

# A Critical Review On *Ruellia Tuberosa*, *Saccharum Benghalense* And *Dichanthium Annulatum* With Huge Availability In 'Middle Ganga Segment'

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## Abstract

One of the most significant sources of medications comes from plants. Plants have been used as remedies from the prehistoric era. This review was based on the chemical investigation and pharmacological evaluation of some medicinal plants i.e., *Ruellia tuberosa*, *Saccharum benghalense* and *Dichanthium annulatum* found in middle ganga segment. This review consists an extensive survey of literature from the Scopus/PubMed, Google Scholar, and other international reputed sources. The plant *Ruellia tuberosa* belongs to the Acanthaceae family and was introduced as a decoration to an Indian garden. It is a native of Central America. It has been employed in traditional medicine as a diuretic, antidiabetic, antipyretic, analgesic, and anti-hypertensive, as well as a quencher of thirst and an antidote. *Saccharum benghalense* is synonym for *Triplidium bengalense* that is also called as munj grass that grows in desert regions and along river banks. It is native to Myanmar, Bangladesh, Nepal, Afghanistan, Pakistan, northern India, and Iran. In the form of a solution or a powdered mixture, the plant's barks, leaves, roots, fluids, gums, fruits, and seeds are used to cure a variety of illnesses including fever, inflammation, bleeding wounds, burning sensations and herpes etc. *Dichanthium annulatum* belongs to Poaceae (Graminae) family. This review leads to the conclusion that the nutritional components of Saccharum munja, which include sodium, potassium, calcium, magnesium, chloride, bicarbonates, iron, phosphate, and sulphate, are what give the plant its medicinal value.

**Keywords:** Chemical constituents, *Ruellia tuberosa*, *Saccharum benghalense*, *Dichanthium annulatum*, pharmacological activity, review

## INTRODUCTION

One of the most significant sources of medications comes from plants. Plants have been used as remedies from the prehistoric era. The Rig-Veda allusions to some herbs' therapeutic capabilities in India appear to be the country's first records of the use of plants as remedies [1]. The traditional system of medicine and the contemporary system of medicine both make substantial use of medicinal plants around the world.

The two primary streams of the traditional medical system [2] are-

- The local, folk, or tribal stream
- The codified and organised Indian medical system, including Ayurveda, Siddha, and Unani, among others.

Despite advancements in contemporary medical and pharmaceutical research, the usage of medicinal herbs has evolved into a significant aspect of daily living over the centuries. In India, there are 3000 plant species that are known to have therapeutic qualities. The use of therapeutic herbs is mentioned in the Rigveda (3700 B.C.). Herbs are used as a treatment in many of our traditional medical systems, including Ayurveda, Yunani, Siddha, and homoeopathy. According to estimates, 40% of the world's population relies solely on plant-based medicines for their medical needs [3]. Indian medicinal plants provide affordable and secure health care options. Numerous attempts have been made to investigate indigenous knowledge regarding the use of common medicinal plants for the treatment of illnesses related to diverse human systems.

### 1. *Ruellia tuberosa*

The plant *Ruellia tuberosa* belongs to the Acanthaceae family and was introduced as a decoration to an Indian garden. It is a native of Central America [4]. The West Indies, Central America, Guyana, and Peru all use it medicinally [5]. Tuberous roots and a clever seed dispersion system help *Ruellia tuberosa* survive the dry season and proliferate. When water drops land on ripe seed capsules of *Ruellia tuberosa*, the capsules violently crack apart, releasing the seeds far from the plant. Due to its explosive activity, the plant earned the English nickname "Cracker plant."

It has been employed in traditional medicine as a diuretic, antidiabetic, antipyretic, analgesic, and anti-hypertensive, as well as a quencher of thirst and an antidote [6,7].

**Common names:** Snapdragon root, Duppy gun, Bluebell, Daniel's great gun, large bell-flower, Minnie root, popping pod & sheep potato.

*R. tuberosa* is called as Chatakani Phallis (Hindi) and Cracker (English).



