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# *MARSDENIA TENACISSMA*: A REVIEW ON ITS TAXONOMY & ITS MEDICINAL APPLICATION

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**Keywords:**

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**ABSTRACT:** *Marsdenia tenacissima* (MT), a traditional herbal medicine (Family Asclepiadaceae), during the past several years, there has been increasing interest in the uses of various medicinal plants from the traditional system of medicine for the treatment of different ailments. The present review highlights the pharmacognosy, phytochemistry, and pharmacological study of *Marsdenia tenacissima*. In this, pharmacognostical studies are concerned with the determination of physicochemical constants like ash value, extractive value, pH, and loss on drying. It is used in various pharmacological activities like anti-cancer, anti-diarrheal, anti-inflammatory, Analgesic, Antioxidant, Antidiabetic, Antihyperlipidemic, and Anti-arthritic activities. *Marsdenia tenacissima* has been used in traditional medicine as a household remedy for various diseases.

**INTRODUCTION:** The term "Medicinal Plant" includes various type of plants used in herbalism ("herbology" or "herbal medicine"). It is the use of plants for medicinal treatment. The word "herb" has been derived from Latin word. "Herba" and the old French word "herbe". Currently a day's refers to any part of plant-like fruit, seed, steam, flowers, bark, leaf, stigma or a root, likewise as a non-woody plant [1]. Herbal medicine provides traditional and ethnic medicine and is also promising for highly efficient novel bioactive molecule. Ayurveda is one of the oldest medication systems that used plants and their extracts to treat various diseases [2]. The word Ayurveda is made up of two parts *Ayu+Veda. Ayu* means life and Veda means knowledge.

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Thus Ayurveda means "Science of life [3]. The history of Indian medicinal plants is very old e.g., before 3500. The curative value of plants has been mentioned in the Rig-Veda and Atharvaveda (3500-1500). In the Ayurveda, many plants and their curative values are described. Charak Samhita and Susruta Samhita is well treatise of Ayurveda [4]. The plants used in traditional medicine, therefore, have a critical role in the maintenance of health all over the word. The drug of herbal, flavourer, herbo-mineral and animal origin are employed by the normal traditional medication to keep up health and treat diseases since antiquity. Such medicines are wide utilized in Africa and Asia, as well as India and China.

Due to the adverse side-effects and conjointly the event of resistance against synthetic drug, the uses of plant derived drug have become popular in developed countries [5]. *Marsdenia tenacissima* is a medicinal plant & commonly known as "*Mural* or *Murva"* it's belonging to family *Asclepiadaceous* is perennial climber that is well known as Tong-

guang-teng" in Chinese folk medicine and it has long been used as remedy to treat asthma, tonsillitis, cystitis and pneumonia.

There are two kind of major active constituents in *M. tenacissima*, phenolic acid and $C_{21}$ steroidal glycoside which mainly consist of six types of steroidal skeleton approximately 196 ingredients including steroids, organic acids and teriterpenes have been isolated from this plant [6, 7].

It is a large stout, bearing green flowers, and located in tropical tracts of peninsular India and Vindhya ranges as well as lower Himalayan tracts & Kerala forest and Chitrakoot Satna ghati.

This plant prefers poor soil. Murva is found growing in tropical, subtropical dry and moist deciduous forests having annual rainfall between 1000 mm and 1500 mm. It grows in moist places in nature and is a shade-loving pant [8]. Traditionally the plant is widely used, to cure various diseases such as Stomach ache, diabetes mellitus, epilepsy, abdominal colic, Cancer, lung cancer, Antiscorbutic, Urinary diseases, Arthritis, Heart disease, Skin disease, Thirst and Vomiting, Intermittent fever.

The root is the most important or useful part of this plant. It has potent cytotoxic and anti-HIV activity Murva root is used such as single and compound formulations of Ayurveda such as Aragvadhadi kvatha curna, Patoladi kvatha churna, Prameha Mihira Taila, and Sudarsana churna [9].

The whole tree is useful in our physical diseases its leaves and flowers are used for Analgesic, Asthma, cough, Joint pain, Gonorrhoea, Anti-inflammatory, Anti-diarrheal and Antitumor.

The leaves paste applied externally over major burns. This review article attempts to present an overview describing the entire study of the *marsdenia tenacissima* plant.

