



Hibiscus rosa sinensis Linn – “Rudrapuspa” : A Review

V. M. Jadhav*, R. M. Thorat¹, V.J. Kadam¹ & N. S. Sathe²

¹Department of Quality Assurance, Bharati Vidyapeeth's College of Pharmacy, Sector 08, CBD Belapur, Navi-Mumbai – 400614, India,

²Y. M. T. Ayurvedic Medical College, Kharghar, Navi-Mumbai

Received on:07-02-2009; Accepted on: 03-04-2009

ABSTRACT

“World Health Organization” has recommended that traditional health and folk medicine systems are has proved to be more effective in health problems worldwide. *Hibiscus rosa sinensis* Linn. is certain to emerge in the near future as a major player in the growing field of herbal health supplements and medicines both in daily self-care and in professionally managed health care system. The principal constituents of *Hibiscus rosa sinensis* Linn. are flavones. Flavones contain quercetin-3-diglucoside, quercetin-3,7-diglucoside, cyaniding-3,5-diglucoside, quercetin-3-sophorotrioside, kaempferol-3xylosylglucoside, cyaniding-3-sophoroside-5-glucoside and other constituent are cyclopeptide alkaloid, cyanidin chloride, hentriacontane, riboflavin, ascorbic acid, thiamine, taraxeryl acetate, β -sitosterol, cyclicacids sterculic and malvalic acids. All the parts of *Hibiscus rosa sinensis* Linn and chemical constituents are used as anti-tumor, antifertility, antiovolutory, antiimplantation, anti-inflammatory, analgesic, antiestrogenic, antipyretic, antispasmodic, antiviral, antifungal, antibacterial, hypoglycaemic, spasmolytic, CNS depressant, hypotensive and juvenoid activity. This article compile all the information related to *Hibiscus rosa sinensis* Linn.

Keywords: *Hibiscus rosa sinensis* Linn, Malvaceae, Traditional medicine, Antifertility.

INTRODUCTION

India is one of the nations blessed with a rich heritage of traditional medical systems and rich biodiversity to complement the herbal needs of the treatment administered by these traditional medical systems. The recognized Indian systems of Medicine are Ayurveda, Siddha and Unani, which use herbs and minerals in the formulations. India which use 15 agro-climatic zones, 4700 plant species of which 15000 are reported to have medicinal properties varying degrees¹.

The herb *Hibiscus rosa-sinensis* Linn [Malvaceae] is a glabrous shrub widely cultivated in the tropics as an ornamental plant and has several forms with varying colours of flowers. In medicine, however, the red flowered variety is preferred².

Vernacular Names

Eng. - Shoe-flower plant, Chinese Hibiscus.
Hindi - Jasut, Jasum, Java, Odhul, Gurhal, Arahul.
Mar. - Jasavanda, Jassvandi.
Sanskrt - Japa, Java, Rudrapuspa, Aundrapuspa, Trisandhya.
Beng. - Joba, Jiwa, Oru.
Guj. - Jasvua, Jasunt.
Kan. - Dasavala.
Mal. - Himbarathi, Ayamparatti, Chebarathi.
Ori. - Mondaro.
Punj. - Jasum, Jaipushpa, Gurhal.
Tam. - Sapattuu, Semparutti.

Tel. - Dasanam, Dasana, Mandarapuvvu.

Arab. - Anghara-hindi.

Assam - Joba.

Oriya - Mondaro.

Pers. - Angara-hind³⁻⁵.

Distribution

It is a native of China. It is grown as an ornamental plant in gardens throughout India and often planted as a hedge or fence plant⁵.

Propagation and Cultivation

Hibiscus rosa sinensis grows best under moderate temperature and relatively high humid conditions. It thrives best on well drained porous loamy soil. The Plant is usually propagated by cuttings, preferably from mature wood of current year growth. Layering, budding, grafting and air layering can also be successfully applied. Plants propagated by air or ground layering show better growth and flowering. Shoe flower is seriously infected by insects like mites and red spider causing curling of leaves, which stops further growth and flowering⁵.

Parts Used

Flowers, Roots, Leaves⁵.

Description of plant parts



Fig 1 : Photograph of *Hibiscus rosa sinensis* Linn

*Corresponding author.

Dr. (Mrs.) Varsha M. Jadhav

HOD and Professor

Bharati Vidyapeeth's College of Pharmacy, Sector 8, CBD Belapur, Navi Mumbai.

