**Review on Pharmacognostical & Pharmacological Properties of *Pyrostegia venusta*: An Ornamental Plant**

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**ABSTRACT:**

Herbal and natural folk remedies have been used in all cultures of the world for centuries. Plants are undoubtedly a reservoir of potentially useful chemical compounds that act as medicines and provide new clues and clues for modern synthetic design. *Pyrostegia venusta*, also known as flame vine or orange trumpet vine, is a species of flowering plant in the genus Pyrostegia family Bignoniaceae, native to southern Brazil, Bolivia, northeastern Argentina and Paraguay. It is a popular garden species today. In traditional Brazilian medicine, it has been widely used as a tonic to treat certain skin infections such as leukoderma, vitiligo, etc., as well as to treat diarrhea, cough and common respiratory diseases associated with infections such as bronchitis, colds and flu. Phytochemical studies on *Pyrostegia venusta* revealed sterols, triterpenes, flavonoids, fatty acids, n-alkanes, nitrogen compounds such as allantoin and carbohydrates. Crude extracts from PyroSstegia venusta have a wide range of pharmacological effects, such as antioxidant, anti-inflammatory, analgesic, antinociceptive, wound healing, antimicrobial effects and are useful in the treatment of pathological disorders such as colds and flu. Also used to relieve menopausal symptoms and increase melanogenesis.

**KEYWORDS:** *Pyrostegia venusta*, Flamevine, orange trumpet vine.

**INTRODUCTION:**

*Pyrostegia venusta*, also known as flame vine, is a species of plant in the genus Pyrostegia in the family Bignoniaceae, native to southern Brazil, Bolivia, northeastern Argentina and Paraguay. It is a popular garden species today. John Miers first described this species in 1863. This evergreen, vigorous climber is a fast grower and can spread like wildfire if left unattended. The height can be up to 5 meters. Foliage consists of two or three opposite leaflets, 4–8 cm across, pinnate leaves and a three-pronged tendril protruding from the end of the petiole. The orange flowers are 5–9 cm long and densely clustered and appear from winter through spring. Hummingbirds pollinate plants. The fruits are brown capsules that are smooth and 3 cm long. The plant is sensitive to cold winds and prefers sun and shelter. It tolerates the salinity of the soil. The plant's branching tentacles will cling to any hard surface, including brick walls. The family Bignoniaceae is a family of dicotyledons with 100–125 genera and 700–800 species. Chemical components identified in the genus include lapacol-type naphthoquinones, iridoid glycosides, flavones, triterpenes, alkaloids, polyphenols, tannins, and fixed oils from seeds. The isolation of oleanolic acid from both aerial parts and flowers of *Pyrostegia venusta* has been documented in the literature. Oleanolic acid has been shown to be biologically very important. It has anti-cancer, anti-tumour, antioxidant, anti-inflammatory, acetylcholinesterase, alpha-glucosidase, antimicrobial, hepatoprotective, anti-inflammatory, antipruritic, antispasmodic, anti-allergic, antiviral and immunomodulatory effects. The compounds acetin-7-O-β-glucopyranoside and β-sitosterol isolated from the flowers, roots and aerial parts of *Pyrostegia venusta* also showed anti-inflammatory activity.

**PLANT DESCRIPTION:**

**Biological Source:** *Pyrostegia venusta*, also known as flame vine or orange trumpet vine, is a plant species in the Bignoniaceae family Pyrostegia.

 “Fig. 1 – Whole Plant of *Pyrostegia venusta*”



 “Fig 2 – Flower of the plant”



“Fig 3 – Different seeding phases of *Pyrostegia venusta*”



**Taxonomy of *Pyrostegia venusta*:**

 Class: Equisetopsida

 Subclass: Magnoliidae

 Superorder: Asteranae

 Order: Lamiales

 Family: Bignoniaceae

 Genus: *Pyrostegia*

**Synonyms:**

Flame flower, flame vine, flaming trumpet vine, orange creeper, orange trumpet vine, Flaming trumpet, Golden shower trumpet, Orange Bignonia, flame creeper

**Distribution:**

Argentina Northeast, Bolivia, Brazil North, Brazil Northeast, Brazil South, Brazil Southeast,

Brazil West-Central, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Mexico Central, Mexico Gulf, Mexico Northwest, Mexico Southeast, Mexico Southwest, Panamá, Paraguay, Peru, Suriname, Venezuela

