**Review**

*Rivea hypocrateriformis* (Desr.) Choisy: A Review of its Ethnobotanical uses, Phytochemistry and Biological activities

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**Abstract:** *Rivea hypocrateriformis* (Desr.) Choisy is a robust woody climbing shrub of the genus *Rivea* which is found in India, Nepal, Sri Lanka, Pakistan, Bangladesh, Myanmar and Thailand. *R. hypocrateriformis* is a promising medicinal herb with enormous helpful and wellbeing advancing impacts. *R. hypocrateriformis* has been utilized as a customary medication for a long time to treat rheumatic pain, fever, urogenital problem, snake bite, cough, piles, malaria, and skin disease. Apart from the traditional uses its leaves and young shoots are cooked and eaten as a vegetable and for preparation of bread with millet flour. This review comprehensively summarizes the up-to-date information on the botanical characterization, distribution, traditional uses, phytochemistry, pharmacology and toxicity study of *R. hypocrateriformis*. Phytochemical investigation has been revealed that alkaloids, glycosides, coumarins, flavonoids, xanthones, stilbenes, and other organic compounds are contained in *R. hypocrateriformis*. Crude extracts and isolated compounds have exhibited numerous pharmacological activities such as anovulatory effect, antifertility activity, antiarthritic, antimicrobial, anticancer, antioxidant, hepatoprotective, antilithiatic, and antimitotic. *R. hypocrateriformis* is a promising restorative spice with monstrous remedial and wellbeing advancing impacts. Along these lines, further investigations on the bioactive mixtures and systems of *R. hypocrateriformis* are justified. Extra clinical and toxicological examinations are expected to assess its wellbeing.

**Keywords:** *Rivea hypocrateriformis* (Desr.) Choisy; Traditional medicines; Phytochemistry; Biological activity; Pharmacology

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1. **Introduction**

The family Convolvulaceae is a fairly large and homogeneous group comprising about 50 genera and nearly 1,700 species [1-3]. *Rivea hypocrateriformis* (Desr.) Choisy is a robust woody climbing shrub belonging to the family Convolvulaceae and is found in subtropical forests of India, Nepal, Sri Lanka, Pakistan, Bangladesh, Myanmar and Thailand [4]. The different parts of the plant are utilized for the treatment of different sorts of sicknesses, for example, malaria, cancer, mental disorders and to relieve pain. Even though the plant is known for a large number of biological activities such as anti-oxidant, anti-implantation, antimicrobial, pregnancy irritation, as anticancer and as an antiarthritic [5-8]. Indigenous populations of Tharparkar of Pakistan utilize this plant for the treatment...
of malaria fever and pain. Indians utilize these plants as hallucinogenic medication while Pakistanis utilize this plant as psychoactive medication plant like different types of a similar family, for example, Rive corymbosa Hall and Ipomea violacea L. found in Mexico [9].

Argyrea bona-nox Sweet, Argyrea uniflora Sweet, Convolvulus hypocrateriformis Desr., Lettsomia uniflora Roxb., Modesta coriacea Rafin., Rivea bona-nox Choisy, Rivea fragrans Nimmo are the synonyms of R. hypocrateriformis. Taxonomical classification of R. hypocrateriformis is Kingdom: Plantae; Phylum: Tracheophyta; Class: Magnoliopsida; Subclass: Asteridae; Order: Solanales; Family: Convolvulaceae; Genus: Rivea [10]. It is likewise known by a variety of names, such as “Midnapore Creeper” in English, “Thor-kibel” or “Phang” in Hindi, “Sanjvel” in Marathi “Budthi Kiray” or “Musuttai” in Tamil, and “Niruboddi” in Telugu [11,12]. Customarily, its bark, roots, and leaves are utilized for the treatment of different diseases and issues [13]. Other than its customary uses, leaves and youthful shoots - cooked and eaten as a vegetable. The leaves are bubbled along with toppings and arranged dishes, for example, bhaji [14,15] or jowari flour which is then made into bread [14]. The plant has high nutrient A substance (almost 2.34 retinal reciprocals), holding 75 - 98% of this in any event, when cooked [16,17]. The leaves are a decent useful food. They contain a scope of dynamic mixtures and have gentle cell reinforcement potential. The plant is acceptable wellspring of energy and micronutrients and can be utilized as nutritious verdant vegetable in everyday life and explicitly in conditions, for example, when experiencing conditions like hack, skin sickness, and asthma [18].

