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by Gunawan .

Submission date: 26-Sep-2021 08:34PM (UTC+0700)
Submission ID: 1657672219
File name: article_Gunawan_PDWM.pdf (561.53K)
Word count: 3281
Character count: 18172

DOI 10.18551/rjoas.2021-09.13

AUTECOLOGY AND DISTRIBUTION PATTERN OF BACCAUREA MACROCARPA IN SOUTH KALIMANTAN OF INDONESIA

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ABSTRACT
Baccaurea macrocarpa is an underutilized plant, which has potential as a medicinal plant. However, a little information known about this plant, especially on microhabitat and distribution pattern. This study is the first to reveal the microhabitat dan distribution pattern of *B. macrocarpa* in South Kalimantan. This study used purposive sampling method by exploring the area where *B. macrocarpa* commonly found. Distribution was analyzed used Morishita index and the microhabitat analysis was performed using Principal Component Analysis (PCA) generated from Minitab 16 software.

KEY WORDS
Baccaurea macrocarpa, PCA, microhabitat, distribution pattern.

Indonesia is a country rich in biological resources including fruits (Susilawati et al, 2021). Almost every region has local fruit, but its development and utilization are not yet optimal. Kalimantan is one of the big islands in Indonesia which has a wet tropical forest area with a high level of diversity. Kalimantan is also one of the centers for the diversity of the Baccaurea genus, with 25 species of Baccaurea found in Kalimantan (Haegen 2000). Genus of Baccaurea is a group of plants that produce fruit, but its existence is not as popular as other fruit plants. Besides being taken as fresh fruit and wood as building materials, members of genus Baccaurea have been used by the lokal community in Kalimantan as medicinal plants to treat several diseases, including constipation, swelling of the eyes, arthritis, abdominal pain, facilitating menstruation and urination (Ullah et al. 2012; Lim 2012; Usha et al. 2014; Goyal et al. 2014; Gunawan et al. 2016).

Baccaurea macrocarpa or known as "Kapul" is one of the endemic fruits in Kalimantan, contains potential phytochemical compounds. Previous studies have obtained information that the methanolic extract of *B. macrocarpa* fruit contains secondary metabolites in the form of saponins, flavonoids, and alkaloids. The extract has the antioxidant activity of IC50 33.11µg/mL (Tirtana 2013). The methanol extract and the skin fractions of *B. macrocarpa* contain broad-spectrum antibacterial properties because they can inhibit the growth of *Staphylococcus aureus*, a gram-positive bacterium, and Escherichia coli, a gram-negative bacterium (Yunus et al. 2014). Phytochemical analysis of the research results of *B. macrocarpa* fruit contains alkaloid compounds, saponins, and flavonoids (Pardede 2020), antibacterial (Norhayati 2019), antioxidant (Bakar 2014). In addition, *B. macrocarpa* leaves also contain antibacterial (Zamzani 2019). Likewise, the skin of the fruit also contains anti-bacterial (Yunus et al. 2014). Local people in Kalimantan are more familiar with this fruit for various natural remedies to facilitate menstruation, abdominal pain, facilitate urine, and as a treatment for constipation (Gunawan et al. 2016).

B. macrocarpa is threatened by illegal logging which reduces its population in nature. Until now there is no information on the conservation status of this pnat listed in the International Union for Conservation of Nature (IUCN). However, based on observations at

the research site, many habitats have been converted into plantations, housing, and roads. Conservation efforts can be started through autecological studies and data collection on the distribution of star fruit. Autecologic studies have an important role in understanding a species, providing information on the relationship between environmental factors and vegetation composition and the presence of a species in a particular habitat. Research on the distribution and ecological interaction of red star fruit with its environment has never been reported.

Autecological studies have an important role in understanding a species, explaining the structure and dynamics of a community (Botanri 2010). Autecological studies can also provide information on the relationship between environmental factors and vegetation composition and the presence of a species in a particular habitat. Autecological studies on individuals of each species can examine plant identity, plant morphology, plant associations, plant utilization, and environmental factors around plants (Botanri 2010). The distribution pattern is a characteristic of a plant that lives in a particular habitat. The distribution of a plant is closely related to the biological and environmental factors of a species (Sofiah et al. 2013). Information on the distribution and microhabitat of plants is needed to understand its ecology and to establish its future conservation efforts and policy (Kusuma & Astuti 2009). The aims of this study was to analyze the distribution pattern of *B. macrocarpa*, microhabitat characteristic, and abiotic factors that influence the existence of *B. macrocarpa* populations in South Kalimantan.

