Content list available at BioEnv

Bioresources and Environment

Journal homepage: www.bioenvuitm.com

A Preliminary Review on the Morphological and Phytochemical Characteristics of Rambutan *(Nephelium lappaceum L.)*

Liliwirianis Nawi[1]*, Noranisah Laila Norsham[1], Nurun Nadhirah Md Isa[1], Sarah Laila Md. Jan[1], Siti Norhafiza Mohd Khaazai[1], Nur Thabitah Shaikh Nasir[1], Nor Lailatul Wahidah Musa[1]* & Ainur Awanis Mohd Badiazaman[1]

[1]*Faculty of Applied Sciences, Universiti Teknologi MARA UiTM Pahang, 26400 Bandar Tun Abdul Razak Jengka, Pahang Malaysia*

Received August 14, 2025, Accepted in revised form October 16, 2025
Available online October 28, 2025
DOI: 10.24191/bioenv.v3i3.111

ABSTRACT. Rambutan (*Nephelium lappaceum* L.), a member of the family Sapindaceae, is a tropical fruit species native to Southeast Asia and recognised for its nutritional and medicinal potential. This preliminary review aims to summarise the basic morphological characteristics of *N. lappaceum*, including its leaves, flowers, and fruits. Besides compiling available information on its phytochemical composition and biological activities. A systematic literature search was conducted using books and databases such as Scopus, PubMed, and ScienceDirect, applying defined inclusion and exclusion criteria. The findings show clear morphological differences among the plants, highlighting the need for more detailed comparisons and consistent taxonomic descriptions. Taxonomic uncertainties also persist due to overlapping morphological traits and limited molecular phylogenetic data. Although phytochemical studies have shown strong antioxidant, antimicrobial, and anti-inflammatory effects, standardized testing and in vivo verification are still limited. This preliminary synthesis provides a foundational reference for future, in-depth studies on the taxonomy, morphology, and pharmacological potential of *N. lappaceum.*

Keywords: Morphological, Nephelium lappaceum, rambutan, Sapindaceae

1. INTRODUCTION

A total of 500 distinct types of fruits can be found in the various ecosystems of Asia, which contributes to the exceptional fruit diversity that can be found in this region. A total of 20 *Nephelium* species, including four undetermined species, were documented in Malaysia, Thailand, and Indonesia. Malaysia recorded the most species, which is 12, including one that is unknown, followed by Thailand and Indonesia, each of which recorded six species, including two unknown species in Thailand and three unknown species in Indonesia. Besides, Siebert (1991) reported that there were 22 species of *Nephelium* in the world, and 16 of them were found in Kalimantan and 15 species found in Sabah and Sarawak (Adema et al., 1996).

The vernacular name of *N. lappeceum* is rambutan in Malay. In Sabah, it is called rangalau (Dusun Ranau), while in Sarawak, it is referred to as buah abong (Kenyah), buah maha (Punan Tutoh), lung bipuyoh (Berawan), sangan (Bidayuh Sadong), and situgog (Bidayuh). The 'rambutan' tree, also known as *N. lappaceum* is a tropical tree member of the Sapindaceae family. The term "hair" is the root of the Malay word "rambut," which is where the name "rambutan" originates from. A tree that is indigenous to the Malay Archipelago is called a rambutan. "Rambutan" is a tropical fruit variety, widely cultivated in Southeast Asian countries mainly in Malaysia, Thailand, Indonesia, and

*Corresponding author:
E-mail address: *liliwirianis@uitm.edu.my* (Liliwirianis)

India. In addition to being cultivated in India and Sri Lanka, the Malay Archipelago, often referred to as the East Indies, encompasses the mainland of Indonesia, Malaysia, and Southern Thailand (Kaur et al., 2022). It is native to the Malay Peninsula, Borneo (including Sabah and Sarawak), the Sumatera Islands and Thailand. It is also distributed in Singapore, the Philippines and Sri Lanka. *N. lappaceum* is also widely cultivated in Hawaii and Australia. In China, the Taiwan and Hainan provinces have planted a large area of the species, but wild *N. lappaceum* is found in Sipsongpanna in the Yunnan province (Li et al., 2018). The *N. lappaceum* varieties from Malaysia and Indonesia were introduced to Mexico in the 1950s.

