of seedlings was a composite soil from organic fertilizer, soil, and husk (1: 2: 1). Each polybag consist of one plant (Rahmah et al., 2014).

Soil Water Content

The several different levels of water content availability calculated using the Pressure Plate Method (pF 2.54). The stages of methods are as follows: samples of dry soil were weighed and put into the sample ring according to the weight of the contents. The ring sample arranged on the apparatus pressure plate then let it saturated for ± 24 hours. Then put in pF device and put pressure 1/3 atm or pF 2.54. Wait until the water drops stop (48 hours) then the soil is lifted, and the water content is determined. Determination of water content uses a gravimetric method. The moisture content of the field capacity from laboratory experiments (% field capacity) served as the basis for giving water to the pot experiments at a greenhouse.

Plant Cultivation

Fertilization is carried out at the beginning of planting. This process is carried out by removing weeds that grow around the plant as well as controlling. pest and disease.

Plant Sampling

Plants sampling was taken around 28 days after treatment by picking leaves that have maturity physiology.

Standard Quercetin Solutions

A quercetin standard solution was made into several concentrations. A total of 0.5 mL of quercetin standard solution, 0.1 mL of aluminum (III) chloride 10% and 0.1 mL sodium acetate 1 M were added into 2.8 mL of distilled water. Each solution concentration measured by its absorbance at a wavelength of 415 nm (Chang et al., 2002).

Quercetin Standard Curves

The standard curve of quercetin was made by correlating the concentration of a standard solution with absorbance obtained from measurements using a UV-Vis spectrophotometer.

Determination of Total Flavonoid in Extracts

The 0.5 mL of the test sample together with 0.1 mL of aluminum (III) chloride 10% and, 0.1 mL of sodium acetate 1 M were added into 2.8 mL of distilled water and shaked until homogeneous, then left for 30 minutes. The concentration was measured by its absorbance using a UV-Vis spectrophotometer at a wavelength of 415 nm (Chang et al., 2002).

Data Analysis

The data were analyzed using ANOVA (one-way analysis of variance), if there was a significant difference, then it was tested further with DMRT (Duncan Multiple Range Test) at the level of 5%.

RESULTS AND DISCUSSION

The Effect of Soil Water on Growth (*Gynura procumbens* (Lour) Merr.)

The results of the 5% DMRT test on plant height showed that there were significant differences in each level of soil water content. The treatment of 80-100% field capacity was the optimal soil water moisture for development of plant height and leaf number. The treatment of 40-60% field capacity showed the higher leaf area, fresh weight, dry weight and root length (Table 1).

Table 1. The effect of soil water content on plant growth of Gynura procumbens (Lour) Merr. on 28 days after treatment

Soil water content	Plant height (cm)	Leaf number	Leaf area (cm^3)	Fresh weight (gram)	Dry weight (gram)	Root length (cm)
100% field capacity	19.10 c	12.20 a	13.84 b	6.72 a	0.66 a	15.40 a
80% field capacity	17.30 b	14.00 b	17.43 c	8.54 ab	0.86 ab	16.20 a
60% field capacity	17.10 b	11.80 a	18.77 d	10.12 b	1.22 b	18.50 b
40% field capacity	15.50 a	11.00 a	11.76 a	8.92 b	1.14 b	20.00 b

The number followed by the same letter shows that it is not significantly different from the DMRT test at the 5% level.

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The decrease in soil water content will cause disrupted physiological and morphological activities and eventually cause cessation plant growth (Gopinath & Pavadai, 2015). The level of soil water profoundly influences growth of the plant because the process of plant growth begins with the process of forming shoots (Figure 1).

Figure 1. Plant Height *G. procumbens* at Different Soil Moisture Levels

The inhibition of plant growth can be due to several factors, including the availability of water. Availability of soil water is a significant factor in plant growth and development (Bergmark, 1987). The availability of water is crucial for plant growth, namely when the land is in a condition of field capacity. Field capacity is the maximum content of water in the soil after excess water leaves the soil due to gravity. The different soil water content also affects the number of leaves. The 5% DMRT test results showed a significant difference between 100% field capacity with treatment of 80% field capacity.

The soil water content of 80% field capacity was the optimal treatment in development of leaf number. The lowest number of leaves was on the treatment of soil moisture content of 40% field capacity. The 80% field capacity can optimize the formation of leaves and result in the high of leaf number (Figure 2).

