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Ethnopharmacological aspects of the genus *Samanea* Merrill (Fabaceae)

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The rain trees are specially denomined species of *Samanea* genus as *Samanea saman*, *Samanea tubulosa* and *Samanea inopinata*. These kinds of plants are recognized by its characteristic umbrella-shaped canopy and they are cultivated and naturalized throughout the tropics. These trees have been widely used in traditional medicine for the production of home remedies using various parts of the tree. The boiled bark is applied as a poultice to cure constipation, the decoction of the inner bark and fresh leaves is used for diarrhea, the roots of the tea of the roots is used for stomach cancer, the decoction of the fruit is used as a sedative and the seeds are chewed for sore throat. These plants, especially *S. saman* is also used in folk medicine for intestinal diseases, stomach pain (gastritis), colds, headaches and as an antibacterial for wounds and injuries. Due to accessibility of these plants and valuable medicinal aspects, the species of genus *Samanea* has become a potent medicinal remedies in many parts of the world. This paper is in overview form that present comprehensive analyzed information on the ethnopharmacological aspects of the species of genus *Samanea*.

Key words: *Samanea* genus, ethnobotanical, ethnopharmacological.

INTRODUCTION

The species of the *Samanea* genus, previously classified within the genus *Albizia*, comprises flowering trees in the pea family, Fabaceae, which is native to the Neotropics. Its range extends from South Mexico to Peru and Brazil, but it has been widely introduced to South and South East Asia, as well as the Pacific Islands, including Hawaii. As this is a recent botanical classification, there are few reports in the literature on the biological activities of the species of this genus.

Barneby and Grimes (1996), and recently Lewis and Rico Arce (2005) observed the existence of three species of the genus *Samanea* Merrill, endemic in intertropical area of North and South America, with a distribution that ex-tends for El Salvador, Brazil, Bolivia and Paraguay. Among these species, the *Samanea tubulosa* (Benth) Barneby & Grimes, has a peripheral distribution of the Amazon basin to the south and southwest, being exclusively Andean and allopatric with *Samanea saman* (Jacq.) Merrill and *Samanea inopinata* (Harms) Barneby & Grimes.

S. tubulosa and *S. inopinata* are closely related in nature, which makes its complex differentiation. The difference between both species is observed through fruiting in *S. tubulosa*. The ripe fruit has a continuous,

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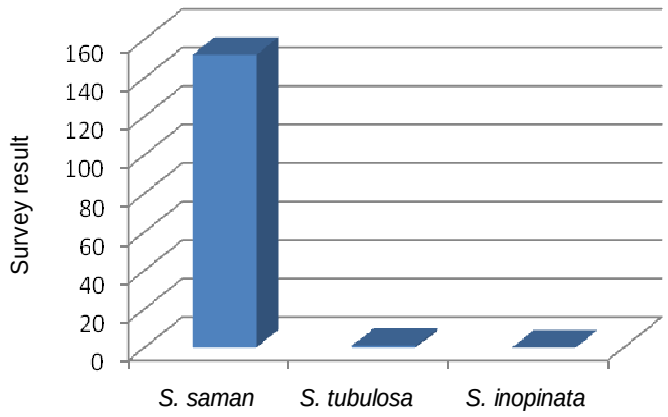

Figure 1. Results of the survey in Web of Science typing the name of each species of the genus *Samanea* in the search field.

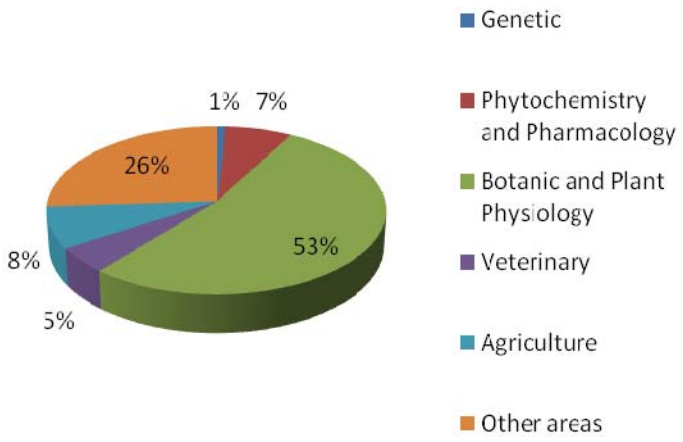

Figure 2. Main areas of publishing the results in the Web of Science data with the binomial *S. saman*.

