



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
[www.phytojournal.com](http://www.phytojournal.com)  
JPP 2020; 9(4): 651-655  
Received: 22-05-2020  
Accepted: 25-06-2020

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***Oxalis corniculata* Linn. (Oxalidaceae): A brief review**

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DOI: <https://doi.org/10.22271/phyto.2020.v9.i4i.11777>

**Abstract**

*Oxalis corniculata* Linn. is a highly useful and important traditionally used medicinal herbaceous plant which is found in tropical and subtropical areas of the world. The plant is commonly called creeping wood sorrel and it is belonging to the family Oxalidaceae. The plant has been used in different system of traditional medication for the treatment of diseases and ailments of human beings. The present review reveals the diverse ranges of phytomolecules which was previously isolated such as flavonoids, alkaloids, tannins, steroids, polyphenols, glycosidic compounds, lipids and volatile oil. The leaves of the plant contain medicinal substances like isovitexine, flavonoids, and vitexine-2-O-beta-D- glucopyranoside. It is a rich source of essential fatty acids like palmitic acid, oleic, linolenic and stearic acids. It possesses various important pharmacological activities like antioxidant, anti-cancer, anthelmintic, anti-inflammatory, antimicrobial, astringent, diuretic, febrifuge, cardio-relaxant and stomachic properties. These reports are very encouraging and indicated that the herb should be studied more details for its future therapeutic benefits. The current review article briefly describes the botanical features, ethnomedicinal uses, pharmacological properties and phytochemical composition of this medicinal herb. The present study is an attempt to combine and document the necessary information on different aspects of *Oxalis corniculata* and highlights the need for research and development.

**Keywords:** *Oxalis corniculata*, phytochemicals, ethnomedicine, pharmacology

**Introduction**

For thousands of year's natural resources has been an origin of medicinal plants and healthcare facilities. A tremendous number of modern drugs have been made from natural resources. Based on the applications of traditional medicine many of the important medicinal herbs were isolated from the nature. The usage of these was mentioned in the initial pledge of Indian medication system from ancient time. The herb derived folkloric treatment system continuously play a vital role in healthcare with about 80% of the world's inhabitants relying mainly on ethno medicines for their primary treatment purposes. Large proportions of world's population depend on traditional or folk medicine because of shortage and high cost of orthodox medicine and its unpleasant side effects [1, 7]. In India, the foundation of treatment system and remedy for several illnesses is herbal medicine from ancient days. Herbs are providing humans some of the very important lifesaving drugs which are used in the modern medication as well. There is a faith that herbal therapies are less toxic and risk free compared to the synthetic drugs in human body. Even practitioner of modern medication system has realized the significance of dietary items, in the form of nutraceuticals and in the treatment of many chronic diseases. The ethno pharmacologists, botanists, microbiologists and natural product researchers are constantly in search of efficacy and mode of action of different medicinal plants and their important medicinal substances as well [8, 11].

*Oxalis corniculata* Linn. is widely distributed in Asia, Europe, America and Africa. It belongs to the family of Oxalidaceae. It is freely grows in human settled areas, roadsides, garden, yards, almost in all warmer parts of India, especially in the Himalayas up to 2500 m of height. It is a herbaceous plant which generally grows in dampened and dark places. In India it is a renowned plant and the biological benefits of this herbaceous medicinal plant is known in all over the world. It contains essential phytochemicals that are required for normal and good health of human beings. It removes piles, kapha, vata and it is useful in diarrheas, dysentery and skin problems also [12, 15].

The herb is a good appetizer. To remove warts and in corneal opacity, infusion of its leaves is used externally. It has anti-scorbutic, anti-inflammatory, refrigerant, anti-septic, diaphoretic, anti-diabetic and diuretic properties also. It is used as a complementary medicine for curing cuts, anemia, dyspepsia, cancer, piles, dementia and convulsions.

