Rhubarb (*Rewand*)
A Review

Shamshad Alam and Naeem A. Khan
Department of Ilmul Advia,
Faculty of Unani Medicine,
Aligarh Muslim University, Aligarh-202002,
India.

Rhubarb is a perennial herb of *Polygonaceae* family. It consists of the dried rhizomes of *R. emodi* and *R. webbianum* and other species of *Rheum*. Mostly three main types of Rhubarb viz., the Chinese Rhubarb, the Indian or Himalayan Rhubarb and the Rhaphontic Rhubarb are found. The commercial Rhubarb known as Chinese, Russian, Turkish and East Indian, is said to be obtained from the *R. officinale* and *R. palmataum* but Chinese rhubarb is the best among them. It is of saffron colour, has a fractured surface, and is friable. In India it is distributed in the Himalayas from Kashmir to Sikkim at altitudes of 3,300-5,200 mts. It is also cultivated in Assam. It has been used for centuries in Unani System of Medicine for its effect as a Purgative, Resolvent, Liver Tonic, Anti-inflammatory, Stomachic, Diuretic and Emenagogue and Deobstruent.

Keywords: Rhubarb perennial herb, Rhubarb Purgative Diuretic.

Introduction

Rheum Linn. (Polygonaceae) is a genus of fifty species[1, 2] about 10 species occur in India[3, 1]. It has been described in *Kitabul-Hashaish* (Dioscorides, 78 C.E.). Rhubarb is mentioned in a Chinese herbals dated about 2700 B.C.[4]. Dioscorides refers to this drug as *rha* (the ancient name of Volga, a river in European Russia) or rheon[5, 4, 2, 6, 7]. It is brought from beyond the Bosphorus[8, 9, 5]. Scribonius Largus and Celsus in the first century C.E. called the drug "Radix Pontica or Rha-Ponticum" (Pontus Euxinus being the ancient name for the Black Sea). It has, therefore being suggested that Rhubarb imported via the Black Sea would be called Rhaphonticum[4] and that coming via Barbarike country, possibly Turkey, would be known as Reu-barbarum, were used by Latin writers of about 550 C.E.[5, 2, 6, 7]. From these origins we derive the modern

name Rhubarb[10, 7]. From the 12th to the 18th century Rhubarb was carried from China to Persia by caravans and thence to Aleppo, Tripoli, Alexandria and Smyrna. From these levant ports the drug was shipped to Europe and became known as Turkey Rhubarb[5, 8, 9, 2, 10]. On the opening of the trade with the Northern Chinese Ports in 1842 the Russian Trade rapidly diminished and the bulk of Rhubarb began to come and still comes directly from China to Europe[10]. Mostly three main types of Rhubarb viz., the Chinese Rhubarb, the Indian or Himalayan Rhubarb and the Rhaphontic Rhubarb are found[3]. The Indian Rhubarb gained importance during World War II, when the supplies of Chinese Rhubarb became scarce. It consists of the dried rhizomes of *R. emodi* and *R. webbianum* and other species of *Rheum*[3, 11, 12, 2]. The structure of commercial Rhubarb indicates that the drug is derived from two species of *Rheum*. One of these is *R. officinale*, Ballon, and the other is probably *R. palmatum* Linn. Practically all the Chinese Rhubarb now exported, passes through Hankow to Shanghai for shipment to Europe. Formerly the drug was conveyed by caravans via Persia to the Syrian ports whence it reached Europe and was known as Turkey Rhubarb. Some was sent direct from China (China or Canton Rhubarb) and some was shipped via India (East India Rhubarb). The latter being the most common variety as early as 1640[13, 10]. The first International symposium on Rhubarb was held in Chengd, China (1990) under the title "Rhubarb 90"[2].

Distribution

The commercial Rhubarb known as Chinese, Russian, Turkish and East Indians, is said to be obtained from the *R. officinale* and *R. palmataum*[14, 15, 16].

R. officinale is found abundantly in central and western China at an elevation of 3,000 to 4,000 meters and *R. palmatum* Linn. It occurs in the thrives province of Kansu (Henry 1999; Wallis, 1985), sub-alpine and alpine Himalayas, 11,000-12,000 ft.[14, 17, 18, 19].

R. emodi distributed in the Himalayas from Kashmir to Sikkim at altitudes of 3,300-5200 mts. It is also cultivated in Assam[3, 20, 6, 21] *R. palmatum* grown in long chain of mountains, partly naked forests, skirting Chinese Tartary on the West, commence to the North not far from the town of Selia, and extend to the South as far as Lake Kokanore, near Tibet[22]. In Himalayas, *R. emodi* is found growing wildly in various parts of Nepal and Sikkim to Kashmir at altitudes of 4,000-12,000 ft.[2, 14, 23, 16, 9, 17].

