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GROWTH AND MULTIPLICATION OF ORCHID BUDS IN VITRO WITH THE ADDITION OF CORN *(Zea mays)* AND TOMATO (*Licopersicum esculentum mill)* EXTRACT

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Abstract:

Vanda Foetida orchid is a popular ornamental plant because of its beautiful flowers. Propagation of *Vanda* orchids by tissue culture method can be done to facilitate the supply of plant seeds. This study aims to determine the concentration of corn and tomato extracts and their interactions to produce growth and multiplication of *Vanda* orchid buds. The study was conducted at the Jember Polytechnic Culture Laboratory. This study used factorial Completely Randomized Design, the first factor was tomato extract with a concentration of 100 ml / L, 125 ml / L, 150 ml / L and the second factor was corn extract with a concentration of 50 g / L, 100 g / L, 150 g / L with 3 replications. Observation variables included plant height, number of leaves, number of shoots, number of roots and width of leaves. Data was analyzed by Analysis of Variants and if significantly different continued with LSD test at the level of 5%. The results of the study showed that the use of corn and tomato extracts had not been able to significantly influence the improvement of all observed parameters in *Vanda Foetida* Orchids.

1. Introduction

Orchids are flower ornamental plants that are popular with many people. One type of orchid is *Vanda* orchid (*Vanda* Sp). *Vanda* orchids are popular because of the beauty of the flowers. The *Vanda* genus in Indonesia is estimated to number more than 40 species with a very wide spread. Orchid production in Indonesia is still experiencing fluctuations [1]. Orchid production still experiences fluctuations due to the limited availability of orchid seeds. The supply of orchid seeds is generally carried out in Vitro because this method can produce orchid seeds in large quantities and in a relatively short time. In In vitro cultivation, the media has a very important role in supporting the growth of explants [2] [3] [4]. Invitro media generally uses materials derived from chemicals, therefore the use of chemicals should need to be reduced to reduce production costs by using organic matter.

Growth regulating substances derived from organic materials and can be used in the multiplication of orchid seeds, including corn extract and tomato extract. Corn is a natural ingredient containing Zeatin which is a group of cytokinin hormones that function in cell division, inhibits chlorophyll degradation and aging so that it can increase shoot height. Corn grains also contain vitamins and various essential minerals, such as K, Na, P, Ca, and Fe [5]. Therefore, the presence of nutrients is expected to produce enough energy to encourage cell elongation and stimulate growth. According to Febriyanti *et al*. [6], in the treatment of the addition of 50 g/L hybrid corn extract with NAA 0.01 mg / L produced the

highest number of shoots, namely 8 shoots per explant in one individual from *Dendrobium Heterocarpum* Lindl orchid.

Tomato extract contains a growth regulator in the form of auxin. The auxin hormone content in tomato extract can stimulate organogenesis, somatic embryogenesis and shoot growth in micropopagation in various plant species [7]. Tomato extract also contains vitamin C, and high total carotene which serves to overcome oxidation of phenolic compounds and prevent browning. The use of tomato extract on *Coelogyne pandurata* Lindl. With a concentration of 12.5 per liter of media produced the highest number of shoots (3.67 shoots) and the highest number of leaves (11.33 leaflets) [8], whereas according to Dwiyani *et al*. [7], the addition of tomato extracts in the media can induce colored protocomes and suppress embryonic death or orchid protokom *Vanda Tricolor* Lindl. The purpose of this study was to determine the effect of concentrations of maize extract (Zea mays) and tomato extract (Licopersicum esculentum mill) as well as their interactions with the growth and multiplication of Vanda foetida orchid buds.

2. Methods

The study was conducted at the State Polytechnic Culture Laboratory of Jember, Jember, East Java at an altitude of 90 m above sea level. The study was conducted on August 7, 2018 - February 19, 2019. The research method used was the experimental method in the laboratory, using factorial completely randomized design. The treatment tested consisted of 2 factors, namely the first factor of corn extract consisting of three levels (50 g / L, 100 and 150 g / L corn extract), while the second factor was tomato extract consisting of three levels (100, 125 and 150 ml / L tomato extract). Each treatment consisted of 2 bottles and repeated 3 times, so that the total treatment consisted of 54 bottles. Each bottle unit has 3 explants, so that the total explants are 162 explants. Observation variables passed the height and number of shoots, number of roots, number and width of leaves. Analysis of observational data used to find out the parameters observed, then at the end of the study a List of Variable fingerprints (DSR) was prepared. The treatment that had a significant effect was the LSD test at the level of 5%.