N. lappeceum is a tree or sometimes a shrub. *N. lappaceum* can grow up to 60 feet high with a dense, low, spreading, rounded and dull green crown. *N. lappaceum* tree is known for its evergreen leaves throughout the year. Turner (1995) reported that the tree grows in lowland and hill forests to 600 m (ubiquitously cultivated) and is also scattered in the wild.

N. lappaceum begins to produce fruits for the first time in 3-4 years and then has fruits once a year. For trees to thrive, it requires a humid environment with rainfall ranging from 250 to 350 centimeters. According to Harahap et al. (2012) and Manaf et al. (2013), seeds contain fat, protein, fiber, carbohydrate, ash, and minerals, while fruits contain carbs, fat, protein, ash, minerals, and vitamin C. Suganthi & Josephine (2016) state the fruit can prevent diarrhoea and dysentery. Therefore, it can help as a stomach and anthelmintic to treat stomach aches. The seeds contain compounds, such as arachidic and oleic acids (Manaf et al., 2013), which are useful as an antioxidant and anti-hyperglycemic agents (Palanisamy et al., 2011; Soeng et al. 2015), analgesics, anti-inflammatory agents (Lee et al., 2025) and cures for hypertension (Ding et al., 2025), while the seed oil can create candles and soap (Suganthi & Josephine, 2016). A literature review on this plant is still lacking. The high diversity of *N. lappaceum* can potentially be used as a germplasm resource to develop new superior cultivars (Anggraheni & Mulyaningsih, 2018). Thus, in this paper, an updated review of this important plant will focus on the macromorphological characteristics.

2. SCIENTIFIC CLASSIFICATION

The systematic classification for *Nephelium lappaceum* is shown in Table 1.

Table 1. Scientific Classification of ‘rambutan’.

Domain	Plant
Kingdom	Plantae
Subkingdom	Tracheobionta
Super division	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales
Family	Sapindaceae
Genus	*Nephelium*
Species	*Nephelium lappaceum*

3. MORPHOLOGICAL CHARACTERISTICS OF *NEPHELIUM LAPPACEUM*

3.1. Leaf

The *N. lappaceum* leaf is 1-foliolate or each with up to 8 pairs of leaflets. The leaves measure 5–15 cm wide and 10–30 cm long (Suganthi & Josephine, 2016). Leaflets are elliptic and arranged in 2 or 3 pairs, usually alternate or rarely opposite. They are coriaceous, glabrous or occasionally slightly hairy on the midrib above, variable in hairiness underneath, with domatia being either common or absent.

The leaves of *N. lappaceum* are green, oval to obovate, measuring between 5 - 28 cm in length and 2 - 10.5 cm in width (Lestari et al. 2013; Adema et al., 1996). The leaf edges are smooth and scattered, while the base can be acute or rounded, often tapering, and the margins are strongly curved (Adema et al., 1996). The apex and base leaf blades are also acuminate, pinnate (Li et al., 2018) and nearly straight and parallel. However, the leaf apex can also be either acute or truncated. The midrib is slightly raised to slightly sunken on the upper side. The lateral veins are spaced 0.5 to 2 cm apart and have a slightly raised to slightly sunken appearance. The intermediate lateral veins are mostly inconspicuous, while the intercostal veins can be finely or coarsely reticulated. The veinlets often tend to be scalariform and are frequently raised above the surface. They have cylindrical petioles. Petiole lengths range from 5 to 12 mm, broadly and shallowly grooved, with or without a median or lateral rib, or may be narrowly grooved or flat without a rib above.

Oval leaflets develop in pairs, typically consisting of one to four pairs of leaflets. Each leaflet measures 6 - 18 cm in length and 4 - 7.5 cm in width, with an elliptic or obovate shape and an entire margin (Li et al., 2018). The leaflet tips are rounded and either orbicular or lanceolate in shape, with a wedge-shaped base. The branchlet is cylindrical, with a wrinkled texture and a grey-brown color, while the twigs are covered in fine hairs (puberulous). The combined length of the leaf and petiole ranges from 15 to 45 cm, and the rhachis is somewhat thick. The leaf blades feature 7 to 9 pairs of maroon lateral veins, which are bulging on the surface and have small, scrobiculate veins. The length of each petiolule is 5 mm.

