Available online www.jocpr.com

Journal of Chemical and Pharmaceutical Research, 2013, 5(4):106-111

Research Article

ISSN : 0975-7384
CODEN(USA) : JCPRC5

Phytochemical evaluation of Bignoniaceae flowers

Joseph Joselin, Thankappan Sarasabai Shynin Brintha, Augustian Rajam Florence and Solomon Jeeva*

Department of Botany, Scott Christian College (Autonomous), Nagercoil, Tamilnadu, India

---

ABSTRACT

Aqueous, petroleum ether, chloroform, ethanol and acetone extracts of the flowers were prepared by adding 50 g of fresh fallen flowers of the family Bignoniaceae (Jacaranda mimosifolia D. Don, Markhamia lutea (Benth.) K. Schum., Millingtonia hortensis Linn., Spathodea campanulata Beauv., Tabebuia rosea (Bertol.) DC. and Tecomaria capensis(Thunb.), Tecoma stans (L.) Kunth) *to 200 ml of these solvents; the constituents were shaken at room temperature for 24 h. After incubation, the extracts were filtered using Whatman No. 1 filter paper, collected and stored at 4°C. The extracts were concentrated using vacuum evaporator and dried at 60°C. Preliminary phytochemical screening was carried out according to the standard methods. The present study screened the phytochemical properties of seven ornamental flowers with thirty five extracts and showed varied degree of phyto-constituents present. The presence or absence of the phyto-constituents depended upon the solvent used and physiological property of the flowers. From these results, it can be concluded that the seven ornamental flower extracts may be used as broad-spectrum bioactive agents after extensive investigation.*

Key words: *Jacaranda mimosifolia* D. Don, *Markhamia lutea* (Benth.) K. Schum., *Millingtonia hortensis* Linn., *Spathodea campanulata* Beauv., *Tabebuia rosea* (Bertol.) DC. and *Tecomaria capensis* (Thunb.), *Tecoma stans* (L.) Kunth, Phytochemistry, Bignoniaceae, Secondary metaabolites

---

INTRODUCTION

Ornamental flowers offer aesthetic value and ecological balance to the environment. Most flowering ornamental plants are utilized more for their beauty as they radiate different colors to the surroundings. When the flowers bloom, they serve their purpose; however, when they wilt, they just fall off as trash. Before this happens, these flowers could still be of use as pharmaceuticals or nutraceuticals. Several studies show that flowers have a wide array of secondary metabolites of medicinal value offering antioxidant, antifungal and antibacterial activities [1-5].
Petals form the most eye-catching part of the flower, and serve to attract pollinators with inviting colors and appealing scent. Anthocyanins are a major class of compounds forming floral pigmentation. The accumulation of anthocyanins is well characterized both at the gene expression and biochemical levels and comprehensive analysis as well as metabolic engineering of the anthocyanin composition of flowers has been reported several times [6,7]. Along with anthocyanins, flavanones and flavonols are present in petals as anthocyanin co-pigments and contribute to the different shades of flowers [7,8]. The biosynthesis of fragrant volatiles, including terpenoid and phenylpropanoid/benzenoid compounds as well as aliphatic esters, amines (indols) and thiols, occurs predominantly in the petal tissues; their emission is under temporal regulation and occurs when pollinators are active [9,10]. The color and fragrance provide the aesthetic properties to ornamentals and cut flowers, and bioengineering approaches are on-going for commercial purposes [11].

Bignoniaceae commonly called the ‘trumpet vine’ or ‘trumpet creeper family’ is a widespread family named after the genus Bignonia. The well known medicinally important members of this family are *Tecoma*, *Catalpa*, *Tabebuia* and *Jacaranda*, while other ornamental species have large spectacular flowers [12]. A striking feature of

Bignoniaceae is the assortment of colourful showy flowers. The most conspicuous part of the plant is the flower and their beauty has encouraged man to know more about them and to grow them in gardens. Many uses have been found for the flowers, plants and trees in this family. Some are featured in ornamental landscaping or in decorative gardens, while others serve as natural remedies for specific health issues.

