“RECENT DEVELOPMENT FOR THERAPEUTIC POTENTIAL OF PEDALIUM MUREX IN THEIR FUTURE PROSPECTS”

A Project Report Submitted

In Partial Fulfillment of the Requirements

for the Degree of

BACHELOR OF PHARMACY

by

Ishit Sharma
(Enrollment No-19021020117)

Under the Supervision of

Mr. Satendra Kumar
Assistant Professor
Galgotias University
Greater Noida.

Department of Pharmacy
GALGOTIAS UNIVERSITY
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May, 2023

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DEDICATED

TO

MY FAMILY

GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

DECLARATION

I hereby declare that the work embodied in this project report entitled "**RECENT DEVELOPMENT FOR THERAPEUTIC POTENTIAL OF PEDALIUM MUREX IN THEIR FUTURE PROSPECTS"** in Partial fulfilment of the requirements for the award of Bachelor of Pharmacy, is a record of original and independent research work done by me during the academic year 2022-23 under the supervision and guidance of **Mr. Satendra Kumar, Assistant Professor, Department of Pharmacy, School of Medical and Allied Sciences, Galgotias University, Greater Noida**. I have not submitted this project for award of any other degree or diploma of any other Institute or University.

Date: **(MR. ISHIT SHARMA)**

Place: Greater Noida **Name and Signature of candidate**

GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

CERTIFICATE

Certified that **Mr. ISHIT SHARMA (Enrollment No-19021020117) (Admission No.-19SMAS1020033)** has carried out the research work presented in this dissertation entitled "**RECENT DEVELOPMENT FOR THERAPEUTIC POTENTIAL OF PEDALIUM MUREX IN THEIR FUTURE PROSPECTS"** for the award of **Bachelor of Pharmacy** from **Department of Pharmacy, School of Medical and Allied Sciences, Galgotias University, Greater Noida** under our supervision. The work is completed and ready for evaluation in partial fulfillment for the award of Bachelor of Pharmacy during the academic year 2022-2023. The project report has not formed the basis for the award of any Degree/Diploma/Fellowship or other similar titles to any candidate of any University

Mr. Satendra Kumar

Supervisor

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GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

CERTIFICATE

This is to certify that project work entitled "**RECENT DEVELOPMENT FOR THERAPEUTIC POTENTIAL OF PEDALIUM MUREX IN THEIR FUTURE PROSPECTS"** done by **Mr. Ishit Sharma** submitted to the Department of Pharmacy, is a bonafide research the supervision and guidance of **Mr. Satendra Kumar, Assistant Professor, Department of Pharmacy, School of Medical and Allied Sciences, Greater Noida, U.P, India.** The work is completed and ready for evaluation in partial fulfillment for the award of Bachelor of Pharmacy during the academic year 2022-2023. The project report has not formed the basis for the award of any Degree/Diploma/Fellowship or other similar titles to any candidate of any University.

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Date: -…….

GALGOTIAS UNIVERSITY

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

BONAFIDE CERTIFICATE

This is to certify that the project work entitled **"**entitled "**RECENT DEVELOPMENT FOR THERAPEUTIC POTENTIAL OF PEDALIUM MUREX IN THEIR PROSPECTS"** is the bonafide research work done by **Mr. Ishit Sharma** who carried out the research work under my supervision and guidance for the award of Bachelor of Pharmacy under Galgotias University, Greater Noida during the academic year 2022-2023. To the best of my knowledge, the work reported herein is not submitted for the award of any other degree or diploma of any other Institute or University.

Mr. Satendra Kumar

Supervisor

Assistant Professor

Department of Pharmacy,

School of Medical & Allied Sciences,

ACKNOWLEDGEMENT

I consider it a great privilege & honour to have had the opportunity to undergo and conduct a project work in Galgotias University. Hence, I would like to offer my heartiest thanks to **Prof. (Dr.) P.K Sharma** (Dean, Department of Pharmacy, SMAS) and **Prof. (Dr.) Niranjan Kaushik** (HOD, Department of Pharmacy). I am greatly indebted to **Mr. Satendra Kumar** (Assistant Professor, Department of Pharmacy, School of Medical and Allied Sciences) for her huge support, suggestions and affectious cooperation during the whole course of my project work. I also thanks to my parents for appreciating and supporting me for this grateful work project at last, but not least, I am greatly thankful to all my seniors and colleagues in Galgotias University for extending their constant cooperation which went a long way toward the completion of this Project Work.

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Abstract:

Pedalium murex, commonly known as large caltrops, is a plant species that belongs to the family Pedaliaceae. It is an underutilized medicinal herb that has multiple uses in traditional medicine, particularly in the treatment of reproductive disorders, urinary and gastrointestinal tract disorders. The herb is native to India and Africa, and its fruits, known as 'Gokhru,' are widely used in Ayurveda for their aphrodisiac properties and urological disorder treatment. The use of Pedalium murex in traditional medicine has been well documented. It is primarily used to cure reproductive disorders such as impotency in men, nocturnal emissions, gonorrhoea, and leucorrhoea in women. Additionally, it is also useful in the treatment of urinary and gastrointestinal tract disorders. However, despite the widespread use of the herb in traditional medicine, its detailed scientific evaluation is still unexplored. One of the most significant challenges associated with the propagation of Pedalium murex is the difficulty of extracting the seeds from the fruit. The fruits of Pedalium murex are four-angled, indehiscent, and hard pyramidal, with four sharp spines. The hard, spiny exterior makes it difficult to extract the seeds, and there is no standardized germination test for Pedalium murex seeds.The development of a standardized germination test is a crucial requirement for seed sale labeling, and it would enable better propagation of Pedalium murex. Propagation through seed is one of the primary methods of propagation for the herb, and a standardized germination test would ensure that the seeds sold are of high quality.

Keywords: *Pedalium murex*, Therapeutics potential, Natural Products

“Recent development for therapeutic potential of Pedalium murex in their future prospects”

1. Introduction:

One species of plant, Pedalium murex Linn (family: Pedaliaceae) (P. murex), belongs to the genus Pedalium. It is found in tropical countries like Sri Lanka, Pakistan, and India.

P. murex, an annual herb, is a common sight along the coastal states and countrirs, and tropical Africa in the regions of Tharparkar and Cholistan. P. murex is very important in medicine. The amygdalin glycoside and diosmetin glucuronides are present in the P. murex leaves extract [1, 2]. Dysuria and gonorrhoea can be treated using an infusion made from the plant's leaves and stems. The flowers and leaves have been used to extract a large number of flavonoids. Tetratriacontanyl octacosanoate and heptatriacontan-4-one are two further novel substances that have recently been identified and extracted from P. murex fruit [3]. A fruit-based broth is utilised as an aphrodisiac, diuretic, demulcent, antispasmodic, and its root broth serve as an anti-biliary. Clinical uses of P. murex have demonstrated that its many plant parts are a repository for various medicinally active chemicals, ensuring the plant's pharmacological potential. As a result, it offers the opportunity to look into its medical potential even more. Some scientists think P. murex can be used as a powerful fertility-enhancing medication and biopesticide plant [4]. Trioctanyl dotrioctanoate and 2',4',5'-trihydroxy were used to treat urogenital diseases. Its fruits are a source of 5,7-dimethoxy flavones [5]. It has historically been used to treat wounds, general debility, ulcers, fevers, puerperal ailments, tonics for the digestive system, and other conditions. The presence of phytochemicals in the plant is also investigated. The study of phytochemicals gives us hope for new insights into a more appealing pharmacological synthesis.

P. murex is used ethanolic for a variety of reasons.

Throughout the beginning of time, Indians have used this plant to treat a variety of illnesses. In areas where the use bada gokhru to treat various disabilities is highly significant, significant amount of data regarding plant uses is likely to be gathered. They are thought to have therapeutic qualities. Phytochemicals are very significant restorative compounds found in herbs that have the potential to influence specific physiological changes on the animal body. These plants' flavonoids, alkaloids, phenolic compounds, and tannins make up the majority of their essential bioactive ingredients.

The native botanicals are still heavily utilised for treating common diseases in underdeveloped nations. A thorough examination and interactions with regional herbal drug suppliers, ethanolic- pharmacologists, and rural healers revealed that native bada

gokhru components often widely used to treatment of many animal and human illnesses [6]. Farid buti in Urdu, yenugupalli in Telugu, brihatgokshur in Sanskrit, bada gokhuru in Hindi, and huge caltrops in English are a few of the different names for P. murex that it goes by in other languages. This plant is a member of the kingdom Plantae, Phylum/Division Magnoliophyta, and Class Magnoliopsida (Dicotyledonae). Moreover, it belongs to the Lamiids subclass along with the Caryophyllales order and Pedaliaceae family. Moreover, it is a member of the genus Pedalium and goes by the name of p murex. The flowering period lies between may to December and fruiting period lies in June to January.

1.1. Geographical distribution:

This plant belongs from forest of Himalayas India, Burma and several countries, the prostate herbs growing throughout India up to 3500m in Kashmir. Pedalium murex is the only species that makes up P. murex. It is found around the world in Pakistan, India, Sri Lanka, and Tropical Africa. The primarily found in Tamil Nadu, Rajasthan, Uttar Pradesh, Gujarat, and Punjab, among other places, in India. From latitude 33S to latitude 18E, it is quite common [7].