Kuswandi et al. (2014) studied the diversity of leaf morphology in various accessions of *N. lappaceum*. They discovered that the leaflets typically had an elliptical or obovate shape, with obtuse apices and acute bases. A subsequent study by Najira et al. (2020) examined *N. lappaceum* plants from the Aceh province and found a range of leaflet shapes, including elliptical, ovate, and obovate, as well as different leaflet tips, such as acute, acuminate, and rounded. Additionally, variations were observed among *N. lappaceum* cultivars in terms of the number of leaflets per leaf, rachis length, petiole length, leaflet length, leaflet width, leaflet shape, and leaflet apex. These findings indicate that leaf morphological characteristics can serve as a useful identification tool for distinguishing between different cultivars of *N. lappaceum*.

3.2. Inflorescence

The inflorescences of *N. lappaceum* can be found in three locations: axillary, pseudoterminal, or occasionally terminal (Adema et al., 1996). The flowers, which are greenish-white or yellowish green to white, and form long spikes

(thyrsoid). These flowers are small and appear in large clusters. They lack petals and emit a mild, sweet scent. The species is dioecious (with male and female flowers on separate trees) or can have bisexual flowers, and it is rich in nectar, attracting bees. The inflorescence features many branches, with a length that is almost isometric with the leaves. It is also covered with short, rusty pubescence. The peduncles are short, and the leathery calyx measures about 2 mm long and has an ovate shape with puberulous characteristics. The flowers are apetalous, and the stamens are approximately 3 mm long, with each flower containing six to eight stamens. The superior ovary consists of one to two lobes and has a single style (Sukmandari et al., 2017).

3.3. Flower structure

The flower of *N. lappaceum* features sepals that are nearly free or more than halfway fused, measuring between 0.7 and 2.1 mm in length. The petals are mostly absent, though sometimes there may be up to four small petals. These petals have a claw that is approximately 1.1 mm long and a blade that is around 0.5 x 0.5 mm. The margins of the petals are infolded and fused at the base, and they are either glabrous or have a few long hairs on the outside. The margins are long-ciliate, and the inside is woolly. The disc may be hairy or glabrous. The flower typically has 4 to 9 stamens (usually 5 to 8), and the ovary can be 2 to 3 locular.

3.4. Fruit

The fruits of *N. lappaceum* are notable for their striking colors, commonly red but occasionally yellow, and they are densely covered in thick, coarse, wavy hair or soft spines. *Nephelium* fruits can be categorised as capsular, drupaceous, ovoid, single-seeded berry (one fruit contains one seed) (Windarsih & Efendi, 2019) or as having two or three samaras. When they are capsular, they typically open by splitting along the locules, also known as loculicidal. It is quite rare for them to be septicidal (opening along the septa) or septifragal (where the valve surface splits from the septa or locule partitions) (Adema et al., 1996).

N. lappaceum fruit also found oval or globose berry. The plant is responsible for producing spherical fruits with dense spines covering that resemble soft hairs on the rind. The *N. lappaceum* fruit surface is greenish when it is still young but as it matures and ripe, the skin of the fruit changes colour to either red or yellow, depending on the type. Fruits are edible, oval to spherical drupes, leathery skin with flexible hairy spines, and mature from green to red. Aril is white, fleshy, edible and sweet and surrounds a single large seed (Wee, 2003). The fruit flesh is translucent white with a sweet yet creamy taste, and the seed in the middle is oval (Adema et al., 1996). According to Corner (1988), the seeds contain toxic chemicals and can be poisonous, bitter and narcotic if not prepared well. *N. lappaceum* appears like Pulasan (i.e., *Nephelium mutabile*, another soapberry fruit in the same family) but *N. lappaceum* fruits are much larger with thinner skin and long, spiky hair (Wang et al., 2025). Fruits are edible, oval to spherical drupes, leathery skin with flexible hairy spines, and mature from green to red. Aril is white, fleshy, edible and sweet and surrounds a single large seed (Wee, 2003).

Additionally, fruits of *N. lappaceum* are rarely stalked, ellipsoid to subglobose, measuring up to 6 cm long and the width is 3 - 5 cm (Suganthi & Josephine, 2016; Adema et al., 1996) and they grow in clusters of 10–18. and are

glabrous. The fruit wall is coriaceous, with a thickness of up to 2.5 mm. Appendages can be sparse or dense, with a bulbous or broad base that tapers towards strap-shaped or filiform upper parts, which are curved and measured between 0.5 to 2 cm in length.

