MEDICINALLY IMPORTANT PLANT CLEOME GYNANDRA: A PHYTOCHEMICAL AND PHARMACOLOGICAL EXPLANATION

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Received: 16 August 2017, Revised and Accepted: 21 October 2017

ABSTRACT

Cleome genus includes 601 plant species from the family Cleomaceae. Of more than 600 plants, 206 (34.3%) plants are having accepted species names. Cleome gynandra Linn. is a well-known medicinal plant with traditional and pharmacological importance. A good number of secondary plant metabolites have also been isolated from different parts of C. gynandra. Our investigation confirms two mutant varieties of C. gynandra exists in India. Accordingly, the objective of this study was designed to critically evaluate the pharmacological and phytochemical evaluation of C. gynandra of two mutant variety, to provide a consolidated platform for research potential of both the mutant varieties of C. gynandra. Careful scrutiny reveals that the plant possesses a huge range pharmacological applications, such as anti-inflammatory, free radical scavenging, antinocuous, immunomodulator, and anti-diabetic agents. To arrive its pharmacological importance the published papers also shown an enormous amount of phytochemicals endorsement. Scientific perusal reveals different parts of the plant has an immense medicinal importance which proofs its traditional use round the globe. But in North-Eastern region of India, the same plant abundantly found in pink mutant variety. To date, there is not much research investigation for this mutant variety to validate its pharmacological importance. Therefore, research needs to scrutinize and compare the medicinal claims of the pink mutant variety in the bio-diverse region of North-East India.

Keywords: Cleomeaeae, Cleome gynandra Linn., Pharmacological, Phytochemicals, Pink mutant variety.

INTRODUCTION

India is rich in its natural assets and considered as one of the 17 megadiverse nations of the world. The Indo-Burma, Western Ghats, and Eastern Himalayan Regions are the focused biodiversity hotspots of India. North-East (NE) India is included the eight states encompassing Assam, Manipur, Arunachal Pradesh, Nagaland, Tripura, Meghalaya, Mizoram, and Sikkim and supports half of India’s biodiversity. The region spreads more than 255,037 km² or about 7.7% of India’s aggregate geological territory. NE states mostly rocky with plateaus, slopes and mountains overwhelming. Level marshes are at a top-notch covering just 27% of the region. Rainfall is exuberant with 6,300 mm yearly a normal event in the Cherrapunji region. In the rest of the N.E region, normal yearly precipitation ranges from 1000 to more than 4000 mm with the affluent occurrence during the monsoon periods of June–October. Originating from this rich tropical vegetation ranging from alpine, subtropical pine and mountain to evergreen and wet deciduous flours making the region a focus of worldwide biodiversity hotspot [1,2]. N.E states of India is honored with an extensive variety of physiographic and ecoclimatic conditions and above all is the topographical passage for quite a bit of India’s endemic flora.

• Of the nine vegetation types of India; six important types are well established in N.E region.
• Of about 15000 flowering plant species, 8000 are found in the N.E area, which includes 500 pteridophytes, 400 gymnosperms, 825 orchids, 25 species of canes, 80 species of rhododendrons, and 60 bamboo species.
• An aggregate of 3624 species of insects, 236 species of fishes, 137 species of reptiles, 50 molluscs, 64 amphibians, 160 mammalian species, and 850 birds have been so far revealed, and the count is continuously rising.
• Out of 15 known species belonging to three families of primates; 9 found in N.E region.
• Of 6 largest cats from India and the globe; N.E region registers 4, especially the clouded leopards.

In addition, the region represents an essential part of the Indo-Myanmar biodiversity hotspot, among the 25 world’s biodiversity hotspots recognized to date over the globe [3]. 51 unique forest are found in this region, which incorporates tropical moist deciduous forests, evergreen semi-tropical forests, and evergreen wet tropical forests, moderate and subtropical, and mountainous forests [4]. Further, Fig. 1, depicts the percentage distribution of forest in N.E region and Table 1 summarizes eight states of N.E region with total area, climatic condition, and diversities of plant species.

Numerous valuable medicinal plants are practically associated culturally as well as socially. In addition, these plants are generally utilized for food, clothing, fuel, shelter, and different necessities of sustainable life by the local inhabitants and indigenous communities of this region [5]. Among extensive diversity of medicinal plants, C. gynandra has been found abundantly growing as a weed in common infertile land and in crop grounds [6,7].

Cleome gynandra Linn.

