Article Type: Review
J Name: Modern Phytomorphology
Short name: MP
ISSN: ISSN 2226-3063/ eISSN 2227-9555
Year: 2024
Volume: 18
Page numbers: 124 -132
DOI: 10.5281/zenodo.200121
(10.5281/zenodo.Year-Volume-PDFNo.)
Short Title: The multidimensional therapeutic potential of *Rumex Nepalensis:* A comprehensive review

REVIEW ARTICLE

The multidimensional therapeutic potential of *Rumex Nepalensis:* A comprehensive review

Mohit Kumar[1]*, Antim[2], Poonam Yadav[1], Tejaswi[1]
[1] Department of Pharmacy, School of Healthcare and Allied Sciences, GD Goenka University, Sohna, Gurgaon, India
[2] Northern Institute of Pharmacy and Research, Alwar, Rajasthan, India

***Corresponding author:** Mohit Kumar, Department of Pharmacy, School of Healthcare and Allied Sciences, GD Goenka University, Sohna, Gurgaon,India
Email: imohitkumarofficial@gmail.com

Received: 07.08.2024, Manuscript No: mp-24-144732 **| Editor Assigned:** 10.08.2024, Pre-QC No. mp-24-144732 (PQ) **| Reviewed:** 27.08.2024, QC No. mp-24-144732 (Q) **| Revised:** 02.09.2024, Manuscript No. mp-24-144732 (R) **| Accepted:** 08.09.2024 **| Published:** 15.09.2024

Abstract

Rumex nepalensis spreng. (*Polygonaceae*), sometimes known as Nepal Dock, has broad-spectrum therapeutic qualities and has been used in traditional medicine for millennia. This plant's extracts and metabolites are anti-inflammatory, antioxidant, antibacterial, antifungal, antiviral, antipyretic, analgesic, purgative, anti-algal, central nervous system depressant, wound healing, and skeletal muscle relaxant. The leaves of this shrub are edible and strong in antioxidants. It has the potential to be a rich source of treatment against major illnesses due to its extraordinary biological activity. More research is needed, however, to describe the mechanism of action, isolate and identify the active ingredients, and scientifically validate the plant's traditional use. We give a comprehensive analysis of its botany, ecology, traditional use, and significant pharmacological activities discovered in recent years, and hope that this will serve as a resource for future study on this plant.

Keywords: *Rumex nepalensis*, Phytochemical, Antimicrobial activity, Anti-ulcer, Anti-inflammatory, Antioxidant

Introduction

According to a World Health Organization report, around 70% of the world's population in developing countries continues to utilize traditional medicines for basic health care, while approximately 25% of contemporary pharmaceuticals are derived from natural sources. *Rumex* has around 200 herb species. *Rumex Nepalensis Spreng. (Polygonaceae)*, commonly known as "jungli palak" in Hindi. *Rumex* is derived from the Latin word for dart, which refers to the shape of the leaves. It is a temperate Himalayan plant that thrives in the Western Ghats, Nilgiri, and Nainital highlands. *Rumex Nepalensis* is a member of the *Magnoliopsid* family and genus. *Rumex Nepalensis* is widely utilized for a number of therapeutic purposes in Indian traditional medicine. According to research, the roots of *Rumex Nepalensis* exhibit purgative, analgesic, antipyretic, anti-inflammatory, psychopharmacological, antibacterial, and antifungal activities. *R. Nepalensis* is frequently used in traditional medicine (Bursal et al., 2021). In many places of the world, almost every plant component is employed as a traditional cure. Its leaf extract is used to cure colic and migraines, as well as skin blemishes and syphilitic ulcers. Its aqueous extract can also be used as a wash to alleviate pain. The root has a cleansing effect. Dislocated bones are treated using the root (Kumar et al., 2011). To treat diarrhea and dysentery, a preparation of the root

is applied to swollen gums. In some parts of Nepal, it is also used as a green leafy vegetable. For 5 to 15 consecutive days, on an empty stomach, a root infusion of *R. Nepalensis* is administered orally in Ethiopia to cure ascariasis, gastrointestinal hemorrhage, and peptic ulcers. Plant-derived bioactive phenolic compounds have been found as potent acetylcholinesterase inhibitors with potential applications in Alzheimer's disease treatment (Tab. 1.) (Jain et al., 2018).