Three distinct components make up the skin of the fruit: the exocarp, the mesocarp, and the endocarp (Windarsih & Efendi, 2019). According to Van Balgooy (1998), there are fleshy, flexible spines that cover the exocarp's surface. These spines can be either soft or stiff, and they each have a bend at one end. The endocarp is white and covers the flesh of the fruit. The flavor of the fruit flesh ranges from sweet to sour, and it is translucent and whiteIt may include much water or less water, and it can be consumed. The meat of the fruit is a salute of the seed, which is also referred to as the aryl. It may be simple to peel off the aryl, or it may be challenging to do so. Windarsih & Efendi (2019) stated that the seed is encased in an aryl, and the seed coat has a thin, woody consistency.

3.5. Seed

The seed is bright brown and measures 2–3 cm long (Suganthi & Josephine, 2016). The shapes of *N. lappaceum* seed from Parakan and Sinyonya are oblong, Aceh sample is obovoid elongated, while the sample from Rapiah and the wild type is roundish (Windarsih & Effendy, 2019).

4. BENEFIT OF *NEPHELIUM LAPPACEUM*

Some plants are utilized in a variety of traditional medical practices. These plants include promising bioactive chemicals that have maintained value in contemporary pharmacological therapy. For thousands of years, people in China and other Asian nations have been using traditional herbs and fruits as a form of traditional medicine to strengthen their immune systems (Shahrajabian et al., 2019). *N. lappaceum* has historically assisted and managed diabetes and high blood pressure (Sukmandari et al., 2017). Chigurupati et al. (2019) have reported that *N. lappaceum* is well-known for its high antioxidant content and has been used to treat diabetes and bacterial infections (Table 2). On top of that, in vitro and in vivo, on rambutan peel extracts show a variety of bioactivities that are mostly dependent on the phenolic profiles and concentrations of the various extracts (Tingting et al., 2022).

Antioxidants have demonstrated the ability to diminish cellular harm and maybe lower the likelihood of cancer in numerous individuals. The *N. lappaceum* fruit contains around vitamin C content ranged from 22.047.8 mg/100 g, making it a nutritious food source (Wall, 2006). As previously stated, Vitamin C, as an antioxidant, can combat free radicals, potentially preventing the occurrence of cancer. Vitamin C facilitates the absorption of heme ions, specifically iron. Insufficient vitamin C levels in males may lead to infertility. According to a study by Akmal et al. (2006), vitamin C supplements for infertile men can increase sperm motility, count, and morphology, which may enhance semen quality. Vitamin C and niacin (vitamin B3), included in *N. lappaceum*, improve bodily functions by boosting immune system function and metabolic activities. *N. lappaceum* contains fat-soluble vitamins (A, D, E, and K) that enhance the immune system (Mirghani, 2019) (Table 2).

Among the many health advantages of *N. lappaceum* is its ability to strengthen bones. It is well known that vitamin D plays a critical function in increasing bone density and encouraging bone development. The *N. lappaceum* peel extract contains copper (Archana et al., 2025), which is crucial for synthesizing white and red blood cells. Scientists have found that Vitamin C can contribute to the prevention of aging by maintaining the health of white blood cells (Sasidharan & Huehn, 2024). Due to the advantageous health properties of *N. lappaceum* fruits and the fat found in their seeds (Issara et al., 2014), they have garnered significant attention since fats are like cocoa fat. Furthermore, the fruit of *N. lappaceum* is also used as a food product. *N. lappaceum* is commonly eaten by removing or splitting its rind and then consuming it whole. Sometimes, the fruits that have had their skin removed are prepared by cooking and then served as a sweet dish. They are infrequently preserved in syrup (Eviana Pratiwi & Setiawan, 2020). Fruits are commonly sold in their fresh state, although they have a limited duration before spoiling.

