

REVIEW ARTICLE

A REVIEW ON PLANT PROFILE AND PHARMACOLOGICAL ACTIVITY OF *POLIANTHES TUBEROSA* LINN.**Chantra I*, G. Umarani, Sevanthi D, Priyanka M, Lokeshwari P and Gayathri S**

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Abstract:

Polianthes tuberosa Linn., commonly known as tuberose, is a perennial plant belonging to the family Asparagaceae. Widely cultivated for its fragrant flowers, it has been traditionally used in various medicinal systems across the globe. This review aims to provide a comprehensive overview of the plant's botanical characteristics, phytochemical composition, and reported pharmacological activities. The plant is rich in bioactive compounds such as glycosides, saponins, flavonoids, and essential oils, which contribute to its therapeutic potential. Various studies have highlighted its antimicrobial, antioxidant, anti-inflammatory, and analgesic properties, supporting its ethnomedicinal uses. Additionally, the aromatic oil extracted from its flowers finds extensive application in perfumery and aromatherapy. Despite its traditional significance, scientific exploration of *Polianthes tuberosa* remains limited, indicating a need for more detailed pharmacological and toxicological studies. This review underscores the medicinal potential of *P. tuberosa* and advocates for further research to validate and expand its applications in modern medicine.

Keywords: *Polianthes tuberosa*, Plant Profile, Pharmacological Activity.

1. Introduction:

Medicinal plants have been a cornerstone of human health and healing practices for thousands of years, forming the basis of traditional medicine systems across the world. In India, such plants are integral to systems like Ayurveda, Siddha, Unani, and various forms of folk medicine. Historical texts such as the Charak Samhita and Sushruta Samhita document hundreds of plant species used for treating a wide range of ailments. Today, it is estimated that about 80% of people in developing countries still rely heavily on plant-based remedies for their primary healthcare needs. This reliance is largely due to the accessibility, affordability, and cultural familiarity of traditional medicines compared to modern pharmaceuticals^[1].

Polianthes tuberosa L., a member of the Agavaceae family (also classified under Asparagaceae or Amaryllidaceae by some botanists), is a flowering plant widely known in English as 'Double Pearl

Tuberose’ and locally in Bangladesh as ‘Rojonigondha’. It is characterized by long, grass-like leaves, an underground bulb, and tall flowering stems bearing clusters of white, fragrant flowers. Traditionally, various parts of this plant have been used in ethnomedicine in Bangladesh for treating conditions such as tumors, sexual disorders, urinary issues like gonorrhea and as a laxative, diuretic, emetic and cosmetic [2].

The alcoholic extract of tuberose flowers has demonstrated notable antibacterial effects against *Proteus mirabilis* and *Escherichia coli*, along with antioxidant properties that help neutralize free radicals—factors often linked to inflammation and neurological or psychiatric disorders. Additionally, certain aromatic compounds isolated from tuberose have been found to possess antioxidant activity. Phytochemical studies have identified various constituents in the plant, including flavonoids, spirostanol, and furostanol derivatives[3].

2. Plant Profile

2.1 Taxonomical Classification^[4]

Kingdom	-	Plantae
Sub-kingdom	-	Tracheobionta
Division	-	Magnoliophyta
Class	-	Liliopsida
Sub-class	-	Liliidae
Order	-	Liliales
Family	-	Agavaceae
Genus	-	Polianthes
Species	-	Tuberosa
ScientificName	-	<i>Polianthes tuberosa</i> L

2.2 Vernacular Name^[5]

In India, tuberose is commonly known as

- Tamil - Nila Sampangi
- Hindi - Gulchari and Galshabbo
- Bengali - Rajanigandha
- Telugu - Sukandaraji and Nelasanpengi
- Kannada - Sugandharaja
- English - Double Pearl Tuberose

2.3 Distribution

Tuberose, scientifically known as *Polianthes tuberosa*, is originally indigenous to Mexico. It thrives best in warm climates, typically flourishing in tropical and subtropical regions.

Tuberose cultivation is widespread across several countries, including India, China, Bangladesh, Mexico, Kenya, Italy, France, Morocco, the United States, Hawaii, and South Africa.

In India, it is commercially cultivated in states like West Bengal, Karnataka, Tamil Nadu, Maharashtra, Uttar Pradesh, and the North Eastern regions^[6].

3. Pharmacognostical Description

3.1 Habitat:

Polianthes tuberosa, commonly known as tuberose, is native to Mexico, particularly in the seasonally dry tropical regions of central and southern areas. It is believed to have been domesticated by the Aztecs and is no longer found in the wild.

