Re-submitting *Musa sapientum* L. ssp. *sylvestris* for more phytochemical and pharmacological investigations

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Abstract

A review is done on the phytochemical profile and biological effects of *Musa sapientum* L. ssp. *sylvestris*. The findings suggest that it contains a number of important phytochemicals, which may link with its promising pharmacological activities such as antioxidant, antibacterial, anti-fungal, cytotoxic effects, anti-hemolytic effect, anti-hemaggulination. Extracts from various parts of this plant can be used to treat above-mentioned diseases/purposes, especially oxidative stress and its related diseases. More researches are highly appreciated to isolate and identify the active principles and their mechanisms of action of the biological activities.

Keywords: ethnobiological; phytochemical; pharmacological activities.

Introduction

Fruits, the oldest forms of food have not changed much throughout the history of human civilization. Bananas are the fourth most important agricultural food product [1]. Various spices, parts and forms (unripe/ripe) of banana or the banana plant have been used for different ethnopharmacologically applications [2]. Among the other species, the *Musa sapientum* (Family - Musaceae) has been reported to have a promising anti-ulcer [3], antioxidant and anti-inflammatory [4,5], anti-diabetic [6], cytotoxic, and anti-cancer [5] activities.

*M. sapientum* L. ssp. *sylvestris*, in Bangladesh locally known as ‘Bichi kola’ or ‘Aitta kola’. The fruit of it is used in the treatment of diarrhoea, dysentery and in excess menstruation [7]. This paper will sketch a database (PubMed, ScienceDirect, We of Science, MedLine and Google Scholar)-dependent current scenario on its phytochemical and pharmacological properties.

Methodology

A search was made with the keyword ‘*Musa sapientum* L. ssp. *sylvestris*’, pairing with ‘phytochemical’, ‘pharmacological activity’, ‘biological activity’, ‘cytotoxic effect’, ‘antioxidant potential’, ‘anti-microbial activity’, ‘anti-bacterial activity’, and ‘anti-fungal activity’. No language restrictions were imposed. Articles were assessed for the information about the dose or concentration /route of administration, test system, results and discussion, final conclusion and the possible action mechanism. Inclusion and exclusion criteria of evidences found in databases have been given below.

Inclusion criteria:

1. studies carried out in vitro, ex vivo or in vivo with or without using experimental animals, including humans and their derived tissue and cells, microorganisms, and rodents;
2. studies that utilized crude extracts, fractions or isolated compounds;
3. studies with preliminary and advanced phytochemical reports;
4. studies with *M. sapientum* L. ssp. *sylvestris* and other herbal combinations;
5. studies with or without proposing activity mechanisms.

Exclusion criteria:

1. duplication of data and titles and/or abstracts not meeting the inclusion criteria;
2. unpublished and data overlapped dissertations or reviews;
3. reports on other *M. sapientum* L. ssp. *sylvestris* species uncovering the current topic.

In total 11 evidence were observed in the databases: PubMed = 0, MedLine = 0, ScienceDirect = 6; and Google Scholar = 5 after exclusion a total 3 were included (PubMed = 0, ScienceDirect = 0, Google Scholar = 3). And the overall findings have been discussed below.

Results and discussion

Phytochemical reports

The methanolic leaf extract contains alkaloids, cardiac glycosides, flavonoids, steroids, saponins, and tannins [8].
**Pharmacological reports**

**Antioxidant activity**

The methanolic extracts (5, 25, 50, 100, 200 μg/mL) of the peel, pulp and seeds of the species were found to show 1, 1-diphenyl-2-picrylhydrazyl radical (DPPH·) scavenging as well as cupric and ferric ion reducing capacity in a concentration-dependent manner, where the seed extract showed a strong antioxidant capacity [9]. The methanolic leaf extract (2-10 μg/mL) of the plant was also found to show DPPH· and hydrogen peroxide (H₂O₂) scavenging as well as total reducing capacity [8].

