

## Study of weed plants *Oxalis Corniculata* and *Anagallis Arvensis* and their evaluation of their antioxidant and antimicrobial properties

Gopal Jee Tiwari, Rashi Verma, Pragya Srivastava, Neelam Singh  
Department of Biotechnology, Bansal Institute Of Engineering and Technology, Lucknow  
Email ID - [jeetiwari.gopal@rocketmail.com](mailto:jeetiwari.gopal@rocketmail.com)

### Abstract

Weeds have been neglected and their use for medicinal purpose has not been considered on a large scale. *Oxalis Corniculata* and *Anagallis arvensis* is a very popular herb and it has many medicinal properties. The common name of *Oxalis Corniculata* is Indian sorrel and *Anagallis arvensis* is scarlet pimpernel. Our investigation is planned to explore the medicinal potential of *Oxalis Corniculata* and *Anagallis arvensis*. Our study associate with the phytochemical screening of any therapeutic importance, antimicrobial properties and antioxidant properties from these weed plants. The phytochemical analysis of *Oxalis Corniculata* and *Anagallis arvensis* extract revealed the presence of Proteins, Sterols, Saponins, Alkaloids, Phenolic compounds. The result obtained indicates that the plant is good for maintenance of good health and can also be used for the manufacturing of drugs. Antioxidant and antimicrobial activities of selected weed plants were also evaluated in this study. Plant extract using different solvent methanol, ethanol and chloroform were tested for antimicrobial activity against *Staphylococcus Aureus* and *Pseudomonas Aeruginosa*. The methanol extracts of *Oxalis Corniculata* and *Anagallis arvensis* demonstrated the highest antimicrobial activity against *Staphylococcus Aureus* with ZOI of 1.4mm and 4.9mm, respectively. Methanol extract *Anagallis Arvensis* also exhibited the highest antimicrobial activity against *Pseudomonas Aeruginosa* with a ZOI of 8.2mm, but *Oxalis Corniculata* did not inhibited. *Oxalis Corniculata* and *Anagallis arvensis* chloroform extract does not exhibit any inhibition against both of the microorganisms. Although ethanol extract of both plant exhibits ZOI of 0.7mm and 2mm against *Staphylococcus Aureus*, and *Anagallis Arvensis* inhibition against *Pseudomonas Aeruginosa* with ZOI of 7.8mm *Oxalis* does not exhibit any inhibition against it the antioxidant capacity of all the extracts was evaluated by employing DPPH radical scavenging. The methanol fraction of *Anagallis arvensis* demonstrated the highest antioxidant activity (68%). The findings showed that these plant all natural sources of antioxidants and antimicrobial. Both of the chosen weed is widely distributed, therefor their therapeutic characteristics can be utilized for human wellbeing.

**Keyword:** Phytochemical, antimicrobial, antioxidant, DPPH, ZOI

**Abbreviations** - WHO (World Health Organization), *S. aureus* (*Staphylococcus aureus*), DPPH (2, 2 – Diphenyl 1-picrylhydrazyl), ZOI (zone of inhibition)

### Introduction

There exists a pool of knowledge and information and the benefits of herbal drug in our ancient literature of Indian medicine Charak Samhita (1000 B.C.) mentions the use of over 2000 herbs for medicinal purpose. A large proportion of world's population depend on traditional medicine because of scarcity and high cost of synthetic medicines and their side effects. The chemical components of the plants and their pharmacological screening can provide us the basis for development of novel agent. The plant herbs provided us the lifesaving drugs. There is a worldwide belief that natural remedies are safer and less damaging to humans than synthetic drugs that's why the world is engaged in screening of plants for their bioactive activities with therapeutics potential. The traditional Indian medicinal system has a variety of herbal remedies for the treatment of disease (Srikanth et.al). India is the richest sources of traditional herbal plants with their prescriptions. In India, phytochemicals as well as medicinal plants have become the most abundant source of health care and life improvement since very long time. Phytochemicals are non-nutrient bioactive compounds which are responsible for scavenging toxic radicals after oxidative stress by generating antioxidants. They are chemicals found in plants that protect plants against bacteria, viruses, and fungi. They may act as antioxidants or nutrient protectors or prevent cancer causing agents from

forming. Plants are able to produce a large variety of bioactive components. Phytochemicals in fruits and vegetables in a high concentration can protect against free radical damaging. Plants which have phytochemicals can fulfill the needs of the human body by acting as natural antioxidants.

