



JOURNAL OF PHARMACEUTICAL SCIENCE AND BIOSCIENTIFIC RESEARCH (JPSBR)

(An International Peer Reviewed Pharmaceutical Journal that Encourages Innovation and Creativities)

Pharmacological Evidences and chemical compounds of *Platonia insignis* Mart: A review

Khaled Rashed

Department of Pharmacognosy, National Research Centre, 33 El Bohouth st.-Dokki, Giza, P.O.12622, EGYPT

Article History:

Received 30 Jun 2020

Accepted 02 Aug 2020

Available online 10 Aug 2020

Citation:

Khaled R. Pharmacological Evidences and chemical compounds of *Platonia insignis* Mart: A review. *J Pharm Sci Bioscientific Res.* 2020. 10(2):175-179

*For Correspondence:

Dr. Khaled Nabih Zaki Rashed

Department of Pharmacognosy,

National Research Centre, 33 El-Bohouth

St.-Dokki, Giza, Egypt P.O.12622.

www.jpsbr.org

ABSTRACT:

Platonia insignis Mart., is a plant from Clusiaceae family. It is a native tropical fruit from the Brazilian Amazon and Northeast Regions. Its seeds was used to treat inflammatory diseases, diarrhea and skin problems intraditional medical practices. The bark is astringent and it was used to treat diarrhea. Chemical composition showed high water content (76%), 20% of carbohydrate, 3% of lipids, less than 1% of proteins and other chemical compounds. Pharmacological studies proved its bactericide, antifungal, spasmogenic and anti-protozoal activities.

KEY WORDS: *Platonia insignis*, phytoconstituents, plants, bioactivities

INTRODUCTION

Plants can be considered as a rich source of therapeutic agents for the prevention and treatment of numerous diseases [1]. The increase search for new drugs from plants led to the discovery of many metabolites with potential for drug development through the isolation, elucidation of structure, composition and evaluation of bioactivity based on phytochemical composition and uses in traditional medicine [1,2]. Clusiaceae family had many potent medicinal value [3]. This family includes trees, shrubs, lianas and herbs of economic interest for the production of edible fruits, woods, chemicals of pharmaceutical interest and paints [4]. Previous studies on the chemical composition of the plants of this family proved that they are rich in xanthenes and polyisoprenylated benzophenones that were isolated not only from the resins, but also in other parts of the plants [5,6] and also the known biological activities as antidepressive, antioxidant, antifungal, anti-HIV and antibacterial activity. *Platonia insignis* is an evergreen species belonging to the Clusiaceae family. It is popularly known as "bacurizeiro" It is found mainly in open areas, especially anthropozoic areas, and is rarely found in dense primary forests. The greases

obtained from *Platonia insignis* seeds are commonly used as cicatrizantes and anti-inflammatory agents [7]. There are reports in the literature where the extracts of the seeds, fractions and isolated compounds were tested in several biological activities and presented promising results as, reduction of oxidative stress [8-10], Immunomodulatory effects and low in vivo toxicity have also been reported for extracts obtained from the seeds [11]. *P. insignis* seeds are vert rich in fatty acids, triacylglycerols and metabolites with potential therapeutic activity, such as xanthenes that exhibit antiepileptic and antiparasitic effects [12] and polyisoprenylated benzophenones, with vasorelaxant effect in animal models [13]. A triacylglycerol isolated from the hexane extract of its seeds, 1,3-distearyl-2-oleylglycerol (TG1), in formulations, was effective in healing wounds in rats [14]. This review gave information on previous chemical compounds isolated from the plant and biological studies of the plant.