**Macroscopic Description:**

**Leaves**

Bipinnate, often with an apically trifid terminal tendril (the ends rarely branch again, bifid or trifid) or leaves trifoliate; Petioles densely hairy, tributary pilose or glabrous; Leaflets ovate (rarely lanceolate), slightly subinequilateral, chartaceous (rarely membranous), 3 to 5 pairs of lateral veins protruding below, densely pubescent to glabrous, transparent, abaxially often particularly conspicuous, with large axillary glands of the lower lateral veins, base rounded or obtuse (rarely cordate), tip shortly acuminate-slimy or acuminate -mucronulate (blunt-mucronulate or acuminate).

**Staminode**

Located 1.2-1.6 cm higher than the placement of the anthers.

**Fruit:**

Capsule glabrous; Drying with an olive sheen, central vein visible but not prominent; base acute; Apex Aristate.

**Inflorescence:**

A terminal or axillary panicle, generally dense or subcorymbous, with calyxes that often overlap in dried specimens; unbranched or 1- or 2-fold (rarely 3-fold) branched; Stem, leaf rachis and bracteoles almost glabrous to densely hairy or hairy; the trichomes are initially perpendicular to the surface; calyx without teeth at apex, with sparse scales of lepidoptera; glabrous to densely hairy to hairy, ciliated at tip; Crown narrowly tubular-infundibular, orange or reddish-orange (rarely yellow); tube serious inside at and below the base of stamens and staminodes, glabrous outside; lobes elongate, apical and hairy on the margin; Stamens 1.3–3.5 cm distant from the base of the corolla tube, stigma lobes broadly ovate, ovate, orbicular or broadly oblong.

**Flowers:**

The flowers of *Pyrostegia venusta* are typical of hummingbird pollinators: odorless and petals mostly bright red-orange, quite thick in structure, with narrow tube and wide opening and more or less naked inside.

 **Phytochemical and Pharmacological activities:**

Genus of Pyrostegia belonging to the family Bignoniaceae. This family includes four species native to South America. Plants of this family are used for traditional purposes in Brazil. According to a literature review, the Pyrostegia genus is traditionally used to treat diarrhea, cough, vitiligo, jaundice, and respiratory diseases such as colds, coughs, and bronchitis. Flavonoids, phenolic compounds, phenylpropanoids, phenylethanoid glycosides, triterpenes and sterols have been found in the phytochemical compounds of the genus Pyrostegia. Pyrostegia extract possesses a broad spectrum of pharmacological effects including antioxidant, antimicrobial, antifungal, anti-inflammatory, wound healing, antinociceptive, analgesic, vascular relaxant, antitumor, cytotoxic, hepatoprotective, antitussive, anthelmintic, hyperpigmentation, hypertensive and disease treatment. The Pyrostegia genus is widely used in traditional medicine and exhibits a wide range of pharmacological effects. However, most Pyrostegia species require further research on their chemical components and pharmacological effects. *Pyrostegia venusta* is a plant that contains phytochemicals such as terpenoids, alkaloids, tannins, steroids, and saponins found in flower and root extracts.

 According to the literature review, flowers of *Pyrostegia venusta*, from which the compounds β-sitosterol, n-hentriacontane, acacetin-7-O- β-glucopyranoside and mesoinositol have been isolated. Other studies have indicated the presence of carotenoids in the flowers and rutin in the leaves. Gas Chromatography Mass spectropscopy (Gc-MS) analysis of flower extract has showed the presence of Acetophenone; alpha.-l-Mannopyranoside, methyl 6-deoxy-2,3,4- tris-O-(trimethylsilyl)-;3H-3a,7-Methanoazulene, 2,4,5,6,7,8- hexahydro-1,4,9,9-tetramethyl-, (3aR (3a.alpha.,4.beta.,7.alpha.))- (Synonym Cyperene); trans-3-Hexenedioic acid, bis(trimethylsilyl) ester; beta.-DL-Arabino pyranose, 1,2,3,4-tetrakis- O- (trimethylsilyl)- (Synonym- B Arabipyranos); Ethyl malonate, ethyl trimethylsilyl ester; Propionic acid, pentamethyldidilanyl ester; Glycoside, .alpha.-methyl-trtrakis-O-(trimethylsilyl);Hexadecenoic acid, methyl ester (Synonym-Palmitic Acid; D-Xylose, tetrakis(trimethylsilyl)-;Glycoside,. Alpha.-methyl-trtrakis-O- (trimethylsilyl)-;Gluconic acid, 2-methoxime, tetra(trimethylsilyl)-, trimethylsilyl ester; 12-Octadecadienoic acid, methyl ester (Synonym Linoleic acid); 9-Octadecenoic acid (Z)-, methyl ester (Synonym Oleic Acid) ;Myo-Inositol, 1, 2, 3, 4, 5, 6-hexakis-O- (trimethylsilyl)-; Docosanoic acid, methyl ester; 1,2-Benzenedicarboxylic acid, mono(2-ethylhexyl) ester; Methyl 10-methyl-undecanoate; (1,2,4)Triazolo(1,5-a)pyrimidine-6carboxylic acid, 4, 7-dihydro-7- imino-, ethyl ester; Dotriacontane; Silicic acid, diethyl bis(trimethylsilyl) ester; Tetracosanoic acid, methyl ester; Di-ndecylsulfone; Dodecahydropyrido(1,2-b)isoquinolin-6-one; Heptacosane; Tetra siloxane, decamethyl-;