Table 1: Local names of *Rumex Nepalensis*

Language	Local Name	References
English	Nepal dock, Sheep sorrel	(Kunwar et al., 2010; Gaire et al., 2011)
	Amlya, Jangli palak,Amlora	
Hindi	Ubbal	(Kumar et al., 2011; Solanki et al., 2012)
Pangwali	Pahari palang	(Rana et al., 2014)
Bengali	Amlavetasa	(Ghosh et al., 2003)
Sanskrit	Shalkhay, Hoola	(Sisay et al., 2020)
Pakistani	Halhale sag, Ban haldi	(Begum et al., 2014; Iqbal et al., 2004)
Nepali	Aliphiri	(Kunwar et al., 2010; Gaire et al., 2011; Rokaya et al., 2010)
Kashmiri	Girshu, Gorengoch	(Rokaya et al., 2010)
Ethiopian	Kathura	(Gaire et al., 2011; Ahmad et al., 2012)
Uttarakhandi	Albar	(Giday et al., 2010)
Bhangali	Torongkhongchak	(Tauchen et al., 2015)
Manipuri	Sukkankeerai	(Handa et al., 2000)
Tamil		Handa et al., 2000)

Literature Review

Dissemination of *Rumex Nepalensis*

R. Nepalensis is found in the following countries: China, Afghanistan, India, Indonesia, Japan, and Myanmar. Among the countries covered are Nigeria, Nepal, Pakistan, Tajikistan, Vietnam, South-West Asia, Turkey, Bhutan, and South Africa. It is widely farmed in India. It can be found from Kashmir to Bhutan in the Himalayas. It is also known as "Tult" in Amharic and "Shuultii" in Oromifa. Traditional medical systems in Nigeria, India, China, Indonesia, Ethiopia, and Nepal have used *R. Nepalensis* (Yadav et al., 2011).

Plant description

It is a fairly widespread plant that grows between 900 m and 4000 m on moist and dry slopes, in the shadow, and even in the plains of the Western Ghats, Nilgiri, Pulney Hills, Nainital Hills, and Palni Hills at elevations between 1200 m and 4,300 m. It thrives at higher elevations. Flowering takes place in April and May, while fruiting happens in June and July in *R. Nepalensis*. A plant that grows in warm, moderate to tropical climates, mainly at higher altitudes. Thrives in most soil types, but prefers a place in full sun or part shade, a deep fertile, somewhat heavy soil that is rich in humus (Sisay Zewdu et al., 2020; Shrestha et al., 2017; Kunwar et al., 2010; Gaire et al.,2011; Solanki et al., 2012; Rana et al., 2014).

Phytochemical analysis and bioactive constituents of rumex nepalensis

R. Nepalensis has a significant amount of organic chemicals that are both complex and biologically active, according to phytochemical analysis. Numerous secondary metabolites, including flavonoids, phenols, anthraquinones, naphthalene's, saponins, cardiac glycosides, stilbenoids, terpenes, sterols, tannins, steroids, and reducing sugars, were found in the majority of prior phytochemical research studies (Ghosh et al., 2003; Begum et al., 2014; Iqbal et al., 2004; Rokaya et al., 2010; Ahmad et al., 2012; Giday et al., 2010; Tauchen et al., 2015; Shaikh et al., 2018; Kumar et al., 2011). Currently, the majority of the research on the solvent-based isolation and characterization of *R. Nepalensis* has come from the plant species' root portions, for reasons that are not fully stated. Phytochemical screening revealed the existence of an

alkaloid component in the plant species. Anthraquinones found in roots include emodin, chrysophanol, nepalensides A and B, chrysophanein, pulmatin, and chrysophanol glycoside. chrysophanol-8-O-β-D-(6'-O-acetyl) glucopyranoside, and emodin-8-O-β-D-(6-O-acetyl) glucopyranoside; naphthalene like torachrysone, rumexoside, orientaloside, and lyonorecinol 3-O-β-D-glucopyranoside; glycosides like chrysophanol-8-O-β-D-glucopyranoside, neopodin-8-O-β-D-glucopyranoside, and emodin-8-O-β-D-glucopyranoside; and aglycones like neopodin and physcion (Himi et al., 1999; Anthony et al., 1992; Liang et al., 2010; Mei et al., 2009; gautam et al., 2011; Anusuya et al., 2012; Sharma et al., 2020; Kumar et al., 2020). The roots and aerial parts of plants include quercetin-3-O-D-glucuronide, 3-O-methyl epicatechin, and -sitosterol-3-O-D-glucoside, which may be detected in ethyl acetate and n-butanol fractions. Numerous monoterpenoids, oxygenated monoterpenoids, sesquiterpenoids, oxygenated sesquiterpenoids, and hydrocarbons were detected by GC-MS analysis. Piceatannol, resveratrol, and rutin are present in the roots, stems, and leaves in varying amounts that may be caused by variations in genotype, ontogenetic variability, climatic changes, and tissue specialization (Jeelani et al., 2017). The n-BuOH extract of the roots of *R. nepalensis* contains substances like epicatechin-3-O-gallate and (3,5-dimethoxy-4-hydroxyphenol)-1-O--D-(6-O-galloyl) glucose Cicoemodin and rumexoside C are present in the *R. nepalensis* extract according to a spectral study. Rumexneposide A and B, as well as citreorosein and torachrysone-8-O--D-glucopyranoside, were recovered from an ethanolic extract of *R. Nepalensis* roots. Ethanolic extract of *R. nepalensis* shows the presence of β-sitosterol; daucosterol; hexadecanoic acid; hexadecanoic-2,3-dihydroxypropyleste; gallic acid; ethyl gallate; physcion-8-O-βD-glucopyranoside; kaempferol; kaempferol-3-O-α-L-rhamnopyranoside; quercetin; and quercitroside.

