MIT International Journal of Pharmaceutical Sciences, Vol. 6, No. 1, January 2020, pp. 16–20
ISSN 2394-5338 (Print); 2394-5346 (Online) © MIT Publications

Review Article

ETHNOMEDICINAL AND PHYTOPHARMACOLOGICAL ASPECTS OF *SYZYGIUM JAMBOS L.* ALSTON (MYRTACEAE)

Kolhe Rohini C*, Chaudhari Rajesh Y, Patil Vijay R

T.V.E.S. Hon. Loksevak Madhukarrao Chaudhari College of Pharmacy, District- Jalgaon, Maharashtra-425503, India.

*** Corresponding Author:** *E-mail: rohini.kolhe@gmail.com*

ARTICLE INFO

Received 17 July 2020

Revised 18 August 2020

Accepted 22 August 2020

Keywords:

- Syzygium jambos
- Myrtaceae
- Ethnomedicine
- Phytochemistry
- Pharmacology.

ABSTRACT

Syzygium jambos (Myrtaceae), commonly known as pink apple or jambs, is an important medicinal plant used in the indigenous medicine system. It is found in sub-Saharan Africa, in Central America and in Asia. Traditionally, the plant has been used for the treatment of asthma, chronic bronchitis, diarrhea, epilepsy and inflammation. Phytochemical studies of the different parts of the plant revealed the presence of several bioactive phyto-costing agents, such as phenolic compounds, glycosides, triterpenoids and volatile oils. It has also been reported that the plant has significant pharmacological activities such as antimicrobial, antinociceptive, antitumor, antidiabetic, anti-inflammatory, antifungal, antioxidant and hepatoprotective that are evaluated using various animal models. The objective of the review is to gather all relevant published information related to traditional uses, phytochemicals and the pharmacological potential of Syzygium jambos. The review shows the importance of this plant in ethnomedicine and its enormous potential in modern medicine.

1. INTRODUCTION

Medicinal plants play an important role in the growth of human culture. As a source of medicine, medicinal plants have always effectively guided all civilization cultures. Medicinal plants are considered rich sources for traditional medicines and many of the modern medicines are produced by them. The practice of traditional medicine prevails in China, India, Japan, Pakistan, Sri Lanka and Thailand [1].

The plant synthesizes a wide variety of chemical compounds, which can be classified according to their chemical class, biosynthetic origin and functional groups in the primary and secondary metabolites. The primary metabolites constitute the physical integrity of the plant cell and are involved in the primary metabolic process of building and maintaining living cells. Secondary metabolites are not considered vital for the immediate survival of the organism that produces them and are not an essential part of the process of building and maintaining living cells. With the development of natural product chemistry, the potential of chemotaxonomy is becoming increasingly evident. The application of chemical data to systematics has received great attention from a large number of biochemists and botanists over the past three decades [2].

The medicines of plant origin have been used all over the world in traditional medicines for the treatment of various diseases. According to a survey conducted by the NCI in the United States. In the United States, 61% of the 877 new chemical entities of small molecules introduced as medicines worldwide during the period 1981-2002 were inspired by natural products [4].

In recent years, there has been a growing interest in alternative therapies and the therapeutic use of natural products, mainly those derived from plants. Plants are one of the main sources of biologically active materials. Phytochemical screening of medicinal plants has contributed to the discovery of new drugs. Several medicinal plants have undergone detailed chemical investigations that have led to the isolation of pure bioactive molecules. These pure bioactive molecules have been subjected

ISSN 2394-5338 (Print); 2394-5346 (Online) © MIT Publications

to pharmacological evaluation [5]. Plant species continue to be a rich source of many new biologically active compounds, as very few plant species have been thoroughly studied for their medicinal properties. Therefore, there is a renewed interest in phytomedicine which leads to the detection of species of medicinal plants for phytopharmacological aspects.

