Physiological Characteristics of Vernonia Bruceae And Ficus Pumila Cuttings

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Abstract- This experiment was conducted to investigate the effect of different plant growth regulators to increase percent mortality, time budding, root number, root length, root weight, leaf width, shoot weight, branch length, rod circumference, leaves number and leaves length. The main objective of this research is to what extent the role of natural auxin contained in onion extract and rabbit urine for the success of rooting cuttings and shoot growth of *Vernonia bruceae* and *Ficus pumila*. This research was conducted using a 2x4 factorial Completely Randomized Design (CRD) with 2 factors and 3 replications. The first factor is the type of ornamental plant with 2 levels, namely T1: *Vernonia brucea*, P2: Ficus pumila and the second factor is the type of auxin with 4 levels, namely A1: IBA, A2: NAA, A3: onion extract, A4: rabbit urine. Results declared that the application of synthetic and natural plant growth regulators was the same for the Time of budding(days) *Vernonia bruceae* and *Ficus pumila*. The highest root number was produced by rabbit urine on *Ficus pumila* cuttings (22.3), the heaviest root weight (1.0 mg) in the interaction of onion extract with *Vernonia bruceae*, the highest root length (11.7 mm), leaves width (16.7 mm), Shoot weight (1.2 mg), branch length (14.9 mm), leaves number (13.7) on the interaction of IBA and Vernonia *bruceae.* Meanwhile, the highest rod circumference (4.2mm) was the interaction between rabbit urine extract and *Vernonia bruceae*.

Index Terms- *Vernonia elliptica, Ficus pumila*, IBA, NAA, onion extract, rabbit urine

I. Introduction

Vegetative propagation of plants through stem cuttings is one of the most frequently used methods for ornamental plants. However, many leafy ornamental plant species take root poorly without pretreatment of cuttings with auxin. One of the factors that affect the success rate of cuttings is growth hormone which can induce the formation of roots and shoots (Hartmann *et al*., 2002). Growth regulators (PGR) have been used successfully in many plant species to increase the rooting ability of stem cuttings. These include indole-3-acetic acid (IAA), naphthalene acetic acid (NAA) and indole-3-butyric acid (IBA)). Another factor that creates a suitable environment for rooting stem cuttings is the rooting medium (Tchinda *et al*. 2013). Various studies have reported variations in rooting ability in genotypes at the same location due to natural genetic variations (Mabizela *et al*. 2017). Plant hormones are part of the genetic regulatory process and function as growth promoters. Environmental stimuli trigger the formation of plant hormones. When the hormone concentration has reached a certain level, a number of genes that were originally inactive will begin to express. Plant growth regulators can be better described as "plant bioregulators" and can be further subdivided into "plant biostimulants" and "plant retardants" as well as into five other groups: (1) auxins, (2) gibberellins, (3) cytokinins, (4) abscisic acid, and (5) ethylene (Neill et al, 2019). Plant growth regulators are non-nutritive organic compounds that in low concentrations (< 1 mM) promote, inhibit or qualitatively alter plant growth and development (Salisbury and Ross. 1992). Auxins are involved in the regulation of almost all developmental processes in plants. Exogenous auxin can be applied as a powder or aqueous solution to freshly cut stem cuttings. In recent years a great deal of information on the concentrations of phytohormones, as well as their types and timing of application has become available for individual species or even cultivars of ornamentals and shrubs. So the phytohormone stimulation method is widely used in nursery practice, mainly because it appears to be beneficial (Pacholczak *et al*., 2017). Shallot tubers contain vitamin B1 (thiamin), riboflavin and ZPT auxin and rhizokaline. Thiamin and riboflavin in shallots are natural auxins and as raw materials for IAA synthesis (Dule and Murdaningsih, 2017). Utilization of onion extract to increase plant growth is quite necessary. Shallot bulbs which are also as shoot growing areas contain a lot of auxin in the amount of 10.355 ppm. The onion extract that has been tested is able to increase the percentage of cuttings, increase the number of shoots that grow, and increase the growth of plant root length at a dose of 70% on roses and 90-100% on Ixora sp (Salsabila *et al*, 2021). Shallot extract contains growth regulators that have a similar role to Indole Acetic Acid (IAA). Indole acetic acid (IAA) is the most active auxin for various plants and plays an important role in promoting optimal growth (Husein and Saraswati, 2010).