R. emodi sporadically growing between 2800-3800 mtrs. in Kullu, Simla and other parts of H.P. is also distributed in Kashmir, Punjab and U.P.[1]. The drug appears to be still obtained from both wild and cultivated

Rhubarb. The plant grows easily in cool, temperate climates, on high altitude of Asia from Tibet to South East China[2, 24, 9, 25]. Rhubarb has been successfully grown in certain parts of Assam[14, 16]. It is recorded that 11000 kg. of rhizomes and roots are annually collected from Kulu and Kangra[3]. It is propagated by rhizome cutting and seeds[1, 3, 20].

Unani Description

Rewand chini is found on hills in Tibet, Turkistan, Khorasan, and in some parts of India. It is obtained by digging out the roots from underground stem and appear blackish. It is cut into pieces 2/3 for easy handling and dried[26, 27, 28, 9, 29, 30, 31, 32] had described the Rewand is a root of Ribas, Riwaj or Riwas. Ibn Sina first noticed both the plants of 'Ribas' (Riwas, Pers) and the drug 'Ravand' (Revandpers). The former is an acid plant and the later evidently Chinese Rhubarb, which is also called *Bekh-e-Jigari* in Persian[9, 33, 34, 35]. According to the author of *Makhzanul-Advia* Ribas it is a herbaceous plant a cubit in height, with one or two flattened stems emerging from the center about 2 fingers by 1" in thickness having a pubescent bark, while the lower portion is purplish, and the upper green similar to stem of a lettuce. Internally the stem is white, soft and juicy; it has a sour and astringent taste. The top of the stem is branched, and between the branches are green rough bracts. The flowers are red with slightly acidic and sweetish taste. The plant grows in the cold snowy mountains, delicate, succulent and subacid, with a stout talk-stalk. The root without corky layer is *Rewand*[28].

Good Rhubarb should be moderately heavy, compact and brittle, cylindrical or flattish segments, externally reddish yellow in colour[8, 36, 24, 37, 38, 28]. The roots are cut into 2 or 3 pieces, pierced by holes and hung on to cords. Therefore, many pieces show holes pierced for drying[7, 8, 9, 32].

The fractured surface has the grain of a bull's hump, and is friable, it is called *Revand-e-Lahmi* (meaty rhubarb) and should be in large pieces like a horse's hoop and not worm eaten and when powdered, is of saffron colour[26, 39, 24, 7, 31, 32, 9]. It has a peculiar aroma. Tastes bitter and astringent and when chewed it feels gritty under the teeth and it colours the saliva, yellow[4, 6, 7, 9, 40, 41]. Best types are Chinese, Tibetan, Khurasani, and Chinese rhubarb being among them, having saffron colour, has a fractured surface, and is friable[37, 24, 28, 38, 26, 42].

Ethanobotanical Description

R. emodi is a perennial herb with thick, long stout roots and hollow stem. Leaves are large upto 40 cm long, broadly ovate. Flowers are

dark, purplish, minute appearing in large bunch and bloom in the month of June-July[1, 3, 17, 19, 20, 23]. The Hakims are better acquainted with Rhubarb than the Hindu practitioners. It is not an article of the Hindus Materia Medica, but the modern Hindus have become acquainted with its properties through Mohammadan and European physicians[5, 15]. It is one of the articles first introduced into practice by the Arabians[5] assuming that the older accounts are still substantially correct[2]. The rhizomes and roots are harvested in autumn, and dug up late in September when about 8-10 years old after the removal of most of the bark, are either cut into pieces or segments and kiln or sun dried, or the segments may be bored with holes and suspended on strings to dry[2, 3, 14, 42]. The official drugs occur in pieces of varying size and shape, small and large. These 2 principal forms are known as 'rounds' and 'flats'[2, 6, 10, 13, 42]. The Rhizomes of *R. emodi* wall are solid, compact, heavy, and somewhat cylindrical; barrel shaped ranging: from 3.5-5.5 cm in length and 2.5-3.5 cm in diameter. 2-20 cm (length) and 1.58 cm (diameter)[18, 11] according to (Pandey *et al.,* 1996)[44], 7-10 cm length and 3-6 cm diameter. Outer surface is mostly irregularly longitudinally wrinkled and they are usually covered with brownish or yellowish brown cortex. Inner surface possesses yellow colour. Fracture shows cambium line. The taste is bitter and astringent and is aromatic and slightly pungent[3, 11, 13, 18, 19, 21, 23].

