

## Phytochemical Contents of Underutilized Edible Plant from Riau Province, Ridan (*Nephelium maingayi* Hiern – Sapindaceae)

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**Abstract:** Ridan (*Nephelium maingayi*) is one of *Nephelium* (Sapindaceae) member distributed in Riau Province. This underutilized edible plant is commonly found as wild species, and poses three different fruit morphologies (oval, asymmetric and rounded shaped fruit). The phytochemical contents of these fruit species had not been reported. This study aimed to identify the phytochemical contents of fruit parts (peel, aril and seed) of three different fruit shapes of *N. maingayi* (oval, asymmetric and rounded shaped fruit) from Riau Province. A total of six secondary metabolite groups were tested (alkaloid, terpenoid, steroid, flavonoid, saponin dan tannin), using qualitative analysis based on the presence of precipitation (alkaloid), the change of mixture color (steroid, terpenoid, flavonoid and tannin) and soapy foaming substance for saponin. The result showed that peels of Ridan (*N. maingayi*) gave the highest phytochemical contents (alkaloid, terpenoid, flavonoid, saponin and tannin.). Terpenoid and saponin were found in peel, aril and seed of three different fruit shapes. This study concluded that the phytochemical contents of three fruit shapes of Ridan (*N. maingayi*) varies among the different shapes of fruit. This result of this study provide the first information of bioactive profile of *N. maingayi* form Riau Province.

**Keywords:** Phytochemical Content, Secondary Metabolite, Riau, Ridan, Underutilized Fruit, Wild *Nephelium*.

### Introduction

The study of phytochemical contents of *Nephelium* (Sapindaceae) members is very limited. The most common species that had been screened its secondary metabolite is Rambutan (*Nephelium lappaceum*) as reported many by scientists i.e. Halim *et al.* (2019), Nethaji *et al.* (2015), Kamlanathan *et al.* (2015) Muhtadi *et al.* (2017) and Sukmandari *et al.* (2017). Ridan (*Nephelium maingayi* Hiern) is one out of 25 *Nephelium* member). This species is characterized by its hairless peel, with small fruit (ca.1.2 – 2.2 cm length x 1 – 1.5 cm width). Most of the *Nephelium* members have long appendage

that resemble as “hair”. Therefore, the local name of hairy fruit *Nephelium* is Rambutan (from “rambut” – hair). The fruit of *N. maingayi* has no long appendage and grouped as hairless *Nephelium*. The edible part of Ridan fruit is aril. However, due to its small and almost sour aril, this plant is rarely found as cultivated species at Riau Province but commonly found as wild species. Moreover, the stem has low economical value due to its small size. Therefore, *N. maingayi* is one of underutilized wild species in this province.

The color of fruit peel of *Nephelium* members, including Ridan are reddish yellow to blackish red. These color derived from the natural plant pigment such as lycopene (Kong *et*

*al.* 2010), anthocyanin (Lian *et al.* 2011) or anthocyanin (Hock *et al.* 2017). The study of Lian *et al.* (2011) reported that anthocyanin is natural pigment of peel of *N. lappaceum*. During our previous exploration at Kuantan Singingi and Kampar District Riau Province, we observed that the peel fruit color of Ridan (*N. maingayi*) varies from light red to dark red color, based on the shape of fruit. These colors indicate high phytochemical contents of peel of Ridan. A total of three different fruit shape are identified from Riau, i.e. ovale shaped fruit, asymmetric shaped fruit dan rounded shaped fruit. Every fruit shape has different peel color.

The phytochemical study of *Nephelium* species was commonly investigated on *N. lappaceum*, the most common *Nephelium* species. However, there is no report on phytochemical content of *N. maingayi*. The phytochemical profiling on plant is necessary in order to discover plant bioactive profile. This examined the health benefit of a plant species. Therefore, this study aimed to conduct phytochemical screening of the peel, aril and seed of Ridan (*N. maingayi*).

## Materials and Methods

### Sample collection

All of samples were collected from the field using exploration method. During the exploration we identified a total of three variations of fruit morphology, i.e. oval shaped fruit, asymmetric shaped fruit and rounded shaped fruit. Table 1 shows the specimens that examined in this study.

### Phytochemical screening

The phytochemical screenings had been carried out on fruit peel, aril and seed of three different fruit shape of *Nephelium maingayi* (Table 1). The secondary metabolite groups observed in this study were alkaloid, terpenoid, steroid,

flavonoid, saponin, and tannin. Table 2 presents the materials and methods of phytochemical screening, as well as the positive parameter of each secondary metabolite test. The result of phytochemical screenings was presented using symbol + (positive) and – (negative). The data were then tabulated and descriptively analysed.

