



UDC 633; DOI 10.18551/rjoas.2022-08.19

ECOLOGICAL FACTORS AFFECTING THE DISTRIBUTION OF LIMPASU (*BACCAUREA LANCEOLATA*) IN SOUTH KALIMANTAN, INDONESIA

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ABSTRACT

The aim of this study was to provide information on the distribution and determine the strongest factors that influence the distribution of *Baccaurea lanceolata*. The identification of these parameters in a particular ecosystem helps us implement appropriate management for the present and future development of *B. lanceolata* restoration and development. This study used purposive sampling method by exploring the areas where *B. lanceolata* commonly found. The geographic distribution of accessions was visualized with the DIVA-GIS program. The relationship between environmental factors and *B. lanceolata* plants was analyzed using Principal Component Analysis (PCA) which was generated from Minitab software version 16. Based on field surveys, *B. lanceolata* plants were found in Gunung Raya, Hamak Timur, Hamak Utara, Patika Lain, Batang Alai Timur, Marajai, Loksado, and Geronggang. The results showed that the most important factors in the distribution of Limpasu in South Kalimantan were altitude and air humidity.

KEY WORDS

Baccaurea lanceolata, PCA, South Kalimantan, altitude, humidity.

Indonesia is a tropical country that has a high diversity of fruits. Almost every region has local fruit, but its development and utilization are not yet optimal. Kalimantan is one of the large 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). The *Baccaurea* genus is a group of plants that produce fruit, but its existence is not as popular as other fruit plants. In addition to taking the fruit as fresh fruit and wood as building materials, members of the *Baccaurea* genus have been used by the community as medicinal plants to treat several diseases, including constipation, swelling of the eyes, arthritis, abdominal pain, facilitating menstruation and urination (Usha *et al.*, 2014; Ullah *et al.*, 2012; Goyal *et al.*, 2014; Lim 2012; Gunawan *et al.*, 2016).

One of the members of the genus *Baccaurea* is Limpasu (*Baccaurea lanceolata*). Limpasu has several names, including ampusu, asam pauh, buah lepasu, buah lipau, empawang, kalampesu, lampaung, lapahung, laptu, lipasu, tamasu and tampoi. In traditional medicine this plant was used to treat stomach pain, treat swelling and treat drunk due to alcohol (Lim 2012). Voon and Kueh (1999) reported *B. lanceolata* fruit consist of 92.4% water, 18 kcal energy, 0.2% protein, 0.2% fat, 3.7% carbohydrate, 0.8% ash content, P 6 mg,



K 126 mg, Ca 35 mg, Mg 11 mg, Fe 0.3 mg, Mn 2 ppm, Cu 1.5 ppm, Zn 6.3 pm and vitamin C 0.6 mg. *B. lanceolata* fruit also contains phenols, flavonoids, anthocyanins, and carotenoids (Bakar *et al.*, 2014).

The phytochemical content of *B. lanceolata* was found in the pericarp and flesh of the fruit, with the highest content found in the flesh. Antioxidant activity test using three methods (DPPH, ABTS, and FRAP) of the pericarp, fruit flesh and seeds showed high antioxidant activity, with the highest activity found in the fruit flesh (Bakar *et al.*, 2014). Ethanolic extracts of fruit, leaves, and stem bark of *B. lanceolata* contain chemical groups of alkaloids, phenols, flavonoids, tannins, and saponins (Fitriansyah *et al.*, 2018).

Conversion of forests into plantations, housing, and roads was one of the causes of habitat loss and reduced population of *B. lanceolata* plants. Conservation efforts can be started through ecological studies and data collection on the distribution of *B. lanceolata*. Ecological 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. The information on the existence of a plant in a place and its variations was useful for data collection of plant populations, recording the diversity of flora and its habitat, also its development for further uses (Lestari 2014; Djuita *et al.*, 2016). This study was aimed to provide distribution information and determine the strongest factors affecting the distribution of *B. lanceolata*. Identification of these parameters in a given ecosystem helps us to management conservation and development in the present and future.

MATERIALS AND METHODS OF RESEARCH

Sampling was conducted in nine locations in South Kalimantan: Gunung Raya, Hamak Timur, Hamak Utara, Patika Lain, Batang Alai Timur, Marajai, Loksado, and Geronggang, based on local community and local government information who knew the existence of the *B. lanceolata* (Figure 1). Ecological data analysis and herbarium processing were done in Biosystematic Laboratory of Department of Biology of Lambung Mangkurat University.

