

Fenologi pembungaan dan pembuahan *Acer laurinum* (Sapindaceae) di tapak konservasi *ex-situ*

Flowering and fruiting phenology of *Acer laurinum* (Sapindaceae) at ex-situ conservation site

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Abstrak. Hidayat IW, Suhendri Y. 2020. Fenologi pembungaan dan pembuahan *Acer laurinum* (Sapindaceae) di tapak konservasi *ex-situ*. *Pros Sem Nas Masy Biodiv Indon* 6: 525-529. *Acer laurinum* (Sapindaceae) merupakan spesies tumbuhan pohon yang terancam dengan status beresiko rendah. Sejauh ini, informasi mengenai siklus perkembangan mengenai pembungaan dan pembuahan spesies ini sangat sedikit diketahui. Seiring dengan meningkatnya kerusakan di habitat alamnya, tidak mengherankan bila di masa depan statusnya akan semakin terancam. Oleh karena itu, diperlukan studi tentang siklus fenologi spesies ini untuk tujuan perkembangbiakan selanjutnya. Dalam rangka mendapatkan pengamatan yang berkelanjutan dan berurutan, maka pengamatan fenologi pembungaan dan pembuahan dilakukan di tapak konservasi *ex-situ*. Iklim mikro pada siklus tersebut juga diamati, untuk mengetahui pengaruhnya terhadap fenologi pembungaan dan pembuahan. Studi dilakukan pada spesimen pohon *A. laurinum* yang ditanam pada 1986 di Kebun Raya Cibodas Cianjur, Jawa Barat, dengan menggunakan analisis kuantitatif deskriptif berdasarkan observasi eksploratif-inventarisasi data fase pembungaan dan pembuahan dan kondisi iklim mikro yang diukur dari 2014 dan 2015. Hasil pengamatan menunjukkan bahwa pembungaan dan pembuahan terjadi di awal, Januari hingga April, dan pada akhir tahun, September hingga Desember, seiring dengan tingginya level hujan pada periode tersebut. Meskipun unit iklim mikro lainnya juga berubah dinamis, tetapi tidak berpengaruh terhadap perkembangan bunga dan buah. Dengan demikian disarankan pengumpulan buah dan penyetakan ulang dilakukan pada periode tersebut agar mendapatkan hasil yang maksimal.

Kata kunci: *Acer laurinum*, fenologi pembungaan dan pembuahan, kondisi iklim mikro, konservasi tumbuhan *ex-situ*

Abstract. Hidayat IW, Suhendri Y. 2020. Flowering and fruiting phenology of *Acer laurinum* (Sapindaceae) at ex-situ conservation site. *Pros Sem Nas Masy Biodiv Indon* 6: 525-529. *Acer laurinum* (Sapindaceae) is a threatened tree plant species with least concern (LC) status. There is only limited information regarding the phenology of flowering and fruiting of this species. Along with the increasing damage to its natural habitat, not surprisingly, in the future, this status will be more threatened. Therefore, it is necessary to study the phenology cycle of this species for the purposes of further development. In order to achieve a continuous and sequenced observation, the study was conducted in a built environment, one of an ex-situ plant conservation site. Furthermore, the study also conducted to analyze the effect of the microclimate on this cycle. The study conducted with *A. laurinum* tree specimen planted in 1986 at Cibodas Botanic Gardens, Cianjur, West Java. The study used descriptive quantitative analysis based on the exploratory-inventory observation of flowering and fruiting phase data, and the microclimate conditions assessed from 2014 to 2015. The results showed that the flowering and fruiting occurred from early January to April, and at the end of the year, from September to December, along with the high level of precipitation of the periods. Even the other microclimate units also dynamically changed, but there were no significantly affected the flowering and fruiting phenology. The results suggested that these periods can be conducted seeds harvesting and (re)stock in order to achieve maximum results.

Keywords: *Acer laurinum*, ex-situ plants conservation, flowering and fruiting phenology, microclimate conditions

INTRODUCTION

Many studies represent that one-fifth of plants species worldwide are respected at risk of becoming extinct in the wild (Pimm and Raven 2017). Based on the arising impacts of climate change forecast unprecedented risk and the values of endangerment, traditional conservation assessment (e.g., habitat protection and management) alone will not likely be able to avoid the species extinction. The existence of wild plants in their ecosystem getting

overpressed. The extant habitats of a growing number of species are becoming less viable for their survival for a variety of reasons, including global warming, disease, drought, fragmentation, and deforestation (Braverman 2014). Along with the increasing damages and pressures to its natural habitat, not surprisingly, in the future, many plant species will more be threatened.