Natural auxins found in urine need to be considered. its use, because it is easy to obtain, inexpensive and easy to use. Auxin contained in urine consists of auxin-a (aukentriollic acid), auxin-b and other auxin (hetero auxin) which is IAA (Indol Acetic Acid). The auxin comes from various substances contained in forage

protein from animal feed (Kusnadi and Tivani, 2017). In the body of livestock, auxin does not decompose, so it is excreted as filtrate along with urine which secretes specific substances that encourage rooting. Animal urine is limited to replace the function of synthetic auxin which is needed to stimulate rooting of cuttings. Rabbit urine has a fairly high nutrient content, namely N 4%, P2O5 2.8%, and K2O 1.2% relatively higher than the nutrient content in cattle (N 1.21%, P2O5 0.65%, K2O 1 .6%) and goats (N 1.47%, P2O5 0.05%, K2O 1.96%). Rabbit fertilizer contains organic matter C/N: (10–12%) and pH 6.47–7.52. The benefits of organic fertilizer from rabbit urine are that it helps increase soil fertility and increase plant productivity (Indabo, and Abubakar, 2020). Rabbit urine contains growth-stimulating substances that can be used as growth regulators, including Indole acetic acid (IAA). It was further explained that rabbit urine also has a positive influence on plant vegetative growth, because of its distinctive smell, rabbit urine can also prevent the arrival of various plant pests, so rabbit urine can also function as insect pest control (Said et al., 2018). 50% rabbit urine resulted in higher plant height, number of leaves, stem diameter, number of tillers, and dry weight of red ginger rhizome than other treatments at the age of 20 weeks (Kusnadi and Tivani, 2017).

In relation to the length of time required for Vernonia bruceae and *Ficus pumila* to sprout and the role of Growth Regulators contained in onion extract and rabbit urine for shoot growth, this study is expected to increase the formation of roots and shoots of *Vernonia bruceae* and *Ficus pumila*.

II. MATERIALS AND METHODS

Stock plants

Vernonia bruceae and *Ficus pumila* stock plants were planted in the ground and allowed to propagate. Trimmed regularly once a month, photo period 12 hours during the day and 12 hours at night. Weed control was done manually every month and plants were sprayed with a mixture of fungicide.

Cuttings

Thirdly two cuttings of each *Vernonia* bruceae and *Ficus pumila* were taken from stock plants with young shoots and minimal branching. All cuttings were tip pruned and cut at the base 2 mm below the last node. *Vernonia* bruceae cuttings (5 nodes and 150 mm in length), were taken from semi-hardwood tissue and all leaves and side shoots were removed except leaves from the top two nodes (two leaves total per cutting). While Ficus pumila cuttings (6 nodes and 110 mm in length), were taken from softwood tissue and retained leaves on the topmost node only (two leaves total per cutting).

Propagation Excised cuttings were immediately placed into a plastic bag filled with soil and manure in a 1:1 ratio and maintained in indoor growth rooms under the plastic net.

Auxin

Weigh 500 mg (0.5 grams) of IBA, put in a 25 ml beaker. Give a few drops of 96% alcohol until the IBA dissolves then add 10 ml of distilled water. Enter in a 1000 ml volumetric flask, add aqua dest to the mark on the volumetric flask. Likewise to make 500 ppm NAA. Shallot extract was made by weighing 1 kg of onion bulbs. The onion bulbs are then mashed using a blender. The onion bulbs that have been blended are then filtered using a filter cloth to separate the liquid from the pulp. The resulting liquid is an extract preparation which is considered 100%. Rabbit urine used 50 ml of urine dissolved in 100 ml of distilled water

Giving ZPT

Cuttings that have been separated based on the part, namely the tip of the stem, then soaked in a natural growth regulator as high as 2 cm from the base of the cuttings for 1 hour according to the treatment, namely by using a solution of IBA, NAA, onion extract, rabbit urine.