3. Result and Discussion

Based on the results of the study (Tables 1 and 2) showed that the application of several concentrations of tomato and corn extract to the growth and multiplication of *Vanda foetida* orchid shoots did not significantly influence all observational parameters. The concentration of corn extract used did not affect the observed parameters, presumably because the concentrations used were too high so the plants were in the suboptimal stage. Auxin content in corn extract if it exceeds cytokines in explants can inhibit shoot growth. Setiawati's research [9] revealed that the average number of shoots was lowest in BAP 1 ppm + corn extract ie 2.33 shoots. This is because BAP 1 ppm + corn extract is still at suboptimal concentration so that the response of plants to increase shoots is not optimal.

Table 1. Recapitulation of F Test on Parameters of Growth and Multiplication of *Vanda foetida Orchid* Buds in Vitro with Addition of Corn (*Zea Mays*) and Tomato Extract (*Licopersicum Esculentum* Mill)

Observation Parameters	F Calculate of Corn extract	F Table 5%	F Table 1%	F Calculate of Tomato Extract	F Table 5%	F Table 1%	F Calculate of tomato X corn extract	F Table 5%	F Table 1%
Plant height									
2 DAP	1,36 ns	3,55	6,01	1,18ns	3,55	6,01	2,31 ns	2,93	4,58
4 DAP	0,36 ns	3,55	6,01	0,98ns	3,55	6,01	0,27ns	2,93	4,58
6 DAP	0,79ns	3,55	6,01	3,21ns	3,55	6,01	0,61ns	2,93	4,58
8 DAP	1,00ns	3,55	6,01	1,86ns	3,55	6,01	1,27ns	2,93	4,58
10 DAP	0,92ns	3,55	6,01	1,73ns	3,55	6,01	0,89ns	2,93	4,58
12 DAP	0,65ns	3,55	6,01	1,17ns	3,55	6,01	0,81ns	2,93	4,58
Number of Leaves									
2 DAP	2,83ns	3,55	6,01	1,51ns	3,55	6,01	1,49ns	2,93	4,58
4 DAP	0,67ns	3,55	6,01	2,69ns	3,55	6,01	1,17ns	2,93	4,58
6 DAP	1,49ns	3,55	6,01	1,83ns	3,55	6,01	1,74ns	2,93	4,58
8 DAP	1,43ns	3,55	6,01	0,62ns	3,55	6,01	1,46ns	2,93	4,58
10 DAP	0,96ns	3,55	6,01	1,00ns	3,55	6,01	1,01ns	2,93	4,58
12 DAP	0,42ns	3,55	6,01	0,04ns	3,55	6,01	1,19ns	2,93	4,58
Leaf Width									
2 DAP	0,02ns	3,55	6,01	1,61ns	3,55	6,01	1,15ns	2,93	4,58
4 DAP	1,08ns	3,55	6,01	0,80 ns	3,55	6,01	0,05ns	2,93	4,58
6 DAP	2,34ns	3,55	6,01	0,78ns	3,55	6,01	0,40ns	2,93	4,58
8 DAP	1,55ns	3,55	6,01	1,83ns	3,55	6,01	0,36ns	2,93	4,58
10 DAP	0,19ns	3,55	6,01	0,56ns	3,55	6,01	0,56ns	2,93	4,58
12 DAP	0,13ns	3,55	6,01	0,77ns	3,55	6,01	1,14ns	2,93	4,58
Number of Buds									
2 DAP	1,20ns	3,55	6,01	0,61ns	3,55	6,01	2,07ns	2,93	4,58
4 DAP	1,35ns	3,55	6,01	0,20ns	3,55	6,01	0,54ns	2,93	4,58
6 DAP	1,17ns	3,55	6,01	1,13ns	3,55	6,01	0,50ns	2,93	4,58
8 DAP	0,94ns	3,55	6,01	1,69ns	3,55	6,01	0,31ns	2,93	4,58
10 DAP	0,68ns	3,55	6,01	1,70ns	3,55	6,01	0,55ns	2,93	4,58
12 DAP	0,78ns	3,55	6,01	1,45ns	3,55	6,01	0,75ns	2,93	4,58
Number of Root									
2 DAP	0,00ns	3,55	6,01	0,00ns	3,55	6,01	0,00ns	2,93	4,58
4 DAP	2,15ns	3,55	6,01	1,00ns	3,55	6,01	0,54ns	2,93	4,58
6 DAP	0,56ns	3,55	6,01	0,09ns	3,55	6,01	1,11ns	2,93	4,58
8 DAP	1,21ns	3,55	6,01	0,78ns	3,55	6,01	2,1ns	2,93	4,58
10 DAP	0,24ns	3,55	6,01	2,26ns	3,55	6,01	2,55ns	2,93	4,58
12 DAP	0,60ns	3,55	6,01	2,97ns	3,55	6,01	2,59ns	2,93	4,58