Table 1: Ethnomedicinal uses of Syzygium jambos plant

Parts	Uses	Ref.
Roots	In treatment of epilepsy	6
Bark	Asthma, bronchitis and hoarseness antibacterial and antifungal emetic and astringent	6, 7,8
Leaf	Diabetes, diuretic, an expectorant in the treatment of rheumatism; to treat sore eyes; and as a febrifuge. Antiviral activity towards herpes simplex type 1 and type 2 and towards vesicular stomatitis virus. antibacterial activity against P. acnes antioxidant, analgesic effects and anti-inflammatory properties	6, 9, 10
Flower	Reduce fever	11
Seeds	Treatment of diarrhea, dysentery, and catarrh antifungal diabetics anesthetic headache, heartburn, abdominal colic	12, 6,13
Fruit	Tonic for brain and liver and as a diuretic	12

2. PHYTOCHEMISTRY

Slowing K. et al (1994) isolated two flavonol diglycosides from the leaves of Eugenia jambos which were characterized as quercetin and myristin-3-obeta-D-xylopyranosyl(1-2) alpha-L-rhamnopyranosidesby means of spectral analysis like 2D NMR technique and NOE experiments [14]. Ghareeb M.A. et al (2017) isolated total of 8 compounds from the n-butanol extract of S. jambos (Family Myrtaceae) plant, they were identified as quercetin- 3-O-rutinoside (1), prenylbenzoic acid 4-β-D-glucoside (2), morolic acid 3-O-caffeate (3), 5,4'-dihydroxy, 7-methoxy, 6-methyl-flavone (4), 3,4,5-trihydroxybenzoic acid (5), quercetin (6), isoetin-7-O-β-D-glucopyranoside (7), and (4'-hydroxy-3'-methoxyphenol-β-D-[6-O-(4"-hydroxy-3",5"-dimethoxylbenzoate)] glucopyranoside) (8). [15]. Rezende W.P. et al. (2013) evaluate the influence of environmental factors on the chemical composition of essential oils of S. jambos leaves. Studies on the influence of environmental factors on the composition of essential oils are important because they provide data for their cultivation, harvest and establish parameters for the essential oil components. The composition of the essential oils of the leaves was mainly influenced by the nutrients of the leaf (N, Mn, Co, Fe, S and Mg) and by the nutrients of the soil (Na, Al, S and H + Al) [16]. Sharma R. et al (2013) studied the ethanol extract from the leaves of S. jambos that led to the isolation of three known compounds and precisely; squalene, an analogue of anacardic acid and ursolic acid that are first reported from this plant. It has also been found that the ethanol extract contains three commercially acquired compounds, that is; Myricetin, micricitrin, gallic acid [9] Hossain et al. (2016) presented the HPLC extract for the identification and quantification of the main bioactive polyphenols present in S. jambos. High levels of hydrated catechins and routine hydrates (respectively 99.00 and 79.20 mg / 100 g of extract) and moderate amounts of ellagic acid and quercetin (59.40 and 69.30 mg / 100 g of extract, respectively) were quantified in HPLC. The catechin hydrate of this plant extract was determined for the first time by HPLC. The individual phenolic compounds of S. jambos were identified and quantified by HPLC. Based on the experimental results, of all the compounds present in S. jambos, it was found that the hydrated catechin (99.00 mg / 100 g of dry extract) had the highest concentration followed by the routine hydrate in a slightly amount lower (79.20 mg / 100 g of dry extract). Other compounds, such as ellagic acid and quercetin, have also been detected in moderate amounts [17].

