

Research Review on Secondary Metabolite Compounds of Mangifera Casturi Bark and Their Functions

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ABSTRACT

Mangifera casturi is one of 31 species of mangoes found in Kalimantan, Indonesia. In 2000, species were collected in the island of Borneo (Sarawak and Sabah). The 'Casturi' originated in a rural area around Banjarmasin in southern Borneo, called Kalimantan or Kasturi. *Mangifera casturi* is a specific plant with superior characteristic. This species can reach a height of 15 m and tolerate extreme weather conditions. *Mangifera casturi* contains bioactive compounds such as alkaloid,

flavonoid, tannin, terpenoid and phenolic groups proven can be applied as antioxidant, anti-inflammation, antibacterial, antifungal, antidiabetic, antileukemic and immunostimulatory. *Mangifera casturi* is potential as a traditional treatment.

Keywords: *Mangifera casturi*, Kalimantan, Compounds, Treatment

INTRODUCTION

Diversity of plants can be found in Indonesia. Some of them only found in certain region of Indonesia. *Mangifera casturi* is one of 31 species of mangoes found in Kalimantan, Indonesia. The species were collected in 2000 on the island of Borneo (Sarawak and Sabah). The 'Casturi' may have originated in a very small area around Banjarmasin in southern Borneo, where it is called Kalimantan or Kasturi. The species was endemic to the region. The tree is about 10–30 m tall. It is due to the study that the 'Casturi' mango tree can reach a height of 15 m (measured from ground level to the top of the tree) and a trunk diameter 40–115 cm measured at 50 cm above ground level. Bark is grayish white to light brown; sometimes there are small cracks or fissures with 1 cm of dead bark. The crown diameter is approximately 12.0 m and the crown shape is semi-circular. The 'Casturi' mango tree growth habit is spreading with dense foliage.^{1,2}

Mangifera casturi is a specific plant with superior characteristic. This species can tolerate extreme weather conditions. Based on the study, they optimally grow at temperature as low as 29°F for 5 hours or more with only minimal damage. They grow with good vigor and have no environmental limitations.³

Other characteristics of *Mangifera casturi* are dark-brown stems with roughly surface and sticky, green leaves, lancet-shapes, fruit skin has a purplish brown colour, flesh of fruit has a bright yellow till orange colour, distinctive smell, slightly sour sweet taste, and contains lots of fiber. This endemic plant also contains bioactive compound used as medicine. *Mangifera casturi* bark known contains alkaloids, flavonoids, terpenoids, phenols, and saponins. It has been proven by chemical identification test and analysis of thin layer chromatography (TLC) in some studies.⁴