MATERIALS AND METHODS OF RESEARCH

Sampling was conducted in eight locations in South Kalimantan, based on information local community and local goverment (Figure 1). yang mengetahui keberadaan tumbuhan Kapul (Figure 2). Analysis Ecological data and herbarium were done in Biosistematic Laboratory of Department Biology Lambung Mangkurat University.

Data colledted was done by purposive sampling by visiting the location where possible the discovery of kapul (Rugayah et al. 2004), based on information from local people. Then made a plot with size 20 x 20 m. The number of plots made in this research amounted to 39 plots. The data recorded in each plot is the number of individuals of kapul were altitude, light intensity, humidity, temperature, soil moisture, and soil pH. The equipment used during the observation were GPS 60 Garmin (altitude), Termohygrometer Haar-Synth-Hygro, Germany (air temperature and relative humidity), Soil tester TEW Type 36, Demetra, Japan (soil pH and relative humidity), and Lux meter (light intensity).

Using Principal Component Analysis (PCA) generated from Minitab software version 16. The pattern of distribution of belimbing merah can be known based on Morishita indeks (Morishita 1959):

$$I\delta = Q\ \frac{\sum_{i=1}^{q} Xi\ (Xi-1)}{T(T-1)}$$

Where: Iδ = Indeks Morishita To-i = (i=1,2,3....0); Xi = The number of individual X each plot Q = Total plot; T = The total number of individual of a species per plot; If Iδ = 1 distribution pattern random, Iδ < 1 distribution pattern uniform, Iδ > 1 distribution pattern clumped.

Degree of Uniformity (Iδ < 1):

$$Mu = \frac{xi^2\ 0{,}975 - n + \sum xi}{\sum xi - i}$$

Degree of grouping (Iδ >):

$$Mc = \frac{xi^2\ 0{,}025 - n + \sum xi}{\sum xi - i}$$

Where: X^2 0,975 = Value chi-square from the table with db (n-1), interval 97,5%; X^2 0,025 = Value chi-square from the table with db (n-1), interval 2,5%; ∑X1 = The total number of individu of species in plot I; n = The number of plot standart Morishita degree.

Figure 1 – Sampling locatioan in South Kalimantan. TL= Tanah Laut; BN = Banjar; TP = Tapin; HS = Hulu Sungai Selatan; HT = Hulu Sungai Tengah; KB = Kota Baru; BL = Balangan; TG = Tabalong

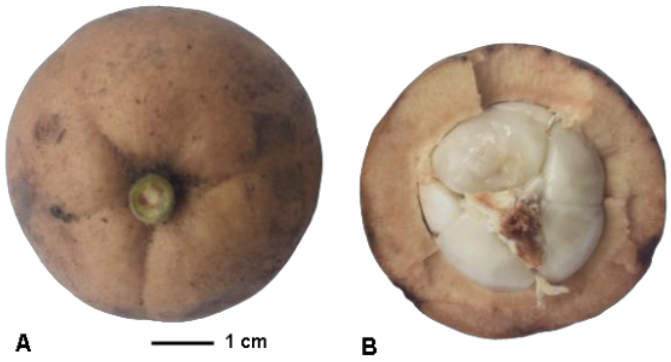

Figure 2 – Kapul (*Baccaurea macrocarpa*) A. fruit. B. Transversal section of fruit.

Standart Morishita degree (Ip):

If Iδ ≥ Mc > 1.0, then:
$Ip = 0,5 + 0,5 \frac{I\delta - Mc}{n - Mc}$

If 1.0 > Iδ > Mu, then:
$Ip = -0,5 \frac{I\delta - 1}{Mu - 1}$

If Mc > Iδ ≥ 1.0, then:
$Ip = 0,5 \frac{I\delta - 1}{Mc - 1}$

If 1.0 > Mu > Iδ, then:
$Ip = -0,5 + 0,5 \frac{I\delta - 1}{Mu - 1}$

Calculation of the Ip value will show the pattern of distribution of the dominant plant species in a community. The values and patterns of species distribution are as follows:

- Ip = 0, Plant species have *random* distribution;
- Ip > 0, Plant species have *clumped* distribution;
- Ip < 0, Plant species have *uniform* distribution.