One of tropical trees is being threatened in the wild is *Acer laurinum* (Sapindaceae). *A. laurinum* or maple tree or *Dadap putih* is a 'least concern (LC)' tree species based on

conservation status of IUCN (IUCN 2019). This species is widespread from India to southeast Asia (Figure 1). It is native to India, Cambodia, Myanmar, Nepal, Malaysia, Thailand, Viet Nam, China, Lao PDR, Indonesia, and the Philippines (Noorsiha 2004; Tingzhi et al. 2008). Within China the species is widespread and present in Guangxi, Hainan, Xizang, and Yunnan. It grows in evergreen forest scattered at 700 to 2,500 m asl with the habitat type of forest. Population density varies widely across the species range. It is considered uncommon in some parts of Sumatra and Borneo as the forest is not truly seasonal but is more abundant throughout the rest of its range and in areas of montane, peat swamp, and limestone forest. In Sarawak, the species is locally common (Noorsiha 2004). In the Flora of China considers this species 'relatively rare' (Tingzhi et al. 2008). This tree commonly used and traded locally for construction or structure materials and for other household goods (IUCN 2019).

There is no current information about the population trend (IUCN 2019). There was some recent information about the existence of *A. laurinum* in some protected areas of Java (Sulistyawati 2012; Hakim and Miyakawa 2015), but lack of its population and the trend records. There are no specific threats to the species. However, it occurs within a region suffering a high rate of deforestation, logging, and land conversion. At present, it still does not know the extent to which this affects this species (IUCN 2019).

In order to support the conservation efforts of this species, it needs to gather information of flowering and fruiting phase phenology of *A. laurinum*, which used in the future to plan seed collection and to produce a mass seedling. There are several reasons to construct the phenological calendar i.e., to unravel data about the ecosystem functioning; to obtain data for crop seasonality and to do farm work in the right season; to observe the relation between temperature or other abiotic factors with phenology; to support conservation of other species related with the plants observed; to determine the proper time for plant seed collection, etc. (Sulistyawati 2012).



Figure 1. Geographic of *A. laurinum* (Source: IUCN 2019)

Comprehensive phenology of a species is a hard and costly conducted in the wild. Then, this study conducted in an ex-situ plant conservation, Cibodas Botanic Garden (CBG). CBG as one Indonesian botanic gardens has conducting ex-situ plant conservation, especially for mountainous tropical plants. This study aimed to describe the flowering and fruiting phase phenology of *A. laurinum* from 2014 and 2015 and to analyze the effect of the microclimate related to the cycle. The exploratory observation conducted to *A. laurinum* tree specimen that planted in 1986. The study expected can be supporting the conservation efforts of *A. laurinum*, especially the periods of seeds harvesting and (re)stock for further propagation needs. This is an important effort to cultivate this species as a part of species introduction in the conservation frameworks.

MATERIALS AND METHODS

Study area

The study was conducted at CBG, Cianjur, West Java. CBG is located at 107° 0' 10.476" E to 107° 0' 59.275" E and 6° 44' 6.787" S to 6° 44' 51.112" S. The location is mountainside of mount Gede Pangrango, at an altitude of approximately 1,300-1,425 meters above sea level, with an area of 84.99 hectares (Widyatmoko et al. 2010). The average temperature is 20 °C, humidity of 80.82%, and average precipitation of 2,950 mm per year (Registration Unit-CBG 2018).



Figure 2. *A. laurinum* tree of CBG as the subject of the study (Photograph by Habibulloh)

The subject of study was three specimens of *A. laurinum* tree. These trees planted in the garden on February 1st, 1986. The specimens morphology are relatively uniform, 10 to 11 meters height with diameter of breast height 28.5 to 39.2 cm and canopy diameter 7.65 m to 8.5 m (Figure 2).