Other alternative uses such as anthelmintic, anti-inflammatory, astringent, depurative, diuretic, febrifuge and stomachic properties has also been reported. The plant is also used in the treatment of fever, cold, cough, diarrhea, traumatic injuries, urinary tract infections and sprains. The important phytochemicals like  $\beta$ -carotene, Vitamin C and niacin are present in this plant. Extract of the plant is helpful in stomach troubles and jaundice [16, 21].



**Fig 1:** Natural habitat of *Oxalis corniculata* Linn.

#### Taxonomical Classification [7].

**Kingdom:** Plantae

**Division:** Magnoliophyta

**Class:** Magnoliopsida

**Order:** Oxalidales

**Family:** Oxalidaceae

**Genus:** *Oxalis*

**Species:** *corniculata*

**Botanical Name:** *Oxalis corniculata* Linn.

#### Vernacular Names [7].

Telegu- Ambotikura; Bengali- Amrul Shak; Assamese- Changeritenga; English- Indian sorrel; Oriya- Sialthur; Hindi- Khatari; Arabic- Hememdab; Tamil- Puliakire; Kannada- Julihunise gida; Malyalam- Puliyarila; Marathi- Bhinsarpati; Sanskrit- Shuklika.

#### Ethnomedicinal Uses

*Oxalis corniculata* has diverse range of ethno medicinal uses. It is used for liver and digestive problems in the village of Nepal. To cure headache the leaf paste is applied over the forehead. Crushed leaves are used to stop bleeding from cuts. The Boro tribals of Assam use the juice of the plant as eye drop for healing conjunctivitis. For digestion and diarrhea boiled plant parts are used with butter milk [22, 24].

It is also a good appetizer which removes kapa, vata, piles, dyspepsia and anaemia. It heals the skin diseases such as warts, corns and swelling. In case of snake bite Zairian people make a salted mixture paste of the plant with *Aframomum saguineum* and cover the whole bite area. It is also used as anti-venom purposes. As a home remedy of insomnia, the leaf extract of the plant is mixed with castor oil and taken for good sleep [25, 27].

The decoction of the plant leaves is also used to remove opacities of the cornea and it is applied into the eyes for itching lids. Leaves are used for gurgle purposes and it is also used as an antidote which happens due to poisoning by the

*Datura* seeds, arsenic and or by mercury. The sup of the leaves is applied to insect bites, burns and skin eruptions. The whole plant parts are used as anti-scorbutic in the treatment of scurvy [2, 3].

#### Distributions

*Oxalis corniculata* Linn. (Figure 1) is a herbaceous medicinal plant and it is low in growing habit and fragile. It is widely distributed in roadside, yards, gardens, parks, human settled areas and nearly all warmer parts of India and it grows up to a height of 2500 m of the Himalayas. Throughout the temperate and tropical regions of West Indies, South, Central and North America it is found widely. All over in Florida these medicinal plants are found, it is a cosmopolitan weed occurs in the old world as well. It is also spread in the eastern seaport town of the United States and in Ontario and Texas states [7, 28].

#### Morphological Descriptions

*Oxalis corniculata* is bushy in nature and creates a mat forming structure in its growing areas. The top portion of the plants are erected weakly smooth or bushy. They are branching from the bottom and rooted at the nodes [28].

**Leaves:** The leaves of the plants (Figure 2) are trifoliate, thin and heart shaped. The leaflets have a distinct apical indentation. Along the stem the leaves are arranged alternately and leaflets have reticulate venation [28].

**Stem:** The stem (Figure 3) of the plant is slender in shape and covered with soft short hairs. The internodes are 5 to 9 cm in length. It is sour in taste and smells like acidic [29].



**Fig 2:** Leaves



**Fig 3:** Stem & Root



**Fig 4:** Flower



**Fig 5:** Fruits

**Root:** The root (Figure 3) is dark brownish, thin, branched, soft; with no odor and taste [7].

**Flowers:** The flowers (Figure 4) are 6-12 mm wide and have 5 yellow petals [28].

**Fruits:** The fruits (Figure 5) are a capsule, 1-1.5 cm long, cylindrical, pointed and ridged [22].

**Seeds:** The seeds are oval in outline, rounded, basally pointed, flattened, light brown and have a surface distinctly ridged. It has stolons also [28].