## Result and Discussion

In this study, phytochemical screening had been carried out from a total of 9 samples of Ridan (*N. maingayi*). It had been done using qualitative analysis based on the presence of precipitation (alkaloid), the change of mixture color (steroid, terpenoid, flavonoid and tannin) and soapy foaming substance for saponin. Figure 1, 2, and 3 show the phytochemical screening of each examined sample, indicated by the change of the mixture after being tested.

Based on the phytochemical result of three different fruit shapes of Ridan (*N. maingayi*) presented in Figure 1, 2 and 3, the phytochemical contents vary among the examined samples. Alkaloid was found in four out of nine samples, i.e. three extracts of fruit peel (oval shaped fruit, asymmetric shaped fruit and rounded shaped fruit) and one extract of seed (oval shaped fruit). The alkaloid content is indicated by the presence of red or orange precipitation. The peel extracts of oval shaped fruit (Fig.1.Ap), asymmetric shaped fruit (Fig 2.Ap) and rounded shaped fruit (Fig. 3.Ap) shows the precipitation at the bottom of test tube. Only seed extract of rounded shaped fruit of Ridan (Fig. 1.As) that indicates the presence of alkaloid.

Table 1. List of examined specimen in this study

No.	Fruit Characteristic	Organ	Sample Codes	Note
A.	Oval shaped fruit: Oval fruit has the biggest size among the other fruit, with ca. 1.5 cm long and 1 cm wide, narrower toward base, tip rounded, fruit base and tip are symmetric. The peel of this fruit is light red	1. Peel	1	Bangkinang Village, Bangkinang, Kampar, Riau Province
		2. Aril	2	
		3. Seed	3	
B.	Asymmetric shaped fruit: asymmetric at the base and tip of fruit, wider at the base, ca. 1.2 cm. The peel is dark red peel.	1. Peel	4	Tanjung Village, Hulu Kuantan, Kuantan Singingi, Riau Province
		2. Aril	5	
		3. Seed	6	
C.	Rounded shaped fruit: fruit shape is rounded, ca. 1 cm in diameter, dark red peel	1. Peel	7	Rumbio Jaya, Kampar, Riau Province
		2. Aril	8	
		3. Seed	9	

Table 2. Methods and Parameters of Phytochemical screening

No.	Group of secondary metabolite	Materials and Methods	Parameters of Positive Result (+)
1	Alkaloid	4 gr of ground sample + Chloroform + 10 ml ammoniac-chloroform, filter. 10 filtrate drops + H <sub>2</sub> SO <sub>4</sub> 2N, mix well. 3 drops of upper layer + Dragendorff.	Red, orange precipitation
5	Terpenoid	50 mg of ground sample + AAG incubate for 15 min + 3 drops H <sub>2</sub> S <sub>4</sub>	Orange, purple
6	Steroid		Green to blue
2	Flavonoid	200 gr ground sample, + 5 ml 70% ethanol, heat for 5 min + 3 drops of absolute HCL + 0.2 gr mg powder.	Yellow, orange to dark red or magenta
3	Saponin	2 gr thin cut sample + aquades, boiled 2 – 3 min. Shake the mixture strongly.	Soapy foaming substance
4	Tannin	20 mg thin cut sample + 70%, ethanol. 1 ml mixture +2 drops of 1% FeCl <sub>3</sub>	Blueish dark, green

(References: Sangi *et al.* 2008; Deepa *et al.* 2014; Raman *et al.* 2018)

For terpenoid test, all of the samples contain this secondary metabolite, indicated by the presence of orange to purple coloration as seen in Fig. 1B, 2B and 3B. In contrast, there is no samples have steroid due to no green or blue coloration. All of the fruit parts (peel, aril and seed) from three different fruit shapes indicated the presence of terpenoid. Figure 1.Bp, Ba and Bs show the terpenoid test result of peel, aril and seed of oval shaped fruit. The peel gave the strongest purple colour (Fig. 1.Bp) than aril (Fig. 1.Ba) and seed (Fig. 1.Bs). The terpenoid test for peel of asymmetric shaped fruit, also shows the strongest purple colour (Fig. 2.Bp). For rounded shaped fruit, the terpenoid test shows that peel is only slightly different coloration than aril and seed).