The fractured surface should be compact, free from decay and discolouration and marbled throughout its whole substance with reddish brown lines interrupted with yellowish white matter. It has a strong peculiar and faintly aromatic fragrance and a bitter, somewhat astringent and nauseous taste, and when chewed it feels gritty under the teeth[2, 6, 42, 43]. The transverse section of the root shows brown bark which consists of 10-14 layers of cells cambium is wavy and is much compressed. Medullary rays are prominent[11, 21, 23, 42].

Therapeutic Actions

The actions of *Rewand* is described in detail in Unani classical books and in ethno botanical literature as purgative, stomachic, liver-tonic, calefacient, desiccative, resolvent, attenuant, deobstruent, purifier, febrifuge, diuretic and emenagogue, aperient, astringent, detergent, anodyne, alexipharmic/anti-dote, corrosive, anti-Inflammatory, expectorant[3, 7, 12, 13, 14, 16, 19, 20, 32, 45, 46, 47], anti-coagulant, anti-bacterial, anti-cancer[18], anti-dysentery[14] and lithotriptic[7, 24, 34].

Therapeutic Uses

Rheum is therapeutically used in different diseases such as stomach

pains, constipation, dysentery[7, 12, 15, 19], throat swelling, tonsillitis, earache[1, 20], indigestion with diarrhea[1, 13, 16, 20], liver and stomach ailments[8, 37, 9, 43, 47], atopic dyspepsia, wounds, cuts, muscular pain, swelling and mumps, diarrhoea, hypochondriasis[13, 14, 15, 16, 35, 37, 48], thread worm[43], chronic fever[8, 24, 14, 43, 47], intestinal debility, palpitation, obstruction in chest chronic bronchitis, asthma, lambago, piles, pains and bruises, tuberculosis, heamoptysis, jaundice, ascitis, gastric ulcer, bilious fever, intermittent fever, headache, migrain, paralysis[3, 7, 8, 9, 10, 14, 43], mania, vertigo, sciatica. All complaints of brain, tinnitus[8], conjunctivitis[7, 27, 32], ring worm, vitiligo scars, hepatitis, amenorrhea, anuria, cold venoms spec. scorpions, renal and vesicle calculi, chronic cough, chronic inflammation, tetanus, scabies[7, 8, 16, 24, 26, 27, 46], heating of brain, sore eyes, corrhyza, obstruction in liver and spleen[14, 19], ulcer, renal and vesicle pain[24, 38, 16], hiccup[36, 38, 40], hernia, uterine pain, hemorrhage, insect bites[38].

Pharmocological Studies

The nephroprotective effect of the alcoholic extract of Revand Hindi (*Rheum emodi*) were investigated on cadmium chloride, mercuric chloride, potassium dichromate and gentamicin-induced nephrotoxicity in rats, the investigations provided evidences that it has nephroprotective effect possibly through antioxidant action[48]. The methanolic extract of rhizome of Himalayan rhubarb (*Rheum emodi*) displayed mild yeast as well as mammalian intestinal α-glucosidase inhibitory activity and compounds may have value in the treatment and prevention of hyperglycemia associated diabetes mellitus[49]. Anthraquinone, derivative of *R. officinale*, experimentally found to be effective against herpes simplex virus type I and type II varicella zoster virus, pseudo rabies virus, influenza virus, adeno virus, rhino virus[50].

312 cases of gastric and duodenal ulcer bleeding were treated with 3 kinds of Rhubarb namely *R. officinale, R. palmatum* and *R. tangutium* in the form of alcoholic extract tablets. This study showed that they are efficient in curing the upper digestive tract bleeding as 90.7% and 93.7% and 92.8% respectively[51]. *Emodin* an active principle of *R. officinale* with appropriate concentration (14.8 mumol/L) strengthened the effect of acetylchotine (*Ach*) on the isolated ileum and large intestine of guinea pigis ($P<0.05$ and $P<0.01$). But high concentration of emodin could reduce and even completely antagonize the effect of *Ach.* Its effect is related to Calcium ion[52]. Extracts of 178 Chinese herbs were screened for their anti-bacterial activity against bacteroidsfragilis, a major anaerobic micro-organism in the intestinal flora of human, is one of the causes of inflammation of the bile ducts, gall bladder, and liver; *Rhein* has substantial