1.2. Morphology of Gokhru:

Plant morphology: Pedalium murex L., an annual creeper with branches spread out all over and a chromosome number of 8, is a succulent, glandular plant. Simple, opposite, ovate leaves, glabrous, alternating, meaty, estipulate, uneven in shape, and growing in pairs of 5 to 8 leaves that range in size from 4.0 to 6.5 cm and 4.0 to 5.0 cm, respectively. A small amount of nectar is secreted by flowers, and it can be collected near the base of the corolla tube. Solitary, hermaphrodite (bisexual), and zygomorphic yellow flowers with dimensions of 2.5–3.0 cm in length by 1.0–1.5 cm in breadth and a short pedicel emerge from the leaf axis. Five sepals, a gamopetalous corolla, tetradynamous stamens, a bicarpellary pistil in syncarpous condition, and four ovules arranged on an axile placentation are all characteristics of the flower [8]. FIRST rate set is approx. 95% in uncover pollination. The fruit gokhru are dead, light golden brown in colour, and rigid pyramidal in shape with four sharp spines. The plant is entomophilous, meaning that bees and butterflies pollinate it. Flavonoids, sapogenin, and several alkaloids, including pedalintandem, diosmetin, dinatin, and pedalindinatin-7-glucuronide, are abundant in dark brown seed powder. When the

monsoon begins in June or July, germination begins. It grows well at a temperature of 25 to 30 degrees Celsius, and in October or November, flowering and fruiting take place.

1.3. Scientific Classification:

The botanical name of Bara-Gokhru is Pedalium murex L. It belongs to the family Pedaliaceae.

The taxonomical classification of the plant is given below.

Kingdom: Plantae : Plants
Family: Pedaliaceae : Sesame Family
Subkingdom **:** Tracheobionta – Vascular Plants
Genus **:** Pedalium
Superdivision **:** Spermatophyta – Seed Plants
Division **:** Magnoliophyta – Flowering Plants
Species **:** Murex
Class **:** Magnoliopsida – Dicotyledons
Subclass **:** Asteridae
Order : Lamiales

1.4. Botanical Aspects:

While the leaves are in twosomes of five to eight and have an uneven shape, shows that it has a creeper that lengthens to approximately two to three feet and branches that spread out all around. depict small yellow blossoms, while depicts four to five-inch-long brown roots with a fragrant character. a spherical fruit with five to twelve chambers, each containing a seed. The seeds contain fragrant oil. The time of year when the plant flowers and matures into fruit is early winter [9]. P. murex is a succulent and fragrant plant that evolved in Pakistan's Tharparkar and Cholistan deserts as well as South India's coastal regions. It is visible from May through. It has been showing figure No**.** 01.

Figure-1: Gokhru plant

2. Ethnopharmacology Study:

Ethnopharmacology is the study of traditional medicinal practices and the use of natural products in different cultures. Pedalium murex is a plant species that has been investigated for its potential medicinal properties.

Research on Pedalium murex has shown various pharmacological activities, including anti-inflammatory, analgesic, anti-diabetic, antioxidant, and anti-microbial effects. The plant has been traditionally used in Ayurvedic medicine for the treatment of conditions like rheumatism, urinary disorders, and male infertility.

Several bioactive compounds have been identified in Pedalium murex, such as flavonoids, alkaloids, steroids, and terpenoids, which contribute to its therapeutic properties. These compounds may exert their effects through different mechanisms, such as reducing inflammation, scavenging free radicals, and regulating glucose metabolism.

2.1.1. Phytochemistry of Gokhru:

Vanillin and diosgenin make up the majority of the P. murex plant's chemical composition. There are a number of other components that have reportedly been found in the various plant parts. The Phytosterols, tannins, saponins, carbohydrates, reducing sugars, xanthoproteins, flavonoids, alkaloids, triterpenoids, phenolic compounds, alkaloids, resins, flavonoids, saponins, proteins, steroids, stigma sterol, alkaloids, glycosides, stable oil, resins, aromatic oil, triterpenoid, carbohydrates, amino acids, and phenols are among the chemical components found in the P MUREX [10].

2.1.2. Flavonoids:

According to reports, flavonoids make up the majority of the material taken from the P. murex plant's stem, flowers, roots, and leaves. It has pharmacological and physiological characteristics that are well-known.

From the P. murex plant, flavonoids such as pedalitin, diosmetin, dinatin, quercetin, kaempferol, luteolin, and 20,40,50-trihydroxy-5,7-dimethoxyflavone have been isolated.

2.1.2 Saponins:

The two primary phytochemicals obtained from the fruit of the P. murex plant are sitosterol and diosgenin. They are in charge of producing oral contraceptives, corticosteroids, and sexual hormones. It has been showing figure no**.** 02.

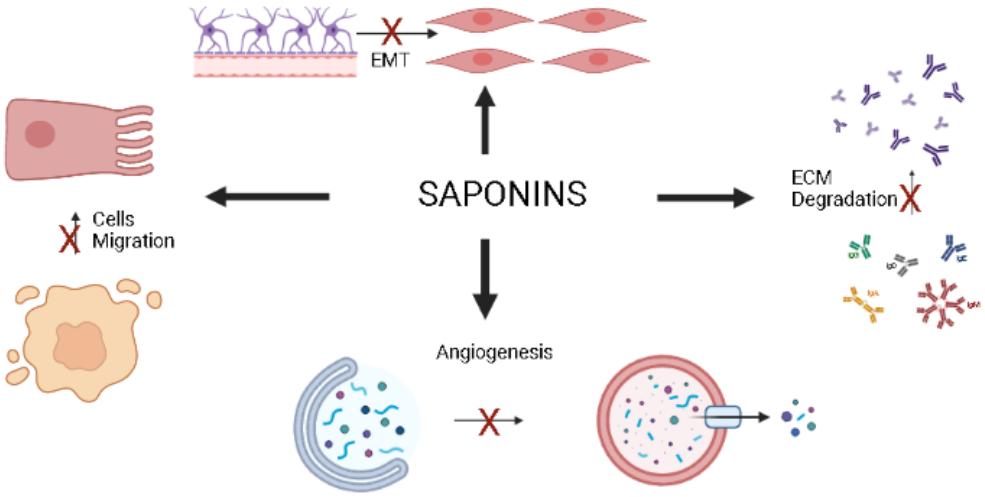

Figure. 02: P. murex plant and contraceptive saponin effects

2.1.3 Terpenoids:

Lupeol acetate is utilized as a chemo preventive agent to treat a variety of diseases and has been shown to have substantial biological properties. Furthermore, Ursolic acid, a pentacyclic triterpenoid, is present as an active component in the plant's fruit. It functions as an anticancer agent and is mostly utilized as an addition in cosmetics.

2.1.4 Phenols:

Vanillic acid and luteolin are two of the P. murex plant's phenolic constituents.

While luteolin functions as an anti-inflammatory, anti-allergy, and anticancer agent, vanillic acid is mostly employed as an antioxidant agent and acts against cardiac disorders. Nonacosane, triacontanol acid, and amino acids including threonine, aspartic acid, glutamic acid, and histidine that were recovered from the fruits of the P. murex plant are the other acids that have been described [11]. The chemical structures of some of the main phytochemical components of the P. murex plant.

2.2 Pharmacognosy of Gokhru:

P. murex, often referred to as giant caltrop and bara gokhru, is a branching, succulent, fleshy, and annual glandular herb that grows up to a height of 30 to 50 cm. The leaves are 3.2–5.3 cm long and 1-2.7 cm wide, simple, reticulate, ovoid, alternating, and opposite.

White plant roots with a pleasant scent are present. Round, solitary flowers are 2.5–3 cm long, bright yellow, and axillary with a short pedicle. They have five calyxes, each with a gamopetalous corolla, five lobes, four stamens, a didynamous, five celled ovules, and a two-lobed style.

Glabrescent hairs make up the corolla tube [12]. This plant produces four angled, meaty fruits with conical horizontal trichrome coming from the angles.

This plant has four-angled, meaty fruits with conical horizontal trichrome coming from the angles. The plant's stem is brittle. When the plant's stem and leaves are soaked in cold water, they transform into a thick, tasteless paste that has potent medicinal qualities [13].

3. Pharmacological activities of Gokhru:

3.1. Antifeedant and bio pesticidal activity:

Via the use of the leaf dip methodology, ethanolic extracts of P. murex root (0.1%, 0.2%, 0.4%, and 0.8%) were investigated for antifeedant and insecticidal activity against Spodoptera litura larvae at various stages [14]. The Spodoptera litura's food intake index, all decreased in accordance with P. murex's indication of anti-feedant activity gokhru, which is a more potent biopesticidal herb than Neem Gold, may be used as one in the near future [15].

2. Antihyperlipidemic activity:

Rats on a high-fat diet were given ethanol extracts bada gokhru to evaluate the plant's ability to prevent hyperlipidemia. P. murex was evaluated against several biochemical elements such blood serum cholesterol, lipoproteins (high density, low density, very low density), and triglycerides in comparison to the reference standards gemfibrozil and atorvastatin, and the results were seen in the treated animals [16]. The ethanolic extract demonstrated a notable decrease in very low density lipoproteins (P 0.01), triglycerides (P 0.01), total cholesterol (P 0.001), low density lipoproteins (P 0.001), and a very noticeable increase in high density lipoproteins (P 0.05) at various tested doses.