**Pharmacognostical Study:**

**Plant Profile:**


**FIG. 1: A-PLANT AND B- LEAFOF *M. TENACISSIMA***


**FIG. 2: A-FLOWER AND B- FRUITS OF *M. TENACISSIMA***

**TABLE 1: TAXONOMICAL CLASSIFICATION & COMMON NAMES**

| Kingdom | Plantae | Plants |
|---|---|---|
| Subkingdom | Tracheobionta | Vascular plants |
| Superdivision | Spermatophyta | Seed plants |
| Division | Magnoliophyta | Flowering plant |
| Class | Magnoliopsida | Dicotyledons |
| Subclass | Asteridae | |
| Order | Gentianales | |
| Family | Asclepiadaceae | Milkweed family |
| Genus | Marsdenia R. Br. | Marsdenia P |
| Species | *MarsdeniaTenacissima* | |

***Marsdenia tenacissima* Common Name in Different Languages:**

**Scientific Name:** *Marsdenia tenacissima* (Roxb) Moon.

**Sanskrit / Ayurvedic:** Madhusrava, Devi, Morata, Piluparni, Snigdhaparni, Devashreni

**Assam:** Murha

**Gujarat:** Moravel

**Bengali:** Chitti, Jitti

**Hindi:** Murva, Safadnishoth, Maruaa-bel

**Marathi:** Morvel

**Kannada:** Koratige Hambu, Kallu Shambu, Kadaluhaleballi

**Malayalam:** Perumkurumba

**Tamil:** Perunkurinjan

**Telgu:** Chagaveru

**Oriya:** Murva, Murga

**Urdu:** Turbudsafed

**Unani:** Moorwa

**Trade Name:** Murva [8, 10]

**Plant Collection:** Murva is found growing in lower Himalayan tracts, Uttrakhand, Assam, Dehradun forest, Kerala forest, Chitrakoot ghati Satna (M.P) India, and it's also found in China and Indonesia, Srilanka. This plant prefers poor soil. It grows in dampish places in nature.

**Botanical Description:** Murva is long creeper its length 10-12 meters. Leaves are 7-15cm long and 7-10 cm wide, broadly ovate, acuminate, deeply cordate at the base with rounded lobes; both surfaces are densely velvety tomentose when young but become almost glabrous above when old. Petioles are pubescent and regarding one 5-10cm long. The flower is greenish-yellow; flowering occurs in March and April.

Flowers are corymbose cyme, axillary, sepals 5 cleft, lobed, long round with a gland in the base of the inner surface, yellowish or yellowish red, and bell-shaped.

Fruits are about 10-12cm long and 1cm in diameter and, densely covered with greyish yellow color & mature in May to June. Seeds are about 1-2 cm long.

The stems are sturdy, flat cylindrical, light brown-yellow, 2-5cm in diameter, coated with crack bark, have a cylindrical lower half and upper flat and a slightly swollen burl, whereas the tender branches are mixed closely by faint yellow fluff. The dried root measures are cylindrical 0.6 – 2.6cm thick and varying length, Outer surface is yellow to buff coloured with dark brown patches, longitudinally ridges, and furrow present.

**Microscopy Characterization:** The detailed microscopy study of the root shows cork cells consisting about 15-20 thin-walled, tangentially elongated, rectangular cells, some are filled with reddish-brown contents, outer region of cortex composed various shapes and size and thickness groups of stone cells, followed by wide zone by oval to polygonal parenchymatous cells; secondary phloem composed of mostly parenchyma with small patches of sieve elements and small strands of stone cells wedge-shaped structure; xylem consisting of parenchymatous tissue, lignified tissue, vessels, tracheids, fibres and xylem parenchyma; secondary xylem vessels, tracheids

and uni to biseriate medullary rays; stone cell and pericyclicfibre are present in yellow colour pitted; lacticiferous tube are present with intraxylary phloem; vascular bundle circularly arranged with uni to multiseriate medullary rays; secondary cortex stone cells, oval to polygonal parenchymatous cells; crystals rosette and few prismatic crystals of calcium oxalate and abundant starch grains with hilum; tracheids narrower with tapering end and xylem fibre with narrow, wavy, pitted [9, 10].

