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, antifungal, cytotoxic effects, anti-hemolytic effect, anti-hemagglutination. 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.*

I. 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 diarhoea, 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.

II. 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.

A. 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.

B. Exclusion Criteria:

1. duplication of data and titles and/or abstracts not meeting the inclusion criteria;
2. unpublished and data overlapped desertations 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.

III. RESULTS AND DISCUSSION

A. Phytochemical Reports

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

B. Pharmacological Reports

1) Antioxidant Activity

The methanol 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 ($DPPH^{\bullet}$) 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 $DPPH^{\bullet}$ and hydrogen peroxide (H_2O_2) scavenging as well as total reducing capacity [8].

*2) **Antimicrobial Activity***

a) Anti-Bacterial Activity

The methanolic leaf extract (20 and 200 µg/mL) concentration-dependently inhibited the growth of *Vibrio mimicus*, *Salmonella typhi*, *Salmonella dysentry*, *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. dysentry*, *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 anti-bacterial effect (ZI: 15 – 19 mm) on the tested bacterial strains.

b) 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].

c) 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% (LC_{50}) for pulp, peel and seed extracts were 304.4, 112.4 and 212.2 µg/mL [13].

d) Anti-Hemagglutination Activity

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

e) Anti-Hemolytic Effect

The methanolic leaf extract (0-1 mg/mL) was found to protect the human erythrocytes (RBCs) from H_2O_2-induced lysis [8].

IV. 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. sylvesteris 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-inflamatory 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. sylvesteris 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. *sylvesteris* 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.

V. 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.

Acknowledgement

I am owed to the NTF, Federal University of Paui, Brazil for internet support.

Conflicts of interest

None declared

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