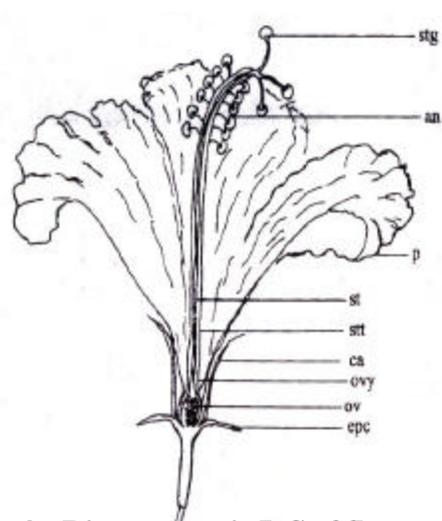
Tel.: + 91-22-27722919,9869046618

Telefax: +91-

E-mail: drvmjadhav_bvcop@rediffmail.com

A. Macroscopic

Flower ebracteate, pedicellate, complete, regular, actinomorphic, bisexual, protandrous hypogynous, cyclic. Epicalyx 5, free, green, linear. Calyx 5, gamosepalous, campanulate, inferior, green. Corolla 5, polypetalous, obovate, sinous upper margin, mucilaginous, twisted, inferior, red. Androecium many, monoadelphous, epipetalous, antisepalous. Gynoecium pentacarpellary, syncarpous, superior, style united below and free at its tips, stigma 5, capitate, velvety red. Odour fragrant ; taste mucilaginous. Diagrammatic L. S. of flower (Fig. 2) shows hypogynous ovary, monadelphous stamen in a staminal tube and style with trifid stigma passing through the staminal tube⁴ .



1. an - anther
2. ca - calyx
3. epc - epicalyx
4. ov - ovules
5. ovy- ovary
6. p - petal
7. stg - stigma
8. st - style
9. stt - staminal tube.

Fig 2 : Diagrammatic L S of flower

B. Microscopic

1. Root – The roots show cork, phelloderm and the secondary phloem which is stratified due to 8-10 tangential bands of phloem fibres alternating with parenchyma. The xylem is a broad zone and some of the vessels show tyloses. Clusters of calcium oxalate are present in the phelloderm.

2. Stem – Microscopically it shows outermost thin cork, the middle region of which is strongly thickened due to the heavy deposition of lignin. Phelloderm is narrow zone followed by a wide zone of secondary phloem. Mucilage cells are present in the pith. Powder mounted in nitrocellulose give green fluorescence under UV light.

3. Leaf – Leaf present a dorsiventral structure. Both the glandular and stellate types of trichomes are present. Stomata are of ranunculaceous or rubiaceous type, present on the lower surface. A few mucilage cells are present in the midrib zone. Starch grains and clusters of calcium oxalate crystals are present. Powdered leaf when treated with 1 N NaoH in methanol emits dark green fluorescence under UV light. Palisade ratio is 4.44 : Stomatal index 20.38; Vein islet number 23-97 per sq. mm.

4. Flower – Flower powder shows spheroidal, pantoporate, pore-circular pollen grains ; stellate trichomes single, elongated, conical or twisted and convoluted; glandular trichomes uni or bi- seriate, multicellular- cylindrical and bi- or multiseriata, multicellular-globose or club-shaped; ranunculaceous type of stomata; sphaeraphide calcium oxalate crystals^{6,7}.

5. Powder – Purplish red . Shows cluster crystals of calcium oxalate ; large, spinuous and yellow pollen grains; glandular, multicellular trichomes, as well as covering stellate type trichomes; fragments of calyx tissue bearing anomocytic stomata and stellate and glandular trichomes; spiral vessel and cluster crystals and fragments of ovary with stellate trichomes, fragments of style with stomata, trichomes and cells with red contents, fragment of another with pollen grains, fragments of hairy stigma with reddish pigments, spinuous walls and trichomes; fragments of corolla tissues⁴.