**Showing the Following Picture of Transverse Section of the Root Cortex Cork and Xylem:**

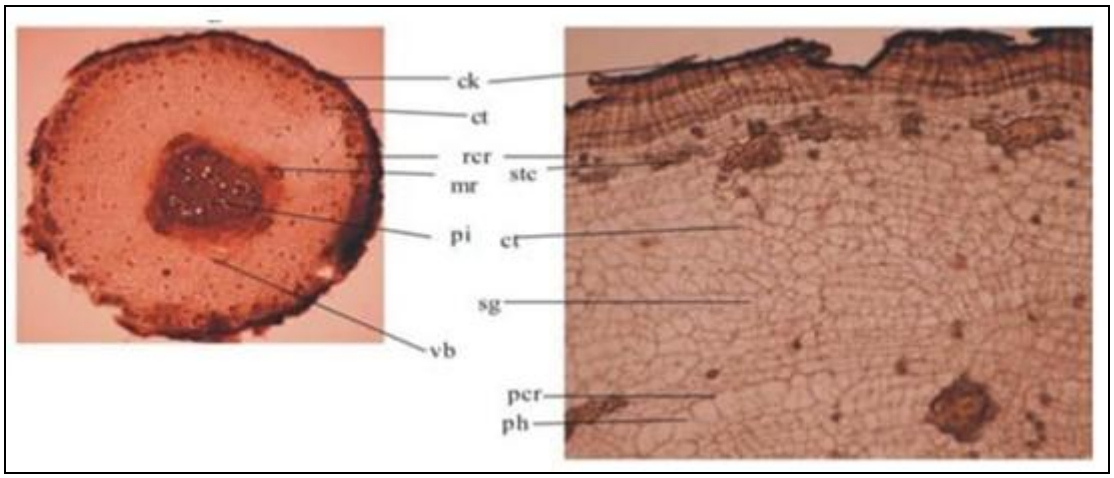



**FIG. 3: TS STEM (DIAGRAMMATIC)**

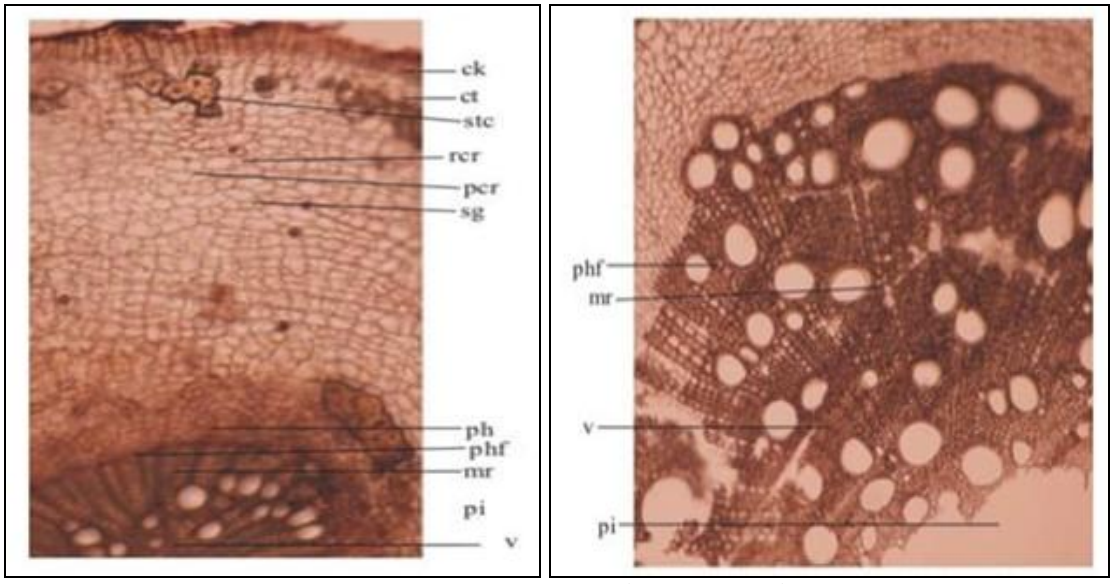



**FIG. 4 AND 5: TS ROOT (ENLARGED)**

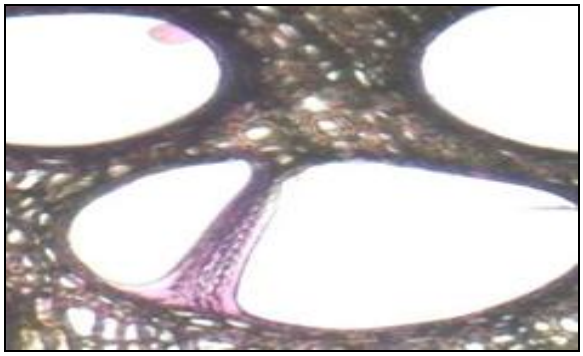


**FIG. 6: LESS INTERVASCULAR PITTING**

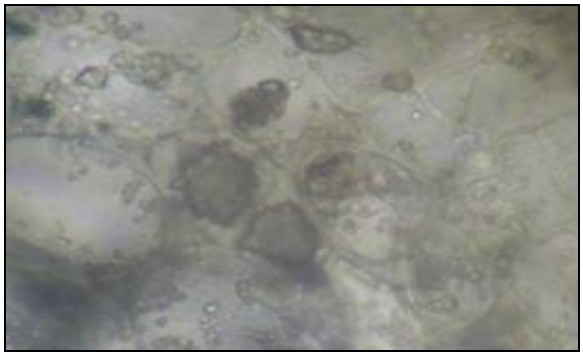