smooth epicarp and grooved longitudinally. Already, *S. inopinata* ripe fruit has a tomentose and strongly grooved suture epicarp horizontally (Zapater et al., 2011).

The *S. tubulosa* and *S. inopinata* are quite different from *S. saman*, the first two species have pubescent leaflets on the beam, pateliforme nectaries at the base of the petioles, floral bracts not exceeding the buttons and thick, yellowish, wrinkled bark, while in *S. saman* leaflets are glabrous and shiny, the nectaries are located between pairs of pinnae, not at the base of the petiole, the floral bracts exceeding the buttons and exfoliating bark is smooth (Durr, 2001).

Research in Web of Science on the genus *Samanea* showed little or no report on phytochemical and pharmacological species *S. tubulosa* and *S. inopinata* studies, however, *S. saman* species is most reported in the literature, perhaps due to its extensive use in traditional medicine against constipation, diarrhea, headache, intestinal pain and stomach pain. 152 results were found for *S. saman*, 1 result for *S. tubular*, no results were found for *S. inopinata* (Figure 1). Of the 152 results found for *S. saman*, the main area of publication highlights the botany and plant physiology, followed by the areas of phytochemistry and pharmacology (Figure 2) (Arulpriya et al., 2010).

MATERIALS AND METHODS

The data presented in this paper were collected using all scientific data from encyclopedia books, journals, articles and websites such as Google Scholar, Scopus and Pubmed.

RESULTS

S. tubulosa

S. tubulosa occurs naturally in sandy, well drained soils on alluvial flood plains and river banks where the soil is well supplied with water and good chemical fertility. It is a large tree, reaching up to 28 m tall and 100 cm (diameter at breast height, measured 1.30 m) in adulthood. Its fruit is fleshy, with sweet, fragrant flesh and sweet flavor. Its wood ranges from mild to moderately dense and durable. Its flowers are showy, with landscaping potential and can be planted in squares, parks and gardens.

The phytochemical approach of *S. tubulosa* revealed as major constituents of the crude extract the following classes of compounds: steroids, alkaloids, simple phenols, flavonols, flavonoids, flavones, saponins and tannins. The ethanol extract showed no significant result in nematicide activity tests on the nematode *Meloidogyne incognita*, larvicide for *Aedes aegypti* and *Artemia salina*. The results corroborate other phytochemical studies of the genus *Samanea*, mentioning the tannins, steroids, flavonoids and alkaloids as major secondary metabolites. Thus, the results obtained from the chemical profile of the genus *Samanea* was directed further in order to isolate and characterize the substances present in the three species of this genus studies.

S. inopinata

The seven shells (*S. inopinata* (Harms) Ducke) species, belonging to the family Leguminosae Mimosoideae, also known as cork flour or dried, is a large tree, reaching 25 to 30 m tall and 1.0 m diameter stem; wide canopy, with up to 30 m in diameter, slightly dense with foliage semicaduca. It is a species classified as early secondary to rapid growth, with dried fruit. Its wood is soft and not very durable and can be used as fodder. Is also noted for its potential use in landscaping and urban forestry potential and can be planted in squares, parks and gardens.

Given the potential of the species mainly for urban forestry, as well as the fact that they are not information about its medicinal use and ethnopharmacological this species become a source for finding new phytomedications since many studies with other species showed numerous secondary metabolites with biological activities.