Therapeutic benefits of *rumex nepalensis*

Several Rumex species have demonstrated strong pharmacological effects. Rumex species' roots and aerial parts are used as medications for a number of human ailments, including purgative, tinea, antioxidant, cytotoxic, antifungal, anti-inflammatory, antipyretic, antidiarrhea, antiviral, and antibacterial, properties. *R. Nepalensis* leaves, roots, and a few flora pieces have reportedly been used to cure skin conditions and syphilitic ulcers. Many investigations on this medicinal plant have shown that it has purgative, analgesic, antipyretic, antifungal, anti-inflammatory, antibacterial, and skeletal muscle relaxant qualities (Tab. 1.) (Bu et al., 2010).

Table 2: Major compounds isolated from the root extract of *Rumex Nepalensis* and their pharmacological activities HN

Isolated Compounds	Method Used	Pharmacological Activities	References
Rumexoside, Torachysone, Orientaloside, Aloesin	Solvent extraction (n-butanol)	Anti-inflammatory	(Jain et al., 2018; Vasas et al., 2015; Kumar et al., 2018)
Chrysophanol and its derivatives, Emodin and its derivatives	Soxhlet extraction (methanol)	Antioxidant Antifungal, Anticancer, Antiinflammatory	(Liang et al., 2010; Mei et al., 2009; Enyew et al., 2014)
Neopodin	Solvent extraction (ethyl acetate)	Anti-inflammatory	(Kumar et al., 2018)
Nepalenside A, Nepalenside B, Torachrysone	Solvent extraction (ethanol)	Antidiabeti, Cytotoxic	(Liang et al., 2010; Kumar et al., 2018)
Chrysophanol Neopodin	Solvent extraction (methanol)	Anti-inflammatory	(Grover et al., 2014)
Aloesin, Epicatechin gallate, Ornicol glucoside	Solvent extraction (methanol)	Antimicrobial, Antioxidant, Antitumor, Antidiabetics, Anti-inflammatory	Jain et al., 2018; Mei et al., 2009; Vasas et al., 2015)

Anti-inflammatory activities

The ethnomedical usage of *Rumex Nepalensis* has included the treatment of inflammation and discomfort. In the carrageenan-induced rat paw edoema model, the anti-inflammatory effect of *R. Nepalensis* ethanolic extract was

investigated in 3 doses: 50 mg/kg, 100 mg/kg, and 200 mg/kg of *R. Nepalensis*. In the carrageenan-induced inflammation model, oral *R. Nepalensis* extracts significantly (p=0.05) inhibited rat paw edoema in a dose-dependent manner, with the maximum percentage inhibition of 60.86% of paw edoema volume occurring 3 hours after carrageenan injection. The maximal percentage of paw edoema inhibition for the conventional medication diclofenac 50 mg/kg dosage was 67.20% and 0.016%. The *Rumex Nepalensis* ethyl acetate extract was tested for Cox-2 inhibitory activity in-vitro using an EIA kit and found to have Cox-2 inhibitory activity in-vitro concentration (Wang et al., 2011). A positive control, celecoxib, is utilized. Because ethyl acetate extract and isolated chemicals inhibited Cox-2, they were tested for anti-inflammatory efficacy in mice with TPA-induced ear edoema (Tonny et al., 2017).