3. **Antinephrolithiatic activity:**

P. murex is widely distributed in the coastal regions of Pakistan and India and has a very effective curative use for ailments related to urinary illnesses.In order to assess P. murex's anti-nephrolithiasis activity ,Anti-nephrolithiatic activity [17]. The preparation and testing of various extracts, including aqueous, ethanolic, petroleum ether, and chloroform extracts on albino rats, demonstrates that P. murex has significant anti-nephrolithiasis action.

4. **Nephroprotective activity:**

In rats with cisplatin-induced kidney injury, the ethanol extract of P. murex fruit was investigated for nephroprotective activity. To cause nephrotoxicity, Wistar rats were fed cisplatin at a dose of 5 mg/kg body mass. By administering a concomitant oral dose of 250 mg/kg of P. murex's ethanolic extract, losses in body weight, blood urea levels, and serum creatinine levels were seen as signs of kidney impairment [18]. It was discovered that ethanol extract works incredibly well to prevent kidney injury. Consequently, it may be said that P. murex cystone ethanolic extract greatly promotes nephroprotection.

Gastrointestinal bleeding can be induced by peptic ulcer and acid peptic illnesses, which are brought on by poor eating patterns and contemporary lifestyles. Herbal remedies are more suited to have great effectiveness and little negative effects than pharmaceuticals [19]. The significance of P. murex has increased due to the presence of biochemically active phytochemicals and their ethano-medicinal applications.

5. **Antiulcer activity:**

Peptic ulcers in people are the result of changing food and lifestyle choices. Aqueous P. murex leaf extract was investigated for its ability to treat stomach ulcers caused by ethanol ingestion [20]. Several chemical components, including ulcer index, glutathione, acid volume, total acid, and total protein, were examined for this reason. To create an ulcer, 80% ethanol (1 mL/kg) was given orally to rats after a 36-hour fast. An hour later, they were

given aqueous extracts of P. murex leaves at doses of 50, 100, and 200 mg/kg of body mass as well as the reference medication famotidine at a dose of 3 mg/kg of body mass.

6. **Anti-inflammatory effects:**

   Root, leaves, and seeds of P. murex and A. indicum were examined for their potential therapeutic applications [21]. P. murex was discovered to have somewhat greater anti-inflammatory action than Abutilon indicum. The mechanism of carrageenan-induced paw edoema was investigated in albino Wistar rats. Prior to the injection of carrageenan, the concentration level of the paw was assessed in each Wistar rat at intervals of 1 h, 2 h, 3 h, 4 h, 5 h, and 24 h. It was discovered that the concentration level of the paw was significantly higher after the injection [22]. Increased in the intervals after the injection of carrageenan. The inflammation's edematous component was identified.

7. **Anti-oxidant efficacy:**

   The effects of methanolic extract of P. murex on carbon tetrachloride (CCl4)-intoxicated rat liver were examined. Methanolic extract was given orally to rats with hepatotoxic effects for 90 days on a daily basis. The therapeutic effect of CCl4-methanolic extract dosed rats has demonstrated the effectiveness of methanolic extract to counteract oxidative stress caused by hepatic injury and decreased efficacy of glutathione catalase, glutathione reductase, peroxidase antioxidant enzymes, and superoxide dismutase in CCl4-intoxicated [23]. Several concentrations of phenolic components, which are very potent antioxidants for human health, according to the research' findings [1,18]. The main effects of the plant's anti-oxidant activity are micronutrients and phenolic components found in various P. murex preparations. According to the investigations, P. murex is an effective free radical scavenger.

8. **Antibacterial effects:**

   The antibacterial effectiveness of about 12 distinct pathogenic microbes was evaluated against methanolic extracts of leaf and fruit. A negative control revealed no suppression of the positive control's (streptomycin) results. The methanolic extract of P. murex contained phytochemicals such as alkaloids, glycosides, flavonoids, phenols, steroids, and tannins [24]. Compared to Gram-negative bacteria, Gram-positive bacteria such as Streptococcus progeny and Enterococcus faecalis have demonstrated greater antibacterial effectiveness in P. murex methanolic extract.

9. **Hepatoprotective activity:**

The role of reactive oxygen species production and oxidative stress in the development of liver injury is established. Alcoholism and other substance addictions are the causes. The extreme toxicity of the aqueous and ethanoic/methanolic extracts of P. murex fruit was assessed orally on Swiss albino mice in accordance with the acute oral toxicity 425 standards [25]. Alcohol and aqueous extracts of P. murex at dose levels of 400 mg/kg of body mass have been studied for their ability to prevent liver damage caused by alcohol and isoniazid [26]. Rats that had high levels of (intoxicated by isoniazid) triglycerides, total bilirubin, cholesterol, serum glutamic-oxaloacetic transaminase, and serum glutamic pyruvic transaminase were reduced by administering an aqueous alcoholic extract from P. murex fruit. Substantially within the standard range. The primary phytochemicals in P. murex's aqueous-alcoholic extract, tannin and flavonoid groups, are responsible for hepatoprotective action via scavenging free radicals [27].

10. Anti-diabetic effects:

The effectiveness of P. murex root ethanolic extract as an anti-diabetic agent in rats with alloxan-induced diabetes was examined. Three weeks of administration of P. murex ethanolic extract at doses of 100 and 200 mg/kg of body mass resulted in a significant drop in blood sugar levels and an increase in blood insulin [28]. The ethanolic extract of P. murex reduced the production of free radicals in the tissues of the liver and kidney. In addition to its anti-diabetic effectiveness, P. murex ethanolic extract's antioxidant properties have shown a decrease in the components of thio-barbituric acid as well as hydroperoxides and an increase in the levels of superoxide dismutase, catalase, and glutathione peroxide, as well as a decrease in glutathione transferase and glutathione [29]. In comparison, the ethanolic extract of P. murex (200 mg/kg of body mass) has demonstrated greater efficacy in comparison to glibenclamide, a standard reference drug [30].

11. Insecticidal:

When tested against Spodoptera smear at the third, fourth, and fifth larval stages, it was revealed that the root extract of the P. Murex plant exhibited insecticidal action [31]. The tannin component saponin and accountable for the insecticidal qualities.

12. Antimicrobial effects:

According to the research that have been published, the P. Murex plant's entire structure has antibacterial action. According to a paper, ethyl acetate extracted from P. Murex plant flowers was found to be efficient against Lactobacillus, Salmonella typhi, Escherichia coli, Enterococcus faecalis, Bacillus cereus, and Salmonella typhi [32]. The fruit part's ethanolic

extract was discovered to be efficient against a fungus pathogen. Streptococcus pyogenes, E. Faecalis, and Klebsiella pneumonia were all successfully treated with methanolic extract from Trichophyton rubrum, which was isolated from the leaves and fruit section [34].

4. BIOTECHNOLOGICAL ASPECTS:

4.1 Bioactive molecule 5-beta- hydroxyltridicanol benzoate identified in Pedalium murex L. Fruit extract showed antifungal activity against *sclerotinia sclerotiorum**:*** It is well known that plants contain bioactive metabolites, which play a role in the plant's defense mechanisms against insects and other pests [35]. The majority of the metabolites, which are called terpenoids, are responsible for giving plants their smells. Some metabolites, such as quinines and tannins, are responsible for giving plants their pigments. Yet others, such as certain terpenoids, are responsible for giving plants their flavours [36]. These bioactive chemicals, also known as secondary plant metabolites, are made up of low-molecular-weight sub stances that are considered to be unnecessary for the maintenance of life, 68 but are absolutely necessary for the continued existence of the organism. With a wide range of chemical investigation, more than 50,000 structures have been isolated from plants. However, considering that research has been conducted on fewer than twenty percent of all plant species, it is highly probable that the true number of secondary metabolites and functionalized substances found in the plant and be greater than one hundred thousand structures. The category of functionalized substances is typically subdivided 5 primary classes, including: phenolic acids and polyphenolic acids (crude extract) [37].

