

A Comprehensive Review on *Coccinia Grandis*

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ABSTRACT: Parkinsonism is a progressive neurological syndrome characterized by motor manifestations such as bradykinesia, rigidity, tremor and postural instability, primarily associated with dysfunction or degeneration of dopaminergic neurons in the substantia nigra. Oxidative stress, mitochondrial dysfunction, neuroinflammation, excitotoxicity and α -synuclein accumulation are among the important mechanisms involved in dopaminergic neuronal degeneration. Although currently available therapies provide symptomatic relief, the need for safer and more effective neuroprotective approaches has encouraged research into medicinal plants. *Coccinia grandis* (L.) Voigt, commonly known as ivy gourd, is a perennial climbing plant belonging to the family Cucurbitaceae and has been traditionally used for various health conditions. Different parts of the plant contain several bioactive constituents, including alkaloids, flavonoids, triterpenoids, saponins, β -sitosterol, lupeol and β -amyrin. Previous studies have reported diverse pharmacological activities of *C. grandis*, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic and hepatoprotective effects. These reported properties and the presence of biologically active phytoconstituents suggest that *C. grandis* may have potential relevance in the management of neurodegenerative conditions. This review summarizes the available information on Parkinsonism, its pathogenesis, the botanical and phytochemical profile of *C. grandis*, and its reported pharmacological activities, with particular emphasis on its potential as a source of compounds for antiparkinsonian research. The review also highlights the need for further experimental and mechanistic studies to establish the neuroprotective and antiparkinsonian potential of *C. grandis*.

KEYWORDS: *Coccinia grandis*, Parkinsonism, Parkinson's disease, phytoconstituents, neuroprotection, oxidative stress, antiparkinsonian activity.

I. INTRODUCTION

Parkinsonism is essentially a clinical syndrome brought about by combining a number of motor symptoms that include tremors, muscle stiffness or rigidity, bradykinesia or slowness of movement, and postural instability. Such symptoms usually result from the dysfunction or degeneration of dopamine-producing neurons in a specific region of the brain called substantia nigra. Parkinsonism is closely associated with Parkinson's disease as the primary cause of the disease but can also be caused by several other diseases like multiple system atrophy, progressive supranuclear palsy, or due to drug-induced parkinsonism. The symptoms of the disease are generally so progressive that they seriously impair a person's ability to lead an everyday life and bring down a person's quality of life in general. There is no cure; therefore, the treatment objective has remained symptomatic relief in medication, such as with levodopa, physical therapy, and sometimes surgical intervention. Newer therapeutic manoeuvres for symptomatic relief as well as the possibility of checking the syndrome's course are now under study.^[1]

CAUSES OF PARKINSONISM

A wide variety of underlying conditions, medications, and environmental factors results in Parkinsonism. The most common cause includes:

A. Parkinson's Disease (PD): It is the chief cause of parkinsonism and accounts for almost 80%.

Parkinson's disease, there is slow death of neurons in the substantia nigra that synthesizes dopamine which is a chemical playing a crucial role in controlling movements.

B. Drug-Induced Parkinsonism: Several drugs, including antipsychotic drugs and some antiemetic drugs, block the dopamine receptors or decrease concentration of dopamine and cause symptoms almost identical to those seen in parkinsonism. The effects often reverse by stopping the drug

C. Vascular Parkinsonism: This is most commonly the effect of small, multiple strokes to motor control areas. Symptoms can occur suddenly and tend to be less responsive to traditional treatments for Parkinsonism.

D. Traumatic Brain Injury (TBI): Repeated cerebral trauma, as commonly observed in contact sports or accidents, may impair areas of the brain, which control movement and hence lead to parkinsonism. Sometimes, this happens in various disorders, such as chronic traumatic encephalopathy (CTE).

E. Environmental Factors and Toxins: Exposure to specific toxic agents like pesticides and herbicides and some heavy metals has been said to have a predisposition to parkinsonism. MPTP is also an impurity of some synthetic drugs that causes irreversible parkinsonism.