Several plants can optimize their growth when the water content in the soil reaches 40% field capacity. The treatment of 75% field capacity soil water content produced the highest number of leaves (Sullivan, 2002). Leaf area parameters showed a significant result in the level of soil moisture content of 100% field capacity. Soil water content of 60% field capacity showed the optimal condition in forming leaf area, while the lowest leaf area was found in the treatment of 40% field capacity. When plants undergo O_2 deficiency (anoxia) the process of growth and development in their leaf organs will decrease (Chen et al., 2002).

The treatment of various levels of soil water content also affects the plant biomass. The dry weight or biomass of the plants showed a significant difference between the treatment of 100% soil moisture content with the treatment of 60% field capacity and 40% field capacity (Xu et al., 2010).

The treatment of various levels of soil water content affects the root length. Plant root length showed a significant difference between 100% field capacity soil moisture treatment with 60% field capacity and 40% field capacity. The soil moisture of 40% field capacity showed the most extended root length. It means that the lower the availability of water in the soil, the longer the root formed (Figure 3).

Root lengthening in conditions of drought stress will hold the canopy growth rate by releasing growth hormone retardant which inhibits canopy growth, thereby increasing root growth. This mechanism is carried out by plants to prevent excessive water loss.

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Figure 2. Number of leaves *G. procumbens* at Different Levels of Soil Moisture

Figure 3. Plant roots of *G. procumbens* at different levels of soil water content 100%, 80%, 60% and 40% field capacity

The process of root extension can also affect the roaming of roots in the soil in order to absorb more water (Anggarwulan & Mudyantini, 2005).

The Effect of Soil Water Content on the Total Flavonoid Content of *Gynura procumbens* (Lour) Merr.

The DMRT test results at the level of 5% showed that the total flavonoid content of leaves was significantly different between the control treatment of 100% field capacity and other treatments (Figure 4).

Based on figure 4, the 100% field capacity produces the lowest total flavonoid content of 5.949 mg/g whereas at 40% field capacity showed the highest total flavonoid content of 18.884 mg/g. Whereas under favorable conditions the production of secondary metabolites will be more dominant (Nakabayashi et al., 2014; Ghasemi et al., 2019).

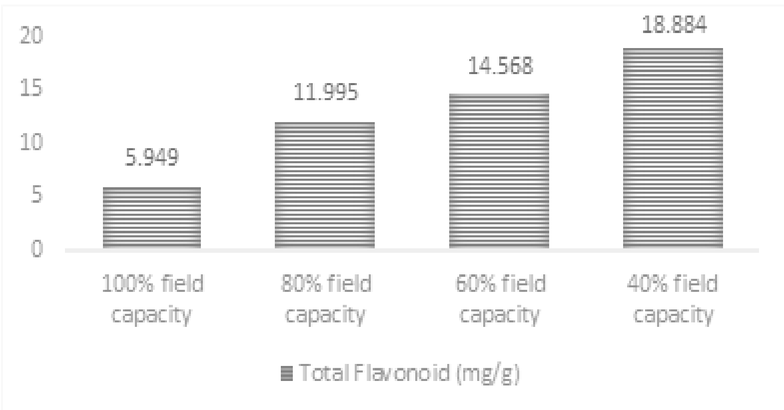

Figure 4. Total flavonoid content of leaves after 28 days of treatment (mg/g)

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The results of previous study showed that the treatment of 60% water deficit stress on tempuyung (*Sonchus arvensis* L.) can increase the highest flavonoid content, which is 2.11% higher than the control (Chang et al., 2002; Yang et al., 2007). The results of this study showed that the lower the soil moisture content, the higher the content of flavonoids produced. Phenylpropanoid metabolism is affected in the early period of drought stress. During drought stress, phenylpropanoid metabolism is very active with high activation phenylalanine ammonia lyase (PAL) which increased phenol and flavonoid content (Ghasemi et al., 2019). Flavonoid compounds function as antioxidants of antidotes to various diseases. It is suggested that the research regarding the effect of soil moisture content on the content of other secondary metabolites which have bioactivity as drugs should be conducted.