Fungi that are harmful to plants inflict serious damage to crops at all stages, from the early developmental phases to the stages after harvest [38]. A wide variety of fungal species are to blame for the decline in agricultural productivity as well as problems in other areas, such as decreased nutritional value and organoleptic qualities, as well as a shorter shelf life. At the same time, illnesses as a result of the creation of molecules that are classified as allergens or mycotoxins. On back days, were treated with a wide range in order to improve agricultural output. However, the benefit of this approach has always been accompanied by a number of undesirable side effects, negative effects on the environment [39]. So, it would be preferable to employ, which are easily ecological. This would be a decision that is alternative to the use of harmful chemicals and does not pose a risk. As a result, there is a significant need for the development of novel antifungals that can belong to a diverse array of structural, act on new aims, and produce tiny adverse visibles. Plant diseases are responsible for the death of between 10 and 20 percent of the world's basic foods and cash

crops, according to recent estimates. There is not a great deal of evidence available at this time concerning the antibacterial capabilities of medicinal plants that are being researched in relation to phytopathogen fungus [40]. The fungi known as Rhizoctonia solani, Sclerotia sclerotium, and Botrytis cinerea are considered to be the three most significant plant diseases. The pathogen Rhizoctonia solani is responsible for a large amount of establishment and yield loss. Sclerotinias clerodendrum is destructive or global soil-borne Ascomycetes. It is responsible for the infection of over 500 different plant species across the globe. According to Zhu et al.96 2016, the annual yield losses caused by Sclerotinia infections amount to more than several hundred million USD per year across the world. Due to their inability to move systematically through plants, fungicides that give complete control on sclerotia of S. Sclerotium [41]. This is because of the disease (Peltier, 2012). Another type of necrophilia around the globe, great diversity, and adaptation to a wide range of environmental circumstances. Botrytis cinerea is the fungus responsible for the illness known as grey mould, which affects a wide variety of dicotyledonous plants [42]. It colonizes injured tissues, and moreover capable of infecting wholesome plants, inflicting major broken to flowers and vegees both before or after harvest in open fields and in greenhouses. Because it satisfies all of the traditional requirements for a pathogen of this kind, B. Cinerea is regarded as an excellent example of a necrotrophic. Its method of infection involves the by the disintegrating that trigger unit destroyed prior the invasion [43]. This is done in order to prepare the host for the hyphal invasion. Pedalium murex L., also known as Bada Gokhru, is a member of the family Pedaliaceae and is well-known in the field of traditional medicine for its pharmacological benefits (including as an aphrodisiac and in the treatment of urological diseases). The plant has a long and illustrious history of use in pharmacological studies. However, its potential use as a biopesticide receives much less attention, despite the fact that the plant has been studied for its insecticidal properties [44] . The plant reportedly possesses antifungal activity that is effective against human diseases. On the other hand, there are some findings indicating that it is due to the antibacterial qualities that it possesses. As a result, antimicrobial or antifungal qualities to an extract that had been prepared using fruits of P. Murex that had been gathered from various locations in India. Additionally, the researchers wanted to isolating and identifying the bioactive compound through chemical analysis [45].

4.1.1 Materials of methods:

Plethora of different extract of gokhru gathered from 10 states across India, each of which has a unique agricultural climate. The National Institute of Science Communication and Information Resources (NISCAIR), which is located in New Delhi, was given all of the fruits that were collected so that they could authenticate them and use them in subsequent investigations. Plant pathogens of agroeconomic obtained from plenty of different governmental authorities. According to the method described by haynes [46]. It has been showing figure no**.** 03.

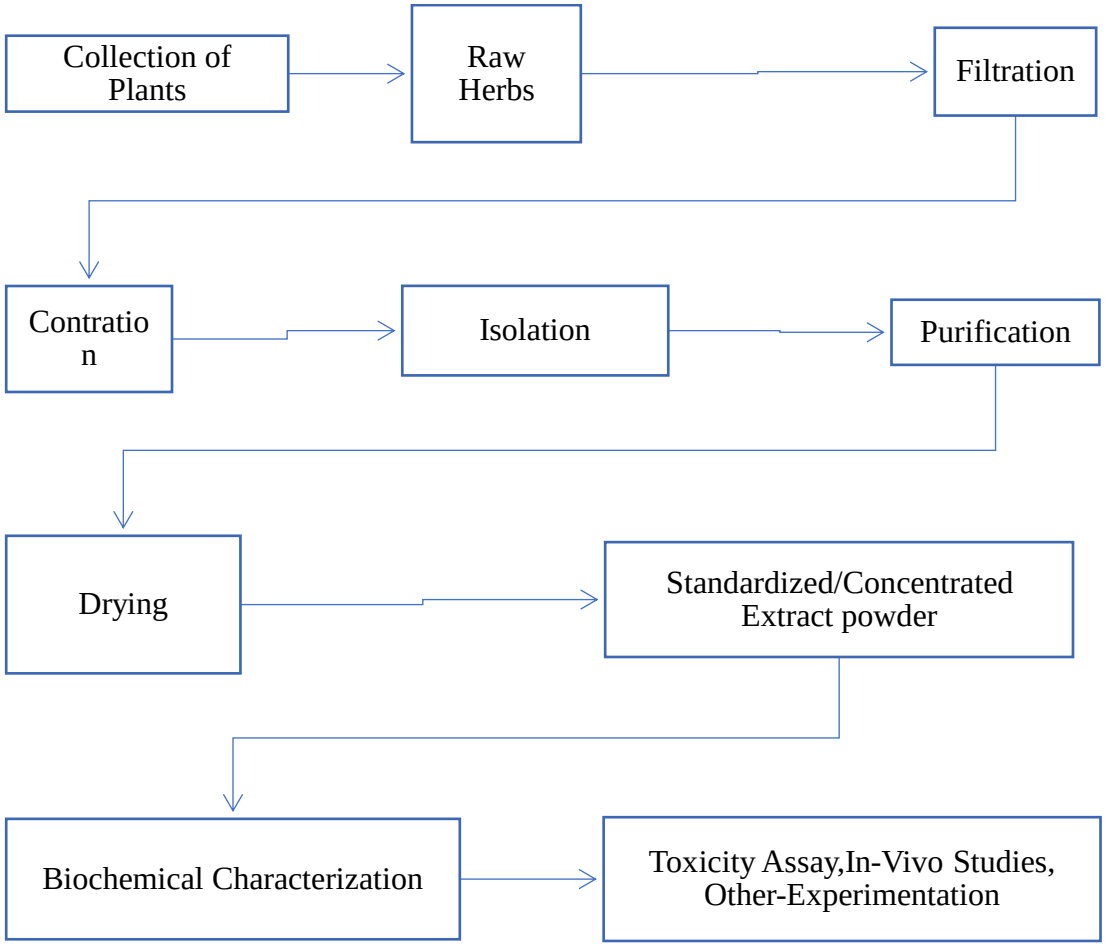

Figure. 03: Plant collection and classification

4.1.2 Preparation of plant extract:

P. Murex fruits that were between 50 and 100 grammes in weight were washed with water, dried in the shade for two-to-five-day period. In a Soxhlet device, the fruit powders were extracted in methanol (ranging from around 300 to 700 milliliters; the exact volume required is dependent on the amount of fruit powder) for forty-eight hours before being concentrated with a rotary evaporator [47]. The extracts were kept at a temperature of 4 degrees centigrade until further investigation. It has been showing figure no**.** 04.

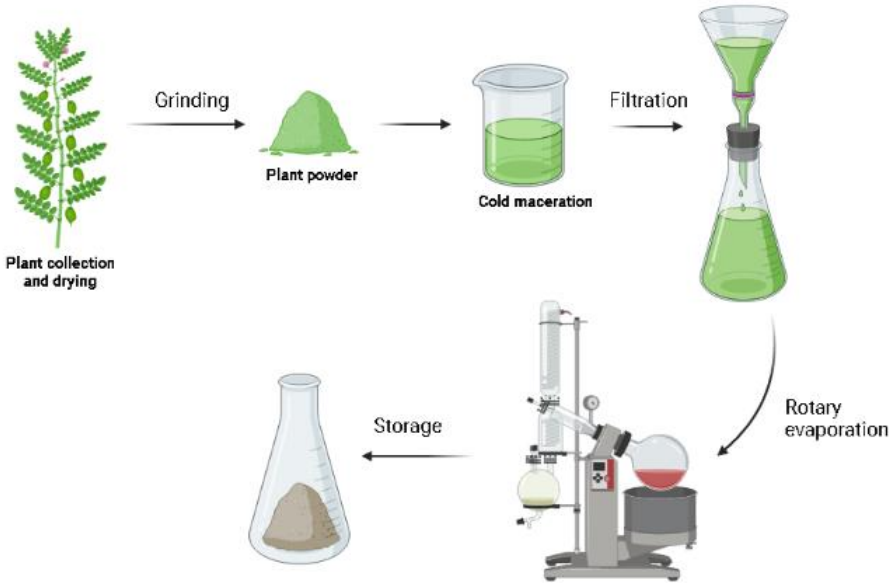

Figure .04: Preparation of plant extract *Pedalium murex*

4.1.3 Extract screening for antimicrobial activity:

Bioassays were carried out in order to investigate whether possessed any antibacterial properties. In order to conduct the test, culture was produced and further alongside methanolic extracts at five different doses, ranging from 0.01-0.01 mg/ml [49]. After that, plates were injected with plant pathogenic fungus in the form of 3 mm2 plugs that were inserted at equal distances apart (2-2.5 cm). After an incubation period of three days consisting of 24 hours in BOD at a temperature of 25 degrees Celsius, radial development was evaluated [50]. The control consisted of six separate inoculations of phytopathogen spread throughout a plate that had only solvent added to it. Determination by applying the respective equations to the data: GI= [(A-B)/A]x 100. By using regression equation analysis, we were able to determine the inhibitory concentration (IC50) (Chaudhary and Kaushik, 2015) [51]. In order to test NAM's effectiveness against bacteria, solution was put into plates. On the surface of each plate made of agar. An impregnated paper disc of 6 millimetres in diameter and 100 microliters in volume was used, and it was placed on equal lenght as the handling [52]. It was acceptable to use the plates. To stand for 30 mins. It has been showing figure no**.** 05.