F. Genetic Causes: The majority of Parkinson's disease cases are idiopathic, but some carry genetic mutations attached with them. Some inherited forms of parkinsonism result from a small set of rare conditions such as Wilson's disease, caused by copper accumulated in the brain. The etiology of parkinsonism has to be established for proper management because the cause varies with the severity of the treatment applicable.^[2]

SIGNS OF PARKINSONISM

A. Motor Symptoms

- ❖ Bradykinesia
- ❖ Muscle stiffness
- ❖ Rigidity
- ❖ Tremor in hands
- ❖ Stooped position
- ❖ Dystonia

B. Non-Motor Symptoms

- ❖ Memory loss
- ❖ Mood changes
- ❖ Sleep Disturbances
- ❖ Constipation and Gastrointestinal problems
- ❖ Dysphagia
- ❖ Drooling
- ❖ Unintentional weight loss
- ❖ Loss of Smell^[3]

TYPES OF PARKINSONISM

A term for a group of disorders whose clinical features mimic those of Parkinson's disease (PD) but are of different etiology, progression, and response to treatment. Major categories include:

A. Idiopathic Parkinson's Disease (PD):

The most prevalent form of parkinsonism is that whose symptoms slowly deteriorate with time due to degeneration of the dopamine-producing neurons in the brain. It generally seems responsive to dopaminergic replacement therapies, such as levodopa.

B Drug-induced Parkinsonism:

Many drugs, particularly antipsychotics, anti-nausea drugs, and some calcium channel blockers, cause parkinsonism by blocking the dopamine receptor. Unlike parkinsonism, manifestations are reversed by the stopping of this drug.

C. Vascular Parkinsonism

This condition arises due to many miniature strokes and decreased blood flows to other parts of the brain that control movement. It responds only in an often-limited way to standard treatments of Parkinson's.

D. Atypical Parkinsonian Disorders (Parkinson-Plus Syndromes)

These are neurodegenerative disorders. Similar in nature to Parkinson's, but differ in characteristics and accelerate faster. This condition is associated with manifestations of effects on different body systems: the motor system, autonomic regulation-such as blood pressure-and often, regulation over bladder function.

- ❖ PSP: It presents with difficulties in balance, saccadic eye movements-vertical being particularly affected-and tends to be more rapidly progressive.
- ❖ Corticobasal Degeneration (CBD): Usually presents asymmetrically with rigidity, cognitive alterations, and "alien limb" phenomena.
- ❖ Dementia with Lewy Bodies (DLB): An overlap of parkinsonism, cognitive decline, visual hallucinations, and fluctuation in alertness.

E. Genetic or Hereditary Parkinsonism:

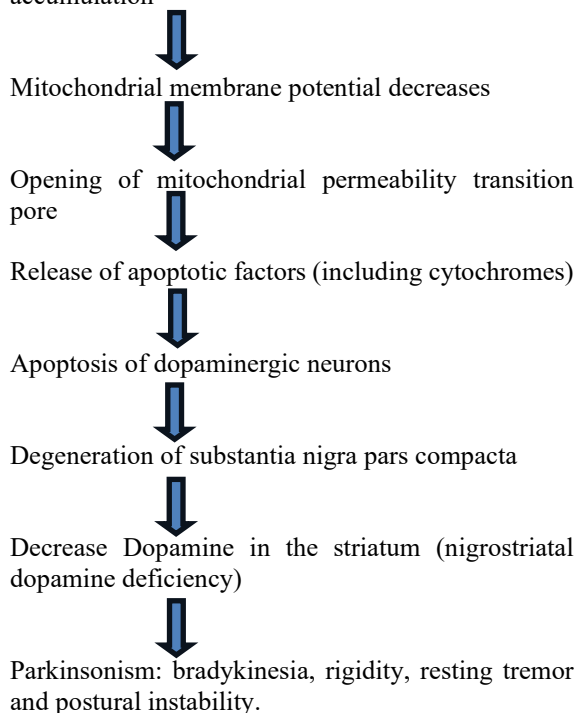
Other genetic mutations have been associated with parkinsonism, although less common, include Wilson's disease which is due to copper deposition and juvenile parkinsonism. These inherited variants sometimes symptomatize similarly to the onset of Parkinson's Disease but very often run their course or respond differently to treatment.