Cleome is a genus of the family Cleomaceae (formerly Capparaceae) is a major group of angiosperms, comprising many species found in tropical and sub-tropical areas of the globe. Cleomaceae family encompassing flowering plants are Brassicales (or Cruciales) order, including more than 764 species belonging to 12 genera of which Cleome is the largest genus with about 601 species of ecological, ethnobotanical, and of course medicinal importance [6,8,9]. Different species of Cleome are therapeutically utilized in Island, North and Central America, Philippines, and Indo-China. In India, of 15 species 12 are reported in Maharashtra [10]. Cleome genus is under constant advancement; numerous species demonstrate a progressive movement from C3 photosynthesis to C4 photosynthesis and this developmental movement is indistinguishable to Brassicaeae individuals like Arabidopsis thaliana. There is extremely inadequate and scattered work in the genus, Cleome. Especially, the anatomical and physiological examinations in the species are uncommon [11]. C. gynandra is an...
Table 1: Area, climatic condition, plant diversity in North Eastern states of India

| States                  | Total area (sq. km.) | Climatic condition | Plant diversity specification |
|-------------------------|----------------------|--------------------|------------------------------|
| Arunachal Pradesh       | 83743                | Yearly rainfall: ~ 1500–3800 mm. Temperature: ~ 0–31°C | ~ 5000 flowering plants species, 238 are endemic to the state. The state has ~500 species of orchids and one of the orchid-rich state in India |
| Assam                   | 78438                | Yearly rainfall: ~ 2000–8000 mm. Temperature: ~ 5–32°C | Flowering plants ~3010 species, of which 102 species are endemic. State is rich in bamboo diversity ~42 species are found |
| Manipur                 | 22327                | Yearly rainfall: ~ 1300–2700 mm. Temperature: ~ 15–38°C | Flowering plants ~2500 |
| Meghalaya               | 22429                | Yearly rainfall: ~ 4000–11500 mm. Temperature: ~ 2–33°C | Flowering plants ~3500 species |
| Mizoram                 | 21081                | Yearly rainfall: ~ 2200–3500 mm. Temperature: ~ 11–29°C | Flowering plants ~2200 species |
| Nagaland                | 16579                | Yearly rainfall: ~ 2000–3000 mm. Temperature: ~ 4–30°C | Flowering plants ~2250 species |
| Sikkim                  | 7096                 | Yearly rainfall: ~ 2700–3200 mm. Temperature: ~ 0–28°C | Flowering plants ~4500 species |
| Tripura                 | 10491                | Yearly rainfall: ~ 2300–2500 mm. Temperature: ~ 4–38°C | Flowering plants ~1600 species, of about 14% of species found is endemic |

Fig. 1: The percentage distribution of forest in North-East region

opulently accessible species and matures as a weed in common sterile land and in crop grounds throughout the world. As a weed, its generally found growing on fertile soils, particularly in those previously blended with animal fertilizer, or with homestead disposed. Ideal growing conditions for *C. gynandra* require suitable soil moisture, high-intensity light and temperatures of ~25°C. In different countries, it is used to treat many diseases as traditional medicine, and it is additionally utilized as a part of different conventional culinary systems for it’s astounding antioxidant and nutritional activities [12-14].

Synonyms of Cleome gynandra L. [9]
- Gynandropsis gynandra (L.) Briq.
- Gymnogonia pentaphylla (L.) R. Br. ex Steud.
- Gymnogonia viscosa (L.) Sw.
- Pedogyne pentaphylla (L.) Hoffmanns.
- Gymnogonia heterotricha DC.
- Gynandropsis glandulosa C. Presl.
- Cleome acuta Schumach. and Thonn.

Taxonomic position of Cleome gynandra L. is as follows
- Kingdom: Plantae
- Division: Angiosperms

- Class: Dicotyledones
- Order: Capparidales (Capparales)
- Family: Cleomaceae
- Genus: Cleome
- Species: Gynandra.

Plant distribution
*C. gynandra* is typically well-known herb in southern Africa reaching out from the Limpopo, the North-West, Mpuumalanga, Gauteng, the Northern Cape, and Namibia. Being semi-cultivated, in the District of Eastern Cape, has most likely broadened its distribution. It is most likely a native of Africa and now broadly circulated in tropical and subtropical areas all through the world [6,15].