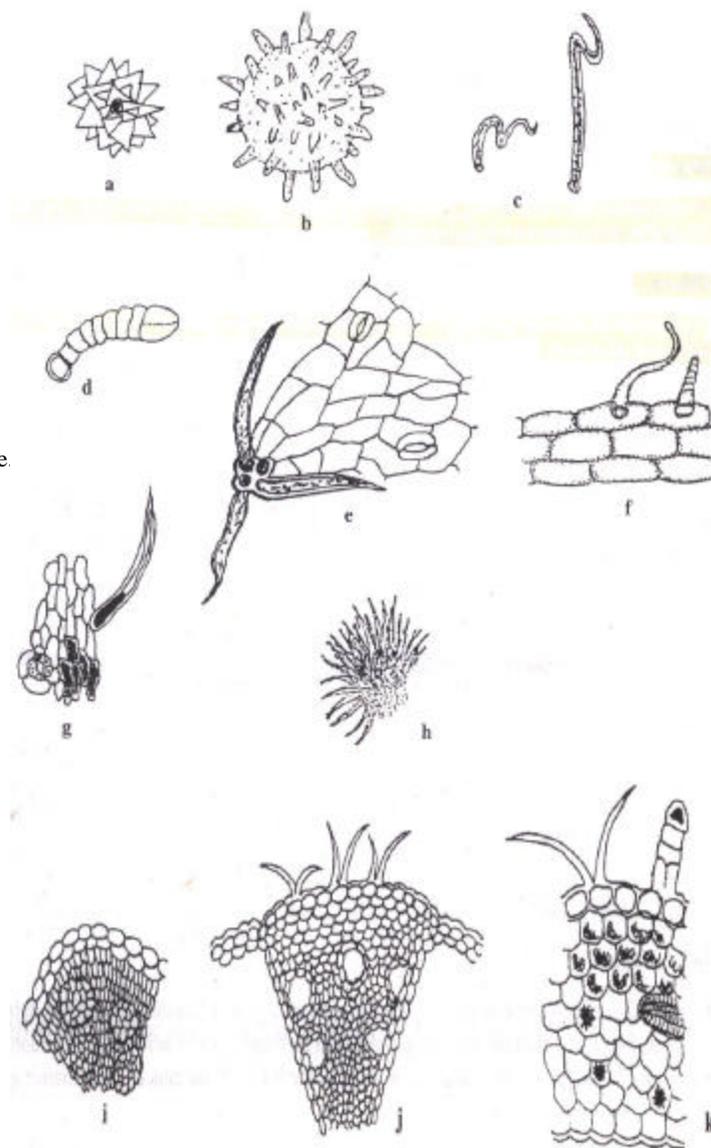


Fig 3 : Powder Microscopy of Hibiscus rosa sinensis flower

- a. Cluster crystals (x 800)
- b. Pollen grains (x 800)
- c. Unicellular trichomes (x 800)
- d. Multicellular glandular trichomes (x 200)
- e. Calyx fragment showing unicellular trichomes and anomocytic stomata (x 200)

- f. Corolla cells having brown substance (x 400)
- g. Fragment of style with stomata, trichome and cells with red content (x 200)
- h. Fragment of stigma having cells with red content (x 320)
- i. Fragment of anther cell with pollen grains inside (x 200)
- j. Fragment of ovary with stellate trichome (x 200)
- k. Fragment of calyx with stellate trichome, glandular trichome, spiral and cluster Crystals (x 200)⁷

Phytochemical Screening

Preliminary photochemical screening was done to study the presence of steroids, carbohydrates, glycosides : flavonoid, fats and alkaloids

Phytochemistry

Analysis of the edible part of flowers [61.6 %] gave the following values ; moisture 89.8; nitrogen 0.064, fat 0.36, crude fibre 1.56 %, calcium 4.04, phosphorus 26.68, iron 1.69 mg / 100gm ⁹.

Flvones from flowers, quercetin-3,5-diglucoside, quercetin-3,7-diglucoside, cyanidin-3,5-diglucoside and cyaniding-3-sophoroside-3-5-glucoside from deep yellow flowers ; all above compounds and kaempferol-3-xylosylglucoside isolate from ivory white flowers ³.

The flowers also contains thiamine [0.031mg %], riboflavin [0.048 mg %], niacin[0.61 mg %] and ascorbic acid [4.16 mg %]⁹, apigenidin, citric acid, fructose, glucose, oxalic acid, pelargonidin, quercetin¹⁰.

Leaves and stems gave teraxeryl acetate, β -sitosterol and the cyclicacids sterculic and malvalic acids¹¹.

The leaves contain carotene [7.34 mg / 100 gm of fresh material]⁹.

Srivastava, Bhatt and Udupa have been identified fatty acids, fatty alcohols, hydrocarbons of *Hibiscus rosa-sinensis* leaves : undecanoic acid, tridecanoic acid, tricosanoic acid, tricosan-1-ol, triacontan-1-ol, tartaric acid, stearic acid, pentadecanoic acid, pentacosanoic acid, pentacosan-1-ol, palmitic acid, octanoic acid, octadecadienoic acid, octacosanoic acid, octacosan-1-ol, N-tricosane, N-triacontane, N-triacontan-1-ol, N-pentacosane, nonanoic acid, nonadecanoic acid, N-octadecane, N-octacosane, N-nonadecane, N-nonacosane, N-hexadecane, N-hexacosane, N-heptadecane, N-heptacosane, N-heneicosane, N-icosane, N-dotriacontane, N-docosane, myristic acid, montanyl alcohol, margaric acid, lignoceric acid, lauric acid, iso-triacontan-1-ol, iso-octacosan-1-ol, hexacosanoic acid, hexacosan-1-ol, heptacosanoic acid, heptacosan-1-ol, heneicosanoic acid, heneicosan-1-ol, docosan-1-ol, decanoic acid, behenic acid, and arachidic acid¹².