Among the many uses for plants, medicinal plants have long been used as a means of treating illnesses by people all over the world (Chaudhary, 1998; Rajbhandari, 2001; Manandhar, 2002). The therapeutic benefits of plants are mentioned in some of the earliest archaeological records from both the Old and New Worlds. Since the Vedic era between 2500 and 500 B.C medicinal plants of the Indian subcontinent, especially the Himalaya, have been researched and documented in various Ayurvedic literatures (Ghimire et al., 2008). The antibacterial compounds found in medicinal plants are abundant (Abi Beaulah et al., 2011).

Natural remedies such as medicinal plants can treat a wide range of human illnesses. Numerous medicinal plants are frequently used as antibiotics by Ayurvedic and Unani medical practitioners. (Perumal et al., 2004) Medical plants were used around the world to treat viral, bacterial, and fungal illnesses.

Due to the worrisome rise in the prevalence of newly emerging and reemerging infectious diseases, there is an ongoing and urgent need to discover new antimicrobial agents with varied chemical structures and unique modes of action.

Herbal products have grown exponentially worldwide in recent years as a result of the massive rise in the usage of plant-based health products. The human body can generate oxygen-centered free radicals, other reactive oxygen species and byproducts through a variety of physiological and biological activities.

According to Erdemoglu et al. (2006), excessive generation of these free radicals causes biochemical oxidative damage that results in a number of chronic disorders. The antioxidant of plant-derived sources has raised due to the potential health benefits because of their ability to scavenge radicals. A free radical is a free atom, molecule, or ion which contains one or more unpaired electrons. The term "antioxidant" tells about a wide range of different molecules. The common feature of antioxidant is their ability to donate electrons while remaining stable themselves and act as reducing agent and minimizing damage caused by free radicals. The antioxidants help us to protect our body against the severe and destructive effects of free radicals damage. Free radicals generated in cells and tissues may be from internal or external sources or from the consequences of decreased protective capacity. High production of free radicals can cause oxidative stress or damage which is not good for our health. Bacteria and fungi have the ability to develop resistance to antibiotics, anti-fungal and antimicrobial drugs at any point of time. It means antibiotics once used to kill or inhibit their growth may be no longer effective against bacteria. The people become resistant to antimicrobial drug because during the treatment of any disease a person is injected with antimicrobial drug that antimicrobial drug kills the most susceptible microbes first but when the treatment is stopped before all the pathogens got killed then the survived bacteria may develop a resistant to that particular antimicrobial drug. In that case, the person gets exposed to the same drug so the next time the antimicrobial drug may get ineffective as the bacteria and their progeny became resistant to that antimicrobial drug. Patients and healthcare systems are being put under a tremendous deal of stress due to the emergence of resistance among the most prevalent human bacterial infection. Traditional medicines have been utilized since the dawn of time to treat infectious diseases with higher plants and their extracts. The world's population relies on plant extracts for defense in about 80% of cases. However, only a small portion of these plants have been tested for their pharmacological or biological effects. Different infections in human races are brought on by microbes that are free to travel the planet. About 43% of all deaths in underdeveloped nations are caused by infectious illnesses. WHO asserts that main infectious illnesses are significantly under control. Pathogenic bacteria have become resistant to a wide variety of antibiotics as a result of the inconsistent usage of antimicrobial medications currently on the market.