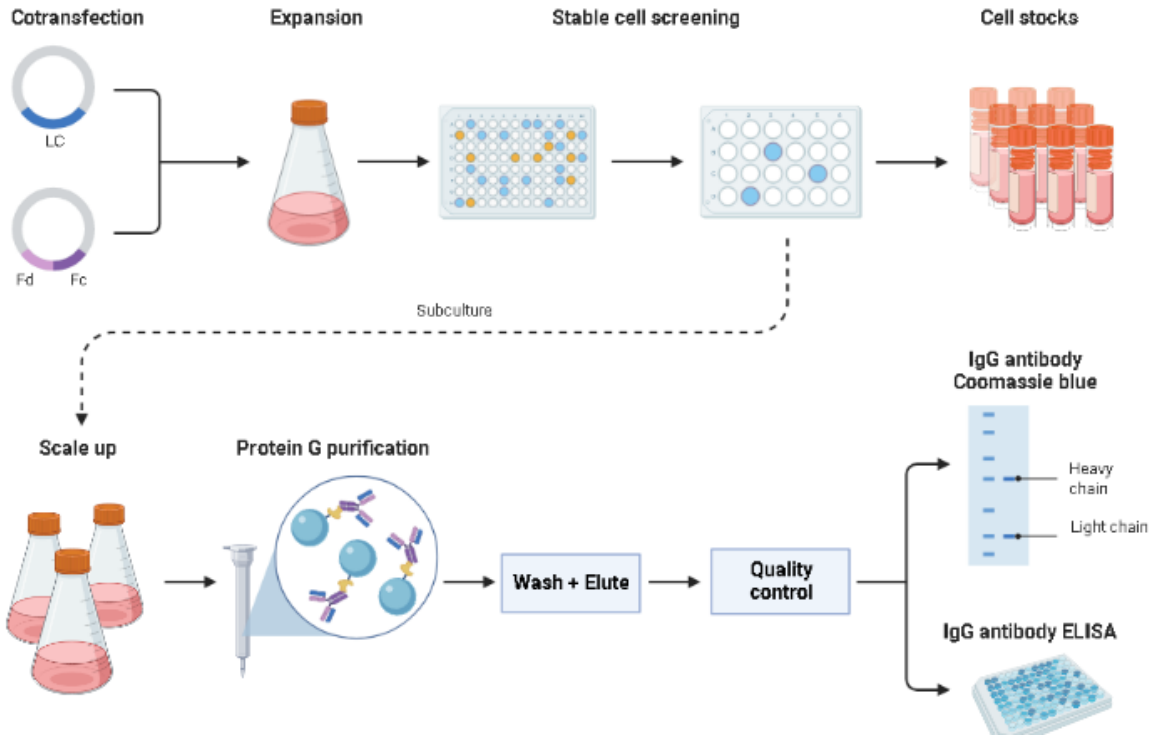

Figure No. 05: Extract screening for antimicrobial activity

4.1.4 Inspection:

ENTIRELY of findings reported to a mean the standard error of the results separate tests. In order to determine whether or not the data obtained at a p-value of less than 0.5 were statistically significant, a one-way analysis of variance was carried out [53].

4.2 TLC and HPLC analysis:

Using preparative thin layer chromatography allowed for the successful separation of the chemical constituents. TLC plates of 20 by 20centimeter dimensions were filled with approximately 200 milligrams of methanolic crude extract, and the plates were then run in a solvent system consisting of six parts ethyl acetate to four parts hexanes [54]. On the TLC plates, it required the use of ultraviolet light with wavelengths of 365 and 366 nanometers. The Rf value of each band was determined, and then each band was removed from the scrap pile individually. Each band that was recovered from the TLC plates was then passed through an HPLC grade methanol three times before [55]. It has been showing figure no**.** 06.

Steps involved in HPLC method:

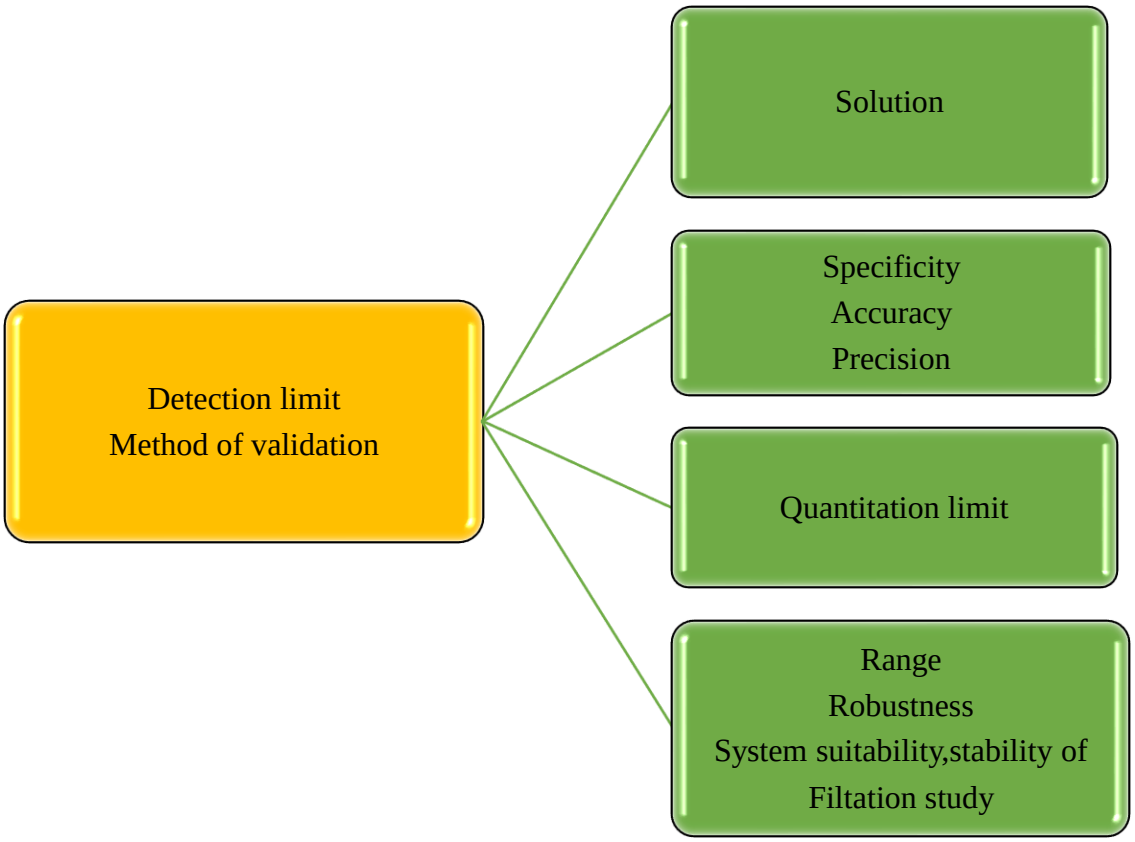

Figure No. 06: Detection limit Method of validation

4.2.1 Inspection:

Chemical constituents were obtained were subjected to HPLC, which was carried out on an HPLC system that was outfitted. It was tested on column that was 250 mm by 4.60 mm and five microns thick. In order to prepare the sample for HPLC, 1 milligrams of the extract were dissolved in 1 milliliter of HPLC-grade methanol [56].

4.2.2 FTIR Spectrum Analysis:

At room temperature, the FT-IR spectra was acquired by employing a spectrometer manufactured by Thermo-Scientific, model number Nicolet 380. The functional group was determined by scanning the sample in the region of 4000-400 cm-1 while using potassium bromide (KBr) pellets as the probe.

4.2.3 MC/LC Analysis:

Experiments with LC-MS were carried out that included a (manufactured by moisture and located, Massachusetts) and a Micro-mass TOFTM (manufactured by Micro-mass and located in Withernsea, United Kingdom) that was outfitted [57].

4.2.4 Ocular task:

Using an Autopol V Polarimeter, optical rotation was measured and analyzed. At a temperature of 25 degrees Celsius, the substance was kept in a cuvette with a volume of 0.5 milliliters and a length of 0.1 millimeters. The angle of rotation was measured using a mercury vapour lamp with wavelengths of 546 and 579 nanometers. The optical rotation, determined using the formula below, at the wavelengths 579 and 546 nm, respectively: [α]T \sλ= α T λ/1. Where: represents the angular distance that has been measured and equals the height of the polarimeter in decimeters, and accumulation of chemical on grammes per one hundred millilitres [58].

4.2.5 Inspection of various activities on extract:

The plethora of fruit extracts of Gokhru obtained to various places across nations analyzed and compared to the antimicrobial activity of plenty of plants. In order to carry out the bioassay, first extract, which ranged from 0.001 to 1 mg/ml. Only 11 of the 29 fruit extracts that were tested against a total of 12 different microorganisms were discovered to have any bioactive compounds, and even those 11 fruit extracts were only effective on different sclerotium species [59]. The samples from village and Indore exhibited the greatest GI, which was 23.21 and 25, respectively. The sample from Neemuch showed at (10 g) of the raw constituents. There was a total of 11 samples. Wide changes in GI (%) have been recorded up until concentrations of 100 g/ml, however these variations tend to become more stable at larger doses. On behalf to the GI (%) value. Other nine microbial species did not exhibit any changes in their growth patterns, and as a result, they will not be discussed here (data not shown). An additional noteworthy finding is that samples of fruit extract taken from one region only respond to certain types of fungi, while other types of fungi are left unaffected by the treatment [60]. In contrast to this, the samples from Agra and Indore demonstrated antifungal activity against two separate kinds of fungi. As an example, the clipping obtained the area effective against S. sclerotium. a result, taking into account its effectiveness against

a wide variety of fungus, our team chose a sample from the Indore region to submit to further study.