activity against *B. fragilis* possibly because of its anti-bacterial action[45, 53]. *Emodin* an active component present in the root and rhizomes of *R. palmatum* Linn. was found to have an inhibitory effect on the pathogenicity of trichomonasvaginalis in mice[54]. The Sera obtained from the rat fed with *R. officinale* inhibited significantly the proliferation of renal tubular cells and the effect become even stronger with the increase of the dosage or the long-time of administration of *R. officinale* to the rat[55]. Effect of Rhubarb on cyclic AMP has been studied. The result showed that cyclic AMP level was raised during fever and decreased after Rhubarb administration[56]. Effect of *Rheum* on renal hypertrophy and hyper filteration of experimental diabetes in rat was studied. The result suggest that *R. officinale* is beneficial to the diabetes in terms of renal hyper trophy and glomerular filtration rate changes at early stage and is recommended in the treatment of diabetic nephropathy[57]. Experimental study of *R. officinale* Baill, in treating severe hepatitis and hepatic coma exhibited beneficial effect in significant manner[58]. Chrysophanol possesses significant inhibition of paw edema[45]. The anti-bacterial and anti-fungal activity of the *R. emodi* isolates is studied[59]. Rhein, physcion, aloe-emodin and chrysophanol isolated from *Rheum emodi* rhizomes exhibited antifungal activity against Candida albicans, Cryptococcus neoformans, Trichophytonmentagrophytes and Aspergillus fumigatus[49]

Phytochemistry

Plant contains anthraquionones (2.24%) which comprised of *physcion, chrysophanolemodin, rhein*and *aloe emodin*[45, 60], astringent constituent consists chiefly of Gallic acid in the form of gluco-gallin which is glycosidal together with small amount of tannin and possibly catechin[3, 13, 14]. Other constituents apparently devoid of medicinal action are *rheinolic acid, starch*, *fat dextroe, levulose, pectin, v. oil* and *calcium oxalate.* The amount of calcium oxalate (7.3%) and consequently also the ash varies widely, from 3.5 to 43.3%. Good Chinese Rhubarb yielding from 7 to 13%[3, 10, 13, 14]. One gram ash of *Rheum emodi* contains the following contents in mg: copper: 0.57; potassium: 45.7; Lead: 0.25; Sodium: 22.1; Magnesium: 18.67; Zinc: 0.35; Iron: 0.237; Chromium: 0.03; Magnese: 0.27[12]. Total ash, (6.15%), Water soluble (1.45%), Acid insoluble, (5.45%); Ph values: in 1% soln. (5.97), in 10% soln. (5.94); Loss on drying at 105ºC, 10.0%; Solid Contents, 73.32%; Successive extractive values, Pet. Ether (40-60º) 3.54%, Benzene 2.65%, Chloroform, 1.38%, Acetone 16.73%, Ethanol 13.35%, Distilled water 8.70%, Phenolics (0.53%), Resin (3.57%), Calcium, 1.03%[23]. Foreign organic matter: not >1%, Alcohol soluble extract: not <30%, Acid in-soluble ash: not> 1%