**Fig 1.** Depiction of leaves + flower of *Ruellia tuberosa*

#### Taxonomy [8]

Kingdom - Plantae  
 Division - Magnoliophyta  
 Class - Magnoliopsida  
 Order - Scrophulariales  
 Family - Acanthaceae  
 Genus - *Ruellia*  
 Species - *tuberosa*

#### Chemical constituents

Part	Chemical constituents	References
Leaves	apigenin & luteolin	[9]
Flowers	malvidin -3, 5- diglucoside	[9]
Flower buds	3% apigenin -7-O-glucuronide, apigenin 7-O-glucoside, apigenin -7-O-rutinoside & luteolin -7- O-glucoside	[9]
Seed oil	myristic, capric and lauric acids	[10]
Ariel part	apigenin 7-B-D glucuronide, maividin 3, 5-diglucoside, masterol, B-sitosterol, campesterol, cholesterol, 21-methylhammer-22-en-3B, 18, 27, triol & Tylocrebrine	[11,12,13,14]
Tubers	n-nonacosane (C29: 44.83%) and n-hentriacotane (26.52%), Sterol-stigmasterol, B-sitosterol, campesterol	[15]

#### Pharmacological properties

##### Gastroprotective

In a rat model of alcohol-induced gastric injury, aqueous extract of *R. tuberosa* roots displayed a potent and dose-dependent gastroprotective action (in terms of reduction in length of haemorrhagic gastric lesions). The extract was well tolerated even with subchronic treatment and demonstrated mild erythropoietic and moderate analgesic efficacy [16].

##### Antioxidant

Different in vitro techniques, such as the 2, 2-diphenyl-1-picrylhydrazyl (DPPH) free radical-scavenging assays and the hydrogen peroxide induced luminol chemiluminescence assay, were used to examine the antioxidant activity of various extracts of the stem of *Ruellia tuberosa* L. The antioxidant activity of the methanolic extract (ME) and its four fractions of water, ethyl acetate, chloroform, and n-hexane were assessed. The results of the DPPH free radical-scavenging assay were the same, except for the rank order of n-hexane and water fraction. The findings offer helpful details on the pharmacological actions of this conventional folk treatment that are linked to free radicals [17].

##### Antimicrobial

Researchers looked at the antibacterial properties of *R. tuberosa* fractions extracted in hexane, dichloromethane, ethyl acetate, and methanol against both Gram positive and Gram-negative microorganisms. The highest levels of antibacterial activity against *Pseudomonas aeruginosa* and *Staphylococcus aureus* were seen in the ethyl acetate and methanol fractions [18].

### Anti-fungal

The zone of inhibition of the *Ruellia tuberosa* root methanolic extract showed promise against a variety of fungus. In comparison to the reference standard kanamycin 30 g/disc, the maximum inhibition was obtained against *Candida albicans* (18 mm), followed by *Aspergillus niger* (16 mm), *Aspergillus ochreus* (15 mm), *Aspergillus ustus* (14 mm), and *Rizopus oryzae* (10 mm). The smallest zone of inhibition against *Trichophyton rubrum* (8 mm) was observed [21].

### Anticancer

Cytotoxicity was present in the *R. tuberosa* herb's methanol extract of the aerial portion. In H460 and MDA-MB231 cancer cells, the lowest inhibitory concentration (IC<sub>50</sub>) for methanol extract was discovered to be 3.5 and 1.9 g/ml, respectively. By using bioassay-directed column chromatography to isolate tylocrebrine from the *Ruellia tuberosa* plant, its anti-inflammatory and anti-cancer properties were revealed [19].

### Analgesic & anti-inflammatory

In experimental mouse and/or rat models, the ethanol extract of *R. tuberosa* L. was assessed for its antinociceptive and anti-inflammatory effects. In the hotplate test, the 300 mg/kg group had the fastest response time to thermal stimuli and the greatest amount of analgesia that could be achieved, which was comparable to diclofenac sodium's effects. Like diclofenac sodium, the extract at dosages of 500 and 250 mg/kg significantly reduced acetic acid-induced writhing in mice. At dosages of 100, 200, and 300 mg/kg, the extract also significantly reduced the rat model of serotonin and egg albumin-induced hind paw edema. The extract's anti-inflammatory activities were comparable to indomethacin's at a dose of 5 mg/kg [20].

### Insecticidal

The results of testing the methanol extract of *Ruellia tuberosa* roots against the bug *Tribolium castaneum* (Herbst) to determine its insecticidal effectiveness are shown in Table 3. At a dose of 50 mg/ml in 48 hours, *Tribolium castaneum* had a maximum fatality rate of 80%. The outcomes demonstrated that *Ruellia tuberosa* root methanolic extract was extremely poisonous to insects [21].

