Pharmacognostical, biochemical activities and zootecchnical applications of *Psidium guajava* (Myrtaceae), plant with high médicinal value in tropical and subtropical parts of the World: A review

Lissette H Degla, Pascal A Ouloulade, Abdou MO Amoussa, Erick VB Azando, Mawulé S Hounzangbe-Adote and Latifou Lagnika

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Abstract

In the search for new molecules capable of treating intestinal parasitosis with less risk in the short, medium and long term, the potential of medicinal plants is explored. *Psidium guajava* is plant used traditional medicine to treat gastrointestinal disorders and intestinal parasitosis. According to the synthesis of reviews presented here, very few studies have been devoted to the evaluation of anthelmintic activities of *Psidium guajava*. *Psidium guajava* has secondary metabolisms responsible for its demonstrated biological activities and reported medicinal uses. The leaves and fruits of *Psidium guajava* contain essential oils that know a great variation in the content of compounds. Geographic and edaphic conditions, and genetic factors are factors that influence the composition of essential oils. The direct consequence is the observation of several chemotypes of essential oils of *Psidium guajava*. Further studies are important to demonstrate the efficacy of *Psidium guajava* in the treatment of intestinal parasitosis.

Keywords: Anthelmintics, bibliographical review, essential oils, intestinal parasitoids, *Psidium guajava*

Introduction

Intestinal parasitosis is a real health problem in both veterinary and human medicine [1, 2]. In small ruminants, they cause production loss while threatening food security [2, 3]. In humans, they contribute to the perpetuation of poverty by compromising the physical and intellectual development of children and reducing the work capacity and productivity of adults [4]. In general, the treatment of these intestinal parasitoses relies on the administration of synthetic drugs (including anthelmintics). However, these drugs have more and more limitations related to side effects and reported parasite resistances [5-7]. It is then convenient to search for new substances, effective, accessible, without toxicity and with a wide spectrum of action, to face these parasitoses and medicinal plants are a great asset. The aim of this work is to make a bibliographic synthesis of the uses, compositions, biological activities of *Psidium guajava* species for a better exploitation in the treatment of human and small ruminant intestinal parasitosis.

Material and method

The material consists of published scientific journals. The collection of these articles was done in the Google scholar engine. The articles are selected according to their relevance to the subject.

Results and discussion

Generalities

*Psidium guajava* is a plant in the Myrtaceae family is a 6-9m tall tree cultivated for its nutritional and mineral values [8, 9]. The leaves are opposite, the flowers are branch colored, and the fruits are small, 3-6 cm long, pear-shaped, and reddish-yellow in color when ripe. The fruit is a berry containing many seeds [8, 10]. *Psidium guajava* is used in tropical and subtropical countries as food and for its medicinal values [11, 12].
Indeed, in traditional medicine, it is used in the treatment of dysentery, diarrhea vomiting, rheumatism, diabetes, and gastrointestinal problems, to cure wounds, ulcer, rheumatism and intestinal parasitosis [13-16]. Phytochemical analyses of the plant reported the presence of the secondary metabolites flavonoids, catechic tannins, saponosides, leucoanthocyanins, anthocyanins, reducing compounds, mucilages, sterols and terpenes [17-19]. Differences in chemical composition may exist. They can be explained by the geographical origin, the nature of the soil, the mode of extraction, the type of organ collected [18]. Psidium guajava fruits are very rich in fiber, vitamin (C and A), minerals such as Potassium (P), Copper and Manganese [8,19].

**Volatile compounds**

The essential oil of *Psidium guajava* has been widely studied in the world [20]. In Benin, the analysis of the essential oils of *Psidium guajava* leaves was carried out by [21, 22], the major compounds are β-caryophyllene, epi-β-bisabolol, Limonene, β-curcumene, α-curcumene, β-bisabolene.

![Figure 1: Majority of compounds identified in the essential oils of *Psidium guajava* leaves collected in Benin](image)

Table 1: Non-exhaustive list of the main compounds of the essential oils of *Psidium guajava* identified in different countries of the world