Antioxidant activity

The crude ethyl acetate extract demonstrated effective DPPH antioxidant activity, with an IC50 SEM of 26.6 g/mL and 3.1 g/mL. The ethanolic extract of *R. Nepalensis* inhibited DPPH radicals' dose-dependently with an IC50 value of 15.84 g/ml, which was almost identical to the standard medication ascorbic acid (IC50: 14.32 g/ml). It also scavenges NO radicals, with an IC50 value of 146.4 g/ml. It also prevented the oxidizing agent-mediated lipid peroxidation. Similarly, with an IC50 value of 97 g/ml, *R. Nepalensis* can chelate metal-induced oxidation or enzyme activation (Waqas et al., 2016; Vasas et al., 2015; Kumar et al., 2018; Enyew et al., 2014; Grover et al., 2014). When the ethanolic root extract of *R. Nepalensis* was compared to the free radical scavenging activity of normal ascorbic acid, the extract demonstrated superior scavenging action. In vitro experiments revealed that the essential oil extracted from the roots of *R. Nepalensis* had antioxidant activity comparable to that of ascorbic acid and vitamin E.

Antipyretic activity

Rats were given 500 mg/kg by oral administration of the hexane, chloroform, ethyl acetate, and methanol extracts made from the roots of *Rumex Nepalensis* to test their antipyretic effects. The findings of the study demonstrated that extracts of hexane and methanol have strong antipyretic efficacy (Devkota et al., 2015).

Antiproliferative activity

The most significant outcomes were obtained from extracts of *Carissa Spinarum, Dodonaea Angustifolia, Jasminum Abyssinicum, Rumex Nepalensis, Rubus Steudneri, and Verbascum Sinaiticum*. However, it was discovered that common MRC-5 cell lines were extremely toxic to *C. spinarum, J. abyssinicum, and R. steudneri. Only D. Angustifolia and R. Nepalensis* extracts demonstrated significant combination antioxidant/anti-proliferative activity (Gautam et al., 2008).

Antidiarrheal activity

Rumex Nepalensis root extract's antidiarrheal activities may be attributed to its reduction of both fluid secretion and gastrointestinal motility. Secondary metabolites discovered through a variety of routes of action may be responsible for the plant's antidiarrheal activity. Throughout the first 24 hours and the remaining 14 days, the crude root extract did not result in any mortalities at a single limit test dose of 2 g/kg. At 100 (P=05), 200 (P=01), and 400 mg/kg (P=001) test dosages, the hydro-methanolic extract significantly delayed the onset of diarrhea and decreased the weight of wet and total faeces in a castor oil-induced diarrheal model (Enyew et al., 2014). Meanwhile, the plant extract significantly reduced the weight and volume of intestinal contents at doses of 200 (P=01) and 400 mg/kg (P=001). The test extract's maximum dose produced the highest antidiarrheal index. Utilizing enters pooling, gastro-intestinal transit, and castor oil-induced diarrheal models, researchers evaluated the test extract's antidiarrheal effectiveness at doses of 100 mg/kg, 200 mg/kg, and 400 mg/kg.

Antifungal activity

Rumex Nepalensis and *Hyptis Suaveolens* (L.) *Poiteau* extracts have antifungal efficacy against the fungal pathogen (*Alternaria solani*) that causes early blight in potatoes. In the in vitro study, the poison food approach revealed that

aqueous extracts of *R. Nepalensis* aerial parts (RnA) were more effective than *R. Nepalensis* roots (RnR) and *H. Suaveolens* (HS) in suppressing fungus diameter growth. RnA >RnR >HS was the order in which the extracts were most effective at all concentrations (20%, 40%, and 60%). For both preventive and curative controls, RnA had a lower Disease Severity Index (DSI) than RnR and HS. RnA exhibited more activity in both in vitro and in vivo treatments than the other two extracts, which all exhibited some antifungal activity against *Alternaria solani*. As a result, RnA extracts have the potential to be utilized as a bio-fungicide to reduce early blight in potatoes (Sanjay et al., 2020).

Antibacterial activity

The crude ethyl acetate extract of *R. Nepalensis* was investigated for its antibacterial properties. With MIC values of 6.3 mg/mL and 3.1 mg/mL, respectively, the ethyl acetate fraction demonstrated an inhibitory activity against *Staphylococcus aureus* and *Escherichia coli*. It displayed no inhibition at all against the tested fungus. For both gram-positive (*S. aureus*) and gram-negative (*E. coli*) bacteria, the ethyl acetate fraction shown a high potential for antibacterial activity (Venkatesh et al., 2003).

