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Cyperus rotundus: A potential medicinal plant

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Abstract

We all know that from ancient times, people used plants and trees for their food, shelter and medicinal purposes. Now a days everybody wants to use the herbal medicine instead of allopathic one because of their side effects. There is a potential medicinal plant named as "*Cyperus rotundus*" commonly known as "Nut Grass", belongs to family Cyperaceae, basically it is a kind of rhizomatous plant. It grows up to 100 cm in small clumps. It is distributed almost throughout all the regions of world because of its great adaptivity with respect to soil, temperature, ph, altitudes and moisture. It shows a wide range of pharmacological activities in *in vivo* and *in vitro* model of experiments including anti-microbial, anti-parasitic, insecticidal repellent, neuroprotective, anti-inflammatory, analgesic, antipyretic, anti-nociceptive, anti-oxidant, hypolipidemic, effect on platelet function, gastrointestinal, hepatoprotective, anti-diabetic, dermatological, anti-dysmenorrhea, effect on lymphocytes proliferation, sedative, aromatic, anti-anxiety, anti-depressive etc. This review article focus on the medicinal properties, distribution, morphology, isolated phytochemicals and their structures with molecular formulas as well.

Keywords: *Cyperus rotundus*, CNS, anti-inflammatory, neuroprotective, antipyretic and herbal

Introduction

Plants play an extremely important role in the life of every human being and animal as well. Plants are used throughout the world for its medicinal properties. Herbal medicine is an important component of traditional system of medicine including Ayurveda, Siddha, Naturopathy and Homeopathy. There are numerous important medicinal plants, which are using now a days for the therapeutic purposes with no or fewer side effects, but there is still a surge to commercialize these therapeutic products including pure and crude as well and one of the most important medicinal plant with a great potential of healing is *Cyperus rotundus* ^[1,2].

The *rotundus* is an important herb of this genus and commonly called Mustaka or Nut-grass and belongs to family Cyperaceae. It is an erect and perennial sedge and it spreads by means of roots with fibres. It has a rhizome part which is positively geotropic, basically which has the medicinal properties. Initially the colour of rhizome is white but it will change to brown and will become woody on maturation. When it reaches to the upper level of ground then it forms a round body called basal bulb from where the shoots will arise. It also forms a tuber which store the food and it will give rise to new rhizome ^[1].

The genus *Cyperus*

This genus includes 700 species which are mostly found in both tropical and temperate regions ^[3]. This genus mostly found in Africa, Western Indian Ocean, Western Asia, Middle Asia, Eastern Asia, Europe, Northern and Southern America ^[1]. The members of this genus are annual/perennial. Most of the species are aquatic but some are grown outside the water bodies. Small as well as large sized members are present in this genus. It has a triangular stem which is circular in cross section. The leaves of the members of this genus are slender-grass at the base of the plant. It has greenish colour of flowers and pollination has been done by wind most probably and the seeds of the members are small in size ^[4,5].

Search criteria

Published literature on recent developments in research up to 2021 on *Cyperus rotundus* including original articles and papers in Science Direct, Wiley Online Library, NCBI pubmed, pubmed Central Database and AYU were taken into study for the report.

Inclusion criteria

All the reports of experiments on different model types including *in vitro*, *ex vivo* and *in vivo* were taken varying from animal and human model system.

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Taxonomic classification: Taxonomic classification of *Cyperus rotundus* is mentioned below in Table No.- 1

Table 1: Taxonomic classification

| Kingdom | Plantae | References |
|----------------|-----------------|------------|
| Sub-kingdom | Tracheobionta | [1] |
| Super division | Spermatophyte | |
| Division | Magnoliophyta | |
| Class | Liliopsida | |
| Subclass | Commelinidae | |
| Order | Cyperales | |
| Family | Cyperraceae | |
| Genus | <i>Cyperus</i> | |
| Species | <i>Rotundus</i> | |

Common names: *Cyperus rotundus* is well known by different names in different area as mentioned below in Table No-2.

Table 2: Different *Cyperus rotundus* names in different area

| Country | Name | References |
|------------|---|------------|
| Arabic | Sa'ed | [1] |
| Chinese | Suo cao, Xinag fu zi | |
| English | Coco grass, Ground almond, Java grass, Nut sedge, Nut grass, Purple nut, Sedge, Purple nut grass, Red nut sedge | |
| French | Souchet rond | |
| German | Knolliges zypergras | |
| India | Motha, Mutha, Mustaka | |
| Italian | Zigolo infestante | |
| Japenese | Hamasuge | |
| Korean | Hyangbuja | |
| Portuguese | Alho bravo, Capim alho, Capim danda, Tiririca, Tiririca vermelha | |
| Spanish | Castanuela, Cipero, Coquito, Juncia real | |
| Swedish | Notag | |

Distribution: *Cyperus rotundus* is distributed across the world as mentioned below in Table No-3.

Table 3: Distributed across the world

| Region | Countries | References |
|----------------------|--|------------|
| Africa | Algeria, Egypt, Libya, Morocco, Tunisia, Western Sahara, Chad, Djibouti, Eritrea, Ethiopia, Somalia, Sudan, Kenya, Tanzania, Uganda, Burundi, Equatorial Guinea, Gabon, Rwanda, Zaire, Benin, Burkina Faso, Cote D'Ivoire, Ghana, Guinea, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, Angola, Malawi, Mozambique, Zambia, Zimbabwe, Botswana, Namibia, South Africa, Swaziland. | [1] |
| Western Indian Ocean | Comoros, Madagascar, Mauritius, Reunion, Seychelles. | |
| Western Asia | Afghanistan, Iran, Iraq, Saudi Arabia, Yemen, Palestine, Lebanon, Syria, Turkey. | |
| Middle Asia | Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan. | |
| Eastern Asia | China, Japan, Korea, Taiwan, India, Nepal; Pakistan, Sri Lanka, Myanmar; Thailand, Vietnam, Indonesia, Malaysia, Philippines. | |
| Europe | Austria, Switzerland, Albania, Bulgaria, Croatia, Greece, Romania, Serbia, Slovenia, France, Portugal, Spain. | |
| Pacific | Marshall Islands, Micronesia, Northern Mariana Islands. | |
| North America | USA, Mexico. | |
| Southern America | Brazil, Bolivia, Colombia, Ecuador, Peru, Argentina. | |
| Caucasus | Azerbaijan, Russian Federation, Armenia. | |

***Cyperus rotundus*: A genetically diverse plant:** There are many plants markers to identify the physiological and morphological characters including tuber length, tuber colour, tuber shape, floral morphology, fruit characteristics, leaves

morphology and some other characteristics of this specie, which indicates the diversity of this medicinal plant [1].