Jacaranda mimosifolia D. Don covers is a tree with intense blue/violet clusters of flowers and when they fall, they create beautiful carpets of vibrant colour. Having antiseptic and antibiotic qualities, *Jacaranda* gives out some secret natural medical gifts, too. The tree is used to treat hepatitis and in folk tradition the flowers, leaves and bark are used to ease neuralgia and varicose veins. It is scientifically proven that *Jacaranda* has qualities that treat leukemia. Hot Jacaranda leaf baths treat wounds and skin infections and the tree also helps in the treatment of acne [13-16].

Markhamia lutea (Benth.) K.Schum. is an upright evergreen tree with bright yellow showy flowers. The trees flower for much of the year. The compounds Verbacoside and iso Verbacoside were obtained from *M. lutea* (Bignoniaceae) were reported to have anti viral properties [17].

Millingtonia hortensis Linn. commonly called as 'Tree Jasmine' , 'Indian Cork Tree' or 'Panneer poo' in Tamil is the sole species in the genus *Millingtonia*. Smoke of dried flower is used for treatment of asthma. Root is used as lung tonic, antiasthmatic; volatile active constituent hispidulin exhibits better bronchodilatic effect. The tree is considered ornamental and the pleasant fragrance of the flowers renders it ideal as a garden tree. The wood is also used as timber and the bark is used as an inferior substitute for cork [18].

Spathodea campanulata Beauv. (African Tulip Tree), also known as 'Fountain Tree' is a magnificent flowering tree that grows very wide, creating a large canopy covered with upward facing red/orange tulip like blooms with crimped edges. The flowers are filled with water before they open. Wild canaries pierce the buds of the trees and drink the water. After the blooms, seed pods split, allowing the wind to carry the seeds away, making this a potentially weedy tree. *Spathodea* is a monotypic genus in the flowering plant family Bignoniaceae [19].

Tabebuia rosea (Bertol.) DC. is commonly called as 'Pink Trumpet Tree' is grown as an ornamental tree for its grand and majestic pink or purple flowers. The wood is valuable and used in the manufacture of furniture. The timber is widely used for general construction and carpentry in many European countries. The graceful beauty is a treat for the eyes, but the tree has medical uses as well. Tea made from the leaves and bark is known to have a fever-reducing effect [20,21].

Tecomaria capensis (Thunb.) Spach also known as 'Cape-honey suckle' is a climbing shrub grown as an ornamental plant in gardens. The corolla or petals are often brightly coloured with markings attractive to insects. The flowers may also be scented. For instance, Honeysuckle has showy, attractive flowers which attract insects by day. Traditionally the leaves were used to treat pneumonia, enteritis, diarrhoea, tonic and analgesic [22,23], antimicrobial, anti fungal, antipyretic [24], and antioxidant activity[25].

Tecoma stans (L.) Kunth also known as 'Yellow Trumpet bush' or 'Yellow bell' is an erect ornamental plant with trumpet-shaped yellow flowers. The leaves of *T. stans* contain the alkaloids tecomine and tecostamine, potent hypoglycaemic agents when given intravenously. Anthranilic acid is responsible for its antidiabetic activity and the roots exhibit a powerful diuretic and vermifuge activity[26].

Phytochemicals with biological activity have had great utility as pharmaceuticals and pharmacological actions. These type of activities of herbal drugs are due to the presence of various active principles or phytoconstituents like alkaloids, glycosides, reducing sugar, tannins, saponins, resins, phytosterols, flavonoids, organic acids, essential oils, fixed oils etc. These phytochemicals are of immense importance to mankind. Phytochemical investigation of plants is an interesting area of research, leading to the isolation of several new compounds. Though voluminous literature has accumulated on secondary products of plant, very little information is available on flowers. It is therefore worthwhile to set a preliminary screening of the presence of secondary metabolites of ornamental plant flowers and establish their possible use as nutraceuticals or pharmaceuticals. This study was a preliminary screening of the secondary metabolites present in seven selected ornamental flowers from Scott Christian College campus.

