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Research paper

Comprehensive review on the nutritional and medicinal potential of *Musa acuminata Colla* bracts

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Abstract

Exploring the traditional and contemporary medicinal applications of *Musa acuminata colla*, referred to as wild banana was carried out in this review article. Historically, various parts of this plant have been used in ethnomedicine for treating a multitude of ailments. According to the World Health Organization, traditional medicine remains a primary source of healthcare for significant portion of the population in developing nations, highlighting an increasing global demand for medicinal plants. *Musa acuminata*, an indigenous one to Southeast Asia, is extensively employed in traditional medicine across diverse regions including Asia, Oceania, India, and Africa. Modern research had validated several of these traditional uses, showcasing the availability of pharmacological properties, such as antioxidant, anti-inflammatory, and antimicrobial effects. The therapeutic potential of plant parts such as fruits, leaves, stems, and flowers are primarily attributed to the presence of bioactive phenolic compounds. Numerous epidemiological studies have discovered a link between higher consumption of nutritious, rich plant-based foods to lower the risk of various diseases, including cancer and cardiovascular disorders. The most effective and long-lasting methods for preventing vitamin A shortage are those that involves diet management. Understanding various characteristics of the fruits, such as their botanical, agronomic, nutritional, and processing qualities, are also essential, to arrive about the nutritional and medicinal potential. This review provides a comprehensive evaluation of the nutritional value, biological activities , and potential health benefits of *Musa acuminata*, offering a scientific foundation for future research, and development of functional foods and phytomedicines derived from this plant.

Keywords: *Antioxidant; Antimicrobial Effects; Therapeutic Potential; Bioactive Phenolic Compounds; Phytomedicines, Musa acuminata colla* bracts

1. Introduction

Throughout history, the use of botanicals in medicine and wellness has been crucial. Ethnobotanical literature reports that the usage of plant extracts, infusions, and powders have long been used historically to cure a wide range of ailments. In many communities around the world, plant parts have traditionally been the only means of healing wounds and illnesses, and they are still utilized as traditional medicine in many countries. Many of these plants have only previously been used by conventional thinking, but recent studies have shown that they can be useful (Banerjee et al., 2014). According to the World Health Organization, a sizable portion of the populace in poor nations receives their primary medical care from traditional medicine. As a result, both developed and emerging nations have a growing need for medicinal plants. Many species (medicinal plants), however, face extinction because the majority are still derived from wild sources without the use of scientific knowledge and management. Vegetables and fruits are essential parts of a balanced diet. Banana has numerous health benefits, it contains minerals, calcium, nitrogen, and phosphorus will help the body to retain these elements, which are necessary for the synthesis of strong, repaired tissues. Native to Southeast Asia, *Musa acuminata Colla* is a wild species of banana. Studies have shown the therapeutic potential in traditional medicine of many components that have been used orally or tropically as treatments with the Musa plant (Nurliyana et al., 2010). *Musa acuminata* which is also known as the wild species of banana found in both tropical and sub-tropical regions. According to the research carried out the causes, health benefits of *Musa acuminata* have received much attention, among researchers and health practitioners. The plant parts such as peels, pseudo stems, corm, sap, leaves, fruits, and flowers were used as traditional medicines for many diseases. (Mathew and Negi, 2017).

2. Taxonomic classification

The Banana plant belongs to the family *Musaceae* and is found to be one of the most consumed fruits worldwide with numerous socio-economic importance and enormous economic value. (Valsalam et al., 2019). Around 80 species have been distributed pleotropically which

belong to the same family. Musa is the largest genus of *Musaceae* and includes cultivated seed sterile bananas and plantains and also wild species including the plantains. According to the survey taken it was estimated that there were 70 species and over 500 cultivars for Musa and a new species also continued to be discovered. (Hakkinen and Hong 2007). To differentiate them from *Musa acuminata* used for dessert, *Musa acuminata* used for cooking may be referred to as plantains in some regions. The fruit is often long and curved, varies in color, size, and firmness, covered in a rind when ripe, and with soft flesh that is high in starch that, can be any color from red to brown from green to purple. The top of the plant has clusters of fruits that dangle there.