Note: The F value calculated followed by a sign (ns) shows no significant difference, the sign (*) shows significantly different in the F test level of 5% and followed by a sign (**) shows a very significant difference in the test level of 1%. DAP (Days after Planting).

The application of tomato extract at several levels of concentration also did not significantly affect all observational parameters. This is due to tomato extract containing koumarin acid which can inhibit growth. Bororoh and Aiman studies [10] also showed no significant effect on the number of *Cattleya* orchid shoots in vitro at the age of 8 to 11 weeks after planting with the administration of tomatoes not showing such differences at concentrations of 100, 150 and 200 g/l.

The effect of interaction on the two factors also still does not show a significant effect. he application of corn extract and tomato extract is thought to have not achieved a balance to stimulate explant growth quickly, because from each treatment the results showed no significant difference. Auxin contained in tomato extract and cytokinine content in corn extract is thought to be unable to work synergistically in spurring cell division. This is presumably according to the statement of Paramartha *et al*. [11], that the content of exogenous auxin with high concentration causes competition with endogenous auxin from explants so that reception of membrane signals inhibits cell growth and development. Auxin and cytokinin can work in the right balance will produce good growth. The interaction between the hormone auxin and the hormone cytokinin plays a role in controlling cell growth and differentiation. Auxin can stimulate primordial cells budding and stimulate differentiation, whereas cytokinins affect bud initiation [12].

Table 2. Table of Mean Growth and multiplication of orchid buds in Vitro at several concentrations of corn and tomato extract

