

Phytochemical content and pharmacological value of banana plants (*Musa* spp.) revealed in Indonesia

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ABSTRACT

Banana (*Musa* spp. family Musaceae) is one of the horticultural crops in Indonesia with a wide variety of cultivars. Apart from being used as a staple food substitute, bananas have long been used as a source of traditional medicine. In an effort to find and develop the medicinal potential of bananas, pharmacological research has been carried out in many banana-producing countries, including Indonesia. The results of pharmacological research on banana plants in Indonesia in the last decade are presented in this paper. Phytochemical studies reveal that banana plants are rich in bioactive compounds which have been shown to have pharmacological properties such as: ascorbic acid, β -carotene, lycopene, saponins, alkaloids, flavonoids, tannins, polyphenols, phenolics, terpenoids, anthocyanins, dienoic acid, and dicarboxylic acid. Pharmacological test revealed banana plant extract has properties as: antioxidant, wound healing, antidiabetic, anti-cholesterol, anti inflammation, anti-tumor, hematopoiesis, anti-atherosclerosis, estrogenic, androgenic, and anti-aspartate aminotransferase. In conclusion banana plants can be used as natural source for plant-derived medicines.

Key words: Pisang, Banana, *Musa* spp., Pharmacological Properties, Banana Phytochemical,

I. INTRODUCTION

Indonesia is the largest archipelagic country in the world with very high plant biodiversity. One type of plant that has high diversity in this country is the banana (Musaceae family). In addition to its high diversity, banana production in Indonesia is also relatively high, surpassing the production of other fruits, with a production rate of more than 7 tonnes per year. [1]

In Indonesia, banana cultivation is generally still done traditionally by rural

communities where bananas are planted in yards, gardens or intercrops. [2] Today, however, the ecosystem and rural community socio-cultural have changed dramatically so that the banana cultivation has also changed.[3]

The use and utilization of banana plants in this country varies greatly depending on the hereditary culture of the local community. The main benefit of bananas, as in other banana-producing countries, is as a substitute for staple foods. Some ethnobotanical studies showed that banana has been used for a long time as traditional medicines and, in certain communities in Indonesia, such as in Bali, bananas are also used as part of traditional or religious ceremonies. [4, 5]

In recent decades, in many tropical banana-producing countries, such as Malaysia, Pakistan and India, including Indonesia, there has been a great deal of research on the pharmacological benefits of this plant.[6-8]

This review article presents several scientific studies in the last 10 years focused on the phytochemical content and pharmacological properties of the banana plant extracts that have been conducted in Indonesia.

II. PHYTOCHEMICAL CONTENT OF BANANAS

Phytochemical studies of bananas in Indonesia are generally focused on determination of bioactive compounds in pharmacological interest. There are three species of banana that have been studied the most here, namely *Musa acuminata*, *Musa paradisiaca* L, *Musa balbisiana*, all of which are cultivated bananas, rather than wild types. In Indonesia the three cultivated banana species consist of several varieties, therefore there are many local names used here, depending on the variety. The problem is, many researchers of pharmacology of medicinal plants do not really understand about the taxonomic differences in

banana varieties, so that each banana variety is only called with a local name and species name. Regardless of whether there is overlap in the identification of varieties, the research findings illustrate that the banana plant of the genus *Musa* is

rich in bioactive compounds that have pharmacological potential. The list of types of bananas and their phytochemical compounds that have been identified by researchers in Indonesia in the last 10 years is presented in Table 1.

Table 1 Phytochemical compounds contained in plant extract of bananas

Species name	Local name	Plant parts extracted	Phytochemical detected	Publication year	Reference
<i>Musa</i> spp	Pisang muli	pseudo stem	ascorbic acid , β- carotene , lycopene, saponin, alkaloid, flavonoid, tannin.	2014	9
<i>Musa acuminata</i>	Pisang kepok	fruit peel	ascorbic acid (Vitamin C)	2015	10
<i>Musa paradisiaca</i> L	Pisang kepok	pseudo stem	tanin, alkaloid, saponin	2015	11
<i>Musa paradisiaca</i> L	Pisang ambon	fruit peel	Saponin, alkaloid , flavonoid, tannin	2016	12
<i>Musa balbisiana</i>	Pisang kepok	fruit peel	polyphenol	2017	13
<i>Musa acuminata</i> (L.)	Pisang goroho merah	fruit peel	alkaloids, flavonoids, tannins	2018	14
<i>Musa acuminata</i> var. Jarum	Pisang jarum	fruit	phenolic, flavonoid, terpenoid, alkaloid, saponin	2019	15
<i>Musa acuminatae</i> , L	Pisang kepok	stalk and corm	flavonoid, saponin, polyphenol.	2019	16
<i>Musa paradisiaca</i> var.Sapientum	Pisang Ambon	fruit peel	saponin, polyphenol, tannin, flavonoid, terpenoid	2019	17
<i>Musa paradisiaca</i> L	Pisang kepok	pseudo stem	saponin, flavonoids, tannins	2021	18
<i>Musa sapientum</i> L.var Rubra	Pisang merah	fruit peel	anthocyanins	2022	19