Table 2. Summary of compounds and biological activities of *Nephelium lappaceum.*

Plant part	Primary and secondary metabolites found	Potential usage	Reference(s)
Fruit	alkaloids, carbohydrate, cardiac glycosides, flavonoids, protein, steroids, triterpenoids, coumarins, saponins and tannins phenols	Anticancer, Antioxidant, immune booster, supports fertility and metabolism	Perumal et al., (2021)
Peel	Phenolic acids, flavonoids, oleic acid	Antioxidant, natural anti-microbial agents in the food industry, and natural food preservative.	Jantapaso & Mittraparp-Arthorn, (2022); Liu et. al., (2024), Tsong et el., (2021), Yunusa et al., (2018)
Seed	Phenolic and flavonoid, saponin, alkaloid, oleic acid, hydrocyanic acid, phenols, oxalate, tannins, phytates, fat-soluble vitamins (A, D, E, and K)	Antioxidant, alleviating oxidative-stress, biocoagulant,	Fila et al., 2012); Mirgani, (2019); Tsong et el., (2021)
Leaf	Phenolic, flavonoid, saponins, and tannins	Antidiabetic, antidiarrhea, antibacteria	Chigurupati et al. (2019); Fadilah et al., (2024); Tanjung, & Purba, (2023); Zulkipli et al., (2025)

In the recent past, there has been a growing interest in the potential of this fruit to be used in a variety of ways to benefit the industrial and nutraceutical. The cultivation of rambutan has been on the rise, as it is potential for export and the fresh market (Bhattacharjee et al., 2022). This has contributed to the improvement of the quality of life for cultivators. Additionally, they are regularly preserved through canning or utilized in the production of jams and jellies. On top of that, *N. lappaceum* trees are perennial and create visually attractive landscape features due to their abundant and vibrant fruit as well (Tripathi, 2021).

Based on Tripathi, (2021) the leaves of *N. lappaceum* are used as poultices to ease headaches. The fruit shell, which contains tannins, acts as an astringent. Meanwhile, Javanese people dried the fruit for traditional medicine. In

Malaysia, the roots of the plants are boiled to treat fever. Nevertheless, in the Philippines, these can be consumed either in their fresh state or in large quantities, provided they are peeled and chilled to increase their shelf life. While the seeds are said to be poisonous in their raw state, they are sometimes roasted and eaten (Tripathi, 2021). Besides, Thakur et al., (2024) reported rambutan leaf extract offers a viable, environmentally friendly substitute for alcohol-based sanitisers.

5. CONCLUSION

In conclusion, rambutan, scientifically known as *N. lappaceum*, is a tropical fruit that is widely consumed. The morphological characteristics of this species vary significantly, especially among different cultivars. A conservation strategy is essential to reduce the risk of species degradation in Malaysia, which boasts a rich botanical diversity. This strategy will serve as a valuable resource for prioritizing various studies, particularly those aimed at ensuring food security. To gain a more thorough understanding of the species, ongoing research will be necessary. Additionally, the preservation of plants requires a combination of scientific, economic, and social frameworks from all parties.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the support of Universiti Teknologi MARA (UiTM), Cawangan Pahang Kampus Jengka for providing the facilities and opportunity to conduct this study.

AUTHOR CONTRIBUTIONS

Writing – Original draft preparation, **Liliwirianis Nawi** and **Noranisah Laila Norsham**; Literature Review, **Nurun Nadhirah Md Isa**, **Nur Thabitah Shaikh Nasir**, and **Siti Nurhafiza Mohd Khazaai**: Writing – Review and editing, **Liliwiranis Nawi**, **Nor Lailatul Wahidah Musa**, **Sarah Laila Mohd Jan** and **Ainur Awanis Mohd Badiazaman.**

FUNDING

Not applicable.

DATA AVAILABILITY

Not applicable.

COMPETING INTEREST

The authors declare that there are no competing interests.

COMPLIANCE OF ETHICAL STANDARDS

Not applicable.

SUPPLEMENTARY MATERIAL

Supplementary material is available on the publisher’s website along with the published article.

REFERENCES

Akmal, M., Qadri, J. Q., Al-Waili, N. S., Thangal, S., Haq, A., & Saloom, K. Y. (2006). Improvement in human semen quality after oral supplementation of vitamin C. *Journal of Medicinal Food*, *9*(3), 440–442. https://doi.org/10.1089/jmf.2006.9.440

Archana, E., Saravanan, P., Aseef, A., Arumugam, K. V., Rajeshkannan, R., & Kumar, S. V. (2025). A green route fabrication of copper oxide nanoparticles using *Nephelium lappaceum* L Peel to study antioxidant, antibacterial, antibiofilm, anti-inflammatory, phytochemical, and photocatalytic dye degradation properties. *Sustainable Chemistry One World*, *8*, 100120. https://doi.org/10.1016/j.scowo.2025.100120

Adema, F., Leenhouts, P. W. & Van Welzen, P. C. (1996). Sapindaceae. In Soepadmo, E., Wong, K. M., & Saw, L. G. (Eds), Tree flora of Sabah and Sarawak (Volume II), Kepong: Forest Research Institute Malaysia (FRIM).