Physico-chemical properties: Physico-chemical properties of *Cyperus rotundus* is mentioned below in Table 4, 5 & 6.

Table 4: Physico-chemical properties of *Cyperus rotundus*

| Moisture | 9% | References |
|-------------------|-------------|------------|
| Total ash | 8.06-12.87% | [1] |
| Acidinsoluble Ash | 2.23-4.56% | |
| Water Soluble Ash | 5.1-6.4% | |
| Sulphated Ash | 9.56-10.2%2 | |

Table 5: Extractive values of *Cyperus rotundus* rhizome

| Water Soluble Extract | 9.01-15.15% | References |
|-------------------------|-------------|------------|
| Alcohol Soluble Extract | 7.63-21.27% | [1] |

Table 6: Successive extraction

| Petroleum ether | 1.27-1.53% | References |
|-----------------|------------|------------|
| Chloroform | 2.52% | [1] |
| N-Hexane | 1.79% | |
| Acetone | 1.82% | |
| Alcohol(90%) | 1.78% | |
| Aqueous | 1.47% | |

Loss on drying - 3.57%

Crude fiber content - 39.98%

Traditional uses: Traditional uses of *C. Rotundus* are mentioned below in Table No.-7**Table 7:** Traditional uses of *C. Rotundus*

| S. No. | Plant part | Traditional uses | References |
|--------|------------|---|------------|
| 1. | Rhizome | Treatment of gastrointestinal spasma, Treatment of stomach disorders, Treatment of nausea, Treatment of intestinal parasites, Useful in case of vomiting, Treatment of food poisoning, Used in case of indigestion, Treatment of fever, Treatment of wounds, Treatment of bruises and carbuncles, Treatment of malaria, Treatment of cough, Treatment of bronchitis infection, Treatment of renal and vesical calculi, Treatment of urinary tenesmus, Treatment of amenorrhoea, Treatment of dysmenorrhoea, Useful in case of deficiency of lactation, Treatment of loss of memory, Useful in case of insect bite, Treatment of dysuria, Used in case of infertility, Treatment of cervical cancer, Treatment of menstrual disorders. | [1] |

Alternative and complementary medicinal uses

The aromatic oil of the *Cyperus rotundus* rhizome is used in the perfumes and splash and in many other products of cosmetic industries. The different extracts of rhizome are used as an astringent, analgesic, carminative, antitussive, emmenagogue, lithalytic and as well as a valuable tonic [6].

Morphology

Cyperus rotundus is rhizomatous plant. The stem is smooth and it goes upto 30-40 cm in height. The leaves will arise from the base of the plant and are arranged in a specific manner around the stem. Leaves are 20-30 cm in length and 0.2-1.0 cm in width and greenish in colour. The flowers of

this species are on the top of stem and grows in clusters of 10-40 flowers. Flowers are reddish brown in colour and has no petals but has bracts as well. It has a dry fruit with single seed. The fruit is 2 mm in length and blackish brown in colour with grey lines [1].

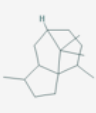
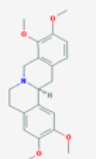
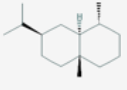
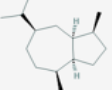
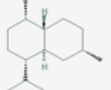
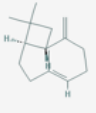
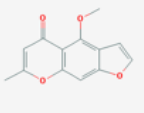
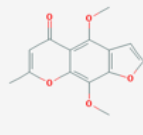
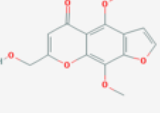
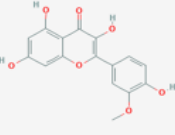
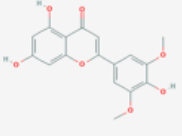
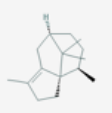

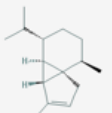
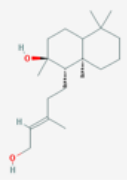
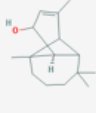
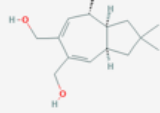
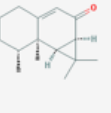
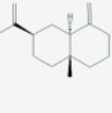
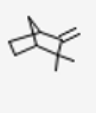
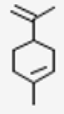
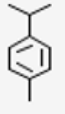




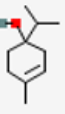

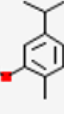
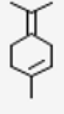
Phytochemical analysis and phytoconstituents of *Cyperus rotundus*