It is also used as an ingredient in ayurvedic formulation “Parnasapancaka” used for the treatment of asthma [19]. Till date there is no review available on the R. hypocrateriformis. Therefore, the present review aimed at providing a more comprehensive analysis on the ethnomedicinal uses, phytochemistry, and biological activities. Furthermore, this study would highlight areas for future research on potential bioactivities of R. hypocrateriformis.

2. Research Methodology

The research methodology adopted for the selection of articles for this review is stipulated as flow chart in Figure 1.

![Figure 1. Flow diagram of research methodology.](image-url)

3. Botanical Description

3.1. Habitat
Midnapore Creeper is a robust woody climbing shrub, found in dry subtropical forests of India, Nepal, Sri Lanka, Pakistan, Bangladesh, Myanmar and Thailand. In India it is found in Assam, Bihar, Maharashtra, Rajasthan, and Tamil Nadu [20] (Figure 2).

Figure 2. Natural distribution of *R. hypocrateiformis* in the India. The shaded area represents its natural habitat.

3.2. Morphological and Microscopical Characteristics

Morphological characterization of *R. hypocrateiformis* plant and its parts (Figure 3a-d) describes that its flowers are creamy white, typical morning glory form, flat-faced, 6-9 cm long. Flowers usually solitary, occasionally subspicate. Sepals unequal, ovate, blunt apically, 10-12 mm long, densely short villose. Leaves are rounded-heart-shaped, blunt apically, densely appressed velvet-hairy below. Fruit indehiscent or tardily dehiscent, dry-baccate, 2 cm long. Seeds are brown, hairless, smooth, glabrous, slightly trigonous, surrounded by dry white pulp. Transverse sections of the leaf showed that the upper and lower epidermis comprise of single-layered polygonal cells that cover the adhesive fingernail skin; vein islet and vein termination 9–11 and 13–15, individually [21,22].
R. hypocrateriformis, an ordinary ayurvedic plant, is utilized by various local populace bunches in different manners due to the different helpful employments of its bark, roots, organic products, leaves and blossoms (Table 1).

### Table 1. Ethnomedicinal Uses of R. hypocrateriformis.

<table>
<thead>
<tr>
<th>Plant Part used</th>
<th>Method of Administration</th>
<th>Uses</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole plant and root</td>
<td>The plant juice/paste is orally taken</td>
<td>Treatment of snake bite</td>
<td>[23-25]</td>
</tr>
<tr>
<td>Whole plant</td>
<td>Powder</td>
<td>Piles and Heart disease</td>
<td>[26]</td>
</tr>
<tr>
<td>Leaves</td>
<td>Cooked</td>
<td>Indigestion</td>
<td>[27]</td>
</tr>
<tr>
<td>Whole plant</td>
<td>Powder</td>
<td>Constipation</td>
<td>[28]</td>
</tr>
<tr>
<td>Leaves</td>
<td>Paste</td>
<td>Diarrhoea</td>
<td>[29-31]</td>
</tr>
<tr>
<td>Whole Plant</td>
<td>Powder</td>
<td>Diuretic</td>
<td>[32]</td>
</tr>
<tr>
<td>Whole Plant</td>
<td>Powder</td>
<td>Laxative</td>
<td>[32]</td>
</tr>
<tr>
<td>Stem</td>
<td>Powder</td>
<td>Cough and Headache</td>
<td>[27]</td>
</tr>
<tr>
<td>Leaves</td>
<td>Juice with Cow’s milk</td>
<td>Rheumatic pain</td>
<td>[33]</td>
</tr>
<tr>
<td>Leaves</td>
<td>Juice</td>
<td>Skin disease of hair scalp</td>
<td>[33]</td>
</tr>
<tr>
<td>Whole plant and Root</td>
<td>Plant juice/paste is orally taken</td>
<td>Snake bite</td>
<td>[23,24,34]</td>
</tr>
<tr>
<td>Root</td>
<td>Decoction</td>
<td>Fever</td>
<td>[35]</td>
</tr>
<tr>
<td>Leaf</td>
<td>Powder</td>
<td>Urogenital problem (Hematuria)</td>
<td>[36]</td>
</tr>
<tr>
<td>Leaf</td>
<td>Powder</td>
<td>Blood purifier</td>
<td>[37]</td>
</tr>
<tr>
<td>Root</td>
<td>Paste</td>
<td>Cough, swelling and headache, poisonous animals bite</td>
<td>[23-25]</td>
</tr>
<tr>
<td>Leaf</td>
<td>Internal Use</td>
<td>Stomach wounds</td>
<td>[39]</td>
</tr>
<tr>
<td>Leaf</td>
<td>Internal use (Cooked)</td>
<td>Stomach upset and Indigestion</td>
<td>[40,41]</td>
</tr>
<tr>
<td>Root</td>
<td>Powder</td>
<td>After Parturition</td>
<td>[16]</td>
</tr>
</tbody>
</table>