EXPERIMENTAL SECTION

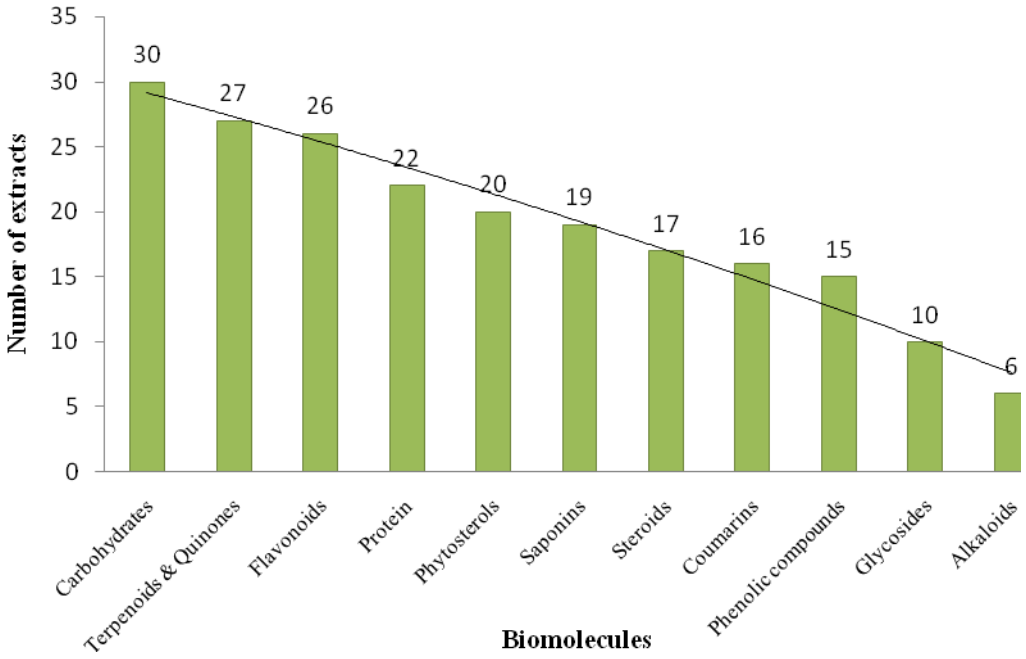
The flowers of *J. mimosifolia* D. Don., *M. leutea* (Benth.) K. Schum., *M. hortensis* Linn., *S. campanulata* Beauv., *T. Rosea* (Bertol.) DC., *T. capensis* (Thunb.) Spach and *T. stans* (L.) Kunth of the family Bignoniaceae were collected from Scott Christian College, Tamilnadu, India and identified by using the Flora of Scott Christian College Campus [27]. The flowers were examined carefully and old, infected and fungus damaged flowers were removed. Extracts

were prepared from fresh flowers. 50 grams of flowers was collected and kept in conical flask with 200 ml of aqueous, petroleum ether, chloroform, ethanol and acetone in a shaker at room temperature for 24 h. After incubation, the extracts were filtered through Whatman No.1 filter paper and the extracts were collected and stored in the refrigerator at 4°C. The extracts were concentrated using vacuum evaporator and dried at 60° C. The preliminary phytochemical screening was performed using standard procedures [28].

RESULTS

In the present study the phytochemical screening was performed on some spectacular flowers of Bignoniaceae using aqueous, petroleum ether, chloroform, ethanol and acetone extracts. The results were presented in Table. 1. Out of the thirty five tested extracts, thirty extracts showed the presence of carbohydrates, twenty seven extracts showed the presence of terpenoids and quinones, twenty six extracts showed the presence of flavonoids, followed by protein in twenty two extracts. Phytosterols were noticed in twenty extracts and saponins showed its presence only in nineteen extracts. Steroids showed its presence in seventeen extracts, followed by coumarins in sixteen extracts, phenolic compounds in fifteen extracts, glycosides in ten extracts and alkaloids were noticed only in six extracts (Figure 1).

Figure 1. Occurrence of phytochemicals in Bignoniaceae flower extracts



DISCUSSION

All the plants exhibited different kinds of secondary metabolites. The ornamental flowers tested showed a varied degree of phytoconstituents in all the extracts. Phytoconstituents are believed to be responsible for therapeutic properties [29-34]. Floral extracts of *Tecoma stans* showed the availability of maximum number of phytoconstituents in aqueous and ethanolic extracts. *Millingtonia hortensis* and *T. capensis* showed maximum phytoconstituents in ethanolic extracts. Aqueous extracts of *J. mimosifolia* and *S. campanulata* showed the availability of more number of bioactive components. Similar results were noticed in the previous studies done by Gambaro *et al*. [14] in *J. mimosifolia* indicates that water is a good sovent to extract anthocyanins, phenolic compounds and alkaloids found in this species. Former studies of the water extract of this species revealed that these compounds could be responsible for its antimicrobial activity against *B.cereus*, *E. coli* [16] and *P. aeruginosa* [13]. *Markhamia leutea* and *T. rosea* showed best results in chloroform extracts.