*Staphylococcus aureus* (*S. aureus*) is a spherical, clustered, gram-positive bacterium that mostly affects humans and animals. It belongs to the *Staphylococcus* genus and the *Staphylococcaceae* family. Sir Alexander Ogston (1881), a Scottish surgeon, found that *Staphylococcus* could result in wound infections in living

products in both developed and developing nations (Jain et al., 2006; Zafar, 2009; Hasan, 2014).

creatures while carrying out an operation. About one-third of the population typically has *S. aureus*, or "Staph" bacterium, on their skin or nose. In healthy people, these bacteria typically cause mild skin infections. But when *S. aureus* bacteria develop antibiotic resistance, they can lead to dangerous opportunistic infections or illnesses. Around 5% of the population reportedly has the MRSA strain, according to a survey conducted by the US Centers for Disease Control and Prevention (CDC). In 1961, MRSA was first identified. It is resistant to several popular antibiotics, including methicillin, penicillin, oxacillin, cloxacillin, cefazolin, and cefoxitin. The most important factors affecting the treatment of *S. aureus* infections are the kind of infection and whether or not drug-resistant strains are present. When antimicrobial therapy is required, the type of infection, as well as other circumstances, heavily influences the length of time and the type of therapy. Penicillin and vancomycin are still the recommended medications for isolates that are susceptible to them (MSSA, or methicillin-sensitive *S. aureus* strains), respectively. Alternative therapies may occasionally be required in addition to antibiotics. Any molecular species with an unpaired electron in an atomic orbital is referred to as a free radical. Numerous diseases can be brought on by free radicals. Free radical played important roles in the development of many chronic diseases, including cardiovascular diseases, aging, heart disease, anaemia, cancer, inflammation, etc. Antioxidant properties can protect cells from the cell damage caused by free radicals. The root cause of the development and progression of several diseases is because of oxidative stress. Supplementing antioxidants or boosting endogenous antioxidant defences the body by reducing the undesirable effects of reactive oxygen species (ROS) induced oxidative damage. Plants have an innate ability to biosynthesize a wide variety of non-enzymatic antioxidants which are capable of attenuating ROS-induced oxidative damage.

*Oxalis corniculata* is an Indian penny wood. Creeping wood sorrel, creeping oxalis, sleeping beauty and procumbent yellow sorrel all are common names of *Oxalis corniculata*. *Oxalis corniculata* belongs to the family of Oxalidaceae. It is a well-known plant in India and is one of the most important and consequently used medicinal plants having a wide range of biological activities. It is known as creeping wood sorrel. It is a well-known plant in the natural habitat having all the essential constituents that are beneficial for normal and good health of humans.

Creeping wood sorrel is a worldwide weed which is almost impossible to get rid of. It has beautiful yellow flowers with uncertain origin. It has become so widespread long ago branching from the base and often rooted at the nodes. The upper portion is ascending or weakly erect, smoothly and heady. The leaves are arranged alternately along the stems. A single long stalk arises from the axils of the leaf from which it extends 3 flower stalks each with a single flower. The fruit is a capsule 1-1.5 cm long, cylindrical, pointed typically and 5 ridged in cross section. Creeping wood sorrel is also found in the Himalayan altitudes of

300 to 3000 m. Flowering is from February to October the flowers are 7 to 11 mm wide and have 5 yellow petals. The seeds are oval in outline, basally pointed, flattened in cross section, light brown and have a surface distinctly transversely ridged.

It is a very effective herb used for treating stomach and liver problems in Ayurveda medicine system. Leaves of this plant are edible, with tangy taste just like taste of lemons. This herb is richest source of vitamin -C, B, potassium and oxalic acid. Flowers are sour in taste and rich in oxalic acid and potassium oxalate. Leaves of this plant are astringent and bitter in taste. It is a self-pollinator flower which is having a capacity to grow fast in open grasslands. This plant is used as weed for glasshouses. Red to brown, yellow and orange dyes are obtained from this plant. This plant is edible and it is used as salad. This plant is anti-scorbutic and used in the treatment of scurvy. This herb is anti-inflammatory, anthelmintic, diuretic, febrifuge, relaxant, stomachic, astringent, analgesic and styptic in nature. The most occurring chemical compound present in this herb are oxalic acid and vitamin C. This herb is also rich in water, fat, proteins, calcium, phosphorous, iron, niacin and beta carotene. Other chemical compounds present in this herb are flavonoids, phytosterols, phenol, tannins, fatty acids and volatile oils. Leaves are rich in flavonoids, isovitexine, and vitexine. It also contains essential fatty acids such as oleic acid, palmitic acid and stearic acid. Stem of this plant is rich in tartaric, malic acid and citric acid.