Specimens obtained from the field were transferred to new newsprint, arranged and pressed in a bag, then dried in an oven for 2-3 days at a temperature of 50-60°C. The dried specimens were arranged on acid-free herbarium plaque paper measuring (43x30) cm2, then mounted on the specimen. Placing the specimens was done by sewing the stems/fruits or using 3M tape, then the herbarium label was affixed to the bottom right of the plaque paper with a distance of 0.5 cm from the edge (Djarwaningsih 2002).

RESULTS AND DISCUSSION

This study is the first to reveal the microhabitat and distribution pattern of the kapul (*B. macrocarpa*) plant in South Kalimantan. The calculation of the distribution pattern using the Morisita index shows that the Kapul plants in South Kalimantan are mostly scattered in groups. The distribution of all plants in nature consists of three basic patterns, namely random, regular, and clustered (Sofiah et al. 2013). This distribution pattern is thought to be related to environmental factors (micro-climate) in the habitat of *B. macrocarpa* growth and the type of plant reproduction. Plants that reproduce by seeds usually have a clustered distribution pattern. This is due to the tendency of the fruit to fall near the parent which has the same microclimatic conditions. The random distribution pattern is thought to be influenced by habitat fragmentation caused by forest conversion to roads, oil palm plantations, and rubber plantations. Climatic factors, topography, and changes in land use are factors that influence the distribution pattern of plants (Abolmaali et al. 2018).

Table 1 – Distribution pattern of *B. macrocarpa* in South Kalimantan

Location	Distribution Index	Distribution Pattern
Tanah Laut	0.0000	Random
Banjar	0.0000	Random
Tapin	0.0063	Clumped
Kotabaru	0.0000	Random
Hulu Sungai Selatan	0.0062	Clumped
Hulu Sungai Tengah	0.0000	Clumped
Balangan	0.0000	Clumped
Tabalong	0.0000	Clumped

The distribution pattern of plant species is influenced by differences in environmental conditions, resources, and competition. In addition, Guissan & Thuiller (2005); sinclair et al. (2005) stated that the distribution pattern is also influenced by humans and climate change. Information of species distribution patterns is very helpful to the success of conservation management both ex-situ and in-situ.

Abiotic factors have an important role in the growth, development, and distribution of plants. Plants will make morphological and physiological adaptations to survive in environmental conditions. According to Sofiah et al (2013), each plant species requires suitable environmental conditions to live so that the requirements of life for each species are different, where they only occupy a suitable environment for their life. Abiotic environmental factors in the form of air temperature, humidity, soil pH, soil temperature, altitude, and temperature of kapul plants are presented in Table 2. Kapul plants in South Kalimantan are mostly found at an altitude of 112-126 m above sea level, air humidity is 75-80%, temperature 29 – 30 oC, light intensity 1120 – 3207 lux, soil moisture 71 – 79%, and soil pH 6 – 6.5.

Air temperature is inversely proportional to the humidity of the air around the study site. This relationship shows that if the temperature increases, the humidity will decrease. The humidity affects the photosynthesis of plants in the form of a decrease in the rate of

photosynthesis. In addition, air temperature is one of the climatic factors that affect the growth rate and metabolic processes of plants. The variation in air temperature at the study site is caused by differences in the shade of the trees around the star fruit and sunlight. The higher the altitude, the lower the temperature generally.