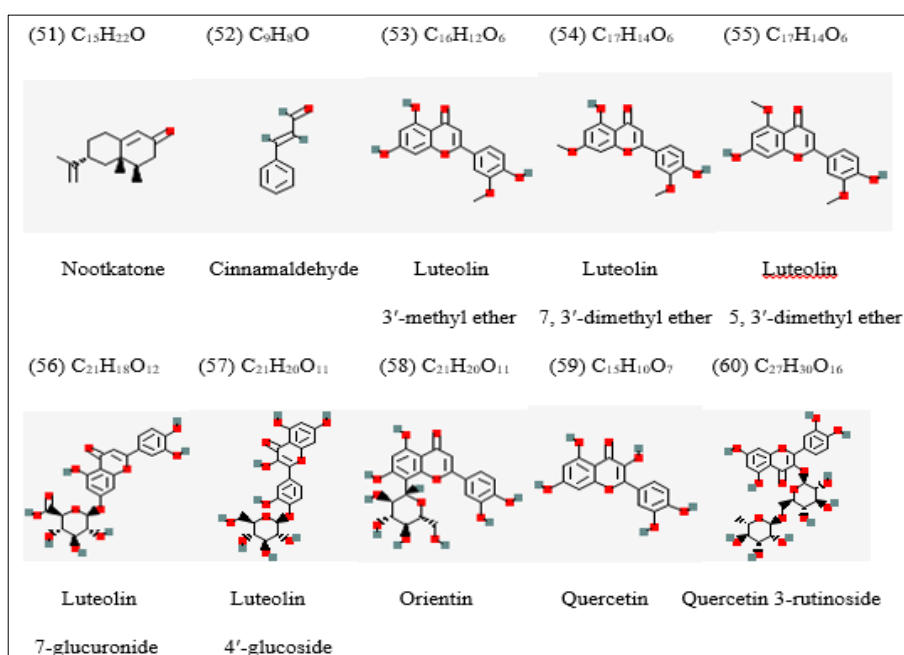
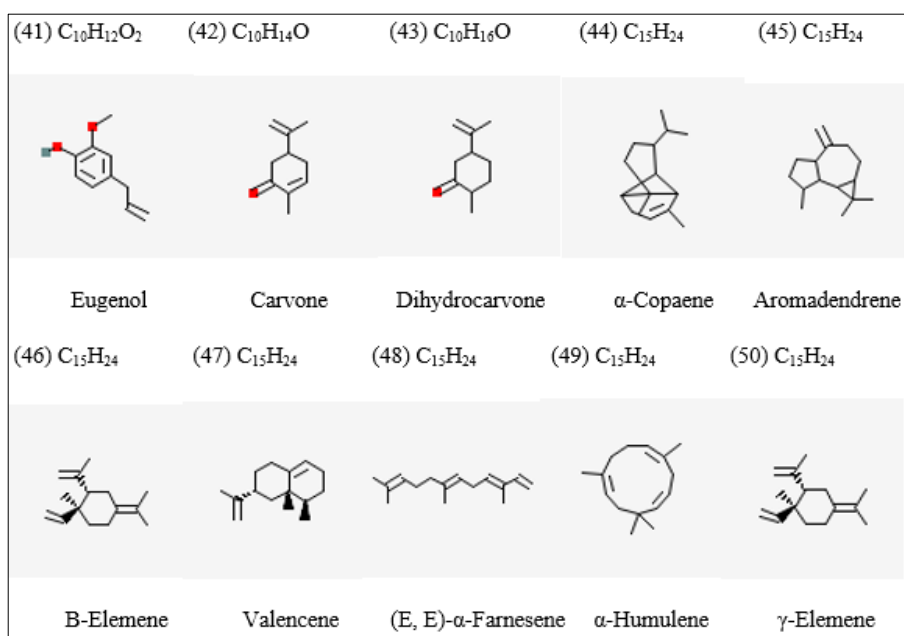
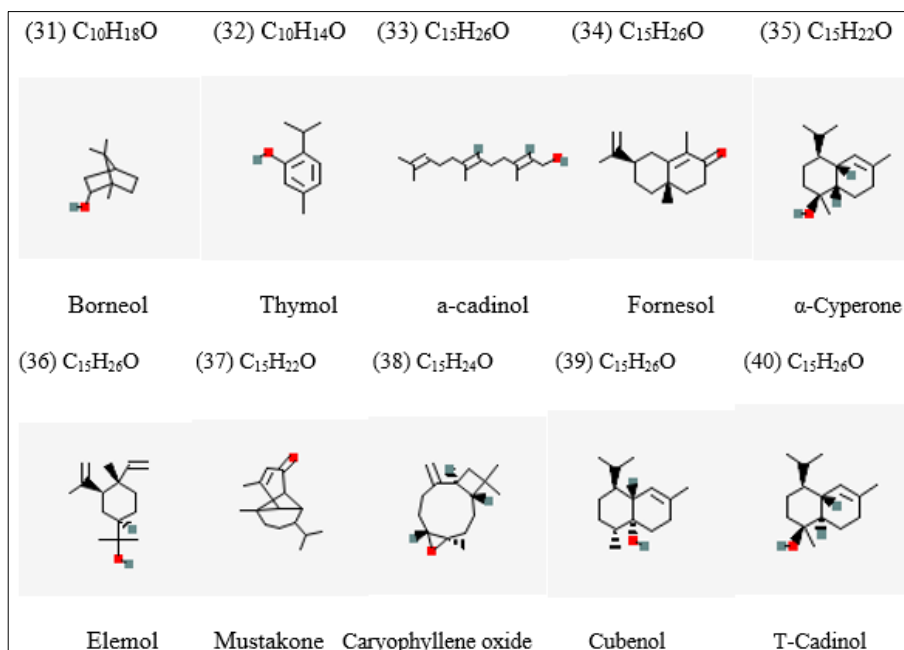
Phytochemicals analysis of herbal extracts has been investigated by various analytical techniques using sophisticated instruments such as GC-MS, HPLC, LC-MS, NMR, IR, FTIR etc. The major phytoconstituents of *C. Rotundus* are mentioned below in Table No 8.

