

Phenology of *Cinnamomum cullilawan*

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Abstract

Abstract *Cinnamomum cullilawan* is one type of forest plants that is included in the type of aromatic plants. The purpose of this study was to determine the flowering development process as a basic information for the development and the breeding of this plant. The method used in this research was a descriptive method. The results of the observations indicated that the process of flowering *C. cullilawan* can be grouped into three major parts: the stage of initiation, budding and flowering, where each stage requires different formation times. At the initiation stage, since the emergence of generative shoots on the armpit until the formation of panicles takes two months. Furthermore, the stage of the appearance of buds at the ends of panicles and the formation of reproduction of flowers required two months period. After that the flowers will break slightly and then the petals will turn black and fall in the second week, after the flower process has blossomed.

Keywords: *Cinnamomum cullilawan*, fenology, flowering, initiation

Introduction

Phenology is a phase of flower formation which is one of the developmental processes in higher plants. This process of change is often known as floral evocation, where the flower parts will differentiate from the vegetative phase to the reproductive phase. This development is certainly different in each species.

Cinnamomum is a genus of forestry plants from the Lauraceae family which is included in the type of aromatic plant. Sein and Mitlöhner (2011), said that the Lauraceae family has the characteristics of trees with bark to twigs containing essential oils. Heyne (1987) further stated that *Cinnamomum* consisted of 8 species namely *C. burmanii* BL., *C. camphora* Nees & Eberm., *C. casia* BL., *C. javanicum* Bl., *C. parthenoxylon* Meissn., *C. sintok* Bl. ., *C. zeylanicum* Breyn and *C. culilawan*. In Indonesia, the distribution of these species is uneven, as *C.culilawan* is only found growing and developing well in the Maluku Islands and Papua.

The potential of *C. cullilawan* in Papua is currently decreasing, this is indicated by the increasing difficulty of this plant being found in the field. The hunting of this species to be processed into oil and also the clearing of forest areas to clear roads for isolated areas and also the expansion of territories in Papua, make this species increasingly difficult to find. This species is much sought after by the public because of the value of the oil extracted from the bark of this plant is useful as aromatherapy, is also used as a warm rubbing oil, as well as a mixture of several medicinal herbs. Thus,

to overcome the scarcity of this plant, it is necessary to develop various efforts for the cultivation of *C. culilawan* plants.

The growth and development of plants is very dependent on the conditions in which the plants grow, as well as climatic and weather factors that can trigger the flowering process (Kumar et al., 2014; Siburian *et al* 2020; Mundoni and Siburian, 2019). This also greatly affects every phase of the development of plant parts. Even in some types of plants, the stages of the flowering process require certain environmental conditions to be able to form flowers. In this regard, research on the stages of development of *C.culilawan* flowers needs to be carried out as basic information needed for the development and breeding techniques of this plant in the future.

Research methods

This research was carried out at the beginning of the flowering period of *C.culilawann* in the Faculty of Forestry, University of Papua. The observed tree has a branch-free height of 3 meters with a total tree height of 8.5 meters, and a tree diameter of 12 cm. This research was conducted in early January to May 2019 at the Faculty of Forestry Campus, Papua Manokwari University.

The tools needed in this research are camera, ladder and writing utensil. While the object in this study is the flower of the *C.culilawan* tree where the diameter of the tree trunk observed is 38 cm.

Observation Stage

1. Observations were made on productive branches which were marked by the appearance of flower stalks.
2. Observations were made based on the criteria used by Jamsari *et al* (2007) with several modifications, namely (1) initiation stage (2) small bud stage (3) large bud stage. For this reason, at each stage an observation limit is made to facilitate observation (Table 1). The data is then described and documented.

Table 1 Stages of flower and fruit development of *C. cullilawan*

No	Stages	Description
1	Initiation	The emergence of buds on the flower stalks will appear until the appearance of small flower buds
2.	Bud	At this stage the flower parts begin to form like small buds, until the appearance of the petals that begin to develop.
3.	Flowering	The petals begin to open until all parts of the flower are formed, until the gunga changes color and the petals fall.
4.	Ovary	When the flower petals begin to turn black and shrivel and then fall, the end of the fruit will appear in the petals
5.	Mature fruit	The development of the fruit to start from small light green to dark green until the fruit turns dark purple, which indicates the fruit is ripe.

Results and Discussion

The results showed that the stages of development of *C. cullilawan* flowers in this study showed some rather specific characteristics at each stage, both in terms of color and size.

Initiation Stage

The stages of flower development begin with the formation of generative buds or flower primordia buds (reproductive meristem apex) in the leaf axils, where this process lasts approximately 2 months. Syamsuwida, 2012 said that flower initiation in the mindi species occurred for 3 months, even in the *Shorea stenoptera* species this process lasted for 6 months (Owen and Ogutu, 2013).

At the initiation stage where the floral meristem will form several parts that will differentiate into flower parts, the plant must reach a certain vegetative phase (maturity & ripeness to flower) and change to a reproductive phase. In part this change is often referred to as floral evocation. The length of each phase of vegetative change is highly dependent on each species, where each plant takes a different time to reach the ready-to-flower phase.



Figure 1 The initiation stage of the flower panicle of *C.cullilawan*

Bud Stage

At this stage the flower panicles begin to develop, where the type *C. cullilawan* has the type of compound interest. Small buds begin to appear at the ends of the flower panicles. This process lasts for one week, which is followed by bud development. Where the size of the flower buds will appear to start to grow. Sandip *et al* (2015) stated that in the development process the size of the flower buds began to enlarge, at that stage the formation of ovaries and flower reproductive organs would occur, as shown in Figure 2.




Figure 2 Stages of *C.culilawan* flower bud development in panicles




Flowering

C. culilawan flower buds then develop into mature flowers, followed by an increase in flower panicle size. Changes in color can be seen starting from a light green color to a yellowish white color. Next the flowers begin to bloom, by opening them a little flower petals. The blooming of *C. culilawan* flowers occurred almost simultaneously both at the base of the panicle and at the tip of the panicle. The average number of flowers in each panicle is between 30 and 50 flowers. The stages of development of flower morphology *C. culilawan*.

Based on observations during the development of *C. culilawan* flowers, environmental conditions where plants grow, such as rainfall, wind speed, and humidity, greatly affect the process, in addition to plant genetic factors (Siburian *et al*, 2019, Wabia and Siburian, 2019). This can be seen from the number of flowers at the beginning of the observation until the end of the observation, which experienced a very large reduction, especially in March and April, where there were quite a lot of rainy days at the time of the observation.

Table 2 Flower Morphological Development Process

No	Picture	Duration	Information
1		1 week	<ul style="list-style-type: none"> • Flower buds are starting to appear • The number of flowers in one stalk of observation is 23

No	Picture	Duration	Information
2		3 weeks	<ul style="list-style-type: none"> • Fresh flowers begin to appear with white petals and there are sepals • The number of flowers in one stalk of observation is 20
3		5 weeks	<ul style="list-style-type: none"> • The flower petals turn blackish white • The number of flowers in one stalk of observation is 15
4		8 weeks	<ul style="list-style-type: none"> • the petals are missing and only the sepals are left • The number of flowers in one stalk of observation is 15

Conclusion

Flower development of *Cinnamomum culilawan* Blum. lasts for four months, starting from the initiation stage, flower buds, flowers, with a different time span at each stage. The stages of flower development are strongly influenced by the climate of the area where the plant grows.

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