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CHASSALIA CURVIFLORA (WALL. EX KURZ) THWAITES: A REVIEW

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ABSTRACT

Chassalia curviflora (Wall Ex Kurz) Thwaites is an important ethno medicinal plant which is yet to be explored pharmacologically. The plant has been used to treat rheumatism, pneumonia, malaria, cough, phlegm, ulcers, snake and insect bite and to treat headache. The plant reported to have anti-hepatotoxic property, anti-hypertensive activity, anti-bacterial, anti-microbial, insecticidal, and cytotoxic activities. It contains important chemical constituents such as alkaloids, carbohydrates, saponins, phytosteroids, phenols, flavonoids, terpenoids, fixed oils and fats. There is a promising future for this medicinal plant as they are widely distributed around the world, and most of the medical activities are not yet investigated and their hidden potential of medical activities could be decisive in the treatment of present and future studies.

KEYWORDS

Chassalia curviflora, Phytochemistry, Anti-hypertensive, Anti-hepatotoxic and Cytotoxic.

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INTRODUCTON

Traditional medicines plants have always played a vital role as important alternatives to conventional medicines in developing countries. Nowadays chemical constituents of medicinal plants used in different traditional systems in the world are being increasingly explored for human benefits[1].

The World Health Organization (WHO) evaluated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. The primary benefits of using plant derived medicines are that they are relatively safer and non-toxic than synthetic alternatives, offering profound therapeutic benefits and more affordable treatment. For

example, the plants are generally readily available and their products are biodegradable. Natural plant products have been considered as the major ingredients of most of the modern medicines. Among the estimated 250 000 - 500 000 plant species, only a small percentage has been investigated phyto-chemically[1].

Chassalia curviflora (Wall Ex Kurz) Thwaites belonging to the family Rubiaceae, is an erect shrub with white or tinged pinkish flower and shiny black fruits that grows widely in western guts of India. It is distributed from India to South China and Philippines. The plant is commonly called curved flower woody *Chassalia* and Vellakurinji, Yamari or Mundanchedi in Malayalam. In India the plant is distributed in Sikkim, Darjeeling, Meghalaya, Maharashtra, Karnataka, Andaman and Western Ghats[2].

Chassalia curviflora is a subshrubs, erect, 1-2 m tall; branches weakly flattened to subterete, glabrous or rarely sparsely puberulent[3].

Leaves opposite; petiole 1-4 cm, glabrous; blade drying membranous to thinly papery and often yellowish green, oblong-elliptic, elliptic, oblanceolate, or narrowly lanceolate, 6-27 × 1.5-7.5 cm, glabrous, base cuneate-attenuate, apex acuminate-long acuminate; secondary veins 8-17 pairs, without domatia; stipules persistent, united shortly around stem, with interpetiolar portion broadly ovate or broadly triangular, 1.5-4.5 mm, acute or obtuse, entire or usually shortly bifid, with 1 or 2 bristles 0.3-1 mm, often gland-tipped[3].

Inflorescence cymose, pyramidal to rounded, several to many flowered, puberulent; peduncle 1-5 cm; branched portion 3-7 cm; axes weakly flattened; bracts lanceolate to triangular or usually multifid, 0.5-3 mm[3].

Flowers subsessile, trimorphic: with anthers exserted and stigmas included, with anthers included and stigmas exserted, or with anthers and stigmas both exserted. Calyx with hypanthium portion ellipsoid to obovoid, 1-1.5 mm, glabrous; limb 5-lobed, 0.5-1 mm; lobes 0.3-0.5 mm, acute. Corolla is white and pink, red, or orange on lobes, outside glabrous to sparsely puberulent and longitudinally ridged to winged along tube then midribs of lobes; tube shallowly to markedly curved, straight or bent at base, 10-15 mm, pubescent inside; lobes (4 or)5, ovate-triangular, 2-2.5 mm, at apex thickened. Infructescence axes becoming swollen and red[3].