| Country | Parts | Majority compound | Most represented class | Comments |
|---------|-------|-------------------|-----------------------|----------|
| Benin [21] | Leave | limonene, β-bisabolol, (2E, 6E)farnesol, β-bisabolene, 1,8-cineole, sabinene, β-caryophyllene, (Z)β-ocimene | | Majoritary compounds depend on the sampling stations |
| Benin [22] | Leave | β-bisabolene, ar-curcumene, β-bisabolol | Sesquiterpenes, Hydrocarbon compound, Hydrocarbon sesquiterpenes | |
| Brazil [25] | Leave | β-caryophyllene, α-humulene, aromadendrene oxide, δ-selinene, selin-11-en-4α-ol | | |
| Egypt [9] | | D-Limonen, α-Pinene | Monoterpene hydrocarbons, Sesquiterpene hydrocarbons | the majority compounds depend on the variety of the tree |
| Country     | Leaves          | Compounds                                                                 | Biological activities                                                                 |
|------------|-----------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Egypt [23] | fruits          | β-Caryophyllene, Globulol, β-caryophyllene limonene                       | Consistent with those of [40-42] who demonstrated the antidiarrheal potential of Psidium guajava. Gastrointestinal disorders (vomiting, diarrhea) are also manifestations of intestinal parasitosis. |
| Mexico [24]| Leave           | β-caryophyllene                                                           | Anthelmintic activity                                                                  |
| Nepal [14] | Leave           | (E)-nerolidol, (E)-caryophyllene                                          | Very few authors have studied the anthelmintic activity of Psidium guajava [43-47]. The common methods used for in vitro evaluation of anthelmintic activity of plant extracts are: egg hatch test, adult worm mobility test, and larval migration inhibition test. The helminths used are Haemonchus contortus nematode of small ruminants [44, 47] and Pheritis posthuma study model of human helminthes [43]. According to the results of [47], hydroalcoholic extracts of Psidium guajava stem barks act much more on the eggs by preventing their hatching. This has the advantage of suspending the life cycle of the parasite and limiting reinfections and contamination of the pasture. These observations corroborate those of [45] who showed that Psidium guajava extracts can also cause paralysis of adult worms. The results obtained from these studies justify the use of Psidium guajava in the treatment of intestinal parasitosis of humans and small ruminants. The leaves could also be used as a food supplement as sources of tannins and those for the reinforcement of biological parameters in the fight against gastrointestinal parasitosis of small ruminants [48]. |
| Egypt [15] | Leave           | Limonene, α-phellandrene, eucalyptol, α-terpinol, spathulenol, caryophyllene, dihydrocarvone acetate, nerolidol, caryophyllene oxide | Anthelmintic activity                                                                  |
| Pakistan [26] | Leave          | α-phellandrene, eucalyptol, α-terpinol, spathulenol, caryophyllene, dihydrocarvone acetate, nerolidol, caryophyllene oxide | Anthelmintic activity                                                                  |
| Oman [27]  | Leave           | iso-caryophyllene, veridifloreone, farnesene                              | Anthelmintic activity                                                                  |
| Pakistan [18] | Leave        | β-caryophyllene                                                           | Anthelmintic activity                                                                  |
| Nakhon [28] | Leave           | Limonene, α-Pinen, α-pinene                                               | Anthelmintic activity                                                                  |
| Alexandria [29] | Leave       | (E)-caryophyllene, (E)-nerolidol                                         | Anthelmintic activity                                                                  |
| FazendaTabuleiros II [30] | Leave | β-caryophyllene                                                           | Anthelmintic activity                                                                  |
| India [31]  | Leave           | α-terpinyl acetate, trans–caryophyllene, nerolidol                        | Anthelmintic activity                                                                  |
| Brazil [32] | Leave           | α-Humulene, β-caryophyllene, β-Selinene, α-Selinene                        | Anthelmintic activity                                                                  |

The most represented compound classes are sesquiterpenes and hydrocarbon compounds [23]. These results corroborate the observations of [20] that essential oils obtained from Psidium species are rich in mono- and sesquiterpene compounds. The promoter of monoterpenes is geranyl pyrophosphate (C10) and that of sesquiterpenes is farnesyl pyrophosphate [20]. The analysis of Table I, shows that Psidium guajava essential oils have several chemotypes [14].
activities of Psidium guajava, previous results have demonstrated its potential in the treatment of gastrointestinal disorders. Further studies are needed for proper use of Psidium guajava in the control of gastrointestinal nematodes of small ruminants and humans.

Références

1. Olouladé PA, Azando EVB, Hounzangbé-Adoté MS, Tam Ha TB, Leroy E, Moulis C et al. In vitro anthelmintic activity of the essential oils of Zanthoxylum zanthoxyloides and Neoboldia laevis against Strongyloides ratti. Parasitology Research, 2012;110:1427-1433.

2. Akouedegni CG, Daga FD, Olouladé PA, Allowanou GO, Ahoussé E, Tamboura H et al. Evaluation In vitro et In vivo des propriétés anthelmintiques de feuilles de Spondias mombin sur Haemonchus contortus des ovins djalonke. Agronomie Africaine 2019;31(2):213-222.