Tetra decanoic acid, 12- methyl-, methyl ester; Stigmasteryltosylate; 2-p-Nitrophenyloxadiazol-1, 3, 4-one-5; 2-Methyl-6-(5-methyl-2-thiazolin-2- ylamino)pyridine; Diazo progesterone; 1, 6-Dibromo-2- cyclohexyl pentane; Cyclotrisiloxane, hexamethyl-; cis2-Hexen-1- ol, trimethylsilyl ether.

 It has been demonstrated that the compounds acacetin-7-O-β glucopyranoside and βsitosterol showed anti-inflammatory activity. The Dr. Dukes phytochemical and ethnobotanical database has mentioned some of these compounds to be useful in various medicinal complications. Database has mentioned that Acetophenone are useful Antibacterial, fungicide, pesticide, hypnotic, perfumery, soporific; 3H-3a,7-Methanoazulene, 2, 4, 5, 6, 7, 8hexahydro-1, 4, 9, 9-tetramethyl-, (3aR-(3a.alpha.,4.beta., 7.alpha.))-(Cyperene) is an Antimalarial and Anti-plasmodial; Hexadecenoic acid, methyl ester (Synonym-Palmitic Acid) is an Antioxidant, hypo-cholesterolemic-nematicide, pesticide, antiandrogenic flavour, haemolytic, 5- Alpha reductase inhibitor; 9, 12- Octadecadienoic acid, methyl ester (Synonym - Linoleic acid) is an Anti-inflammatory, hypo-cholesterolemic cancer preventive, hepatoprotective, nematicide, insectifuge, anti-histaminic antieczemic, anti-acne, 5-Alpha reductase inhibitor, anti-androgenic, anti-arthritic, anti-coronary, insectifuge; 1,2-Benzenedicarboxylic acid, mono (2-ethylhexyl) ester (Phthalic acid) is useful in preparation of perfumes and cosmetics, and as plasticized vinyl seats on furniture and in cars, and clothing including jackets, raincoats and boots, as well as in textiles, as dye stuffs, cosmetics and glass making; Myo-Inositol, 1, 2, 3, 4, 5, 6-hexakis-O- (trimethylsilyl)- is useful in anti-depression, liver problems, panic disorders and diabetes; 9-Octadecenoic acid (Z)-, methyl ester is a 5-alpha-reductase-inhibitor, allergenic, alpha-reductase-inhibitor, anemiagenic, anti-alopecic, anti-androgenic, anti-inflammatory, anti-leukotriene-D4 (antiplatelet activating factor), dermatitigenic, insectifuge, perfumery, propecic cancer-preventive, choleretic, flavour, hypocholesterolaemia, irritant, percutaneostimulant; Stigmasteryltosylate is used as anti-hepatotoxic, anti-inflammatory, anti-ophidic, anti-oxidant, estrogenic, sedative.