The species is also native to the following regions/countries [15]
- Northern Africa: Egypt and Mauritania
- Western Africa: Cameroon, Ghana, Guinea, Côte d’Ivoire, Mali, Niger, Nigeria, and Sierra Leone
- Central Africa: Angola, Burundi, and Zaire Eastern
- Africa: Ethiopia, Kenya, Somalia, Sudan, Tanzania, and Uganda
- African Islands: Madagascar, Mauritius, Reunion, and Seychelles
- Middle East: Oman and North Yemen
- Far East: Afghanistan
- Asia: Brunei, India, Java, Malaya, Moluccas, Philippines, Sri Lanka, Sulawesi, and Thailand
- Australasia: Fiji

Numerous species of the genus *Cleome* are discovered from India, but most normally available species are the *C. chelidonii* with blue flower and *C. viscosa* with a yellow flower. A careful scrutiny reveals that the species is available in Sri Lanka to India in whole Asia. A summarized finding is tabulate in Table 2 w.r.t the occurrence or distribution, habit, some morphological traits, and flowering period.

In Indian literature *C. gynandra* is distinguished by the accompanying vernacular names of the following:

Vernacular names in India [14]
- Sanskrit: Pasuagndhi, Ajagandha
- Assamese: Bhumnula
- Bengali: Harharua, Shulte
- English: Dog Mustard
- Gujarati: Talvani, Dhejtalvan
- Hindi: Hulhul, Hurhur, Kavali
- Kannada: Naram bele Soppu, Nayeetulasí
- Kashmiri: Gendi Buti
Gulma - Annual herb
Gynandrophore 1 cm long

Acetone – 4–8 cm

Dark brown, oily; under microscope shows

Black mostly with waste place

Chloroform

Shri Lanka to India to whole Asia

n-Hexane

Mostly 5 foliate pinnately compound; leaf

Ethanol (90%)

White

August–December

This review endorses in N.E region of India the same plant abundantly found in pink mutant variety. Fig. 2 further illustrates the white; Fig. 2(a) and the pink; Fig. 2(b) mutant verities, respectively.

Phytochemical importance of C. gynandra

Qualitative phytochemical screening of the powdered leaf revealed the presence of following class of compounds summarized in Table 3 [16].

A good number of phytochemicals have been isolated from different parts of white mutant C. gynandra which confirms its current understanding of nutritional claims and pharmacological evidence, whereas a few compounds, namely, clenbuterol, stearin compound, bicyclohexyl derivatives, and (5Z,8Z)-3-hydroxypropyl dodeca-5,8-dienoate only been isolated from the pink mutant variety, only available in N.E. states. Table 4 further summarizes the isolated phytochemicals from both the mutant varieties of C. gynandra with respective citations.

Pharmacological importance of C. gynandra

The pharmacological importance of C. gynandra is referred in Ayurveda; Gulma (tumor, irregularity, or diverticulosis), Krmiroga (worm infection), Asthila (Prostate enlargement), Kandu (pruritus), and Karnaroga (ear infections) [27,28]. The indigenous information of numerous traditional medicine has been figured, reported, and eventually wind up noticeably with composed frameworks of the drug, for example, Ayurveda, Unani, Siddha, and other indigenous traditional system throughout the world [8]. The following are some therapeutic investigation reported by various researchers from India and from other nations as well [14–24, 29,30]:

- Sap from leaves utilized as a pain relieving agent, especially in cerebral pain.
- Sap from pounded leaves is pressed into ears, nostrils, and eyes to treat epileptic fits and ear infection.
- A decoction or mixture of bubbled leaves and/or roots is regulated to:
  - Encourage labor pain in pregnant ladies.
  - Treat stomach-throb and constipation.
  - Treat conjunctivitis.
  - Treat serious thread worm disease.
  - Relieve burning chest pains.
- The leaves have anti-inflammatory activities and are utilized to treat joint inflammation.
- Leaves are rubefacient and vesicant and used to treat neuralgia, otalgia, rheumatism, and stiffness. The leaves are rubbed on the affected parts.
- In Taiwan, it is utilized to treat looseness of the bowels, gonorrhea, fever, and rheumatoid arthritis. In India, the plant has been usually utilized as a rubefacient and anthelmintic agents. Leaves are applied directly over the injuries to prevent sepsis. The plant also used to treat piles, different stomach aches and in tumor. The juice of the root is utilized to treat fevers.
- Bruised leaves are applied to boils to stop pus discharge.
- Infusion from leaves is utilized to treat iritenent deficiency.
- Sap from the leaves used to cure intermittent intestinal sickness.
- Leaves are rubbed onto the skin to relieve pneumonia.
- An infusion of the leaves utilized as an eyewash.