3. Allowanou GG, Olouladé AP, Koudandé OD, Babatondé S, Hounzangbé-Adoté MS. Effets de la digestion dans le rumen sur les propriétés anthelmintiques de Brindelia ferruginea (Benth.), Mitragyna inermis (Willd.) Kuntze et Combretum glutinosum (PERK. EX DC.) Revue. CAMES 2015;03(02):50-56.

4. Sylla K, Koulé Tine RC, Sow D, Lelo S, Ndiaye LA, Thiendella Faye B. Epidemiological Profile of Intestinal Parasitic Infection among Preschool and School Children Living in a Rural Community in Senegal: A Cross Sectional Survey. Journal of Bacteriology and Parasitology 2018;9(4): 1-7.

5. Furtado LFV, Medeiros CS, Zuccherato LW, Alves WP, de Oliveira VNGM, da Silva VJ. First identification of the benzimidazole resistance-associated F200Y SNP in the betatubulin gene in Ascaris lumbricoides. PLoS ONE 2013(10):1-11. e0224108.https://doi.org/10.1371/journal.pone.0224108.

6. Paraud C. La résistance aux anthelminthiques des strongyles gastro-intestinaux chez les petits ruminants laitiers élevés au pâturage. Anses – Les Cahiers de la Recherche N° 10 - Santé, Environnement, Travaill 2017, 56-58.

7. Aguerre S. Résistance génétique aux nématoles gastro-intestinaux chez les ovins : évaluation des stratégies de sélection et de leur impact à l’échelle de l’élevage. Thèse de Doctorat de l’Université de Toulouse 2019. 172

8. Rishika D, Sharma R. An update of pharmacological activity of Psidium guajava in the management of various disorders. International Journal of Pharmaceutical Sciences and Research 2012;3(10):3577-3584.

9. Hassan EM, El Gendi AY, Abd-ElGamad AM, Elshamy AF, Farag MA, Alamer FY, Omer EA. Comparative Chemical Profiles of the Essential Oils from Different Varieties of Psidium guajava L. Molecules, 2021;26(119):2-11.

10. Metwally AM, Omar AA, Ghazy NM, Harraz FM, El Sohafy SM. Monograph of Psidium guajava L. leaves. Pharmacognosy Journal 2011;3(21):89-104.

11. Shruthi SD, Roshan A, Timilsina SS, Sunita S. A review on the medicinal plant Psidium guajava Linn. (Myrtaceae). Journal of Drug Delivery and Therapeutics, 2013;3(2):162-168.

12. Anand V, Manikandan, Kumar V, Kumar S, Pushpa, Hedina A. Phytopharmacological overview of Psidium guajava Linn. Pharmacognosy Journal 2016;8(4):314-320.
25. Silva EAJ, Esteveam EBB, Silva TS, Nicolella HD, Furtadob RA, Alvesa CCF et al. Antibacterial and antiproliferative activities of the fresh leaf essential oil of Psidium guajava L. (Myrtaceae). Brazilian Journal of Biology 79(4):697-702.

26. Hanif MU, Hussain AI, Chatha SAS, Kamal GM, Ahmad T. Variation in Composition and Bioactivities of Essential Oil from Leaves of Two Different Varieties of Psidium guajava L. Journal of Essential Oil Bearing Plants, 2018;21(1):65-76 DOI: 10.1080/0972060X.2018.1431152

27. Weli A, Al-Kaabi A, Al-Sabahi J, Said S, Hossain MA, Al-Riyami S. Chemical composition and biological activities of the essential oils of Psidium guajava leaf. Journal of King Saud University – Science; 2019;31:993-998.

28. Pettrachaianan T, Chaiyasirisuwan S, Athikomulkulchai S, Sareedenchai V. Screening of acetylcholinesterase inhibitory activity in essential oil from Myrtaceae. Thai Journal of Pharmaceutical Sciences 2019;43(1):63-68.

29. El-Sabrout AM, Salem MZM, Bin-Jumah M, Allam AA. Toxicological Activity of Some Plant Essential Oils Against Tribolium castaneum and Culex pipiens Larvae. Processes 2019;7(12):933. doi:10.3390/pr7120933.

30. De Carvalho Castro KN, Costa-Júnior LM, Lima DF, Canuto KM, De Brito ES. Acaridical activity of cashew nut shell liquid associated with essential oils from Cordia verbenacea and Psidium guajava on Rhizipephalus microplus. Journal of Essential Oil Research, 2019, 1-7, https://doi.org/10.1041/2019.10.1580225.

31. Borah A, Pandey SK, Haldar S, Lal M. Chemical Composition of Leaf Essential Oil of Psidium guajava L. from North East India. Journal of Essential Oil Bearing Plants 2019, DOI: 10.1080/0972060X.2019.1574213

32. Siani AC, Souza MC, Henriques MGMG, Ramos MFS. Anti-inflammatory activity of essential oils from Syzygium cumini and Psidium guajava. Pharmaceutical Biology 2013;51(7):881-887.