Methods

Data acquisition

Collected databased were consisted two main data, microclimates series data (i.e., temperature, humidity, precipitation) and information of flowering and fruiting phenology of *A. laurinum*. All the data were recorded and collected from 2014 to 2015. Microclimates data were collected from the weather station established at CBG. Weather equipment used was *Precision Weather Station Davis Instruments Vantage Pro2 Plus™*. The equipment was automatic constantly sent current data to the server regarding microclimates condition of CBG. The observation equipment was located in front of management office of CBG. The collected data were accurate to describe weather conditions surrounding equipment minimum in a radius of the one-kilometer square.

The second data was flowering and fruiting phenology of *A. laurinum*. This reproductive study conducted by documenting observations of the frequencies of flowering and fruiting events (Hatta et al. 2005). The reproductive growth stages consist: (i) flower buds, (ii) flowering, (iii) young fruits, and (iv) ripe fruits. These events documented based upon the following five different categories: Rank 5 is defined by more than 80% of flowering or fruiting (abundant); Rank 4, flowering or fruiting on 60 to 80% (moderately abundant); Rank 3, flowering or fruiting on 30

to 60% (moderate); Rank 2, flowering or fruiting less than 30% (rare), and Rank 1 without flowering or fruiting, 0% (nothing) (Hatta et al. 2005).

Data analysis

The microclimates series data are presented such quantitative-descriptively. Then, in order to resolve the differences among data, both in value and unit, the number will be transferred in natural logarithm, $\ln(x_i)$. The amount of variation of series data, it used a standard deviation (σ). A low σ indicates that the data points tend to be close to the mean or less variety, while a high σ indicates that the data are spread out over a wider range of values or much variety. The reproductive stages of *A. laurinum* are presented through a monthly time-series based on the rank of each phase of reproductive growth. All the collected data were shown in a graphic form.

RESULTS AND DISCUSSION

Based on data series from 2014 to 2015, microclimates data and reproductive stages of *A. laurinum* at CBG were described below. There was a dynamic value trend both in month and year.

Microclimate characteristics of Cibodas

Microclimates series data of CBG from 2014 to 2015 were details presented in Figure 3. Nevertheless, at several times occurred errors either in the weather equipment or the server, so these can't be recorded. Unrecorded data were precipitation of January 2014, and temperature-relative humidity-precipitation of March to November 2014.

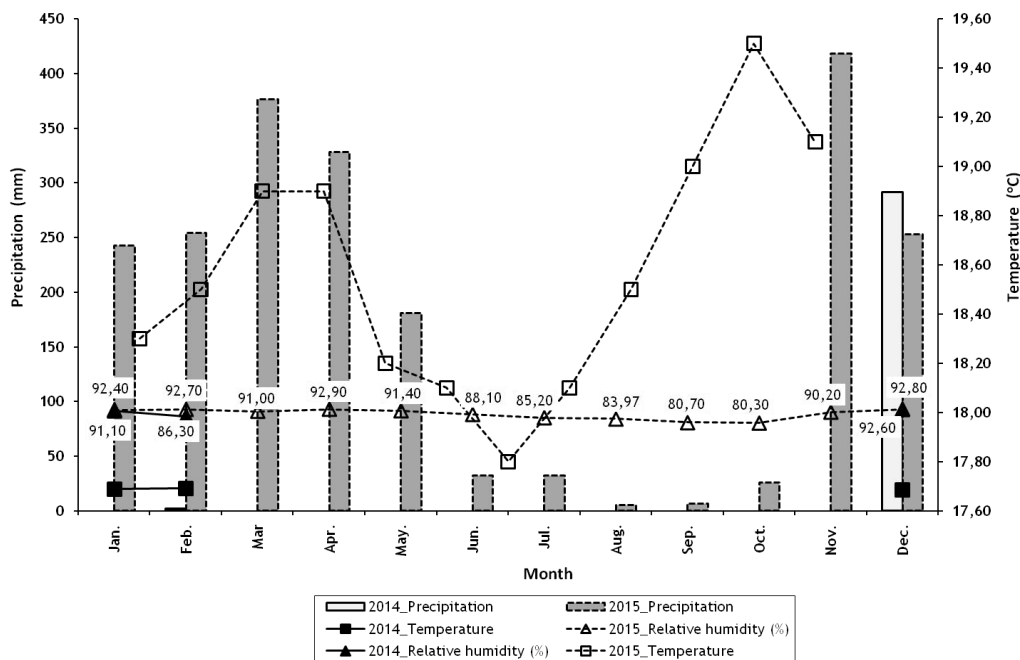


Figure 3. Microclimates series data record of CBG from 2014 to 2015. (Note: Solid line indicates 2014 data and broken line indicates 2015 data. Rainfall (bar graph), relative humidity (triangle; and number), and temperature (rectangle) are shown).

