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CHARACTERIZATION OF *MELALEUCA LEUCADENDRA* AS FOOD FOR HONEY BEES IN THE SAWOJAJAR AREA OF MALANG CITY, EAST JAVA

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ABSTRACT

Malang Raya has very promising potential for developing honey bee cultivation, this is because it has a large area and forest location. One important family is Myrtaceae, for example eucalyptus (*Melaleuca leucadendron*) in supporting the honey bee industry. This plant has the advantage of being a conservation plant, flowering all year round, providing road shade, producing honey glands, resin, pollen for honey bee food. The method was carried out through an exploratory survey at the Sawojajar Malang housing complex, while collection, characterization and making a herbarium at MUBR (Unibraw). The research results show that eucalyptus plants (*Melaleuca leucadendron*) grow well, and have the potential to be developed in the greater Malang area in the development of the honey industry and conservation.

Key words : *Melaleuca leucadendron*, Sawojajar Housing Complex, Malang.

Introduction

The *Melaleuca leucadendra* or *Melaleuca leucadendron* is a plant native to Indonesia, its main distribution is on the island of Seram, Ambon, belonging to the Myrtaceae family (Backer and Bakhuizen Van Den Brink, 1968; Batoro *et al*., 2021; Firman *et al*., 2021). Members of the Myrtaceae family have great potential as food for honey bees, supporting the honey bee industry, this is due to their abundant flowering, either annually or throughout the year (Batoro *et al*., 2021; Jaya *et al*., 2021).

This plant contains essential oil, cineol (eucalyptus oil), especially in young stems and leaves (Thorhill *et al*., 2012; Helfiansyah, 2013). *Melaleuca leucadendra* essential oil contains medicinal properties, because it contains anti-oxidants, both for external and internal treatment of the human body (Helfiansyah, 2013; Jaya *et al*., 2021; Wibowo *et al*., 2021).

Myrtaceae includes the tribes Backhousieae, Melaleuceae, Metrosidereae, Osbornieae and Syzygieae. Melaleuceae is mostly found in Australia, but also occurs in Malesia, Lord Howe Island and in New Caledonia with nine genera (Thorhill *et al*., 2012). Members of this family have great potential as food for honey bees and as nest sites (Batoro *et al*., 2021).

Myrtaceae pollen is parasyncolpate with arcuate or angular colpi and a rugulate exine pattern. However, there are slight variations in the size, shape, surface carvings of the pollen grains, where the pollen grains are mostly larger in the *Melaleucae* tribe. Characterization of *Melaleuca leucadendron* L.f. according to Backer and Van Den Brink (1968), 5-10 meters high, bark with irregular scales. Leaves are spirally arranged, 4-8 nerved, coriaceous, densely pellucid-dotted, brown in color.

Flower compound, white are located above the leaves; calyx tube urceolate, 1.5-2.5 mm high; semi-orbicular lobes, short; calyx are oval, white, have yellow oil glands, 2-3 mm long. Filaments 5-9 inches in each fascicle, 5-10 mm long. Leaves are short-stem, oval-lanceolate, with a blunt-pointed base, often slightly curved, when crushed they smell fragrant of eucalyptus, 4.5-17.5 cm × 0.75 -4 cm, often irregular 10-20.

The Sawojajar housing complex is in the city of Malang, located at an altitude of around 450 m asl., located in the Kedungkandang sub-district (Batoro *et al*., 2021). Various other plant species are planted to shade roads, gardens, as medicinal ingredients and as ornamental plants.

Species of flowering plants that produce honey glands comes from nectar are often visited by honey bees, including: klanceng (*Apis florea*), *Apis melifera*, *Apis dorsata* and *Apis cerana* (Ingel *et al*., 2012; Comman *et al*., 2015; Ilyasov *et al*., 2018; Bankova *et al*., 2019; Wibowo *et al*., 2021). The presence of honey bees naturally searches for various plant species, especially angiosperms in the form of honey glands, pollen and resin in the Sawojajar residential area. This research aims to characterize the habitus of eucalyptus plants (*Melaleuca leucadendron*) in relation to honey bee food.

Melaleuca leucadendra grows well in swampy areas, coastal areas, limestone soil (Wonosari forest) Gunung Kidul Yogyakarta. Perhutani Madiun and Bromo Tengger Semeru regions east Java as supporters of the eucalyptus oil producing industry and non-timber forest products (NTFPS) (Batoro *et al*., 2021). Likewise, forest areas outside Java where kayu putih (eucalyptus) plantations are widely developed include the islands of Timor, Ambon, Seram, West Java, East Java and Kalimantan. The Perhutani area as a production forest also has many industrial crops developed including: coffee (*Coffea* spp.), cemara gunung (*Casuarina junghuhniana*), eucalyptus (*Melaleuca leucadendron*), damar (*Agathis dammara*), mahoni (*Switenia mahagoni*), pinus, pine (*Pinus merkusii*), kayu jati (*Tectona grandis*), etc.

Local Name : *Melaleuca leucadendron*, kayu putih (Ind), gelam (Java), gelam wood (Sunda), galam (Banjarmasin), ghelam (Madura), gelag wood (Timor), ilano (Nusa Laut), sakelan (Seram), baru galang (Makasar).