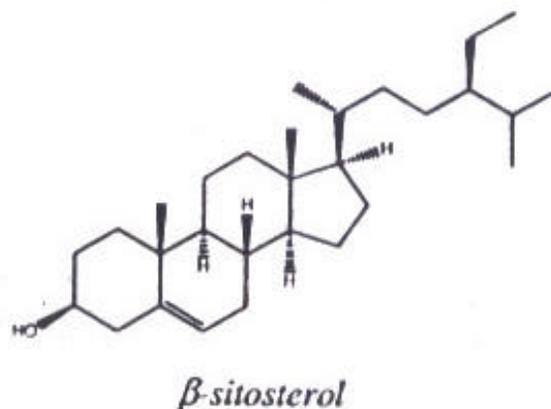
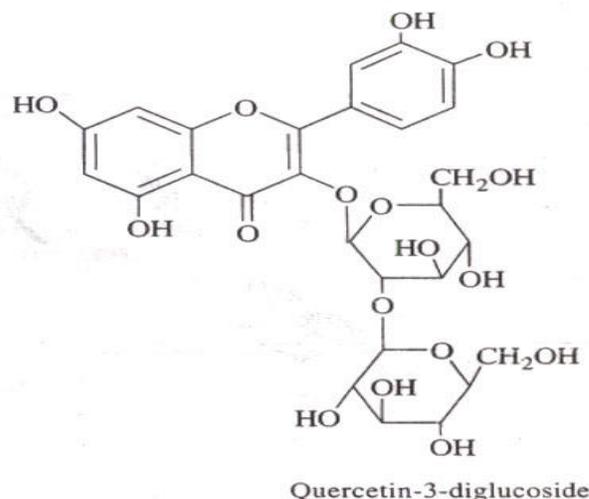
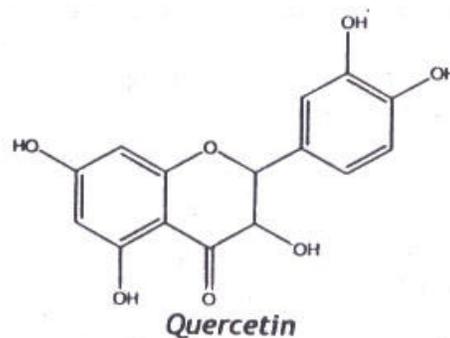
Pattanaik have been reported petals and leaves, contain catalase¹³.

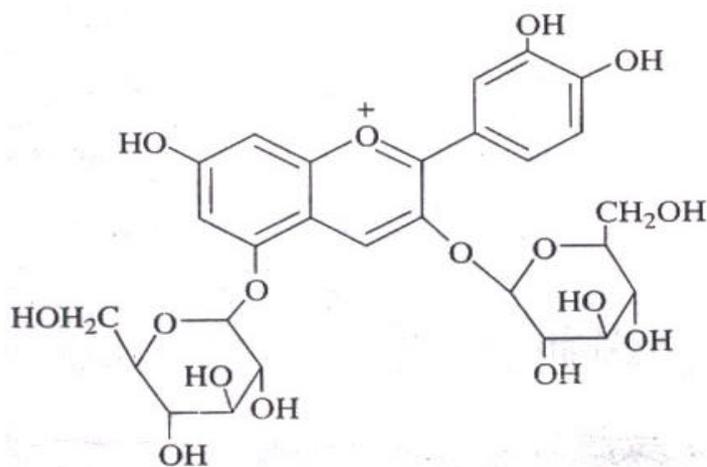
Griffiths have been reported gentisic acid in leaves¹⁴. Shimizu and Takada have been reported Hibiscus mucilage in leaves¹⁵. Flowers, leaves and stems also contain minor quantity cyanin, cyanidin chorides, methyl-10-oxa-11-octadecynoate, methyl-8-oxa-9-octadecynoate, methyl-9-methylene-8-oxaheptadecanoate and methyl-10-methylene-9-oxactadecanoate⁶. Root barks of *Hibiscus rosa sinensis* have been reported with oclade (-1) -yn-1-oic acid methyl ester 10-oxa ¹⁶, dec-9-ynoic acid methyl ester, non-8-ynoic acid methyl ester, nonadec-trans-10-enoic acid, 11-methoxy-9-oxo-methyl ester, octadec-11-ynoic acid, 10-oxo methyl ester, octadec-9-ynoic acid, 8-oxo methyl ester octadecanoic acid, 10-methylene-9-oxo methyl ester ¹⁵, cyclopropanoids¹⁷. Stem barks of *Hibiscus rosa sinensis* have been reported with dec-9-yn-1-oic acid methyl ester, dec-9-yn-1-oic acid,

non-8-yn-1-oic acid methyl ester , non-8-yn-1-oic acid, octadec-9-yn-1-oic acid methyl ester¹⁶, dec-9-ynoic acid, non-8-ynoic acid , non-8-ynoic acid methyl ester ¹⁸.

Petals of *Hibiscus rosa sinensis* have been reported with quercetin-3-di-0-beta-D-glucoside, quercetin-3-7-di-0-beta-D-glucoside, quercetin-3-0-beta-D-sophorotrioside, kaempferol-3-0-beta-D-xylosyl-glucoside¹⁹, cholesterol, campesterol, β -sitosterol¹⁰, catalase¹³.

Whole palnt of *Hibiscus rosa sinensis* have been reported cyclopeptide alkaloid²⁰, quercetin, hentriacontane ¹².





Cyanidin-3,5-diglucoside

Pharmacological / Biological Activities

1. Antifertility Activity

The benzene extract of flowers of *Hibiscus rosa sinensis* showed antifertility effect in rats^{21,31}. The ethanol extract showed an effect on sex ratio in favour of male pups at birth²¹. Flowers collected in winter season showed maximum post-coital antifertility activity²².