Table 1. Standard deviation (σ) value of the normalized microclimates unit

Microclimates unit	σ value of the normalized microclimates unit, $\ln(x_i)$
Temperature	0.04
Humidity	0.05
Precipitation	1.81

Based on microclimates series data from 2014 to 2015, the unit which has the widest amplitude was precipitation ($\sigma = 1.81$), and the others have a minor variety (Table 1). This was suspected because of the location of CBG in the elevation of the mountain with wet tropic zone characteristics (Underwood et al. 2014). The temperature

and relative humidity less diverse. Heavy rainfall (≥ 100 mm per-months) occurred in early and ends of the year (wet season) given a significant variant of microclimates condition surrounding CBG. The number of wet months more than dry months, between seven to eight months per year, and accumulatively above 1,000 mm annual rainfall (Mueller-Dombois and Fosberg 2013; Corlett 2014). Based on Schmidt-Ferguson classification, CBG was the type of C to B, or less wet to wet, and based on Koppen, it can be included in rainy tropical climates or wet tropic 'Am'.

Heavy rainfall has occurred at early-end of the year, and along with this, solar radiation decreased. This can be understood when heavy rainfall occurred, cloud cover very thick so that prevent solar radiation penetrations. Furthermore, rainfall occurred closely related to air pressure differences, bigger differences will give a bigger chance for occurrence of rain.