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| Acetophenone; alpha.-Mannopyranoside |  |
| Diethyl malonate  |  |
| Docosanoic acid  |  |
| octadecadienoic acid  |   |
| Benzenedicarboxylic acid  |  |
| Tetracosanoic acid |  |
| Tetra decanoic acid |  |
| Stigmasteryl Tosylate  |  |
| Di-n decylsulfone  |  |
| *myo*-inositol  |  |
| Nitrophenyloxadiazol  |  |
| Cyclotrisiloxane  |  |
| Linoleic acid   |  |
| Ethyl malonate  |   |
| DL-Arabinose pyranose  |   |

**Table 1.1:** S**tructures of *Pyrostegia venusta* phytoconstituents**

**TRADITIONAL USE:**

The flowers, leaves and seeds of *Pyrostegia venusta* are used in traditional Brazilian medicine as an infusion or decoction as a tonic and also to treat diarrhea, leukoderma, cough and common respiratory infections such as inflammation of bronchi The aerial parts of *Pyrostegia venusta* are used in traditional Brazilian medicine as an infusion or decoction as a tonic and also to treat diarrhea, vitiligo, cough and common respiratory infections such as bronchitis, flu and colds. The isolation of oleanolic acid from the aerial parts and flowers of *Pyrostegia venusta* has been documented in the literature. Oleanolic acid has proven to be very important in biology. It has antimicrobial, hepatoprotective, anti-inflammatory, antipruritic, antispasmodic, antiangiogenic, antiallergic, antiviral and immunomodulatory effects. Acetin7-glucopyranoside and -sitosterol isolated from the flowers, roots and aerial parts of *Pyrostegia venusta* also showed anti-inflammatory activity. These findings highlight the potentially productive activity of *Pyrostegia***.**

**BIOLOGICAL STUDIES:**

**Antioxidant activity:**

The antioxidant capacity of *Pyrostegia venusta* flowers, seeds, leaves and roots was investigated by using 1,1-diphenyl-2-picrylhydrazyl (DPPH), 2,2'-azinobis-3-ethylbenzothiazoline-6-sulfonic acid (ABTS) and Ferric reducing antioxidant capacity (FRAP) assays.

**Treatment of unhealthy/ sickness behavior:**

The study investigated the effects of a hydroalcoholic extract of *Pyrostegia venusta* flowers on lipopolysaccharide-induced sick behavior in mice. *Pyrostegia venusta* extract reduced lipopolysaccharide-induced depression-like and exploratory behaviours. These findings support previous claims about the usefulness of these plants in traditional medicine and suggest that they may be useful in the treatment of sick behavior disorders such as the flu and the common cold.

**Estrogen activity:**

In recent years, a tea made from the *Pyrostegia venusta* plant has been used to relieve symptoms of menopause. However, the active ingredients of this extract are in relatively small concentrations. Plant tissue culture is an alternative for the production of plant extracts with higher concentrations of metabolites.

**Genotoxic activity:**

*Pyrostegia venusta* extracts were tested for genotoxicity in mice using the micronucleus assay and the chromosomal aberration assay. Different concentrations (50, 100 and 200 mg/kg body weight) were orally administered to the test groups. Compared to the negative control group that received water, the frequency of micronucleated polychromatic erythrocytes in the experimental controls was significantly lower and statistically lower than in the positive control group that received cyclophosphamide. *Pyrostegia venusta* showed no genotoxic activity.

**Antimicrobial activity:**

The methanolic extract of *Pyrostegia venusta* flowers exhibited moderate antimicrobial activity against the following organisms: Bacillus subtilis, Staphylococcus epidermidis,

Staphylococcus pyogenes, Staphylococcus aureus, Escherichia coli, Micrococcus luteus, Enterobacter aerogenes, Salmonella typhi, Pseudomonas aeruginosa, Candida albicans, Aspergillus niger, and Candida tropicana are among the bacteria that have been identified.

**Melanogenic activity:**

The melanogenic activity of hydroalcoholic extracts from leaves and flowers of *Pyrostegia venusta* on B16F10 murine melanoma cells was recently studied; Both extracts, leaves (0.1; 0.3; 1 and 3 g/ml) and flowers (0.03 and 0.1 g/ml) increased the melanin content in a concentration-dependent manner after 4-day incubation on melanoma cells. Cell viability was also tested in murine B16F10 cells using the MTT assay (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) which revealed that no cell death was detected at the same tested concentrations of both extracts. Both extracts were also tested for fungal tyrosinase activity in vitro. In fact, neither extract was able to alter tyrosinase activity.