Fruit purple, oblate to globose or weakly didymous, 5-7 × 6-9 mm[3].

Traditional uses

C. curviflora has several traditional uses. The plant has been used to treat rheumatism, pneumonia, malaria, cough, phlegm, ulcers, snake and insect bite and to treat headache. The plant is used as poultice[2]. Oil boiled with leaf juice is used for the treatment of ear and eye diseases, ulcers and sore throat. Root decoction is given as a remedy for phlegm, rheumatism and pneumonia[4].

Phytochemistry

Sanis Juliet, *et al*, reported the presence of various phyto-constituents such as steroids, terpenoids, alkaloids, tannins, phenolic compounds, flavonoids, carbohydrates and amino acidsby preliminary phytochemical screening of crude drug powder[5]. They investigated thephysico-chemical and biochemical analysis of the crude drug powder of the stem of *Chassalia curviflora* (Wall. Ex Kurz) Thwaites, is an ethno-medicinally predominant plant belonging to coffee family (Rubiaceae). The physicochemical analysis exhibit foreign content 0.313%, moisture content 11.333 %, total ash content 11.416%, acid soluble ash 56.833%, water soluble ash 15.054 % and alcohol soluble ash 10.595. The result of biochemical contents revealed that, the highest value of dry matter was 88.666 ± 0.166%, followed by

Carbohydrate 63.027 ± 0.023%,
Crude fibre 14.693 ± 0.170 %,
Crude protein 13.125 ± 0.004%,
Total ash 11.416 ± 0.289%,
Moisture 11.333 ± 0.166%
Crude fat 1.099 ± 0.062%.

The extractive values of the stem were determined by using different solvents. This information's are useful for the pharmacognostical evaluation of this plant material[6].

Nor Adila Mhd Omar, *et al*, reported that the GC-MS analysis of the leaves revealed presence of the

following compounds: bis (2-ethylhexyl) ester (34.64%), Cyclotrisiloxane, hexamethyl- (31.14%), (Phenylthio)acetic acid, 1-adamantylmethyl ester (30.90%), Hexanedioic acid, Cyclononasiloxane, octadecamethyl- (18.357%), Oleic Acid (16.56%), n-Hexadecanoic acid (15.23% and 14.15%), 4H-Pyran-4-one, 2, 3-dihydro-3, 5-dihydroxy-6-methyl- (16.43% and 12.98%) and Trichloromethane (11.03%)[7].

The n-Hexadecanoic acid is the highest compound found of *C. curviflora*. N-Hexadecanoic acid was found to act as antioxidant, hypocholesterolemic, nematicide, hemolytic and also 5-alpha reductase inhibitor. Antioxidant may relate to the anti-hypertensive. The phytol compound of 3.05% function for antidiabetic, anti-angeogenic, antimicrobial, anticancer, anti-inflammatory and also antidiarrhoeal. Besides, Vitamin E was also can be found. Even though vitamin E only small amount in the sample, it gave lots of activities. Vitamin E which from compound methylated phenols can contribute to antioxidant activity, antiatherogenic, antithrombotic, anticoagulant, neuroprotective, and antiviral. Besides, vitamin also play important role in immune-modulatory, cell membrane stabilizing and antiproliferative actions[7].

Alstrostine was isolated from *C.curviflora,* it is an unusual class of alkaloids comprising one tryptamine and two iridoid units. Alstrostines contain a pyrrolidinoindoline core and are alkaloids of the Psychotria alliance[8].