Anggraheni, Y.G.D., Mulyaningsih, E.S. (2018). Evaluasi keragaman genetik sembilan varietas rambutan (*Nephelium lappaceum*) dengan marka RAPD (Evaluation of nine rambutan (*Nephelium lappaceum*) varieties genetic diversity using RAPD markers). *Biopropal Industri*, *9*(1): 1-8.

Bhattacharjee, P., Das, S., Das, S. K., & Chander, S. (2022). Rambutan (*Nephelium lappaceum* L.): A potential fruit for industrial use, serving nutraceutical and livelihood interests and enhancing climate resilience. *South African Journal of Botany*, *150*, 26-33. https://doi.org/10.1016/j.sajb.2022.06.064

Corner, E. J. H. (1988). Wayside Trees of Malaya. 3rd ed. Kuala Lumpur: The Malayan Nature Society.

Chigurupati, S., Vijayabalan, S., Selvarajan, K. K., Nanda, S. S. Satpathy, R. (2019) Antidiabetic, Antioxidant and in Silico Studies of Bacterial Endosymbiont Inhabiting *Nephelium lappaceum* L. *Ovidius University Annals of Chemistry*, *30*(2), 95–100. https://doi.org/10.2478/auoc-2019-0017

Ding, J., Zhang, S., Li, Q., Xia, B., Wu, J., Lu, X., You, Q. (2025). Geraniin attenuates isoproterenol-induced cardiac hypertrophy by inhibiting inflammation, oxidative stress and cellular apoptosis. *The Korean Journal of Physiology and Pharmacology*, *29*(3), 307-319. https://doi.org/10.4196/kjpp.24.200

Eviana Pratiwi, D. & Setiawan, I. (2020). The formulation of rambutan leaf (*Nephelium* lappaceum L.) extract on syrup preparation. *Journal of Nutraceuticals and Herbal Medicine*, *3*(1), 1-9.

Fadilah, N. N., Nofriyaldi, A., Junaedi, S. A. (2024). Antipyretic activity test of rambutan (*Nephelium lappaceum* L.) seed in white male mice (*Mus musculus*). *AIP Conference Proceedings*, *2720*, 030003. https://doi.org/10.1063/5.0137639

Fila, W. O., Johnson, J. T., Edem, P. N., Odey, M. O., Ekam, V. S., Ujong, U. P., & Eteng, O. E. (2012). Comparative anti-nutrients assessment of pulp, seed and rind of rambutan (*Nephelium lappaceum*). *Annals of Biological Research*, *3*(11), 5151-5156.

Harahap, S. N., Ramli, N., Vafaei, N. and Said, M. (2012). Physicochemical and nutritional composition of rambutan anak sekolah (*Nephelium lappaceum* L.) seed and seed oil. *Pakistan Journal of Nutrition*, *11*(11): 1073- 1077.

Issara, U., Zzaman, W., & Yang, T. A. (2014). Rambutan seed fat as a potential source of cocoa butter substitute in confectionery product. *International Food Research Journal*, *21*(1), 25-31.

Jantapaso, H., & Mittraparp-Arthorn, P. (2022). Phytochemical composition and bioactivities of aqueous extract of rambutan (*Nephelium lappaceum* L. cv. Rong Rian) peel. *Antioxidants*, *11*(5), 956. https://doi.org/10.3390/antiox11050956

Kaur, G., Muskaan, Chaudhary, N., & Zorempuii. (2022) A review paper on rambutan. *The Pharma Innovation International Journal*, *11*(1S), 1052-1060.