Phytoconstituents and BIOLOGICAL ACTIVITIES

Stem bark and its major compound Lupeol and its antileishmanial effect

This study evaluated the antileishmanial effects of the ethanol extract (EtOH-Ext), hexane fraction (Hex-F), and its main isolated obtained from stem barks of *P. insignis* against *Leishmania (Leishmania) amazonensis*, as well as their cytotoxicity and possible mechanisms of action. The EtOH-Ext, Hex-F, and Lupeol inhibited the growth of *L. amazonensis* promastigote forms at IC₅₀ of 174.24, 45.23, and 39.06 $\mu\text{g}/\text{mL}$, respectively, as well as *L. amazonensis* axenic amastigote forms at IC₅₀ of 40.58, 35.87, and 44.10 $\mu\text{g}/\text{mL}$, respectively. The mean cytotoxic concentrations for macrophages (CC₅₀) were higher than those for amastigotes (341.95, 71.65, and 144.0 $\mu\text{g}/\text{mL}$, resp.), indicating a selective cytotoxicity towards the parasite rather than the macrophages. Interestingly, all treatments promoted antileishmanial effect against macrophage-internalized amastigotes at concentrations lower than CC₅₀. Furthermore, increases of lysosomal volume of macrophages treated with EtOH-Ext, Hex-F, and Lupeol were observed. Only Lupeol compound stimulated increase of phagocytic capability of macrophages, proved that compound can be as biomarker for the antileishmanial effect of *P. insignis* stem bark, as well as the involvement of immunomodulatory mechanisms in this effect [15].

Cytotoxic and Immunomodulatory effects

This study investigated the in vitro cytotoxic and immunomodulatory effects of the hexanic extract of *P. insignis* seeds, and also in vivo acute oral toxicity. The biological evaluation was performed by the determination of cyto-toxic (MTT and hemolysis assay) and immunomodulatory (phagocytic capacity, lysosomal volume and nitrite production) activities of EHSB in murine peritoneal macrophages. In addition, the oral acute toxicity was evaluated using female Wistar rats treated with EHSB (2.0 g/kg), in accordance with the OECD423 Guideline. The EHSB showed low toxicity for macrophages in the MTT test (CC₅₀ value: 90.03 g/ml), as well as for erythrocytes, which caused only 2.5% hemolysis at the highest concentration. A strong immunomodulatory activity was observed by a markedly increase of the NO production, phagocytic ability and lysosomal volume. On the other hand, it was not observed deaths or changes in the clinical and behavioral parameters in the toxicological evaluation. So this study proved the immunomodulatory and toxicological effects of *P. insignis* [16].

Antioxidant effect

The fruit of *P. insignis* were studied in relation to their Antioxidant chemical constitution. The total phenolic content ranged from 3.86 ± 0.47 to 33.38 ± 1.51 mg GAE/100 g, and the total flavonoid content ranged from 1.75 ± 0.22 to 19.44 ± 0.87 mg QUERE/100 g, where the contents showed a significant correlation with DPPH and ABTS antioxidant assays. Bacuri showed the highest antioxidant and α -glycosidase inhibitory capacity (IC₅₀ 15.20 $\mu\text{g}/\text{mL}$) [17].

Hypotensive Effect

This study evaluated the biological potential of the ethanol extract (Pi-EtOH) and ethyl acetate fraction (Pi-EtOAc) of *P. insignis* fruit shells on the cardiovascular system of rats. Pi-EtOH or Pi-EtOAc (12.5, 25, and 50 mg/kg) was administered intravenously in normotensive rats (260–300 g), and the mean arterial pressure and the heart rate were monitored. The Pi-EtOH induced hypotension (-11.56 ± 0.89 , -7.43 ± 0.85 , and -17.56 ± 1.97 mmHg) followed by bradycardia in two highest doses (-8.89 ± 3.62 and -15.79 ± 1.83 beats/min) and Pi-EtOAc, at the same doses, induced hypotension (-11.2 ± 1.03 , -14.48 ± 1.13 , -29.89 ± 2.67 mmHg) more intensively, followed by tachycardia at the dose 12.5 and 25 mg/kg (15.64 ± 2.06 , 19.31 ± 1.92 beats/min) and bradycardia at a dose of 50 mg/kg (-9.98 ± 7.33 beats/min). Hence, Pi-EtOAc can act similarly to the α_2 -adrenergic as hypotensive agent (18).