Materials and Methods

The research used an exploratory survey and was carried out randomly at the Sawojajar housing location,

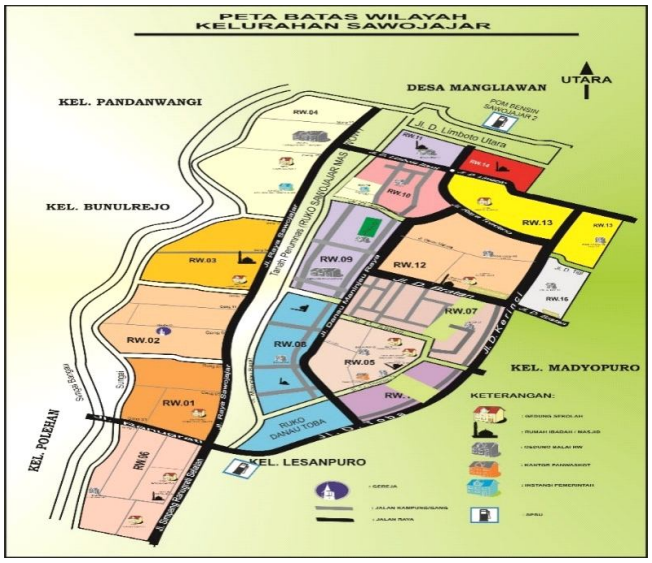

Fig. 1 : Sawojajar residential area of Malang, East Java.

Kedung Kandang sub-district, Malang city, East Java (Fig. 1). The habitus of *Melaleuca leucadendra* was recorded, identified, includes stems, branches, leaves and flowers, fruit were taken to observe the location of the sap, honey glands, color and volume and a herbarium was made at MUBR (Unibraw). Identification used the book Flora of Java by Backer and Van Den Brink (1968), while morphological characters used the flora characterization manual (De Vogel, 1987; Bell, 1991; Harris and Harris, 2003).

Results and Discusion

Melaleuca L. nom.cons., *Melaleuca leucadendra* L., *Melaleuca leucadendron* L.f. (Flora of Java) 1, 347. Backer & Bakhuizen van den Brink. National Herbarium of New South Wales (NSW), The Royal Botanic Gardens and Domain Trust, NSW19972. Collector: Banks, J.; Solander, D., #s.n. (1770), holotype. *Melaleuca leucadendron* (Linnaeus) Linnaeus, var. albida Cheel, in Ewart & Davies, Fl. N. Territory 301. 1917. Basionym: Melaleuca sieberi Schauer 1843.

Habitat and Ecology : In forest, agroforestry (Perhutani), hausing area, road shading Stems 6-10 cm in diameter, 5-10 meters high with white-yellow-dark-brown skin color; along the stem surface is scaly and peeling. Branched stems, hanging downwards (Fig. 2a, 2b). Leaf. The leaves scattered, sometimes crossed, stiff and green; leaves spirally arranged, 4-8 nerved, coriaceus, densely pellucid-dotted;eleptic 5.5-8.5 cm × 1-2 cm (Fig. 2c). Petiole erect to curved, round-flat 5 mm × 1 mm, often round-slightly wide. Color green-yellow; the leaf veins are curved almost parallel to the length of the leaf, the number of leaf veins is 5-7; flat edge, pointed-pointed tip, pointed base, oblique, curved or slightly flared. Backer

Fig. 2a : Stem, **2b :** Habitus tree dan flowers.

Fig. 2c : Leaves and flower. **2d :** Flower with anthers.

and van Den Brink (1968) reported leaves spirally arranged, 5-7 nerved, coriaceus, densely pellucid-dotted. Flower solitary in axil of bract; crowded selected into terminal spike, the axis of wich afterwards developes into a leafy branch; calyx-tube campanulate or urceolate, produced beyond the ovary; lobes 5, scarious, caducous after anthesis; patent, caducou; stamens connate into oppositi-petalous fascicles, much exerting; filaments wide, anthers dorsifixed.

White compound flowers, appear between the axils and compound flowers are 6-8 cm long, while the number of flowers on each stalk is 20-35.Solitary flower; base of stalk 0.5- 1.5 mm, tubular. yellow-phink, stalk with pubescent white-haired surface. At the end of the branch there is a bundle of 2.5 mm × 2.5 mm, flower stalks that have collapsed (Fig. 2c, 2d, 2e). Flowers spikes grabrous, pubescent; axis above the highes flower producing at fist caducous scale, afterward above them leaves; calyx-tube urceolate, 1,5-2,5 mm high; lobes semiorbicular, short.Petals oval, green-white, bearing yellow-clear oil glands, 2-3mm long. Filaments 5-9 in in each fascicle, 5-10 mm long; style 7-10 ml.

The calyx of green-yellow color is tubular, campanulate-urceolate, number of petals 5, attached to each other (gamosepalus), the attached part is more than half the length of the petal, the tips are short (notched, lobatus), regular symmetry (actinomorph), star-shaped, light green, the surface is setose, petal length 2.5–3 mm. The calyx tube of green-yellow color is tubular (campanulate)-urceolatus.