Kuswandi, Sobir, & Suwarno W. B. (2014). Keragaman genetik plasma nutfah rambutan di Indonesia berdasarkan karakter morfologi. *Jurnal Hortikultura*, *24*(4): 289-298. https://doi.org/10.21082/jhort.v24n4.2014.p289-298

Lee, E. J., Ahn, S. M., Nam, Y. H., Kim, M. D., Jo, C. S., Hong, B. N., & Hwang, J. S. (2025). Anti-Inflammatory Effects of *Nephelium lappaceum* Peel Extract and Geraniin on External Skin Stimulation. *Cosmetics*, *12*(3), 117. https://doi.org/10.3390/cosmetics12030117

Lestari, S. R., Djati, M. S., Rudijanto, A., & Fatchiyah. (2013). Production and potency of local rambutan at East Java as a candidate phytopharmaca. *AGRIVITA Journal of Agricultural Science*, *35*(3), 270-276. https://doi.org/10.17503/Agrivita-2013-35-3-p270-276

Li, W., Zeng, J., & Shao, Y. (2018). Rambutãn—*Nephelium lappaceum*. *Exotic Fruits*, *2018*, 369-375. https://doi.org/10.1016/B978-0-12-803138-4.00048-4

Liu, Q., Ma, Q., Li, J., Sun, L., & Zhuang, Y. (2024). Hypoglycemic effect of rambutan (*Nephelium lappaceum* L.) peel polyphenols on type 2 diabetes mice by modulating gut microbiota and metabolites. *Molecular Nutrition & Food Research*, 68(22), e2400555. https://doi.org/10.1002/mnfr.202400555

Manaf, Y. N. A., Marikkar, J. M. N., Long, K., & Ghazali, H. M. (2013). Physico-chemical characterisation of the fat from red-skin rambutan (*Nephellium lappaceum* L.) seed. *Journal of Oleo Science*, *62*(6), 335-343. https://doi.org/10.5650/jos.62.335

Mirghani, M. E. S. (2019). Rambutan (*Nephelium lappaceum*) fats. In Ramadan, M. F. (Ed) Fruit oils: Chemistry and functionality. Cham: Springer International Publishing, pp. 273-280.

Najira, Mardudi, Latif D. A., Ningrum, R. M., Subakti, R. & Husna, I. Y. (2020). Cultural characteristics of rambutan plant (*Nephelium lappaceum* L.) through morphological approaches in Aceh Province. *Bioedukasi*, *18*(2), 107-111. https://doi.org/10.19184/bioedu.v18i2.19494

Palanisamy, U., Manaharan, T., Teng, L. L., Radhakrishnan, A. K., Subramaniam, T., & Masilamani, T. (2011). Rambutan rind in the management of hyperglycemia. *Food Research International*, *44*(7), 2278-2282. https://doi.org/10.1016/j.foodres.2011.01.048

Perumal, A., AlSalhi, M. S., Kanakarajan, S., Devanesan, S., Selvaraj, R., & Tamizhazhagan, V. (2021). Phytochemical evaluation and anticancer activity of rambutan (Nephelium lappaceum) fruit endocarp extracts against human hepatocellular carcinoma (HepG-2) cells. *Saudi Journal of Biological Sciences*, *28*(3), 1816-1825. https://doi.org/10.1016/j.sjbs.2020.12.027

Sasidharan Nair, V., & Huehn, J. (2024). Impact of vitamin C on the development, differentiation and functional properties of T cells. *European Journal of Microbiology and Immunology*, *14*(2), 67-74. https://doi.org/10.1556/1886.2024.00017

Shahrajabian, M. H., Sun, W., & Cheng, Q. (2019). Modern pharmacological actions of longan fruits and their usages in traditional herbal remedies. *Journal of Medicinal Plants Studies*, *7*(4), 179-185.

Siebert B. (1991). *Nephelium lappaceum*. In Verheij EWM, Coronel (eds) Sumber Daya Nabati Asia Tenggara 2 (Buah-buahan yang dapat Dimakan). Jakarta: PT. Gramedia Pustaka Utama.

Soeng, S., Evacuasiany, E., Widowati, W., & Fauziah, N. (2015). Antioxidant and hypoglycemic activities of extract and fractions of Rambutan seeds (*Nephelium lappaceum* L.). *Biomedical Engineering*, *1*(1), 13-18.