Antimicrobial activity

At a concentration of 400 g/well, the methanolic extract showed antibacterial activity against all of the test species. The extract's inhibitory impact was determined to be greatest against *Escherichia Coli* (12 mm) for antibacterial activity and *Aspergillus Niger* (11 mm) for antifungal activity. *Aloeemodin*, an anthraquinone isolated from the roots of *Rumex Nepalensis* Spreng, was investigated for antibacterial effectiveness against four bacterial strains and antifungal activity against three fungus strains using the well diffusion method. Ampicillin 10 g/well (antibacterial) and Fluconazole 10 g/well (antifungal) were utilized as reference standards in this investigation. At a concentration of 400µg/well, the methanolic extract showed some antibacterial efficacy against all the test species. *Aloeemodin*, a component of the plant, has been shown to have antibacterial properties. For various substances, the agar plate well diffusion technique was employed. A majority of the test microorganisms were significantly inhibited by extracts of benzene and ethyl acetate. benzene and ethyl acetate extracts showed significant activity against gram-positive bacteria S. mutans, which was much higher than the inhibition Zone observed for control Ciprofloxacin (29 mm). This suggests that gram-positive bacteria are more susceptible to benzene and ethyl acetate extracts than gram-negative bacteria (Andargie et al., 2022; Pokhrel et al., 2022).

Purgative activity

At oral doses of 100 mg/kg–400 mg/kg, *Rumex Nepalensis* Spreng. roots showed strong and dose-dependent purgative action 11.

Anti-allergic activity

As an anti-allergic, crushed *Rumex Nepalensis* leaves are applied to wounds (Kumar et al., 2022).

Anti-diabetic activity

Rumex Nepalensis ethanolic root extract is employed. Normal and glucose-loaded rats were used in an in-vivo hypoglycemia investigation. *R. Nepalensis* (200 mg/kg) significantly (p0=05) decreased blood glucose levels in normal rats and glucose-loaded rats at 60 minutes and 120 minutes. Metformin (50 mg/kg) is the typical medicine used (Khatri et al., 2018).

Anti-ulcer activity

In pyloric ligation, cold restraint stress, and acetic acid-induced ulcer models, the effects of *R. Nepalensis* crude hydromethanolic extract and solvent fractions at dosages (100 mg/kg/day, 200 mg/kg/day, and 400 mg/kg/day) and repeated dosing (200 mg/kg/day for 10 days and 20 days) were investigated. As normal medications and as a positive control, omeprazole (20 mg/kg/day) and/or cimetidine (100 mg/kg/day) were employed. Pretreatment with the crude extract substantially and dose-dependently decreased the amount of stomach secretions, pH, total acidity, and ulcerations

in the pylorus ligation-induced ulcer model. The gastroprotection provided by *R. Nepalensis* 400 mg/kg test extract was equivalent to the standard. The ethyl acetate fraction, at 400 mg/kg, provided the best protection against ulcers, whereas the chloroform fraction proved ineffective. In the cold restraint stress-induced ulcer model, *R. Nepalensis* at 200 mg/kg and 400 mg/kg significantly decreased the lesion index (p=0.01). A dosage of *R. Nepalensis* at 200 mg/kg and 400 mg/kg cured ulcers considerably with a curative ratio of 53.22% and 54.59%, respectively, in a relevant chronic ulcer model therapy (Sisay Zewdu et al., 2020).

Wound healing activity

R. Nepalensis leaf extract was applied to the affected body after being combined with butter or *Vaseline. R.* Nepalensis's use as a traditional medicinal herb to treat wounds is further supported by the antibacterial and antipyretic properties of the plant products (Kunwar et al., 2010; Begum et al., 2014). Additionally, it has been observed that the plant species' secondary metabolites have wound-healing abilities (Khan et al., 2018). Plant species' capacity to cure wounds has been disclosed through the powder or juice of their leaves (Dwivedi et al., 2019).

Insecticidal activity

Sitophilus oryzae is significantly insecticidal to the *R. Nepalensis* methanolic root extracts. A significant death rate was also observed for *R. Nepalensis* methanolic extract against *Rhyzopertha Dominica, Callosobruchus analis, and Trogoderma granarium.*

Cytotoxic activity

Recent research on the cytotoxicity of *R. Nepalensis* methanolic root extracts against Artemia salina has been published. It was noted that methanolic root extracts at a concentration of 1,000 g/mL significantly exhibited cytotoxic action against *Artemia salina* (Hussain et al., 2010; Devkota et al., 2015).

Skeletal muscle relaxant activity

R. Nepalensis root extract in methanol had muscle-relaxing properties. The rotarod test revealed that the methanolic extract caused notable animal skeletal muscle relaxant activity and motor discoordination (Gautam et al., 2008).