**Antitumor activity**:

Hydroalcoholic extract of *Pyrostegia venusta* have moderate cytotoxicity and significant antitumor activity.

**Hyperpigmentant activity:**

Low concentration of hydroalcoholic extracts of leaves and flower of *Pyrostegia venusta* indicated anti vitiligo (hyperpigmentant) activity

**CONCLUSION:**

Plants have tremendous therapeutic and economic value throughout the world. *Pyrostegia venusta* has numerous pharmacological effects, which are discussed in this review. Studies on this plant have revealed that it has a wide range of pharmacological properties with high medicinal value. It has been observed that almost all parts of the plants have been widely used as traditional medicine for centuries. *Pyrostegia venusta* has significant pharmacological potential and a promising effect, especially in the field of tropical diseases, skin problems and respiratory diseases. Therefore, the *Pyrostegia venusta* described in this review can be an important source of natural bioactive medicines and arouses great interest for further research.

**REFERENCES:**

1. Montandon A, Zuza E, Toledo BE. Prevalence and reasons for tooth loss in a sample from a dental clinic in Brazil. *Int J Dent.* 2012;2012:719750.
2. Shivakumar KM, Vidya SK, Chandu GN. Dental caries vaccine. *Indian J Dent*

# *Res.* 2009;20:99–106.

1. Sasaki EY, Ito LA, Canteli VC, Ushirobira TM, Ueda-Nakamura T, Dias Filho BP, et al. Antioxidant capacity and *in vitro* prevention of dental plaque formation by extracts and condensed tannins of *Paullinia cupana*. *Molecules.* 2007;12:1950–63.
2. Argimón S, Alekseyenko AV, De Salle R, Caufield PW. Phylogenetic analysis of glucosyltransferases and implications for the coevolution of mutans streptococci with their mammalian hosts. *PLoS One.* 2013;8
3. Kolenbrander PE, London J. Adhere today, here tomorrow: Oral bacterial adherence. *J Bacteriol.* 1993;175:3247–52.
4. Palomer LR. Dental caries in children: a contagious disease. *Rev Chil Pediatr.* 2006;77:50– 6.
5. Coronado-Castellote L, Jiménez-Soriano Y. Clinical and microbiological diagnosis of oral candidiasis. *J Clin Exp Dent.* 2013;5:279–86.
6. Campisi G, Pizzo G, Milici ME, Mancuso S, Margiotta V. Candidal carriage in the oral cavity of human immunodeficiency virus-infected subjects. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2002;93:281–6.
7. Kumamoto CA. A contact-activated kinase signals *Candida albicans* invasive growth and biofilm development. *Proc Natl Acad Sci U S A.* 2005;102:5576–81.
8. Socransky SS, Haffajee AD. Dental biofilms: Difficult therapeutic targets. *Periodontology.* 2012;28:12–55.
9. Paquette DW, Williams RC. Modulation of host inflammatory mediators as a treatment strategy for periodontal diseases. *Periodontol.* 2000;2000(24):239–52. [[](https://pubmed.ncbi.nlm.nih.gov/11276870)
10. Shetty S, Bose A, Sridharan S, Satyanarayana A, Rahul A. A clinico-biochemical evaluation of the role of a herbal (Ayurvedic) immunomodulator in chronic periodontal disease: A pilot study. *Oral Health Dent Manag.* 2013;12:95–104.
11. Ferreira DT, Alvarez PS, Houghton PJ, Braz-Fillho R. Chemical isolated compounds from roots of *Pyrostegia venusta* and considerations about its medicinal importance. *Quim Nova.* 2000;23:42–6.
12. Scalon SP, Vieira MC, Lima AA, Souza CM, Mussury RM. Pregerminative treatments and incubation temperatures on the germination of “cipó-de-São-João” [*Pyrostegia venusta* (Ker Gawl.) Miers]-Bignoniaceae. *Rev Bras Plant Med.* 2008;10:37–42.
13. Veloso CC, Bitencourt AD, Cabral LD, Franqui LS, Dias DF, dos Santos MH, et al.

*Pyrostegia venusta* attenuate the sickness behavior induced by lipopolysaccharide in mice. *J Ethnopharmacol.* 2010;132:355–8.