**FIG. 7: ROSETTE CRYSTAL**

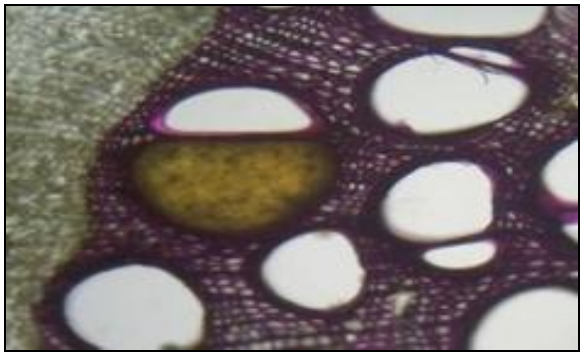


**FIG. 8: LACTIFEROUS CELL**

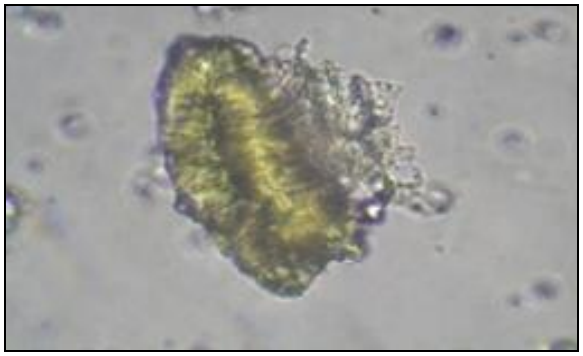


**FIG. 9: LIGNIFIED STONE CELL**

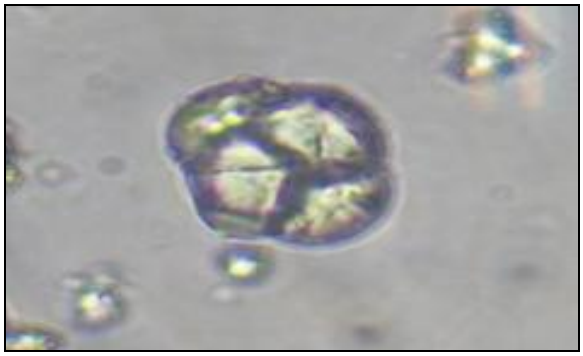


**FIG. 10: STRACH GRAINS**

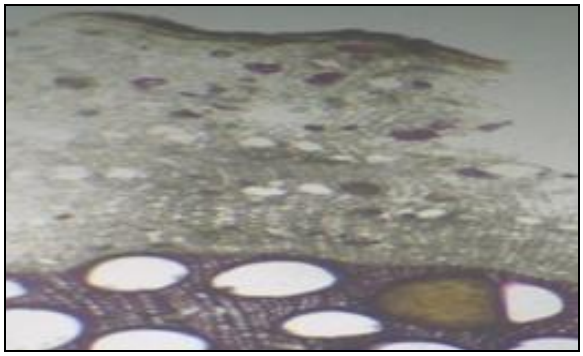


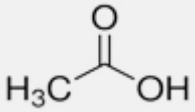
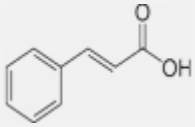
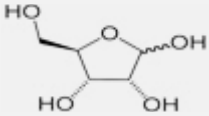
**FIG. 11: CORK, CORTEX & XYLEM**