Ethanol [95 %] extract of dried flowers, taken orally by human females at a dose of 750.0 mg / person, was active. The dose was divided and taken 3 times daily from the 7th to the 22nd day of the menstrual cycle. Twenty-one women 15 to 35 years of age, were in the test group. Seven of the women discontinued the treatment. Three of the 7 women discontinued treatment due to non-associated illness. No pregnancies have developed in the 14 women after up to 20 months²³.

2. Abortifacient Activity

Water insoluble and ether soluble fractions of a total benzene extract of dried flowers, administered by gastric intubation to rats at a dose of 186.0 mg / kg were active²⁴.

Ether soluble and water insoluble fractions of a total benzene extract, at a dose of 73.0 mg / kg, were active¹⁰.

3. Analgesic Activity

Ethanol [70 %] extract of dried leaves, administered orally to mice at a dose of 125.0 mg / kg, was active vs inhibition of aconitine-induced writhing²⁵.

4. Anticonvulsive Activity

The ethanol extract of flowers was active. The ethanol extract protected animals from maximum electro-shock, electrical kindling and pentylenetetrazole induced convulsions in mice.

D-amphetamine were antagonized and pentobarbitone induced sleep was potentiated. The brain content of gamma-aminobutyric acid and serotonin were raised and the extract was found to be anxiogenic and general depressant of the central nervous system²⁶.

5. Antiestrogenic Activity

Studies with the total benzene extract of *Hibiscus rosa sinensis* flowers revealed antiestrogenic activity in bilaterally ovariectomized immature albino rats. It disrupts the estrous cycle in rats, depending on the dose and duration of treatment. The extract led to a reduction in the weights of the ovary, uterus and pituitary. Ovaries showed folli-

cular atresia and uterine atrophic changes. These effects could be reversed 30 days after withdrawal of the plant extract.

In guinea pigs, the benzene and ethanolic extract of the flowers produced an increase in the ovarian weight, as well as in the weight and diameter of the corpora lutea, indicating an anti-estrogenic activity. Benzene extract of the flowers administered orally to ovariectomized rats at doses of 50.0, 100.0, 150.0, 200.0 and 250.0 mg / kg were active. Ethanol [95 %] extract of the flowers, administered orally to ovariectomized rats, was inactive at a dose 100.0 mg / kg and active at doses of 150.0, 200.0 and 250.0 mg / kg²⁷ and significantly decreased ovarian, uterine and pituitary weight²⁸. Ethanol / Water [1:1] extract was active at a dose of 75.0 mg / kg, reduction of glycogen content in uterus of treated animals is claimed indicative of antiestrogenic activity²⁹.

6. Anti-implantation Activity

Hibiscus rosa sinensis has been investigated extensively for its antifertility effect. Different parts of the plant have been screened for their effect on the reproductive system. The benzene extract of *Hibiscus rosa sinensis* flowers [100 mg / kg] revealed postcoital antifertility effect in female albino rats, leading to 80 % reduction in the implantation site on the 10th day of pregnancy. The fetal loss in the rats was within the normal range, indicating the absence of any abortifacient effect in the benzene extract. The petroleum ether extract was devoid of antifertility effect, whereas with the ether and ethanolic extract of the flower petals, a change in the sex ratio of the pups born was observed, the incidence of male: female pups born being higher in the extract-treated rats. Benzene extract of the flower, administered orally to rats at doses of 50.0 and 250.0 mg / kg, was active^{30,31}. It inhibited the hyperpermeability of endometrium capillaries³².

7. Anti-inflammatory Activity

Ethanol [70 %] extract of dried leaves, administered intraperitoneally to rats at a dose of 100.0 mg / kg, was active vs carragenin-induced pedal edema²⁵.

8. Antipyretic Activity

Ethanol [70 %] extract of dried leaves, administered intraperitoneally to rats at a dose of 100.0 mg / kg, was active vs brewer's yeast-induced pyrexia²⁵. Ethanol / Water [1:1] extract of the aerial parts, administered intraperitoneally to mice at a dose of 500.0 mg / kg, was active³³.

9. Antispasmodic Activity

Ethanol / Water [1:1] extract of the aerial parts was active on guinea pig ileum vs Ach and histamine induced spasms³³.

10. Antiovarulatory Activity

Benzene extract of the flowers, administered intraperitoneally to adult mice at doses of 125 and 250 mg / kg body weight, produced an increase in atretic follicles and the absence of corpora lutea. This effect may be due to an imbalance in the hormonal environment, as there may be an increase in the endogenous secretion of estrogen by the atretic follicles and to the estrogenicity of the extract³⁴.

11. Antifungal Activity

Ethanol / Water [50 %] extract of dried leaves was active on *Rhizoctonia solani*. Mycelial inhibition was 34.50%³⁵.

12. Antiviral Activity

Ethanol [80 %] extract of freeze-dried plant, in cell culture at variable concentrations, was equivocal on coxsackie B₂ virus, measles virus and polio-virus I, and inactive on adenovirus, Herpes virus type I and

semlickiforest virus vs plaque inhibition³⁶.