4.2.6 Isolation and detoxification:

The fruit extract sample from Indore had a wide range of effects, we decided to use to the component or the identification of characteristics. In order to isolate the chemical, the extract went through a preparative TLC fractionation process [61]. A total of nine unique individuals who have been certified by peer review are the authors and funders of the study. We reserve all of our rights. There is a strict ban on recycling without prior approval. In the TLC plate, visible and UV light both revealed the presence of bands with Rf values corresponding to 0.029, 0.076, 0.194, 0.235, 0.318, 0.441, 0.482, 0.558, and 0.91 respectively. All of these bands were scraped off, and the resulting material was extracted in methanol and put through HPLC testing to look for the presence of single or multiple chemicals [62]. TLC analysis revealed the distinct and a hype in a corresponded an Rf value of 0.318 in each of the nine samples that were investigated. Some fractions collected from the TLC plates had a variety of peaks, which indicated the existence of numerous complex compounds. It has been showing figure no**.** 07.

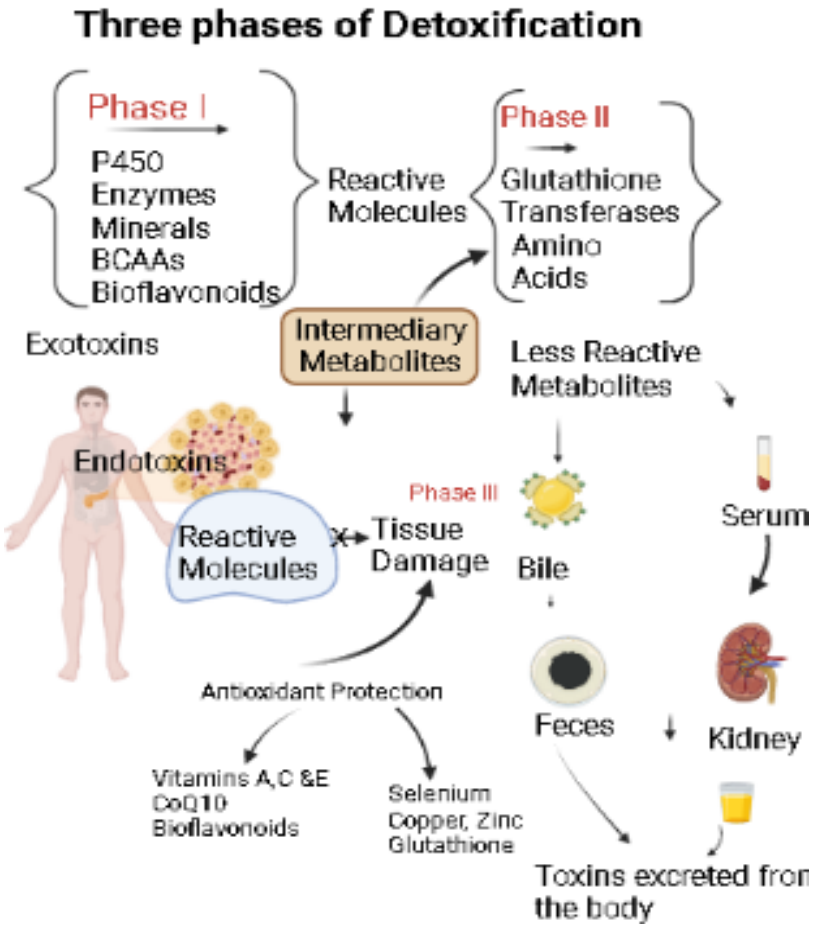

Figure No. 07: Three phase of Detoxification

4.2.7 Inspection of compartmented molecule:

Elucidating the structure, tested the distinct methods for the presence of bioactive chemicals using a bioassay on the three microorganisms that had previously been screened: R. solani, B. cinerea, and S. sclerotium. Among all of the samples that were evaluated, the band with an Rf value of 0.318 shown considerable and powerful activity against the fungal phytopathogen known as S. sclerotium with an IC50 value of 454 g/ml by inhibiting the growth of the pathogen's mycelia at a growth radius of 5.7 mm [63]. Other species, such as R. solani and B. cinerea, that were discovered to be vulnerable to the crude extracts were not discovered to be susceptible against this particular fraction of metabolites. Carbendazim is a widely used, broad-spectrum benzimidazole fungicide, and we tested its effectiveness against microbes under conditions that were very similar to those of our assay [64]. We discovered that it is highly effective against the microbes because it inhibits their growth even at very low

concentrations [65]. This allowed us to verify that our test was accurate. In contrast to this, we investigated whether or not the isolated chemical had any effect on helpful fungi such as Trichoderma. At varying concentrations of the isolated chemical, we were unable to identify any discernible changes.

4.2.8 Estimation of the active constituents:

The seclusion part underwent FTIR analysis in order to more thoroughly define it. The IR spectrum signals were determined for a few positions 3015, indicating CH; at positions 2945, 2837, 1735, and 1641 representing C=O; and at positions 1510, 1427, 1415, and 1085 representing C-O accordingly.

4.2.9 Architectural interpret of the compounds:

Triplet peak of the proton of C2 was observed in the proton spectrum at a frequency of 4.09 Hz, whereas the triplet peak of the proton of C3 was observed at 0.99 Hz and J-=6.5 Hz, and the triplet peak of the proton of methanol was observed at 10. At position 1 C demonstrates the comprehensive multi certified through. We reserve all of our rights [66]. There is a strict ban on recycling without prior approval.

C7 reveals that C=O. The molecule's 13 266 C NMR exhibited carbon resonance at a value of two bonds, afterwards validated to indicate existence. The molecular ion peak was located in its mass spectrum corresponds to the molecular formula of the molecule (C20H32O3) [67]. The complex dissociates into its constituent parts at coordinates (14.5), 215 (2.7), 207 (10.3), 199 (3.2), 177 (3.6), 143 (45.1), 121 (2.8), 113 (59.2), and 105. (73.5). In light findings, the purified molecule, which has an optical rotation of 0.143 degrees.

4.3 Modularly effects of methanolic fruit fraction of *Paledium murex* on salphasalazine-induced male reproductive system:

4.3.1 Initiation:

The inability to become pregnant after having sexual relations without protection (WHO, 2013). A significant problem in today's society, infertility affects about 50 million couples who are trying to start a family [68]. Worldwide, with an alarming pace of increase. It is estimated that approximately forty percent of infertility issues are caused by male factors,

and more than ninety percent of male infertility issues are brought on by either low sperm counts or low. Hormonal abnormalities, low semen volume, and other seminal markers of epididymal, prostatic, and seminal vesicle function are some of the remaining causes of male infertility. Other causes of male infertility include [69].

The usage of medicinal plants and the byproducts of those plants that have curative qualities is nearly as old itself Significant amount primary source of many drugs. Traditional medicines made from plants are said to be less hazardous to one's health and more reliable equivalents. In the southern regions of India, Mexico, tropical Africa, and Sri Lanka. Folk medicine recognizes the significant therapeutic and medicinal potential of Pedalium murex for the treatment of ulcers, digestive tonics, fevers, wounds, and puerperal disorders [70] . Pedalium murex is well-appreciated for its great therapeutic and medicinal value. Antifeedant, anti-hyperlipidemic, nephroprotective, and antibacterial properties have been attributed to P. murex in more recent. P. murex has a long history of use in the Ayurveda medical system, where it is not only considered an aphrodisiac but also a sexual desire enhancer and treatment for renal and bladder issues. Although, there are no comprehensive on the fertility-booming working principle. Because of its ability to alter increasing abnormalities, sulfasalazine (SSZ) was utilized in the process of inducing reproductive dysfunction in rats (Sharma & Kalla, 1994) [72]. This was done in order to study the effects of SSZ on male reproductive dysfunction. As a result, the purpose of this particular study was to investigate the impact that the methanolic fruit fraction of P. murex had on the experimentally induced disruption of male reproductive function.

4.3.2 Components and processes:

4.3.2.1 Compositions:

Clomiphene citrate and SSZ were acquired from a local market. Both of these substances were produced in India by BAL Pharm Ltd. Using kits developed, were able to determine the values of many biochemical parameters. All of the besides compositions and reactive molecules that were utilised to this process [73].

4.3.2.2 Plant constituents:

The freshly ripened bada gokhru were gathered at the institute of Indian state of Rajasthan. Correctly confirmed by the Department of Botany in Jaipur, India. Moreover, specimen was placed at the herbarium.

4.3.2.3 Construction toward herb snippet:

After the herbal constituents had been dried and ground into a powder in a mechanical grinder, it was subjected to thorough extraction with 100% methanol using a Soxhlet apparatus at room temperature for seventy-two hours. In order from the extracts that were obtained, before. In the end, the residue was subjected to a second round of fractionation using chromatography performed serving the solvent for the mobile phase. The methanolic fraction was subjected to additional purification and crystallisation before being used in the subsequent experimental technique [74].