For flavonoid test, all of three extracts of peels gave positive result indicated by yellow, orange to dark red or magenta coloration (Fig. 1.Cp, Fig. 2.Cp and Fig. 3.Cp). This secondary metabolite was not found on aril (Fig. 1.Ca, Fig. 2.Ca and Fig. 3.Ca) and seed (Fig. 1.Cs, Fig. 2.Cs and Fig. 3.Cs) of three fruit shapes due to no coloration presence. As well as terpenoid, saponin was found in all of nine tested sample. The saponin content can be observed by the presence of soapy foaming substance as seen on Figure 1.Dp, Figure 2.Dp and Figure 3.Dp. The tannin content was found in four samples i.e. peel extracts of three fruit shape (Fig. 1.Ep, Fig. 2.Ep, and Fig. 3.Ep), and seed extract of oval shaped fruit (Fig. 1.Es). The result of phytochemical contents of each sample is tabulated at Table 3. The higher number of secondary metabolite is

found in peel of three different fruit shape, with a total of five compound (alkaloid, terpenoid, flavonoid, saponin and taninn). The similar secondary metabolite among the examined samples was also observed on aril. However, only two compound found in this part. i.e. terpenoid and saponin. The Seed of oval shaped

fruit gave the highest number of secondary metabolite, with a total of four compounds ie. Alkaloid, terpenoid, saponin and tanin). On the other hand, only two compounds (terpenoid and saponin) were present in seed of asymmetric shaped fruit and rounded shaped fruit of *N. maingayi*.

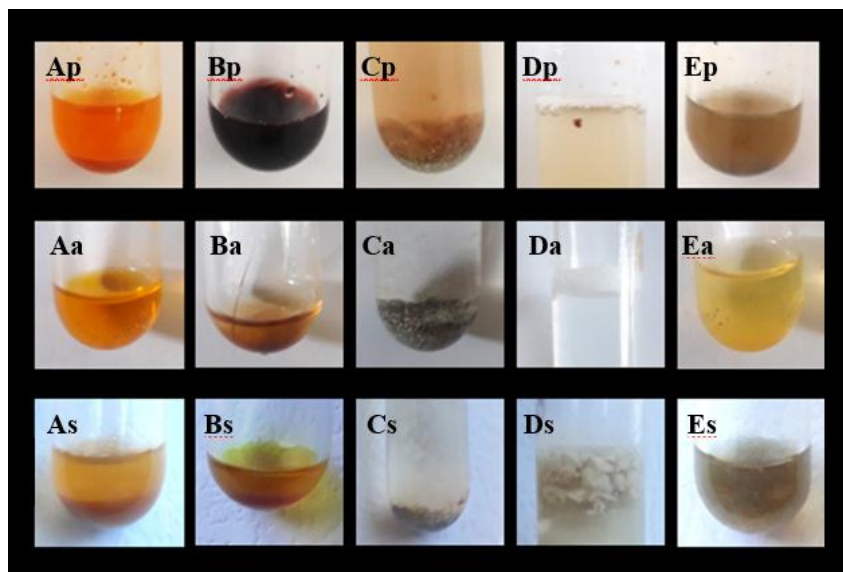


Figure 1. The phytochemical screening result of oval shaped fruit of Ridan (*N. maingayi*) (A = alkaloid, B = terpenoid and steroid, C = flavonoid, D = saponin, E = tannin, p = peel, a = aril, s = seed).

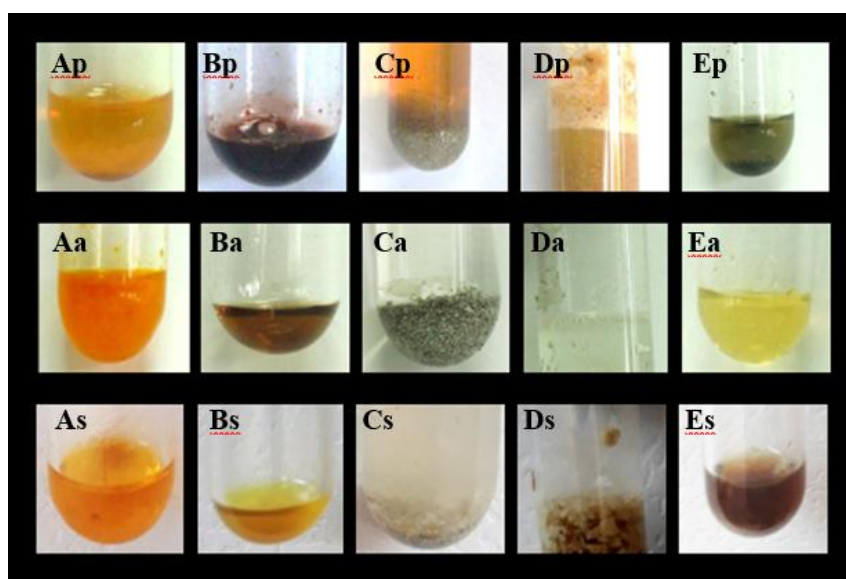


Figure 2. The phytochemical screening result of asymmetric shaped fruit of Ridan (*N. maingayi*) (A = alkaloid, B = terpenoid and steroid, C = flavonoid, D = saponin, E = tannin, p = peel, a = aril, s = seed).