Anti-hepatitis activity

24 plants were mentioned by herbalists as being used to treat hepatitis; the most often mentioned herbs were *Rumex Nepalensis, Vangueria apiculata, and Solanum incanum.* Traditionally, remedies were made by crushing or powdering them, then combining them with water and ingesting them (Hussain et al., 2010; Ghosh et al., 2002). 42 persons were diagnosed and treated as hepatitis patients by herbalists, of which eight of them were HBsAg-positive but no positives for anti-HCV ELISA. Three people treated with various combinations of commonly quoted botanicals showed suppression of blood HBV-DNA at the third and sixth months of viral load evaluation among HBsAg-positive (Beykaso et al., 2023).

Conclusions

This review aimed to shed light on the useful applications of this precious and endangered plant species. Both humans and animals can benefit from its great medicinal and dietary value. *Rumex Nepalensis* was the focus of a literature review to assemble the phytochemical and pharmacological information, which indicated that this plant is a good source of Phyto complexes and medicinally relevant pure chemicals for the treatment of various illnesses. Numerous medicinal, pharmacological, and phytoremediation capabilities of *Rumex Nepalensis* have been demonstrated, underscoring the importance of this plant. However, further clinical research must be done to verify the efficacy of pure plant extracts as well as any side effects and toxicity. Extensive, in-depth pharmacological study at the molecular level is

necessary to learn more about this plant's latent potential. As a result, future study may focus on broad pharmacological and therapeutic studies, as well as human metabolism. Furthermore, it is critical for present and future researchers to understand the underlying processes of pure compounds having pharmacological activities. More research is needed, however, before this promise may be achieved through nanotechnologies. This plant might be improved by using classic breeding methods, genetic engineering techniques for metal tolerance, or ways for organic compound metabolism. As a result, there is a plethora of study opportunities in these areas.

References

Bursal E, Yılmaz MA, Aras A, Türkan F, Yildiko U, Kılıç O, Dey A (2021). Determination of phenolic content, biological activity, and enzyme inhibitory properties with molecular docking studies of Rumex nepalensis, an endemic medicinal plant. *J Food Nutr Res*. **9**:114-123.

Kumar SU, Joseph LI, George MA, Bharti VI (2011). Antimicrobial activity of methanolic extracts of Rumex nepalensis leaves. *Int J Pharm Pharm Sci*. **3**:240-242.

Jain P, Parkhe G (2018). An updated review on pharmacological studies of Rumex nepalensis. *J Pharm Innov*. **7**:175-178.

Yadav S, Kumar S, Jain P, Pundir RK, Jadon S, Sharma A, Khetwal KS, Gupta KC (2011). Antimicrobial activity of different extracts of roots of Rumex nepalensis Spreng**.** *Indian J Nat Prod Resour*. **2**:65-69**.**

Sisay Zewdu W, Jemere Aragaw T (2020). Evaluation of the anti-ulcer activity of hydromethanolic crude extract and solvent fractions of the root of Rumex nepalensis in Rats. *J Exp Pharmacol*. **14**:325-337**.**

Shrestha L, Timilsina N (2017). Antioxidant and antimicrobial activity and GC-MS analysis of extract of Rumex nepalensis Spreng. *J Pharma Innov* **6:**155-158**.**

Kunwar RM, Burlakoti C, Chowdhary CL, Bussmann RW (2010). Medicinal plants in farwest Nepal: Indigenous uses and pharmacological validity. *Med Aromat Plant Sci Biotechnol*.**4**:28-42**.**

Gaire BP, Subedi L (2011). Medicinal plant diversity and their pharmacological aspects of Nepal Himalayas. *Pharmacogn J*. **3:**6-17**.**

Solanki R, Dalsania S (2012). Evaluation of CNS action of Rumex nepalensis Spreng. (Polyginaceae) using mice as experimental animal. *Int J Res Pharm. Biomed Sci*. **3**:1750-1752.

Rana PK, Kumar P, Singhal VK, Rana JC (2014). Uses of local plant biodiversity among the tribal communities of Pangi Valley of district Chamba in cold desert Himalaya, India. *Sci World J*. **2014**:753289.

Ghosh L, Gayen JR, Murugesan T, Sinha S, Pal M, Saha BP (2003). Evaluation of the purgative activity of roots of Rumex nepalensis. Fitoterapia. **74**:372-374.

Begum S, AbdElslam NM, Adnan M, Tariq A, Yasmin A, Hameed R (2014). Ethnomedicines of highly utilized plants in the temperate Himalayan region. *Afr J Tradit Complement Altern Med*. **1**:132-142.