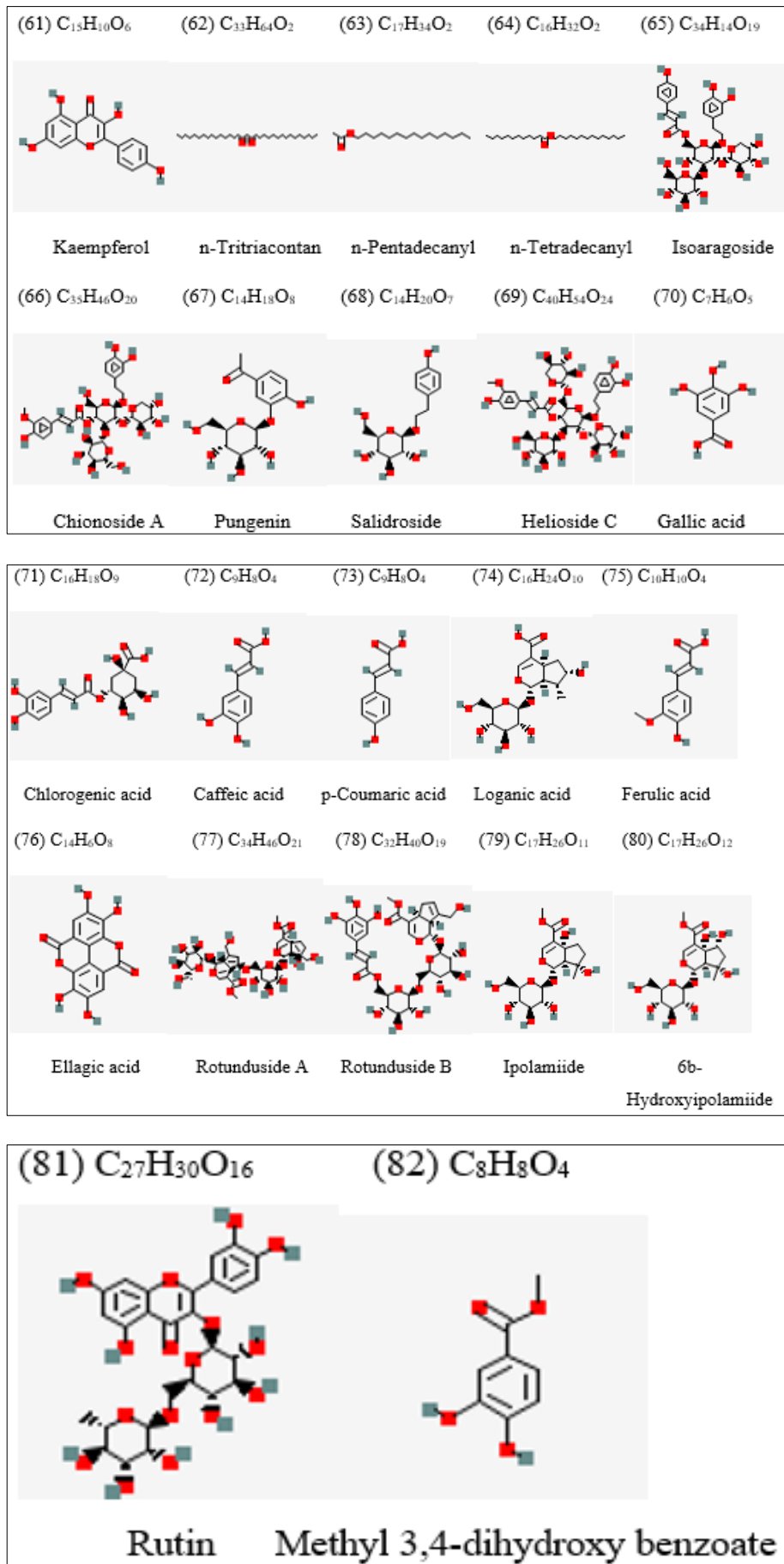
Table 8: Phytoconstituents of *C. Rotundus*

| S. No. | Class | Compound | Reference |
|--------|---|--|-----------|
| 1. | Sesquiterpene | Patchoulane; Rotundine; Eudesmane; Guaiane; Cadinane; Caryophyllene | [1] |
| 2. | Flavonoids | Visnagin; Khellin; Ammiol; Isorhamnetin; Tricin | |
| 3. | Phenolic acids | Salicylic acid; Protocatechuic acid; Caffeic acid; p coumaric acid | |
| 4. | Steroids | Steroidal glycoside; Sitosteryl-(6'-hentriacontanoyl)-β-D-galactopyranoside | |
| 5. | Essential oil (Sesquiterpenes, monoterpenes and terpinoids) | Oxo-α-ylangene; α-cyperene; Trans-pinocarveol; cyperene; α-pinene; Cyclopentene-3-ethylidene-1-methyl; Sabinene; β-pinene; p-cymene; 1-limonene; 8-cineole; Trans-pinocarveol; Terpinen-4-ol; Citronellol; 4, 4-dimethyl-tricyclo-(3, 2, 1)octan-6-on; p-cyman-8-ol; 1-α-terpineol; Cis-dihydrocarvone; Myrtenol; Verbenone; 1-β-4,4-trimethyl-bicyclo(3, 2)hept-6-en-2-ol; Trans-carveol; Carvone; Carvenone; α-cubebene; Dihydro-carvylacetate; α-copaene; Isolongifoline; Cyperene; Trans-caryophyllene; Dihydro-romadendrene; Aromodendrene-epoxide; Naphthalene, 1,6-dimethyl-4-(1-methyl ethyl); α-silenene- Cis-calamenene; Trans-calamenene; Elema-1, 3, 11(13)-trien-12-ol; Caryophyllene-oxide; Cis-12-caryophyll-5-en-2-one; Caryophylla-2(12), 6(13) dien-5-one; Cyclohexane, 1, 1, 2-trimethyl-3, 5 bis-1-methyl ethyl; Cyclo-hexanone, 2, 3, 3-trimethyl (3-methyl-butadienyl); Isopropyl,4αβ, 8αβ-dimethyl; Longiver benone; 10-epi-α-cyperene; Caryophyllenol; Vulgarol A and B; Vellerdiol; Aristolone; Ledenoxyde; Dimethyl-7-isopropenyl-bicyclo-dec-1-en-3-one; Longifolinaldehyde; Longipynocarvone; Cyperene; Caryophyllene oxide; α-longipinone; β-salinene | |
| 6. | Others class | Quinones; Saponins; Alkaloids; Coumarins; Starch; Carbohydrates; Protein and Amino acid | |

Structures of some major isolated compounds are mentioned below Figure (1-83)