(Anonymous, 1970). Alcohol soluble extract: not <19%, water soluble extract not <12%, Total ash: not >7%, Acid insoluble ash: not >4%[18]. Foreign matter: not >2%, Total ash: not >11%, Acid insoluble ash: not >2.5%, Alcohol soluble extract: not <22%, water soluble extract: not <19%[21]. The anthraquinone derivatives present in Rhubarb are emodin 2%, Chrysophanol 0.14%, rhein, aloe-emodin-mono methyl ether. Tannin ($C_{26}H_{20}O_{14}$) named Rheo-tannic acid. These occur partly free, partly as glycosides and possibly also in some other undetermined combination occurring in the amorphous non-glucosidic resinous mixture (Chief laxative constituent) extracted from Rhubarb by Tutin and Clewer in 1911 and referred to as "Rheonigrin" which yields upon hydrolysis with dilute sulphuric acid, gallic acid, glucose, cinnamic acid, rhein, emodin, aloe-emodin mono-methyl ether, Chrysophanic acid and a trihydroxydihydro-anthracene[2, 5, 10, 13, 14]. According to Wallis (1985)[10] the pieces of the drug "Indian Rhubarb" (*R. emodi* Wall.) does not contain rhaponticin, it gives a positive reaction for the anthraquinone derivatives. Small quantities of albuminoidsubtances, malic acid, fat and sugar have also been met within Rhubarb. The amount of mineral constituents is exceedingly variable. Fluckiger and Hanbury obtained from two good samples of Chinese Rhubarb, dried at 100^0C and incinerated, 12.9 and 13.87% of ash, another pale sample yielded not less than 43.27%. The ash consists of carbonates of calcium and potassium[61]. All anthraquinone derivatives based on *emodin,emodin-3-monomethylether (Physcione) chrysophanol; aloe-emodin (9, 10-dihydro-1-8-dihydroxy-3-dihydroxymethy-9, 10-dioxo-anthracene)* and*rhein,* these occur free and as *quinone, anthrone, or dianthrone glycosides*[3]. The gallic acid and cinnamic acids are probably present as esters. In addition to the resin the drug contains derivatives of anthraquinone in the free-state and also in the form of glycosides. These substances are all derivatives of oxymethylanthraquinone and are accompanied in the drug by rheinolic acid. *Chrysophanic acid*, $CH_3.C_{14}H_5O_2$ $(OH)_2$, is a dihydroxy-methylanthraquinone, *Emodin,* $CH_3.C_{14}H_4O_2$ $(OH)_3$, is hydroxychrysophanic acid and is therefore a trihydroxymethylanthraquinone. *Emodinmonomethylether*, $CH_3.C_{14}H_4O_2$ $(OH)_2O$, CH_3 is the corresponding methoxychrysophanic acid, may be prepared from *emodin*. *Aloe-emodin*, $C_{14}H_5O_2$ $(OH).CH_2.OH$, is the primary alcohol (hydroxymethyl-dihydroxy-anthraquinone) corresponding to chrysophanic acid. *Rhein,* $C_{14}H_5O_2$ $(OH)_2$ CO_2H is the corresponding carboxylic acid, and may be obtained by the oxidations of *aloe-emodin*. The total quantity of oxymethylanthraquinones, free and combined, present in Rhubarb has been estimated to vary from 2-4%. Only *Chrysophanic acid* and *aloe-emodin* are laxative. The mixed glucosides of the oxymethylanthraquinones crystallise readily together, this crystalline mixture termed by Gilson *rheopurgarine*, is however devoid of purgative action.

According to Gilson, the gallic acid is present as a glucoside (glucogallin) and gallic acid, cinammic acid and rheosmin as another glucoside (tetrarin) but this is unlikely.[13] The following analysis by Elborne shows the percentage composition of three samples of English Rhubarb and four of the Eastern drug. Analysis of samples of the drug cultivated at low and high altitudes respectively gave the following value[3, 5, 14]:

	***R. o.* ordi. cult.**	***R. o.* hi. cult.**	***R. rhap.***	**E.I.R.**	***R. e.* low cult.**	***R. e.* hi. cult.**	***R. R.***
Moisture	6.06	7.9	5.57	5.4	6.06	7.9	12.6
Ash	9.33	4.9	7.9	9.28	9.33	4.9	6.63
Mucilage (sol. in water)	6.5	4.8	4.1	4.0	6.5	4.8	5.5
Cathartic acid	3.5	3.2	3.3	4.5	3.5	3.2	3.2
Organic acid (Resinous subs.)	3.3	2.2	1.5	3.0	3.3	2.2	4.5
Solu. in alcohol Fat and Free	2.6	2.0	3.4	4.6	2.6	2.0	5.2
Chrysophanic acid (solu. in Pet. ether)	0.4	0.3	0.2	0.7	0.4	0.3	1.5

R. o. = *Rheum officinale;* ordi. cult = ordinary cultivation; Hi. cult = high cultivation; *R. rhap.* = *Rheum rhaponticum;* E.I.R. = East Indian Rhubarb; *R. e.* = *Rheum emodi;* R. R. = Russian Rhubarb.

A recent investigation has shown that two major glycosidic active principles, viz. sennoside A ($C_{42}H_{38}O_{20}$) and sennoside B ($C_{42}H_{38}O_{20}$) are present along with free anthraquinone, sennosides are the dianthroneglucoside of rhein. Sennosides are metabolized by animals and humans into monometricrhein. The resulting metabolite rhein is further reduced to rheinanthrone as laxative principle. Rhizome/roots yield an essential oil (0.05%), containing *eugeno*l, an unidentified terpenic alcohol,

