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Pharmacognostical Identification of *Rumex nepalensis* Spreng (Polygonanceae) - an Adulterant for Indian Rhubarb

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Abstract – Pharmacognostic studies on the shape, microscopic structure, and morphology of *Rumex nepalensis* (Polygonaceae) were carried out. These studies provided referential information for identification of this crude drug.
Keywords – *Rumex nepalensis* (Polygonaceae), macroscopy, anatomy, ash values, extractive values, microscopic, phytochemical

Introduction

In recent years, there has been a rapid increase in the standardization of selected medicinal plants of potential therapeutic significance (Reddy *et al.,* 1999; Venkatesh *et al.,* 1994). The use of plant drugs is subject to their correct identification, in general potent drugs are always either adulterated or substituted depending on morphological characters or biological activity. Despite the modern techniques, identification of plant drugs by pharmacognostical studies is more reliable.

Rumex nepalensis Spreng. (Polygonaceae) is an erect herb growing wild in temperate areas like Himalayas, Nilgiris, Pulney hills, Darjeeling in India. The tuberous roots of this plant are well known for purgative properties (Chopra *et al.,* 1956), used as antipyretic, anthelmintic (Bhattaraj, 1993), as a dye (Bennett, 1983), to treat scabies, diarrhoea, and dysentry (Manandhar, 1995). Anthraquinones, steroids, and triterpenes (Khetwal *et al.,* 1987; Sharma *et al.,* 1978) were reported from the roots.

A perusal of the reports reveals that the root of *Rumex* species is used as a substitute for rhubarb (Wallis, 1985). The tuberous roots of *Rumex nepalensis* were sold in the market of Calcutta, India under the name of Rewandchini, which is an official synonym of Indian rhubarb (Chopra *et al.,* 1956; Shrama *et al.,* 1978; Kirtikar and Basu, 1988). Official Indian rhubarb consists of *Rheum emodi* Wall. and *Rheum webbianum* Royle. (Polygonaceae) and rhubarb compound powder preparation is widely used as purgative (Anonymous, 1966). To the best of our knowledge no pharmacognostical work has been carried out on the roots of *R. nepalensis* and therefore it is dealt with in this paper.

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Experimental

Plant material – Fresh whole plants of *R. nepalensis* were collected in Nilgiri hills, Tamilnadu, India and authenticated by Dr. Vijayan, Botanical Survey of India (Southern Circle), Coimbatore, India. A voucher specimen (SV/068/98) is being maintained in G. Pulla Reddy College of Pharmacy, Hyderabad, India. The roots were separated and used for the study of macroscopic and microscopical characters; whereas dried material was used for the determination of ash values, extractive values, and phytochemical constituents. All the reagents used were of analytical grade obtained from Sigma Chemical Co, St. Louis, USA or S.D. Fine Chemicals Ltd., Mumbai, India.

Results and Discussion

I. Macroscopical characters

a) Colour Outer surface yellowish brown and yellowish internally

b) Size and shape 20 to 30 cm (l); 2 to 3 cm (d) and tuberous, subcylindrical

c) Taste Bitter

d) Odour Odouress

e) Surface Longitudinally wrinkled, furrowed

II. Anatomy

Transverse section of root (Fig. 1): The sections were

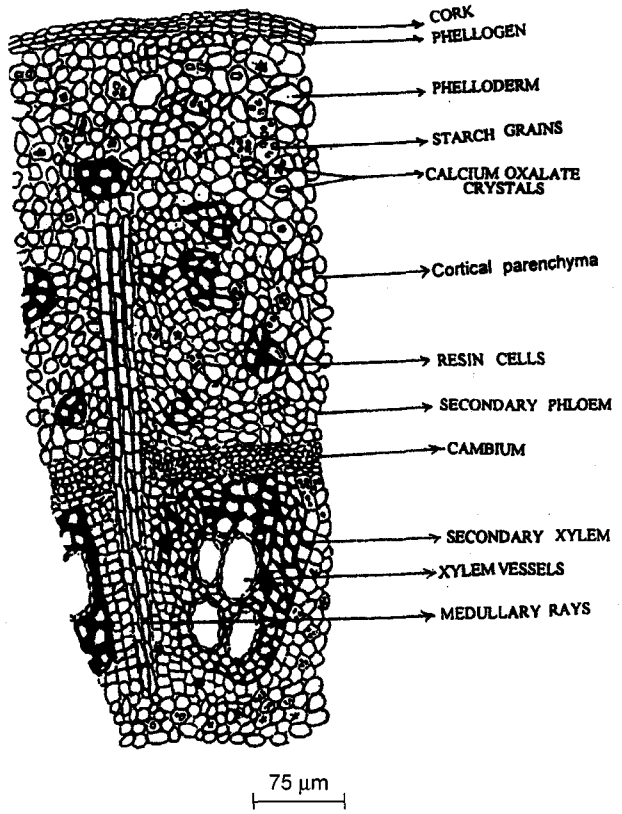

Fig. 1. Transverse section of *R. nepalensis* Spreng root (x 60).

