

## ANALYSIS OF ABILITY AND DETERMINANT FACTORS AT THE FLOWERING STAGE

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### ABSTRACT

In every higher plant, there will be a change from vegetative to generative. In this change, a series of new structures will be formed, namely flowers. Flowers are an expression of genes that were not previously expressed. The flowering stage is one of the stages of the development phase that needs to be considered in plants. Therefore, it is necessary to understand the factors that influence the flowering stage. This study aims to determine the factors that influence flowering. The method used in this article is through journal reviews. The number of journal articles reviewed and analyzed was 15 journal articles that had relevant topics. Then the results of the study are presented in descriptive form and presented in a table. Based on the results of the literature review, it is known that there are many factors that influence the flowering stage, including temperature and humidity, paclobutrazol, the influence of auxin and gibberellin growth regulators, types of containers and fertilizer concentrations, photoperiods, various types of fertilizers, eco enzymes and pinching.

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### Introduction

In every higher plant, there will be a change from vegetative to generative. In this change, a series of new structures will be formed, namely flowers. Flowers are an expression of genes that were not previously expressed. In vegetative plants that are competent to flower, only changes are needed in their determinants. The ability to flower in plants is when there is an appropriate signal, namely being able to respond to photoperiod, namely signals received from leaves, and then in a suitable environment it can be considered competent to flower.

In some plants, the flowering stage is an important phase that is considered to be a determinant of production or fruit. This is in accordance with the results of research (Putro et al., 2023) which states that based on the results of their research, the size of a dragon fruit production result can be influenced by the number of flowers that are able to produce fruit. Then mangosteen production in Indonesia is relatively low and unstable every year which can be caused by several factors, one of which is mangosteen flowering which is biennial bearing (Anggraini et al., 2023). In addition, mango flowering management in the field is the most important process in mango production activities (Fauzi et al., 2017)

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Flowering patterns in various plants are different, but generally begin with the emergence of flower buds and end with pollination. Flowering is influenced by several factors, namely temperature, duration of sunlight, topography, rainfall. In accordance with the statement (Rizkyma et al., 2023) that flowering and fruiting are influenced by duration of sunlight, temperature, and air humidity. The transition from vegetative to generative phase is partly determined by genetics and other factors such as temperature, water, fertilizer and sunlight (Arnanto et al., 2024). Then nutrients are needed that are met both during vegetative and generative growth, this can use various types of fertilizers (Sumiati et al., 2020).

Some plants require stimulation of the surrounding environment that is more relative to be able to flower. Giving the PGR paclobutrazol can increase the flowering of ornamental plants if given at the right dose (Atikabudi et al., 2022). The need for this stimulation cannot be equated for various types of plants. It is known that there are internal and external factors that can affect flowering in plants. Based on this, by knowing the influence and factors that affect flowering, the ability to flower in plants will be able to maximize the growth and development of plants. Thus, it is hoped that the literature review of this article can provide scientific information regarding the factors of ability and determinants of flowering.

## **Method**

The method used to conduct this literature review is by collecting, identifying and then evaluating, and interpreting information. The method used is to collect information and data through literature reviews from various relevant previous scientific research results. Then the use of information obtained from each stage is obtained from previous research and collected from various sources of scientific articles. For the stages in the process by conducting article literacy and grouping each piece of information, in order to obtain in-depth information about the ability and determinant factors in the flowering process, so that it can be used as material for writing articles.