### Phytochemical Components

Different types of phytochemical components have been isolated in previous studies from this medicinal herb such as tannins, flavonoids, polyphenols, steroids, alkaloids, volatile oil, fatty acid, glycosides etc. Essential fatty acids like palmitic acid, linoleic acid, linolenic acid, stearic acid and oleic acid presence were detected in this plant from earlier studies. The plant leaves are the huge source of vitexine-2-O-beta-D-glucopyranoside and vitexine. Carbohydrates, proteins, amino acid, fiber and calcium are detected in methanolic and ethanolic extracts of the plant in previous investigations. The stem and leaves are the huge source of citric and tartaric acid and the stem contains mallic acid also. The plant parts are also contains Vitamin C and carotene. It is enriched with oxalates and the leaves and stem taste acidic due to the presence of acidic phytocompounds [23, 30].

### Pharmacological Properties

The herb *Oxalis corniculata* showed various pharmacological activities in previous studies. These are as follows:

#### Wound Healing Property

The alcoholic and petroleum ether extracts of the whole plant has been assessed for its wound healing activity by using excision, incision and dead space wound models in animals. The whole plant extracts of *Oxalis corniculata* at the dose of 300 and 500 mg per kg body weight, respectively showed significant wound healing activity by generating an increase in contraction rate, breaking and significantly decreases in epithelization period [17, 31].

#### Anti-diarrheal Property

The anti-diarrheal activity of aqueous and methanolic decoctions of the plant was evaluated on castor oil induced diarrhea in rats and on small muscle intestinal transit. At all doses of the aqueous extract appeared to be more effective than the methanolic decoction. An oral administration of doses such as 160, 320 and 640 mg/kg of body weight showed the anti-diarrheal effects. These decoctions decreased the propulsion of charcoal meal through the small intestine and reduced the wetness of faecal droppings in castor oil induced diarrhea. Both the decoctions prolonged the time of onset of diarrhea and inhibited the frequency of defecation [32].

#### Anti-cancer Property

From a previous study it is concluded that ethanolic decoction was fruitful in inhibiting the tumor growth in ascites and solid tumor models. Ethanolic decoction was evaluated for its anticancer effects in Ehrlich ascites carcinoma induced in Swiss albino mice [33, 34].

### Anti-implantation and Abortifacient Property

In previous research study the petroleum ether and ethanol extracts of the whole plant was given orally at a dose of 100 and 200 mg/kg, respectively from day 1 to 7 of pregnancy period to determine the anti-implantation property. The pregnant animals which was given the treatment from day 8 to 14 of pregnancy period showed abortifacient effects and it was maximum (78.55%) with high dose of petroleum ether decoction. All the treated groups showed prominent anti-implantation property when laparotomised on day 10 and it was optimum (76.42%) on petroleum ether decoction [35].

### Anti-diabetic Property

An earlier study showed that the aqueous decoction of the plant has been tested for the inhibitory potential against procaine pancreatic amylase. The organic extracts did not show any prominent inhibition which may conclude that the bioactive compounds showed only amylase inhibitory effects in the water decoction. In this study 100µg/ml of extract concentration exhibited a maximum inhibition of 89.27% [1].

### Antibacterial Property

Antibacterial property of methanolic and ethanolic decoctions of the plant has been reported in earlier study. Methanolic and ethanolic decoctions showed significant antibacterial property against *Xanthomonas* and fourteen human pathogenic bacterial strains. In comparison to K-cycline and Bact-805 against bacteria, methanol decoctions showed significant effect, among the decoctions. In case of human pathogenic bacteria methanolic decoctions observed with moderately significant antibacterial property when compared with standard antibiotic streptomycin [36].

