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Nephelium Lappaceum (L.): An overview

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Abstract
Nephelium lappaceum is a native inhabitant of Southeast Asian countries such as Indonesia, Malaysia, Thailand and the Philippines where it is commonly known as rambutan. It is a medicinal and commercial crop. The fruits are eaten fresh or as canned products and some medicinal uses include the treatment for diarrhea, fever, dysentery and dyspepsia. Dried fruit rind is used in traditional medicine, cooking and in the manufacture of soap. The roots bark and leaves have various uses in medicine and in the production of dye.

Keywords: *Nephelium lappaceum*, Rambutan, fruits, leaves, root, bark

1. Introduction
Nephelium lappaceum L. is native to South East Asia. It commonly known as rambutan (King of Fruits) which belongs to the family of Sapindaceae, is an attractive tropical fruit widely distributed in Malaysia and Indonesia. In Malaysia, red and yellow rambutan fruits are available in the market. The fruits are ovoid, with a red or yellow pericarp covered with soft spines that vary in colouring from yellow and red (Figure 1). They are different in taste. The fruits are distinctive for its large size, unique odor and a formidable thorn covered hersk (Maran 2013). The custard-like flesh has an exquisite flavor and is at the same time aromatic and sweet with a strange balsamic taste. Rambutan has been claimed that the fruit possess great rejuvenating power.

Botanical Description
Nephelium Lappaceum is a medium sized tropical tree. It is an evergreen tree growing to a height of 12-20m. The leaves are alternate 10-30 cm long, pinnate with 3-11 leaflets, each leaflet 5-15cm wide and 10-30cm broad. The fruit is round or oval drupe, 3-6cm long and 3-4cm broad. The leathery skin is reddish (rarely orange or yellow) and covered with fleshy pliable spines. The seed is glossy brown 2-3cm with a white basal scar.

Climatic Factor
Nephelium lappaceum is adapted to warm tropical climates around 22-30^{o}c and is sensitive to temperature below 10^{o}c. It is grown within 12-15^{o}c of the equator. The tree grows well on heights up to 500m (1600ft) above sea level and they soil rich in organic matter and thrive only on hilly terrain as they require good drainage.

Harvest
Nephelium lappaceum tree bears twice annually, once in late and early winter. The fragile nutritious fruits must be ripened on the tree. The best quality *Nephelium lappaceum* is generally that which is harvested still attached to the branch. They are harvested over a four to seven week period. The fresh fruits are easily bruised and have a limited shelf life it is less susceptible to rot damage, pests and remains fresh for a much longer time than the ones harvested from the branch. *Nephelium lappaceum* can be kept for three to five days in the refrigerator and covered with plastic wrap to reduce moisture loss or leave them out in a humid environment.

Chemical constituents
Fruits contains fat 35%, ash 2% and vitamin C 4%. Seeds were abundant in fats (38.9%), protein (12.4%) and carbohydrates (48%). The seeds have traces of an alkaloid, sugar, starch and ash. The Flesh pulp of the fruit yields saccharose 7.8%, dextrose 2.25% and levulose 1.25 %.The testa of the seed is toxic due to the presence of saponin and tannin. Rambutan seeds contain equal proportions of saturated and unsaturated fatty acids, where arachidic (34%) and oleic (42%) acids so seeds are highest in fat content. Major fatty acids were oleic acid (40.45%) and arachidic acid (36.36%). AOO (arachidoyl-dioleoylglycerol) was the major triacylglycerol compound of rambutan seed oil (49.84%) (Harahap *et al*., 2012).

Seed oil showed an acid value of 0.37%, iodine value (37.64%) and saponification value 157.07.The pleasant fragrance of rambutan fruit derives from numerous volatile organic compounds, including beta-damascenone, vanillin, phenylacetic acid and cinnamic acid.