Apart from these ethnomedicinal uses its leaves and young shoots are eaten as a vegetable and roots are given after parturition. Cooked leaves of this plant are utilized as vegetable curry by the tribals of India. Leaves of this plant are used as vegetable by some hill dwelling Kandha tribes of Odisha [42]. Ayurvedic physicians use R. hypocrateriformis to prevent fertility in women. Leaves and young shoots are eaten as a vegetable and roots are given after parturition. Cooked leaves of this plant are utilized as vegetable curry by the tribals of India. This plant had maximum vitamin A activity and has the capacity of maximum (75-98%) retention of β-carotene upon processing [43,44].

### 3.4. Physiochemical and Nutritional Analysis

Loganayaki et al. studied the extractive value of leaf, stem and flower parts of R. hypocrateriformis with three different solvents chloroform, methanol and acetone respectively. Flower part of this plant exhibited higher extractive value 13.3%, followed by flower methanol extract 12.5%, flower chloroform extract 11.5%, leaf methanol extract
8.6%, Stem methanol extract 7.43%, leaf acetone extract 5.9%, leaf chloroform extract 2.9%, stem acetone extract 1.87%, stem chloroform extract 0.7% [45]. Nutritional analysis of *R. hypocrateriformis* reported that its leaves contains Carbohydrate (%) 57.63, Fat (%) 2.66, Protein (%) 19.27, Energy 331.54 kcals/100 g, Moisture content (%) 6.25, Calcium (%) 0.99, Magnesium (%) 0.34, Phosphorous (%) 0.32, Zinc (%) 0.011 [18].

Loganayaki et al. studied the total phenolic content determination of different parts (leaves, stem and flower) of *R. hypocrateriformis* in different solvent. Quantitative parameters of different parts were depicted in Table 2. Higher total phenolic content was reported in the flower acetone extract and flower methanolic [45].

Table 2. Quantitative phytochemical content in *R. hypocrateriformis*.

<table>
<thead>
<tr>
<th>Plant Part</th>
<th>Extract/Fraction</th>
<th>Total Phenolic Content</th>
<th>Total Flavonoid Content</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerial</td>
<td>Polyphenolic</td>
<td>0.170 μg TAE/mg fraction</td>
<td>0.193 μg QAE/mg fraction</td>
<td>[17]</td>
</tr>
<tr>
<td></td>
<td>Chloroform</td>
<td>1.1 g GAE/100 gm</td>
<td>---</td>
<td>[45]</td>
</tr>
<tr>
<td></td>
<td>Acetone</td>
<td>2.1 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methanolic</td>
<td>1.1 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chloroform</td>
<td>0.9 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acetone</td>
<td>1.5 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methanolic</td>
<td>1.2 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chloroform</td>
<td>1.6 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Stem</td>
<td>Acetone</td>
<td>4.2 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Methanolic</td>
<td>3.5 g GAE/100 gm</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

TAE: Tannic acid equivalent; QAE: Quercetin equivalent; GAE: Gallic acid equivalent.

4. Phytochemistry

The qualitative phytochemical screening of different parts of *R. hypocrateriformis* showed the relatively presence alkaloids, flavonoids, tannins, saponins, phenolic compounds, glycosides, steroids, carbohydrates, phytosterols, and amino acids [18, 46-50]. These phytochemicals have shown a wide variety of pharmacological effects. FTIR analysis of whole plant of *R. hypocrateriformis* revealed the presence of various functional groups viz. phenol, alkanes, nitrocompounds (oxime and lactams), ethers, aromatic compounds, and halogen derivatives (chloro and bromo compounds) [36].