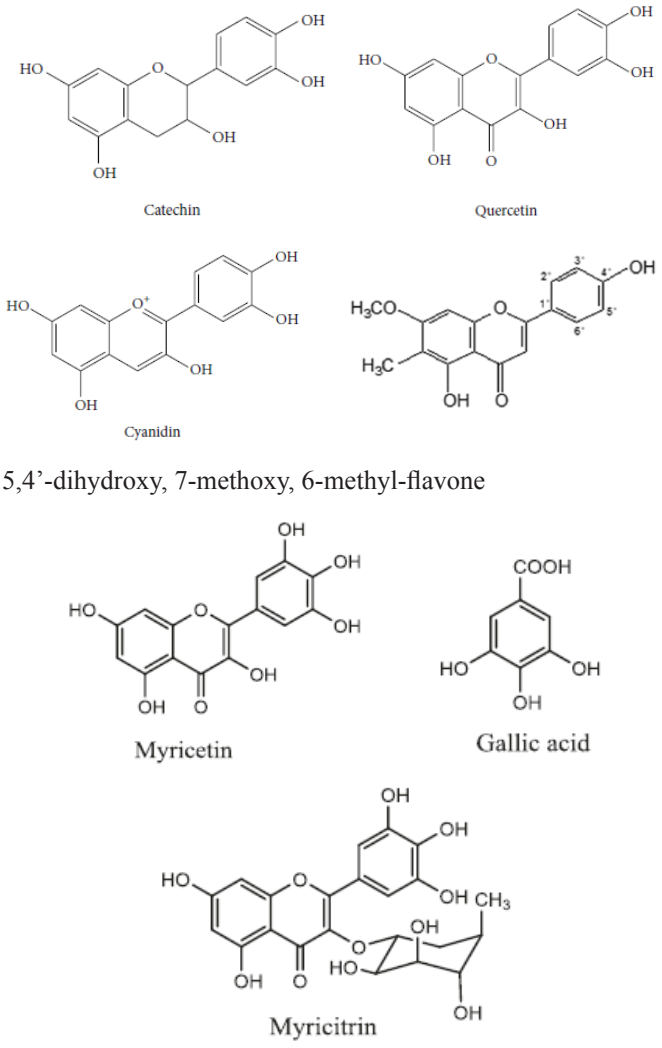

Fig. 1: Structure of some important isolated Phytoconstituents from Syzygium jambos plant

ISSN 2394-5338 (Print); 2394-5346 (Online) © MIT Publications

Dhanabalan R. et al. (2014) performed the preliminary phytochemical detection test of S. jambos leaf extracts that revealed the presence of alkaloids and flavonoids. The presence of qualitatively positive tannin was observed in the S. jambos ethanol extract. A specific group of saponins called triterpenoid has been observed in the extract of methanolic and ethanolic leaves. Together with the extract of methanol leaves, it was predicted that the presence of essential phytosterol in the diet was positive in the chloroform leaf extract and, in addition to the polyphenols, the presence of saponins in all extracts was also confirmed.

The quantitative analysis of S. jambos leaf extracts revealed the presence of alkaloids in chloroform, ethanol, methanol and aqueous extracts. The perception of flavonoids was higher in the chloroform extract than in other extracts. Water-soluble polyphenols called tannins were higher in aqueous extract. An appreciable amount of saponin in aqueous extract was estimated[18].

3. PHARMACOLOGY

3.1 Antimicrobial activity

Djipa C.D. et al (2000) studied the antimicrobial activity of acetone and aqueous S. jambos bark extracts in vitro using the agar dilution method in Petri dishes [7].

Mohanty and Cock (2010) reported the antimicrobial activity and toxicity of the methanol extracts of S. jambos leaves. The ability of S. jambos leaf extract to inhibit the growth of gram-positive and gram-negative bacteria. Antimicrobial activity is determined using a modified Kirby-Bauer disc diffusion method [6].

Murugan S. et al. (2011) evaluated the antimicrobial efficacy of aqueous extracts and bark acetone, leaves and seeds of Syzygium jambos (L) Alston (Myrtaceae) against eight different in vitro microorganisms using the method of agar diffusion in Petri dishes [11]

Sharma R. et al (2013) evaluates the potential of Syzygium jambos L. (Alston) leaf extract and its compounds for antibacterial activity against P. acnes pathogens using the broth dilution method [9].

3.2 Anti-inflammatory activity

Slowing K. et al (1994) studied the anti-inflammatory activities of hexane, dichloromethane, ethyl acetate and methanol extracts from the leaves of Syzygium jambos. It was found that ethyl acetate and methanol extract were effective against phenylbutazone [19].

3.3 Antinociceptive activity

Peña D.A. et al (2007) studied the analgesic activity of hydroalcoholic leaf extracts in rats. To estimate the cutaneous nociception, tests with hot plates and formalin were used, while measurements were taken of the grip strength of the forelimbs to evaluate muscular nociception in normal and inflammatory conditions [10]

3.4 Antioxidant activity

Ekramul Islam et al (2011) studied the ethanolic extract of the bark of Syzygium jambos to determine its antioxidant potential. The in vitro antioxidant activities of the extract were evaluated by the DPPH free radical elimination test, the total antioxidant capacity, the ability to reduce potency, the total phenol content and total flavonoids. The extract demonstrated significant antioxidant activity with an IC50 value of 6.75 µg / ml [8].

Majidul Haque et al (2015) evaluated the antioxidant activity of Syzygium jambos. for its activity of evacuation of free radicals. The activity of removing free radicals of plant extracts was determined in the stable radical produced by 1,1-diphenyl-2-picrylhydrazyl (DPPH). The methanol extract of the stem bark and the chloroform soluble fraction of this plant showed an important activity of elimination of free radicals [20].

Hossain H. et al (2016) studied the antioxidant activity of the ethanolic extract of Syzygium jambos leaves. The antioxidant activity was determined using 2,2'-azino bis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS), elimination of radicals, reduction of power dose, total antioxidant capacity, total flavonoid and phenol content. Total antioxidant activity was found in relatively significant quantities compared to standard ascorbic acid per g of extract [17].