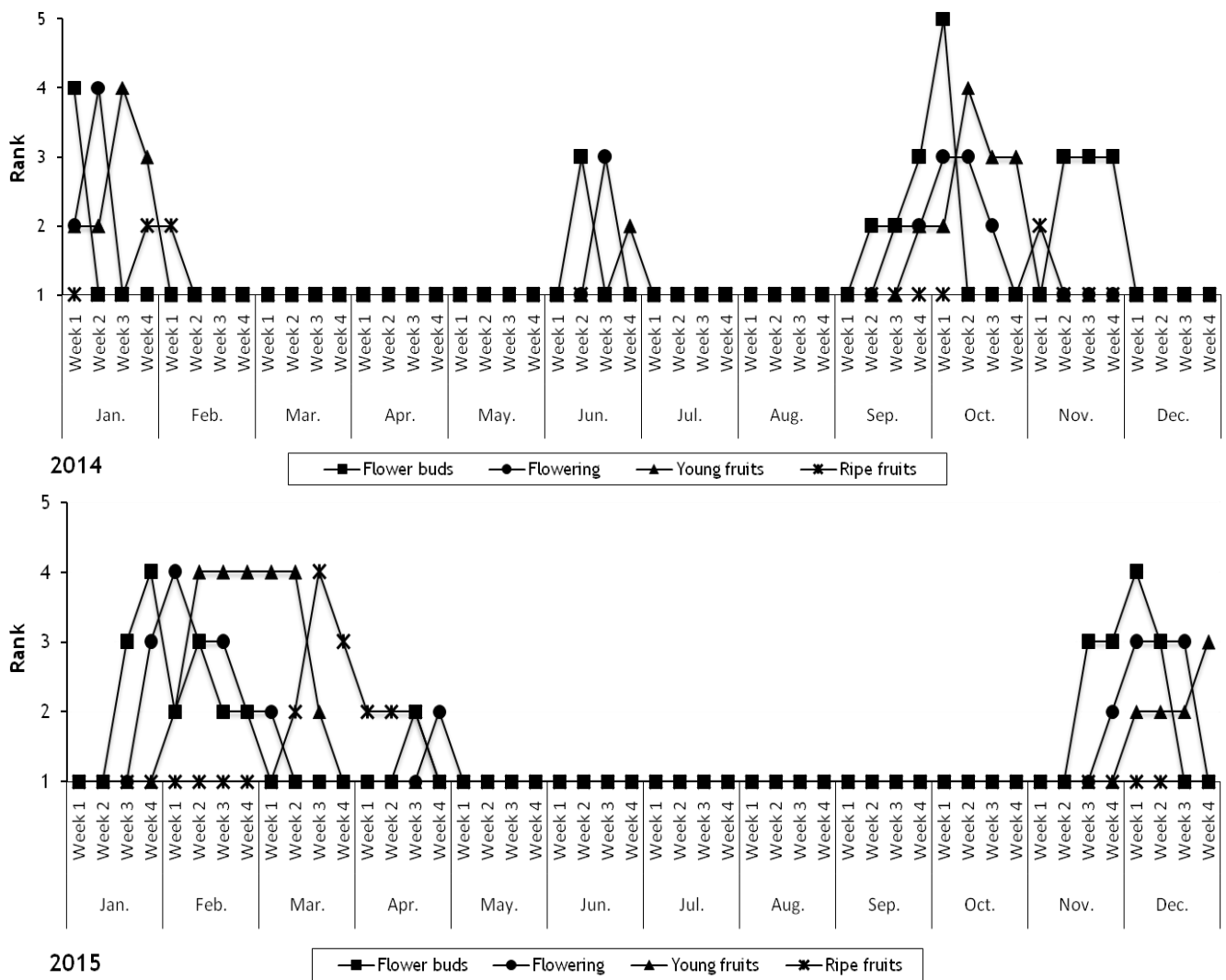


Figure 4. Flowering and fruiting phenology of *A. laurinum* at CBG during 2014 and 2015

Flowering and fruiting period of *A. laurinum* in Cibodas

Based on the observation inventory, there were slight differences in the period between 2014 and 2015 (Figure 4). In 2014, the sequence of the arise of flower buds to ripe fruits occurred in the early year in a shorter time. The period begins in the first week of January to the second week of February 2014, approximately only a month. On the other hand, in 2015, the period of the sequence was longer. It begins in the third week of January until the fourth week of April, almost three and a half months. This assumed caused by the condition of rainfall in early 2015 at relatively high, which occurred from January to May (≥ 100 mm per-months).

In June 2014 has also occurred a slight development of the reproductive stage, but only resulted in immature fruits. This condition assumed caused by the low level of rainfall or included in a dry month (≤ 50 mm per month). Next, in the second week of September 2014, *A. laurinum* of CBG begins to develop the flower buds and more growth into flower and fruits in the next weeks until the fourth week of November. In 2015, the reproductive growth of *A. laurinum* was a little shift. It begins in the third week of November and continuing to grow to generate fruits until the end of the year. This also assumed that the level of rainfall affected the flowering and fruiting phase of *A. laurinum*.

The development of a flowering and fruiting period of *A. laurinum* at CBG evidently has a different from the species in the nature habitat. Based on Sulistyawati et al. (2012), although not specifically observing the development of the phenology of *A. laurinum*, but they note that *A. laurinum* found in the Mount Papandayan Nature Reserve begins to develop the flowering in July of 2010. But they were also inventoried that in that month, the level of rainfall at a high volume (≥ 200 mm per month). This further strengthens the presumption that the level of rainfall conditions are thought to have an influence on the development of flowering and fruiting of *A. laurinum*.

There are a number of factors, which may influence the timing of flowering and fruiting including rainfall, moisture, temperature, and photoperiod (Anderson et al. 2005; Kikim and Yadava 2001; Gunter et al. 2008). It seems that the pattern of fruiting and flowering in this study may coincide with the fluctuation of rainfall. Some species also showed similar patterns such as *Mangifera indica* (Makhmale et al. 2016), *Barringtonia acutangula* (Nath et al. 2016), and *Bauhinia variegata* (Dutta and Devi 2015). During the relatively high rainfall months (wet season), the intensity of *A. laurinum* producing flower and fruit were high. The precise timing of flowering and fruiting could be site-specific (Anderson et al. 2005; Kikim and Yadava 2001; Gunter et al. 2008).

Results of this study suggested that seed harvesting of *A. laurinum* can be conducted during peak fruiting seasons (early and the end of the year). Seeds harvesting and (re)stocking are an important effort to cultivate this species as a part of species introduction in the conservation frameworks.

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