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

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**ABSTRACT:**

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

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

**INTRODUCTION:**

*Pyrostegia venusta*, also known as flame vine or orange trumpet vine, is a species of plant in the genus *Pyrostegia* of the Bignoniaceae family, native to southern Brazil, Bolivia, northeastern Argentina and Paraguay; it is a popular garden species today. John Miers first described this species in 1863. An evergreen vigorous climber, this vine grows quickly and can spread like wildfire if left unattended, height can reach 5 meters. The foliage consists of two or three 4-8 cm leaflets arranged oppositely, pinnate leaves and a three-branched tendrills emerging from the end of the leaf stalk. The orange flowers are 5-9 cm long and densely clustered and appear from winter to spring. Hummingbirds pollinate plants. The fruits are brown capsules that are smooth and 3 cm long. The plant is sensitive to cold wind and prefers sun and shelter. It tolerates soil salinity. The branchy tentacles of the plant cling to any hard surface, including brick walls. The family Bignoniaceae is a family of dicots with 100-125 genera and 700-800 species. Chemical constituents identified in the genus include lapacol-type naphthoquinones, iridoid glycosides, alkaloids, flavones, triterpenes, polyphenols, tannins and seed oils. The isolation of oleanolic acid from both aerial parts and flowers of *Pyrostegia venusta* has been recorded in the literature. Oleanolic acid has proven to be very important biologically. It has cytotoxic, antitumor, antioxidant, anti-inflammatory, anti-HIV, acetylcholinesterase, alpha-glucosidase, antimicrobial, hepatoprotective, anti-inflammatory, antipruritic, antispasmodic, anti-angiogenic, 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, flame flower vine, golden shower, golden shower vine, golden showers, orange creeper vine, orange trumpet creeper, Chinese cracker flower, belas, Flame vine and Orange trumpet,

**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**

Bpinnate, often with an apically trifid terminal tendril (the ends rarely branched again, bifid or trifid), or leaves 3-foliolate; petioles densely pubescent, pilose in the adaxial canal or glabrous; leaflets ovate (rarely lanceolate), slightly subinequilateral, chartaceous (rarely membranous), 3 to 5 pairs of lateral veins prominent below, densely short-pilose to glabrous, pellucidlepidote, often especially conspicuous abaxially, with large glands in the axils of lower lateral veins, base rounded or truncate (rarely cordate), apex briefly acuminate-mucronulate, or acuminate-mucronulate (obtuse-mucronulate or acuminate).

**Staminode**

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

**Fruit:**

Capsule glabrous; drying with [olive](https://www.longdom.org/peer-reviewed-journals/olive-21612.html) cast, midvein apparent, but not conspicuous; base acute; apex aristate.

**Inflorescence:**

A terminal or axillary panicle, generally dense or subcorymbose, with calyces often overlapping in dried specimens; unbranched or 1 or 2 (rarely 3) times branched; peduncle, rachis, and bracteoles nearly glabrous to densely puberulent or pilose; the trichomes initially perpendicular to the surface; calyx excluding denticules at apex, with sparse lepidote scales; glabrous to densely short-pilose to puberulent, apex ciliate; corolla narrow tubular-infundibular, orange or reddish orange (rarely yellow); tube internally sericeous at and below insertion of stamens and staminode, externally glabrous; lobes oblong, puberulent apically and marginally; stamens inserted 1.3-3.5 cm from base of corolla tube, stigma lobes broadly ovate, ovate, orbicular, or broadly oblong.

**Flowers:**

The flowers of *Pyrostegia venusta* are typical for hummingbird pollinators: odorless and petals usually bright red-orange, quite thick in structure, with a narrow tube and wide mouth, 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 review of the literature, the genus Pyrostegia has traditionally been 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 has a wide range of pharmacological activities, including antioxidant, antimicrobial, antifungal, anti-inflammatory, wound healing, antinociceptive, analgesic, vasorelaxant, antitumor, cytotoxic, hepatoprotective, antitussive, anthelmintic, hyperpigmentation, hypertension and disease treatment. The genus Pyrostegia is widely used in traditional medicine and has a wide range of pharmacological effects. However, most Pyrostegia species require further research on their chemical constituents and pharmacological effects. *Pyrostegia venusta* is a plant that contains phytochemicals such as terpenoids, alkaloids, tannins, steroids and saponins have been 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 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 (MN) and chromosome aberration (CA) tests. Different concentrations (50, 100, and 200 mg/kg body weight) were administered orally to the experimental groups. When compared to the negative control group receiving water, the frequency of micro nucleated polychromatic erythrocytes (MNPCE) in the experimental controls was significantly lower, and it was statistically lower than that of the positive control group receiving Cyclophosphamide. *Pyrostegia venusta* exhibited no genotoxicity 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 of *Pyrostegia venusta* leaves and flowers on murine B16F10 melanoma cells was recently investigated; both extracts, leaves (0.1; 0.3; 1 and 3 g/mL) and flowers (0.03 and 0.1 g/mL), increased melanin content in a concentration dependent manner after 4 days incubation on melanoma cells. Cell viability was also tested in murine B16F10 cells using the MTT (3-(4,5-dimethythiazol-2-yl)-2,5-diphenyl tetrazolium bromide) assay, which revealed that no cell death was detected at the same tested concentrations of both extracts. Both extracts were also tested in vitro for mushroom tyrosinase activity. Actually, neither extract was able to change the 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 promising activity, especially in the field of tropical diseases, skin problems and respiratory diseases. Therefore, *Pyrostegia Venusta* described in this review can be an important source of natural bioactive drugs and encourages 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.