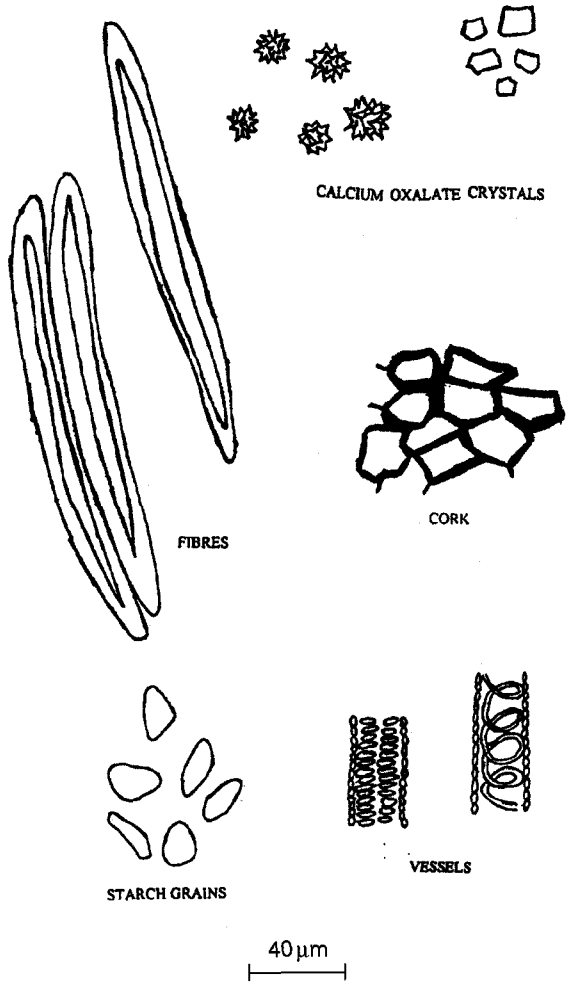

Fig. 2. Powder analysis of *R. nepalensis* Spreng root (x 100).

treated with appropriate reagents and mounted on a glass slide. The following characters were observed.

i) The root shows distinct secondary characters and has circular outline

ii) Cork layer is 4 to 6 layers of tangentially elongated cells, arranged in radial rows and brown in color

iii) Phellogen consist of two layered tangentially elongated parenchymatous cells

iv) Cortical parenchyma is made up of thin walled loosely arranged parenchyma cells containing starch grains, prisms, and rosette type of calcium oxalate crystals and resin cells

v) Secondary phloem consists of sieve tubes, companion cells and phloem parenchyma

vi) Cambium is distinct, represented by a ring of 4-6 layers of thin walled cells

vii) Medullary rays are bi-multiseriate, traverse the xylem parenchyma and extended up to cortex

viii) Secondary xylem is well represented, consists of thick lignified vessels, fibers and wood parenchyma

ix) Starch grains are found in phloem parenchyma and wood parenchyma

Powder analysis (Fig. 2)

i) Fibers are few, usually occur in a group of 2-3, thick walled, lignified with lumen and measures 300-500 µm in length and 40-60 µm in width

ii) Vessels are lignified with scalariform and spiral thickening

iii) Fragments of cork with thick walled cells containing brownish matter

iv) Yellowish brown resin cells

v) Abundant starch grains simple, oval, and measures 10-20 µm

vi) Rosette type of calcium oxalate crystals as big as 70 µm in diameter with well defined and pointed corners, few in number

III. Histochemical color reactions

Histochemical color reactions were carried out on the transverse section of the root by standard methods (Kokate, 1994; Trease and Evans, 1983) and given in Table 1. Results indicate that glycosides, steroids, triterpenoids, calcium oxalate crystals, starch, and lignin were present.

IV. Behaviour of powder with chemical reagents

Behaviour of root powder with different chemical reagents was studied to detect the phytoconstituents with color changes under daylight by reported method (Pratt and Chase, 1949) and the results were shown in Table 2.

V. Ash values

Total ash, acid-insoluble ash, water soluble ash, and sulphated ash values of the root powder was determined by standard method (Anonymous, 1985). The results are tabulated in Table 3.

VI. Extractive values

Extracts were prepared with various solvents by standard method (Kokashi *et al.*, 1958). Percentage of the extractive values was calculated with reference to air-dried drug (Table 4).