Antibacterial and antifungal effects

Hydroalcoholic and ethanol extracts of the bark, pulp and seeds of Açaí (*Euterpe precatoria*), Bacuri (*Platonia insignis*), Ingá (*Inga edulis*) and Pequiá (*Caryocar villosum*) were used. The minimum inhibitory concentrations (MIC) of the extracts were obtained by the microdilution broth method. The results showed low antimicrobial effect of Açaí, Bacuri and Ingá extracts, and more relevant was just the action of ethanolic extracts of bark and seeds from Bacuri and Ingá against *C. albicans* with MIC 500 $\mu\text{g}/\text{mL}$. The Pequiá extracts showed significant antibacterial activity against many pathogens. *Salmonella choleraesuis* was inhibited by hydroalcoholic extracts of bark, pulp and seeds with MIC ranging 125, 500 and 125 $\mu\text{g}/\text{mL}$ respectively and the ethanolic extract from bark and pulp with MIC 500 and 62.5 $\mu\text{g}/\text{mL}$. *S. arizonae* and *S. Typhi* were also inhibited, with better results for the ethanolic extract of pulp on the first bacteria and the hydroalcoholic of bark to the second one with MIC 250 and 125 $\mu\text{g}/\text{mL}$, respectively.

Streptococcus pyogenes was sensitive to hydroalcoholic extracts of bark, pulp and seeds with MIC of 125µg/mL for the first two extracts and MIC 62.5µg/mL to seed extract. Other significant results were the activities of hydroalcoholic extract from the pulp of Pequiá against *Yersinia enterocolitica* with MIC 250µg/mL, and ethanolic and hydroalcoholic extracts of pulp against *Shigella dysenteriae* with MIC 250 and 500µg/mL, respectively (19).

Cytotoxicity, mutagenicity and in vitro antioxidant of 2-oleyl-1,3-dipalmitoyl-glycerol

2-oleyl-1,3-dipalmitoyl-glycerol (ODG) isolated from *Platonia insignis* (bacurizeiro) seeds showed a median lethal dose (LD₅₀) greater than 1200 µg mL. ODG compound at the highest concentration was slightly cytotoxic with decrease in the size of roots and mitotic indexes, but did not induce chromosomal alterations. ODG (8.75–140.00 µg mL⁻¹) was found to reduce nitric oxide production by 41.6 %, while the antioxidant standard ascorbic acid (AA) reduced 54.14 %. ODG (15.625–250.00 µg mL⁻¹) promoted removal of the hydroxyl radical by 35.69 % at the highest concentration and was able to prevent lipid peroxidation induced by 2,2'-azobis-2-amidinopropane (AAPH), inhibiting the amount of TBARS formed, up to 35.69 %, a result close to that obtained with AA. So ODG moderately reduced the levels of hydroxyl radicals, nitric oxide, and TBARS in vitro and was nontoxic at low concentrations (20).

Volatile Composition of bacuri

The volatile profiles were studied by two High Concentration Capacity Headspace techniques (HCC-HS), Headspace Solid Phase Microextraction (HS-SPME) and Headspace Sorptive Extraction (HSSE), in combination with GC-MS. Bacuri is characterized by terpenes (41%), non-terpenic alcohols (24%), esters (15%), aldehydes (6%), and others (12%) (21).

CONCLUSION

This review showed the Chemical compounds and pharmacological effects of *Platonia insignis* Mart.

REFERENCES

1. Pan SY, Zhou SF, Gao SH, Yu ZL, Zhang SF, Tang MK, Sun JN, Ma DL, Han YF, Fong WF, Ko KM. New perspectives on how to discover drugs from herbal medicines: CAM's outstanding contribution to modern therapeutics. Evidence-Based

Complementary and Alternative Medicine. 2013 Oct;2013.