4.3.2.4 BRUTE:

Rats of weighed 170 10 g each. These rats were kept in polypropylene cages measuring 430 mm 270 mm 150 mm and were kept at a temperature of 25 3 °C with a humidity level of 50% and a light cycle that alternated between 12 hours of light and 12 hours of darkness. The animals were provided with a conventional feed (a commercial pelleted diet obtained from in addition to water on an as-needed basis [75].

4.3.2.5 Dire noxious inspect:

The tiny poisnous research of bada gokhru carried out in accordance with the recommendations of OECD-423, which were obtained from the association. MfPm was given to the rats via oral administration at escalating body weight. When the drug was administered, all of the animals were monitored for gross behavioural, neurological, autonomic, and toxic effects at short intervals of time for the first five hours and then for the following twenty-four hours. Throughout the course of seven days, daily records of food consumption and body weight were kep [76]t. On day seven, all of the animals were slaughtered, and a gross pathological examination was performed on the organs that had been taken (Turner, 1965).

4.3.2.6 Tentative methods:

A total of 40 male fertile healthy albino rats were used to make up each of the four groups, each with a size of n = 10. Normal control rats (NC) in Group I were given in Group II were also given, and in Group III were given as a reference standard drug. Rats in Group IV that had been treated with SSZ were given MfPm at a dose of 50 mg/kg body weight [77]. Every treatment, with the exception of NC, was taken orally for the whole course of the study (which lasted for sixty days). In accordance with the methodology presented by Rahman et al., the fertility experiment was carried out between 55 and 60 days (2014). The rats were housed in a ratio of one male to three

females, and a successful mating was determined to have taken place if a vaginal smear the following morning revealed as well as sperm cells. On 16th day of pregnancy, the fertilised females were slaughtered so that the implantation locations could be recorded. The fertility % was determined. This formula used to get the percentage. The patient's starting body weight as well as their final body weight after treatment were both recorded. After waiting for 24 hours after the previous dose, blood was drawn from the heart of the animal using a cardiac puncture and left to clot at room temperature. The blood was then centrifuged at 4 degrees Celsius at 500 times g for 15 minutes in order to separate the serum. The animals were put to sleep with a low dose of anaesthesia in accordance with the CPCSEA guideline [78]. on a temperature of 20 degrees Celsius for subsequent biochemical and histopathological analysis.

4.3.3 Examination of gametes and their agility:

A small incision was made in the cauda epididymis in order to access the spermatozoa, which were then transferred to 100 millilitres of normal saline (0.9% sodium chloride) [79]. The epidydimal sperm count was determined with the use of a Neubauer's hemocytometer, and the results were expressed as millions of sperm per millilitre of solution (Jayaram, 1992). The motility of sperm was determined by placing one drop of a solution that had been equally mixed on a microscopic slide and covering it with a cover glass. The percentage of motile spermatozoa was found by counting the number of motile and nonmotile spermatozoa present in the same location.

4.3.4 Tissue biochemical analysis:

They also assessed the amount of sialic acid in testes and cauda epididymis. Using Mann's approach, we were also able to determine the amount of fructose present in the seminal vesicle (1964).

4.3.5 Testicular cell dynamics:

The estimate that was produced for each cell type per cross-section of the seminiferous tubule was the basis for that carried out. Under high magnification (800), the round spermatids that were 5 micrometres thick [80]. These rudimentary counts were refined through the application of the Abercrombie correction factor (Abercrombie, 1946). Several types of interstitial cells, such as fibroblasts, mature Leydig cells, counted using vibrant

counting techniques on a population of 200 cells, and the results were statistically confirmed.

4.3.6 Statistical analysis:

All of the data are shown as the mean standard error of the mean (SEM), and there were six rats in each group. The statistical significance of the difference in mean values was determined using one-way analysis of variance (ANOVA), followed by the Duncan's multiple comparison test (Statistical Package for Social Sciences, SPSS, v21.0). Values were considered significant if they had a p-value of less than 0.01, and the mean values were presented as such [81].

5 RESULT:

5.1 Small noxious learning:

The investigation of tiny poisnous, the result in any vibrations in culture, and there were lack of deaths recorded betwist the course of the research. When compared to the group that had been treated with the vehicle, there was no discernible change in either the body weight or the amount of food consumed [82]. As a result, the MfPm can be administered therapeutically without risk of adverse effects.

5.2 Germination study in gokhru seeds:

Pedalium murex L. has a superior profile and has the potential to be a natural source for the treatment of a wide variety of diseases, whether they are acute or chronic [83]. In Ayurvedic medicine, Pedalium murex is primarily employed as a tonic, an aphrodisiac, a substance that stimulates hunger, and a substance that is effective in the treatment of strangury, urinary discharges, vesicular calculi, cough, and asthma. It has been showing figure no**.** 08.

Figure No. 08. Fresh Gokhru seed

asthma, pain, skin disorders and heart problems, piles, and leprosy are all cured by this remedy. It cleanses the blood and eliminates stone formation in the bladder [85]. Because the adverse effects of medications on human health have been documented, ayurveda practitioners are increasingly turning to the use of medicinal plants in their practises. The Gokhru crop has not yet begun to be cultivated for commercial purposes. Sand-covered wastelands are the best places to look for it. After reaching full maturity, the gokhru fruit drops to the ground, where they remain dormant until the following year, when the environment is just right in terms of temperature and moisture for growth. Because there is a shortage of planting material, a significant amount of focus is being placed on the cultivation of therapeutic plants. It is essential to have a solid understanding of the various types of propagating material available in order to successfully cultivate any type of plant. Testing the seeds is a necessary step in determining the potential success of a planting and reducing the likelihood of the planting attempt being unsuccessful. Seed testing is obligatory for the purpose of determining the quality standards under seed law enforcement and is deterministic of the amount that should be planted. The development of seed quality testing procedures will make the domestication of Gokhru and the commercialization of seed much easier to accomplish. Germination is contingent not only on the inherent qualities of the seeds but also on external conditions including temperature, moisture content, and substrate. During the germination process, temperature effects the rate of

chemical reactions and imbibitions, which in turn determines the uniformity of the process and the overall germination rate [86]. Certain species perform better when the temperature is held constant, while others germinate more successfully at higher temperatures.

At a variable temperature [87] Journal of Ayurveda and Herbal Medicine|January-March|2022. While selecting a substrate, it is important to take into account the features of the seeds, such as their size, the amount of water and light they need, the ability to count them, and their overall quality [88]. At this point in time, there are no seed standards that have been produced for this crop. As a result of this necessity, it is vital to set standards for the certification of seed. Certification agencies will apply the defined seed standards in order to guarantee the quality of the seed, and the seed testing technique will be employed in laboratories that conduct seed testing. As a result, the purpose of this work was to design a technique in order to establish a standard for the routine evaluation of the quality of gokhru seed. It has been showing figure no**.** 09.

Figure No.09: Dried Gokhru seed

5.3 Materials and method:

The freshly harvested seeds of Gokhru (Pedalium murex L.) were collected from Bhaleri (28°32'15.3"N 74°46'22.4"E) and Dadreva (28°40′22″N 75°13′58″E) village of Distt. Churu (Rajasthan). A study on seed quality parameters was conducted at the Department of Seed Science & Technology, CCS Haryana Agricultural University, Hisar during the year 20 The fruits of Pedalium murex L. are indehiscent, pyramidal, and rigid, and they have four spines on each corner (Figure 1). The seeds must be carefully extracted from the

fruit, which can be a challenging process. As a result, research was carried out on both the fruit and the seed. After the spines had been removed from the fruits utilising a mechanical scarifier for ten seconds, the fruits' seeds were retrieved from them.

The percentage of seedlings that germinated, the length of the seedlings, their dry weight, and their vigour indices were all observed and recorded. The germination test was carried out in accordance with the regulations of the International Seed Testing Association [8], with four replications of 100 fruits or seeds using three different methods, namely, Top of Paper (TP), Between Paper (BP), and Sand (S) methods were used at two constant temperatures of 25, 30 and one alternating temperature of 20-30oC (20°C for 16 hours and 30h for 8h). The seed germinator should have a relative humidity of 90–95% [89].

When there was no longer any indication of an increase in germination, the final count was made, and only healthy seedlings were taken into account for calculating the percent of germination. The test weight of seeds and fruits was estimated by counting one thousand fruits and seeds at random over three replications, then weighing each one on an electronic balance. The average of these individual weights was then recorded as the test weight in grammes [90]. During the germination test, ten normally developing seedlings were chosen at random from each replication, and their average length was measured in centimetres for the final computation. This was done so that we could estimate the length of the seedlings. After determining the length of the seedlings, ten new seedlings were selected and then dried in an oven at a temperature of 80 10 degrees Celsius for twenty-four hours. After drying, the seedlings, an accurate weight was obtained for each replication, and this weight was then stated as an average in mg. Calculations of seedling vigour indices were carried out using the approach outlined below, which was proposed by Abdul-Baki and Anderson:

The Vigor Index–I equals the percentage of germination times the average seedling length (mm)

The formula for calculating the Vigor Index–II is as follows: Germination (%) x Average seedling dry weight (g)

The experiment was carried out using a factorial totally randomised design in accordance with the conventional method recommended by Panse and Sukhatme, and the data was analysed with the use of an online statistical programme called OPSTAT that was developed by Sheoran.