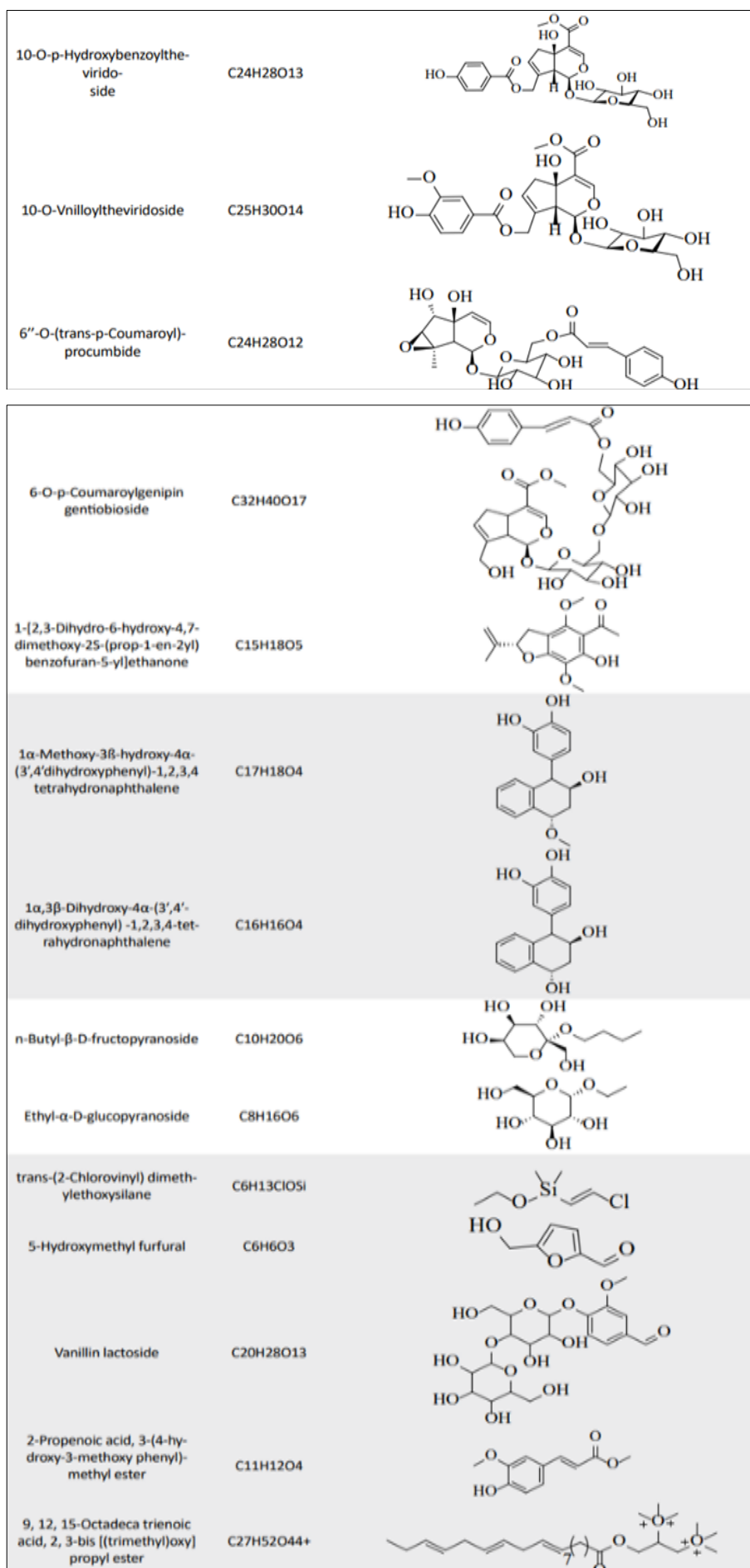
| | | | | |
|---|---|---|--|---|
| (1) $C_{15}H_{26}$ | (2) $C_{21}H_{25}NO_4$ | (3) $C_{15}H_{28}$ | (4) $C_{15}H_{28}$ | (5) $C_{15}H_{28}$ |
|  |  |  |  |  |
| Patchoulane | Rotundine | Eudesmane | Guaiane | Cadinane |
| (6) $C_{15}H_{24}$ | (7) $C_{13}H_{10}O_4$ | (8) $C_{14}H_{12}O_5$ | (9) $C_{14}H_{12}O_6$ | (10) $C_{16}H_{12}O_7$ |
|  |  |  |  |  |
| Caryophyllene | Visnagin | Khellin | Ammiol | Isorhamnetin |
| (11) $C_{17}H_{14}O_7$ | (12) $C_{15}H_{24}$ | (13) $C_{10}H_{16}O$ | (14) $C_{15}H_{24}$ | (15) $C_{20}H_{36}O_2$ |
|  |  |  |  |  |
| Tricin | Cyperene | Myrtenol | Alpha-cubebene | Vulgarol A |
| (16) $C_{15}H_{24}O$ | (17) $C_{15}H_{24}O_2$ | (18) $C_{15}H_{22}O$ | (19) $C_{15}H_{24}$ | (20) $C_{10}H_{16}$ |
|  |  |  |  |  |
| Vulgarol B | Vellerdiol | Aristolone | Beta-Salinene | Camphene |
| (21) $C_{10}H_{16}$ | (22) $C_{10}H_{14}$ | (23) $C_{10}H_{16}$ | (24) $C_{10}H_{16}$ | (25) $C_{10}H_{16}$ |
|  |  |  |  |  |
| Limonene | p-cymene | Sabinene | Alpha-pinene | Beta-pinene |
| (26) $C_{10}H_{18}O$ | (27) $C_{10}H_{18}O$ | (28) $C_{10}H_{18}O$ | (29) $C_{10}H_{14}O$ | (30) $C_{10}H_{16}$ |
|  |  |  |  |  |
| 1,8-cineole | Terpinen-4-ol | a-terpineol | Carvacrol | Terpinolene |





Source: From pubchem Compound - NCBI

Some other complex derivative compounds and their structures are mentioned below in Figure No 84-85



Source: [2]

Pharmacological reports

The survey of literature was revealed that *C. Rotundus* has been investigated for the various pharmacological activities which are mentioned in the Table No.-9. The different crude extracts, fractions of plant and isolated compounds from the plant have been employed for the scientific studies. The literature of plant included pharmacological activities, plant

part used, extracts, fractions, isolates, tested doses of samples and positive controls along with their route of administration, *in vivo* and *in vitro* experimental models, animals used in *in vivo* experimental models, experimental studies, design, parameters assessed during studies, sort of mechanism and inference concerned with activity and references.