Table 2: Summarized review of the specie available in Sri Lanka to India to whole Asia

| Specifications | The plant Cleome gynandra Linn. |
|----------------|---------------------------------|
| Native         | Sri Lanka to India to whole Asia |
| Morphology     | The erect plant is 250–600 mm tall |
| Soil type needed | Black mostly with waste place |
| Habitat        | Annual herb |
| Leaves         | Mostly 5 foliate pinnately compound; leaf stalk is 20–50 mm long with glandular hairs |
| Fruits         | The fruits are in capsule form |
| Microscopic structures | Dark brown, oily; under microscope shows a number of fragments of epidermis; Leaf thickness ranges from 112 to 398 μm |
| Inflorescence  | Corymbose-racemes |
| Flower color   | White |
| Androecium     | 6 |
| Gynoecium      | Gynandrophore 1 cm long |
| Capsule (Length) | 4–8 cm |
| Seed           | Muricate, dark brown, globose 1.5 mm in diameter |
| Flowering and fruiting | August-December |

Table 3: Qualitative phytochemical screening of the powdered leaf of C. gynandra

| Phytochemicals     | n-Hexane | Benzene | Chloroform | Acetone | Ethanol (90%) | Water |
|--------------------|----------|---------|------------|---------|---------------|-------|
| Alkaloids          | -        | -       | -          | -       | -             | -     |
| Anthraquinones     | -        | -       | -          | -       | -             | -     |
| Carotenoids        | -        | -       | +          | +       | ++            | ++    |
| Cardiac glycosides | -        | -       | +          | +       | +             | +     |
| Cyanogenetic glycosides | -       | -       | +          | +       | ++            | ++    |
| Flavonoids         | -        | -       | -          | ++      | ++            | +     |
| Phenols            | -        | -       | -          | ++      | ++            | ++    |
| Saponins           | -        | -       | -          | ++      | ++            | ++    |
| Sugars             | +        | ++      | +          | -       | -             | +     |
| Tannins            | -        | -       | +          | +       | ++            | ++    |
| Triterpenes        | -        | -       | +          | +       | ++            | ++    |

++: Marked change, +: Moderate change, -: No characteristic change
### Table 4: Brief review of the isolated phytochemicals from two mutant varieties of *C. gynandra* [6,16]

| Plant part used                                      | Phytochemicals                                           | Relevant citation                  |
|------------------------------------------------------|----------------------------------------------------------|------------------------------------|
| Seeds oil                                            | Oleic acid ($C_{18}H_{34}O_2$; Molecular Mass: 282.26)  | Misra and Dutt 1937 [17]           |
|                                                      | Linolic acid ($C_{18}H_{32}O_2$; Molecular Mass: 280.24) |                                    |
|                                                      | Palmitic acid ($C_{16}H_{32}O_2$; Molecular Mass: 256.24) |                                    |
|                                                      | Stearic acid ($C_{18}H_{36}O_2$; Molecular Mass: 284.27) |                                    |
|                                                      | Arachidic acid ($C_{20}H_{40}O_2$; Molecular Mass: 312.30) |                                    |
| Defatted alcoholic extract of the seed               | Hexacosanol ($C_{26}H_{54}O$; Molecular Mass: 382.42)    | Gupta, 1968 [18]                   |
|                                                      | β-sitosterol ($C_{29}H_{50}O$; Molecular Mass: 414.39)   |                                    |
|                                                      | Kaempferol ($C_{15}H_{10}O_6$; Molecular Mass: 286.05)   |                                    |
| Methanolic extract of the leaf                       | Glucocapparine or methyl glucosinolate ($C_{8}H_{15}NO_9S_2$; Molecular Mass: 333.02) | Saleh, 1976 and Hasapis, 1981 [19,20] |
| Leaf in Egypt                                        | Centauridin ($C_{18}H_{16}O_8$; Molecular Mass: 360.08) | Ali *et al.*, [21]                 |
|                                                      | Kaempferol ($C_{15}H_{10}O_6$; Molecular Mass: 286.05)   |                                    |
|                                                      | Kaempferol 3,7-di-O-glucoside ($C_{27}H_{30}O_{16}$; Molecular Mass: 610.15) |                                    |
|                                                      | Quercitrin ($C_{21}H_{20}O_{11}$; Molecular Mass: 448.10) |                                    |