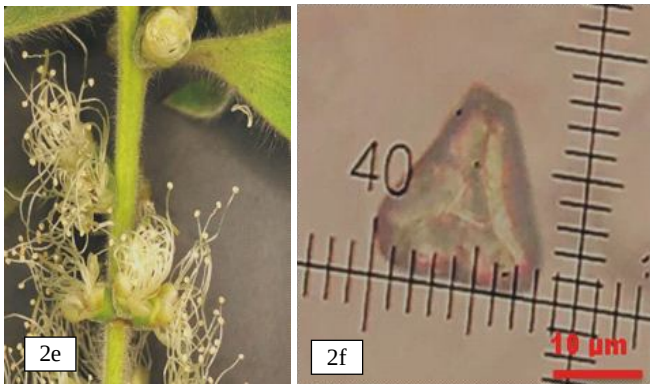

Fig. 2e : Flower and Anthers. **2f :** Pollen.

In corolla number of petals 5, petal length 1.8 – 2.5 mm, petal with between 1.8 – 2 mm, separate or independent (dialypetalus, polypetalus), regular symmetry (actinomorph), star shaped (rotarus, stellatus), white, smooth surface glabrous.

Stamens on top of the petals, many in number, numerous bundle, 3 – 5 x 0.5 – 1 cm long, white, smooth surface or glabrous.

In Anther there are two chambers (theca), one chamber consists of 2 locules, dorsifixed attachment type, the anthers open longitudinally, the color of the anthers is yellowish white, the number of anthers in one flower is ± 99 and the number of pollen in one anther is ±1355.

Pistillum is brownish yellow, supported by a yellowish white pistil tube; the pistil tube surface is smooth and 0.8 – 1.3 cm long.

Pollen (400x). Length 20 µm × 20 µm, thickness 12.5 µm; colpus length 5 µm, pore length 2.5 µm, triangular shape, syncolporate aperture colpus shaped and there is a porus at the equatorial, there are 3 colpus and 3 pores.

Ovarium is ovary convex, pubescent hairs, apex which is impressed around the style, 3 celled; ovules numerous, ascending on peltate placenta; style filiform; stigma small; fruit sessile. loculicidally at apex dehiscent at apex, semipersistent after the seeds have fallen out, seeds small, cuneate. Seed. Profuse ovules, placenta peltatus; filiform; small stigma; with oil glands yellow-clearin the base of the flower.

Fruit is sessile, hard, loculicidely, at the apex broken, semipersistent, seeds small, pointed.

In the Sawojajar housing complex, it is used as road shade, in gardens and is very rarely cultivated.In the NTT and Ambon regions, eucalyptus plants have been used to support the honey bee feed industry (Batoro *et al*., 2021). Backer and Van Den Brink (1968) reported further more in Karimundjawa island and Bawean especially swampy forest. The mangrove zone, very rarely, sometimes

cultivated (*Melaleuca leucadendron* L.f.).

Eucalyptus oil industry, cineole, essential oil (cajuput oil), firewood, building materials, telon oil mixture, honey bee feed, conservation, agroforestry, road shade, planted in housing. Other uses are as an anti-fungal agent, insecticide, anti-depressant effect. Leaves, especially flowers, contain honey glands, pollen and resin, which are very necessary for the life of honey bees and can further support the honey bee industry.

Palynology is important in basic and applied sciences, for example. bee feed industry, biology, medicine, forensics, earth history, climatology and food production *viz*. honey bee food (Hesse *el al*., 2009; Batoro *et al*., 2021). The structure pollen of *Melaleuca dendron* is in the form of tripartite features synaperturate pollen (Figs. 1a, 1b, 1c), as is the case in *Melaleuca armillaris* (Myrtaceae) (Hesse *et al*., 2009; Qodriyyah *et al*., 2015).

The eucalyptus plant (*Melaleuca leucadendron*) planted in the Sawojajar housing complex has very good growth, but its distribution is very rare. The honey bees that take a lot of honey are the klanceng (*Apis florea*) and *Apis cerana*. Malang Raya has quite extensive land, for example in villages and production forests, with the potential to develop eucalyptus cultivation.

The forest area in KPH Yogyakarta with an area of 16.358.60 ha is divided into production forest areas, protected forests and conservation forests (Tahura) with the main commodities being eucalyptus (*Melaleuca leucadendron*), pine, kesambi, mulberry, rattan, pineapple, porang and honey bees (KMIS, 2019). In Yogyakarta in the KPH Wonosari Yogyakarta forest and the eucalyptus oil industry has been developed.

Conclusion

Melaleuca leucadendron has a tree habit, is evergreen, grows very well at a height of around 500 m asl, in the Sawojajar housing complex, Kedungkandang subdistrict, Malang city. This plant has multiple benefits ie, road shade, oxygen source, medicinal industryingredient (eucalyptus), garden beauty, food for honey bees and has the advantage of flowering all year round.The production of eucalyptus flowers indicates the potential availability of honey glands, pollen, both external and internal and resin to support the honey bee industry.

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