**TABLE 2: PHYSICOCHEMICAL PARAMETERS OF MURVA ROOT [8, 13, 14]**

| Parameter | Values |
|---|---|
| Loss on Drying | 6.84 |
| Total Ash value. Acid | 5.91 |
| Insoluble Ash. Water | 0.92 |
| soluble Ash | 2.37 |
| Extractive Value | |
| Ethanol-Soluble extractive | 6.9 |
| Water-Soluble extractive | 10.4 |
| pH Value | 6.57 |
| Swelling Index | 10.5 |
| Foreign organic matter | 3.72 |

**Phytochemical Studies:** Phytochemical screening was carried out on ethanolic, methanolic, ethyl acetate, petroleum ether, and water extract of *M.* T*enacissima* root and left to detect the presence of potential phytochemical constituents of alkaloid, carbohydrates, glycosides, flavonoids, phenol, spooning, portions, steroids and tannins [11]. A day's approximately 196 chemical ingredients covering steroids, triterpenes, and organic acids have been identified from different parts of this plant. Steroids are a major character and bioactive constituents of this plant [15]. In this plant, roots and seeds are reported to be rich in pregnane glycosides of 2-deoxysugars, which on hydrolysis give genins, sugar, cinnamic, and acetic acid [12].

**TABLE 3: PHYTOCONSTITUENT ISOLATED FROM *M. TENACISSIMA* AND PHARMACOLOGICAL ACTIVITIES [10, 11, 12, 14, 15, 16, 19]**

| Isolated Phytoconstituent | Part used | Biological activity |
|---|---|---|
|  Acidic acid | Root, Seed | Antitumor activity |
|  Cinnamic Acid | Root, Seed | Antitumor, Anti-Angiogenic Effects |
|  2-Doxysugurs | [Roots] Seed | Antioxidant, Antitumor 2-Doxysugurs Activity |

| | | |
|---|---|---|
| Tenacigenin A | Roots | Antitumor Activity |
| TenacigeninB | Whole Plant | Antitumor, Anti-inflammatory, Analgesic activity |
| 11α-*O*-tigloyl-12β- *O*-acetyltenacigeninB | Root, Seed Leaves | Antitumor, Immunomodulatory, Anti-HIV, Anti-Diarrheal Activity |
| 11α,12β-di-*O*- tigloyltenacigenin B | Whole Plant | Antipyretic Activity |
| 11α-*O*-2-methylbutanoyl-12β-*O*-tigloyltenacigenin B | Whole Plant | Antitumor Activity |
| 11α-*O*-(2-methylbutanoyl)- 12β-*O*-benzoyltenacigenin B | Whole Plant | Immunomodulatory, Effect |
| Tenacissoside C | Roots | Antitumor, Activity |

**Pharmacological Activities:** The Pharmacological activity depends on the active constituent of the crude drug.

**1. Antitumor Activity:** The ethanolic root extract of *M.tenacissima* displayed strong antitumor effects against the hematologic neoplasma cells. The anti-cancer activity of plants-based compounds some of these plants and their compound prove to be very effective against one or more types of cancers. Based on their activities, the following plants are selected for the *in-vivo* and in vitro anti-cancer activities of their compounds [17] and its multi-mechanism of action might be associated with the cell cycle (G0/G1) arrest, induction of apoptosis through up-regulation protein expressions of bax, caspase-9 and caspase-3 genes and downregulation of the expression of cyclin D1 and B-cell lymphoma (Bcl)-2genes, a decrease in tumourmicro vessel density and an increase of TUNEL-positive cells *in-vivo* [18, 14]. Also, in another study they analyzed the antitumor activity of MTE with $^{1}$H NMR-based metabolomics approach. For that purpose, they used frozen mice liver and kidney tissue and analyzed the alteration of crucial metabolites, mainly succinated and lactate, which contributed a major role in cancer formation [23].