33. Naseer S, Hussain N, Naeem N, Pervaiz M, Rahman M. The phytochemistry and medicinal value of Psidium guajava (guava). Clinical Phytoscience 2018;4(32), 2-8.

34. Correa MG, Couto JS, Teodoró AJ. Anticancer Properties of Psidium guajava - a Mini-Review. Asian Pacific Journal of Cancer Prevention 2016;17:4199-4204.

35. Díaz-de-Cerio E, Verardo V, Gómez-Caravaca AM, Fernández-Gutiérrez A, Segura-Carrero A. Health Effects of Psidium guajava L. Leaves: An Overview of the Last Decade. International Journal of Molecular Science 2017;18(897):1-31.

36. Ashraf A, Sarfraz RA, Rashid MA, Mahmood A, Shahid M, Noor N. Chemical composition, antioxidant, antitumor, anticancer and cytotoxic effects of Psidium guajava leaf extracts, Pharmaceutical Biology, 2016;54;10, 1971-1981, DOI: 10.3109/13880209.2015.1137604.

37. Farhana JA, Hossain MF, Mowlah A. Antibacterial Effects of Guava (Psidium guajava L.) Extracts Against Food Borne Pathogens. International Journal of Nutrition and Food Sciences 2017;6(1):1-5.

38. Oseghele FO, Fasina KA, Ohifueme A, Omoruyi J, Biocontrol of Food Spoilage Microorganisms using Leaf extracts from Magnifera indica (Mango) and Psidium guajava (Guava). Journal of Chemical. Society of Nigeria 2020; 45(4):712 -723.

39. Choudhury S, Sharan L, Sinha MP. Phytochemical and Antimicrobial Screening of Psidium guajava L. Leaf Extracts against Clinically Important Gastrointestinal Pathogens. Journal of Natural. Product and Plant Resourse 2012;2(4):524-529

40. Ojewole AOI, Awe EO, Chiwororo WDH. Antidiarrhoeal activity of Psidium guajava Linn. (Myrtaceae) leaf aqueous extract in rodents. Journal of Smooth Muscle Research 2008;44(6):195-207.

41. Ezekwesili JO, Nkemdirim UU, Okeke CU. Mechanism of antidiarrhoeal effect of Ethanolic extract of Psidium guajava leaves. Biokemistry 2010;22(2):85-90.

42. Koriem KMM, Arbid MS, Saleh HN. Antidiarrheal and protein conservative activities of Psidium guajava in diarrheal rats. Journal of Integrative Medicine 2019;17(1):57-65.

43. Ismail M, Minhas PS, Khanum F. Anthelmintic Activity of Guava [Psidium guajava]. International Journal of Research in Pharmaceutical and Biomedical Sciences, 2012;3(1):76-77.

44. Pathak AK, Dutta N, Banerjee PS, Sharma K, Pattanaik AK. Efficacy of various condensed tannins extracts from tanniferous tree leaves on egg hatching inhibition of Haemonchus contortus. Veterinary Practitioner 2013;14:127-129. https://www.cabdirect.org/cababstract/abstract/201431896642.

45. Molla SH, Bandypadhyay PK. In vitro anthelmintic activity of Psidium guajava against sheep gastrointestinal nematode, Haemonchus contortus. Environment and Ecology 2014;32(2a):616-621.

46. Debiage RR, Goncalves FMF, Pereira AR, da Silva RMG. Anthelmintic potential of Psidium guajava in sheep. Planta Medica, 2016;82(S01):997. https://www.thieme-connect.com/products/ejournals/abstract/10.1055/s-0036-1596981.

47. Silva LP, Debiage RR, Bronzel-Júnior JL, Da Silva RMG, Mello-Peixoto ECT. In vitro anthelmintic activity of Psidium guajava hydroalcoholic extract against gastrointestinal sheep nematodes. Anais Academia Brasileira Ciencias 2020:92(2):5-15.

48. Jan OQ, Kamili N, Ashraf A, Iqbal A, Sharma RK, Rastogi A. Haematobiochemical parameters of goats fed tannin rich Psidium guajava and Carissa spinarum against Haemonchus contortus infection in India. Journal of parasitic Disease 2015;39(1):41-48.

49. Piña-Vázquez DM, Mayoral-Peña Z, Gómez-Sánchez M, Salazar-Olivo LA, Arellano-Carabajal F. Anthelmintic effect of Psidium guajava and Tagetes erecta on wild-type and Levamisole-resistant Caenorhabditis elegans strains, Journal of Ethnopharmacology 2017;202:92-96.