Iqbal I, Hamayun M (2004). Studies on the traditional uses of plants of Malam Jabba valley, District Swat, Pakistan. *Ethnobot leafl*. **2004**:15.

Rokaya MB, Münzbergová Z, Timsina B (2010). Ethnobotanical study of medicinal plants from the Humla district of western Nepal. *J Ethnopharmacol*. **130**:485-504**.**

Ahmad KS, Kayani WK, Hameed M, Ahmad F, Nawaz T (2012). Floristic diversity and ethnobotany of Senhsa, district Kotli, Azad Jammu & Kashmir (Pakistan). *Pak J Bot*. **44**:195-201.

Giday M, Asfaw Z, Woldu Z (2010). Ethnomedicinal study of plants used by Sheko ethnic group of Ethiopia. *J Ethnopharmacol*. **132**:75-85.

Tauchen J, Doskocil I, Caffi C, Lulekal E, Marsik P, Havlik J, Van Damme P, Kokoska L (2015). In vitro antioxidant and anti-proliferative activity of Ethiopian medicinal plant extracts. Industrial Crops and Products. **74**:671-679.

Handa N (2000). Wild flowers of India. *Books Today*.

Shaikh S, Shriram V, Srivastav A, Barve P, Kumar V (2018). A critical review on Nepal Dock (Rumex nepalensis): A tropical herb with immense medicinal importance. *Asian Pac J Trop Med*. **11**:405-414.

Kumar S, Joseph L, George M, Kaur L, Bharti V (2011). Skeletal muscle relaxant activity of methanolic extract of Rumex nepalensis in albino rats. J Chem Pharm Res. **3**:725-728**.**

Himi H (1999). Chromosome numbers of 11 species in Japanese Rumex subg. Rumex (Polygonaceae). *J Phytogeogr Taxon*. **47**:121-130**.**

Anthony Julian Huxley (1992). The new Royal Horticultural Society Dictionary of Gardening, Vol 4 Macmillan Press, Cornell University. **4**:315-318

Liang HX, Dai HQ, Fu HA, Dong XP, Adebayo AH, Zhang LX, Cheng YX (2010). Bioactive compounds from Rumex plants. *Phytochem Lett*. **3**:181-184.

Mei R, Liang H, Wang J, Zeng L, Lu Q, Cheng Y (2009). New seco-anthraquinone glucosides from Rumex nepalensis. *Planta Medica*. **75**:1162-1164.

25.Gautam R, Srivastava A, Jachak SM (2011). Simultaneous determination of naphthalene and anthraquinone derivatives in Rumex nepalensis Spreng. Roots by HPLC: comparison of different extraction methods and validation. *Phytochem Anal.* **22**:153-157**.**

Anusuya NA, Gomathi RA, Manian SE, Sivaram VE, Menon AN (2012). Evaluation of Basella rubra L., Rumex nepalensis Spreng, and Commelina benghalensis L. for antioxidant activity. *Int J Pharm Pharm Sci.* **4**:714-720.

Sharma R, Jandrotia R, Singh B, Sharma U, Kumar D (2018). Comprehensive metabolomics study of traditionally important Rumex species found in Western Himalayan region. *Nat Prod Commun***. 13**:1934578X1801300219**.**

Kumar S, Singh PK (2020). Phytochemical investigation and antioxidant characterization of essential oil from roots of Rumex nepalensis Spreng high altitude of North India. *Mater Today Proc*. **26**:3442-3448.

Jeelani SM, Farooq U, Gupta AP, Lattoo SK (2017). Phytochemical evaluation of major bioactive compounds in different cytotypes of five species of Rumex L. *Ind Crops Prod*. **109**:897-904**.**

Bu W, Liu G (2010). Chemical constituents of glycosides from Rumex nepalensis. *J Dali Univ.* **6:**114122

Wang N, Zhu B, Sheng HF, Chen Y, Yang Y (2011). Studies on chemical constituents of Rumex nepalensis. *Chin J Exp Tradit Med Formulae*. **17**:132-136**.**

Tonny TS, Sultana S, Siddika F (2017). Study on medicinal uses of Persicaria and Rumex species of Polygonaceae family. *J Pharmacogn Phytochem*. **6**:587-589**.**

Waqas M, Afridi S, Ahmad N, Sohail A, Hayat A, Ramzan R, Niaz M (2016). Anti-microbial activity of Rumex Nepalensis and Urtica Diocia. *Int J Sci Res*. **5**:1563-1566.

Vasas A, Orbán-Gyapai O, Hohmann J (2015). The Genus Rumex: Review of traditional uses, phytochemistry, and pharmacology. *J Ethnopharmacol*. **175**:198-228.