In this literature review, there will be various determining factors in the flowering process in several plants. And each article will be reviewed and conclusions will be obtained regarding the ability and determinant factors in flowering. And the scientific journal articles used are the latest journal articles published in the last 6 years. In this study, 15 relevant articles were reviewed regarding the ability and determinant factors in flowering in plants

## **Research result**

This literature review research was conducted by reviewing 15 relevant articles discussing factors that can influence the flowering process in various plants, which can be seen in the table below:

**Table 1. Identification Of Journal Articles Based On Flowering Factors**

<b>No</b>	<b>Journal Article Title</b>	<b>Writer</b>	<b>Year</b>	<b>Flowering factors</b>
	Pengaruh Faktor Suhu Dan Kelembaban Terhadap Pembungaan Dan Penguasaan Tanaman Buah Naga	Yeni Eka Lestari, Kanthi Pangestuning, Ahmad Hadi	2024	Temperature and Humidity. Temperature and humidity have no effect on flowering, namely in the phase of the number of flowers appearing, but there is an effect on the number of flowers blooming.
2.	Induksi Pembungaan Manggis ( <i>Garcinia mangostana</i> L.)	Baiq Fhariska Anggraini,	2023	Paclobutrazol. Paclobutrazol treatment can accelerate flowering by increasing the C/N ratio in

	Menggunakan Paklobutrazol	Nurrachman, Jayaputra		mangosteen plants. Paclobutrazol concentration of 2,000 ppm/tree (P2) is the best concentration in increasing the number of flowers and the number of fruits of mangosteen plants.
3.	Efektivitas Auksin Dan Giberelin Terhadap Umur Berbunga Dan Panen Tanaman Koro Pedang ( <i>Canna lily ensiformis</i> )	Driska Arnanto, Yekti Maryani, Galih Indra Koswara, Dian Eka Kusumawati	2024	The effect of the growth regulators auxin and gibberellin did not have a significant effect on flowering age. This was because the dose given was not quite right.
4.	Penggunaan Beberapa Jenis Pupuk Daun Dan Jenis Bahan Wadah Pada Fase Pembungaan <i>Phalaenopsis</i> Sp.	Astutik, Astri Sumiati, I Made Indra Agastha dan Sutoyo	2022	Type of container and concentration of leaf fertilizer. The type of planting media and type of fertilizer and the concentration of fertilizer solution given greatly determine the productivity of the orchid flowers produced
5.	Pengaruh Ems Dan Paklobutrazol Terhadap Pertumbuhan Dan Pembungaan Krisan ( <i>Chrysanthemum Morifolium</i> ) Di Dataran Rendah	Ryan Dwiky Atikabudi, Sukendah, Widiwurjani	2022	mutagen Ethyl Methanesulfonate (EMS), ZPT Paklobutrazol, the interaction of EMS treatment and paclobutrazol concentration on the time of bud emergence and the time of perfect blooming. The combination treatment of EMS + paclobutrazol concentration of 200 ppm proved to be the best interaction result at the time of flower bud emergence
6.	Respon Pembungaan <i>Turnera Subulata</i> Terhadap Intensitas Penyinaran Dan Macam Pupuk P	Umi Kusumastuti Rusmarini1, Lilik Eko Mardiyanto	2021	intensity of illumination and length of illumination or photoperiod. The intensity of illumination and the provision of P fertilizer can accelerate the flowering of <i>Turnera subulata</i> plants. The increase in the number of flowers formed is supported by good vegetative growth.
7	Pengaruh Pupuk NPK 16-16-16 Mutiara dan EM4 (Effective Microorganisms4) Terhadap Pertumbuhan Varietas Tanaman Buah	Raihan Saputra, AdiMuliawan	2023	The significant effect of NPK 16-16-16 Mutiara and EM4 fertilizers on the growth of fruit plants
8.	Respon Pertumbuhan Vegetatif dan Pembungaan Tanaman Cabai Merah Keriting ( <i>Capsicum annum L. cv. Jacko</i> ) pada Aplikasi	Endang Saptiningsih, Ardiyanti, Sri Widodo Agung Suedy, Sri Darmanti	2024	BAP and GA3 hormones. a The application of BAP and GA3 concentration ratio significantly increased the number and length of lateral branches, leaf area, and accelerated the time of flower