F. Post-Traumatic Parkinsonism:

Most of the times also carry a past or a history of traumatic brain injury in athletes, which are recurrent cranial injuries. This may lead to a condition known as chronic traumatic encephalopathy, which shares symptoms with parkinsonism but is accompanied by other cognitive and behavioural changes.^[4]

PATHOGENESIS OF PARKINSONISM ^[5]

Oxidative stress, Mitochondrial dysfunction, Excitotoxicity, Inflammation and α -Synuclein accumulation



PLANT PROFILE

Coccinia grandis (L.) Voigt, commonly known as ivy gourd, is a fast-growing perennial climbing plant belonging to the family Cucurbitaceae, commonly known as the gourd, melon and pumpkin family. It is widely used as a food crop as well as in traditional medicine. The plant is native to East Africa and has spread widely throughout tropical regions of Asia, America and the Pacific. *Coccinia grandis* is characterized by its climbing habit, alternate heart- to pentagon-shaped leaves, large white star-shaped flowers, red ovoid fruits and succulent tuberous roots. The plant has attracted considerable attention because of its traditional medicinal importance and diverse pharmacological properties. Different parts of *Coccinia grandis* contain several bioactive constituents, including β -sitosterol, alkaloids,

flavonoids, triterpenoids, saponins, lupeol and β -amyryn. Traditionally, the plant has been used for conditions such as diabetes, inflammation, infections and gastrointestinal disorders. The reviewed literature reports pharmacological activities including antidiabetic, antioxidant, anti-inflammatory, antimicrobial, antiulcer, hepatoprotective, hypoglycemic, antimalarial and antidyslipidemic activities, indicating its potential as an important medicinal plant.^[6]



Mitochondrial membrane potential decreases

Figure 1: *Coccinia grandis*

TAXONOMICAL CLASSIFICATION ^[6]

Kingdom	:	Plantae
Division	:	Magnoliopsida
Class	:	Magnoliophyta
Order	:	Violales
Family	:	Cucurbitaceae
Genus	:	<i>Coccinia</i> Wight & Arn
Species	:	<i>Coccinia Grandis</i> L Vight

SYNONYMS OF COCCINIA GRANDIS ^[6]

Coccinia indica Wight
Arn, Bryonia grandis
Coccinia cordifolia auct.

VERNACULAR NAMES OF COCCINIA GRANDIS ^[6]

Malayalam : Kowai

Hindi	:	Parval, Tindora, Tinda,
Kannada	:	Tondekayi
Telugu	:	Dondakaya
English	:	Scarlet
Chinese	:	Hong Qua
Marathi	:	Tindora, Tondli
Japanese	:	Yasai, karasuuri
Spanish	:	Pepino, cimaron

BOTANICAL DESCRIPTION

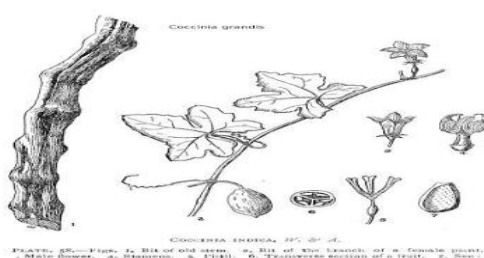


Figure 2: Botanical characteristic of *coccinia grandis*

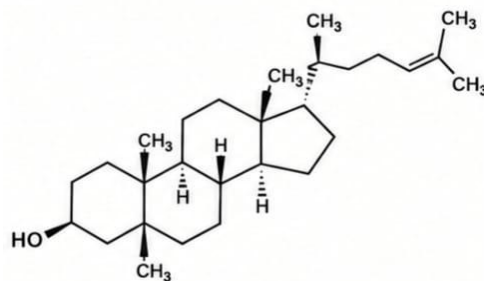
This plant is a perennial climber with single tendrils and glabrous leaves. The leaves have 5 lobes and are 6.5–8.5 cm long and 7–8 cm wide. The species is dioecious Female and male flowers emerge at the axils on the petiole, and have 3 stamens.^[7]

THERAPEUTIC USE^[8]

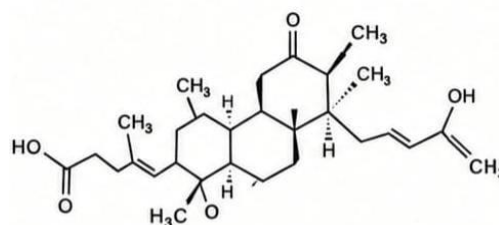
- ❖ Antidiabetic
- ❖ Antioxidant
- ❖ Osteoarthritis
- ❖ Joint pain
- ❖ Antihyperlipidemic
- ❖ Anti-diarrheal
- ❖ Anti-ulcer
- ❖ Cardiovascular diseases
- ❖ Anticancer
- ❖ Hepatoprotective
- ❖ Anti diabetic