Cuttings

The cuttings are planted in the media that has been prepared in advance, holes are made so that the cuttings are not damaged due to friction with the planting media. After being given a growth regulator, the cuttings are planted vertically.

Cuttings maintenance

Seedlings were planted in pots with a diameter of 35 cm with a mixture of soil: goat manure (1: 1) then reared under 50% net shade.

Plant maintenance includes watering, replanting, controlling pests or diseases, and weeding weeds. Watering is done 2 times a day in the morning and evening to maintain the humidity of each cutting. Embroidery is carried out as early as possible, namely when the plant is 1 week after planting (MST) on plants that are dead, damaged, or attacked by pests and diseases using spare seeds. Weeding was done manually, weeding was done by cleaning weeds in the experimental area both inside and outside the plot. Pest control is carried out when pest activity is seen on plants.

Observation Parameter

Observations were made on all plants with the observed variables including percent mortality, time budding, root number, root length, root weight, leaf width, shoot weight, branch length, rod circumference, leaves number, and leaves length.

Statistic analysis

The data obtained were then tested for variance with analysis of variance (ANOVA) to determine the effect of treatment and if there was an effect of treatment, it was continued with Duncan's multiple distance test at 5% level to determine the difference between treatments.

III. RESULTS AND DISCUSSION

RESULTS

Microclimate

Air temperature will affect plant vegetative growth because air temperature affects water absorption, mineral absorption, assimilation and plant respiration. During the tuning process, the air temperature ranges from 27^0C to 28^0C (Table 1).

Table 1. Microclimate Conditions Cuttings

Month	Air temperature(^{o}C)	Average Relative Humidity (%)
March	27	85
April	27	87
May	28	84
June	28	87

Ideal temperature conditions under the shade of net are needed to stimulate root and shoot growth of cuttings. Based on the requirements of the air temperature, the air temperature in the cover of the cuttings supports the growth of the cuttings. Air humidity will prevent the cuttings from drying out before the cuttings take root because in general the water content of the cuttings is relatively small. According to Pujaningrum and Simanjuntak (2020), optimal air humidity should be maintained at around 90% during root initiation and can be reduced to 75% after that level. While Hartmann et al., (2002) stated that during the cutting process, the optimal air temperature requirement is 21^0C to 27^0C, where at that optimal temperature there will be stimulation of root formation and growth of cuttings.

The results showed that the interaction between Kind of creeping plant (Cp) and Kind of Plant Growth regulator (Gr) had an effect on Time of budding, Branch length, rod circumference and Leaves number but had no effect on percent mortality, and leaves length. Kind of creeping plant (Cp) had an effect on Time of budding, Branch length, rod circumference, leaves number and leaves length, but had no effect on percent mortality. Kind of Plant Growth regulator(Gr) has an effect on Branch length, rod circumference, Leaves number and Leaves length but has no effect on percent mortality and time of budding. Vernonia bruceae and Ficus pumila have the same effect both interactions with IBA, NAA,extract onion or with rabbit urine.

Ficus pumila treated with IBA had a significantly 23.7% higher Time of budding than *Vernonia bruceae. Ficus pumila* treated with NAA had a 27% significant time of budding compared to Vernonia bruceae. Ficus pumila treated with onion extract had a significantly 26.07% higher Time of budding than *Vernonia bruceae*. Ficus pumila treated with rabbit urine had a significantly 24.02% higher Time of budding than *Vernonia bruceae* (Fig.1).