Table 2 – Microclimate around *Baccaurea macrocarpa* locations

Locations	Microclimate					
	Altitude (m asl)	Humidity (RH%)	Temperature (°C)	Light Intensity (Lux)	Soil Moisture (RH %)	Soil pH
Binah Laut	60	75	29	1870-2260	72	6.3
Banjar	70	76	30	2645-3110	71	6.2
Tapin	79	79	29.5	1330-1450	72	6
Kotabaru	75	75	30	2650	71	6.4
Hulu Sungai Selatan	112	80	30	1587	70	6.5
Hulu Sungai Tengah	146	79	29	2600	79	6.3
Hulu Sungai Utara	135	79	29,5	2228	77	6
Balangan	126	79	29	1120-1880	72	6.3
Tabalong	105	80	30	3207	77	6

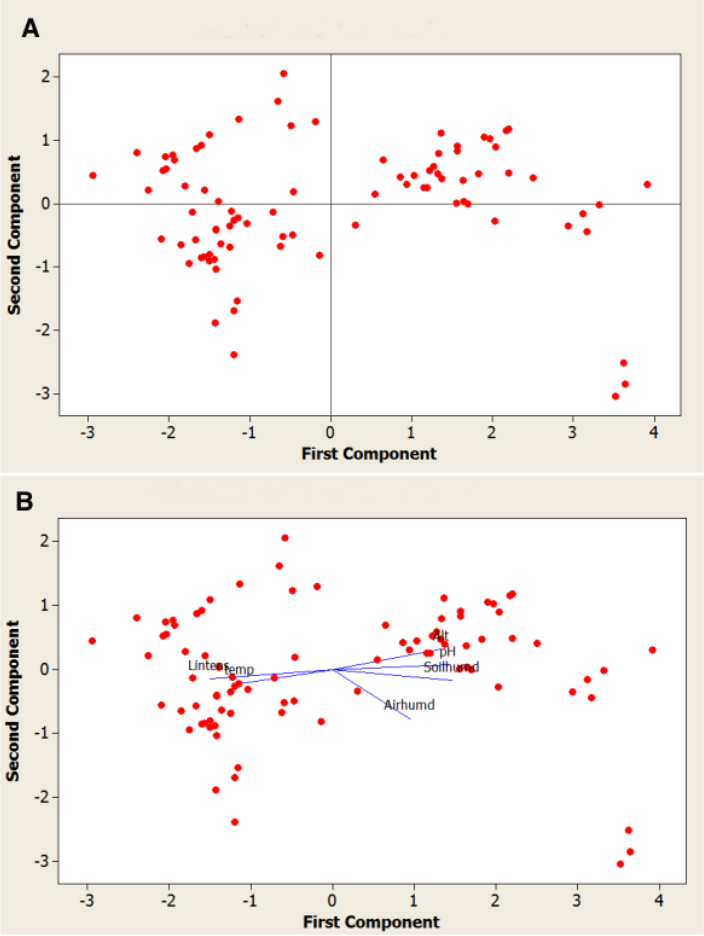

Figure 3 – A. Distribution of *B. macrocarpa*; B. Correlation of environmental factors to the distribution of *B. macrocarpa*.

Based on the Principal Component Analysis (PCA) analysis carried out on the kapul plant (B. macrocarpa) it is known that the light intensity and temperature factors have an influence on the presence of the this plant population (Fig 3). Mattjik and Sumertajaya (2013) explained that the closer the point position to the variable vector line, the higher the value of the variable's contribution to the plant population. The highest value of the two component factors indicates the availability of abiotic factors that will characterize the presence of *B. macrocarpa*.

The main component of the results of PCA analysis is light intensity. This component contributes 49.8% to the presence of red star fruit. The main component II is the temperature which contributes 22.2% so that the cumulative of the two main components is 72.2%. Gunawan et al. (2021) also revealed that temperature, solar radiation, and precipitation were the key environmental factors influencing the distribution of *B. macrocarpa*. Zoratti et al. (2014) explained that light is a very important abiotic factor because it affects the growth, development, and production of metabolites.

Light intensity is a very important environmental factor that affects plant regeneration. This is because light affects plants in the process of flowering and seed germination. Zhu et al. (2014) explained that light intensity affects flowering, seed germination, macro climate, and temperature around plants. The physiological response of plants to short lengths of irradiation or light they receive is called photoperiodism. The short length of light is related to the process of plant development, including the initiation of plants to flower. Rezazadeh et al. (2018) stated that the short length of irradiation is a factor that controls the induction and initiation of flowering in several plants species. Nurtjahjaningsih et al. (2012) explained that flowering is influenced by external factors in the form of sufficient sunlight and nutrients. In addition, flowering is also influenced by internal factors such as genetics, phytohormones. The intensity of light is very important, it is related to the process of photosynthesis which is responsible for providing energy for the flowering process.