(Contd.)
Table 4: (Continued)

| Plant part used | Phytochemicals | Relevant citation |
|-----------------|----------------|------------------|
| Methanolic extract of the defatted seeds | 5,7-dihydroxy chromone (C\(_{15}\)H\(_{10}\)O\(_{4}\); Molecular Mass: 178.03) | Jain and Gupta; Rastogi et al. [22,23] |
| | 5-hydroxy-3,7,4' /trimethoxy flavones (C\(_{18}\)H\(_{16}\)O\(_{6}\); Molecular Mass: 328.09) |  |
| Alcoholic extract fresh flower | Rutin (C\(_{27}\)H\(_{30}\)O\(_{16}\); Molecular Mass: 610.15) | Ragunathan, et al. [24] |

(Contd...)
### Table 4: (Continued)

| Plant part used                                                                 | Phytochemicals                                                                                      | Relevant citation                          |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--------------------------------------------|
| Air dried whole plant (without seeds) petroleum ether extract                    | Cleogynol \((C_{30}H_{50}O; \text{Molecular Mass: 426.39})\)                                      | Das, et al., [25]                          |
| Essential oil analysis by GC-MS                                                  | Carvacrol \((C_{10}H_{14}O; \text{Molecular Mass: 150.10})\)                                     | Lwande, et al., [26]                       |
|                                                                                  | Trans-phytol \((C_{20}H_{40}O; \text{Molecular Mass: 296.31})\)                                  |                                            |
|                                                                                  | Linabol \((C_{10}H_{18}O; \text{Molecular Mass: 154.14})\)                                       |                                            |
|                                                                                  | Trans-2-methyl cyclopentanol \((C_{6}H_{12}O; \text{Molecular Mass: 100.09})\)                  |                                            |
|                                                                                  | β-caryophyllene \((C_{15}H_{24}; \text{Molecular Mass: 204.19})\)                                |                                            |
|                                                                                  | Methyl isocyanate \((C_{2}H_{3}NO; \text{Molecular Mass: 57.02})\)                              |                                            |
| Argentation-TLC followed by re-crystallization of fractions of seed oil          | Clenbuterol \((C_{18}H_{28}O_{2}; \text{Molecular Mass: 850.76})\)                             | Roy, S., Ph.D Thesis 2007 [27]             |
|                                                                                  | β-sitosterol \((C_{29}H_{50}O; \text{Molecular Mass: 414.39})\)                                 |                                            |

(Continued...)
As an anti-inflammatory agent

In 2008 group of scientists uncovered the anti-inflammatory action of *C. gynandra*. They utilized thermal stimuli in hotplate test and the writhing reaction of the tested animals to an intraperitoneal infusion. From the outcomes, it was clear that the aqueous extract, to an intraperitoneal infusion. From the outcomes, it was clear that a notable antinociceptive activity in the hotplate test and writhing response, which is similar to that of the standard. Studies show that different flavonoids, for example, luteolin, rutin, hesperidin, quer cetin, and bioflavonoids produced substantial antinociceptive and anti-inflammatory activities [31]. A couple of reports on tannins as anti-inflammatory activities and antinociceptive properties. NSAIDs: nonsteroidal anti-inflammatory drugs in peripheral tissues can hinder cyclooxygenase, thus interfere transduction mechanism. The antinociceptive activity could be because of the flavonoid-mediated peripheral mechanism.

Most of the NSAIDs have all around adjusted mitigating and ulcerogenic exercises, which are thought to be because of prostaglandins synthetase inhibitor activity [32-34].

As an antioxidant agent

Antioxidant activity of ethanolic extract of *C. gynandra* was assessed against Ehrlich Ascites Carcinoma cell line at the doses of 400 and 200 mg/kg body weight intraperitoneally. The outcome indicated significant decline in tumor volume, viable cell count, tumor weight, and raised the life expectancy of tumor-bearing mice when compared with normal control mice. Hemoglobin, red blood cell, white blood cell, and lymphocyte count returned to the normal level in treated mice. Result reveals the extract has potent dose-dependent anticancer activity [36].