2. Dias DA, Urban S, Roessner U. A historical overview of natural products in drug discovery. *Metabolites*. 2012 Jun;2(2):303-36.
3. Bilanda DC, Dimo T, Djomeni PD, Bella NM, Aboubakar OB, Nguelefack TB, Tan PV, Kamtchouing P. Antihypertensive and antioxidant effects of *Allanblackia floribunda* Oliv.(Clusiaceae) aqueous extract in alcohol-and sucrose-induced hypertensive rats. *Journal of ethnopharmacology*. 2010 Apr 21;128(3):634-40.
4. Lustosa AK, Arcanjo DD, Ribeiro RG, Rodrigues KA, Passos FF, Piauilino CA, Silva-Filho JC, Araújo BQ, Lima-Neto JS, Costa-Júnior JS, Carvalho FA. Immunomodulatory and toxicological evaluation of the fruit seeds from *Platonia insignis*, a native species from Brazilian Amazon Rainforest. *Revista Brasileira de Farmacognosia*. 2016 Jan 1;26(1):77-82.
5. Piccinelli AL, Campone L, Dal Piaz F, Cuesta-Rubio O, Rastrelli L. Fragmentation pathways of polycyclic polyisoprenylated benzophenones and degradation profile of nemorosone by multiple-stage tandem mass spectrometry. *Journal of the American Society for Mass Spectrometry*. 2011 Nov 22;20(9):1688-98.
6. da Costa Júnior JS, de Almeida AA, da Rocha Tomé A, Citó AM, Saffi J, de Freitas RM. Evaluation of possible antioxidant and anticonvulsant effects of the ethyl acetate fraction from *Platonia insignis* Mart.(Bacuri) on epilepsy models. *Epilepsy & Behavior*. 2011 Dec 1;22(4):678-84..
7. dos Santos Júnior RQ, Soares LC, Maia Filho AL, de Araujo KS, Santos ÍM, da Costa Júnior JS, Saffi J. Estudo histológico da cicatrização de feridas cutâneas utilizando a banha de bacuri (*Platonia insignis* Mart.). *ConScientiae Saúde*. 2010;9(4):575-81.
8. Costa Júnior JS, Freitas RM, Citó AM, Henriques JA, Saffi J. Evaluation of effects of ethanolic extract (EE) from *Platonia insignis* Mart. on pilocarpine-induced seizures. *J Biol Sci*. 2010;10:747-53..
9. Maria do Socorro MR, Alves RE, de Brito ES, Pérez-Jiménez J, Saura-Calixto F, Mancini-Filho J. Bioactive compounds and antioxidant capacities of 18 non-traditional tropical fruits from Brazil. *Food chemistry*. 2010 Aug 15;121(4):996-1002.