Table 9: Pharmacological activities reported for *C. Rotundus*

| S. No. | Pharmacological Activity | Plant part/Extract /Fraction/Isolate/Compound/Formulation | Doses tested/Route of administration | Positive control | Subjects | Experimental studies/design/model/parameters assessed during studies /Some sort of mechanism action | Inference in concern with activity | Reference |
|--------|--|---|--|--|------------------|---|--|-----------|
| 1. | Antimicrobial activity | Rhizome/Oils | 5 µl | Ofloxacin, Rifampicine, Amphotericin B 5 µg/disc | Microbes | Disc diffusion method | Shown activity against gram positive but no activity against gram negative | [7] |
| 2. | Antimicrobial activity | Rhizome/Petroleum ether, Chloroform, Ethanol and Water extracts | 250/500/1000 µg/ml | Gentamycin and Amphotericin 20 µg/ml | Pathogen | Disc diffusion method | Ethanol extract shown activity | [8] |
| | | | | | | | Against bacteria but no activity against fungi | |
| 3. | Antimicrobial Activity | Tuber/Extract | 0.5/4.0 mg/ml | - | Microbes | - | Shown activity | [9] |
| 4. | Antimicrobial Activity | Plant/Oils | - | - | Microbes | - | Shown activity | [10] |
| 5. | Antimicrobial activity | Root/Petroleum ether, acetone, methanol and water extracts | - | - | Microbes | Zone inhibition assay | Methanol extract shown activity | [11] |
| 6. | Antimicrobial activity | Aerial parts/Methanol extract/Fractions | - | Tetracyclin | Microbes | - | Ethyl acetate fraction shown activity | [12] |
| 7. | Antimicrobial activity | Plant/Oils | 2.5/5/7.5/10/15/20/25/30/35/40 g/dl and final concentration-0.001% v/v | - | Microbes | MIC and MBC assay | Shown activity against gram positive, less against gram | [13] |
| | | | | | | | Negative and no activity against <i>P. Aeruginosa</i> and <i>P. Vulgaris</i> | |
| 8. | Antimicrobial activity | Plant/Ethanol extract | - | Amoxicillin 20 µg/ml | Microbes | Zone Inhibition assay | Shown activity against some Microbes | [14] |
| 9. | Antimicrobial activity | Plant/Hydroalcoholic extract | 10-100 µg/ml | - | Microbes | End point titration technique and Cytopathogenic assay | Shown activity | [15] |
| 10. | Antimicrobial activity | Plant/Ethanol extract/Isolated Compounds | - | - | HBV | Anti HBV <i>in vitro</i> assay | Shown activity | [16] |
| 11. | Antiparasitic and Insecticidal Repellent | Tuber/n-hexane extract | - | - | Mosquito vector | Repellency assay | Shown activity | [17] |
| 12. | Antiparasitic and Insecticidal repellent | Plant/Sprays of different fractions | - | - | - | Pesticidal test | Shown activity | [18] |
| 13. | Antiparasitic and Insecticidal Repellent | Tuber/Oils | 5-150 ppm | - | Aedes albopictus | Assessed the effects on eggs And larvae | Shown activity | [19] |
| 14. | Antiparasitic and Insecticidal repellent | Tuber/Isolated compounds | - | - | Vector | Antimalarial assay | Shown activity | [20] |
| 15. | CNS activity | Plant/Ethanol extract | 300/500 mg/kg | - | - | Open field, head dip, rearing traction and force swimming test | Shown mild activity | [21] |
| 16. | CNS activity | Plant/Crude extract | 300/500 mg/kg | - | - | - | Shown activity | [22] |
| 17. | CNS activity | Plant roots and Rhizome/Ethanol extract | - | - | Mice | - | Shown significant activity | [23] |
| 18. | CNS activity | Rhizome/Ethyl acetate fraction and Isolated compounds | - | - | Rat | Radio ligand binding assay | One compound shown activity | [24] |
| 19. | CNS activity | Plant/Essential oils | 500 mg/kg | - | Rat | MES produced convulsion | Shown significant | [25] |