Today, tuberose is widely cultivated in tropical and subtropical regions around the world, including India, for its fragrant flowers used in perfumery and ornamental purposes^[7]

3.2 Leaves:

The leaves of *Polianthes tuberosa* (tuberose) are long, narrow, and lanceolate, typically measuring 30–60 cm in length and 1–1.5 cm in width. They are arranged in a basal rosette and are slightly succulent, with a dull green to glaucous appearance^[8].

Microscopically, the leaf epidermis exhibits paracytic stomata, and the mesophyll is composed of palisade and spongy tissues, which are involved in scent emission during anthesis. These morphological characteristics contribute to the plant's ornamental value and its use in perfumery^[8].

3.3 Inflorescence:

The research revealed that planting depth and bulb size had no significant effect on certain traits such as the number of days to spike emergence, spike length, number of nodes per spike, and inflorescence length. However, other growth parameters were significantly influenced by these factors. Bulb size, in particular, played a vital role in determining spike emergence timing, spike diameter and length, and the germination percentage. Smaller bulbs generally failed to flower, likely due to their lack of physiological maturity. In contrast, larger bulbs demonstrated better flowering performance, and although they germinated slightly later, they developed more quickly due to enhanced metabolic activity. For optimal yield and superior flower quality in tuberose cultivation, using bulbs of 3.5 cm diameter planted at a depth of 6 cm is recommended^[9].

3.4 Flowers:

The flowers of *Polianthes tuberosa* are waxy, white, tubular, and highly fragrant, often blooming in the evening and night, which makes them popular in perfumery. They are borne on a terminal spike and typically arranged in pairs at the nodes, showing acropetal development (flowers open from bottom to top). Each flower has a 6-lobed perianth with a slender tube, contributing to its ornamental and commercial value^[10].

4. Ethnomedicinal Uses of the Plant

In addition to its use in Bangladesh, various parts of the tuberose plant are also utilized for medicinal purposes in other countries. The plant is used for gonorrhea, insomnia and low sex drive by people of In the Kolli Hills region of Namakkal district, Tamil Nadu, India, tuberose is traditionally used to enhance sex drive. In the Dominican Republic, its flowers are consumed as tea to support women's health. Various parts of the plant—including the root, stem, flower, and the entire plant—are utilized in the treatment of tumors, as cosmetics, laxatives, cooling agents, placebos, and for managing sexual disorders, hair coloring, as well as acting as emetics, diuretics, and remedies for gonorrhoea^[11].

5. Phytochemical of *Polianthes tuberosa* Linn.

S. No	Plant Parts	Phytochemicals	Reference
1	Aerial Parts	- Bidesmosidic cholestane glycoside - 3 new spirostanol saponins - Cholestane glycoside	12
2	Bulbs	- 3 Glycosides - Long chain alcohol (e.g., tricosanol)	13, 14
3	Underground Parts	- 4 new spirostanol saponins with 5 monosaccharides	15
4	Fresh Tubers	- 6 new steroid glycosides (2 spirostanols: polianthosides B & C; 4 furostanols: polianthosides D–G) - 7 known spirostanols - 1 known furostanol saponin	16, 17
5	Leaves	- Tuberolactone - Kaempferol - Kaempferol-3-O-xyloside - Kaempferol-3,4'-O-dixyloside - Alpha-D-glucoside	18
6	Whole Plant Extract	- Geraniol - Indole - Methyl anthranilate	19, 20
7	Isolated Compounds	- Geraniol	21
8	Essential Oils	- Geraniol (from <i>Cymbopogon martinii</i> and <i>Pelargonium graveolens</i>)	22
9	Flowers	- Aromatic compounds - Methanolic extract - Essential oils	23

6. Pharmacological Activity

6.1 Freeradical Scavenging Activity (Antioxidant Capacity)

We tested the antioxidant properties of the extracts using the DPPH method. Various concentrations of the extract or standard (ranging from 500 to 0.977 µg/mL) were mixed with 3 mL of DPPH solution (20 µg/mL in methanol). After a 30-minutes incubation at room temperature in the dark, the absorbance was recorded at 517 nm using a UV-Vis spectrophotometer (Shimadzu, Japan), with methanol as the blank. The percentage of radical scavenging was calculated using the formula:

$$(I\%) = (1 - A_{\text{sample}}/A_{\text{Blank}}) \times 100$$

The IC₅₀ value, indicating the concentration required to inhibit 50% of DPPH radicals, was determined from the inhibition curve. This study reveals the extract possessing biological activity such as antioxidant effect^[24].