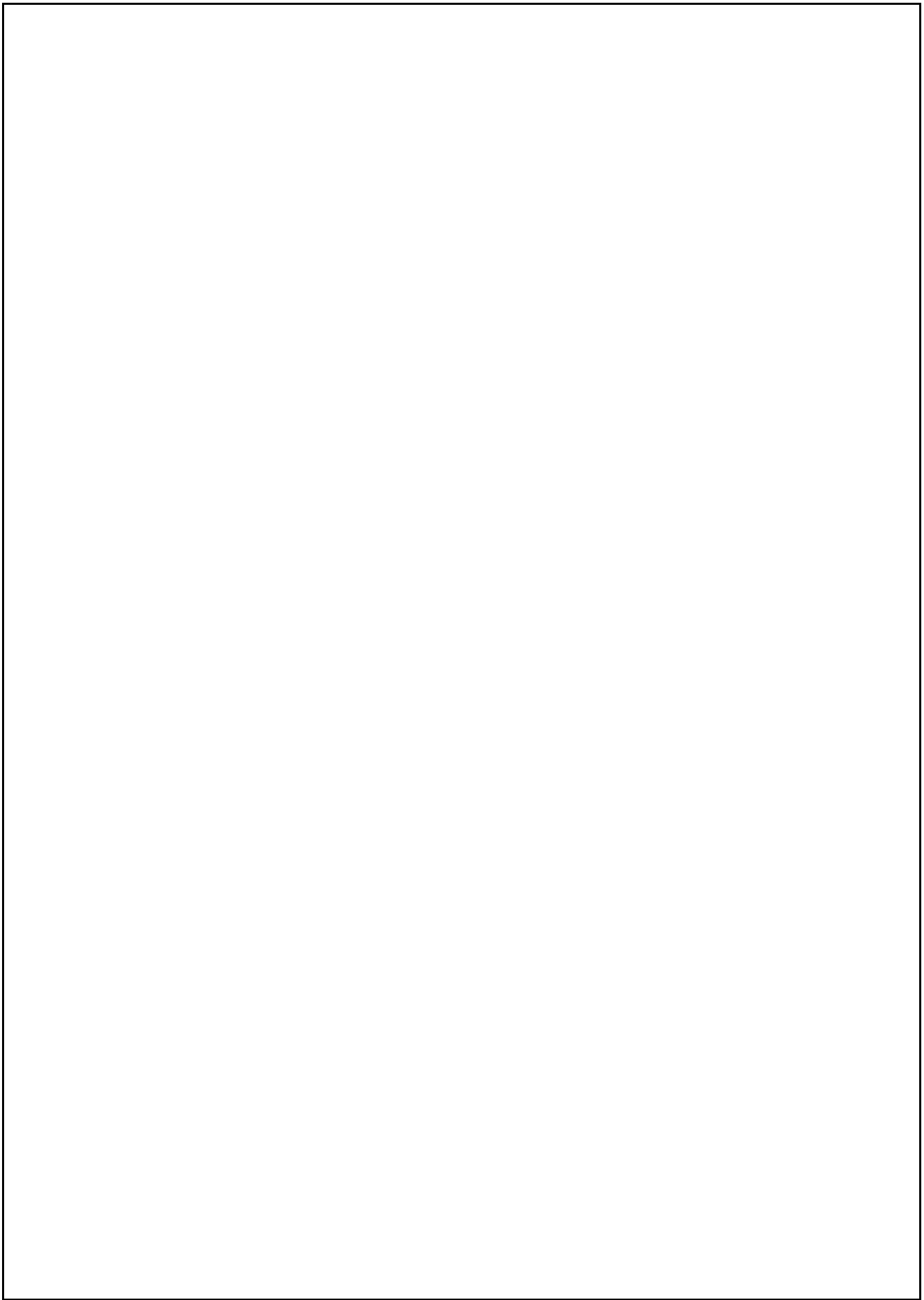
One of the study revealed that either the roots and bark of binjai and kasturi contain common chemical compounds, saponin and tannin. Saponin

is a chemical compound having active property for diabetic therapy. This property comes as a result of its ability to inhibit the absorptions of glucose which eventually prevent to increase glucose level in blood. Additionally, it can also reduce the rate of glucose in blood. This condition known well as wound healing process.⁵

Another study, thin layer chromatography (TLC) analysis demonstrates that methanolic extract of *Mangifera casturi* fruit known contains terpenoid and phenolic compounds which apply as antioxidant agents. They play crucial role in inflammatory related diseases. It indicates that *Mangifera casturi* can be applied as anti-inflammation agent. This extract significantly inhibiting the migration of leukocytes induced by thioglycollate.⁶

Mangifera casturi fruit known can inhibit the growth of *Streptococcus mutans* that causes dental caries. Dental caries is the main problem often found in the oral cavity, where in Indonesia alone dental caries have a prevalence of 90.05%. Based on the study, the methanol extract of Kasturi mango fruit contains alkaloids, flavonoids, phenolics, terpenoids, and saponins that has antibacterial activity. These bioactive compounds can against the growth of *Streptococcus mutans*. The other study revealed that saponin fractions from bark of *Mangifera casturi* can inhibit *Escherichia coli* and *Staphylococcus Aureus* activities that cause pneumonia, mastitis and urinary tract infections.^{7,8,9}

Mangifera casturi leaves also known applied as immunostimulatory agent. Leaf extract kasturi (*Mangifera casturi*) proven to increase the activity and capacity of macrophage phagocytosis. *Mangifera casturi* stem has been proven as antifungal agent. Extract methanol bark of kasturi contains phenolic groups, terpenoids and saponins that are antifungal. Another part, the fruit of *Mangifera casturi* is known to have anticancer activity from bioactive compound, triterpenoid, named Lupeol. This compound can be applied as anti-inflammatory agent as well.^{10,11,12}



SOME RESEARCH OF KASTURI

Some researches about the treatment of *Mangifera casturi* and its compounds.