Kumar V, Ganeshkhind C, Shriram V (2018). A critical review on Nepal Dock (Rumex nepalensis): a tropical herb with immense medicinal importance. *Asian. Pac. J. Trop. Med.* **2**:405-414.

Enyew A, Asfaw Z, Kelbessa E, Nagappan R (2014). Ethnobotanical study of traditional medicinal plants in and around Fiche District, Central Ethiopia. *Curr Res J Biol Sci*. **6**:154-167.

Grover J, Kumar V, Singh V, Bairwa K, Sobhia E, Jachak M (2014). Synthesis, biological evaluation, molecular docking and theoretical evaluation of ADMET properties of nepodin and chrysophanol derivatives as potential cyclooxygenase (COX-1, COX-2) inhibitors. *Eur J Med Chem.* **80**:47–56.

Devkota SR, Paudel KR, Sharma K, Baral A, Chhetri SB, Thapa PP, Baral KP (2015). Investigation of antioxidant and anti-inflammatory activity of roots of Rumex nepalensis. *World J Pharm Pharm Sci*. **4**:582-594.

Gautam R, Jachak SM (2008). Anti-inflammatory and cyclooxygenase (COX)-2 inhibitory activities of Rumex nepalensis Spreng. *Planta Medica*.**74**:320**.**

Enyew A, Asfaw Z, Kelbessa E, Nagappan R. (2014). Ethnobotanical study of traditional medicinal plants in and around Fiche District, Central Ethiopia. *Curr Res J Biol Sci*. **6:**154-167**.**

Kumar S, Singh PK. (2020). Phytochemical investigation and antioxidant characterization of essential oil from roots of Rumex nepalensis Spreng high altitude of North India. *Mater Today: Proc*. **26:**3442-3448**.**

Venkatesh S, Reddy BM, Reddy RD, Ramesh M. (2003). Antipyretic activity of Rumex nepalensis roots. *Niger J Nat Prod Med.* **7:**53-54.

Andargie Y, Sisay W, Molla M, Adela M. (2022). Evaluation of In vivo antidiarrheal activity of hydro-methanolic extract of the root of Rumex nepalensis in Swiss Albino mice. Metabolism Open. **15:**100197**.**

Pokhrel B, Choden D. (2022). Antifungal efficacy of Hyptis suaveolens and Rumex nepalensis extracts against Alternaria solani: An approach for bio-pesticides. *Biocatal Agric Biotechnol*. **43:**102439.

Kumar M, Paul Y, Anand VK. (2009). An ethnobotanical study of medicinal plants used by the locals in Kishtwar, Jammu and Kashmir, India. *Ethnobot Leafl*. **2009:**5.

Khatri D, Chhetri SB, Poudel P, Jamarkattel N. (2018). Hypoglycemic and analgesic activity of root extract of Rumex nepalensis. *World J Pharm Pharm Sci*. **7:**730-743**.**

Begum S, AbdElslam NM, Adnan M, Tariq A, Yasmin A, Hameed R. (2014). Ethnomedicines of highly utilized plants in the temperate Himalayan region. *Afr J Tradit Complement Altern Med*. **11:**132-142.

Khan AN, Bhat I. (2018). Extraction, qualitative and quantitative determination of secondary metabolites of Rumex nepalensis roots. *J Drug Deliv Ther*. **8:**97-100**.**

Dwivedi T, Kanta C, Singh LR, Prakash I. (2019). A list of some important medicinal plants with their medicinal uses from Himalayan State Uttarakhand, India. *J Med Plants*. **7:**106-116.

Hussain F, Ahmad B, Hameed I, Dastagir G, Sanaullah P, Azam S. (2010). Antibacterial, antifungal and insecticidal activities of some selected medicinal plants of polygonaceae. *Afr J Biotechnol*. **9:**5032-5036**.**

Hussain F, Hameed I, Dastagir G, Khan I, Ahmad B. (2010). Cytotoxicity and phytotoxicity of some selected medicinal plants of the family Polygonaceae. *Afr J Biotechnol*. **9**.

Ghosh L, Arunachalam G, Murugesan T, Pal M, Saha BP. (2002). Studies on the psychopharmacological activities of Rumex nepalensis Spreng. root extract in rats and mice. *Phytomedicine*. **9:** 202-206**.**

Beykaso G, Teklehaymanot T, Mulu A, Berhe N, Alemayehu DH, Giday M. (2023). Medicinal Plants in Treating Hepatitis B Among Communities of Central Region of Ethiopia. *Hepat Med.* **15:**265-277.