13. CNS depressant Activity

Ethanol / Water [1:1] extract of the aerial parts, administered intraperitoneally to mice at a dose of 500.0 mg /kg, was active³³.

14. Hypoglycemic Activity

The alcoholic extract of leaf, administered orally to rats at a dose of 250 mg / kg daily for 7 days, showed significant improvements in the ability to utilize the external glucose load. Average blood glucose lowering was 39 %¹⁰.

15. Hypotensive Activity

Ethanol / Water [1:1] extract of the aerial parts, administered intravenously to dogs at a dose of 50.0 mg /kg, was active³³.

16. Hypothermic Activity

Ethanol / Water [1:1] extract of the aerial parts, administered intraperitoneally to mice at a dose of 500.0 mg / kg, was active³³.

17. Juvenile Hormone Activity

Acetone extract of dried stem produced weak activity on *Dysdercus cingulatus*¹⁰.

18. Hair Growth Activity

Petroleum ether extract of leaves and flowers of *Hibiscus rosa sinensis* was evaluated for its potential on hair growth by in vivo and in vitro methods. The leaf extract when compared to flower extract, exhibits more potency on hair growth².

19. Miscellaneous Activity

The 50% ethanol and benzene extract administered orally showed partial antagonism with estradiol dipropionate on K⁺ content of uterine flushings in ovariectomized rats³⁷. Aqueous infusion of flowers reduced the duration of oestrous cycle in albino rabbits³⁸. The aqueous extract of the flowers lowered the lactate dehydrogenase content in males of *Rhinopoma kinneari*³⁹. Oral administration of benzene extract affected spermatogenesis and endocrine functions of the testis of male albino rats⁴⁰.

Ayurvedic Properties

Rasa	-	Kashaya, Tikta, Madhura.
Guna	-	Laghu, Snigdha.
Veerya	-	Sheeta.
Vipaka	-	Katu, Madhura.
Doshagnata	-	Kaphapittashamaka.
Rogagnata	-	Kshata, Indralupta, Daha, Unmada, Kasa.
Karma	-	Keshya, Hiradya, Raktarodhaka, Stambhana ^{3,5} .

जपा संग्राहिणी केश्या त्रिसन्ध्या कफघ्नातजित्।

(भावप्रकाश)

Japā sangrāhiṇī keśyā trisandhyā kaphavātajit.
(*Bhāvaprakāṣa*)

Classical Use

Japaa flowers, pounded with sour gruel, followed by jaggery, were prescribed as a contraceptive [Bhaavaprakaasha]. Buds used in Garbha Anaasthaapaka yoga, which given internally for contraception. A paste of Japaa flowers and

Aamalaka [*Emblca officinale*] was prescribed externally as a hair tonic for retarding premature graying of hair [Vrindamaadhava]. For leucorrhoea and other gynaecological disorders 10-12 buds of Japaa flowers pounded with milk; in amenorrhoea. Japaa flowers and Jyotishmati [*Celastrus paniculatus*] leaves, pounded with sour gruel, were administered [Chakradatta].

In folk medicine, flowers, crushed with sugar, added to the fresh juice, are given for controlling excessive uterine bleeding. Flowers, fried in clarified butter, are also given in menorrhagia. In Unani medicine, Sharbat-e-Gurhal [Qaraba-deen-e-Jadeed] is prescribed as a refrigerant and vitaliser in palpitation, cough, fever, burning sensation in the body. The roots and flowers are given for cough and fevers. Flowers are made into a paste and applied to swellings and boils. A decoction of roots is given in venereal diseases.

A black hair dye is prepared from the petals of Japaa flowers and is extensively used for blackening of hair¹¹.

Toxicity Assessment

Ethanol [70 %] extract of dried leaves, administered intraperitoneally to mice, produced LD₅₀ 1.533 gm / kg²⁵. Ethanol / Water [1:1] extract of the aerial parts, administered intraperitoneally to both sexes of mice, produced LD₅₀ 1.0 gm / kg³³.

Therapeutic Evaluation

An uncontrolled clinical trial using the ethanolic extract of *Hibiscus rosa sinensis* flowers was carried out on 21 women in the reproductive age group by administering 750 mg / day in 3 divided doses from the 7th to 22nd day of menstrual cycle (total of 229 cycles). Fourteen women did not have pregnancy for 4 years, whereas 7 women dropped out of the trial.

In another, uncontrolled clinical study on 20 patients of mild to moderate hypertension, powdered Japa flowers (6 to 9 gm per day in divided doses) were reported to produce significant reduction in the blood pressure, the effect on the diastolic pressure being more marked than on systolic.

Clinical trials were conducted with Vidangadi yoga (a herbal preparation containing *Embelia ribes* seeds, *Hibiscus rosa sinensis* flowers and *Ferula foetida* oleo-gum resin) for its antifertility activity. The dug was found to be quite effective with no toxic effects⁶.

Formulations and preparations

Madhukadyavaleha, Patrangasava, Vidangadi yoga⁶.

Dosage

Powder : 5 to 10 gm[†].