S. saman

S. saman (Jacq.) Merr. [sin. *Albizia saman* (Jacq.) F. v. Muell.] has been recognized as a species of tree legumes with relative biological, ecological and agroforestry potential. It is characterized as a species native to America and can be found from Southern Mexico to Paraguay, presenting a broad introduction in South and Southeast Asia, as well as some Pacific islands such as Hawaii

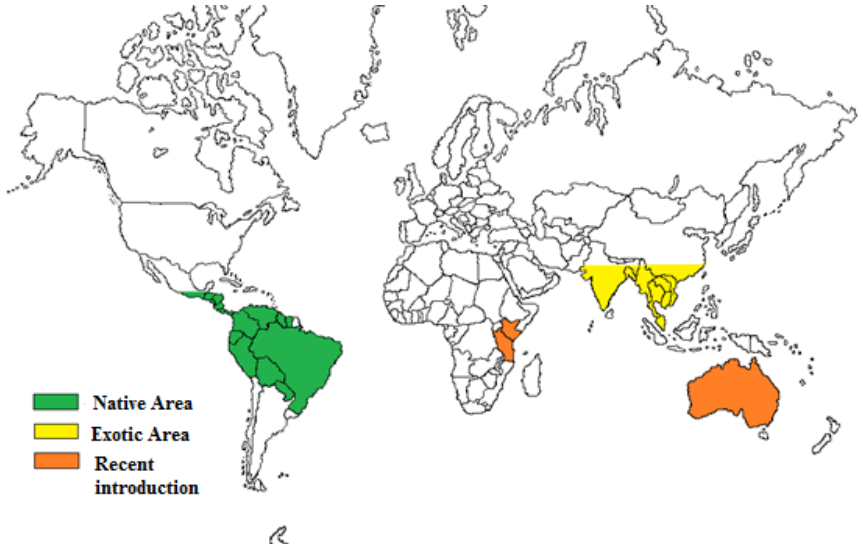

Figure 3. Worldwide distribution of *S. saman.*

(Figure 3).

S. saman has been classified within the group of the Rain Tree (Tree of Rain), it is easily recognized by its shape canopy that acts as an umbrella. When grown in the open reaches about 15 to 20 m in height having a canopy diameter of 50 to 60 m. The name Rain Tree is attributed to the trees that have light sensitive leaflets that close on cloudy days and at dusk, allowing it rain canopy. The lawn under the tree is a deeper green, nectaries on the leaf petioles excrete a sugary juice that sometimes falls from the crown as if rain during flowering and stamens may fall from the canopy similar to raindrops (Staples and Elevitch, 2004).

S. saman is taxonomically a typical member of the subfamily Mimosoideae characterized by the symmetry of their flowers that have more than 10 stamens. But the present united filaments were grouped within the *Ingeae* tribe, which is the main difference in *Acacieae* tribe. Below this level there has been a considerable taxonomic disagreement among botanists, reflecting a debate over 150 years to subdivide *Ingeae* tribe. It was originally named by *Mimosa saman* (Jacquin, 1809), through two distinct genres, *Pithecellobium* (Bentham, 1844) and *Enterobilum* (Prain, 1897) and culminating with the genre *Samanea* (Merrill, 1916), the latter being the most widely accepted taxonomy. However, a more thorough review of the tribe *Ingeae* conclude that *S. saman* spp. fall within the definitions of the genus *Albizia*, recognizing previous studies by von Mueller (1891). Much of the taxonomists have accepted the change as published in the 80s (Smith, 1985). However Nielsen (1992) recommended that the binomial *S. saman* should persist until a more thorough review of the American species were performed. Consequently, Barneby and Grimes (1996) conducted a review of the species present in America and concluded that the genus *Samanea* should be recognized as a distinct genus *Albizia*, moreover, were enriching their studies in order to rectify the treatment of *S. saman* as a single species constituent of the genre. Based on some consistent differences nectaries of petiole, the floral bracts and the number of seeds per pod Brazilian collections were renamed in *S. tubulosa* (Bentham) and *S. inopinata* (Harris) (Durr, 2001).