4.1. Alkaloids

Three pyrrolizidine alkaloids macrophylline (1), meteloidine (2) and Symlandine (3) as well as three tropane alkaloids cochlearine (4), darlingine (5) tigloidine (6) and one more alkaloidal compound serratanidine (7) were found in the root of *R. hypocrateriformis* [51]. Two other alkaloids were found in the aerial part of *R. hypocrateriformis* namely hypocretine 1(8i) and hypocretine 2 (8ii) [17]. The presence of aminopyrimidine pyrimethanil (9) was reported in the root of *R. hypocrateriformis* [51]. These alkaloids are shown in Figure 4.
4.2. Glycosides

Four glycosides bergenin (10), norbergenin (11), rivebergenin A (12i) and rivebergenin B (12ii) were reported from the stem of *R. hypocrateriformis* [52]. One aromatic glycoside lucuminic acid (13), one cardiac glycoside oleanrose (14) were found in the root of *R. hypocrateriformis* [51]. Their structures are shown in Figure 5.

4.3. Flavonoids

Godipurge et al. reported the presence of quercetin (15) in polyphenolic fraction of aerial part [17] (Figure 6). Two flavonoid C-glycosides 3'-deoxymaysin (16) and 6-C-Glu-copyranosylpilloin (17), one flavonoid O-glycoside peruvianoside II (18) and one prenylated flavonoid morusin (19) were found in the root of *R. hypocrateriformis* [51] (Figure 6).

4.4. Xanthones

Xanthone derivative dulciol B (20) mangostenone B (21) were reported in root of *R. hypocrateriformis* [51] (Figure 7).
4.5. Stilbenes

Blestriarene B (22) and α-viniferin (23) was reported in the root of *R. hypocrateriformis* [51] (Figure 8).

4.6. Coumarins

Tomentolide A (24) and calophyllolide (25) was reported in the root extract [51] while desmethylbergenin hemihydrates (26) was found in the whole plant of *R. hypocrateriformis* [51] (Figure 9).

4.7. Sterols and fatty acid derivatives

Sphingosine (27) and 3S,7S-dimethyl-tridecan-2S-ol (28) were found in root of *R. hypocrateriformis* [51] (Figure 10).

One long-chain fatty aldehyde pentadecal (29), two fatty acids 2-hexyl-decanoic acid (30) and 1-palmitoyl lysophosphatidic acid (31) and 2,4-undecadienal (32) were found in the root of *R. hypocrateriformis* [51] (Figure 10).
4.8. Other compounds

Other compounds have been also reported (Figure 11). N-acetylmuramoyl-alanine (33) belongs to the class of organic compounds known as acylaminosugars. These are organic compounds containing a sugar linked to a chain through N-acyl group. Two tripeptides His-His-Lys (34) and Asp-Arg-Asp (35), one bipeptide Glu-His (36) and one amino cyclitol streptidine (37) and one volatile compound methyl jasmonate (38) were reported in the root of *R. hypocrateriformis* [51].

5. Biological activities

Extracts from *R. hypocrateriformis* possess a broad spectrum of pharmacological activities. Past research affirmed that presence of phenolic acids and flavonoids is liable for its cancer prevention agent potential [53-55]. Past research uncovered that phenolic compounds are profoundly dynamic cell reinforcements, and such cancer prevention agent rich botanicals offer promising potential in the administration of degenerative illnesses. Phenolic compounds are auxiliary metabolites blended in plants because of ecological anxieties like assaults from microbes and bugs, UV radiation, and wounds [56]. These phytochemicals can kill hydroxyl extremists [57], superoxide anion revolutionaries [58], lipid peroxyl revolutionaries [59] and even to chelate metals, other than to assume an indispensable part in the steadiness of food items, just as in the protection components of natural frameworks [60]. These atoms likewise forestall oxidative misfortunes and have cytoprotective, mitigating, and adaptogen properties. The numerous pharmacological activities have been also reported, by the extracts and isolated bioactive compounds from *R. hypocrateriformis* including antiarthritic, anticancer, anti-inflammatory, antimicrobial, anovulatory, antioxidant, hepatoprotective, antifertility, antimitotic, antiproliferative, antilithiatic activity. Simultaneously, several *in vitro* and *in vivo* studies on pharmacological profile of *R. hypocrateriformis* are under way. Scientific exploration has revealed that
different types of *R. hypocrateriformis* extracts possess multiple bioactive attributes (Table 3).