**a. Lung Cancer:** As per an *in-vivo* study of *Marsdenia tenacissima* effects against lung cancer, one of the most frequent malignant tumours and the leading cause of cancer-related deaths globally, with more than 85% cases of lung cancer. Radiotherapy, chemotherapy, and surgical resection are the major treatment for lung cancer patients. One meta-analysis has indicated that XAP injection with chemotherapy increases the effective rate and quality of life improvement and reduces the toxicities of chemotherapy alone used in treating (non-small cell lung cancer cell) NSCLC. Additionally, to the results on these signal pathways, MTE might inhibit gefitinib metabolism by heavy the key CYP enzyme activities of CYP2D6 and CYP3A4, lowering gefitinib metabolic clearance and increasing gefitinib concentration within the HepG2 human hepatic carcinoma cell line [19]. Also, in another *in-vitro* study, the stem of MT ethanolic extract shows significant antiproliferation mechanisms of MTE in NSCLC in relation to apoptosis as well as autophagy, which are two critical forms to control cancer cell survival and death in that they revealed a new mechanism for the anti-tumor activity of MTE against NSCLC [24].

**b. Hepatic Carcinoma:** Hepatic carcinoma (HCC) is the second most common cancer, ranking the third most common cause of cancer-related death worldwide. Studies have shown that MT has promising anti-hepatoma effects when used alone or combined with chemotherapeutics. One water-soluble polysaccharide can improve immune function in normal mice and inhibit tumor growth in H22 hepatic carcinoma cells in tumor-bearing mice by significantly enhancing the activities of certain substances, such as GSH-Px, SOD and CAT, YAP, a direct downstream effector of the tumor-suppressive Hippo pathway.

**c. Haematological Carcinoma:** Leukaemia, also known as blood cancer, is a kind of malignant tumor in the hematopoietic system. Generally, it can be divided into several types: acute lymphoblastic leukaemia, acute myeloid leukaemia, and chronic myelocytic leukaemia. The studies crude ethanolic extract of *Marsdenia tenacissima* exhibited strong cytotoxicity against CML cell lines K562 *in-vitro* and *in-vivo*; this cytotoxicity was related to inducing cell cycle (G0/G1) arrest through upregulating cyclin D1 and cell apoptosis

proteins caspase-3, caspase-9, and Bax. Another report showed that MTE also suppressed cell proliferation and induced apoptosis in Jurkatleukemia cells by inactivating the PI3K/AKT/m TOR signaling pathway. Another study revealed that MTE inhibited tumor growth and decreased angiogenesis in A20 lymphoma cells by reducing the expression of VEGF, MMP-2 and MMP-9 in the serum.

**2. Antioxidant Activity:** The *in-vitro* Antioxidant activity performs in various methods. It has been found that alcoholic and ethyl acetated extract was determined as root parts of MT. The extract found that a concentration of 200-1000ug/ml has maximum scavenging of stable radical and reduces nitric oxide production. The methanolic extract and ethyl acetated extract showed less antioxidant potential in DPPH (1-1-Diphenyl 2-Picryl Hydrazyl), NO (Nitric Oxide), and stander Acorbic acid. It has also been found that the leaves part of a plant in alcoholic extract showed MtMe capacity higher than MtME. In DPPH, the alcoholic extract showed scavenging radical activity MtMe revealed moderate activity compared to ascorbic acid $IC_{50}$, in hydrogen peroxide, and it has higher reducing capacity respectively [11, 12, 20]. In another *in-vivo* acute toxicity study for ethanolic extract MT stem, MTEE was lethal to the rats at a 2000mg/kg dose. Toxicity signs such as Tremors, Behavioural changes; Sedation, and Mortality are observed [21]. Another reveals that the antioxidant potential of plants is diabetes is associated with increased formation of free radicals and decreased antioxidant potential. The presence of antioxidant activity in the plants will help in antidiabetic action [13].

**3. Antihyperlipidemic:** *In-vitro* hypoglycaemic activity in ethanolic extract of the root of *M. tenacissima* was evaluated by the O-Toluidine method and Glucose oxidase method at three different pH 2, 7, 9 and showed better activity highest % inhibition of glucose were 68% and 55% for *M. tenacissima*. *In-vivo*, the plant extract was evaluated in glucose-loaded hyperglycaemic animals and in fasted normal rats. The extract revealed a significantly antihyperglycemic effect in 200-400mg/kg dose compared to control group animals in the glucose-loaded hyperglycemic animal's model. Significantly reduced blood glucose concentration compared to the control group, indicating the significant antihyperglycemic effect of the extract shows better effect [13].