Sudha S.S. et al. (2017) evaluated the properties of the elimination of free radicals and the cytotoxic activity of four acetone, aqueous, chloroform and methanol extracts using the human embryonic renal cell line (HEK 293). The study shows that the acetone and methanol extracts of S. jambos significantly reduce free radicals compared to other extracts, as well as those extracts less toxic to human cells [21].

Ramadhania et al. (2017) evaluated the antioxidant activity of hexane, ethyl acetate and methanol extracts from S. jambos leaves compared to the DPPH test method. Methanol extracts have better antioxidant activity than other solvents. The methanol extract of S. jambos showed the highest antioxidant activity among all extracts with an IC50 value of 7.90 µg / ml [22].

Bonfanti G. et al. (2014) investigate the effect of Syzygium jambos leaf extracts on the activity of δ-aminolevulinate dehydratase (δ-ALA-D), antioxidant activity and the possible protective action on erythrocytes with oxidative stress. In the erythrocyte samples, the effect of the δ-ALA-D activity, the H2O2-induced oxidative stress and the 2,2'azobis-induced hemolysis (2-amidinopropane) (AAPH) was evaluated. The extract of S. jambos leaves has shown a remarkable efficacy in the fight against lipid peroxidation induced by H2O2 and in the maintenance of cellular integrity against the heapolysis induced by AAPH [23].

3.5 Anti-cancer activity

Dhanabalan R. et al (2014) studied the antitumor activity of Syzygium jambos. Leaf extracts extracted with aqueous methanol, ethanol and chloroform were selected to determine

their antitumor activity in MCF-7 cells. It has been discovered that S. jambos chloroform leaf extracts are potent antiproliferative but do not reach the level of citoxan [18]

3.6 Antifungal activity

Sudha S.S. et al. (2016) evaluated the antifungal activity of acetone and S. jambos aqueous leaf extract against A. niger, C. albicans, C. neofromans and T. rubrum. Acetone extracts have significant antifungal activity that is similar to fluconazole activity. The plant leaf extracts showed a variable degree of antifungal activity against the fungal strains. The most significant 100% inhibition was observed against C. neoformans [24].

3.7 Hepatoprotective activity

Selvam N.T. et al (2013) studied the hepatoprotective activity of the methanolic extract of Syzygium jambos (Alston) (Linn.) against paracetamol-induced liver damage in Wistar albino rats at two different doses, 100 and 200 mg / kg body weight. It was found that the effectiveness of the extract is dose dependent. The histopathological study of the liver also supports the presence of hepatoprotective activity in patients with S. jambos, showing an improved cytoarchitecture of liver cells in the treated groups [24].

3.8 Antidiabetic activity

Gavillan-Suarez et al (2015) show that S. jambos shows better efficacy in vivo to reduce the level of blood glucose, when evaluated in models of genetic mice with diabetes. Blood glucose levels were monitored in mice treated with plant or control extracts (total of 12 treatments) at 5 and 10 weeks after treatment. At 5 weeks, the mice treated with S. jambos showed a better glycemic modulation [26].

3.9 Antiulcer activity

The Chaturvedi A. et al (2009) study includes the effect of ethanolic extract of E. jambolana seeds against gastric ulcers induced by 2-hour cold restriction stress, aspirin (ASP, 200 mg / kg, 4 hours) , 95% Ethanol (1 ml / 200 g, 1 hour) and 4 hours of pylorus ligation in rats. It was found that the 200 mg / kg extract administered orally for 10 days in rats reduces the ulcer index in all gastric ulcer models. It tends to reduce acid-pepsin secretion, increases mucin and mucous glycoprotein and decreases cell shedding, but has had no effect on cell proliferation. It has demonstrated antioxidant properties indicated by the decrease in lipid peroxidation and by the increase in glycoprotein and glutathione levels in the gastric mucosa of rats [27].

3.10 Hypoglycemic and hypolipidemic effect

Sharma S.B. et al (2003) studied the hypoglycemic and hypolipidemic effect of the ethanol extract obtained from E. jambolana seeds in diabetic rabbits induced by aloxane. The hypoglycemic activity was evaluated by reducing fasting blood glucose to 90 minutes and also decreasing the blood glucose peak during the glucose tolerance test in subdiabetic and mild diabetic rabbits. The ethanolic seed extract also showed a significant hypolipidemic effect, as evidenced by the fall in total serum cholesterol, the ratio between high density lipoprotein cholesterol, low density lipoprotein cholesterol levels and the decrease in HMG activity. -CoA reductase [28].