| | | | | | | | | |
|-----|---|--|--|--|---------------|--|----------------------------|------|
| 20. | CNS activity | Rhizome/Hydroalcoholic extract | 100/200/400 mg/kg I.P. | Valproate 100 mg/kg I.P. | Brain of mice | PTZ induced seizure effect | Shown significant activity | [26] |
| 21. | CNS activity | Roots and Rhizome / Hydroalcoholic extract | 50/200 mg/kg orally | Diazepam 0.5 mg/kg I.P. | Mice | PTZ and Picrotoxin induced seizures | Shown activity | [27] |
| 22. | CNS activity | Plant/Ethanol extract | - | - | - | Strychnine and Leptazol induced convulsion | Shown activity | [23] |
| 23. | CNS activity | Plant/Hydroalcoholic extract/Essential oils | 100/200/400 mg/kg, 10/20/40 mg/kg, 50/100/200 mg/kg I.P. | Rivastigmine 0.6 mg/kg I.P. | Mice | Scopolamine induced memory deficit | Shown no activity | [28] |
| 24. | Neuroprotective activity | Rhizome/Water extract | 50/100 µg/ml | - | - | 6- Hydroxydopamine induced neuronal damage | Shown protective effect | [29] |
| 25. | Neuroprotective activity | Plant/Ethanol extract | 100 mg/kg/day orally | - | Rat | Global transient ischemia | Shown no activity | [30] |
| 26. | Neuroprotective activity | Plant/Isolated flavonoids | 100/200 mg/kg orally | - | Rat | Model of cerebral ischemia and reperfusion | Shown significant activity | [31] |
| 27. | Neuroprotective activity | Plant/Ethanol extract | 200/400 mg/kg I.P. | Galantamine 0.5 mg/kg orally and Pyritinol 100 mg/kg Orally | Rat | Sodium nitrite induced hypoxia injury | Shown protective effect | [32] |
| 28. | Neuroprotective activity | Rhizome/extract | - | - | - | MTT and LDH assay | Shown protective effect | [33] |
| 29. | Antiinflammatory activity | Plant/Alcoholic extract | - | - | Rat | Carrageenan induced oedema | Shown activity | [34] |
| 30. | Antiinflammatory Activity | Plant/Crude extract | 300/500 mg/kg | Aspirine | Rat | Carrageenan induced oedema | Shown activity | [22] |
| 31. | Antiinflammatory and Analgesic activity | Plant/Essential oils | 250/500 mg/kg orally | Indomethacin 10 mg/kg and diclofenac sodium | Rat | Carrageenan induced, formaldehyde induced arthritic problems and formalin induced writhing | Shown significant activity | [25] |
| 32. | Antiinflammatory and Analgesic activity | Plant/Methanol, Ethyl acetate and Water extracts | 50/150/300 µg/ml | Dexamethasone 300 mg/kg and Diclofenac sodium 100 mg/kg | Mice | Ear oedema induced by xylene and stomach contraction induced by acetic acid models | Shown significant activity | [35] |
| 33. | Analgesic activity | Plant/Ethanol extract | 300/500 mg/kg orally | - | - | Tail flick method | Shown Significant activity | [14] |
| 34. | Analgesic activity | Plant/Ethanol extract | - | Pentobarbitone, Diazepam and Meprobamate | Mice | 1.2% acetic acid induced writhes and stretches | Shown activity | [23] |
| 35. | Analgesic and Antinociceptive activity | Whole plant/extract | 50/100/200 mg/kg | Morphine sulphate 5 mg/kg I.P. and Diclofenac sodium 10 Mg/kg I.P. | Mice | Hot plate and tail immersion test | Shown significant activity | [36] |
| 36. | Analgesic activity | Plant/Methanol extract/Ethyl acetate and n-hexane fraction | - | - | - | Transient receptor potential vanilloid channel was assessed | Shown significant activity | [37] |
| 37. | Antipyretic activity | Plant/Alcoholic extract | - | - | Rat | Brewer's yeast induced pyrexia | Shown significant Activity | [21] |
| 38. | Antipyretic and Analgesic activity | Plant/Alcoholic and Petroleum ether extracts | - | Acetyl salicylic acid | Rat | Brewer's yeast induced pyrexia | Shown significant activity | [38] |
| 39. | Antiinflammatory activity | Plant/Water extract | - | - | Rat and Mice | Paw edema model of inflammation and acetic acid induced peritonitis | Shown significant activity | [39] |
| 40. | Analgesic activity | Plant+Another herb/Crude Powder | 500 mg | - | Patients | Assessed | Shown | [40] |
| | | | | | | Different Parameters | Significant Activity | |
| | | | | | | Regarding with Analgesic like | | |
| | | | | | | Duration of Morning | | |
| | | | | | | Sickness, grip | | |
| | | | | | | Strength and | | |
| | | | | | | Articular index | | |
| | | | | | | Etc | | |
| 41. | Antiinflammatory activity | Rhizome/Methanol extract | - | - | - | Overproduction of NO and O2- induced Inflammation | Shown activity | [41] |
| 42. | Antiinflammatory | Rhizome/Ethanol extract | - | - | - | LPS induced Inflammation | Shown | [42] |

| | Activity | And n-hexane fraction | | | | Activity | |
|-----|--|---|---|--|--------|--|--|
| 43. | Antiinflammatory activity | Rhizome/extract | - | - | Mice | LPS activated RAW2647 cells and cecal ligation and puncture induced sepsis | Shown activity [43] |
| 44. | Anticancer activity | Aerial parts/Methanol, Ethyl acetate and Water extracts/Flavonoid Fractions | - | - | - | Mutagenic and DPPH assay | Shown free radical scavenging activity [44] |
| 45. | Anticancer Activity | Rhizome/Ethanol extract And n-hexane fraction | - | - | - | Cell growth Inhibition assay | Shown Activity [45] |
| 46. | Anticancer activity | Plant/Ethanol, Methanol and Water extracts | 100 mg/ml | - | - | Anti-proliferation assay | Shown activity [46] |
| 47. | Antioxidant activity | Rhizome/Extract | 1000 µg/0.1 ml | - | - | Feso4 induced mitochondria lipid Peroxidation | Shown activity [47] |
| 48. | Antioxidant Activity | Plant/Methanol extract | 2.5-10.0 mg/ml | - | - | DPPH assay | Shown Activity [48] |
| 49. | Hypolipidemic activity and Weight control effect | Rhizome/Alcoholic extract | 70/140/280 mg/kg orally | Simvastatin 5 mg/kg/day orally and Fenofibrate 20 mg/kg/day Orally | Rat | Hyperlipidaemia induced by high fat diet | Shown significant activity [49] |
| 50. | Hypolipidemic activity and Weight control effect | Rhizome/Ethanol extract | 500 mg/kg orally | - | Rat | Age associated changes in glucose and lipids in young and aged rats | Shown protective effect [50] |
| 51. | Hypolipidemic activity and Weight control effect | Tuber/n-hexane extract | 45/220 mg/kg for <i>in vivo</i> and 250 µg/ml for <i>in vitro</i> | - | Rat | Weight gaining <i>in vivo</i> and binding <i>in vitro</i> assay | Shown activity [51] |
| 52. | Effect on platelet function | Plant/Ethanol extract | - | - | Rat | <i>In vitro</i> platelet Aggregation study | Shown activity [52] |
| 53. | Effect on platelet Function | Plant | - | - | Rat | Hemorrhologic AI changes in rat | Shown activity [53] |
| 54. | Gastrointestinal Activity | Plant/Crude extract | 300/500 mg/kg orally | - | Rat | Aspirin induced Ulcers | Shown activity [22] |
| 55. | Gastrointestinal Activity | Plant/Extract | 100/200 mg/kg | - | Rat | Ischemia/Reperf Usion method | Shown activity [54] |
| 56. | Gastrointestinal Activity | Rhizome/Decoction | 1.25/2.5/4.0 g crude Drug/kg orally | - | Rat | Gastric ulcers | Shown activity [55] |
| 57. | Gastrointestinal activity | Rhizome/Methanol extract | 250/500 mg/kg orally | Ranitidine | Rat | Aspirine Induced gastric ulcers | Shown Significant activity [56] |
| 58. | Gastrointestinal activity | Tuber/Water extract | 125/250/500 mg/kg orally | Loperamide 2 mg/kg orally and Atropine sulphate 2 Mg/kg orally | Mice | Castor oil induced diarrhea and charcoal meal test | Shown activity [57] |
| 59. | Gastrointestinal activity | Rhizome/Methanol extract/Petroleum ether and Ethyl acetate fractions | 250/500 mg/kg | - | Mice | Castor oil induced diarrhoea | Methanol and petroleum ether shown activity [58] |
| 60. | Gastrointestinal activity | Tuber/Decoction | - | - | - | Representative assay of diarrheal pathogenesis | Shown activity [59] |
| 61. | Gastrointestinal activity | Root bulbs/Decotion | 1 g/16 ml | Ofloxacin 1 µg/ml, Metronidazole 10 µg/ml, 2 mercaptoethanol And Gallic acid | - | Biological assays | Shown inhibition activity [60] |
| 62. | Hepatoprotective activity | Plant/n-hexane fraction | - | - | Mice | Gene targeting assays and assessed the product of genes | Shown activity [61] |
| 63. | Anti-diabetic activity | Plant/Hydroalcoholic extract | 500 mg/kg orally | - | Rat | Alloxan induced hyperglycemia | Shown significant Activity [62] |
| 64. | Anti-diabetic activity | Tuber/Decoction | 2.5 ml/kg orally | - | Rabbit | Alloxan induced diabetes | Shown significant activity [11] |
| 65. | Dermatological activity | Tuber/Alcoholic extract converted to ointment | 0.5/1/2% w/w | Nitrofurazone 0.2% w/w | Rat | Excision, Incision and dead space wound model | Shown activity [63] |
| 66. | Analgesic activity | Plant/Ethanol extract | - | - | - | 1.2% acetic acid induced writhes and stretches | Shown activity [23] |
| 67. | Anti-dysmenorrhea activity | Rhizome/Essential oil and Isolated compounds | 0.01/0.02/0.1 g/kg | - | - | Oxytocin 0.1 ml induced dysmenorrhea model | Fraction shown significant activity [64] |
| 68. | Effect on Lymphocytes proliferation | Plant/Extract | 1-1000 µg/ml | - | - | Lymphocyte proliferation assay | Shown activity [39] |
| 69. | Anticancer activity | Plant/Ethanol extract | 10/100/1000 µg/ml | - | - | Brine shrimp Bioassay | Shown activity [14] |