Table 1. Preliminary phytochemical studies of Bignoniaceae flower extracts

Phyto-constituents	Solvents																																			
	Aqueous							Petroleum ether							Chloroform							Ethanol							Acetone						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Alkaloid	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-
Phenolic compounds	+	-	-	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-	-	+	+	+	-	+	-	-	+	+	+	-
Flavonoids	+	+	+	+	+	-	+	+	-	+	-	-	+	-	-	-	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Saponins	-	+	+	+	+	+	-	-	+	-	+	+	+	+	-	+	-	+	-	-	-	-	-	+	+	-	+	+	-	+	-	+	-	-	+
Glycosides	-	-	+	-	+	-	-	-	-	+	-	+	+	-	-	-	+	-	+	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-
Terpenoids	+	-	+	+	+	+	+	-	-	+	+	+	-	-	-	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+
Steroids	-	-	+	-	-	-	+	-	+	+	+	-	-	-	-	+	+	+	+	-	+	-	+	+	-	-	+	+	-	-	+	-	+	+	-
Coumarins	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	+	-	+	-	-	+	-	-	+	+	-	-	+	+	-	-	+	+	+	+	+
Quinones	+	-	+	+	+	+	+	-	+	+	+	+	+	-	+	-	+	-	+	+	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-
Phytosterols	+	+	+	+	-	+	+	-	+	+	-	-	+	-	+	+	+	+	+	-	-	-	+	+	-	-	+	-	+	-	+	+	-	-	-
Proteins	+	-	-	+	+	+	+	-	-	-	+	+	+	-	+	+	+	+	-	+	-	-	-	+	+	+	+	-	-	+	+	-	+	+	+
Carbohydrates	+	+	+	+	+	+	+	+	-	+	-	+	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

(1) *Jacaranda mimosifolia*; (2) *Markhamia lutea*; (3) *Millingtonia hortensis*; (4) *Spathodea campanulata*; (5) *Tabebuia rosea*; (6) *Tecomaria capensis*; (7) *Tecoma stans* (-) absent; (+) present.

Active compounds found in plants have been shown to possess antimicrobial activity against various pathogenic organisms. Out of seven flower extracts studied, alkaloid was found in aqueous, chloroform, ethanol and acetone extract of *T. capensis* and chloroform extract of *T. rosea*. Past studies proved that anti-dysenteric and anti-diarrhoeal properties of medicinal plants have been due to the presence of alkaloids, flavonoids and saponins [35]. Saponins were present in at least one extract of all tested flowers. Saponins have been responsible for the antioxidant activities [36]. Phenolic compounds, steroids and glycosides were noticed in the tested flowers of Bignoniaceae. Tannins have been widely used in the treatment of sprains, bruises and superficial wounds [31]. Phytocompounds like flavonoids and phenolic compounds commonly found in plants have been reported to have multiple biological effects, including antioxidant activities [36,37]. Flavonoids were noticed in twenty six extracts. Flavonoids of Bignoniaceae are responsible for the anti-inflammatory, diuretic, anti-arthritic, anti-fungal and anti-bacterial activities [33].

Terpenoids and quinones were noticed in 27 extracts. Quinones like Lapachol of Bignoniaceae are reported to have antitumor activities. Two quinones sterochenols A and B, were isolated from methanolic extract of the stem bark of *Sterospermum chelonoides* (Bignoniaceae) in addition to the known naphthoquinones sterequinone and sterekunthals B [39].