No.	Title of research	Method of Research	Conclusion / Resarch Result
1	Antibacterial activity saponin fractions from stem bark of <i>Mangifera casturi</i> .	Thin Layer Chromatography analysis and diffusion method	Stem bark of <i>Mangifera casturi</i> can inhibit the growth of <i>E.coli</i> and <i>S.aureus</i>
2	Anti-inflammatory activity of methanolic extract kasturi in thioglycollate - induced leukocyte migration on mice	Thin Layer Chromatography (TLC) analysis and counting leukocytes. Anti-inflammatory effect was tested by Leukocyte migration method.	Methanolic extract of <i>Mangifera casturi</i> fruit contains terpenoid and phenolic compounds that have inflammatory activity that is lower than the positive control.
3	Semi-polar fraction from <i>Mangifera casturi</i> leaves	Phytochemical test	The fraction showed the existence of flavonoids, tannins and triterpenoids
4	Antioxydant activity assay of extracts and active fractions of kasturi fruit (<i>Mangifera casturi</i> Kosterm)	1,1-diphenyl 2-picrylhydrazyl (DPPH) method	Methanolic extracts of <i>Mangifera casturi</i> had antioxydant activity
5	Fractionation of Methanol extract from <i>Mangifera casturi</i> leaves	Gradient fractionation method using n-hexane	The fractionation showed the present of flavonoids
6	The total of flavonoid content and anti-oxidant activity from ethanol extract of <i>Mangifera casturi</i> leaves with DPPH method.	1, 1-diphenyl-2-picrylhydrazyl (DPPH) method	Ethanol extract of <i>Mangifera casturi</i> leaves has high anti-oxidant activity
7	Immunostimulatory effect of leaf extract kasturi (<i>Mangifera casturi</i>) in mice	Observation from activity and phagocytic capacity macrophages in mice	Kasturi leaves (<i>Mangifera casturi</i>) can be applied as immunostimulatory
8	The study potency of binjai (<i>Mangifera caesia</i>) and kasturi (<i>Mangifera casturi</i>) as antidiabetic by phytochemistry fitokimia.	Phytochemistry screening	Kasturi contains saponin that can reduce the rate of glucose in blood
9	Antibacterial activity and mechanism of action of methanol extract from kasturi mango fruit on caries-causing bacterium <i>Streptococcus mutans</i>	Antibacterial activity was tested by agar diffusion method and GCMS analysis	The study showed that the methanol extract of Kasturi mango contains alkaloids, flavonoids, phenolics, terpenoids, and saponins. The methanol extract of Kasturi mango fruit has an inhibitory activity against the growth of <i>Streptococcus mutans</i>
10	Identification of alkaloids from methanol extract kasturi's bark	Thin Layer Chromatography (TLC) analysis	The existence of alkaloids in methanol extract kasturi's bark
11	The comparison of antibactery activity between kasturi's bark extract and ampicillin in <i>Staphylococcus aureus</i> in vitro.	Bacterial test with diffusion method	The results showed that there were significant differences between the treatment kasturi's bark compared to ampicillin
12	Fractionation of Methanol extract from <i>Mangifera casturi</i> leaves	Gradient fractionation method using n-hexane	The fractionation showed the existence of flavonoids
13	Determining total phenolic and flavonoid of ethanol extract from Kasturi (<i>Mangifera casturi</i>) leaves, cortex, and peel	Thin Layer Chromatography (TLC) analysis	The highest content of phenolics and flavonoids present in the leaves while the total phenolic content was lowest for the cortex and total flavonoid content was lowest for the peel.