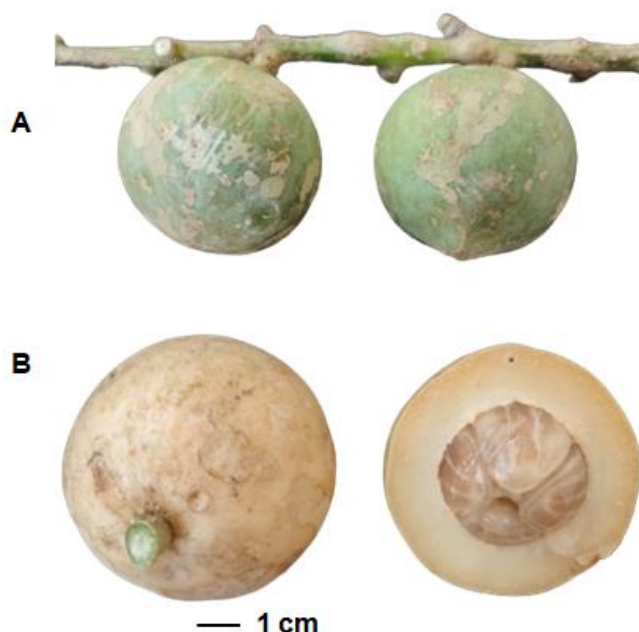


Figure 1 – Limpasu (*Baccaurea lanceolata*) fruit: A. young fruit, B. Mature fruit

Data collection was done by purposive sampling by visiting the location based on information from local people where possible the discovery of *B. lanceolata* (Rugayah *et al.*, 2004). The data recorded in each location were the number of individuals of *B. lanceolata*, 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).

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, and then mounted on the specimen. Placing the specimens was done by sewing the stems/fruits or using 3M tape, and 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).

In this study, the geographic distribution of accessions was visualized with the DIVA-GIS program (Hijmans *et al.*, 2001). The relationship between environmental factors and *B. lanceolata* plants was analyzed using Principal Component Analysis (PCA) generated from Minitab software version 16.

RESULTS AND DISCUSSION

Baccaurea lanceolata is a wild fruit plant that has not been cultivated by the community. Local people generally use this plant to take its wood as building material for light construction. In addition, local people also take the fruit of this plant for sale. Humans play a role in the spread of a plant species through the dispersal of seeds. Humans are also the cause of the decline of a plant species. Based on the field survey, Limpasu plants were found in Gunung Raya, Batu Licin; Hamak Timur, Hamak Utara, Hulu Sungai Tengah; Patika Lain, Tapin; Batang Alai Timur, Marajai, Loksado; and Geronggang, Kota Baru. Limpasu distribution in South Kalimantan was presented in Figure 2.

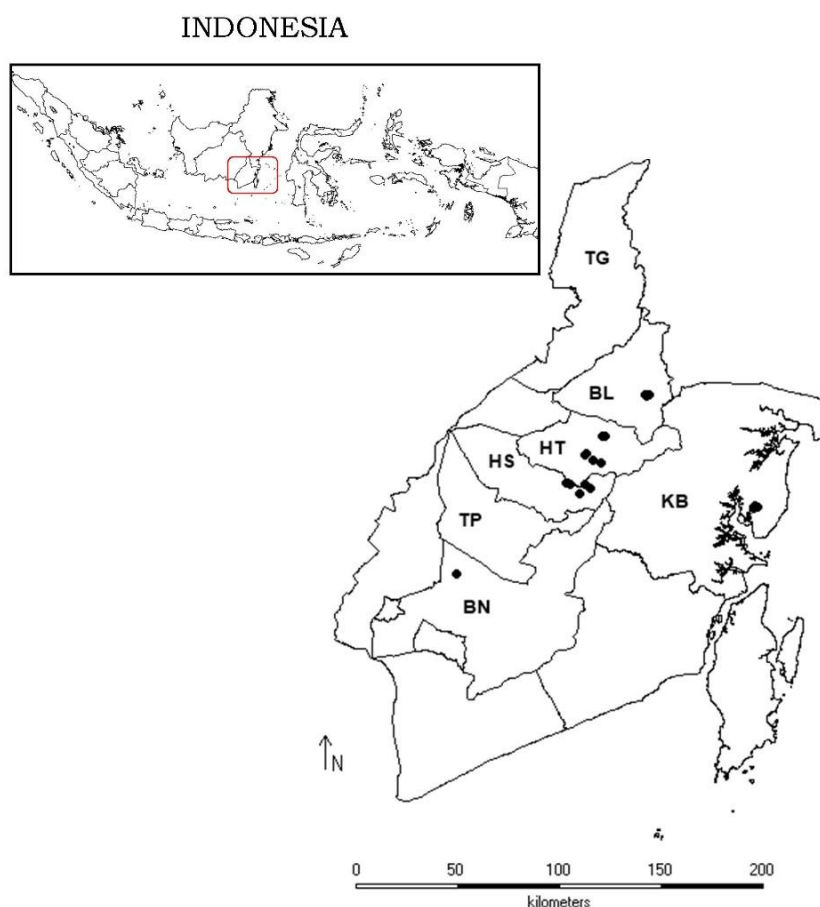


Figure 2 – Distribution of Limpasu (*Baccaurea lanceolata*) in South Borneo. TG = Tabalong; BL = Balangan; HT = Hulu Sungai Tengah; HS = Hulu Sungai Selatan; BN = Banjar; TP = Tapin; KB = Kota Baru