### Hypoglycaemic

By giving methanol extract, n-hexane, and ethyl acetate fractions orally to healthy and diabetic rabbits, *R. Tuberosa*'s hypoglycemic efficacy was assessed. Alloxan monohydrate (150 mg/kg body weight) was injected intraperitoneally to cause diabetes. Rabbits with diabetes and normal blood glucose levels both significantly decreased after receiving the recommended amount of *R. tuberosa* (500 mg/kg). While n-hexane fraction (150 mg/kg) had moderate anti-diabetic activity and decreased blood glucose levels by about 15.17 0.58% (P0.005), ethyl acetate fraction (100 mg/kg) demonstrated the strongest anti-diabetic activity. The outcomes were compared to the standard medication tolbutamide (100 mg/kg) [22].

## II. *Saccharum benghalense*

*Saccharum benghalense* is synonym for *Tripidium bengalense* that is also called as munj grass that grows in desert regions and along river banks. The grass is tall, with smooth, greenish brown panicles. The grass is overgrown and can reach heights of up to 7 feet. Leaf sheaths are straight, pale straw in colour, villous on the edges at the apex with long white hairs that are typically much longer than the normal internode, and the highest sheath might occasionally reach beyond the base of the panicle. White blooms on it provide decorative significance. The plant is known by its common names, Kana, Sarkanda, and Moonja, and it is found in Pakistan and Afghanistan as well as northern and western India. Large tufted grass, the plant is of limited use as fodder because cattle and buffalo only consume the new leaves when there is a food shortage. The stem is used to make moorhas and chiks [23]. It is native to Myanmar, Bangladesh, Nepal, Afghanistan, Pakistan, northern India, and Iran. Northeastern India, particularly Assam in the Terai-Duar grasslands at the foot of the Himalayas, is a major region of native distribution [24].

Since the ancient civilizations of the Romans, Egyptians, and Arabs, plants with antibacterial qualities have been well known. In the form of a solution or a powdered mixture, the plant's barks, leaves, roots, fluids, gums, fruits, and seeds are used to cure a variety of illnesses. Inorganic nutrients from *Saccharum munja*'s stem, flowers, and surrounding soils were identified with consideration for the plant's medicinal use [25].

It was traditionally used in following ailments-

- Fever
- Inflammation
- Bleeding wounds
- Burning sensations
- Thrush
- Herpes
- Dyspepsia
- Dyscaria,
- Erysipelas
- Dspepsia
- Vertigo Giddiness

- Dysuria

Common names: with the common names munj sweetcane, baruwa sugarcane or baruwa grass, bahupraja, bana, bhadramunja, Kana, Sarkanda and brahmanya.

### Taxonomy

Kingdom - Plantae  
 Class - Liliopsida  
 Order - Poales  
 Family - Poaceae  
 Genus - Saccharum (Tripsidium)  
 Species - *benghalense*



**Fig 2.** Depiction of *Saccharum (Tripsidium) benghalense*

### Chemical constituents

Part	Chemical constituents	References
Stems	Reducing sugars i.e., glucose, xylose, galactose and rhamnose Magnesium, Calcium, Bicarbonates, Phosphate & chloride ions	[26,28]
Blossoms	Iron	[27]
Flower	Magnesium, Calcium, Bicarbonates, Phosphate & chloride ions	[28]

These are following mentioned medicinal uses of munj grass [29,30]-

- As a refrigerant, saccharum munja is utilised.
- Saccharum munja is beneficial for conditions like burning, thrush, herpes, dupepsia, dyscaria, erysipelas, urinary complaints, and eye diseases.
- Roots are used for vertigo, giddiness, and dysuria.
- It is applied to stop bleeding from wounds.
- Roots are also used to treat fever and inflammation.
- As a form of gauze-pad to block blood flow, saccharum munja grass.
- After giving birth, the smoke from burning roots scalds the skin.

### III. *Dichanthium annulatum*

*Dichanthium annulatum* belongs to Poaceae (Graminae) family. It belongs to the Poales order, is perennial, and is also referred to as marvel grass. A perennial grass, sheda grass grows to a height of about 25 cm. Due to its straightforward and affordable development from seed, it is used as forage. In India, these species appear promising for grazing or hay-making following reseeding into damaged grassland. In addition, it was used to uneven lawns. A high-quality fodder that can withstand brief flooding or drought is *Dichanthium annulatum* [31].