	Rasio Konsentrasi BAP dan GA3 Setelah Pemangkasan Pucuk			emergence compared to the control. Treatment with a concentration ratio of BAP 0 ppm: GA3 100 ppm and BAP 200 ppm: GA3 100 ppm gave the best results in vegetative growth and accelerated flowering.
9.	Pemberian berbagai Konsentrasi Hormon Giberelin terhadap Pertumbuhan dan Pembungaan Tanaman Kenikir ( <i>Cosmos sp.</i> )	Fiko Dalili Sharfina, Yuliani	2023	Gibberellin Hormone. Giving various concentrations of gibberellin hormone affects the growth and flowering of kenikir plants. The optimal concentration in increasing the growth and flowering of kenikir plants is 800 ppm with an average number of flowers of 156.80 florets, a flower diameter of 3.38 cm, and an average flowering time of 41.2 HST.
10.	Pengaruh Bahan Tanam Dan Pemberian Paclobutrazol Terhadap Pertumbuhan Dan Pembungaan Tanaman Hortensia ( <i>Hydrangea Macrophylla</i> )	Dwinesa Aprinda Nawahepta, Nora Augustien K., Sutini	2022	Planting material, Paclobutrazol. The best combination treatment was obtained in the treatment of planting material 1 leaf field and paclobutrazol concentration of 400 ppm (B1P4) which was able to produce the fastest flower formation time with an average of 21.00 HST.
11.	Pengaruh Paklobutrazol dan GA3 terhadap Pertumbuhan dan Pembungaan pada Tanaman Cabai ( <i>Capsicum annum L.</i> )	Rahma Adilah, Rochmatino, Lucky Prayoga	2020	administration of paclobutrazol and GA3 affects the growth and flowering of chili plants. Paclobutrazol with a concentration of 250 ppm and GA3 with a concentration of 50 ppm are the best concentrations for growth and flowering in chili plants.
12.	Efektivitas Plant Growth Promotion Rhizobacteria (PGPR) dan Pupuk NPK terhadap Pertumbuhan dan Pembungaan Tanaman <i>Aster ericoides</i> ( <i>Symphyotrichum ericoides</i> )	Sitawati1, Murti Binary Sintawati, Sisca Fajriani	2022	PGPR Application Treatment gave higher number of flowers compared to without PGPR application. The response of Aster plants to NPK and PGPR Fertilizer application with concentrations of 10 ml L-1 and 20 ml L-1 showed a sigmoid trend where NPK fertilizer application at a certain dose could increase to reach the optimal point and decrease with the addition of NPK dose.
13.	Pengaruh Berbagai Konsentrasi Eco Enzyme dan Pinching Terhadap Pertumbuhan dan Pembungaan Tanaman Pacar Air ( <i>Impatiens</i> )	Poppy Rizky Damayanti, Cicik Udayana, Sitawati	2023	There is an interaction between the provision of eco enzyme and pinching on all variables of growth and flower production of water hyacinth plants. The provision of eco enzyme at a concentration of 10

	hawkeri Bull) Pada Vertical Pipe			ml.l-1 with double pinching gives a result of 2.95 times more flowers.
14.	Studi Pembungaan Pada Tanaman Tanjung (Mimusops Elengi) Di Persemaian Fakultas Kehutanan Universitas Lambung Mangkurat	Wildani Syahri Ramadhan, Adistina Fitriani, dan Yusanto Nugroho	2022	The intensity of sunlight will affect the efficiency of photosynthesis of a plant depending on the position or location of the tanjung plant. The number of flower candidates will be greater on large and numerous branches.
15.	Respon Pertumbuhan Dan Pembungaan Anggrek Dendrobium Salaya Pink Terhadap Beberapa Jenis Pupuk	Fatimatuz Zuhro, Lila Maharani, dan Hasni Ummul Hasanah	2024	Nutrigan organic fertilizer and Ekoenzim fertilizer gave the best effect on the number of leaves, while Ekoenzim fertilizer gave the best effect on the number of flowering plants.