2. Origin and distribution

The hot, tropical regions of Southeast Asia are where the plants that fall under the *Musaceae* family first appeared. Although *Musa acuminata* is one among the widespread species, its primary center of origin is thought to be Malaysia (AA and AAA cultivars) (Wang et al., 2001). Later, it made its way to Burma and India (Musa et al., 2010), the home of *M. balbisiana* a native species. Naturally occurring hybridization in the Indo-Burman peripheral area between *M. acuminata* and *M. balbisiana* gave rise to triploid AAA cultivars of bananas. As a result, out of 600 types of Musa germplasm, India is considered the primary origin of over 300 different banana cultivars. That the banana is mentioned in old Indian texts like the Chilappthikaram (500 AD), the Ramayana (2000 BC), and the Arthsastra (250 BC) shows how long ago the banana was domesticated in India. The Latin acuminate refers to sharp, and it describes the apex of the plant fruits. The genus name was chosen to honor Antonius Musa, a Roman physician and botanist who lived from 63 BC to 14 AD. Natural habitats of *Musa acuminata* have been found in the southern and middle Andaman Islands, the Western Ghats of Karnataka, the Kaziranga forest range in Assam, and the Khasi hill ranges in Meghalaya (Subbaraya, 2006). Nowadays, *Musa acuminata* is grown around the world, including Brazil, China, and other significant producers Brazil, China, India, Ecuador, Columbia, and Venezuela.

3. Botanical description

The herbaceous monocotyledon *M. acuminata* has an underground stem and a pseudostem. Perennial, the plants might stand abundantly (4–30 stems) or sparingly (1-2 stems). The rhizome, which grows horizontally underground, or the corm, which vertically increased the compact structure covered in a loose layer of thin leaves, are the real stems of plants. The pseudostem, which comprises closely spaced overlapping leaf sheaths, is thinner than the leaf sheaths of most farmed bananas, measuring less than 25 centimeters and 3-5 meters in height (Dahham et al., 2015).

4. Traditional uses of *Musa acuminata*

Red bananas are thought to be an inexpensive and reasonably priced food option that can enhance a weaned infant's nutritional status and lessen malnutrition brought on by hunger. When utilized as a natural supplement, adult food, or as a weaning diet, bananas can help avoid disease. Among global crop importance, banana ranked sixth in terms of export markets. It includes all the elements like dietary fiber, provitamins, minerals, and vitamins—that are critical in reducing the risk of chronic illness. A type of banana with purple-red skin is called a red banana, also referred to as a red dacca. The majority of the parts of the banana plant have medicinal uses, making it the oldest plant in existence. (Amarasingle et al, 2021). The development of low-cost, highly nutrient-dense food supplements is a continuing issue for emerging nations where indigenous foods were employed during the food transition. In the tropics and subtropics, bananas are frequently grown for their decorative and fiber qualities. They are also regarded as an essential food crop. Fungal infections posed a significant threat to the cultivation of mussabrack, which is why there was great interest in muss breeding initiatives. The primary emphasis was on breeding initiatives to enhance the quality of plantains and bananas for human consumption.

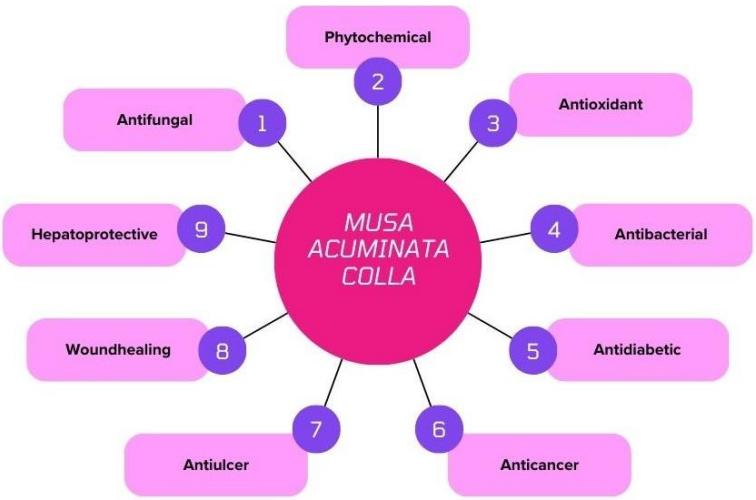

Fig. 1: Diagrammatic Representation of the applications of *Musa acuminata Colla*.

5. Advantages of *Musa acuminata* in biotechnological aspects

Banana (*Musa* spp., *Musaceae*) are an important food crop in the subtropics and tropics and are also routinely cultivated for ornamental purposes and for fibre (abaca cloth and Manila hemp). Recently, fungal infections have become a major hazard to Musa cultivation, which has increased interest in Musa breeding programs. Breeding programs are mostly focused on raising the quality of bananas and plantains

for human use. Information gathered through conventional means has been supplemented by biotechnological advancements, such as interspecific hybridization, ploidy modifications, and seed fertility screening (Thaipong et al., 2006).