**Antimicrobial activity**

**Anti-bacterial activity**

The methanolic leaf extract (20 and 200 μg/mL) concentration-dependently inhibited the growth of *Vibrio mimicus*, *Salmonella typhi*, *Salmonella dysentery*, *Staphylococcus aureus* and *Bacillus cereus* within the inhibition zones (ZI) 6 to 17 mm [8]. In this study, the highest ZI was observed at 200 μg/mL against *V. mimicus*, *S. typhi*, *S. dysentery*, *S. aureus* with the ZI from 16 – 17 mm. On the other hand, the methanolic peel and pulp extracts (400 μg/disc) were found to act against *B. cereus*, *B. megaterium*, *B. subtilis*, *S. aureus*, *Sarcina lutea*, *Escherichia coli*, *Pseudomonas aeruginosa*, *S. paratyphi*, *S. typhi*, *Shigella boydii*, *S. dysenteriae*, *Vibrio mimicus*, and *V. parahemolyticus* within the ZI 7 to 19 mm. The seed extract at the same concentration showed sensitivity against *E. coli*, *S. boydii*, *S. dysenteriae*, *V. mimicus*, and *V. parahemolyticus* [13]. In this study, the pulp extract exhibited a strong antibacterial effect (ZI: 15 – 19 mm) on the tested bacterial strains.

**Anti-fungal activity**

The methanolic peel and pulp extracts (400 μg/disc) were found to act against *Aspergillus niger*, *Candida albicans*, *Saccharomyces cerevisiae* between the ZI 7 and 19 mm. The pulp extract was stronger than the peel extract as it exhibited ZI within 16 to 19 mm [13].

**Cytotoxic effects**

The methanolic peel, pulp and seed extracts of the plant (1 – 500 μg/mL) were evident to show cytotoxic effects in brine shrimps in a concentration-dependent manner. The lethal concentration 50% (LC₅₀) for pulp, peel and seed extracts were 304.4, 112.4 and 212.2 μg/mL [13].

**Anti-hemagglutination activity**

The methanolic leaf extract (1.23-5 mg/mL) is evident to show an anti-hemagglutination activity in a concentration-dependent manner [8].

**Anti-hemolytic effect**

The methanolic leaf extract (0-1 mg/mL) was found to protect the human erythrocytes (RBCs) from H₂O₂-induced lysis [8].

**Discussion**

Free radicals play important physiological roles in our body. However, excess production is uncontrollable by the body’s antioxidant systems, which can cause oxidative stress [10]. Both, reactive oxygen and nitrogen species (ROS/RNS) can damage cellular macromolecules such as carbohydrates, proteins, lipids, and genetic materials (e.g. – DNA, RNA) [11]. Undoubtedly, oxidative stress is linked to many pathological conditions in animals. Substances having antioxidant capacity may act by (a) scavenging the ROS/RNS, (b) reducing the oxidized substance to be protected, (c) oxidized and form stable complex, and (d) activate/stimulate/potentiate the physiological antioxidants. Plants, especially those are involved in diets are one of the promising sources of antioxidants, and can be used in the treatment of many oxidative stress-mediated diseases [12]. Some *in vitro* studies conducted by the *M. sapientum* var. *sylvestris* part extracts revealed a potent antioxidant capacity, including by scavenging damaging free radicals, suggesting promising antioxidant capacity.

Oxidative stress is also linked to the inflammatory processes by stimulating the production and secretion of pro- and/or inflammatory mediators in a host [14]. Thus checking the anti-inflammatory effect of this plant is necessary, as the species *M. sapientum* is already evident to have antioxidant and anti-inflammatory activities [4,5]. Generally, these two effects relate the protective role of a substance. The substances those are strong antioxidants, are known to exert a pro-oxidative effect in biological systems [15]. For an example, ascorbic acid is evident to act antioxidant (protective) at low dose, while it is cytotoxic at high dose [16]. Thus, the cytotoxic effect of *M. sapientum* var. *sylvestris* for its antibacterial and antifungal activity may link to its pro-oxidative effects.

Hemagglutination inhibition assay is performed to investigate the receptor binding affinity of a substance on erythrocytes. Literature findings suggest that *M. sapientum* var. *sylvestris* has binding affinity for the receptors of erythrocytes, which may prevent agglutination, suggesting a possible antiviral therapy [8]. The inhibition of hemolysis is not only a correlation to the linking of the receptors of human erythrocytes but also its potential cytoprotective effects on the RBCs.
Conclusion
Findings suggest that the *M. sapientum* var. *sylvesteris* is an important medicinal plant, which is rich in a number of important phytochemicals and promising biological activities. More researches are necessary concerning its compound isolation and identification, and evaluation of mechanism(s) of action for each pharmacological activity.

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Conflicts of interest
None declared

References