Based on the results of the research it can be concluded that the level of soil moisture content affects the growth and content of the total flavonoids in *G. procumbens* plants. The level of soil moisture content of 40% field capacity produces the highest total flavonoid content of 18.884 mg/g. The optimal of growth was in moisture content of 100-80% field capacity, while the optimal root length development was found at soil moisture content 40% field capacity. The level of soil moisture of 40% field capacity can be reference to produce the secondary metabolites.

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REFERENCES

Anggarwulan, E. & Mudyantini, W. (2005). Pengaruh Ketersediaan Air terhadap Pertumbuhan dan Kandungan Bahan Aktif Saponin Tanaman Ginseng Jawa (*Talinum paniculatum* Gaertn.). *Biofarmasi*, 3(2), 47-51.

Bergmark, C. S. K. C. L. (1987). Growth and Development of the Florunner Peanut Cultivar as Influenced by Population, Planting Date and Water Availability. *Peanut Science*, 14, 11–16.

Chan, L. K., Lim, S. Y. & Pan, L. P. (2009). Micropropagation of *Gynura procumbens* (Lour.) Merr. an important medicinal plant. *Journal of Medicinal Plants Research*, 3(3), 105–111.

Chang, C., Yang, M., Wen, H. & Chern, J. (2002). Estimation of Total Flavonoid Content in Propolis by Two Complementary Colorimetric Methods. *Journal of Food and Drud Analysisi*, 10(3), 178–182.

Dash, P. R. (2016). A Comprehensive Review on *Gynura procumbens* Leaves. *IJP*, 3(4), 167–174.

Drenovsky, R. E., Vo, D., Graham, K. J., & Scow, K. M. (2004). Soil Water Content and Organic Carbon Availability Are Major Determinants of Soil Microbial Community Composition. *Microbial Ecology*, 48(3), 424–430.

Ghasemi, S., Kumleh, H. H. & Kordrostami, M. (2019). Changes in the Expression of Some Genes Involved in the Biosynthesis of Secondary Metabolites in *Cuminum cyminum* L . Under UV Stress. *Protoplasma*, 256, 279–290.

Gopinath, P. & Pavadai, P. (2015). Morphology and Yield Parameters and Biochemical Analysis of Soybean (*Glycine max* (L.) Mrr.) Using Gamma Rays, EMS and DES Treatment. *International Let-*

ters of Natural Sciences, 35, 50–58.

Hendriyani, I. S. & Setiari, N. (2009). Kandungan Klorofil dan Pertumbuhan Kacang Panjang (*Vigna sinensis*) pada Tingkat Penyediaan Air yang Berbeda. *J.Sains & Mat*., 17(3), 145–150.

Nakabayashi, R., Mori, T. & Saito, K. (2014). Alternation of Flavonoid Accumulation Under Drought Stress in *Arabidopsis thaliana*. *Plant Signaling and Behavior*, 9(8), e29518-1-e29518-3.

Rahmah, Munifatul Izzati, S. P. (2014). Pengaruh Pupuk Organik Cair Berbahan Dasar Limbah Sawi Putih (*Brassica chinensis* L.) Terhadap Pertumbuhan Tanaman Jagung Manis. *Buletin Anatomi dan Fisiologi*, 22(1), 65–71.

Rebey, I. B., Jabri-karoui, I., Hamrouni-sellami, I. & Bourgou, S. (2012). Effect of Drought on the Biochemical Composition and Antioxidant Activities of cumin (*Cuminum cyminum* L .) seeds Effect of Drought on the Biochemical Composition and Antioxidant Activities of Cumin (*Cuminum cyminum* L.) seeds. *Industrial Crops & Products*, 36(1), 238–245.

Sullivan, B. P. (2002). Drought Resistant Oil. NCAT Agriculture Specialist.

Xu, Z., Zhou, G. & Shimizu, H. (2010). Plant Responses to Drought and Rewatering. *Plant Signaling and Behavio*r, 5(6), 649–654.

Yam, M. F., Sadikun, A., Asmawi, M. Z. & Rosidah. (2008). Antioxidant Potential of *Gynura procumbens*. *Pharmaceutical Biology*, 46(9), 616–625.

Yang, Y., He, F., Yu, L., Chen, X., Lei, J., & Ji, J. (2007). Influence of Drought on Oxidative Stress and Flavonoid Production in Cell Suspension Culture of Glycyrrhiza inflata Batal. *Zeitschrift Für Naturforschung C*, 62(5–6), 410–416.