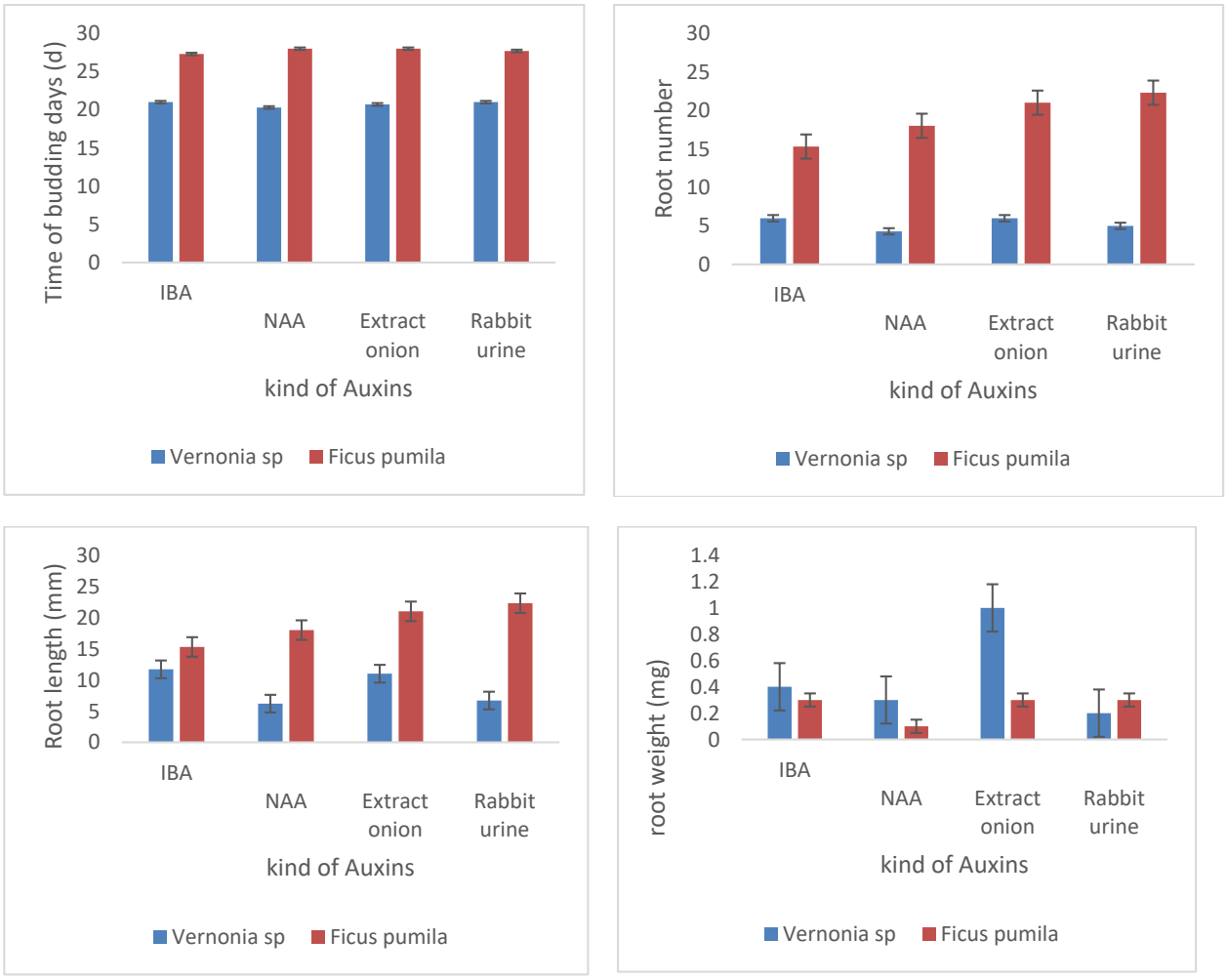


Fig. 1. Time of budding, root number, root length, and root weight of *Vernonia bruceae and Ficus pumila* on various Auxins.

Ficus pumila treated with IBA had a significant 155% higher root number than *Vernonia bruceae*. *Ficus pumila* treated with NAA had a significant root number of 318% than *Vernonia bruceae*. *Ficus pumila* treated with onion extract had a significant root number of 250% higher than *Vernonia bruceae*. *Ficus pumila* treated with rabbit urine had a significantly higher root number of 346% than *Vernonia bruceae*.

Vernonia bruceae treated with IBA had a real 88.7% higher root length than *Ficus pumila*. *Vernonia bruceae* treated with NAA had a real root length of 24% than *Ficus pumila*. *Vernonia bruceae* treated with onion extract had a markedly 54.9% higher root length than *Ficus pumila*. *Vernonia bruceae* treated with rabbit urine had a significantly higher root length 11.6% than *Ficus pumila*.