1. Roy P, Amdekar S, Kumar A, Singh V. Preliminary study of the antioxidant properties of flowers and roots of *Pyrostegia venusta* (Ker Gawl) Miers. *BMC Complement Altern Med.* 2011;11:69.
2. Moreira CG, Horinouchi CD, Souza-Filho CS, Campos FR, Barison A, Cabrini DA, et al. Hyperpigmentant activity of leaves and flowers extracts of *Pyrostegia venusta* on murine B16F10 melanoma. *J Ethnopharmacol.* 2012;141:1005–11.
3. Silva RM, Rodrigues DT, Augustos FS, Valadares F, Neto PO, Santos L, et al. Antitumor and cytotoxic activity of *Kielmeyeracoriacea* mart. Zucc. And *Pyrostegia venusta* (Ker Gawl.) Miers extracts. *J Med Plants Res.* 2012;6:4142–8.
4. Nisha PV, Shruti N, Swamy KS, Kumari M, Vedamurthy AB, Krishna V, et al. Anthelmintic activity of *Pyrostegia venusta* using *Pheretimaposthuma*. *Int J Pharm Sci Drug*  *Res.* 2012;4:205–8.
5. Veloso CC, Bitencourt AD, Cabral LD, Franqui LS, Santa-Cecília FV, Dias DF, et al. Anti-inflammatory and antinociceptive effects of the hydroethanolic extract of the flowers of *Pyrostegia venusta* in mice. *Rev Bras Farmacognosia.* 2012;22:162–8.
6. Roy P, Amdekar S, Kumar A, Singh R, Sharma P, Singh V. *In vivo* antioxidative property, antimicrobial and wound healing activity of flower extracts of *Pyrostegia venusta* (Ker Gawl) Miers. *J Ethnopharmacol.* 2012;140:186–92.
7. CLSI. *Clinical and Laboratory Standards Institute, Reference Method for Broth Dilution Antifungal Susceptibility Testing of Yeasts: Approved Standard M27-A2. NCCLS.* Villanova, PA, USA: CLSI; 2002.
8. Bauer AW, Kirby WM, Sherris JC, Turck M. Antibiotic susceptibility testing by a standardized single disk method. *Am J Clin Pathol.* 1966;45:493–6.
9. Holetz FB, Pessini GL, Sanches NR, Cortez DA, Nakamura CV, Filho BP. Screening of some plants used in the Brazilian folk medicine for the treatment of infectious diseases. *Mem Inst Oswaldo Cruz.* 2002;97:1027–31.
10. Hamada S, Torii M, Kotani S, Tsuchitani Y. Adherence of *Streptococcus sanguis* clinical isolates to smooth surfaces and interaction of the isolates with *Streptococcus mutans* glucosyltransferase. *Infect Immun.* 1981;32:364–72.
11. Ooshima T, Osaka Y, Sasaki H, Osawa K, Yasuda H, Matsumura M, et al. Caries inhibitory activity of cacao bean husk extract in *in-vitro* and animal experiments. *Arch Oral Biol.* 2000;45:639–45.
12. Ishida K, de Mello JC, Cortez DA, Filho BP, Ueda-Nakamura T, Nakamura CV. Influence of tannins from *Stryphnodendron adstringens* on growth and virulence factors of *Candida albicans*. *J Antimicrob Chemother.* 2006;58:942–9.
13. Tada H, Shiho O, Kuroshima K, Koyama M, Tsukamoto K. An improved colorimetric assay for interleukin 2. *J Immunol Methods.* 1986;93:157–65.
14. Aligiannis N, Kalpoutzakis E, Mitaku S, Chinou IB. Composition and antimicrobial activity of the essential oils of two *Origanum* species. *J Agric Food Chem.* 2001;49:4168
15. Duarte MC, Figueira GM, Sartoratto A, Rehder VL, Delarmelina C. Anti-Candida activity of Brazilian medicinal plants. *J Ethnopharmacol.* 2005;97:305–11.
16. Ower PC, Ciantar M, Newman HN, Wilson M, Bulman JS. The effects on chronic periodontitis of a subgingivally-placed redox agent in a slow release device. *J Clin Periodontol.* 1995;22:494–500.
17. Marsh PD. Are dental diseases examples of ecological

catastrophes? *Microbiology.* 2003;149:279–94.