The natural habitat of the *B. lanceolata* was decreasing due to the conversion of forests and yards into housing, plantations, and roads. This also causes the number of *B. lanceolata* populations to decrease, because it was not balanced with cultivation and conservation efforts. Habitat degradation and fragmentation, forest conversion, and increasing human population were seen as crucial factors causing species extinction in the world (Barnosky *et al.*, 2011). In the case of Indonesia, mainly in the Kalimantan region, habitat loss of many tree species was caused by continuous illegal logging, development of human settlements, agriculture, perennial crop, and timber plantations (Budiharta *et al.*, 2011). Habitat restoration is an effort that can be taken to rehabilitate species and conserve its habitat (Yang 2013). Detailed information about the regional distribution of a plant is needed for their rehabilitation.

Table 1 – Microclimate around *B. lanceolata* locations

Locations	Microclimate					
	Altitude (m a.s.l.)	Humidity (RH %)	Temperature (°C)	Light Intensity (Lux)	Soil Moisture (RH %)	Soil pH
Gunung Raya	144	80	28	1870-2260	82	6
Hamak Timur	110	78	29	2645-3110	76	6.3
Hamak Utara	127	79	28.5	1330-1450	75	6.1
Patika Lain	168	80	29	2650	74	6.2
Tapin	108	78	29	1587	77	6.5
Geronggang	135	79	28	2600	79	6.1
Batang Alai Timur	108	80	30	2228	79	6.1
Marajai	114	80	29	3207	79	6.2
Loksado	130	80	28.8	2228	77	6.2

Abiotic factors have an important role in the growth, development, and distribution of plants. The distribution of plants on a wide scale was influenced by climatic factors, especially rainfall and temperature (Ayyad and El-Ghareeb, 1972). Environmental factors measured in this study were altitude, humidity, temperature, light intensity, soil moisture, and soil pH. *B. lanceolata* plants in South Kalimantan grow in ecological conditions, namely altitude ranging from 108-168 m a.s.l., humidity 78-80%, temperature 28.5-30° C, light intensity 1330-3207 lux, soil moisture 74-79%, and soil pH 6-6.5 (Table 1).

Based on the Principal Component Analysis (PCA) carried out on the *B. lanceolata*, it was known that the altitude and air humidity factors have an influence on the presence of this plant (Fig 3). The main component I of the results of PCA analysis was altitude. This component contributes 45.8% to the presence of *B. lanceolata*. The main component II was the temperature which contributes 29.8% so that the cumulative of the two main components was 75.6%. Based on the Principal Component Analysis (PCA) conducted on *B. lanceolata*, it was known that altitude and humidity have an influence on the presence of *B. lanceolata* plant populations. 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. lanceolata* plants.

Altitude is an important physiographic factor that affects plant growth and development since functional traits could show great variance depending on the altitude level (Keles, 2020). Qian *et al.* (2016) explained that climate change can have an effect on distribution, population structure and growth dynamics in plants. Altitude variations even though only slightly and do not cause changes in temperature can affect the distribution of a plant species (Bagheri *et al.*, 2017). Plants will adapt to environmental changes by changing their morphology, physiology and photosynthetic ability to survive in their environment (Liang *et al.*, 2010; Najafabadi and Ehsanzadeh, 2017).

Relative humidity also affects plant growth by inhibiting the absorption of water and nutrients (Chowdhury *et al.*, 2021). Relative humidity was also related to the rate of photosynthesis. The rate of photosynthesis is proportional to the relative humidity level. High humidity will reduce the water concentration in the leaves and increase the stomatal conductance (Han *et al.*, 2019; Islam *et al.*, 2020).