**Table 3. Biological activities of *R. hypocrateriformis*.**

<table>
<thead>
<tr>
<th>Part used</th>
<th>Extract/Fraction</th>
<th>Dose tested / Route of administration</th>
<th>Animals/Cell lines</th>
<th>Experimental models</th>
<th>Results</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaves</td>
<td>Methanolic</td>
<td>250 and 500 mg/kg, p.o.</td>
<td>Wistar albino Rat</td>
<td>Complete Freund’s (CFA) induced arthritis</td>
<td>Extract showed significant anti-arthritic activity</td>
<td>[61]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Au, Ag and Au-Ag alloy NPs</td>
<td>25-100 μg/mL</td>
<td>KP, SA, BS, PA, EC, CA, TR, and CI</td>
<td>Agar Well diffusion method</td>
<td>Green synthesized AgNPs displayed very good antimicrobial Potential compared to AuNPs</td>
<td>[62]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Pet. Ether, chloroform, ethanol and aqueous extract</td>
<td>10000, 5000, 2500, 1250 and 0.625 μg/mL</td>
<td>SA, BS, EC, PA, PV, AN, CA, Af</td>
<td>Agar disk diffusion method</td>
<td>Ethanolic and aqueous extract showed higher antimicrobial potential than other extracts</td>
<td>[48]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Au, Ag and Au-Ag alloy NPs</td>
<td>1-100 μg/mL</td>
<td>MCF7, Si9, Vero</td>
<td>MTT assay</td>
<td>Significant cytotoxicity on tested cancer cells in concentration dependent manner</td>
<td>[17]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Pet. Ether, chloroform, ethanol and aqueous</td>
<td>4x10^3 cells/ml</td>
<td>MCF-7, MCF-15, MOLT-4, HOP-62, prO</td>
<td>SRB assay</td>
<td>Chloroform and ethanolic extracts exhibited strong anticancer activity</td>
<td>[48]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Ethanolic</td>
<td>200 and 400 mg/kg</td>
<td>Wistar albino rat in-vivo (Effect on duration of different phases of oestrous cycle)</td>
<td></td>
<td></td>
<td>[49]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Polyphenolic fraction</td>
<td>---</td>
<td>In vitro</td>
<td>Hydroxyl radical scavenging assay</td>
<td>Extracted demonstrated significant antioxidant activity</td>
<td>[17]</td>
</tr>
<tr>
<td>Aerial</td>
<td>Au, Ag and Au-Ag alloy NPs</td>
<td>10-100 μg/ml</td>
<td>In vitro</td>
<td>DPPH assay</td>
<td>NPs were capable of scavenging DPPH radicals Aqueous extract showed highest DPPH radical scavenging activity</td>
<td>[62]</td>
</tr>
<tr>
<td>Leaf</td>
<td>Aqueous</td>
<td>15.51, 62.5, 250 and 1000 μg/ml</td>
<td>In vitro</td>
<td>DPPH assay</td>
<td>Antioxidant activity was highest in MeAA extracts and while</td>
<td>[18]</td>
</tr>
<tr>
<td>Leaf, Stem and Fruit</td>
<td>Chloroform, acetone and Methanol</td>
<td>In vitro</td>
<td>DPPH, ABTS and FRAP assay</td>
<td></td>
<td></td>
<td>[45]</td>
</tr>
</tbody>
</table>
### Antifertility activity

<table>
<thead>
<tr>
<th>Aerial part</th>
<th>Pet. Ether, chloroform, ethanol and aqueous</th>
<th>200 and 400 mg/kg</th>
<th>Albino Wistar rats</th>
<th>In-vivo (antiimplantation effect)</th>
<th>intermediate in MeAM and MeA extracts.</th>
</tr>
</thead>
</table>

Ethanol extract found significant antiimplantation and interruption of early pregnancy. Extract dose 400 mg/kg showed significant antiimplantation potential. [7]

### Hepatoprotective

<table>
<thead>
<tr>
<th>Aerial part</th>
<th>Polyphenolic fraction</th>
<th>300 and 600 mg/kg</th>
<th>Wistar albino rat</th>
<th>Paracetamol induced hepatotoxicity</th>
<th>↓ALT, ↓AST, ↓ALP, ↓TB [17]</th>
</tr>
</thead>
</table>