CHEMICAL CONSTITUENTS

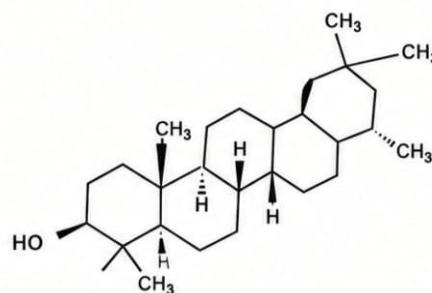
Phytochemicals present herbal medicinal plants are responsible for eliciting pharmacological action. Nature and extent of phytochemicals present in the plants elaborate the medicinal properties. Phytochemical evaluation studies conducted on the plant extracts of *C. grandis*, reveals the presence and content of various components like alkaloids, saponins, reducing sugar alkaloids, steroids, tannins, ellagic acids, phenols, glycosides and triterpenoids that are present in the plants.



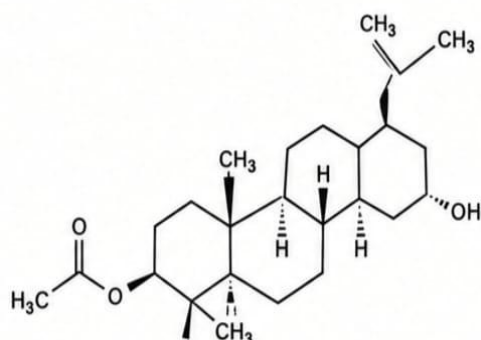
β-Sitosterol



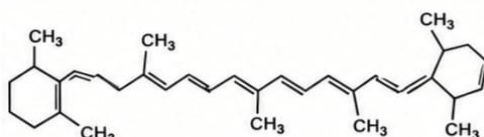
Cucurbitacin B



Lupeol



β -Amyrin acetate



β -Carotene

- ❖ Aerial part: Heptacosane, Cephalandrol, β -sitosterol, Alkaloids Cephalandrins A and B
- ❖ Fruits: β -Amyrin Acetate, Lupeol, Cucurbitacin B, Taraxerone, Taraxerol, β -carotene, Cucurbitacin-B, Lycopene, Cryptoxanthin, Xyloglucan, Carotenoids, β -sitosterol, Stigma-7en-3-one daucosterol.
- ❖ Root: Resin, Alkaloids, Starch, Fatty Acids, Carbonic acid, Triterpenoid, Saponin Coccinoside, Flavonoid Glycoside, Lupeol, β -amyrin, β -sitosterol, Taraxerol^[9]

MICROSCOPY OF *COCCINIA GRANDIS*^[10]

1. Microscopy of Leaf

The transverse section of the leaf of *Coccinia grandis* showed a single-layered upper and lower epidermis covered with a cuticle. The epidermal cells were compactly arranged and stomata were present on the epidermis. The mesophyll was differentiated into palisade and spongy parenchyma. Vascular bundles were present within the mesophyll and were composed of xylem and phloem. Trichomes were

also observed on the epidermal surface. These anatomical features are useful for the identification and authentication of *C. grandis*.

2. Microscopy of Stem

The transverse section of the stem showed a single-layered epidermis covered by a cuticle, followed by parenchymatous cortex. The vascular bundles were collateral and closed, with xylem towards the inner side and phloem towards the outer side. The vascular bundles were surrounded by sclerenchymatous tissues. The central region consisted of a large parenchymatous pith with intercellular spaces. These characteristic anatomical features can be used as diagnostic parameters for *C. grandis*.

3. Microscopy of Root

The transverse section of the root showed an outer epidermal layer followed by a well-developed parenchymatous cortex. The endodermis and pericycle were distinct, and the vascular tissues consisted of alternating xylem and phloem. Xylem elements were prominent and extended towards the centre. A parenchymatous pith was also observed in the central region. Calcium oxalate crystals were reported in the tissues. These features contribute to the anatomical identification of *C. grandis*.