As an immunomodulator

Aqueous and alcoholic extracts of *C. gynandra* significantly diminishes the level of serum immunoglobulin G (IgG) in correlations with the level of IgG. Both aqueous and alcoholic extracts separately influenced IgM and IgG levels. Among the two tested samples, alcoholic extract demonstrated better activity even with lower amounts. The general pharmacological examinations strongly show the immunosuppressant activity of the alcoholic extracts and the aqueous extract of *C. gynandra*. Therefore, T cell-dependent antigen showed the inhibitory effect of both the extracts on T cells. The ethanolic extract of *C. gynandra* demonstrations better action; inhibition about 92.74% cell-induced hypersensitivity in the albino rat to evaluate the impact of the division on cell-mediated immunity [12].

As an antidiabetic agent

Herbal formulation of plants containing minor and trace elements in bioavailable that positively impacts glucose resistance and potentially increases self-ability to improve the diabetic condition. Essential nutrients such as Mg, Na, Fe, Ca, Se, Cu, and Zn has confirmed that many Indian herbs like *Eugenia jambolana* responsible for curing diabetes by providing fundamental supplements [37].

In some place of western Orissa, the leaves and roots are utilized by tribal people and conventional healers as an antidiabetic medicine. The reason of *C. gynandra* to use in diabetes might be anticipated for its antioxidant activities, its nutritive capacity, and immunomodulatory properties. The glucose oxidation enhancing pathway, because of antioxidant activities, its nutritive capacity, and immunomodulatory properties. The glucose oxidation enhancing pathway, because of antioxidant activities, its nutritive capacity, and immunomodulatory properties. The glucose oxidation enhancing pathway, because of antioxidant activities, its nutritive capacity, and immunomodulatory properties. The glucose oxidation enhancing pathway, because of antioxidant activities, its nutritive capacity, and immunomodulatory properties. The glucose oxidation enhancing pathway.
and anti-inflammatory capacities may offer a chance of synergistic treatment for this situation. The various plant phytochemicals supplementation does not have any huge effect on plasma glucose but rather altogether found to diminish malondialdehyde plasma level and the general redox parameters together with a fractional moderation of proteinuria. The experimental results demonstrate that, other than the control of glycemia, interference of phytochemicals with antioxidant and anti-inflammatory properties may have advantageous impacts when coordinated in the standard of the therapeutic regimen. Polyphenolic constituents and flavonoids’ intervention of C. gynandra have been appeared to be in response for the antioxidant property and have been attributed to different properties such as antitumor, antioxidant, and inhibitory of cardiovascular diseases. The aqueous and alcoholic extracts of C. gynandra are a possible foundation of natural antioxidants such as polyphenols and flavonoids. This can be utilized for an effective antioxidant compound that can shield from oxidative. Until April 2014 no hypoglycemic properties were considered or demonstrated. Ravichandra et al., 2014, concentrated the anti-diabetic and anti-lipidemic properties of C. gynandra in alloxan-induced diabetic rats. Ravichandra et al. concentrated the anti-diabetic a hostile to dyslipidemic movement of C. gynandra plant extricates in alloxan-initiated diabetic rats. The effect on the oral administration of alcoholic extract significantly reduced serum glucose and lipid profiles in diabetic control when compared with normal groups. Examination recommended that alcoholic extract of C. gynandra restrains blood glucose levels and dyslipidemia in diabetes rats. Therefore, leaf decoction of C. gynandra folk claims has been ascertained. Further, the mechanism of lowering blood sugar may be attributed to the presence of micronutrients and polyphenolics [10].

CONCLUSION

Over the past two decades, an expanding body of evidence from epidemiological and laboratory studies of the plant C. gynandra L. have demonstrated some nutritional aspect and identified ingredients with potent therapeutic values. Scientific perusal reveals C. gynandra has an excellent an indigenous medicine and act as an inflammatory, radical scavenging, antitumor, immunomodulatory, and anti-diabetic agent. Furthermore, C. gynandra has been used as several other ailments.

Yet, research needs to focus on the isolation of nutritional and therapeutic principles of C. gynandra. Survey of literature motivates both Re-search and Research of the plant to add new empirical solutions of many life-threatening diseases. Evaluation of synergistic/antagonistic outcome may include new herbal medicines to health-care management systems. Because most of the reports in India on this plant that has been carried out on the white mutant variety. However, in North-Eastern region the same plant abundantly found only in pink mutant variety. Extensive research needs to scrutiny this diversity of the plant in this biodiverse region. 

ACKNOWLEDGMENTS

PIPA is thankful to University Grants Commission, New Delhi for financial assistance through a UGC-MRP (F. 36-260/2008) to SBP

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