No.	Title of Research	Method of Research	Conclusion / Resarch Result
14	The comparison of antifungal activity between methanol extract of the bark kasturi with ketoconazole 2% against <i>Candida albicans</i> in vitro	Bacterial test with diffusion method	There is a significant difference between the treatment with ketoconazole 2%
15	The potentiation of <i>Mangifera casturi</i> bark extract on interleukin1 β and bone morphogenic protein-2 expressions during bone remodeling after tooth extraction	Immunohistochemistry method	<i>Mangifera casturi</i> 's bark extract was able to suppress the IL-1 β expression and increase the BMP-2 expression during bone remodeling after tooth extraction.
16	Flavonoid level analysis of binjai leaf extract in Ethanol, methanol, and n-hexane solvents (Research report)	UV-Vis spectrophotometer analysis	There were differences of total flavonoid in binjai leaf extract using ethanol and methanol solvent
17	Flavonoid level test on ethanol extract of binjai leaf	UV-Vis spectrophotometer analysis	The optimal solvent concentration to dissolve flavonoid in Binjai leaf is 95% of ethanol solvent.
18	Isolation an antioxydant compound from the bark of Binjai	Gradient fractionation method using n-hexane	The antioxydant activity of the isolated compounds smaller than vitamin C.
19	The effect of ethyl acetate fraction of kasturi fruit (<i>Mangifera casturi</i> konsterm.) on a cute toxicity, macroscopic and microscopic organ male rats.	Observing the number of mouse deaths, macroscopic picture and microscopic picture of cardiac organ	Fraction of ethyl acetate of <i>M. casturi</i> did not give the effect of inflammation in mouse heart organ.
20	Isolation and identification of active compound of ethylacetate fraction of Kasturi (<i>Mangifera casturi</i> konsterm. fruit from south kalimantan Indonesia	Spectroscopic analyses of UV-Vis, FT-IR, HNMR, CNMR, DEPT and LCMS	The identification found a polyphenol compound, namely (methyl gallate).
21	Chemical structure optimization of lupeol as er- α and HER2 inhibitor.	Hartree-Fock method	These results predict that lupeol has great potential as anticancer that can be developed as a HER2 inhibitor.
22	Antioxydant and antileukemic activity of chemical components from bark of <i>Mangifera casturi</i>	Spectroscopic analysis and ultra-performance liquid chromatography - mass spectrometry	The isolated compound, gallic acid, showed potent antioxidative and antileukemic activity
23	Antioxydant activity of bioactive compound produced by endophytic fungi isolated from endemic plant of South Kalimantan <i>Mangifera casturi</i> Kosterm.	DPPH radical scavenging method, TLC-bioautography assay and GC-MS analysis	The potential of endophytic fungi as a source of antioxydants and can be an alternative to the antioxydants produced by plants to support <i>M. casturi</i> conservation
24	Identification antibacterial activity kasturi bark (<i>Mangifera costuri</i> Kosterm.) extract to <i>Estherichia coli</i>	Disk diffusion method	The kasturi bark extract significantly influenced to the growth of <i>E.coli</i>
25	Total flavonoid and antioxydant activity of some selected medicinal plants in South Kalimantan of Indonesian	Spectrophotometer analysis	Kasturi has the greatest total flavonoid content among others

The comparison of the anti-inflammatory activity from *Mangifera casturi* and other extracts.

No.	Title of research	Method of Research	Conclusion / Resarch Result
1	Anti-inflammatory activity of methanolic extract kasturi in thioglycollate - induced leukocyte migration on mice	Leukocyte migration method.	The anti-inflammatory activity of methanolic extract is lower than the positive control (indomethacin)
2	Anti-inflammatory effect of <i>Moringa oleifera</i> lam extract in rats	leukocyte migration method	The anti-inflammatory activity of methanolic extract is lower than the positive control (indomethacin and hydrocortisone)
3	Anti-inflammatory activity of methanolic extract of <i>Bambusa vulgaris</i> leaves	The cotton pellet granuloma method	The anti-inflammatory activity of methanolic extract is greater than the positive control (indomethacin)

Some researches about gel preparations *Mangifera casturi* and other extracts.