*Oxalis corniculata* is a delicate-appearing, low-growing, herbaceous plant broadly distributed in damp shady places, roadsides, plantations, lawns, nearly all regions throughout the warmer parts of India, especially in the Himalayas up to 8,000 feet cosmopolitan. It is also distributed in ballast about the eastern seaport town of the United States and becomes quite abundant in Texas and Ontario. These weeds are found throughout Florida. They are common in the south-eastern United States, from Newfoundland to North Dakota and southward to Mexico. *Oxalis corniculata* is a weed occurring in temperate and tropical regions of North, Central and South America and the West Indies. They are tap rooted herbs, bushy or mat forming, and 0.1-0.5 m tall, branching from the base and often rooted at the nodes, the upper portions are ascending or weakly erect smooth or hairy. The stem is slender and pubescent about 0.4 to 1.5 cm long. The internodes vary from 4.5 to 8.5 cm in length. It has acidic odour and has sour taste when it is fresh one. The trifoliate (three leaves) leaves are alternate, with thin, heart-shaped, leaflet blades having a distinct variety. This herb is known to have an acid taste due to the high content of oxalate in its leaves and stems.

#### Taxonomic Hierarchy of *Oxalis corniculata*

**Kingdom:** Plantae

**Division:** Tracheophyta

**Order:** Oxalidales

**Family:** Oxalidaceae

**Genus:** *Oxalis*

**Species:** *O. corniculata*

In Nepal village, *Oxalis corniculata* is used as medicinal herb and the leaf decoction is used in fever and dysentery in some areas of Madhya Pradesh. Maceration of the whole plant with leaves of

*Sida acuta* is taken orally to treat gonorrhoea in Cameroon. The herb juice is used as eye drop in conjunctivitis. The local inhabitants of Tehsil Chakwal (Pakistan) use plant sap to cure skin diseases and the leaves act as cooling agent and refrigerant in stomach disorders, fever and acute headache and also in snake bite. Plant pounded with cumin seeds are taken with water thrice a day for dysentery. It is also used for sensitive teeth. This weed plant possess anti-inflammatory, anxiolytic, anticonvulsant, antifungal, anti-ulcer, anti-nociceptive, anti-cancer, anti-diabetic, hepatoprotective, hypo-lipidemic, abortifacient, anti-microbial and wound healing properties. Creeping Wood Sorrel is used in the treatment of influenza, fever, urinary tract infections, enteritis, diarrhoea, traumatic injuries, sprains and poisonous snake bites. The juice of the plant along with mixed butter is applied to muscular swellings, boils and pimples. An infusion can be used as a wash to rid children of hookworms. The plant is a good source of vitamin C and is used as an antiscorbutic in the treatment of scurvy. The leaves are used as an antidote to poisoning by the seeds of *Datura spp*, arsenic and mercury. The leaf juice is applied to insect bites, burns and skin eruptions. It has an antibacterial activity. This herb is a good appetizer as it removes kapha, vata, and piles, cures dysentery and diarrhoeas, skin diseases and fevers. An infusion of the small leaves of it externally, used to remove warts and opacities of cornea. Leaves of this plant are anti-inflammatory, refrigerant and antiscorbutic. The leaves of the plant also contain medicinal substances.

Fresh leaves of *Oxalis corniculata* are crushed and used to halt bleeding from wounds the plant's extract is utilised in cases of scorpion stings.