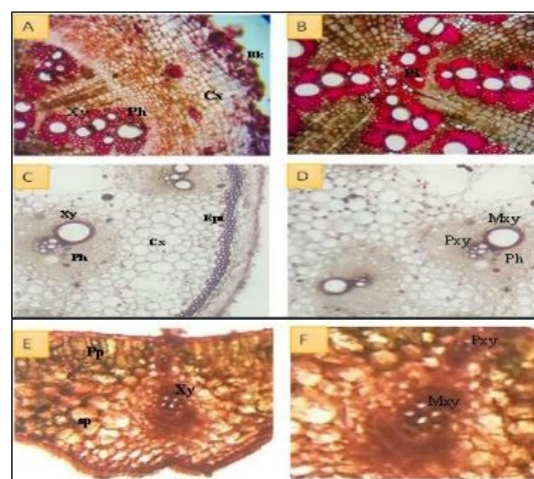


Figure 3: Microscopy of *coccinia grandis*

Microscopy of, leaves, stem and root on *Coccinia grandis* (L.) Voigt. *Coccinis grandis* (L.) Voigt. Piga A& B T.S of *Coccinis grandis* Root, Fig. 3 C&D T.S of *Coccinis grandis* Stem Fig A ES F TS of *Coccinis grandis* Leaf. Bk-Bark; Ep Ep id° rin to Cx-Cortex; Xy-Xylein, Wtxy-hletaxylem, Pxy- Protoxylein, P1-Pith region.

PHYTOCHEMICAL ANALYSIS^[11]

In this study the ethanolic extract of *Coccinia grandis* (fruit) is used.

Test solution was prepared by taking one gram of extract in 5 ml of ethanol.

The preliminary phytochemical screening of ethanolic extract of fruit of *Coccinia grandis* showed the presence of several chemical compounds like carbohydrate, tannins, steroids, terpenoids, flavonoids, amino acid, cardiac glycoside.

Chemical constituents	Test	Result
Carbohydrate	Fehling's test	+
Tannins	Ferric chloride test	+
Steroids	Salkowski test	+
Terpenoids	Salkowski test	+
Flavonoids	Alkaline reagent test	+
Amino acid	Xanthoproteic test	+
Cardiac glycoside	Keller killiani test	+

PHARMACOLOGICAL ACTIVITY OF COCCINIA GRANDIS

ANTI ULCER ACTIVITY

Debdip Mandal et al. (2025) The leaf powder, aqueous extract and methanolic extract of *Coccinia grandis* were evaluated for anti-ulcer activity in albino Wistar rats. The leaf powder was administered at 0.5–2 g/kg, while the aqueous and methanolic extracts were tested at 2 g/kg. Famotidine (20 mg/kg) was used as the standard drug and aspirin (200 mg/kg) as the ulcer-inducing/control treatment. The aqueous extract did not show a significant reduction in ulcer formation, whereas the leaf powder and methanolic extract produced a considerable reduction in ulcers.^[12]

ANTICANCER ACTIVITY

Seran AA et al. (2020) The anticancer potential of *Coccinia grandis* has been investigated using different extracts and experimental models. An ethanolic extract of *Coccinia grandis* and its fractions were evaluated for cytotoxic activity against T47D human breast cancer cells using the MTT assay. The ethanolic extract and its n-hexane, ethyl acetate and aqueous fractions showed cytotoxic activity, with IC₅₀ values of 500.167, 353.131, 109.975 and 303.990 µg/mL, respectively. Among the tested fractions, the ethyl acetate fraction exhibited the highest cytotoxic activity, with an IC₅₀ value of

109.975 µg/mL. The ethyl acetate fraction also demonstrated antiangiogenic activity in the chorioallantoic membrane assay, showing 56.78% inhibition of angiogenesis at 219.95 µg/mL. These findings suggest that *Coccinia grandis* possesses potential cytotoxic and antiangiogenic properties and may warrant further investigation as a source of anticancer compounds.^[13]

ANTIDIARRHOEAL ACTIVITY

Amir Hossain et al. (2014) The ethanolic extract of the leaves of *Coccinia grandis* was evaluated for anti-diarrhoeal activity in mice using the castor oil-induced diarrhoea model. The animals were divided into control, positive control and test groups, with five mice in each group. The control group received 1% Tween 80 in water (10 ml/kg), while loperamide (3 mg/kg) was used as the standard drug. The ethanolic extract was administered orally at a dose of 500 mg/kg, followed by castor oil (0.5 ml) to induce diarrhoea. During the 4-hour observation period, faecal output and diarrhoeic faeces were recorded. The ethanolic extract reduced the total number of faeces and diarrhoeic faeces; however, the effect was statistically insignificant. Therefore, the study did not demonstrate significant anti-diarrhoeal activity of the ethanolic extract under the experimental conditions.^[14]