and a product believed to be methyl-n-heptyl ketone[3, 20, 45]. Estimation of *Rhein* and *Chrysophanol* in the drug was carried out by TLC and colourimetric method. The solvent system (Benzene:Chloroform:acetic acid, 90:10:0.5) was allowed to run a distance 15.16 cm, gave two bands i.e., chrysophanol and rhein. The drug contained about 6.5% tannins, whereas after *Tadbeer* contained 6.1%. The purifactory/detoxificatory process did not alter the quantity of free rhein and tannins significantly present in the drug[45]. Chrysophin, chrysophanic acid, emodin, rheotericacid,oxalateof lime (35%) other constituentsare, rheolicacid, resin, starch, rheolin[4]. Rhubarb roots contain large number of *chrysophanic acid* (*chrysophan*), emodin, a tannin, (rheo-tannic acid), several resins, an albuminoid principle, mucilage, tannic and gallic acid, sugar, starch, pectin, Calcium oxalate and various inorganic salts. Leaves contain oxalic acids[16]. From six rhubarb species, official (*Rheum officinale*, *R. palmatum*, and *R. tanguticum*) and unofficial (*R. franzenbachii*, *R. hotaoense* and *R. emodi*), a total of 107 phenolic compounds were identified or tentatively characterized based on their mass spectra. These compounds include sennosides, anthraquinones, stilbenes, glucose, gallates, naphthalenes, and catechins[62]. Chrysophanol-8-O-β-d-glucopyranoside, desoxyrhaponticin, desoxyrha-pontigenin and rhapontigenin have been isolated in substantial yields from *R. emodi* for the first time[49]. The bioassay-guided chemical examination of the rhizomes of *R. emodi* resulted in the isolation of two new oxanthrone esters, revandchinone-1, revandchinone-2, a new anthraquinone ether revandchinone-3 and a new oxanthrone ether, revandchinone-4[49]. In a study of the anthraderivatives in roots of *Rheum emodi*, three new anthrone *C*-glucosides, named 10-hydroxycascaroside C (1), 10-hydroxy-cascaroside D (2) and 10*R*-chrysaloin 1-*O*-β-D-glucopyranoside (3) were isolated[64].

REFERENCES

1. Bhattacharjee, S.K. and De, L.C., (2005). *Medicinal Herbs and Flowers,* Aavishkar Publishers Distributors, Jaipur, India, p. 219.
2. Evans, W.C., (2007). *Trease and Evans Pharmacognosy,* 15th Edn., WB Saunders Company Ltd., London, UK., pp. 230-231, 238-240.
3. Anonymous, (1999). *The Wealth of India (Raw Materials)*, Council of Scientific and Industrial Research, New Delhi, Vol. IX, pp. 3-4.
4. Hakim Ghulam Jilani, (1944). *Makhzanul-Advia Doctry Matria Medica Ba Tasweer,* Tibbi Kutub Khana Resala Shamsul-Atibba, Bhati Gate, Lahore, Vol. II, 5th Edn., pp. 1445-1451.