Water extract : 10-20 gm[†].

Safety Aspects

The drug used traditionally in prescribed doses may be considered safe⁴.

Conclusion

From the time immemorial, plants have been widely used as curative agents for variety of ailments. Concentrated flowers or leaves extract can be found in various herbal preparations that are in market today. *Hibiscus rosa sinensis* is widely available and employed by practitioner of natural health for contraception, controlling uterine bleeding, menorrhagia, venereal diseases, cough, fever, refrigerant and vitaliser in palpitation. It is reported to contain anthocyanins, flavonoids, cyclopeptide alkaloid, vitamins. The pharmacological and clinical studies reported in the present review confirm the therapeutic value of

Hibiscus rosa sinensis. It is an important source of various types of compounds with diverse chemical structures as well as pharmacological activities. Presence of such wide range of chemical compounds indicates that the plant could serve as “lead” for the development of novel agents having good efficacy in various disorders in the upcoming years.

References

- Kumar, A., Saluja, A. K., Shah, U. D., Mayavanshi, A. V., Pharmacological potential of *Albizia lebbbeck* : A review, *Pharmacognosy Reviews*; 1 (1) : 2007,171-174.
- Adhirajan, N., Kumar, T. R., Shanmugasundaram, N., Babu, M., In vivo and vitro evaluation of hair growth potential of *Hibiscus rosa sinensis* Linn, *Journal of Ethnopharmacology*; 88 : 2003, 235-239.
- Joshi, S. G., *Medicinal Plants*, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi ; 2004, 255.
- Gupta, A. K., Tandon, N., Sharma, M., *Quality Standards of Indian Medicinal Plants, Vol-2*, Indian Council of Medical Research, New Delhi, 2005, 130.
- Sharma, P. C., Yelne, M. B., and Denn's, T. J., *Database on Medicinal Plants Used in Ayurveda*, Central council for research in Ayurveda and Siddna, Vol-2, New Delhi, 2001, 198-199.
- Sharma, P. C., Yelne, M. B., and Denn's, T. J., *Database on Medicinal Plants Used in Ayurveda*, Central council for research in Ayurveda and Siddna, Vol-2, New Delhi, 2001, 199-201.
- Gupta, A. K., Tandon, N., Sharma, M., *Quality Standards of Indian Medicinal Plants, Vol-2*, Indian Council of Medical Research, New Delhi, 2005, 131.
- Pulak, M., *Quality control of herbal drug*, 1st edition, Horizan Publishing, 2002, 303-305.
- The Wealth of India – Raw Materials, Vol-5, Council of Scientific and Industrial Research, New Delhi, 1992, 91-92.
- Ross, I. A., *Medicinal Plants of the World*, 2nd edition Vol-I, Library of Congress Cataloging in Publication data, America, 253-266.
- Khare, C. P., *Encyclopedia of Indian Medicinal Plants*, Springer-Verlag Berlin Heidelberg, New york, 2004, 248-249.
- Srivastava, D. N., Bhatt, S. K. and Udupa, K. N., Gas chromatographic identification of fatty acids, fatty alcohols and hydrocarbons of *Hibiscus rosa sinensis* leaves, *J. Amer. Oil Chem Soc*; 53 : 1976, 607.
- Pattanaik, S., A comparative study of the catalase activity of the petals and leaves of *Hibiscus rosa sinensis*, *Curr Sci* ; 18 ; 1949, 212-213.
- Griffiths, L. A., On the distribution of gentisic acid in green plants, *J. Exp. Biol* ; 10 : 1959, 437.
- Shimizu, N. M., Tomoda, I., Suzuki and Takada, K., Plant mucilages. XLII, A representative mucilage with biological activity from the leaves of *Hibiscus rosa sinensis*, *Biol Pharm Bull* ; 16 (8) : 1993, 735-739.
- Nakatani, M., Fukunaga, Y., and Hase, T., Aliphatic compounds from *Hibiscus rosa sinensis*, *Phytochemistry* ; 25 (2) : 1986, 449-452.
- Nakatani, M., Matsouka, K., Uchio, Y. and Hase, T., Two aliphatic enone ethers from *Hibiscus rosa sinensis*, *Phytochemistry* ; 35 (5) : 1994, 1245-1247.
- Nakatani, M., Yamachika, T., Tanoue, T. and Hase, T., Structures and synthesis of seed-germination inhibitors from *Hibiscus rosa-sinensis*, *Phytochemistry* ; 24 (1) : 1995, 39-42.
- Subramanian, S. S. and Nair, A. G. R., Flavonoids of four malvaceous plants, *Phytochemistry* ; 11(15) : 1972, 188.