Bioactivity

Anti-hypertensive activity

Nor Adila Mhd Omar, *et al*, reported the anti-hypertensive activity of hot water and methanolic extract of the leaves and flower of *Chassalia curviflora* and compared the potential between two different extraction methods. The biuret protein assay was conducted to determine the protein protein concentration in samples. The phytochemical in leaves and flower extracts of *C. curviflora* were analyzed by using GC-MS. The result of protein concentration in *C. curviflora* flower was higher compared to leaves extract of 0.6648 mg/ml and 0.5431 mg/ml, respectively. The hot water extract of *C. curviflora* flower exhibited the highest antihypertensive activity with the percentage of ACE inhibitory activity of 95.50 ± 0.06% with IC50 value of 3.71µg/ml. The 10 highest peak area (%) of phytoconstituent in all samples were: bis (2-ethylhexyl) ester (34.64 %), Cyclotrisiloxane, hexamethyl- (31.14%), (Phenylthio) acetic acid, 1-adamantylmethyl ester (30.90%), Hexanedioic acid, Cyclononasiloxane, octadecamethyl- (18.357%), Oleic Acid (16.56%), n-Hexadecanoic acid (15.23% and 14.15%), 4H-Pyran-4-one, 2, 3-dihydro-3,5-dihydroxy-6- methyl- (16.43 % and 12.98%) and Trichloromethane (11.03%). In conclusion, both of leaves and flower of *C. curviflora* have a potential as antihypertensive agent[7].

Anti-hepatotoxic property

G. Rajeswari Gopal, *et al*, reported anti-hepatotoxic and anti-oxidant effects of the ethanolic extract of roots and leaves of *Chassalia curviflora* in experimentally induced liver injury by carbon tetra chloride. Liver serum marker enzymes as well as antioxidant enzymes mainly superoxide dismutase, catalase and glutathione levels were determined. Preliminary phytochemical screening revealed the presence of alkaloids, sterols, terpenoids, saponins, tannins, flavonoids, amino acids, resins, phenols, cardiac glycosides, reducing sugar, quinines, and steroids. The plant root and leaf ethanolic extracts at 50, 100, 200 mg concentrations significantly (**$P \leq 0.05$) reduced the elevated serum hepato specific enzyme [serum glutamate pyruvate transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), serum alkaline phosphatase (SAKP), serum bilirubin (SB)] and cholesterol levels induced by CCl4. Antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT) and non-enzymatic reduced glutathione (GSH) levels were increased whereas malondialdehyde (MDA) level was reduced by the extracts. Compared to the leaf extract, root extract significantly reduced serum hepato parameters and increased the levels of anti-oxidant enzymes in a dose dependent manner. The results were comparable to that of silymarin, reference drug used for the study. The histopathological studies also supported the biochemical findings. Acute toxicity studies

revealed that it is safe for pharmacological uses upto 2000mg/kg. The present study scientifically validated the traditional use of plant root in hepatoprotection[2].

Acarcidal activity

Sanis Juliet, *et al*, reported the acaricidal effect of ethanolic extract of *C. curviflora* on engorged female ticks of R. (B.) annutatus. The pharmaco-chemical features such as physico-chemical, proximate, phytochemical, fluorescence, and HPTLC profiling were carried out using standard techniques. The pulverized leaves were subjected to soxhlet extraction using ethanol. The ethanolic extract at different concentrations (10% to 1.25%) was tested against ticks using adult immersion test (AIT). The preliminary phytochemical investigation revealed high contents of saponins, alkaloids and flavonoids. The HPTLC profiling of ethanolic extract showed the presence of 14 polyvalent components. Based on AIT, the extract at 10% revealed 43.76% of inhibition of fecundity (IF) and 29.16% of adult tick mortality. The results revealed that the extract has some active compounds that may influence in the reproductive system of female ticks[5].