Figure - *Oxalis corniculata* with leaves and flowers

*Anagallis arvensis* is commonly known as scarlet pimpernel, blue pimpernel, shepherd's clock, poor man's weatherglass. It is a low-growing annual plant found in Europe, Asia and North America. It is traditionally included in the family Primulaceae. *Anagallis* is now considered to be better placed within the related family Myrsinaceae. *Anagallis arvensis* is a small, annual, hairless plant, erect or spreading with cross section stem branched from the base and non-radicant which does not exceed 20 cm in height and 50 cm in length for a prostrate growth habit. The leaves are opposite or in whorls of 3, simple, sessile, with oval lamina, broad at the



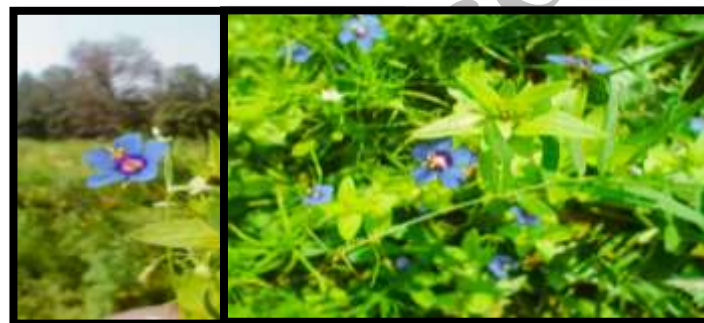
base, acute at the apex, with an entire margin, and glandular. The flowers are solitary and are located on the upper leaf axils. Their pedicel exceeds the leaf that underpins it. The petals are fused at the base. Their colour is either red or blue. The fruit is a spherical capsule with a loculus, with a circular opening. It contains numerous angular shaped seeds with reticulated surface, dark brown to black in colour. The cotyledons of *Anagallis arvensis* are short-stalked and have an oval lamina, attenuated at the base with pointed ends. They are dark green in colour. The first leaves are opposite and glabrous. They are short-stalked with oval lamina which is as long as broad. Dark spots are present on the underside of the leaf. The plant also has a taproot system. The stem is having a squarish cross section which is 10 to 50 cm long. It is prostrate but non-radicand. The flowers of *Anagallis arvensis* are solitary and are located on the upper leaf axils. The pedicel is longer than the leaves which get curved after fertilization. The calyx consists of five oval lobes pointed at the end along with a keeled back fused at their base. The corolla has 5 petals broadly obovate, with rounded or blunt tip, fused at their base. They are of red, orange or blue or mixed colours. The 5 stamens with hairy-filaments are free and they are inserted on the base of the corolla. The sub-spherical ovary carries an elongated style. The placenta is fully covered by the ovules. The fruit of *Anagallis arvensis* are globular, dehiscent, apiculate capsule which has a circular opening. It consists of a single loculus which encloses number of seeds in it. The seed is angular to sub globular, more or less angular. Its surface is cross-linked and dark brown to black.

#### Taxonomic Hierarchy of *Anagallis arvensis*

**Kingdom:** Plantae  
**Order:** Ericales  
**Family:** Primulaceae  
**Subfamily:** Myrsinoideae  
**Genus:** *Anagallis*  
**Species:** *A. Arvensis*

*Anagallis Arvensis* has recognized medicinal values as an anti-mycotic, antimicrobial, molluscicidal, antioxidant, anti-inflammatory, antileishmania, antiviral, cytotoxic, and spermatogenesis. In old Herbals, *Anagallis Arvensis* or Scarlet Pimpernel was used for many purposes both cosmetic and medicinal. It also produces potions for lowering the effects of being bitten by mad dogs. A decoction of the herb is used to treat shortness of breath, tuberculosis, gynecological disorders, and rabies. It is also used as a diuretic and is used for washing wounds that are external. The essence from blooming plants is used in homeopathy. *Anagallis arvensis* (*A. arvensis*) belongs to the family *Primulaceae* is utilized for treating liver diseases, skin rashes, moles, urinary contamination, irritation, wounds, and kidney problems. The aerial parts of this plant are used traditionally to make an ointment for treating external infections or infected pimples and wounds. The plant is used as diaphoretic, expectorant, rheumatism, hepatic and renal complaints, epileptic attacks, mania, oedema, antifungal, and anti-inflammatory agent. The effects of *Anagallis arvensis* crude extract and its folkloric