The distribution of a plant species is indirectly affected by the interaction between plants and temperature, humidity, topographic conditions, and light. The variation in environmental conditions is a factor that affects the distribution pattern of a species in a geographic area. Zhong et al. (2010) explained that temperature is a very important environmental factor in influencing the distribution of a plant. This is because the air temperature affects the speed of metabolism, especially photosynthesis and plant respiration.

CONCLUSION

Baccaurea macrocarpa was randomly distributed in distric Tanah Laut, Banjar, Kotabaru, and clumped distributed Tapin, Hulu Sungai Selatan, Hulu Sungai Tengah, Balangan, and Tabalong. Two abiotic factors affected the distribution of B. macrocarpa were the light intensity and temperature. Microhabitat characteristic around *B. macrocarpa* were altitude of 112-126 m above sea level, air humidity is 75-80%, temperature 29 – 30 oC, light intensity 1120 – 3207 lux, soil moisture 71 – 79%, and soil pH 6 – 6.5.

AKNOLEDGEMENTS

The authors would like to thank Rector of Lambung Mangkurat University for providing PDWM (*program dosen wajib meneliti*) grant which has founded this research.

REFERENCES

1. Abolmaali SMR, Tarkesh M, Bashari H. 2018. MaxEnt modeling for predicting suitable habitats and identifying the effects of climate change on a threatened species, Daphne mucronata, in central Iran. Ecol Inform. 43:116–123.