Vernonia bruceae treated with IBA had 33.3% higher real root weight than *Ficus pumila*. *Vernonia bruceae* treated with NAA had 200% real root weight than *Ficus pumila*. *Vernonia bruceae* treated with onion extract had a real 233.3% higher root weight than *Ficus pumila*. *Vernonia bruceae* treated with rabbit urine had a significant 116.6% higher root weight than Ficus pumila.

Vernonia bruceae treated with IBA had a significantly higher leaf width of 255.3% than *Ficus pumila*. *Vernonia bruceae* treated with NAA had a real leaf width of 190% than *Ficus pumila*. *Vernonia bruceae* treated with onion extract had a significant 195.3% higher Leaf width than *Ficus* pumila. *Vernonia bruceae* treated with rabbit urine had 300% higher Leaf width significantly than *Ficus pumila* (Fig.2)

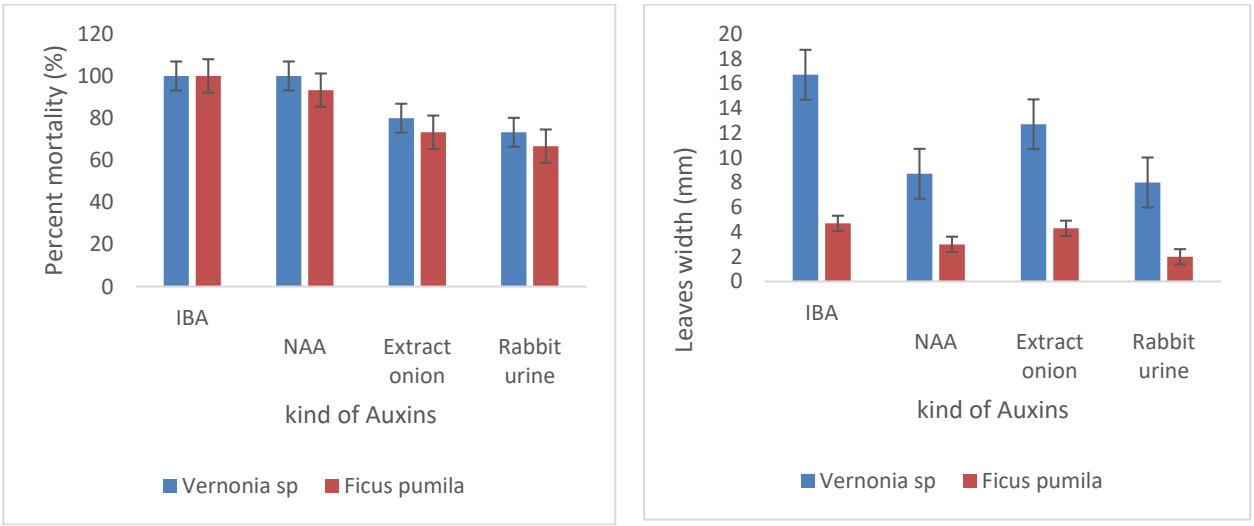
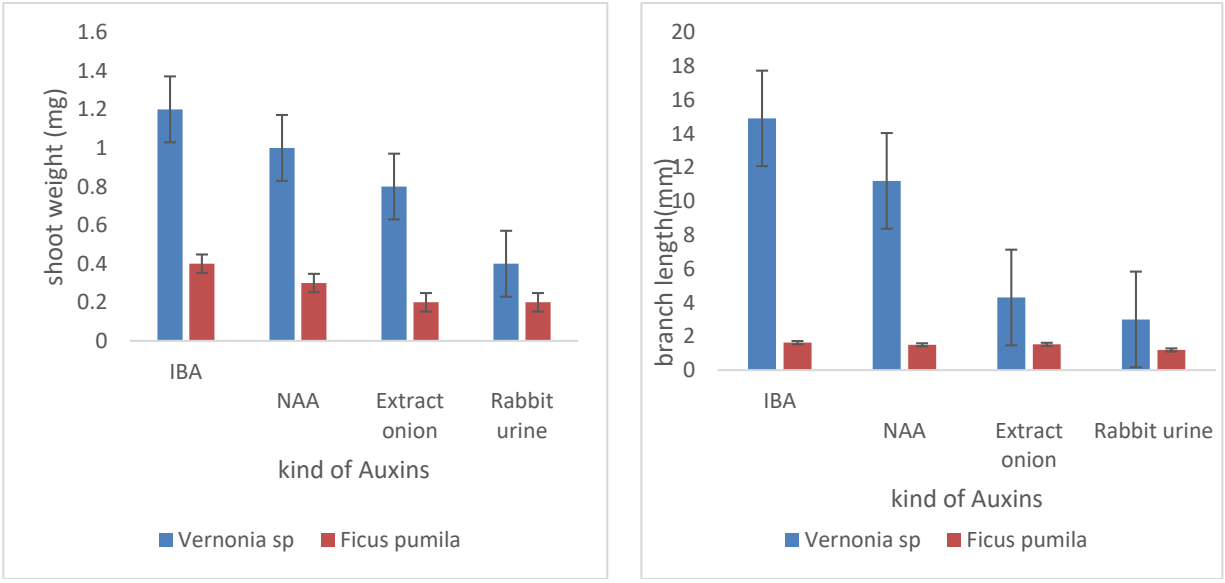