10. Nascimento JL, Coêlho AG, Barros YS, Silva OA, Freitas RM, Rocha MS, David JM, Júnior JS, Arcanjo DD, Oliveira RD, Citó AM. Avaliação da atividade antioxidante in vitro do extrato hexânico da semente do bacuri (*Platonia insignis* Mart.) e de seu complexo de inclusão com β -ciclodextrina. *Boletim Informativo Geum*. 2014 Jun 30;5(2):44.
11. Lustosa AK, Arcanjo DD, Ribeiro RG, Rodrigues KA, Passos FF, Piauilino CA, Silva-Filho JC, Araújo BQ, Lima-Neto JS, Costa-Júnior JS, Carvalho FA. Immunomodulatory and toxicological evaluation of the fruit seeds from *Platonia insignis*, a native species from Brazilian Amazon Rainforest. *Revista Brasileira de Farmacognosia*. 2016 Jan 1;26(1):77-82.
12. Costa Júnior JS, Ferraz AB, Sousa TO, Silva RA, De Lima SG, Feitosa CM, Citó AM, Melo Cavalcante AA, Freitas RM, Moura Sperotto AR, Péres VF. Investigation of Biological Activities of Dichloromethane and Ethyl Acetate Fractions of *Platonia insignis* Mart. Seed. *Basic & clinical pharmacology & toxicology*. 2013 Jan;112(1):34-41.
13. Arcanjo DD, Costa-Júnior JS, Moura LH, Ferraz AB, Rossatto RR, David JM, Quintans-Júnior LJ, Oliveira RD, Citó AM, Oliveira AP. Garcinielliptone FC, a polyisoprenylated benzophenone from *Platonia insignis* Mart., promotes vasorelaxant effect on rat mesenteric artery. *Natural Product Research*. 2014 Jun 18;28(12):923-7.
14. Mendes MC, Lacerda JS, Junior LM, da Silva ML, Coelho ML, da Rocha Tome A, da Costa Junior JS, Ferraz AD, David JM, de Freitas RM. Evaluation of the cicatrizant activity of a semisolid pharmaceutical formulation obtained from *Platonia insignis* Mart. *African Journal of Pharmacy and Pharmacology*. 2015 Feb 15;9(6):154-64.
15. Souza AC, Alves MM, Brito LM, Oliveira LG, Sobrinho-Júnior EP, Costa IC, Freitas SD, Rodrigues KA, Chaves MH, Arcanjo DD, Carvalho FA. *Platonia insignis* Mart., a Brazilian Amazonian plant: the stem barks extract and its main constituent Lupeol Exert Antileishmanial effects involving macrophages activation. *Evidence-Based Complementary and Alternative Medicine*. 2017 Jan 1;2017.
16. Lustosa AK, Arcanjo DD, Ribeiro RG, Rodrigues KA, Passos FF, Piauilino CA, Silva-Filho JC, Araújo BQ, Lima-Neto JS, Costa-Júnior JS, Carvalho FA. Immunomodulatory and toxicological evaluation of the fruit seeds from *Platonia insignis*, a native species from Brazilian Amazon Rainforest. *Revista Brasileira de Farmacognosia*. 2016 Jan 1;26(1):77-82.
17. de Freitas, F.A., Araujo, R.C., Soares, E.R., Nunomura, R.C., da Silva, F.M., da Silva, S.R., de Souza, A.Q., de Souza, A.D., Franco-Montalbán, F., Acho, L.D. and Lima, E.S., 2018. Biological evaluation and quantitative analysis of antioxidant compounds in pulps of the Amazonian fruits bacuri (*Platonia insignis* Mart.), ingá (*Inga edulis* Mart.), and uchi (*Sacoglottis uchi* Huber) by UHPLC-ESI-MS/MS. *Journal of Food Biochemistry*, 42(1), p.e12455.
18. Mendes MB, da Silva-Filho JC, Sabino CK, Arcanjo DD, Sousa CM, Costa IC, Chaves MH, Oliveira RD, Oliveira AP. Pharmacological evidence of α -adrenergic receptors in the hypotensive effect of *Platonia insignis* mart. *Journal of medicinal food*. 2014 Oct 1;17(10):1079-85.
19. Silva AF, Rocha CQ, Silva LC, Júnior AR, Mendes IN, de Araruna AB, Motta EP, Silva RD, Campos CD, Farias JR, Oliveira AD. Antifungal and Antivirulence Activities of Hydroalcoholic Extract and Fractions of *Platonia insignis* Leaves against Vaginal Isolates of *Candida* Species. *Pathogens*. 2020 Feb;9(2):84.
20. do Nascimento Cavalcante A, Lima LK, Araújo CM, da Silva Santos FP, do Nascimento MO, e Sousa JM, Rai M, Feitosa CM. Toxicity, cytotoxicity, mutagenicity and in vitro antioxidant models of 2-oleyl-1, 3-dipalmitoyl-glycerol isolated from the hexane extract of *Platonia insignis* MART seeds. *Toxicology Reports*. 2020 Jan 1;7:209-16.
21. Uekane, T.M., Nicolotti, L., Griglione, A., Bizzo, H.R., Rubiolo, P., Bicchi, C., Rocha-Leão, M.H.M. and Rezende, C.M., 2017. Studies on the volatile fraction composition of three native Amazonian-Brazilian fruits: Murici (*Byrsonima crassifolia* L., Malpighiaceae), bacuri (*Platonia insignis* M., Clusiaceae), and sapodilla (*Manilkara sapota* L., Sapotaceae). *Food chemistry*, 219, pp.13-22.