5.4 Data of investigation germination of fruits:

An investigation of the germination of fruits as well as seeds was carried out [91]. There was a significant interaction (p 0.5) for all of the parameters, with the exception of the interaction between temperature and substrate, in terms of seedling length and vigour index-I of both the seed and the fruit. In the case of fruits, the sand approach proved to be superior by registering the highest level of germination (29.67%), beating out both the Between Paper (23.33%) and Top of Paper (3.11%) ways. It's possible that the low germination rate achieved with the TP technique is the result of insufficient moisture levels. Additional seed quality indicators like the Viogur index-I [213] and the Vigour Index-II (2.20) were also reported to be at their optimum in the sand method, whereas the Between Paper method recorded the maximum seedling length (8.00 cm) and seedling dry weight (0.075 mg) respectively. The weight of one thousand gokhru fruits varies anywhere from 115.0 to 140.0g. Each fruit contains one to two seeds, and the total weight of one thousand seeds is around 2.60 grammes. The final tally was taken on the thirty-first day for the fruits and on the seventh day for the seeds. The following parameters recorded their lowest values at temperatures ranging from 20-30 degrees Celsius: germination (22.78%), seedling length (8.00cm), seedling dry weight (0.142mg), vigour index-I (186) and vigour index-II (2.26). The temperature at which these parameters recorded their maximum values was 30 degrees Celsius.

When the fruits were heated to 20 degrees Celsius, regardless of the substrate, there was no germination observed in the fruits. When seeds were kept at low temperatures for an extended period of time, the process of germination was slowed down because metabolic processes were inhibited. In contrast, seeds germinated more quickly at high temperatures as a result of protein denaturation brought about by increased metabolic activities [92]. This was due to the fact that high temperatures brought about increased metabolic activities. Because it is one of the key requirements for biochemical metabolism, temperature is an extremely important factor in the process of germination. While vigour indices are derived by multiplying seedling lengths and seedling dry weight with germination %, the sand approach resulted in higher vigour indices than the other methods. This is because the sand method had a higher germination percentage. When compared to the "Top of Paper" and "Between Paper" methods, the "Sand Method" may have resulted in a shorter seedling length and a lower seedling dry weight because it promoted a shorter growth rate in the root length.

Germination can be sped up or slowed down, depending on both the temperature and the substrate it is growing on. Germination tests involve a medium, which plays a significant part due to the fact that seeds have specific requirements for germination, including the presence of moisture and oxygen. In the case of the seeds, the final count was taken on the seventh day, and the 'Between Paper' method was used to record the maximum germination (38.33%), seedling length (9.00cm), seedling dry weight (0.076mg), vigour index-I (329) and vigour index-II (2.77). In the seed germination test, a temperature of 30 degrees Celsius registered the highest level of germination (36.0%), as well as the longest seedling length (9.44 centimetres), the lowest seedling dry weight (0.077 milligrams), the highest vigour index-I (341) and the highest vigour index-II (2.79). (2.79). In contrast to the fruits, we found that seeds germination was quite successful. The findings of the study indicate that the temperature of 30 degrees Celsius is ideal for conducting germination tests on Gokhru (Pedalium murex L.), and that the 'Sand' method is the most effective for germination tests on fruit. However, the 'Between Paper' method is the most effective when conducting germination tests on seed [93]. The approach known as "Between Paper" achieved the highest level of germination in senna (83.3%), followed by the "Top of Paper" method (77.8%), and then the "Sand" method (70.0%). Increased germination in the "Between Paper" approach may be explained by a more stable supply of oxygen and moisture up until the end of the germination test.

6 APPLICATION OF P. MUREX [GOKHRU]:

6.1 Traditional Uses of Gokhru: It has been showing table no **Table-2.**

S. No	Active part	Traditional uses	Preparation
1	Root	Antibilious	Dissection
2	Stem	Ardo Urinae	Extract
3	Leaves	Aphthae	Juice
4	Dried fruit	Calculi	With sugar
5	Leaves	Ulcer	Extract
6	Leaves & shoots	Aphrodisiac	Mucilaginous infusion
7	Dried fruit	Incontinence of urine	Decoction

6.2 Marketed Preparation of Ghokhru Plant: It has been showing table no **Table-2.**

S.no	Manufacturer	Activity	Preparation Form	Dose	Reference
1	Basic ayurveda	Used in uti	Liquid	30 ml/day	[94]

2	Bio resurges life	Boost stamina	Tablet	1-2 twice/day	[95]
3	Dr nuske	Antiesthetic,erectile dysfunction	Powder	One spoon	[96]
4	Baidyanath	Booststamina, metabolism	Tablet	2/day	[97]
5	Dabur gokshuradi	Uti,renal stones etc	Tablet	2/day	[98]

7. Conclusion

Pedalium murex, also known as gokhru, is an underutilized medicinal plant with multiple traditional uses. It is mainly used to treat gastrointestinal, urinary, and reproductive tract disorders. However, extracting the seeds from the herb's fruits is challenging, and there is no standardized germination test for its seeds. The herb is indigenous to India and Africa and contains glycosides, saponins, flavonoids, alkaloids, and terpenoids with therapeutic potential. Biotechnological studies are focusing on developing formulations and delivery systems to improve the herb's bioavailability and efficacy. Further scientific evaluation of the herb's efficacy, standardization of the germination test, and biotechnological studies are necessary to exploit its potential fully. Pedalium murex is a significant medicinal plant with a wide range of historical use and therapeutic potential.

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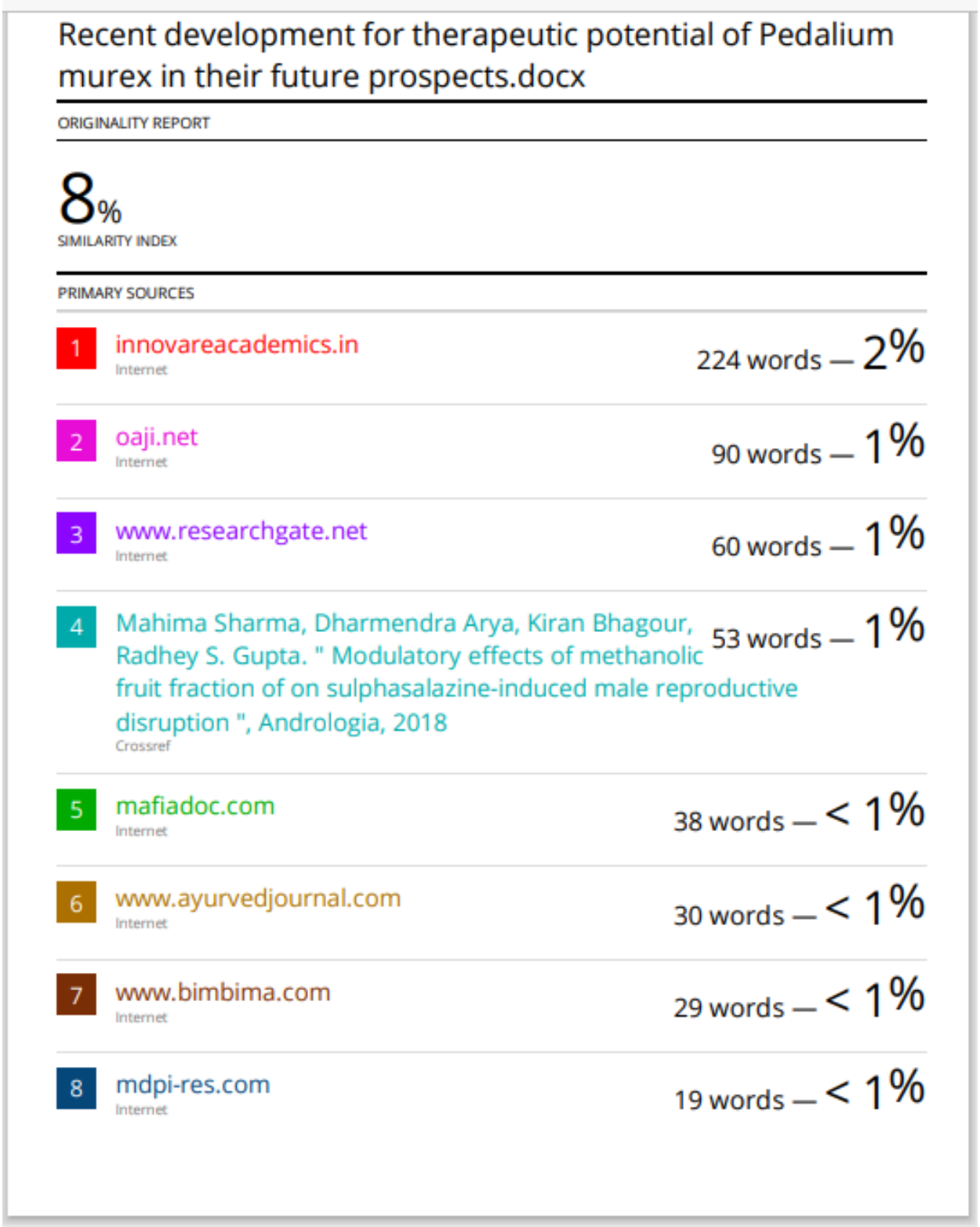

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