usage have been established. The properties of this herb are very active but are not yet fully known so care should be exercised in using it. The entire plant of *Anagallis arvensis* is used to treat cattle in India as a sedative, stimulant, anti-asthmatic, and anti-flatulent. *Anagallis arvensis* is used as an antibacterial and antihemorrhagic in Navarra as a poultice, decoction, ointment, or infusion of entire or aerial portions. *Anagallis arvensis* (Chari saben) is listed under "Plants having Anti-tussive and Expectorant activity".



**Figure - *Anagallis Arvensis***

#### Discussion

The qualitative phytochemical analysis of *Oxalis Corniculata* and *Anagallis Arvensis* extract revealed the presence of protein, sterol alkaloid, tannins, Saponins, phenolic compound, flavonoid and terpenoids. But carbohydrate is absent in extract of *Oxalis Corniculata* and present in extract of *Anagallis Arvensis* that is shown in table 5.1. The presence of these phytochemicals is an indicator that the plant can be a potential source of precursors in the development of synthetic drugs. The results highlighted the capabilities of leaves methanol extracts as good DPPH. The antioxidant activity of *Oxalis Corniculata* by DPPH method. The methanol extract of *Oxalis Corniculata* demonstrated the highest antioxidant activity (68.5%) and the antioxidant activity of methanol extract of *Anagallis Arvensis* is 62.4. The findings showed that these plants are natural sources of antioxidant s. These plant further used against oxidative stress and free radicals. Antimicrobial activities of selected weed plants were also evaluated in this study.

Plant extract using different solvent methanol, ethanol and chloroform were tested for antimicrobial activity against *Staphylococcus Aureus* and *Pseudomonas Aeruginosa*. The methanol extract of *Oxalis Corniculata* and *Anagallis Arvensis* demonstrated the highest antimicrobial properties against *Staphylococcus Aureus* with ZOI 1.4mm and 4.9mm respectively. Methanolic extract of *Anagallis Arvensis* inhibit the *Pseudomonas Aeruginosa* with ZOI 8.2mm but methanol extract of *Oxalis Corniculata* did not inhibited. The chloroform extract of *Oxalis Corniculata* and *Anagallis Arvensis* did not inhibit both microorganisms. The ethanol extract of *Anagallis Arvensis* demonstrate the highest ZOI 2mm than *Oxalis Corniculata* ZOI is 0.7mm against *Staphylococcus Aureus*. The ethanol extract of

*Anagallis Arvensis* inhibit the *Pseudomonas Aeruginosa* with ZOI 7.8mm but ethanol extract of *Oxalis Corniculata* did not inhibit. Since both the selected weeds have many medicinal properties can be exploited and used for human welfare.

### Conclusion

The results reveal the presence of medicinally active constituents in the two weed plants studied. The phytochemical compounds identified in this study have earlier been proved to be bioactive. The presence of some of these compounds have been confirmed by previous workers to have medicinal as well as physiological activity and therefore could be said to be responsible for the efficacy of the leaves of the plants studied in treatment of different ailments. The plant extracts could therefore be seen as a potential source for useful drug. The result revealed that the methanol extract of *Oxalis Corniculata* have highest antioxidant activity than *Anagallis arvensis*. The result also conclude that the methanol extract of *Anagallis Arvensis* inhibit both microorganism with highest ZOI. The continued traditional medicinal use of these plants is therefore encouraged while it is suggested that further work should be carried out to isolate, purify and possibly characterize the active constituents responsible for the antimicrobial and antioxidant activity of these plants and development of herbal drug.

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### Conflict of Interest

The authors have no conflicts of interest to declare. All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication

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