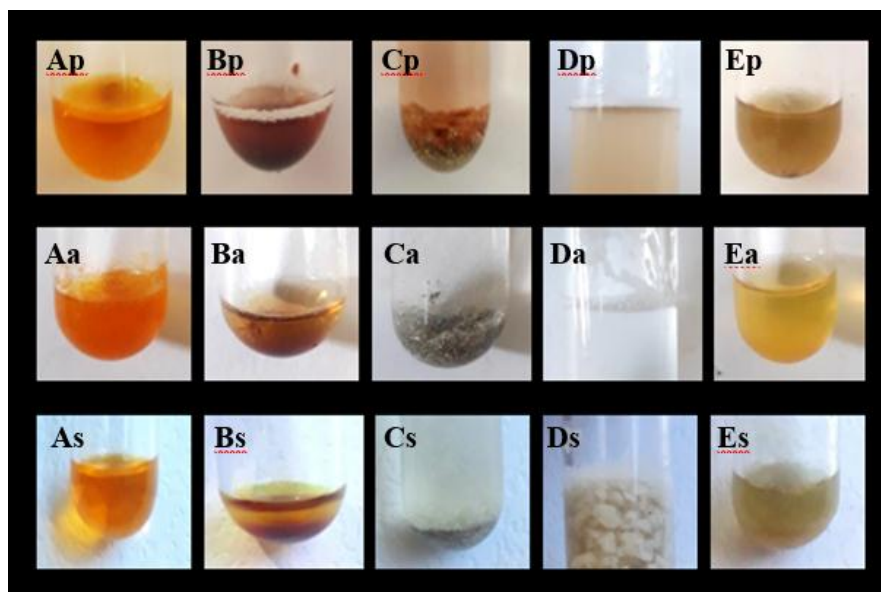


Figure 3. The phytochemical screening result of rounded shaped fruit of Ridan (*N. maingayi*) (A = alkaloid, B = terpenoid and steroid, C = flavonoid, D = saponin, E = tannin, p = peel, a = aril, s = seed).

Table 3. Phytochemical contents of Ridan (*N. maingayi*)

Fruit Characteristic	Sample Codes	Organs	ALK	TER	STE	FLA	SAP	TAN	NSM
A. Oval shaped fruit	1	Peel	+	+	-	+	+	+	5
	2	Aril	-	+	-	-	+	-	2
	3	Seed	+	+	-	-	+	+	4
B. Asymmetric shaped fruit	4	Peel	+	+	-	+	+	+	5
	5	Aril	-	+	-	-	+	-	2
	6	Seed	-	+	-	-	+	-	2
C. Rounded shaped fruit	7	Peel	+	+	-	+	+	+	5
	8	Aril	-	+	-	-	+	-	2
	9	Seed	-	+	-	-	+	-	2

Note: ALK = alkaloid, TER = terpenoid, STE = steroid, FLA = flavonoid, SAP = saponin, TAN = tannin, NSM = number of secondary metabolite.

### Alkaloid

Alkaloid is one of secondary metabolite that commonly present in plant group (Matsuura & Fett-Neto 2015). This group is an organic compound with nitrogen as basic component (Sangi *et al.* 2008). In plant, alkaloid plays an important rule on plant defense from herbivore and pathogen attack due to its toxicity (Ruby & Sara. 2015; Matsuura & Fett-Neto 2015). The presence of alkaloid in this study was known by the presence of precipitation with red or orange coloration. Alkaloid was found in four samples with sample code 1, 3, 4, and 7. Three samples

are the extracts of peel of oval (1), asymmetric (3) and rounded (7) shaped fruit, and one sample is seed extract of *N. maingayi* with oval shaped fruit (4). However, the precipitation of seed extract of oval shaped fruit of *N. maingayi* is thicker than peel extract as seen in Figure 1.As. This result indicates the high amount of alkaloid. The alkaloid test used Dragendroff reagent, and the coloration is present due to the reaction of potassium bismuth iodide (Kumar 2014). The presence of alkaloid compound was reported on *N. lappaceum* (Nethaji *et al.* 2017).