3.11 Antidiabetic and antiulcer effects

Chaturvedi A. et al (2009) evaluates the antidiabetic effects of the ethanolic extract of seeds of dried Eugenia jambolana seeds and its comparative effect on gastric ulcer and on the pepsin acid secretion with standard FL antisecretory blocker. The ethanolic extract (200 mg / kg) showed an anti-hyperglycemic effect on the tenth day of its administration. Furthermore, the ethanolic extract in the previous dose also lowered the cholesterol level with little or no effect on the triglyceride level and reversed the decrease and increase in the level of insulin and glycosylated hemoglobin near the normal level as observed after 30 days of treatment in rats with mild diabetes. The protective effect of Eugenia jambolana's ulcer appears to be due to its antidiabetic and gastric antisecretory effects [29].

4. CONCLUSION

Syzygium jambos is an important medicinal plant that has traditionally been used to treat various ailments. Numerous plant compounds have been isolated, such as flavonoids and the phenolic category, which have a wide range of biological products. Compounds isolated from plants provide a significant justification for their use. Furthermore, it is possible to perform a clinical study on isolated compounds to obtain possible candidates for the treatment of ulcers, diabetes, diarrhea, liver disorders, etc. Therefore, Syzygium jambos is the plant chosen for future research purposes and will certainly attract the attention of research, academics in the fields of pharmacology, drug discovery and phytochemistry.

REFERENCES

[1] Dar RA, Shahnawaz M, Qazi PH. Natural product medicines: A literature update. J Phytopharmacol. 2017;6(6):349-351.

[2] Cragg GM, Newman DJ. Natural product drug discovery in the next millennium. Pharmaceutical Biology. 2001;39:8-17.

[3] Newman DJ. Natural Products as Leads to Potential Drugs: An Old Process or the New Hope for Drug Discovery? Journal of Medicinal Chemistry. 2008;51(9):2589-2599.

[4] Kumar S, Paul S, Walia YK, Kumar A, Singhal P. Therapeutic Potential of Medicinal Plants: A Review. J. Biol. Chem. Chron. 2015;1(1):46-54.

[5] Heinrich M, Gibbons S. Ethnopharmacology in drug discovery: an analysis of its role and potential contribution. The Journal of pharmacy and pharmacology. 2001;53(4):425.

[6] Mohanty S, Cock IE. Bioactivity of Syzygium jambos methanolic extracts: Antibacterial activity and toxicity. Pharmacognosy Res.2010;2(1):4-9.

[7] Djipa CD, Delmee M, Quetin-Leclercq J. Antimicrobial activity of bark extracts of Syzygium jambos (L) Alston (Myrtaceae). J Ethanopharmacol. 2000; l71:307-313.

[8] Md Ekramul Islam et al., In vitro and invivo antioxidant potential of ethanolic extract of Syzygium jambos (L.) Bark. International journal of research in Ayurveda & pharmacy. 2011; 2(3):810-815.

[9] Sharma R, Navneet K, Ahmed H, Namrita L, Antibacterial and anti-inflammatory effects of Syzygium jambos L. (Alston) and isolated compounds on acne vulgaris. BMC Complement Altern Med. 2013;13(292):1-10.

[10] Pena DA, Antinociceptive activity of Syzygium jambos leaves extract on rats Journal of Ethnopharmacology, 112 (2007) 380–385.

[11] Murugan S., Devi PU., Parameswari NK., Mani KR., Antimicrobial activity of syzygium jambos against selected human pathogens, International Journal of Pharmacy and Pharmaceutical Sciences.2011;3(2):4447.

[12] Khoo HE, Azlan A, Kong KW, Ismail A. Phytochemicals and Medicinal Properties of Indigenous Tropical Fruits with Potential for Commercial Development. Evidence-Based Complementary and Alternative Medicine. Volume 2016, Article ID 7591951, 20.

[13] Rao PP, Subramanian P, Reddy PR, Gupta HC. Standardisation of Homoeopathic drug - Syzygium Jambos (L.) Alston. Indian Journal of Research in Homoeopathy. 2011;5(3): 1519.

[14] Slowing K, Shollhuber M, Carreters E, Villas A. Flavonoid glycosides from Eugenia jambos. Phytochemistry.1994;37:255.