No.	Title of research	Method of Research	Conclusion / Research Result
1	Optimization of gel fraction etil asetat fruit kasturi (<i>Mangifera casturi</i> kosterm.) with combination of bases CMC-Na and carbopol using lattice design method	Lattice design method	The optimum effect of the extract can be reached in concentration of 4 % CMC-Na and 1% carbopol
2	The comparison of stability and activity from gel <i>Aloe vera L.</i> on bases CMC-Na and carbopol	Animal design method	The optimum effect of the stability and activity extract can be reached in bases 5% CMC-Na
3	The influence CMC-Na base to the physical quality of gel <i>Aloe vera L.</i>	Gel physical test	The optimum of the gel extract can be reached in bases 5% CMC-Na

DISCUSSION

Mangifera casturi has been proven as a treatment due to the presence of bioactive compounds. Based on the table above, *Mangifera casturi* contains alkaloid, flavonoid, tannin, terpenoid and phenolic compounds that can be applied as antioxydant, anti-inflammation, antibacterial agent, antifungal, antidiabetic, antileukimic and immunostimulatory⁴. Antioxydant is a substance required to neutralize the free radicals and prevent the resultant damages to normal cell, protein and fat. Antioxydant comes from alkaloid, flavonoid, terpenoid and phenolic compounds that found in fruit, leaf, cortex and peel of *Mangifera casturi*. The highest content of phenolics and flavonoids present in the leaves while the total phenolic content was the lowest for cortex and total flavonoid content was the lowest for the peel. Antioxydant also relate to anti-inflammation. Antioxydant plays crucial role in inflammatory related diseases. The anti-inflammatory effect of *Mangifera casturi* extract have been proven in research. We understand that the methanolic extract of *Mangifera casturi* has anti-inflammatory activity compared to the positive control (indomethacin).^{6,14,17,23}

Antibacterial agent known as a substance that inhibit the growth of some bacteria, such as the Gram-positive bacterium *Staphylococcus aureus* and the Gram-negative bacterium *Escherichia coli*. *Mangifera casturi* can be applied as antibacterial agent because the existence saponin and flavonoid. The total flavonoid in *Mangifera casturi* is greatest among plants in Borneo. This compound is well extracted with ethanolic solvent. Flavonoid in *Mangifera casturi* fruit known can inhibit *Streptococcus mutans* which interfere the membrane integrity of the *Streptococcus mutans* bacteria. Saponin in *Mangifera casturi* bark also known inhibit the growth of *Estherechia coli* and *Staphylococcus Aureus*.^{7,8,9}

Antifungal activity in *Mangifera casturi* come from phenolic groups, terpenoids and saponins. They extracted from *Mangifera casturi* bark. The others, root and bark, also contain of saponin which are antidiabetic agent. It can reduce the level of blood glucose.^{5,11}

Antileukimic or anticancer activity is known come from fruit *Mangifera casturi* consist of triterpenoid, named Lupeol. Anticancer activity is predicted to be associated with antiproliferation and induced apoptotic effects of cancer cells. Lupeol is also potentially used as an anti-inflammation.¹²

Furthermore, immunostimulatory activity is known come from *Mangifera casturi* barks and leaves. *Mangifera casturi*'s bark extract was able to suppress the IL-1 β expression and increase the BMP-2 that play crucial roles in in stimulating immune system. *Mangifera casturi* leaves extract

can increase the activity and capacity of macrophage phagocytosis.^{19,21,37}

Mangifera casturi is also applied to gel preparation. Based on some researches, the optimum effect of the extract can be reached on 4 % CMC-Na and 1% carbopol.

CONCLUSION

Mangifera casturi is endemic plant in Banjarmasin, Indonesia proven as a medicine due to the presence of bioactive compounds such as alkaloid, flavonoid, tannin, terpenoid and phenolic groups.

Mangifera casturi has been proven as antioxydant, anti-inflammation, antibacterial, antifungal, antidiabetic, antileukimic and immunostimulatory.

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