| | | | | | | | | |
|-----|---------------------|-----------|-----------------|---|---|------------------------------------|--|------|
| 70. | Anticancer Activity | Plant/oil | 25/50/100 µg/ml | - | - | Cytotoxic assay Against cell lines | Shown Positive Activity Against Carcinoma Cell lines and Negative Against Human tumor Cell lines | [71] |
|-----|---------------------|-----------|-----------------|---|---|------------------------------------|--|------|

I.P.: Intraperitoneal; MIC: Minimum inhibitory concentration; MBC: Minimum bactericidal concentration; HBV: Hepatitis B virus; CNS: Central nervous system; PTZ: Pentylenetetrazole; MTT: 3-(4, 5-Dimethyl-2-thiazolyl)-2, 5-diphenyl-2H-tetrazolium bromide; LDH: Lactate dehydrogenase; NO: Nitric oxide; LPS: Lipopolysaccharide; DPPH: 2, 2-Diphenyl-1-picrylhydrazyl

Effect on other diseases

Alzheimer disease is an irreversible disease that leads to cognitive impairment, neurofibrillary tangles, amyloid plaques, microtubule fibers, neurodegeneration are observed in AD patients. The hydroalcoholic extract of *C. Rotundus* improved the learning impairment and memory impairment in rats. There is an important compound already isolated from *C. Rotundus* known as alpha cyperone which binds and interact with tubulin and reduces the inflammation associated with AD [2].

There is a neurological disease in which degeneration of dopaminergic neurons which plays an important role for the progression of neurodegeneration. The aqueous extract of *C. Rotundus* at the doses of 50 and 100 µg/ml effectively reduced the condition in *in vitro* model of experiment [2].

The hydroalcoholic extract of *C. Rotundus* exhibits anti-anxiety activity. The Chinese polyherbal formulation which possess *C. Rotundus* exhibits and ethanolic extract of *C. Rotundus* at the dose of 240 mg/kg exhibits anti-depressive action in *in vivo* model of experiment. The essential oil and crude extracts of this plant exhibits sedative and analgesic effect in *in vivo* experimental model [2].

C. Rotundus rhizome powder is also used to improve the quality, storability and safety of minced beef meat [65]. The essential oil of *C. Rotundus* exhibits anti-oxidant activity due to the presence of phytochemicals in essential oil including α-cyperone, α-selinene and cyperene [66]. Methanolic extract of *C. Rotundus* rhizome exhibits significant anti-cancer property against all the tested cancer cell lines [67]. *C. Rotundus* showed significant result in the treatment of gastrointestinal, bronchial and vascular disorder in *in vivo* and *in vitro* experimental models [68].

Discussion

C. Rotundus commonly known as “Nut Grass” possess a great therapeutic potential. The tuber of this medicinal plant now a days, used in herbal medicines for different kind of ailments because of the presence of a large group of phytochemicals. The essential of this plant tuber plays an important role in cosmetic industry as well. The tuber of this plant also used in case of chronic disorder with no adverse reaction as per my best of knowledge till today.

Conclusion

The available literature on *C. Rotundus* depicted the fact that it is a popular medicinal plant which is used by Ayurvedic and traditional practitioners for the treatment of chronic diseases by using a different kind of formulation, polyherbal formulation, decoction, crude extracts, isolated phytochemicals and infusions as well. The scientists still looking for the new phytochemicals by using different kind of

extraction and purification procedures and their therapeutic potential which is still not known to the people.

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