Insecticidal, antimicrobial, and cytotoxicity

Patricia Akpomedaye Onocha and Shaiq Muhammad Ali reported the methanolic extract of the dried whole plant *Chassaliakolly* was investigated for insecticidal, antimicrobial, phyto- and cytotoxicity activities. Antifungal activity was observed against only one of the three strains investigated namely, *Candida albicans* The extract however inhibited the growth of all the five human pathogenic bacteria namely: *Salmonella typhii*, *Escherica coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Staphylococcus aureus* tested in the agar cup plate diffusion technique, exhibiting a concentration dependent activity. Cytotoxicity was evaluated using brine shrimp lethality assay revealing its relatively non-toxicity with an LD50 value greater than 1000µg/ml. Phytotoxicity using the Lemna bioassay exhibited a moderate growth inhibitory effect against *Lemna minor*. The insecticidal assay by contact toxicity method also revealed a moderate insecticidal rate of 40% against *Rhizopertha dominica* at the concentration of 1572.7µg/cm. The extract contains glycosides, alkaloids and flavonoids. These results provide some scientific basis for the utilization of the plant in ethno-medicine for the treatment of typhoid fever and as an insect repellant[9].

Antibacterial activity:

Johson Marimuthu Antonisamy, *et al*, reported anti-bacterial hexane and methanolic extract of *Chassalia curviflora* Thw, *Cycleapeltata* Hook. F. and Thomson and *Euphorbia hirta* L. Antibacterial efficacy was carried out by disc diffusion method against the pathogens viz., *Escherichia coli* (*E. coli*), *Staphylococcus aureus* (*S. aureus*), *Salmonella typhi* (*S. typhi*), *Proteus vulgaris* (*P. vulgaris*), *Proteus mirabilis* (*P. mirabilis*) and *Streptococcus pyogenes* (*S. pyogenes*) and incubated for 24 h at 37°C. The maximum degree of antibacterial activity was noticed in *C. peltata* followed by C. curviflora. While *E. hirta* showed comparatively low degree of antibacterial activity. The methanolic and hexane extracts of *C. Curviflora* showed the antibacterial activity against only one bacterium each i.e. *P. vulgaris* and *S. typhi* with the maximum zone of inhibition 13 and 11 mm. This investigation revealed that the *C. curviflora*, *C. peltata* and *E. hirta* are potentially good source of antibacterial agents and demonstrates the importance such plants in traditional medicines[1].

Antioxidant activity

Thenmozhi, *et al*, investigated the phytochemicals and antioxidant properties of different solvent extracts of the fruits of *Caryotaurens L*, *Chassalia curviflora* Thw. *Zizyphusoenoplia* Mill. And *Clerodendrum infortunatum* L. Quantitative phytochemical analysis and *in vitro* antioxidant properties were evaluated by using reducing power assay, DPPH•, NO•, metal chelating and ABTS•+ scavenging activity, β carotene bleaching assay and antihemolytic activity. Acetone fractions of *Caryotaurens* fruit registered significantly high amount of secondary metabolites and it also effectively scavenged off the free radicals in a concentration dependent manner. Similarly, *Zizyphus oenoplia* fruit extracts also exhibited

significant activity than the other said plant samples. In the present study, the fruit extracts of *C. urens* exhibited appreciably high antioxidant activity. Furthermore the present study validates the therapeutic benefits of the plant in medicine. The phytochemical screening revealed the presence of Phenols, Flavonoids, Vitamin C, Saponins, Tannins in *Chassalia curviflora*[4].

Table No.1: Vernacular names

S.No	Language	Name
1	English	Long leaved Chassalia/ Curved flower Chassalia
2	Malayalam	Karutha amalpori
3	Tamil	Yamari
4	Chinese	Wan guan hua

Table No.2: Taxonomy of *Chassalia curviflora*

Kingdom	Plantae
Order	Gentianates
Family	Rubiacaea
Sub family	Rubiodae
Tribe	Psychotriae
Genus	*Chassalia*
Species	*C. Curviflora*
Binomial name	*Chassalia curviflora* (Wall Ex Kurz) Thwaites

Figure No.1: *C. curviflora* leaves and flower

Figure No.2: *C. Curviflora* fruits

CONCLUSION

The plant *Chassalia curviflora* contains various bioactive compounds which are reflected from their diverse medicinal properties. There is a promising future for this medicinal plant as they are widely distributed around the world, and most of the medical activities are not yet investigated and their hidden potential of medical activities could be decisive in the treatment of present and future studies.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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