Sukmandari, N. S., Dash, G. K., Jusof, W. H. W., & Hanafi, M. (2017). A Review on *Nephelium lappaceum* L. *Research Journal of Pharmacy and Technology*, *10*(8), 1-9. https://doi.org/10.5958/0974-360X.2017.00498.X

Suganthi, A., & Josephine, R. M. (2016). *Nephelium lappaceum* (L.): An overview. *International Journal of Pharmaceutical Sciences and Research*, *1*(5), 36-39.

Tanjung, D. S., & Purba, R. A. (2023). Comparison of antibacterial effectiveness of rambutan leaf extract (*Nephelium lappaceum* L.) and tin leaf extract (*Ficus carica* l.) to *Streptococcus* mutans. *Bioscientia Medicina: Journal of Biomedicine and Translational Research*, *6*(18), 2976-2979. https://doi.org/10.37275/bsm.v6i18.744

Thakur, S., Hosny, K. M., Alissa, M., Bairwan, R. D., Yahya, E. B., Sabri, M., & Khalil, H. A. (2024). Antibacterial properties enhancement tropical fruit waste biopolymer hydrogel loaded *Nephelium lappaceum* leaf extract for sanitizing applications. *International Journal of Biological Macromolecules*, *281*, 136297. https://doi.org/10.1016/j.ijbiomac.2024.136297

Tingting, Z., Xiuli, Z., Kun, W., Liping, S., & Yongliang, Z. (2022). A review: extraction, phytochemicals, and biological activities of rambutan (*Nephelium lappaceum* L) peel extract. Heliyon, 8(11), e11314. https://doi.org/10.1016/j.heliyon.2022.e11314

Tripathi, P.C. 2021. Rambutan (*Nephelium lappaceum* var. *lappaceum*). In Ghosh, S.N. & Sharma, R.R. (Eds) Tropical Fruit Crops: Theory to Practical, New Delhi: Jaya Publishing House. pp. 542-575.

Tsong, J. L., Goh, L. P. W., Gansau, J. A., & How, S. E. (2021). Review of *Nephelium lappaceum* and *Nephelium ramboutan-ake*: A high potential supplement. *Molecules*, *26*(22), 7005. https://doi.org/10.3390/molecules26227005

Turner, I.M. 1995. A catalogue of the vascular plants of Malaya. *Gardens' Bulletin Singapore 47*(1&2): 1-757.

Van Balgooy, M. M. J. (1998). Malesian Seed Plant. Volume 2 – Portraits of Tree Families. Leiden: Rijksherbarium/Hortus Botanicus.

Wall, M. M. (2006). Ascorbic acid and mineral composition of longan (*Dimocarpus longan*), lychee (*Litchi chinensis*) and rambutan (*Nephelium lappaceum*) cultivars grown in Hawaii. *Journal of Food Composition and Analysis*, *19*(6-7), 655-663. https://doi.org/10.1016/j.jfca.2005.12.001

Wang, J., Zhu, W., Yang, C., Li, M., Feng, S., Tang, L., & Cui, Z. (2024). Comparative metabolomic and transcriptomic analysis reveals that variations in flavonoids determine the colors of different rambutan cultivars. *Horticulturae*, *10*(3), 263. https://doi.org/10.3390/horticulturae10030263

Wee, Y. C. (2003). Tropical trees and shrubs: A selection for urban planting. Singapore: Sun Tree Publishing.

Windarsih, G., & Efendi, M. (2019). Morphological characteristics of flower and fruit in several rambutan (*Nephelium lappaceum*) cultivars in Serang City, Banten, Indonesia. *Biodiversitas Journal of Biological Diversity*, *20*(5), 1442-1449. https://doi.org/10.13057/biodiv/d200537

Yunusa, A. K., Abdullahi, N., Rilwan, A., Abdulkadir, A. R., & Dandago, M. A. (2018). DPPH radical scavenging activity and total phenolic content of rambutan (*Nephelium Lappaceum*) peel and seed. *Annals: Food Science & Technology*, *19*(4), 774-779.

Zulkipli, H., Fong Whyyan, A., Shahbuddin, M., & Shahbuddin, D. (2025). Phytochemical screening and antimicrobial activities of *Nephelium lappaceum* leaf extracts against food spoilage-causing bacteria, *Bacillus subtilis* and *Pseudomonas aeruginosa*. *Malaysian Journal of Microbiology*, *21*(3), 371-382. https://doi.org/10.21161/mjm.240738