1. Calderone RA, Fonzi WA. Virulence factors of *Candida albicans*. *Trends*

# *Microbiol.* 2001;9:327–35.

# Lohinai Z, Benedek P, Fehér E, Györfi A, Rosivall L, Fazekas A, et al. Protective effects of mercaptoethylguanidine, a selective inhibitor of inducible nitric oxide synthase, in ligature-induced periodontitis in the rat. *Br J Pharmacol.* 1998;123:353–60.

1. Ugar-Cankal D, Ozmeric N. A multifaceted molecule, nitric oxide in oral and periodontal diseases. *Clin Chim Acta.* 2006;366:90–100.
2. de Almeida MV, Teixeira FM, de Souza MV, Amarante GW, Alves CC, Cardoso SH, et al. Thalidomide analogs from diamines: Synthesis and evaluation as inhibitors of TNF-alpha production. *Chem Pharm Bull (Tokyo)* 2007;55:223–6.
3. Ferreira DT, Alvares PS, Houghton PJ, Braz-Filho R.Chemical constituents from roots of *Pyrostegia venusta* and considerations about its medicinal importance. Quím Nova. 2000;23:42-46.
4. Scalon SP, Vieira MC, Lima AA, Souza CM, Mussury RM. Pregerminative treatments and incubation temperatures on the germination of „cipóde- São-João‰ (*Pyrostegia venusta* (Ker Gawl) Miers)-Bignoniaceae. Rev Bras Plantas Med. 2008;10:37-42.
5. Veloso CC, Bitencourta AD, Cabral LD, Franqui LS, Dias DF, dos Santos MH, Soncini R, Giusti-Paiva A. *Pyrostegia venusta* attenuate the sickness behavior induced by lipopolysaccharide in mice. J Ethnopharmacol. 2010;132:355-358.
6. Singh S, Rana A and Chauhan SVS. Impact of environmental changes on the reproductive biology in *Pyrostegia venusta* Presl. J Environ Biol. 2009;30(2): 271-273.
7. Ndayisenga I. *Pyrostegia venusta* ker Gwal Miers. In Thesis: Butare city ornamental plant taxonomy and phytogeography; Submitted for the award of BachelorÊs degree in Biology in University of Rwanda
8. [URL:http://www.biology.nur.ac.rw/IMG/pdf/Ndayisenga\_I\_2011.pdf](http://www.biology.nur.ac.rw/IMG/pdf/Ndayisenga_I_2011.pdf) Dubey R, Misra KJ. Chemical components of *Pyrostegia venusta* flowers. J Indn Chem Soc. 1976;53: 378381.
9. Harbone JB. Comparative biochemistry of the flavonoids VI Flavonoid patterns in the Bignoniaceae and Gesneriaceae. Phytochem. 1967;6: 1646-1651
10. Blatt CTT, Santos MD, Salatino A. Flavonoids of Bignoniaceae from "cerrado" and their possible taxonomic significance. Plant Syst Evol. 1998;210: 289-292.
11. Roy P, Amdekar S, Kumar A, and Singh V. Preliminary study of the antioxidant properties of flowers and roots of *Pyrostegia venusta* (Ker Gawl) Miers. BMC Complement Altern Med. 2011;11: article 69.
12. Gupta MB, Nath R, Srivastava N, Shanker K, Kishor K, Bhargava KP. Anti-inflammatory and antipyretic activities of beta-sitosterol. Planta Med. 1980;39: 157-163.
13. Shen KH, Hung SH, Yin LT, Huang CS, Chao CH, Liu CL, Shih YW. Acacetin, a flavonoid, inhibits the invasion and migration of human prostate cancer DU145 cells via inactivation of the p38 MAPK signaling pathway. Mol Cell Biol. 2010;333: 279-291
14. URL for Dukes phytochemical and ethnobotanical databases- [http://www.arsgrin.gov/cgi-bin/duke/listChemicals.pl](http://www.ars-grin.gov/cgi-bin/duke/listChemicals.pl%2049)
15. Pan MH, Lai CS, Wang YJ, Ho CT. Acacetin suppressed LPS-induced up expression of iNOS and COX-2 in murine macrophages and TPA-induced tumor promotion in mice. Biochem Pharmacol. 2006;72:1293-1303.
16. Pan MH, Hsieh MC, Hsu PC, Ho SY, Lai CS, Wu H, Sang S, Ho CT. 6-Shogaol suppressed lipopolysaccharide-induced up-expression of iNOS and COX-2 in murine macrophages. Mol Nutr Food Res. 2008;52(12):1467-77.