The observation time	J1T1	J1T2	J1T3	J2T1	J2T2	J2T3	J3T1	J3T2	J3T3
				Plant height					
2 DAP	0,49[a]	0,57[a]	0,62[a]	0,54[a]	0,49[a]	0,52[a]	0,53[a]	0,54[a]	0,53[a]
4 DAP	0,79[a]	0,70[a]	0,76[a]	0,71[a]	0,71[a]	0,73[a]	0,76[a]	0,69[a]	0,81[a]
6 DAP	0,93[a]	0,78[a]	0,87[a]	0,80[a]	0,75[a]	0,88[a]	0,85[a]	0,79[a]	0,97[a]
8 DAP	1,04[a]	0,87[a]	0,87[a]	0,81[a]	0,78[a]	0,94[a]	0,92[a]	0,83[a]	0,96[a]
10 DAP	1,05[a]	0,88[a]	0,89[a]	0,84[a]	0,79[a]	0,94[a]	0,93[a]	0,86[a]	1,01[a]
12 DAP	1,06[a]	0,92[a]	0,89[a]	0,87[a]	0,81[a]	0,96[a]	0,94[a]	0,86[a]	1,02[a]
				Number of Leaves					
2 DAP	5,33[a]	5,22[a]	5,00[a]	3,44[a]	4,83[a]	4,94[a]	4,89[a]	4,89[a]	5,56[a]
4 DAP	5,89[a]	5,89[a]	5,56[a]	4,22[a]	5,28[a]	6,17[a]	4,83[a]	5,44[a]	7,06[a]
6 DAP	6,67[a]	6,89[a]	5,78[a]	5,44[a]	5,61[a]	7,44[a]	5,72[a]	7,72[a]	8,33[a]
8 DAP	7,39[a]	8,56[a]	6,33[a]	6,22[a]	6,17[a]	8,33[a]	7,56[a]	8,06[a]	9,17[a]
10 DAP	8,72[a]	9,50[a]	8,06[a]	7,78[a]	7,17[a]	9,39[a]	8,06[a]	9,17[a]	11,17[a]
12 DAP	10,4[a]	10,7[a]	8,17[a]	8,44[a]	8,78[a]	10,1[a]	8,44[a]	8,39[a]	9,89[a]
				Leaf Width					
2 DAP	0,50[a]	0,58[a]	0,61[a]	0,58[a]	0,49[a]	0,61[a]	0,56[a]	0,54[a]	0,57[a]
4 DAP	0,67[a]	0,66[a]	0,74[a]	0,67[a]	0,67[a]	0,71[a]	0,61[a]	0,59[a]	0,65[a]
6 DAP	0,73[a]	0,80[a]	0,82[a]	0,78[a]	0,72[a]	0,77[a]	0,67[a]	0,62[a]	0,74[a]
8 DAP	0,81[a]	0,88[a]	0,90[a]	0,80[a]	0,76[a]	0,89[a]	0,76[a]	0,71[a]	0,83[a]
10 DAP	0,84[a]	0,92[a]	0,86[a]	0,82[a]	0,77[a]	0,91[a]	0,85[a]	0,77[a]	0,89[a]
12 DAP	0,80[a]	0,95[a]	0,84[a]	0,84[a]	0,78[a]	0,96[a]	0,87[a]	0,87[a]	0,92[a]
				Number of Buds					
2 DAP	0,22[a]	0,44[a]	0,00[a]	0,11[a]	0,17[a]	0,11[a]	0,00[a]	0,00[a]	0,22[a]
4 DAP	2,67[a]	1,56[a]	2,33[a]	0,44[a]	1,61[a]	1,67[a]	0,94[a]	1,39[a]	1,33[a]
6 DAP	5,78[a]	2,22[a]	3,56[a]	3,56[a]	2,11[a]	3,33[a]	2,22[a]	2,33[a]	1,89[a]
8 DAP	9,22[a]	3,39[a]	7,22[a]	5,89[a]	2,50[a]	5,72[a]	4,72[a]	3,67[a]	3,89[a]
10 DAP	12,6[a]	4,39[a]	8,89[a]	6,78[a]	2,83[a]	8,50[a]	7,72[a]	5,78[a]	4,50[a]
12 DAP	16,0[a]	5,28[a]	9,44[a]	8,89[a]	4,72[a]	11,2[a]	7,78[a]	6,78[a]	4,50[a]
				Number of Root					
2 DAP	0,00[a]	0,00[a]	0,00[a]	0,00[a]	0,00[a]	0,00[a]	0,00[a]	0,00[a]	0,00[a]
4 DAP	0,11[a]	0,11[a]	0,33[a]	0,11[a]	0,00[a]	0,00[a]	0,33[a]	0,11[a]	0,33[a]
6 DAP	0,33[a]	0,22[a]	0,78[a]	0,22[a]	0,50[a]	0,00[a]	0,56[a]	0,28[a]	0,50[a]
8 DAP	0,33[a]	0,39[a]	1,33[a]	0,78[a]	0,50[a]	0,17[a]	1,61[a]	0,67[a]	0,61[a]
10 DAP	0,56[a]	0,50[a]	1,67[a]	1,33[a]	0,50[a]	0,56[a]	1,83[a]	0,67[a]	0,56[a]
12 DAP	0,67[a]	0,50[a]	1,89[a]	1,33[a]	0,50[a]	0,67[a]	2,00[a]	0,72[a]	0,83[a]

Note: The numbers followed by the same letters on the same line show no significant difference

4. Conclusion

The effect of concentrations of corn extract (*Zea mays*) and tomatoes (*Licopersicum esculentum mill*) and their interactions have not been able to increase the growth and multiplication of *Vanda foetida* orchid shoots. Therefore it is necessary to re-examine the use of corn and tomato extract as vegetable using different concentrations so that later it will be able to increase the growth and multiplication of shoots in orchid *Vanda foetida* carried out in in vitro techniques.

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