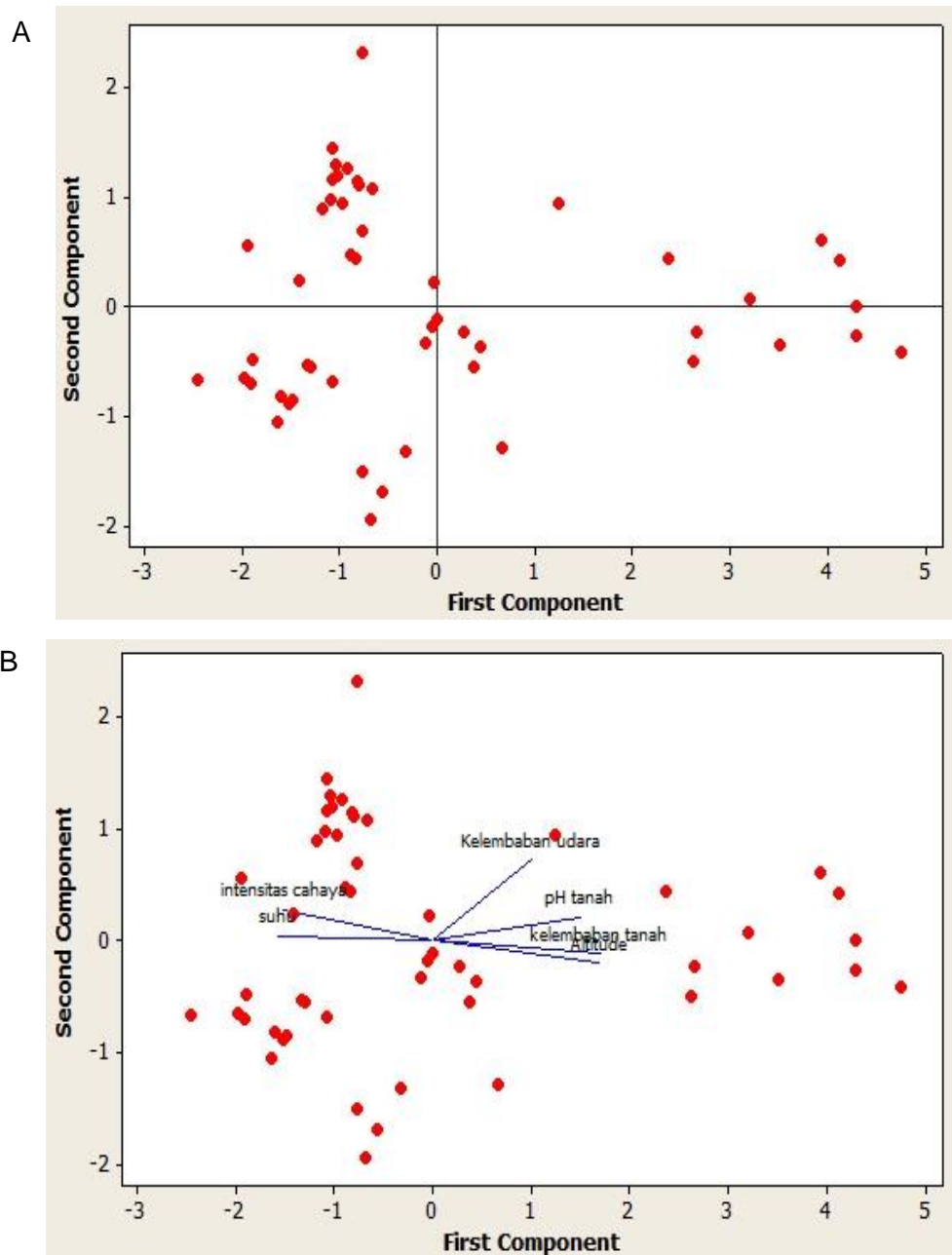


Figure 3 – A. Distribution of *B. lanceolata*; B. Correlation of environmental factors to the distribution of *B. lanceolata*

Each type of plant has different ecological characteristics. Another study reported that light intensity and temperature were environmental factors that have a major influence on *Baccaurea macrocarpa* (Gunawan *et al.*, 2021). Ecological data of each plant is very important, because it can be used for plant conservation efforts.

CONCLUSION

Baccaurea lanceolata was found in 9 locations namely Gunung Raya, Hamak Timur, Hamak Utara, Patika Lain, Batang Alai Timur, Marajai, Loksado, Geronggang. This research showed that the most important factors on distribution of *B. lanceolata* in South Borneo are altitude and air humidity. *B. lanceolata* plants in South Kalimantan grow in ecological conditions, namely altitude ranging from 108-168 m a.s.l., humidity 78-80%, temperature 28.5-30° C, light intensity 1330-3207 lux, soil moisture 74-79%, and soil pH 6-6.5.



ACKNOWLEDGEMENTS

The authors would like to thank LPDP for founding support by Riset Mandiri grant number: 010/E4.1/AK.04/RA/2021.

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