## Discussion

Based on the literature review that has been conducted, it is known that there are several factors that influence the ability and determinants of flowering in plants. Factors that can influence the ability and determinants of flowering are temperature, humidity, plant regulators, photoperiod, fertilizer, Paclbutrazol, eco enzyme and pinching.

In dragon fruit plants, it is known that temperature and humidity are factors that influence flowering. This is in accordance with the statement (Lestari et al., 2024) which states that temperature and humidity greatly affect the dragon fruit cultivation process, especially in the flowering and fruiting phases of dragon fruit. The best temperature in the flowering stage is 20°C-30°C. Meanwhile, when the temperature is too high or too low, it can inhibit the process of flower and fruit formation. The optimal humidity at the flowering stage is 70-80% humidity. Sofyan, et al, (2022) also stated that flowering time is also influenced by environmental factors such as duration of exposure, light intensity and temperature. Based on the results of observations made, it is known that temperature and humidity have an inverse effect, namely if the temperature is high, the humidity is lower and vice versa. Temperature and humidity not only affect the flowering stage but also affect the number of blooming flowers.

Plant flowering is influenced by the intensity of light and the length of light or photoperiod. However, light intensity also has a greater influence and its effects are more consistent than photoperiod. Reducing light intensity will reduce flower initiation. This is in accordance with the results of research on turnera subulata plants which state that light intensity will affect the rate of photosynthesis as a source of energy for the flowering process, while nutrients in the soil provide energy and materials for the formation and development of flowers (Rusmarini et al., 2021). At the flowering stage of dragon fruit, the factor that also influences it is the need for fairly long light during its growth period. The flowering of dragon fruit plants also requires sufficient nutrients for the flower development process (Lestari et al., 2024).

The number of prospective flowers and the flowering process are not always influenced by the intensity of sunlight. As in tanjung flower plants, the number of prospective flowers of tanjung plants is influenced by differences in the size of tree branches and the number of leaves. As is known based on research conducted by (Ramadhan et al., 2022) The intensity of sunlight obtained in the northern part is also greater compared to the intensity of light in the east, south and west, which is caused by several factors, namely in the eastern part the morning sunlight emitted by the plant is blocked by larger trees. This causes the number of potential flowers in

northern plants to be higher or more because they have larger branch sizes (Ramadhan et al., 2022).

The next factor that can affect flowering is Paclobutrazol. It is a plant growth regulator that can inhibit vegetative growth in plants and thus lead to generative growth. (Atikabudi et al., 2022) stated in their research on chrysanthemums that a concentration of 200 ppm paclobutrazol was the best interaction result at the time of flower bud emergence (75.55 HST) and the time of full bloom (46.23 HST). Then in the observation of hydrangeas (Nawahepta et al., 2022) the best combination treatment was obtained in the treatment of leaf meadow planting material and a concentration of 400 ppm paclobutrazol (B1P4) which was able to produce the fastest flower formation time with an average of 21.00 HST. The administration of paclobutrazol and GA3 also greatly affects the growth and flowering of chili plants (Rochmation et al., 2020). This is in accordance with the statement (Anggraini et al., 2023) which states that paclobutrazol treatment can accelerate mangosteen flowering 9.11 HAS and by giving paclobutrazol 2000 ppm/tree, this is because when plants are given paclobutrazol there will be inhibition of gibberellin biosynthesis which will then be able to increase the C/N ratio which encourages plants to be able to produce flowers and fruit. gibberellin plays a role in accelerating plant flowering through the activation of flower meristem genes by producing proteins that will induce the expression of genes that form flower organs, and also the time of administration of auxin and gibberellin affects the induction of plant flowering (Arnanto et al., 2024).