Fig. 2. Percent mortality and leaves weight *Vernonia bruceae and Ficus pumila* on various Auxins.

Vernonia bruceae treated with IBA had a 200% higher real shoot weight than *Ficus pumila*. *Vernonia bruceae* treated with NAA had a real shoot weight of 24% than *Ficus pumila*. *Vernonia bruceae* treated with onion extract had 300% higher real shoot weight than *Ficus pumila*. *Vernonia bruceae* treated with rabbit urine had 100% higher real shoot weight than *Ficus pumila* (Fig.3).



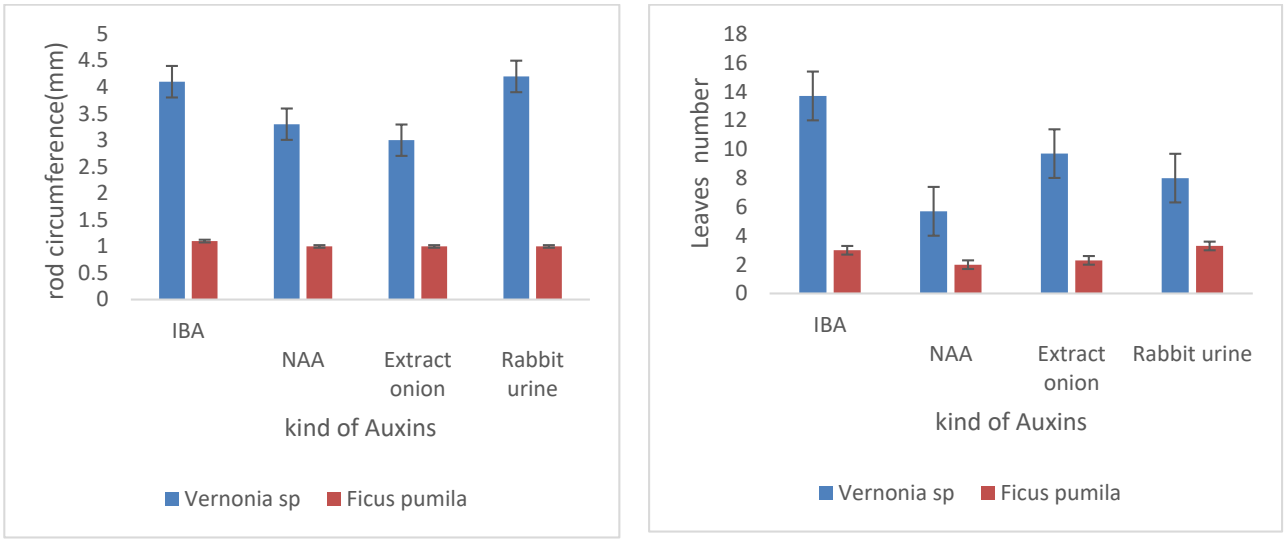


Fig. 3. Shoot weight, branch length, rod circumference and leaves number *Vernonia bruceae and Ficus pumila* on various Auxins.