[15] Ghareeb MA, Hamed MM, Hassan AA, Saad AM, Sayed AbdelAziz, Asmaa Hadad, extraction, isolation, and characterization of bioactive compounds and essential oil from syzygium jambos. Asian J Pharm Clin Res. 2017;10(8):194-200.

[16] Rezende WP, Borges LL, Alves NM, Ferri PH, Paula JR. Chemical variability in the essential oils from leaves of Syzygium jambos. Rev Bras Farmacogn. 2013;23(3):433-40.

[17] Hossain H, Rahman SE, Akbar PN, Khan TA, Rahman MM, Jahan IA. HPLC profiling, antioxidant and in vivo anti-inflammatory activity of the ethanol extract of Syzygium jambos available in Bangladesh. BMC Res Notes. 2016; 9:191.

[18] Dhanabalan R, Palaniswamy M, Devakumar J. Total polyphenol and flavonoid content of Syzygium jambos (L) Alston leaf extracts and its in vitro DPPH radical scavenging activity. Journal of Pharmacy Research. 2014; 8(4): 593-596.

[19] Slowing K, Carretero E, Villar A. Anti inflammatory activity of leaf extracts of Eugenia jambos on rats. J Ethanopharmacol. 1994; 43:9-11.

[20] Begum M, Haque M, Ferdous R, Hasan M, Tarek H, Alam N, Hossain B, Uddin N, Begum T, Choudhury MH. Screening of Antioxidant and Antimicrobial Properties of the Syzygium jambos L. American Journal of Bio Science. Special Issue: Pharmacological and Phytochemicals Investigation. 2015; 3(2-1): 23-26.

[21] Devakumar J, Sudha SS, *In vitro* Phytochemical, Antioxidant and Cytotoxic Evaluation of Syzygium jambos L. (Alston). Journal of Pharmacy Research. 2017;11(3):235-238.

[20] Ramadhania Z, Insanu M, Gunarti NS, Ruslan K, Sukrasno S. Antioxidant Activity from Ten Species of Myrtaceae. Asian journl of pharmaceutical and clinical research. Special issue (may): 5-7.

[23] Bonfanti G, Bona1 KS, Lucca1 LD, Jantsch L, Pigatto AS, Boligon AA, Athayde ML, Moretto MB, Gonçalves TL. Delta-ALA-D inhibitory potential and protective action of Syzygium jambos and Solanum guaraniticum leaf extracts on oxidatively stressed erythrocytes. Redox Report. 2014;19(5): 206-213.

[24] Devakumar J, Sudha SS, Keerthana, Anitha S, Ezhilarasi R. A study on quantification of phytoconstituents and *in vitro* antifungal activity of S.cumini and S.jambos leaf extracts.world journal of pharmacy and pharmaceutical sciences. 2016;5(1):1514-1526.

[25] N. Thamizh Selvam, V. Venkatakrishnan1, R. Dhamodharan, S. Murugesan, S. Damodar Kumar, Hepatoprotective activity of methanolic extract of Syzygium jambos (Linn.) leaf against paracetamol intoxicated Wistar albino rats, AYU | Jul-Sep 2013 | Vol 34 | Issue 3,305-308.

[26] Suárez JG, Perez AA, Ortiz NR, Tirado KR, Cuilan WF, Santiago LM, Martínez GM, Cubano LA, Montemay MM. Chemical profile and in vivo hypoglycemic effects of Syzygium jambos: Costus speciosus and Tapeinochilos ananassae plant extracts used as diabetes adjuvants in Puerto Rico. BMC Complementary and Alternative Medicine. 2015;15:244.

[27] Chaturvedi A, Bhawani G, Agarwal PK, Goel S, Singh A, Goel RK, Antidiabetic and antiulcer effects of extract of Eugenia jambolana seed in mild diabetic rats: Study on gastric mucosal offensive acid-pepsin secretion. Indian J Physiol Pharmacol. 2009 Apr-Jun; 53(2):137-46.

[28] Sharma SB, Nasir A, Prabhu KM, Murthy PS, Dev G., Hypoglycaemic and hypolipidemic effect of ethanolic extract of seeds of Eugenia jambolana in alloxan-induced diabetic rabbits, Ethnopharmacol. 2003; 85(2-3):201-206.

[29] Chaturvedi A, Bhawani G, Agarwal PK, Goel S, Singh A, Goel RK, Effect of ethanolic extract of Eugenia jambolana seeds on gastric ulceration and secretion in rats. Indian J Physiol Pharmacol. 2007;51(2):131-40.