S. saman have been widely used in traditional medicine for the production of home remedies. There are reports of remedies prepared by various parts of the tree. The boiled bark is applied as a poultice to cure constipation. In the Philippines, a decoction of the inner bark and fresh leaves is used for diarrhea. In Venezuela, the roots of the tea are used for stomach cancer. In Colombia the decoction of the fruit is used as a sedative and in Western India, the seeds are chewed for sore throat. The plant is also used in folk medicine for intestinal diseases, stomach pain (gastritis), colds, headaches as well as an antibacterial for wounds and injuries (Ferdous et al., 2010).

A preliminary study of the phytochemical profile of *S. saman* identified plant, mainly in the leaves, the presence of various secondary metabolites such as tannins, flavonoids, steroids, saponins, cardiac glycosides and terpenoids (Prasad et al*.,* 2008), in addition, alkaloids were found in the bark, stem and seeds (Arumugam et al., 2011).

Two alkaloids $C_8H_{17}ON$ and $C_{17}H_{36}ON_3$ (Pithecolobine, LD_{50} = 40 to 225 µg/kg in mice) (Wiesner and Orr, 1960) and a saponin of molecular formula $C_{23}H_{36}O_4$ (Samarin) were isolated from the bark of *S. saman* (Anon, 1948-1876). Other constituents were identified in the bark as gallic acid, glucose, sucrose, fatty acids and phytosterols. Recently, terpenoids, Lupeol and Epilupeol were isolated from the methanol extract of the plant spray (Ferdous et al., 2010).

DISCUSSION

Much of ethnopharmacological studies found in the literature on the genus *Samanea* were performed with *S. saman* spp. Few or no studies were found on the biological and pharmacological activities of the species *S. tubular* and *S. inopinata*.

The main reported biological activities are related to the extracts, since few studies have been conducted with isolated compounds. Even being the only species of the genus studied so far, studies regarding its drug-biological potential are still very recent. The main biological activities relate to the analysis of dry plant extract given that very few substances have been isolated so far. Antibacterial, antioxidant, cytotoxic and anti-ulcerogenic compositions were the main activities studied among which, the antibacterial activity produced the highest

number of papers both from the analysis of the dried extract and the isolated compounds.

A recent study showed the literature to evaluate the antimicrobial activity of the aqueous extract of *S. saman* against *E. coli*, *S. aureus* and *C. albicans*, using penicillin, streptomycin and chloramphenicol as reference compound (Prasad et al., 2008). The tannin fractions rich in tannins showed higher action than methanolic and ethanolic fractions antimicrobial (Ukoha et al., 2011).

Studies on the antioxidant activity of the extract of *S. saman* was mainly observed by testing scavenging free radicals of type 2,2-diphenyl-1-picryl hydrazine (DPPH) (Arulpriya et al., 2010). Cytotoxicity of extracts of *S. saman* has been demonstrated by the lethality of brine shrimp undergoing exposure to each of the extracts and the positive control, vincristine sulphate (Ferdous et al., 2010).

Evaluation of anti-ulcerogenic extracts of the bark of *S. saman* activity has been carried out by inducing gastric damage by ethanol in albino rats. The extracts of *S. saman* showed gastroprotective activity in comparison to other anti-ulcerogenic reference, mainly, omeprazole (Aramugam et al., 2011).

Conclusion

The aim of this work has been done to describe the recent advances about phytotherapy exploration of the genus *Samanea* and to illustrate the potentials therapeutic of plants of this genus. With the current data, it is clear that genus *Samanea* has pharmacologic properties including anti-inflammatory, antileishmania, and gastroprotective among others. As these data show it is possible that components such as tannins, flavonoids, steroids, saponins, glycosides, terpenoids, iridoid glycosides, and phenylethanoid are the major active metabolites of these species and crucial in the development of new medicines for curing various diseases. This overview emphasizes the ethnopharmacological aspects of the species of the genus *Samanea* to be used as a therapeutic agent and lays the foundation for research and investigation of new pharmacologically active compounds isolated from three species of this genus.

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Conflict of interest

The authors have declared that there is no conflict of interests.

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