The discovery of many phenolic substances like Lignans, flavonoids, and flavolignan has recently sparked an increased interest in the phytochemistry of the family Poaceae (Graminae) [32]. Poaceae plants have been utilised in folk medicine for a variety of ailments, including hypertension, diabetes, inflammation, anthelmintic, astringent, ulcerative, diuretic, and antioxidant effects [33]. Poaceae is made up of a variety of different components, including starches, sugar, and secondary metabolites such as volatile oils, alkaloid, saponins, cyanogenetic chemicals, phenolic acids, flavonoids, and terpenoids [34]. Poaceae (Graminae) family member *Dichanthium annulatum* is a perennial grass with densely tufted blades and

rhizomiferous main stems. It is indigenous to regions of Africa, the Middle East, and tropical Asia. It has been brought to many different regions of the world for cultivation, and in some, like Australia, it has established itself as a native species [35].

This pasture grass is well-liked in various regions. It can be harvested for hay and silage and used in fields to graze livestock. It can grow in a wide range of soil types, including those with a lot of clay and sand, poor drainage, and a little saline and alkaline soil. It creates turf that can withstand pressure from grazing animals. It can bounce back from fire and drought, but it can't stand frost and shade as well. Although it doesn't need fertiliser, it does benefit from a little more nitrogen. It is particularly tasty to both horses and cattle. Degraded grasslands can also be replanted with the grass. It is a binding plant that is particularly excellent at preventing erosion. In India, this kind of pasture grass is highly popular. There, it is well-known, widely established, and prosperous [36].

**Common names:** Marvel grass, Diaz bluestem, Kleberg bluestem, Hindi grass, ringed dichanthium, sheda grass, medio bluestem, jargu grass, Delhi grass, vuda bluegrass, two-flowered golden-beard [37,38].



**Fig 3.** Depiction of *Dichanthium annulatum* (Marvel grass)

#### Taxonomy [39]

Kingdom - Plantae  
Division - Tracheophyta  
Class - Magnoliopsida  
Order - Poales  
Family - Poaceae  
Genus - *Dichanthium*  
Species - *annulatum*

#### Chemical constituents

The plant has shown for different chemical constituents as enumerated below [40-49]-

- triclin 4-O-(threo- $\beta$ -guaiacylglyceryl) ether (Salcolin A)
- triclin 4-O-(erythro- $\beta$ -guaiacylglyceryl) ether (Salcolin B)
- epimer of triclin 4-O-[threo- $\beta$ -guaiacyl-(7-O-methyl-9-O-acetyl)-glyceryl] ether
- triclin 4-O-[erythro- $\beta$ -guaiacyl-(7-O-methyl-9-O-acetyl)-glyceryl] ether
- triclin 7-O- $\beta$ -D-glucopyranoside
- triclin 7-O-neohesperidoside
- isoorientin

#### Pharmacological activities

##### Antioxidant

As it scavenges free radicals in a particular reaction medium, antioxidant activity is a metric used to evaluate the medicinal efficacy of plants. The scavenging activity of the different plant extracts for free radicals, such as DPPH, ABTS, and SOR, was measured and compared with a standard antioxidant (ascorbic acid). Ascorbic acid (positive control) has an IC<sub>50</sub> value of 16.913 2.57 g/ml in the DPPH experiment. The strength of the scavenging activity increases with decreasing IC<sub>50</sub>. Marvel grass shown greater DPPH radical scavenging activity in the current experiments among ethanol plant extracts (IC<sub>50</sub> 32.803 9.66 g/ml).

##### Antiviral

The *Dichanthium annulatum* ethyl acetate and n-butanol extracts have negligible antiviral activity against HAV-10 and none at all against HSV-1 and HSV-2. None of the viruses examined by the n-hexane extract had any antiviral activity.

## Antibacterial

The antibacterial efficacy of *Dichanthium annulatum's* ethyl acetate and nbutanol extracts against the majority of the tested particular species was inconsistent. In comparison to the n-butanol extract, the ethyl acetate extract was the most effective against *C. albicans* and *E. coli*. All of the studied bacteria exhibited no antimicrobial activity in response to n-hexane.