### Anti-inflammatory Property

The Methanolic decoction of whole plant was evaluated for its anti-inflammatory and antioxidant properties by *in vitro* methods. Aspirin was utilized as a standard drug for the study of anti-inflammatory property. The anti-inflammatory study was assessed by using albumin denaturation assay, membrane stabilization assay and proteinase inhibitory activity at a different concentrations levels. Results concluded that, the decoction exhibited significant DPPH and nitric oxide radical scavenging property with IC<sub>50</sub> value of 302.93±4.17 µg/ml and 73.07±8.28µg/ml, respectively. The decoction also showed *in vitro* anti-inflammatory property by inhibiting the heat induced albumin protein denaturation as well as RBC membrane stabilization and the IC<sub>50</sub> values of the study results are 288.04±2.78 µg/ml and 467.14±9.56µg/ml, respectively. The proteinase activity was also prominently inhibited by the decoction (IC<sub>50</sub> is 435.28±5.82µg/ml) [37].

### Anti-ulcer Property

In a research investigation the aqueous and ethanolic decoctions of the plants at dose levels of 200 and 400 mg/kg were evaluated for the anti-ulcer property. This was done by using the organic solvent ethanol induced gastric mucosal ulcers and pylorus ligated ulcers. There was a significant decrease in gastric volume as well as reduction in the free and total acidity treatment with the decoctions and the catalase and SOD levels was increased and lipid peroxide was decreased in both the decoctions [38].

### Anti-epileptic Property

Methanolic decoction of the leaves at doses of 200 and 400 mg/kg body weight were applied for assessing the anti-

epileptic property on Maximal Electroshock (MES) and Pentylentetrazole (PTZ) induced seizures models in animals. Same dose dependent study results were acquired in PTZ model by delayed the onset of clonic convulsions. It was reported in both the tests that the complete protective effect was against mortality. The results indicated that the decoction has anti-epileptic property on MES and PTZ induced convulsions and its mechanisms might relate to potentiating of the activity of GABA receptors and their signal transduction processes <sup>[39]</sup>.

### Hypolipidemic Property

Hyperlipidaemia was induced in animals by using high fat diet containing of coconut oil and vanaspati ghee, in a particular ratio at a dose level of 10 ml/kg. The used decoction showed a prominent reduction in biochemical parameters like triglycerides, cholesterol, LDL and MDA in blood. On the contrary, SOD, HDL and CAT were increased prominently in the study <sup>[40]</sup>.

### Toxicological Studies

In research study the methanolic extract on CCl<sub>4</sub>-induced nephrotoxicity in rat was investigated. Intraperitoneal injection of CCl<sub>4</sub> (1 ml/kg body weight, 20% in olive oil) once a day for 7 days caused nephrotoxicity as evident by elevated levels of urinary specific gravity, and biochemical parameters such as RBCs, WBCs, creatinine, protein, urobilinogen and nitrite. The hepato-protective property of aqueous and ethanolic leaves decoctions (200 and 400 mg/kg) were evaluated against thioacetamide-induced hepatotoxicity study. The study results showed that oral administration of the aqueous and ethanolic leaves decoctions at a dose of 400 mg/kg body weight results a prominent reduction in biochemical parameters like GGTP, ALP, SGPT, SGOT and bilirubin content that were comparatively less than the positive control <sup>[1, 2]</sup>.

### Conclusions

From the above explanation of the current review study, it can be said that *Oxalis corniculata* Linn. is was used in folkloric purposes since ancient time and which was reported earlier in various literature as well. The study highlights the morphological, phytochemistry, ethnomedicinal uses, pharmacological properties and therapeutic application of the plant. The plant may be used as a supplementary food source for its easy availability and low cost and it does not require special care for farming. Therefore, considering its entire potentiality it can be concluded that there is an ample scope for future research on *Oxalis corniculata* <sup>[41, 45]</sup>.

### Acknowledgment

The authors are thankful to Dr. Madhusudan Mondal, Former Additional Director, Botanical Survey of India, and Kolkata for identifying the plant and giving taxonomical inputs.

### Conflict of Interest

The author declares no conflict of interest.

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