### Terpenoid and steroid

The tests of terpenoid and steroid were carried together, using Lierman Bauchard reagent that contain H<sub>2</sub>SO<sub>4</sub> and Anhydrate acetic acid (Malik & Ahmad 2017). The presence of terpenoid indicated by orange to purple coloration, while steroid by green to blue coloration (Sangi *et al.* 2008; Raman *et al.* 2018). Terpenoid is large organic chemical in plant that derived from terpene. Plant with terpenoid content has potency as antimicrobial, antioxidant, anticancer and as well as nerf protection (Malik & Ahmad 2017). Steroid is a secondary metabolite of terpenoid group. It functions to increase the growth hormone and protect plant from insect, as well as anti-inflammatory agent (Patel & Savjani 2015). In this study, all of the tested samples showed positive result of terpenoid, due to the presence of orange to purple coloration of the extracts as shown in Figure 1, 2, and 3 (Bp, Ba, Bs). However, the high amount of terpenoid was found on peel extract of three different fruit (Fig. 1.Bp, 2.Bp and 3.Bp), that showed dark purple coloration. In contrast, steroid is not found in all of the tested samples.

### Flavonoid

Flavonoid is a bioactive compound from phenol group that also commonly found in plant (Panche *et al.* 2016). The presence of flavonoid indicated by the yellow, orange to dark red and magenta coloration (Sangi *et al.* 2008; Ruby & Sara 2014). The coloration of flavonoid test is due to the reduction of magnesium and HCL (Robinson 1995). The function of flavonoid in plant is to support the transport of auxin hormone. Root and stem growth as well as pollination (Weston & Mathesius 2013). Flavonoid is also plays an important function in antibacterial activity (Xie *et al.* 2015), anti-fungal, anti-viral (Weston & Mathesius 2013, anti-inflammation and also has anticancer activity (Panche *et al.* 2016)). In this study, flavonoid is only found of peel extracts of three different fruit shapes (Fig. 1.Cp, 2.Cp and 3.Cp). This compound is not presence on aril and seed extracts.

### Saponin

Saponin is derived from latin word “sapo” or soap, due to the soapy active compound at the

surface (Faizal & Gellen 2013). The soapy foaming substance is present when the mixture is strongly shaken, because of colloidal solution in water. Saponin is glycoside, that can be found in some part of plant organ (Guclu-Ustundag & Maaza 2007; Faizal & Gellen 2013). Saponin can be used for pesticide, insecticide, molluscicide, fungicide and for foaming industry (Faizal & Geelen 2013). All of nine samples that had been tested in this study showed the presence of saponin. However, the thickness of soapy foaming substance is different among the samples. The thick layer was observed on 4 samples, i.e. sample code 3 (seed extract of oval shaped fruit; Fig.1.Dp), 4 (peel extract of asymmetric shaped fruit; Fig. 2.Dp), 6 (seed extract of asymmetric shaped fruit; Fig. 2.Ds) and 9 (seed extract of rounded shaped fruit; Fig. 3.Ds). Therefore, these four extracts have higher amount of saponin than the rest extracts that showed thin layer of soapy foaming substance.

### Tannin

Tannins are group of astringent, a polyphenol in plant that produce bitter taste (Ashok & Uphadyaya 2012). Tannins can bind protein and other macromolecule in tanning process. (Constabel *et al.* 2014) and widely used for coloring of textile, animal skin product, food, cosmetic and paper (Kyund, 2018). The presence of tannin indicated by green or blue coloring. In this study, only four out of nine samples that indicate the presence of tannin, i.e. sample code 1 (peel extract of oval shaped fruit; Fig. 1.Ep.), 3 (seed extract of oval shaped fruit; Fig. 1.Es), 4 (peel extract of asymmetric shaped fruit; Fig.2.Ep) and 7 (peel extract of rounded shaped fruit; Fig. 3.Ep).

Based on the explanation above, the phytochemical contents of three fruit shapes of Ridan (*N. maingayi*) varies among the different shape of fruit. The fruit peels contain the highest phytochemical contents. A total of 5 secondary metabolites were identified in fruit peel, i.e. Alkaloid, terpenoid, flavnoid, saponin and tanin. Usually, these compounds are commonly found in medicinal plants, as reported by Dhandapani and Shabna (2008). Therefore, it is necessary to conduct further study on medicinal properties of *N. maingayi*, especially in fruit peel. The other *Nephelium* that had been reported its benefit is *N.*

*lappaceum* (Rambutan) that contain high antioxidant activity (Fidrianny *et al.* 2015).

## Conclusion

The phytochemical contents of three fruit shapes of Ridan (*N. maingayi*) varies among the different shapes of fruit. The fruit peels contain the highest phytochemical contents, ie. Alkaloid, terpenoid, flavonoid, saponin and tannin. This study provides the first information of bioactive profile of *N. maingayi* form Riau Province.

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