VII. Color and consistency of extracts

Color and consistency of the extracts (Pratt and Chase, 1949) are given in Table 5.

VIII. Fluorescence analysis of extracts

All the root extracts are examined in daylight, short and long UV to detect the fluorescent compounds by the reported method (Kokashi *et al.*, 1958). The observations are given in Table 5.

IX. Qualitative phytochemical screening

Freshly prepared organic extracts were tested for the presence of phytochemical constituents using reported procedure (Farnsworth, 1966) and the results are given in Table 6.

Table 3. Ash values of *R. nepalensis* root

Type of ash value	% w/w
Total ash	4.83
Acid insoluble ash	0.74
Water soluble ash	1.59
Sulphated ash	7.24

Table 4. Extractive values *R. nepalensis* root

Type of solvent	% w/w
Petroleum ether 60-80°C	2.31
Chloroform	1.17
Ethyl acetate	2.69
Acetone	2.95
Alcohol	4.14

Table 1. Histochemical color reactions of *R. nepalensis* root

Reagent	Constituent	Color	Histological zone	Degree of intensity
Phloroglucinol + HCl	Lignin	Pink	Xylem	+++
AnilineSO_4 + H_2SO_4	Lignin	Yellow	Xylem	++
Iodine solution	Cellulose	Dark blue	Cortex	++
Conc. H_2SO_4	Cellulose	Green	Cortex	+
Weak Iodine solution	Starch	Blue	Cortex, Xylem	+++
Millons reagent	Protein	–	–	–
Dragendorffs reagent	Alkaloids	–	–	–
Caustic alkali + HCl	Ca. Oxalate	Green	Cortex	++
$SbCl_3$	Steroids/Triterpenes	Reddish pink	Cortex	++
Keddy reagent	Glycosides	Pink	Cortex	+
5% KOH	Glycosides	Red	Cortex	++

+++ High, ++ Moderate, + Slight, – Negative

Table 2. Behaviour of the *R. nepalensis* root powder with different chemical reagents

Reagent	Color/precipitate	Constituent
Dragendorffs reagent	No precipitate	Alkaloids absent
Conc. H_2SO_4	Reddish brown	Steroids/triterpenes present
Aq. $FeCl_3$	Greenish black	Tannins/flavonoids present
Aq. NaOH	Yellow	Flavonoids present, Coumarins absent
Mg-HCl	Magenta	Flavonoids present
Iodine solution	Blue	Starch present
Ammonia solution	Red	Anthraquinone glycosides present
5% Aq. KOH	Red	Anthraquinone glycosides present
Mayers reagent	No precipitate	Alkaloids absent
Aq. $AgNO_3$	No precipitate	Proteins absent

Table 5. Consistency, color, and fluorescence characters of extracts of *R. nepalensis* root

Extracts Parameter	Pet. ether	Chloroform	Ethyl acetate	Acetone	Alcohol
Consistency	Amorphous	Sticky mass	Viscous	Semi solid	Semi solid
Color (day light)	Yellowish brown	Yellow	Greenish yellow	Yellowish green	Green
Short UV	Orange	Yellowish orange	Orange	Yellow	Green
Long UV	Green	Green	Light green	Light green	Light green

Table 6. Qualitative phytochemical analysis of *R. nepalensis* root extracts

Constituent	Pet. ether	Chloroform	Ethyl acetate	Acetone	Alcohol
Alkaloids	–	–	–	–	–
Carbohydrates	–	–	+	+	+
Coumarins	–	–	–	–	–
Flavonoids	–	–	+	+	+
Fixed oils	–	–	–	–	–
Glycosides	–	–	+	+	+
Gums and resins	–	–	–	+	+
Mucilages	–	–	–	–	–
Proteins and amino acids	–	–	–	–	–
Saponins	–	–	+	–	+
Steroids	+	+	+	+	+
Tannins	–	–	+	+	+
Triterpenoids	+	+	+	–	–

+ Present, – Absent

Conclusion

The present study on pharmacognostical characters of *Rumex nepalensis* Spreng. root will provide useful information for its correct identity with regard to the official drug, Indian rhubarb (*Rheum emodi* Wall and *Rheum webbianum* Royle). The presence of lignified fibers with lumen is a characteristic feature of *R. nepalensis*, prisms and clusters of calcium oxalate crystals are found in isolated form, measured up to 70 μm. Whereas, Indian rhubarb consists of abundant clustered calcium oxalate crystals distributed in a group of 4 to 5 and measured not less than 100 μm. The medullary rays are bi-to multiseriate, while in Indian rhubarb 2 to 3 cell wide filled with amorphous yellow to brown substance. The total ash soluble extract value of *R. nepalenis* and Indian rhubarb are 4.8 and 12%, respectively.

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