ANTILARVICIDAL ACTIVITY

Senthilkumar et al. (2012) investigated the larvicidal activity of different solvent extracts of *Coccinia indica* against mosquito larvae. The extracts exhibited significant larvicidal activity, and an oleanolic-acid derivative isolated from the plant also demonstrated activity against mosquito larvae. The study suggested that *Coccinia* species contain bioactive constituents with potential for controlling mosquito vectors.^[15]

ANTIBACTERIAL ACTIVITY

Sivaraj et al. (2011) evaluated the antibacterial activity of *Coccinia grandis* leaf extracts prepared using different solvents, including acetone, ethanol, methanol, aqueous and hexane extracts, against five bacterial species. Among the extracts, the ethanol leaf extract showed high antibacterial activity against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus cereus*, *Klebsiella pneumoniae*, and *Streptococcus* species.^[16]

HYPOGLYCEMIC ACTIVITY

Gunjan et al. (2010) evaluated the antidiabetic activity of the ethanolic fruit extract of

Coccinia grandis in alloxan-induced diabetic rats. The fruit extract was administered at a dose of 200 mg/kg for 14 days. The treatment produced a significant reduction in blood glucose levels, indicating the hypoglycemic and antidiabetic potential of *Coccinia grandis* fruit extract.^[17]

ANTI TUSSIVE ACTIVITY

Pattanayak et al. (2009) evaluated the methanolic fruit extract of *Coccinia grandis* for antitussive activity in experimental animals. The extract was administered at different doses, with 400 mg/kg producing the highest effect. The methanolic extract showed a dose-dependent reduction in chemically induced cough, with maximum inhibition of 56.71% at 90 minutes at 400 mg/kg, comparable to codeine phosphate. The study suggested that the extract acts through the central nervous system.^[18]

HEPATOPROTECTIVE ACTIVITY

Vadivu et al. (2008) evaluated the ethanolic fruit extract of *Coccinia grandis* for hepatoprotective activity against CCl₄-induced hepatotoxicity in experimental rats. The extract was administered at a dose of 250 mg/kg. Treatment significantly reduced the elevated SGPT, SGOT and bilirubin levels, indicating hepatoprotective activity. The effect was suggested to be associated with the antioxidant activity of flavonoids, triterpenes and tannins present in the fruit.^[19]

ANTIDYSLIPIDEMIC ACTIVITY

Singh G et al. (2007) evaluated the chloroform extract of *Coccinia grandis* leaves for antidyslipidemic activity in high-fat-diet-fed dyslipidemic hamsters. The chloroform extract containing polyphenol was administered at a dose of 50 mg/kg body weight. The extract improved the plasma lipid profile by increasing the high-density lipoprotein cholesterol to total cholesterol ratio. It significantly decreased serum triglycerides by 42%, total cholesterol by 25% and glycerol by 12%. C60-polyphenol was isolated from *Coccinia grandis* for the first time and was suggested to contribute to the observed antidyslipidemic activity.^[20]

II. CONCLUSION

Coccinia grandis (L.) Voigt, commonly known as ivy gourd, is a medicinal plant belonging to the family Cucurbitaceae and has been traditionally used for various therapeutic purposes. The plant contains a wide range of bioactive phytoconstituents, including alkaloids, flavonoids, triterpenoids, saponins, β -sitosterol,

lupeol and β -amyrin. Various pharmacological studies have reported antioxidant, anti-inflammatory, antidiabetic, antimicrobial, hepatoprotective and other activities of *C. grandis*. These pharmacological properties and the presence of biologically active constituents suggest that the plant may have potential relevance in neuroprotective and antiparkinsonian research. The pathogenesis of Parkinsonism involves oxidative stress, mitochondrial dysfunction, neuroinflammation, excitotoxicity and α -synuclein accumulation, which may contribute to dopaminergic neuronal degeneration. However, the available information specifically supporting the antiparkinsonian activity of *C. grandis* remains limited. Therefore, further experimental, pharmacological and mechanistic studies are required to establish its neuroprotective and antiparkinsonian potential, identify the active constituents and determine their possible mechanisms of action. Such investigations may provide a scientific basis for the future development of *C. grandis* as a potential source of therapeutic agents for Parkinsonism.

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