5. Dymock, W., Warden, C.J.H. and Hooker, D., (1893). *Pharmacographia Indica,* Trubner and Co. Ltd., Vol. III, pp. 368-370.
6. Daljeet Singh, (1974). *Unani Dravyagune Darsh,* Ayurvedic and Unani Tibbi Academy, Uttar Pradesh, Lucknow, pp. 612-614.
7. Ghani, N., (1921). *Khazeenat-ul-Advia,* Matba Munshi Nawal Kishore, Lucknow, Vol. II, pp. 455-458.
8. Baitar, A.A.I., (1291 H). *Al-Jamiul Mufridat al-Advia-wal-Aghzia,* Matba Amra, Egypt, Vol. II, pp. 129-133.
9. Khan, M.A., (1313 H). *Muheet-e-Azam,* Mataba Nizami, Kanpur, Vol. II, pp. 76-81.
10. Wallis, T.E., (1985). *Text Book of Pharmacognosy,* CBS Publishers and Distributors, Shahdara, Delhi, Vth Edn., pp. 365-372.
11. Anonymous, (1970). *The Indian Pharmacopoeia,* 2nd Edn., Manager of Publications, Delhi, pp. 435-436.
12. Said, H.M., (1997). *Hamdard Pharmacopeia of Eastern Medicine,* Sri Satguru Publications, Karachi, pp. 414-415.
13. Henry G. Greenish, (1999). *Materia Medica,* III Edn., Scientific Publishers, Jodhpur, (India), pp. 34, 360-365.
14. Chopra, R.N., Nayar, S.L. and Chopra, I.C., (1956). *Glossary of Indian Medicinal Plants,* Council of Scientific and Industrial Research, New Delhi, p. 212.
15. Ainslie, W., (1984). *Materia Medica,* Neeraj Publishing House, Delhi, Vol. I, pp. 342-344, 624.
16. Nadkarni, K.M., (2000). *The Indian Materia Medica,* Bombay Popular Prakashan Pvt. Ltd., Bombay, Vol. I, pp. 1056-1059.
17. Hooker, J.D., (1982). *Flora of British India,* M.S Bishen Singh Mahendra Pal Singh, New Connaught Place, Dehradun, Vol. V, pp. 56-57.
18. Farooq, S., (2005). *555 Medicinal Plants – Field and Laboratory Manual,* International Book Distributors, Dehradun, pp. 152-155.
19. Kirtikar, K.R. and Basu, B.D., (1993). *Indian Medicinal Plants,* IInd Edn., International Book Distributors, Rajpur Road, Dehradun, India, Vol. III, pp. 2107-2110.
20. Sharma, R., (2003). *Medicinal Plants of India – An Encylopaedia,* Daya Publishing House, Delhi, pp. 211-212.
21. Anonymous, (2007). *The Unani Pharmacoepia of India,* 1st Edn., Ministry of Health and Family Welfare, Govt. of India, New Delhi, Part I, Vol. II, pp. 91-92.
22. Lindley, J., (1981). *Flora Medica,* Ajay Book Service, New Delhi, pp. 354-355.
23. Anonymous, (1987). *Standardization of Single Drugs of Unani Medicine,* Central Council for Research in Unani Medicine, New Delhi, Part III, pp. 266-270.
24. Antaki, D.A., (1317 H). *Tazkira-e-ulil-Albab* (Arabic), Azhari Press, Egypt, p. 133.
25. Anonymous, (1988). *The New Encyclopaedia Britanica,* Chicago/Auckland/ Geneva/ London, 15th Edn., Vol. X, p. 31.
26. Attar, H.Z., (1305 H). *Ikhtiyarat-e-Badiyee,* Matba Munshi Naval Kishore, Kanpur, pp. 199-200.
27. Al-Harvi, M.Y., (1321 H). *Bahr-ul-Jawahar,* Matba Mehtabi, Delhi, p. 121.
28. Momin, M.H., (1272 H). *Tohfat-ul-Momineen,* Matba Hasani, p. 125.
29. Nasir, M., (1886). *Mufradat-e-Nasiri,* Matba Rahmani, Delhi, p. 51.
30. Nooruddin, M.A., (1239 H). *Alfaz-ul-Advia,* Matba Mustajai, Lahore, p. 129.
31. Hakim, M.A., (2002). *Bustanul-Mufridat Jadeed,* Idara Kitab-ul-Shifa, Kucha Chelan, Darya Ganj, New Delhi, pp. 312-313.