***Nephelium lappaceum* L.**

Traditional Uses

Rambutan has been used as traditional medicine for centuries especially as a remedy for diabetes and high blood pressure (Kabuk *et al*., 2000; Khonkarn *et al*., 2010). In the 1920s, Rambutan fruit products, Inc.,of New York City launched a product (Dur-India) as a health food supplement selling at US$9 for a dozen bottles, each containing 63 tablets (Nethaji *et al.*, 2005). Dried fruit rind is used in traditional medicine, cooking and in the manufacture of soap. The roots, bark and leaves have various uses in medicine and in the production of dyes. The fruit acts as a vermifuge a medicine that destroys intestinal worms and helps to expel them. It is also used against diarrhea and dysentery. The bark is astringent and used as a remedy for thrush. A decoction of the roots is taken as a febrifuge.Fruit is astringent, stomachic, and anthelmintic. The leaves are used in poultices for headaches. In Malaysia, the roots are used in a decoction for treating fever and the bark as an astringent for tongue diseases.

Commercial Uses

Nephelium lappaceum fruit is usually sold fresh used in making jam and jellies. Its single brown seeds is high in certain fats and oil (Oleic and arachidic acid) valuable to industry and used in cooking and manufacturing of soap. Young shoots are used to produce a green colour on silk that is first dyed yellow with turmeric. The fruit walls are used, together with tannin-rich parts of other plants, to dye silk black after a preliminary red staining. The roots, bark and leaves have various uses in medicine and in the production of dyes. Leaves are used, together with mud, as an impermanent black dye. Seeds contain oil formerly used for illumination and a fat used formerly for soap. The seed kernel can be used for the production of rambutan tallow, a solid fat similar to cacao butter, which is used for soap and candles. The fruit wall contains a toxic saponin is dried and used as medicine. Dried fruit rind is also used in traditional medicine, cooking and in the manufacture of soap.

Odour Active Compounds

The volatile compounds from the red-skinned cultivar of rambutan were extracted using both Freon 113 and ethyl acetate solvents. Isolation and characterization of odor-active compounds present in the fruit were mediated by gas chromatography/olfactory (GC/O) chromatography, and spectrometry. GC/O analysis also detected more odor-active compounds in the polar extracts. Over 60 compounds in the extracts had some odor activity. The 20 most potent odorants included β-damascenone, (*E*)-4,5-epoxy-(*E*)-2-decenal, vanillin, (*E*)-2-nonenal, phenylacetic acid, cinnamic acid, unknown 1 (sweaty), ethyl 2-methylbutyrate, and δ-decalactone. On the basis of calculated odor activity values, β-damascenone, ethyl 2-methylbutyrate, 2, 6-nonadienal, (*E*)-2-nonenal, and nonanal were determined to be the main contributors to the fruit aroma (Peter *et al.*,1998)

Phytochemical Studies

Rambutan contains a large variety of substances possessing antioxidant activity such as vitamin C, vitamin E, carotenes, xanthophylls, tannins and phenolics (Ma *et al*., 2008). The Barks, leaves and fruit rind yielded positive for alkaloids, saponins and tannins (Uma *et al.*, 2011). Rambutan fruit peel contains flavonoids, tannins and saponins (Dalimartha 2003).

Antibacterial Activities

The rambutan peel extracts exhibited antibacterial activity against five pathogenic bacteria The most sensitive strain, *Staphylococcus epidermidis*, was inhibited by the methanolic extract (MIC 2.0 mg/mL) (Fidrianny 2015).

Antioxidant Activity

The rambutan unpigmented fruit flesh, does not contain significant polyphenol content, but its colorful rind displays diverse phenolic acids, such as syringic, coumaric, gallic, caffeic and ellagic acids having antioxidant activity in vitro. Ethanol extract of rambutan fruit peels contains ethyl gallate (Muhtadi, *et al.*, 2014) which has the strong antioxidant activity, epigallocatechin-3-gallate (Palanisamy *et al.*, 2011) as the potential antihyperglycemia (Waltner-Law *et al.*, 2002) as well as powerful antioxidants (Tabata *et al.*, 2008). Ethanol extract of rambutan fruit peels are known to have a greater ability as an antioxidant to capture DPPH free radicals than vitamin E (Tamimy 2006).