Plant steroids are known to be important for their cardiotonic activities and also possess insecticidal and antimicrobial properties. They are also used in nutrition, herbal medicine and cosmetics. Steroids are partly responsible for the anti-diarrhoeal activity [40]. In a related species of the family bignoniaceae *Oroxylum indicum* the methanolic leaf extracts revealed the presence of flavonoids, tannins, terpenes, steroidal and cardiac glycosides [37]. Phenolic compounds have been reported to possess antioxidant activities by different mechanism [41]. Two aglycone moieties of the isocoumarin glycosides, four iridoid glycoside, two lignin glycoside, three phenyl ethanoid glycosides and eight phenolic glycosides have been isolated from the bark of *Tabebuia impetiginona* [42]. Similar to the results of the present study phytochemical analysis of the leaves of ten species of the Nigerian Bignoniaceae showed the presence of sterols, flavonoids, terpenes, tannins, resins, carbohydrates and phenolic nucleus in all the species whereas, Phlobatanins and alkaloids remained absent in all the species [16].

CONCLUSION

The spectacular ornamental flowers with colourful blooms are left unutilized after pollination. These flowers not only gives tender treatment with cleansing, calming and beautifying effects to mankind but also act as repositories of wide range of phytochemicals like alkaloids, flavonoids, phenolic compounds, quinones, glycosides, carbohydrate, protein, steroids and coumarins. Knowledge of chemical constituents of plants is desirable, not only for the discovery of therapeutic agents, but also because such information may be of value in discovering new sources such as tannins, oils, gums, precursors for the synthesis of complex chemical substances etc. In addition, knowledge of the chemical constituents of plants would be valuable in discovering the actual value of folkloric remedies. However, there is a need to assess their toxicological and pharmacological effects and establish their safety. Results of this study are important as preliminary for future studies. Furthermore, there are still a lot of flowers which could be given consideration and this in turn may open a new dimension in the field of discovery of new drugs.

Acknowledgements
The authors are sincerely acknowledging the financial assistance provided by the Department of Science and Technology through Scott Christian College with FIST program (www.fist-dst.org/html-flies/Colleges-List-recommended.pdf).

REFERENCES

[1] S Sukumaran; S Kiruba; M Mahesh; SR Nisha; Z Miller Paul; CP Ben; S Jeeva. *Asian Pac J Trop Med*., **2011**, 4(9), 735-738.
[2] S Jeeva; M Johnson; JS Aparna; V Irudayaraj. *Int J Med Aromatic Plants*, **2011**, 1(2), 107-114.
[3] S Jeeva; M Johnson. *Asian Pac J Trop Biomed*., **2012**, 1(S1), S151-S154.
[4] J Joselin; TSS Brintha; AR Florence; S Jeeva. *Asian Pacific Journal of Tropical Disease*, **2012**, 2(S1), S260-S264.
[5] M Johnson; JS Aparna; S Jeeva; S Sukumaran; A Babu. *Asian Pacific Journal of Tropical Biomedicine*, **2012**, 2(S1), S79-S82.
[6] B Winkel-Shirley. *Plant Physiol*., **2001**, 126, 485–493.
[7] AH Nielsen; CE Olsen; BL Møller. *Phytochemistry*, **2005**, 66, 2829–2835.
[8] Y Fukui; Y Tanaka; T Kusumi; T Iwashita; K Nomoto. *Phytochemistry*, **2003**, 63, 15–23.
[9] RC Schuurink; MA Haring; DG Clark. *Trends Plant Sci*., **2006**, 11, 20–25.
[10] CCN Van Schie; MA Haring; RC Schuurink. *Curr Opin Plant Biol*., **2006**, 9, 203–208.
[11] E Pichersky; N Dudareva. *Trends Biotechnol*., **2007**, 25,105–110.
[12] S Choudhury; S Datta; AD Talukdar; M Dutta Choudhury. *Assam University Journal of Science and Technology: Biological and Environmental Sciences*, **2011**, 1, 145-150.
[13] OA Binutu; B Lajubutu. *Afr J Med Sci*., **1994**; 23: 269.
[14] V Gambaro; JA Garbarino; C Galeffi; M Nicoletti; I Messana; GB Marini-Bettolo. *Rev Lat Quim* **1988**, 19,17-19.
[15] C Lans; T Harper; K Georges; E Bridgewater. *BMC complementary and alternative medicine*, **2001**, 1, 1-10.
[16] GE Ugbabe; AE Ayodele; GA Ajoku; OF Kunle; I Kolo; JI Okogun. *Global Research Journals*, **2010**,1(1), 1–5.
[17] MR Kernan; A Amarquaye; JChen; LDFJ Chan; N Sesin; ZJ Parkinson; C Barrett; M Ye; CA Stoddart; B Sloan; P Blanc; C Limbach; S Mrisho; EJ Rozhon. *Journal of Natural Products* **1998**, 61, 564-570.
[18] OP Sharma. *Plant Taxonomy*. Tata Mcgraw-Hill; 1993.
[19] D Gledhill. The Names of Plants (4th ed.). Cambridge University Press; 2008.
[20] AH Gentry. *Annuals of the Missouri Botanical Garden*, **1992**, 79(1), 53-64.
[21] M Sathiya; K Muthuchelian. *Ethnobotanical Leaflets*, **2008**, 12, 1153-57.
[22] E Tamiljothi; V Ravichandiran; N Chandrasekhar; V Suba. *Asian Journal of Plant Science and Research*, **2011**, 1 (3), 34-40.
[23] T Panduraju, PRS Rao, VS Kumar. *Asian Journal of Plant Science and Research*, **2011**, 1, 102-115.
[24] KM Nardkarnis. *Indian materia medica*, Popular Prakashan Pvt. Ltd. **2002**; 1080- 1081.
[25] K Prabhu; P Kumar Karar; S Hemalatha; K Ponnudurai; P Mankar. *Der Pharmacia Sinica*, **2011**, 2 (2), 131-141.
[26] C Khare. Indian medicinal plants and illustrated Dictionary. Springer Science Publishers, New Delhi; 2007.
[27] TS Shynin Brintha. *Flora of Scott Christian College Campus*, M.Phil., Thesis, Department of Botany, Scott Christtian College (Autonomous), Nagercoil, Tamilnadu, India; 2012.
[28] JB Harborne. *Phytochemical methods-A guide to modern techniques of plant analysis.* Chapman and Hall, London; 1998.