6. Different species of *Musa acuminata Colla*

In tropical and subtropical areas, bananas are among the most popular fruits to eat. These edible fruit cultivars are a man-made complex derived from two wild diploid species found in Southeast Asia: *Musa balbisiana Colla* (BB), a homogenous hardly plant with a massive pseudo-trunk, and *Musa acuminata Colla* (AA), a highly polymorphous plant with spindly plants that grow in clumps (Aurore et al., 2009). They are typically divided into two groups: plantains and dessert bananas. The two most significant species of dessert bananas in Malaysia are Mas (AA) and Berangan (AA), whereas the three types of plantains are Awak (AAB), Nangka (ABB), and Raja (ABB) (Hassan, 2004). Kanazawa has categorized bananas as one food high in antioxidants.

7. Role of *Musa acuminata* in different diseases

The action of the natural antioxidants found in fruits has received a lot of interest because it is possible that these substances could lower the degree of oxidative stress (Hassimotto et al., 2005), i.e., stop free radicals from harming lipids, proteins, and DNA (Isabelle et al. 2010). Furthermore, their synergistic effects and protective qualities against a range of degenerative disorders, such as cancer, stroke, cardiovascular disease, Parkinson's disease, and Alzheimer's disease, have been scientifically showed (Abdel Hameed, 2009 ; Kawasaki et al., 2008; Ndhlala et al., 2006). In tropical and subtropical areas, bananas are among the most popular fruits to eat (Alkarkhi et al., 2010).

8. Role of antioxidants in *Musa acuminata*

By raising their antioxidant levels, these tropical fruits can effectively defend themselves against the oxidative stress brought on by the strong sunshine and high temperatures. They are recognized for being a potent secondary antioxidant source despite being a weak primary antioxidant source. (Haripyaree et al. 2010, Lim et al. 2007, Yan et al. 2006) Ascorbic acid, tocopherol, beta carotene, phenolic groups, dopamine, and gallocatechin are among the antioxidant chemicals found in banana (Qusti et al., 2010; Someya et al., 2002). Antioxidants have a major role in the biological activity of plants and can interfere with many phases of cancer development, such as invasion, metastasis, promotion, initiation, and progression. Nowadays, individuals choose biological methods because they are less expensive and harmful. *Musa barbisiana* is rich in potassium, unsaturated fatty acids, carotenoids, dietary fibre, proteins, vitamins, energy, and minerals (Arumugam, 2017). The atomic, molecular, and supramolecular compounds produced by nanotechnology improve their functionality (Moodley et al., 2018).

9. Nanotechnological applications in *Musa acuminata*

The properties of the plant made the researcher to use about the bracts for antimicrobial and wound healing properties. Nanotechnological applications were promising with reduced components for long lasting wound healing activity. NP synthesis via a biological approach has the advantages of faster synthesis, stability, and controlled crystal growth (Saranya et al., 2017). Banana are rich in minerals, flavonoids, polyphenols, anthocyanins, and bioactive amines like dopamine and serotonin that may act as a capping and reducing agent for the formation of NP (Bornali & Khalita, 2013). Banana peels are applied as shoe polish, teeth whitener, and pain remedies. It is also used to reduce the severity of arthritis and aches, treat psoriasis, and treat bug bites.

10. Pharmacological activities

Many pharmacological properties have been reported for it, with findings showing that the key contributor to this feature is phenolic chemicals in *Musa acuminata*. The edible fruit, its nutritional value, and composition are also profiled comprehensively. There is a thorough analysis of the biological activity of the various plant parts and potential pathways and the phytochemical involved have also been connected (Al-Dhabi et al., 2018a).

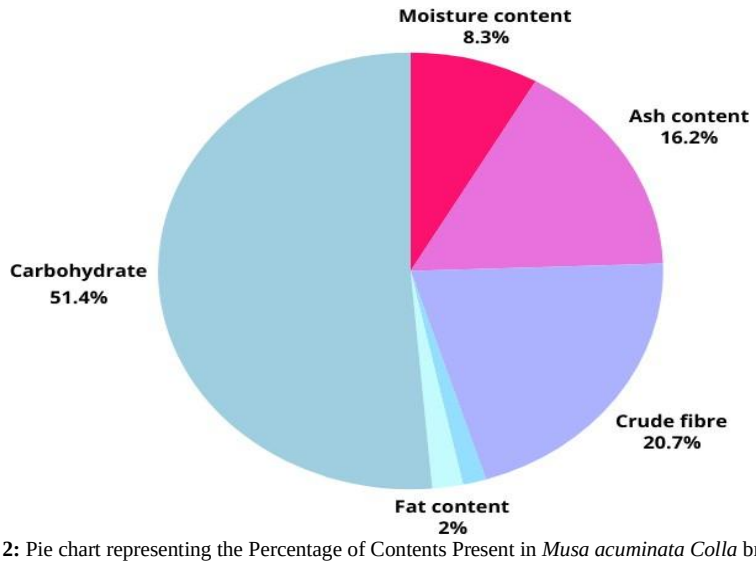

Fig. 2: Pie chart representing the Percentage of Contents Present in *Musa acuminata Colla* bracts.