Hormones such as cytokinins (6-Benzyl Amino Purin/BAP) and gibberellic acid 3 (GA3), have an important role in regulating the growth of shoots and branches, which ultimately affects the number and size of flowers formed. Application of BAP and GA3 hormones accelerates the flower emergence period. GA application accelerates the process by activating genes that trigger flowering, while BAP contributes to the initiation of flowering by increasing gene expression. Then the results of research on kenikir plants conducted by (Sharfina et al., 2023) showed that the administration of various concentrations of gibberellin hormones affected the growth and flowering of kenikir plants. The optimal concentration in increasing the growth and flowering of kenikir plants is 800 ppm with an average plant height of 121.00 cm, stem diameter of 1.20 cm, root length of 19.40 cm, wet plant biomass of 178.40 gr, number of flowers of 156.80 florets, flower diameter of 3.38 cm, wet flower biomass of 14.86 gr, and an average flowering time of 41.2 HST.

The type of planting media and the type of fertilizer also affect the flowering of plants and the concentration of the fertilizer solution given greatly determines the productivity of the orchid flowers produced. Gandasil B is a type of foliar fertilizer that is commonly used for orchids in the generative growth phase. (Astutik et al., 2022) The ingredients contained in Gandasil B fertilizer are macro nutrients and micro nutrients that are quite complete. The macro nutrients include N (6%) : P (20%) : K (30%) and Mg (3%) and micro nutrients include Manganese (Mn), Boron (B), Copper (Cu), Cobalt (Co), Molybdenum (Mo) and Zinc (Zn), as well as vitamins for plant growth such as Aneurine, Lactoflavine, and Nicotinic acid amide. There is an interaction between the type of container and foliar fertilizer in supporting the growth and flowering of *Phalaenopsis* sp. Coconut fiber pots with Gandasil B 2 g/l fertilization are able to produce flower stalks about 7 months after being transferred into the pot and at the age of 8 months, the length of the flower stalk reaches 12 cm with the number of flower buds 2-3 buds. This is in accordance with the results of research conducted by (Zuhro et al., 2024) which shows that the application of several types of fertilizers has a significant effect on the growth and flowering of the Salaya Pink dendrobium orchid. Then research on kenikir plants, one of the factors that affects flowering is the nutrients contained in the planting medium. This

study used a mixture of soil, rice husk charcoal, and goat manure as the planting medium (Sharfina et al., 2023)

Fertilization is essential for plant growth and to obtain optimal results. PGPR application treatment produces a higher number of flowers compared to no PGPR application. The response of Aster plants to the application of NPK and PGPR fertilizers with concentrations of 10 ml L<sup>-1</sup> and 20 ml L<sup>-1</sup> shows a sigmoid trend where the application of NPK fertilizer at a certain dose can increase to reach the optimal point and decrease with the addition of NPK doses. Bacteria in PGPR are able to provide P elements that support the generative phase, flowering in plants. *Pseudomonas* sp. in PGPR is able to increase plant growth by producing growth hormones such as IAA, gibberellin, fixing and dissolving P (Sitawarti et al., 2022). The treatment of fertilizer types has a significant effect on all observation parameters. Nutrigan organic fertilizer and Ecoenzyme fertilizer gave the best effect on the number of leaves, while Ecoenzyme fertilizer gave the best effect on the number of flowering plants (Zuhro et al., 2024). Then the factor of giving fertilizer, especially eco enzyme, also greatly affects flowering. As stated by (Damayanti et al., 2023) who in their observations using water hyacinth plants stated that the interaction between the provision of eco enzyme and the pinching treatment that occurred caused an effect on the generative growth of water hyacinth plants. The provision of eco enzyme at a concentration of 10 ml.l-1 with double pinching gave a result of 2.95 times more flowers. Then the use of EM4 had a positive impact on plant growth, especially on the number and quality of inflorescences and fruits (Putra et al., 2023)

## **Conclusion**

Based on the literature review that has been carried out, it can be concluded that the factors that can influence the flowering stages in plants are internal factors and also external factors from the plant, where these factors are interrelated, in the mechanism of the flowering stages themselves.

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