32. Kareem, N., (1880), *Makhzan-ul-Advia,* Matba Munshi Nawal Kishore, Kanpur, Vol. I, pp. 566-568.
33. Husain, M., (1892). *Makhzan-ul-Advia,* Munshi Gulab Singh, Lucknow, p. 411.
34. Samarqandi, (1907). *Aqsarayee,* Munshi Nawal Kishore Press, p. 210.
35. Ibn Hubl, (1365 H). *Kitab-ul-Mukhtarat,* Hyderebad, Daccan, Vol. II, p. 164.
36. Gazrooni, M.S., (1311 H). *Al-Sadeedi-Fil-Tibb,* Matba Munshi Nawal Kishore, Lucknow, Part II, p. 204.
37. Sadiq, H.M., (1930). *Makhazin-ut-Talim,* Matba Mujtabai, Delhi, p. 98.
38. Ibn Sina, (1906). *Kitab-ul-Qanoon-Fil-Tibb,* Mataba Nami, Lucknow, Vol. II, p. 164.
39. Dayal, K.S., (1933). *Vedic Nighantoo* or *Vadic Makhzanul Mufridat,* 2nd Edn., Kutub Khana Anjuman, Taraqqi Urdu Bazaar, Delhi, p. 139.
40. Lubhaya, R., (1984). *Goswami Bayanul Advia,* Vol. I, pp. 286-288.
41. Bentley, R. and Trimen, H., (1983). *Medicinal Plants,* Agency and International Book Distribution, Taj Offset, Delhi, Vol. III, p. 215.
42. Khory, R.N. and Khatrak, N.N., (1993), *Materia Medica of India and Their Therapeutics,* Neeraj Publishing House Delhi, pp. 510-511.
43. Pandey, S.N. and Ajanta Chadha, (1996). *Economic Botany,* Vikas Publishing House Pvt. Ltd., pp 313-314.
44. Khan, S., (1280 H). *Taleef-e-Sharifi,* Matba Kishore Darussalam, Delhi, p. 110.
45. Zameer Ahmad, M.A. Jafri, Kalim Javed and Aftab Ahmad, M., (1998). Studies on Tadbir of Indian Rhubarb, *Hamdard Medicus,* Vol. XLI(3) pp. 49-55.
46. Marcus, W., (1985). *Gerard's Herball,* Bracken Books London, pp. 98-101.
47. Razi, A.M.B.Z., (1967). *Al-Hawi Fit-Tib,* Dairat-ul-Maarif Osmania Oriental Publications Bureau, Osmania University, Hyderabad, Vol. 20, pp. 523-525.
48. Azhar Alam, M.M., Kalim Javed and Jafri, M.A., (2005). Effect of *Rheum emodi* (Revand Hindi) on renal functions in rats, *Journal of Ethnopharmacology,* Vol. 96(1-2), pp. 121-125.
49. Agarwal, S.K., Sudhir, S. Singh, Sushma Verma and Sushil Kumar, (2000). Antifungal activity of anthraquinone derivatives from *Rheum emodi, Journal of Ethnopharmacology,* Vol. 72(1-2), pp. 43-46.
50. Sydiskis, R.J., Owen, D.G. and Lohr, J.L., (1991). *Inactivation of Enveloped Viruses by Anthraquinones Extracted from Plants,* Deptt. of Microbiology, University of Moryland, Baltimore, (U.S.A.), 35(12) pp. 2463-2466.
51. Zhou, Jiao, (1990). *312 Cases of Gastric and Duodenal Ulcer Bleeding Treated with 3 Kinds of Alcoholic Extract Rhubarb Tablets,* 10, pp. 131-32, 150-151.
52. Jin, Z.H., Ma, D.L. and Lin, Z.X., (1994). Deptt. of Pharmacology, Jianjin Medical College (China), 14(7) pp. 429-431.
53. Cyong , J., Matsumuto, T. and Arakawa, K., (1987). *Journal of Ethnopharmacology,* (Switzerland), Oriental Medicine Research Centre, Kitasato Institute, Tokkyo, Japan, 19(3), pp. 279-283.
54. Wang, H.H., (1993). Anti-trichomonal action of emodin in mice, *Journal of Ethnopharmacology* (Ireland), Deptt. of Internal Medicine Hospital of China Medical College, Tainaung City, Taiwan, 40(2), pp. 111-116.
55. Zheng, (1993). Effect of Rheum officinale on the proliferation of renal tubular cells *in vitro, Chung Hua,* 1, Hsueh Tsa Chih (China), 73(6), pp. 343-345.
56. Gao, C.Y., Zhao, S.Y., Wang, B.E., Ye, S.J. and Li, X.M., (1989). 14(1), pp. 370-371, 384.
57. Yang and Li, (1993). Effect of Rheum on renal hypertrophy and hyperfilteration of experimental diabetes in rat, Institute of Nephrology Jingling Hospital, China, 13(5), pp. 286-288.

58. Hu, L.H., (1986). Experimental study of *R. officinale,* in treatment of severe hepatitis and hepatic com, *Chung Hsi,* 1, Chien, Ho TsaChih (China), 6(1), pp. 41-42, 45.
59. Suresh Babu, K., Srinivas, P.V., Praveen, B., Hara Kishore, K., Suryanarayana Murty, U. and Madhusudana Rao, J., (2003). Antimicrobial constituents from the rhizomes of *Rheum emodi, Phytochemistry,* Vol. 62(2), pp. 203-207.
60. Rastogi and Mehrotra, (1998). *Compendium Indian Medicinal Plants,* New Delhi, Vol. V, p. 721.
61. Tajuddin, M., Khan, N.A. and Tajuddin, (1998). 'Scientific Evaluation of Habb-e-Shifa – A Compound Unani Formulation, Thesis, Deptt. of Ilmul-Advia, Aligarh Muslim University, Aligarh, p. 49.
62. Min, Ye, Jian Han, Hubiao Chen, Junhua Zheng and Dean Guo, (2006). *Analysis of Phenolic Compounds in Rhubarbs Using Liquid Chromatography Coupled with Electrospray Ionization Mass Spectrometry,* Department of Pharmacology, Yale University School of Medicine, New Haven, CT 06520, USA.© 2007, American Society for Mass Spectrometry, Published by Elsevier (Published online, pp. 82-91).
63. Liselotte Krenn, Riddhi Pradhan, Armin Presser, Gottfried Reznicek and Brigitte Kopp, (2004). *Anthrone C-Glucosides from Rheum emodi,* Online Publication Institute of Pharmacognosy, University of Vienna.