Musa paradisiaca	Pisang	corm	dienoic acid , hexadecanoic acid, hexadecanoic acid, octadecenoic acid, dodecatriene, methyl stearate, dicarboxylic acid,	2022	20
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III. PHARMACOLOGICAL VALUES OF BANANA PLANTS

There have been dozens of studies on the pharmacological properties of banana plants that have been conducted in Indonesia in the last decade. There are many pharmacological properties

that have been revealed such as: antioxidant, wound healing, antidiabetic, anti-cholesterol, anti inflammation, anti-tumor, hematopoiesis, anti-atherosclerosis, estrogenic, androgenic, and anti-aspartate aminotransferase (Table 2).

Table 2 List of research results conducted in Indonesia on pharmacological values of banana plant extracts

Pharmacological values	Banana species/cultivar	Local name	Plant parts extracted	Test methods	Publication year	References
Antioxidant properties	Musa paradisiaca	Pisang ambon	fruit peel	DPPH using IC ₅₀ parameters	2018	21
	Musa paradisiaca Formatypica	Pisang kepok	fruit peel	DPPH IC ₅₀ parameters	2018	22
	Musa AAB	Pisang	fruit peel	DPPH free radical immersion method	2019	23
	Musa x Paradisiaca L. AAB	Pisang uli	fruit peel	DPPH IC ₅₀ parameters	2021	24
	Mussa paradisiaca sapientum	Pisang raja	fruit peel	Histopatological condition of Rattus rattus	2021	25
	Musa balbisiana Colla	Pisang	fruit peel	DPPH and FRAP methods	2021	26
Wound healing properties	Musa acuminata	pisang ambon	leaf sheat	Burns wound treatment in rabbits	2016	27
	Musa paradisiaca L	Pisang	leaves	Topical gel treatment	2017	28
	Musa paradisiaca var. Sapientum (L.) Kunt	Pisang ambon	fruit peel	Treatmen of gingiva wound in Wistar rats	2021	29
	Musa paradisiaca L	Pisang saba	fruit peel	Treatment of incision wound in mice	2021	30
Antidiabetic properties	Musa troglodytarum L	Ranggap bananas	fruit	Treatment of alloxan-induced diabetic mice	2018	31
	Musa	Pisang	fruit peel	OGT test against	2021	32

	acuminate L	barangan		sucrose-induced diabetic mice		
Anti-cholesterol activity	Musa acuminate L	Pisang kepok	fruit peel	Treatment of obese mice strain DDY	2018	33
Anti inflammation activity	Musa paradisiaca L	Pisang	pseudo stem	Assessment of anti-inflammatory effect using plethysmometer in albino rats.	2021	34
Anti-tumor activity	Musa paradisiaca Var. Sapiantum	Pisang ambon	pseudo stem	Evaluation of (TNF-A) expression on gastric of rats induced by indomethacin	2018	35
Hematopoiesis activity	Musa paradisiaca Formatypica	Pisang	fruit peel	Evaluation of hematological parameter in rats given intensive training	2021	36
Anti-atherosclerosis activity	Musa paradisiaca Var. Sapiantum	Pisang ambon	fruit peel	Inhibition of NF- κ B and Increased eNOS expression in atherogenic rat	2017	37
Estrogenic properties	Musa paradisiaca L	Pisang	fruit peel	Evaluation of mammary gland development in ovariectomized rats	2011	38
Androgenic properties	Musa sp.	Pisang kepok	fruit peel	Evaluation of serum testosterone in male rats given high-fat diet	2020	39
Anti-Aspartate Aminotransferase activity	Musa paradisiaca Formatypica	Pisang kapok	fruit peel	Evaluation of AST and ALT concentration in Wistar rats induced with high-fat diet	2021	40

IV. CONSTRAINTS IN PHARMACOLOGICAL RESEARCH OF BANANA PLANTS

It must be admitted that banana is a plant that is very high in diversity. In nature alone, bananas consist of various varieties. Furthermore, the process of domestication and cultivation of banana plants by humans has resulted in cultivated varieties which are commonly called cultivars. Currently there are hundreds of banana cultivars in

the world. [41]. This situation has caused the classification and nomenclature of bananas to have long been a complicated issue. In Southeast Asia, including Indonesia, the presence of numerous cultivar names and synonyms in different languages and dialects has become a common obstacle for researchers, especially for non-taxonomist researchers. In many cases, the same cultivars are called by different names while the same name is applied to distinct cultivars [42]. It is

this nomenclature constraint that causes the pharmacological research results of banana plants in Indonesia which we summarize in this paper to seem to overlap one another.

V. CONCLUSION

Banana plants (Genus *Musa*, Musaceae family) contain a very high variety of phytochemical compounds. The bioactivity test of this plant extract shows the many pharmacological properties of the banana plant. Thus it can be concluded that banana plants can be used as natural source of ingredients for plant-derived medicines.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare no conflict of interest.

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