11. Waste management

Although a variety of renewable energy sources can reduce greenhouse gas emissions and meet future energy demands, biodiesel is thought to be the most viable and easily implemented substitute for conventional diesel given the state of the infrastructure now. The benefits of biodiesel include being renewable, nontoxic, safe to handle, low emission, biodegradable, and carbon neutral during its complete life cycle. Biodiesel is a byproduct of transesterification of vegetable oil with methanol (Saravanan & Aradhya, 2011). Biodiesel can run regular diesel engines with no modifications. For industrial biodiesel production, a more straightforward, economical, and ecologically friendly method using a waste biogenic heterogeneous catalyst is extremely required to attract investors and make the fuel competitive with current conventional diesel prices. In this paper, we report on the use of readily manufactured waste biomass catalyst for the room temperature trans-esterification of soybean oil to biodiesel, continuing our focus on the development of green synthetic methods. Our catalyst is free and renewable because it is composed of bio-waste. It can be made simply by burning dried banana peels (*Musa acuminata*), and it can be used as is as a heterogeneous catalyst for manufacturing biodiesel without the need for fictionalization or construction (Issariyakul & Dalai, 2014).

12. Wound healing

Plant-based medicines have been used as a backup for illness prevention and treatment since ancient times, and many more ingredients with natural origin have not yet been fully discovered. This has led the researchers to investigate chemicals derived from plants to treat against various illnesses. Research shows that the antimicrobial, antioxidant, and anti-inflammatory qualities of plant-based components have made it possible to prevent or treat a wide range of infectious diseases (Ibrahim, 2015).

There is a need to develop natural alternatives that may combat the germs that are present in open wounds, which frequently prevent wounds from healing or lengthen the healing process. Antimicrobials or antibiotics are included in topical formulations that are widely accessible on the market to protect the wound bed from bacterial infections and prevent the formation of biofilm (Kanazawa & Sakakibara, 2000). These major drawback is their unidirectional advantage, which prevents them from assisting in other crucial areas of quicker wound healing.

The total amount of antimicrobial resistance increases with continued non-judicial usage of such antibiotics. These formulations disturb the entire microbiome of skin. To solve this, researchers are looking for groundbreaking materials for wound healing that are based mostly on natural sources and can provide the multidirectional qualities needed for quicker wound healing (Kavitha & Ponni, 2017). The wounds, bruises, and cuts are historically treated with various portions of the *M. acuminata* and its subspecies. Furthermore, the literature on a few subspecies shows that they have good dressing properties, wound calming properties, reduce pain perception, and speed up wound healing. The medicinal efficacy of leaves of species relevant to wound healing has not yet been reported, despite substantial studies regarding the anti-ulcerogenic and ulcer healing activities of fruits that showed early healing of ulcer dyspepsia and delaying ulcer recurrences. The subspecies was chosen based on the expectation that, given that the fruits aid in ulcer healing, other portions of the plant, such as the leaves, may also exhibit promising qualities. This would increase the commercial viability for growers and industries (Sulaiman et al., 2011).

13. Conclusion

Thus, the scientific foundation for upcoming studies on *Musa acuminata* that aim to produce nutritional food with enhanced functional qualities and phytomedicine was considered as the findings of this research. According to a proximate study, the contents of *Musa acuminata* fruits can help meet daily requirements for minerals like magnesium potassium, and vitamin C. They can also be used as an ingredient in functional foods. The health benefits of *Musa acuminata* plant parts may be attributed to the rich diversity of phytochemical found in them, which supports traditional medicine and makes them to treat for range of illnesses.

The plant *Musa acuminata* is an effective therapeutic agent; research on animal models against certain pathological illnesses supports this claim, as does the herb's widespread use by many tribes and ethnic groups worldwide. Over a long length of time, various populations throughout the world have consumed varying amounts and types of *Musa acuminata* plant components, and no harm has been observed. The fruits of *M. acuminata*, which are a major edible part of the plant and contain good amounts of energy, vitamins, and minerals, are rarely consumed. Traditionally, the components extracted from *Musa acuminata* have been used as anti-HIV, anti-hypertensive, anti-diabetic, and anthelmintic also. They have shown promise in treating tuberculosis and other respiratory disorders. A clinical investigation has shown the therapeutic impact of *Musa acuminata* with Western medicine; however, the potential of certain of these plant parts in disease prevention is not well understood. Thus, this review was suggestive for a researcher to think about the bracts of banana flower, finishing it in fabrics, with wound healing properties and antibacterial activity for the benefit of the society.

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