In rambutan variety**,** Ethyl acetate extract of lebak bulus rambutan peels had the highest DPPH scavenging activity with IC_{50} 3.5 µg/mL, while ethyl acetate extract of binjai rambutan peels had the highest FRAP capacity with EC_{50} 77.1 µg/mL. N-hexane extract of binjai rambutan peels had the

highest total flavonoid (3.46 g QE/100 g), ethyl acetate extract of lebak bulus rambutan peels had the highest phenolic content (40.9 g GAE/100 g) and n-hexane extract of rapiah rambutan peels had the highest carotenoid content (0.61 g BE/100 g). There was a positively high correlation between total phenolic content with their antioxidant activity using DPPH and FRAP assays.

In rambutan peel, the extraction of antioxidant compounds, FRAP ranged from 3800.25±86.49 to 4116.5±88.41 (µmol Fe2+/g D.W), flavonoid from 6.41±0.48 to 8.57±0.35 (mg Quercetin/g D.W), and total phenolic recovery from 297.78±4.06 to 358.42±4.63 (mg GAE/g D.W.) (*Azaria* and Pi –Jen 2015)

Anti-Hyperglycemic Activity

Geraniin, an ellagitannin, was identified as the major bioactive compound isolated from the ethanolic *Nephelium lappaceum* L. rind extract. It act as an anti-hyperglycemic agent In addition to its extremely high anti-oxidant activity and low pro-oxidant capability, geraniin is seen to possess in vitro hypoglycemic activity alpha-glucosidase inhibition IC50 = 0.92 lg/ml and alpha-amylase inhibition IC50 = 0.93 lg/ml), aldol reductase inhibition activity (IC50 = 7 lg/ml) and has the ability to prevent the formation of advanced glycation end-products (AGE). Geraniin therefore, has the potential to be developed into an anti-hyperglycemic agent (Uma *et al*., 2011)

Geraniin, one of polyphenol compounds, so that total phenolic was used as an index to investigate the optimum condition of extraction from rambutan peel (red and yellow) in Taiwan. The highest total phenolic content found in red rambutan variety was at 1:15 (g/mL) ratio, but no significant difference for yellow rambutan. FRAP ranged from 3800.25±86.49 to 4116.5±88.41 (µmol Fe2+/g D.W), flavonoid from 6.41±0.48 to 8.57±0.35 (mg Quercetin/g D.W) and total phenolic recovery from 297.78±4.06 to 358.42±4.63 (mg GAE/g D.W.).

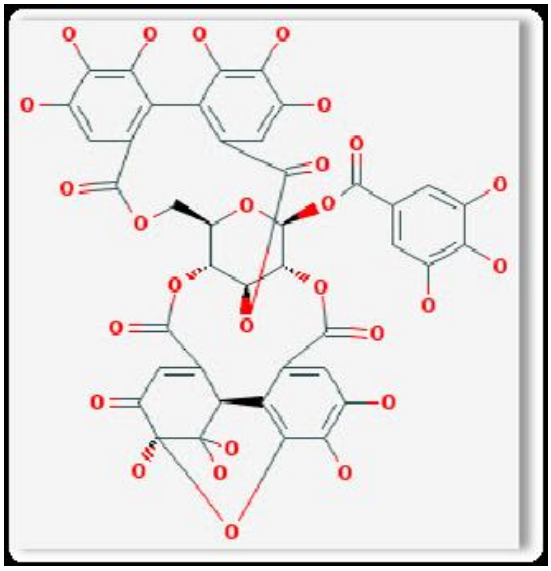

Fig 1: Chemical Structure of Geraniin

Antidiabetic and Antihypercholesterolemic Activities

The highest percentage reduction in blood glucose and cholesterol levels are shown of rambutan fruit peels extract with dose 500 mg/kg and the value of percentage reduction were 61.76±4.26% and 60.75±8.26 (Muhtadi *et al*., 2016).

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