**4. Analgesic Activity:** Analgesia simply means the absence of pain without losing consciousness. Acetic acid-induced Writhing test result showed that ethyl acetated extract (100, 200mg/kg) dose significantly reduced the number of abdominal constriction induced by a solution of acetic acid 1%. But MT as a dose of 200mg/kg showed maximum inhibition of 80.91%, which is closer to that of standard Diclofenac sodium. Another result showed MtMe 1,000mg $kg^{-1}$ presented 50.14% inhibition of writhing responses, similar to standard compound diclofenac-sodium, which inhibited 73.55% writhing in test animals. MtEA 1,000 (mg $kg^{-1}$) exerted moderate inhibitions (35.47%).

- **Formalin-Induced Paw Licking:** Test results for both ethyl acetated and alcoholic extracts showed dose-dependent inhibition 1,000 mg $kg^{-1}$in the first 5 min and the second 5min compared to the dose of the drug Tramadol showed highest inhibition.

- **Hot Plate Method:** showed the reaction time oral administration of different doses of MTEE (100,200mg/kg) and Pentazocin 10mg/kg. The observation period compared to the control at the dose of 200mg/kg body weight p.o showed a significant increase in the mean response time which is closer to that of standard pentazocin [11, 21, 22.]

**4. Anti-Inflammatory Activity:** The xylene-induced ear edema test of ethyl acetated and alcoholic extract demonstrated dose-dependent inhibition. The 1,000 mg $kg^{-1}$ dose of alcoholic extract MtMe exhibited the greatest decrease in edema weight with a maximum of 67.95% inhibition compared to control. The standard diclofenac-sodium created 77.90% inhibition of ear edema.

- Carrageenan-Induced Paw Edema test difference in the paw volume and percentage inhibition of oedema by the ethanolic extract of MT (100, 200mg/kg), and pentazocin 10mg/kg dose used inhibited the carrageenan-induced

paw edema. The hind paw volume was measured after carrageenan injection at 0 and 3 h. At 100mg/kg dose, there is 66% inhibition, and at 200mg/kg there was 70% inhibition observed.

- The cotton pellet-induced granuloma test in methanolic extract 1,000 ($mg/kg^{-1}$) showed 44.43% inhibition against granuloma formation, compared to the standard diclofenac-sodium, which inhibited 54.34% formation. Another result shows that the extract of a higher dose 200mg/kg exhibited inhibition of inflammation close to the inhibitory effect of indomethacin [11, 21].

**5. Anti-Arthritic Activity:** *Marsdenia tenacissima* showed an ethyl acetated in leaves extract in Freud's adjuvant-induced arthritis test. The inhibition in the injected paw swelling in dose-dependent aspirin 10mg/kg showed a maximum result [21].

**6. Anti-Diarrheal Activity:** The study of *Marsdenia tenacissima* effect of leaf alcoholic extract in a dose-dependent manner against castor oil-induced diarrhea on experimental animals. At 500 and 1,000 mg $kg^{-1}$ doses, the extract decreased the severity of diarrhea by reducing the rate of defecation and consistency of feces in mice comparable to that of the standard drug Loperamide [11].

**CONCLUSION:** In this review, it is indicated that *Marsdenia tenacissima* plant of leaves, root, and stem parts was extracted in various solvents like petroleum ether, ethyl acetate, ethanol, methanol, chloroform, and hydroalcoholic. Here in this study, Pharmacognostic standardizations parameter are used because of the presence of various bioactive compounds, proving that the whole plant is medicinally important. *Marsdenia tenacissima* plants of various pharmacological activities like Ash value, extractive value, pH, *etc.*, are present in this paper almost maximum activates present in roots part. The studies show the whole plant is medically active. These reviews contain plant information that may help isolate and identify bioactive compounds; there is also a phytochemical and pharmacological activity for further research in Marsdenia tenacissima leaves and stem-based drugs used in Ayurveda and modern pharmacopoeia.

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