## Cytotoxicity

In comparison to n-butanol, *Dichanthium annulatum's* ethyl acetate and n-hexane extracts were the most effective cytotoxic agents against the investigated cell lines, with IC50 values ranging from 5.42 to 12.0 g/ml. Reactive oxygen species (ROS) are key players in oxidative DNA damage, which can impair biological functions in the body and result in a variety of chronic disorders. The use of herbal remedies to treat various illnesses is also favoured because they are more affordable, secure, and free from negative side effects than synthetic medications. Similar to this, substituting natural antioxidants for synthetic ones could be advantageous.

*Dichanthium annulatum* plant is also used in following ways [50,51]-

- It can be harvested for hay and silage and used in fields to graze livestock.
- It can grow in a wide range of soil types, including those with a lot of clay and sand, poor drainage, and a little saline and alkaline soil.
- It creates turf that can withstand pressure from grazing animals.
- It can bounce back from fire and drought, but it can't stand frost and shade as well. Although it doesn't need fertiliser, it does benefit from a little more nitrogen.
- It is particularly tasty for both horses and cattle.

## CONCLUSION

Traditional medicine has employed *Ruellia tuberosa* to treat a number of illnesses. The analysis of the literature revealed the existence of phenolic, flavonoid, and alkaloid chemicals in diverse plant parts. According to the pharmacological review, *Ruellia tuberosa* (cracker plant) has been shown to have anti-inflammatory, anti-nociceptive, antioxidant, and anticancer properties.

This review leads to the conclusion that the nutritional components of *Saccharum munja*, which include sodium, potassium, calcium, magnesium, chloride, bicarbonates, iron, phosphate, and sulphate, are what give the plant its medicinal value. The plant *Dichanthium annulatum's* aerial portions provide ten new chemicals. Previous studies have shown the potent cytotoxicity of *Dichanthium annulatum's* ethyl acetate and n-hexane extracts. Additionally, the plant's ethyl acetate extract has the strongest antibacterial action against *C. albicans* and *E. coli*, making it a potentially promising medicinal plant species. The flavonolignan and flavonoid contents of the ethyl acetate extract may be the cause of the increased activities of the extract, as they have previously been described.

It concluded that all these plants are effective medicinal herb having numerous pharmacological potentials with broad availability.

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None conflict of interest was given by authors.

## REFERENCES

1. International Union for Conservation of Nature, IUCN, Red List of Flora, cited 1998, updated August, 2010.
2. Prakasha HM, Krishnappa M, Krishnamurthy YL, Poomima SV. Folk medicine of NR Pura Taluk in Chikamagalur district of Karnataka. Indian Journal of Traditional Knowledge 2010;9(1):55-60.
3. World Health Organization. Guidelines for the Assessment of Herbal Medicine Programme on Traditional Medicine. Doc. WHO/TRM/91.4. WHO, Geneva, 2003.
4. Khare CP. Indian Medicinal Plants: An Illustrated Dictionary, Springer. 2007; p.561.
5. Kritikar KR and Basu BD. Indian medicinal plants. 1935; 3:1866-67.
6. Chothani D. L., M. B. Patel, S. H. Mishra, and H. U. Vaghasiya, Pharmacogn. J., 2, 506 (2010).
7. Lin, Y. C, Huang, L. Cheng, S. Sheu, and C. Chen, J. Chin. Med., 17, 103 (2006).
8. Encyclopedia of life. Available at <http://www.eol.org/pages/590262>, Accessed oct 25, 2008.
9. Subramanian SS, Nair AGR. "Apigenin glycoside from *Thunbergia fragrans* and *Ruellia tuberosa*. Current science. 1974; p.480.
10. Howard R. A Medicinal Plants of the Guiana's (Guyana, Surinam, French Guiana). 1983; 314.
11. Wagner H, Danniger H, iyengar NA, Seligurau O, Farkas L, subramannian SS and Nair AGR. Chem. Berr. 1971; 104: 2681.
12. Subramanian SS, Nair AGR. "Apigenin glycoside from *Thunbergia fragrans* and *Ruellia tuberosa*. Current science. 1974; p.480.
13. Singh RS, Pandey HS and Singh BK, Pandey RP. A new triterpenoid from *Ruellia tuberosa* Linn., Indian Journal of Chemistry. 2002; 41B: 1754-56.
14. Andhiwal CK, Chandra Haas Varshney RP. Phytochemical investigation of *Ruellia tuberosa* L. Indian drugs. 1985; 23: 49.