6.2 Antimicrobial Activity

The antimicrobial properties of *P. tuberosa* L. The bulb extract was evaluated using the agar disc diffusion method. Bacterial strains were cultured on Mueller-Hinton agar, while yeast was grown on Sabouraud agar. Inoculates were prepared from 24-hour-old microbial cultures and adjusted to match a turbidity of 0.5 McFarland standard. Once the agar plates (90 mm in diameter) were inoculated with the microbial suspensions, 6 mm discs of Whatman No.1 filter paper were each loaded with 10 µL of the alkaloid extract at a concentration of 50 mg/mL. The discs were carefully arranged on the surface of the agar that had been inoculated. Discs is treated with only solvent which is used as negative controls. Following incubation 24 hours at 37°C for bacteria and 48 hours for yeast the plates were examined, and the diameters of inhibition zones around the discs were measured in millimeters to determine antimicrobial activity. The research emphasized the antimicrobial properties of *Polianthes tuberosa* L. bulbs and bulbils extract^[25].

6.3 Antidiabetic Activity

By In-vitro Drug Release Study

The in vitro drug release profile was studied using the dialysis bag diffusion method. A 5 mL portion of the drug formulation was enclosed within a dialysis membrane (molecular weight cut-off: 1200 kDa Mumbai, India). Both ends of the membrane were securely sealed, and the bag was submerged in 100 mL of phosphate buffer (pH < 7.4) contained in a beaker^[26]. The assembly was positioned on a magnetic stirrer operating at 1000 rpm, with the temperature consistently maintained at 37 ± 1°C. At predetermined time intervals, 5 mL of the buffer solution was removed and promptly replenished with an equal volume of fresh buffer to maintain sink conditions. Throughout the whole study we find the result more satisfying about antidiabetic activity^[26].

6.4 Cytotoxicity

By Cytotoxicity Assay

The cytotoxic effects of the samples were evaluated using the MTT assay (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide). A total of 2×10^3 cells per well were seeded into 96-well plates and incubated for 12 hours to facilitate cell attachment^[27]. After incubation, the cells were exposed to six different concentrations of the test samples in triplicate for 72 hours. After treatment, 20 µL of MTT solution (0.5 mg/mL) was added to each well, followed by a 4-hour incubation at 37°C^[27]. A solubilizing buffer containing 5% isobutyl alcohol, 12% SDS, and 0.01 mol/L HCl (200 µL per well) was used to dissolve the formazan crystals. The absorbance was read at 595 nm using a microplate reader, and IC₅₀ values were calculated using the logit analysis method. Earlier reports indicated that saponins from *Polianthes* species showed cytotoxic effects on several cancer cell lines. In this research work, the essential oil of *P. tuberosa* flowers demonstrated cytotoxic activity against HeLa, A549, and Hep-2 cells, with IC₅₀ values of 103, 93 and 73 µg/mL, respectively^[27].

6.5 Antibacterial Activity

By Paper Disc Diffusion Method

The antibacterial activity of *P. tuberosa* flower, stem, and tuber extracts prepared using hexane, ethyl acetate, and methanol was evaluated through the paper disc diffusion method. Clindamycin hydrochloride was used as reference standard for this study^[28]. The test was carried out against *Staphylococcus epidermidis* and *Propionibacterium acnes*. For the assay, 15 mL of Nutrient Agar (NA) was poured into sterile petri dishes and allowed to solidify. Once solidified, 0.1 mL of the bacterial suspension was evenly spread across the agar surface using a Drygalski spatula, followed by a 15-minute adaptation period^[28].

Each sterile filter paper discs (6 mm in diameter) were saturated with different concentrations of plant extract such as 100%, 50%, 25%, and 12.5% . Tween-80 (5% w/v) served as a negative control, while clindamycin hydrochloride at 50 mg/mL functioned as the positive control. The inoculated plates were incubated at 37°C for 24 hours. After incubation, the inhibition zones were measured using a caliper to assess antibacterial activity. Each test was performed in triplicate to guarantee precision and reproducibility. The ethyl acetate and methanol extracts from the flower, stem, and tuber of *Polianthes tuberosa* L. exhibited antibacterial effects against *Staphylococcus epidermidis* and *Propionibacterium acnes*. All examined parts of the plant exhibited significant antibacterial activity^[28].

Conclusion:

Polianthes tuberosa Linn. is a traditionally valued plant with promising pharmacological properties such as antimicrobial, antioxidant, and anti-inflammatory activities. Its bioactive compounds highlight its potential for medicinal applications. However, scientific research on this plant is still limited. Further studies are needed to explore its therapeutic efficacy and safety for potential pharmaceutical use.

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Declaration Of Competing Interest:

The authors declare that they have no competing interests.

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