2. Bakar MFA, Ahmad NE, Karim FA, Saib S. (2014). Phytochemicals and Antioxidative Properties of Borneo Indigenous Liposu (Baccaurea lanceolata) and Tampoi (Baccaurea macrocarpa) Fruits . Antioxidants. 3: 516-525.
3. Botanri S. 2010. Autekologi, biodiversitas, dan distribusi spasial tumbuhan Sagu (Metroxylon spp) di Pulau Seram Provinsi Maluku [disertasi]. Bogor (ID): Institut Pertanian Bogor.
4. Djarwaningsih T. 2002. Pengeplakan material herbarium. Di dalam: Djarwaningsih T, Sunarti S, Kramadibrata K, editor. Panduan Pengolahan dan Pengelolaan Material Herbarium serta Pengendalian Hama Terpadu di Herbarium Bogoriense. Bogor (ID): Herbarium Bogoriense-Bidang Botani, Pusat Penelitian Biologi – LIPI.
5. Goyal AK, Mishra T, Sen A. 2014. Antioxidant profiling of Latkan (Baccaurea ramiflora Lour.) wine. Indian J Biotechnol. 12(1):137–139.
6. Guisan A, Thuiller W. 2005. Predicting species distribution: offering more than simple habitat model. Ecol Lett. 8: 993-1009.
7. Gunawan, Chikmawati T, Sobir, Sulistijorini. 2016. Review: Fitokimia genus Baccaurea spp. Bioeksperimen. 2(2):96–106.
8. Gunawan, Rizki MI, Anafarida O, Mahmudah N. 2021. Modeling Potential Distribution of Baccaurea Macrocarpa In South Kalimantan, Indonesia. Biodiversitas. 22 (8): 3230-3236.
9. Haegens RMAP. 2000. Taxonomy, phylogeny, and biogeography of Baccaurea, Distichirhops, and Nothobaccaurea (Euphorbiaceae). Blumea. Supplement nomor 12.
10. Lim TK. 2012. Edible Medicine and Non-Medicine Plants: Volume 4. London (GB): Springer.
11. Mattjik AA, Sumertajaya IM. 2013. Perancangan Percobaan dengan Aplikasi SAS dan Minitab. Bogor (ID): IPB Press.
12. Morishita M. 1959. Measuring of The Dispersion on Individuals and Analysis of the Distributional Patterns. Jepang (JP): Kyushu University.
13. Nurtjahjaningsih, Sulistyawati ILG, Rimbawanto WA. 2012. Karakteristik pembungaan dan sistem perkawinan Nyamplung (Calophyllum inophyllum) pada hutan tanaman di Watusipat, Gunung Kidul. Jurnal Pemuliaan Tanaman Hutan. 6(2): 65–80.
14. Norhayati, Noviany A, Carabelly AN. 2019. Antibacterial Potential of Kapul Fruit Skin (Baccaurea macrocarpa) ON Streptococcus sanguis. ODONTO Dental Journal. Vol 6 (2): 118-124.
15. Pardede A, Wardhani AAK, Frasisca E. (2020). Antileukemic Activity Of Methanol Extract From Stem Of Baccaurea macrocarpa, Syzygium jambos, Bouea macrophylla Griff., AND Diospyros discolor Willd. EduChemia(Jurnal Kimia dan Pendidikan). 5 (2): 111-118.
16. Rezazadeh A, Harkess RL, Telmadarrehei T. 2018. The effect of light intensity and temperature on flowering and morphology of potted red firespike. Horticulture. 4(36):1–7.
17. Rugayah, Retnowati A, Windadri FI, Hidayat A. 2004. Pengumpulan data Taksonomi. Di dalam: Rugayah, Widjaja EA, Praptiwi, editor. Pedoman Pengumpulan Data Flora.Bogor(ID): Puslit-LIPI.
18. Sinclair SJ, White MD, Newell GR. 2010. How useful are species distribution models for managing biodiversity under future climates? Ecol Soc 15(1): 8 [online] URL: http://www.ecologyandsociety. org/vol15/iss1/art8/.
19. Sofiah S, Setiadi D, Widyatmoko D. 2013. Pola penyebaran, kelimpahan, dan asosiasi bambu pada komunitas tumbuhan di taman wisata alam Gunung Baung Jawa Timur. Berita Biologi. 12(2):239–247.
20. Susilawati, Irmawati, Sukarmi Sri, Muhammad A, Astuti K, Yusnita, Yayandra. 2021. Growth and yield of shallot under several levels of soil water table. RJOAS, 6(114). DOI 10.18551/rjoas.2021-06.23.
21. Tirtana, E. Idiawati, N. Warsidah. dan Jayuska, A, (2013), Analisa Proksimat, Uji Fitokimia dan Aktivitas Antioksidan Pada Buah Tampoi (baccaurea Macrocarpa), JKK, 2 (1), 42-45.
22. Ullah MO, Urmi KF, Howlader MDA, Hossain MDK, Ahmed MT, Hamid K. 2012. Hypoglycemic, hypolippidemic and antioxidant effects of leaves methanolic extract of Baccaurea Ramiflora. Int J Pharm Sci. 4(3):266–269.

23. Usha T, Middha SK, Bhattacharya M, Lokesh P, Goyal AK. 2014. Rosmarinic Acid, a New Polyphenol from Baccaurea ramiflora Lour. Leaf: A Probable Compound for Its Anti-Inflammatory Activity. Antioxidants 3: 830-842.
24. Yunus, R., Alimuddin, A. H. dan Ardiningsih, P. (2014). Uji Aktivitas Antibakteri Ekstrak Kulit Buah Tampoi (Baccaurea macrocarpa) Terhadap Bakteri Escherichia coli dan Staphylococcus aureus. Jurnal Kajian Komunikasi 2303-1077, 3 (3), 19- 24.
25. Zamzani I, Triadisti N. (2019). Antibacterial Activity of Extract and Fraction of Baccaurea macrocarpa Leaf on Escherichia coli and Bacillus cereus. International Summit on Science Technology and Humanity (ISETH2019). p-ISSN: 2477-3328 e-ISSN: 2615-1588.551-556.
26. Zhu JJ, Lu DL, Zhang WD. 2014. Effects of gaps on regeneration of woody plants: a meta analysis. J For Res. 25(3):501–510.
27. Zoratti L, Karppinen K, Luengo EA, Haggman H, Jaakola L. 2014. Light controlled flavonoid biosynthesis in fruits. Front Plant Sci. 5:1–16.
28. Zhong I, Ma YM, Salama MS, Su Z. 2010. Assessment of vegetation dynamics and their response to variations in precipitation and temperature in the Tibetan Plateau. Clim Change. 103(3):519–535.

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