15. Arun S, Giridharan P, Suthar A, Kulkarni-Almeida A, Naik V, Velmurugan R, Ram V, et. al. Isolation of Tylocrebrine from *Ruellia tuberosa* through bioassay directed column chromatography and elucidating its anti-cancer and anti-inflammatory potential. Book of Abstracts, 7th Joint Meeting of GA, AFERP, ASP, PSI & SIF, Athens, Greece. 2008.
16. Arambewela LSR, Thambugala R and Ratnasooriya WD. Gastroprotective activity of *Ruellia tuberosa* root extract in rats. *Journal of tropical medicinal plants*, 2003; 4(2): 191–194.
17. Chen FA, Wu AB, Shieh P, Kuo DH, Hsieh CY. Evaluation of the antioxidant activity of *Ruellia tuberosa*. *Food Chem.* 2006; 94: 14–18.
18. Wiant C, Hannah M, Yassim M, Hamimah H, Sulaiman M. Anti-microbial activity of *Ruellia tuberosa* L. *American Journal of Chinese Medicine*. 2005; 33(4): 683–685.
19. Arun S, Giridharan P, Suthar A, Kulkarni-Almeida A, Naik V, Velmurugan R, Ram V, et. al., Isolation of Tylocrebrine from *Ruellia tuberosa* through bioassay directed column chromatography and elucidating its anti-cancer and anti-inflammatory potential. book of Abstracts, 7th Joint Meeting of GA, AFERP, ASP, PSI & SIF, Athens, Greece. 2008; p.25.
20. Ashrafual Alam M, Nusrat Subhan et. al Antinociceptive and anti-inflammatory properties of *Ruellia tuberosa*. *Pharmaceutical Biology*. 2009; 47(3): 209–214.
21. Kader Md Abdul, Shumaia Parvin, Md Aktar uzzaman Chowduri, Md Ekramu. Antibacterial, Antifungal and Insecticidal Activities Of *Ruellia Tuberosa* (L.) Root Extra. *Bio-sci.* 2012; 20: 91-97.
22. Ullah S, Shahwar D, Ullah S, Ahmad M and Ahmad N: Hypoglycemic activity of *Ruellia tuberosa* Linn. (Acanthaceae) in normal and alloxan-induced diabetic rabbits. *Journal of Chemical Society Pakistan* 2012; 34: 436-441.
23. Rahar Sandeep, Nagpal Navneet, Swami Gaurav, Arora Manisha, Bansal Suraj, Goyal Sandeep, Singla Shwali, Singh Preeti, Kapoor Reni. Medicinal Aspects of *Sacchrum munja*. *Research J. Pharm. and Tech.* 3 (3): July-Sept. 2010; Page 636-639.
24. *Tripidium bengalense* (Retz.) H.Scholz. *Plants of the World Online*. Royal Botanic Gardens, Kew. Retrieved 2021-09-04.
25. Tirmizi S. A., F. H. Wattoo, M. H. S. Wattoo, S. Kanwal and J.Iqbal. Inorganic nutrients of *Saccharum bengalense*, *Jour.Chem. Soc.Pak.* Vol.27, No.2, 186-189; 2005.
26. Adrian D C, *Trace Elements in the Teerrestrial Enviornment*, Springer, New York (1986).
27. Hery J B and B.E. Statland, *Chemical Pathology and Clinical Chemistry*, W.B. Saunders Company, Philedelphia (1979).
28. Hewitt F J and T. A. Smith, *Plant Mineral Nutrition*. The Eng. Univ. Press Ltd. London (1974).
29. Kabata A. Pendas and H. Pendas, *Trace Elements in Soils and Plants*. CRC Press, Inc. Florida (1986).
30. Kanwal, Thesis, Chemistry department Islamia University, Bahawalpur, Pakistan, 2002.
31. M. Arshad and A R. Rao, *Urumqi China*, 156; 1995.
32. Fatima, I., Kanwal, S., & Mahmood, T. (2018). Evaluation of biological potential of selected species of family Poaceae from Bahawalpur, Pakistan. *BMC complementary and alternative medicine*, 18(1), 27.
33. Jing, Z., Ying, W., Xiao-Qi, Z., Qing-Wen, Z. and Wen-Cai, Y. "Chemical Constituents from the Leaves of *Lophatherum gracile*" *Chin J Nat Med* 2009, 7(6): 428-431.
34. Durazzo, A., Zaccaria, M., Polito, A., Maiani, G., & Carcea, M. Lignan content in cereals, buckwheat and derived foods. *Foods*, 2013;2(1), 53-63.