[29] RG de Oliveira Júnior; C de Souza Araújo; CR Ribeiro; M Pacheco; JRG da Silva Almeida. *Journal of Chemical and Pharmaceutical Research*, **2012**, 4 (10), 4489-4494.
[30] R Prabakaran; S Arivoli; A Hema; C Kamatchi. *Journal of Chemical and Pharmaceutical Research*, **2011**, 3(3), 805-813.
[31] M Jayabharathi; M Chitra. *Journal of Chemical and Pharmaceutical Research*, **2011**, 3(2), 802-806.
[32] V Ramya; VD Dhayalan; S Umamaheswari, *Journal of Chemical and Pharmaceutical Research*, **2010**, 2(6), 86-91.
[33] M Balasubramanian. *Journal of Chemical and Pharmaceutical Research*, **2012**, 4 (3), 1686-1695.
[34] AR Florence; J Joselin; S. Jeeva. *Journal of Chemical and Pharmaceutical Research*, **2012**, 4 (11), 4908-4914.
[35] N Verma; AP Singh; A Gupta; PK Sahu; Ch V Rao. *Indian Journal of Pharmacology*, **2011**, 43(6), 689-693.
[36] T Kalaivani; L Mathew. *Food and Chemical Toxicology*, **2010**, 48(1), 298-305.
[37] H Usman, JC Osuji. *Afri J Trad CAM*., **2007**, 4(4), 476-480.
[38] F Conforti; G Ioele; G Statti; M Marrelli; G Rango; F Menichini. *Food and Chemical Toxicology*, **2008**, 46, 3325-3332.
[39] Z Maitreyi; A Khandhar; S Jain. *Eurasian Journal of Analytical Chemistry*, **2008**, 3(2), 245-257 .
[40] AH Mahmoud; HM Motawa; HE Wahba; Ebrahim. *Asian J Biochem*., **2006**, 1(1), 67-74.
[41] UA Hanwa; AM Musa; MI Sule; A Ejila; A Babale. *Nig Journ Pharm Sci*., **2009**, 8(2),13-17.
[42] T Warashine; Y Nagatani; T Noro. *Phytochemistry*, **2004**, 65, 3-11.