Vernonia bruceae treated with IBA had a significantly higher branch length 814% than *Ficus pumila. Vernonia bruceae* treated with NAA had 646.6% significant branch length than *Ficus pumila. Vernonia bruceae* treated with onion extract had 181% significantly higher branch length than *Ficus pumila. Vernonia bruceae* treated with rabbit urine had 150% significantly higher branch length than *Ficus pumila*.

Vernonia bruceae treated with IBA had a true 272.7 % higher rod circumference than *Ficus pumila. Vernonia bruceae* treated with NAA had a 230% true rod circumference than *Ficus pumila. Vernonia bruceae* treated with onion extract had a significantly 200% higher rod circumference than *Ficus pumila. Vernonia bruceae* treated with rabbit urine had a significantly higher rod circumference of 320% than *Ficus pumila*.

Vernonia bruceae treated with IBA had a significantly higher Leaves number of 356% than *Ficus pumila. Vernonia bruceae* treated with NAA had a significant Leaves number of 185% than *Ficus pumila*. *Vernonia bruceae* treated with onion extract had a significantly higher Leaves number of 321% than *Ficus pumila. Vernonia bruceae* treated with rabbit urine had a significantly higher Leaves number of 142% than Ficus pumila.

Vernonia bruceae has leaves length 60.8% higher than *Ficus pumila*. IBA is the best Kind of Plant Growth regulator, rabbit urine, NAA and onion extract have the lowest Leaves length.

DISCUSSION

For the time of budding Ficus pumila turns out to be longer in forming temporary shoots

Vernonia bruceae is faster. The average shoot formation of *Ficus pumila* cuttings takes time

27.8 days, while *Vernonia bruceae* takes only 20.8 days. Plant growth regulators (PGRs) have been successfully employed in many plant species to improve the rootability of stem cuttings). These include indole-3-acetic acid (IAA), naphthalene acetic acid (NAA), and indole-3-butyric acid (IBA)). Another factor which creates a suitable environment for rooting of stem cuttings is the rooting medium (Mabizela *et al*, 2017). The growth of plant cuttings of *Vernonia bruceae* shown on the branches was better than that of *Ficus pumila*. The IBA treatment on *Vernonia bruceae* produced the same branch length as the NAA treatment on *Vernonia bruceae*. The treatment of onion extract and rabbit urine, which are natural growth regulators, was proven to be less good than IBA and NAA for both *Vernonia bruceae* and *Ficus pumila*. On rod circumference, *Vernonia bruceae* on growth regulators IBA, NAA, Onion extract was better than Ficus pumila on growth regulators. the same one. Leaves number on *Vernonia bruceae* treated with IBA was higher than all treatments. Leaf length parameter of *Vernonia bruceae* cuttings was better than Ficus pumila, while for leaves length due to growth regulator type, IBA was the best. *Vernonia bruceae* cuttings given IBA produced the highest leaf width compared to Vernonia bruceae cuttings given NAA, onion extract or *Vernonia bruceae* cuttings given Rabbit urine or *Ficus pumila* given IBA, NAA, onion extract or Rabbit urine. *Vernonia bruceae* cuttings given IBA produced the highest shoot weight compared to *Vernonia bruceae* cuttings given NAA, onion extract, Rabbit urine and *Ficus pumila* given IBA, NAA, onion extract and Rabbit urine. The wider the area of root absorption, the more water and nutrients will be absorbed so that it affects the wet weight and dry weight of the plant stove. The low wet weight and dry weight of the stover were related to the low number of leaves and the number of roots produced. The number of leaves and roots is small, related to the results of photosynthesis and the content of water and nutrients absorbed by the roots. (Dule and Murdaningsih, 2017)