- Khokhar, I. and Ahmed, A., Studies in medicinal plants of Pakistan : new cyclopeptide alkaloids from the flowers of *Hibiscus rosa sinensis*, *Sci Int.*, Lahore, 1992 ; 4147150. *Chem Abstr* 118 : 250140e.
- Batta, S. K. and Shanthakumari, G., The antifertility effect of *Ocimum sanctum* and *Hibiscus rosa sinensis*, *Indian J. Med. Res.* ; 59 : 1970, 77-78.
- Kholkute, S. D., Mudgal, V. and Udupa, K. N., Studies on the antifertility potentiality of *Hibiscus rosa sinensis*. Parts of medicinal value, Selection of species and seasonal variations, *Planta Med* ; 31 : 1977, 35-39.
- Tiwari, P. V., Preliminary clinical trial on flowers of *Hibiscus rosa sinensis* as an oral contraceptive agent, *J. Res. Indian Med. Yoga Homeopathy* ; 9 [4] : 1974, 96-98.
- Singh, M. P., Singh, R. H. and Udupa, K. N., Antifertility activity of a benzene extract of *Hibiscus rosa sinensis* flowers in female albino rats, *Planta Med* ; 44 : 1982, 171-174.
- Singh, N. R., Nath, A. K. and Agarwal, R. P., A pharmacological investigation of some indigenous drugs of plants origin for evaluation of their antipyretic, analgesic and anti-inflammatory activities, *J. Res. Indian Med. Yoga Homeopathy* ; 13 : 1978, 58-62.
- Kasture, V. S., Chopde, C. T. and Deshmukh, V. K., Anticonvulsive activity of *Albizia lebbbeck*, *Hibiscus rosa sinensis* and *Butea monosperma* in experimental animals, *J. Ethnopharmacol* ; 71 [1-2] : 65-67.
- Kholkute, S. D. and Udupa, K. N., Antiestrogenic activity of *Hibiscus rosa sinensis* flowers. *Indian J. Exp. Biol.* ; 14 : 1976, 175-176.
- Kholkute, S. D., Chatterjee, S. and Udupa, K. N., Effect of *Hibiscus rosa sinensis* Linn on Oestrous cycle and reproductive organs in rats, *Indian J. Exp. Biol.* ; 14 : 1976, 703-704.
- Prakash, A. O., Glycogen contents in the rat uterus response to *Hibiscus rosa sinensis* extracts, *Experientia* ; 35 : 1979, 1122-1123.
- Kholkute, S. D. and Udupa, K. N., Effects of *Hibiscus rosa sinensis* on pregnancy of rats, *Planta Med* ; 29 : 1976, 321-329.
- Kholkute, S. D., Mudgal, V. and Deshpande, P.J., Screening of indigenous medicinal plants for antifertility potentiality, *Planta Med* ; 29 : 1976, 151-155.
- Pal, A. K., Bhattacharya, K., Kabir, S. N. and Pakrashi, A., Flowers of *Hibiscus rosa sinensis*, a potential source of contragestive agent : II. Possible mode of action with reference to antiimplantation effect of benzene extract, *Contraception* ; 32 : 1985, 517-529.
- Bhakuni, O. S., Dhar, M. L., Dhar, M. M., Dhavan, B. N. and Mehrotra, B. N., Screening of Indian plants for biological activity, Part II, *Indian J. Exp. Biol.* ; 7 : 1969, 250-262.
- Murthy, D. R., Reddy, C. M. and Patil, S. B., Effect of benzene extract of *Hibiscus rosa sinensis* on the estrous cycle and ovarian activity in albino mice, *Biol Pharm. Bull.* ; 20 (7) : 1997, 756-758.
- Renu, Fungitoxicity of leaf extracts of some higher plants against *Rhizoctonia solani* kuehn., *Nat Acad Sci. Lett.*; 6 (8) : 1983, 245-246.
- Van Den Berghe, D. A., Leven, M., Mertens, F., Vlietinck, A. J. and Lammens, E., Screening of higher plants for biological activities, II, Antiviral activity, *J. Nat. Prod.* ; 41 : 1978, 463-467.
- Prakash, A. O., Mathur, A., Mehta, H. and Mathur, A., Concentrations of Na⁺ and K⁺ in serum and uterine flushing of ovariectomized, pregnant and cyclic rats when treated with extracts of *Hibiscus rosa sinensis* flowers. *J. Ethnopharmacol* ; 28: 1990,337-347.
- Shukla, V. J., Makavana, H. G., Dave, L. N., Dave, K. K., Dodia, U. A., Sharma, J. M. and Ravishanker, B., Studies on *Hibiscus rosa sinensis* flower- Elucidation of mechanism of action of efficacy in dysfunctional uterine bleeding, *Ayu* ; 12 : 1991, 13-22. , *Med. Aromat. Plant Abstr.* ; 1992 : 9205-3018.
- Singwi, M. S., Lall, S. B., Effects of flower extract of *Hibiscus rosa sinensis* testicular lactate dehydrogenase active tests of a non-scrotal bat *Rhinopoma kinneari* wroughton, *Indian J. Exp. Biol.* ; 19 : 1981, 359-362.
- Kholkute, S. D., Effects of *Hibiscus rosa sinensis* on spermatogenesis and accessory reproductive organs in rats, *Planta Med* ; 31 : 1977, 127-135.

Source of support: Nil, Conflict of interest: None Declared