35. Moreira, F. V., Bastos, J. F., Blank, A. F., Alves, P. B., & Santos, M. R. Chemical composition and cardiovascular effects induced by the essential oil of *Cymbopogon citratus* DC. Stapf, Poaceae, in rats. *Revista Brasileira de Farmacognosia*, 2010;20(6), 904-909.
36. Rathod, J. D., Pathak, N. L., Patel, R. G., Jivani, N. P., & Bhatt, N. M. Phytopharmacological properties of *Bambusa arundinacea* as a potential medicinal tree: An overview. *Journal of Applied Pharmaceutical Science* 2011;01 (10): 27-31.
37. Trease G.E. and Evans W.C., "Pharmacognosy" 15th Edit., BailliereTindall, London, pp. 1990, 37,38.
38. Heuze V., Tran G., Archimede H., 2015. Marvel grass (*Dichanthium annulatum*). *Feedipedia*, a programme by INRA, CIRAD, AFZ and FAO. <https://www.feedipedia.org/node/463>.
39. Integrated Taxonomic Information System – Report. *Dichanthium annulatum*'s. 2022. <https://www.itis.gov/>.
40. Khan AV. Ethnobotanical studies on plants with medicinal and anti-bacterial properties. (PhD Thesis). Aligarh Muslim University, Aligarh, India, 2002, pp. 1- 293.
41. Bouazi, M., Veitch, N. C., Grayer, R. J., Simmonds, M. S. J. and Damak, M. "Flavonolignans from *Hyparrhenia hirta*" *Phytochemistry* 2002;60(5):515-20.
42. Nakajima, Y. Yun, Y. S. and Kunugi, A. "Six new flavonolignans from *Sasa veitchii* (Carr.) Rehd" *Tetrahedron* 2003; 59:8011–8015.
43. Yang, Z., Nakabayashi, R., Okazaki, Y., Mori, T., Takamatsu, S., Kitanaka, S et al. Toward better annotation in plant metabolomics: isolation and structure elucidation of 36 specialized metabolites from *Oryza sativa* (rice) by using MS/MS and NMR analyses. *Metabolomics*, 2014;10(4), 543-555.
44. Wen, P., Han, H., Wang, R., Wang, N. and Yao, X. " C-glycosylfavones and aromatic glycosides from *Campylotropis hirtella* (Franch.) Schindl" *Asian Journal of Traditional Medicines*, 2007;2(4): 149-153.
45. Lin, Y. L., Kuo, Y. H., Shiao, M. S., Chen, C. C. and Ou, J. C. " Flavonoid Glycosides from *Terminalia catappa* L." *Journal of the Chinese Chemical Society*, 2000;47:253-256.
46. Swislocka, R., Kowczyk-Sadowy, M., Kalinowska, M. and Lewandowski W. "Spectroscopic (FT-IR, FT-Raman, 1H and 13C NMR) and theoretical studies of p-coumaric acid and alkali metal p-coumarates" *Spectroscopy* 2012;27:35–48.
47. Otsuka, H., Takeushi, M., Inoshiri, S., Sato, T. and Yamasaki, K. "Phenolic compounds from *Coix lachrymal-jobi* var. ma-yuen" *Phytochemistry* 1989;28(3):883-886.
48. Kamboj, A. and Saluja, A. K. "Isolation of stigmasterol and  $\beta$  sitosterol from petroleum ether extract of aerial parts of *Ageratum conyzoides* (Asteraceae)" *International Journal of Pharmacy and Pharmaceutical Sciences*, 2011;3(1):94- 96.
49. Chaurasia, N., Wichtl, M. "Sterols and steryl glycosides from *Urtica dioica*" *J. Nat. Prod.* 1987;50(5):881-885.
50. Voutquenne, L., Lavaud, C., Massiot, G., Sevenet, T., Hadi, H. A. "Cytotoxic polyisoprenes and glycosides of long-chain fatty alcohols from *Dimocarpus fumatus*. *Phytochemistry* 1999;50:63-69.
51. Cook, B. G., et al. *Dichanthium annulatum*. *Tropical Forages*. CSIRO, DPI&F (Qld), CIAT and ILRI, Brisbane, Australia.
52. Quattrocchi, U. *CRC World Dictionary of Grasses: Common Names, Scientific Names, Eponyms, Synonyms, and Etymology, Volume 1*. CRC Press. 2006. pg. 633.