Ficus pumila cuttings given Rabbit urine produced significantly better root numbers than all treatments including *Vernonia bruceae* cuttings given IBA, NAA, onion extract, Rabbit urine. Vegetative propagation of plants through stem cuttings is one of the most frequently used methods for the production of ornamental shrubs and trees. Leafy and poorly rooted ornamental plant species without pretreatment of cuttings with auxin. Auxins are involved in the regulation of almost all developmental processes in plants. Exogenous auxin can be applied as a powder or aqueous solution to freshly cut stem cuttings (Hartmann *et al*., 2002). Rooting of stem cuttings usually depends on internal and external conditions including ortet age, season, breeding medium

and auxin concentration. Exogenous application of commercially available auxins such as indole-3-butyric acid (IBA) and naphthalene acetic acid (NAA) usually promotes rooting in stem cuttings and the specific actions of these hormones are not well understood. The selection of suitable plant materials, especially those related to tissue maturation and phase changes, continues to be an important topic and still requires study, especially on leguminous trees such as P. pinnata. Seasonal stimuli also play an important role in promoting rooting, which is correlated with the physiological characteristics of the cuttings (Sahoo *et al.*, 2021). *Vernonia bruceae* cuttings given IBA produced the longest root length compared to *Vernonia bruceae* cuttings given NAA, onion extract or *Vernonia bruceae* cuttings given Rabbit urine or Ficus pumila given IBA, NAA, onion extract or Rabbit urine. This clearly indicates that the efficiency of exogenous IBA in inducing rooting from stem cuttings depends on the concentration at which the hormone is applied, and that the concentration of IBA required for maximum rooting may vary from one plant material to another as previously reported (Kanmegne *et al*., 2017). *Vernonia bruceae* cuttings given onion extract produced the heaviest root weight compared to *Vernonia bruceae* cuttings given IBA, NAA, Rabbit urine or Ficus pumila given IBA, NAA, onion extract or Rabbit urine.

One of the growth regulators that can be used is a formulation containing IBA and NAA, so that it can stimulate root formation, root formation will affect the survival of cuttings, the faster and more roots are formed, the greater the possibility of obtaining good seeds. The use of PGR in plant propagation by cuttings is to overcome the problem of root formation. Cuttings treated with ZPT will form roots faster and have a better quality of root system than those without PGR treatment. Auxin is one of the PGR that plays an important role in the process of growth and development of a plant. Auxin is able to increase cell pressure and increase protein synthesis, so that cells will expand, elongate and absorb water (Budianto *et al*., 2013). Application of auxins, especially IBA and NAA are recommended to promote adventitious roots in the propagation of stem cuttings in many shrubs and trees (Kaviani and Negahdar, 2017). Auxins are involved in the regulation of almost all developmental processes in plants. Exogenous auxin can be applied as a powder or aqueous solution to freshly cut stem cuttings (Pacholczak *et al*., 2017). Auxin often accelerates root initiation, increases the number of rooted cuttings, and improves the quality and uniformity of root cuttings (Lodama *et al*., 2016). Auxin is effective in developing root system symmetries such as root percentage, number of roots, and root length. The addition of auxin had a significant effect on the number of adventitious roots and the percentage of callus formation. The significant effect of IBA on root length was observed in *V. dahurica*, but not in *V. pusanensis*, while the number of fresh shoots and shoots, and root weight given NAA had a significant effect on V. *pusanensis* but not on *V. dahurica*. Since the addition of auxin has different effects on different plant species, different types of auxin can affect plant rooting speed (Kim *et al.*, 2021)

IV. CONCLUSION

From the results of this study, it can be concluded that the *Vernonia bruceae* treated with IBA showed the best effect on Branch length, rod circumference, Leaves number, Leaves length, Leaf width, Shoot weight, Root length and Root weight. Ficus pumila has a longer emergence time. The interaction between *Ficus pumila* and rabbit urine gave the highest number of roots.

V. SIGNIFICANT STATEMENT

This study has found that the highest root number was produced by rabbit urine on *Ficus pumila* cuttings (22.3), the heaviest root weight (1.0 mg) in the interaction of onion extract with *Vernonia bruceae*, natural auxin was able to produce the highest number of roots in *Ficus pumila* and root weight in *Vernonia bruceae*

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