Chloroform and ethanol extracts showed significant antimitotic activity. [48]

### Antimitotic activity

<table>
<thead>
<tr>
<th>Aerial part</th>
<th>Pet. Ether, chloroform, ethanol and aqueous</th>
<th>10 mg/ml</th>
<th>Allium cepa root</th>
<th>in-vitro inhibition</th>
</tr>
</thead>
</table>

### Antiproliferative activity

<table>
<thead>
<tr>
<th>Aerial part</th>
<th>Pet. Ether, chloroform, ethanol and aqueous</th>
<th>--</th>
<th>Yeast Saccharomyces cerevisiae model</th>
<th>in-vitro Significant antiproliferative activity</th>
</tr>
</thead>
</table>

Chloroform and ethanol extracts showed significant antiproliferative activity. [48]

### Antilithiatic activity

<table>
<thead>
<tr>
<th>Leaves</th>
<th>Ethanolic</th>
<th>200 and 400 mg/kg</th>
<th>Wistar albino rat</th>
<th>Radiant Heat Tail Flick method</th>
<th>Extract showed significant inhibition of calcium and phosphate accumulation</th>
</tr>
</thead>
</table>

### Antiinflammatory activity

<table>
<thead>
<tr>
<th>Leaves</th>
<th>Ethanolic</th>
<th>200 and 400 mg/kg</th>
<th>Wistar albino rat</th>
<th>Carrageenan induced paw edema</th>
<th>Ethanol extracts showed significant antiinflammatory activity</th>
</tr>
</thead>
</table>

### Analgesic activity

<table>
<thead>
<tr>
<th>Leaves</th>
<th>Ethanolic</th>
<th>200 and 400 mg/kg</th>
<th>Wistar albino rat</th>
<th>Ethanol extracts showed significant analgesic activity</th>
</tr>
</thead>
</table>

### 6. Toxicity Study

The toxicity study of PPFRH indicated, there was no adverse effect on mortality detected in Swiss albino mice and Wistar albino rats that were administered up to 4000 mg/kg, orally. This was observed during 24 h period, and the extract was found to be safe at the given dose [17].

### 7. Conclusions
This survey sums up the wide pharmacological exercises of *R. hypocrateriformis* and its dynamic constituents dependent on customary writing and current proof. Some toxicological examinations on *R. hypocrateriformis* are additionally announced. Our investigation gives an exhaustive and inside and out assessment of *R. hypocrateriformis* and shows that it is a promising conventional medication that can be abused for its helpful and tonic advantages. Leaves of *R. hypocrateriformis* are a good source of energy and micronutrients. It possesses zinc, phosphorous, magnesium, and calcium along with protein, fat, and carbohydrate. It has the highest amount of energy content. The study revealed that the plant is good source of energy and micronutrient and can be used as nutritious leafy vegetable in daily life and specifically in conditions such as cough, skin disease, and asthma. Earlier study revealed that bergenin (10), a C-glycoside isolated from the *R. hypocrateriformis* exhibited hepatoprotective, antiarrhythmic, neuroprotective, antifungal, anti-inflammatory, immunomodulatory, anti-HIV, antifungal, antihypertoxic, wound and ulcer healing potential. Calophyllolide (25) has been reported to exhibit some biological activity, including anti-inflammation, lower capillary vascular permeability, anti-cancer, anti-microbial, and anti-coagulant properties. Earlier researches also reported that stilbene trimers like α-Viniferin (23) exhibited AChE activity in a dose-dependent manner. Therefore, the further clinical studies are warranted these potential derivatives of *R. hypocrateriformis* for development of novel therapeutic approach. Earlier research reported that norbergenin (11), is the O-methyl derivative of bergenin (10) exhibited the neuroprotective potential on rat cortical neurons. Despite the fact that *R. hypocrateriformis* has been utilized broadly as a therapeutic spice and in a few tonics, quality norms have not yet been set up. The current logical techniques are not agreeable to control the nature of *R. hypocrateriformis*. The nature of *R. hypocrateriformis* is affected by the environment and picking time, and the classifications of dynamic segments contrast broadly among various territories and picking times; along these lines, quantitative distinguishing proof is fundamental for control the nature of restorative materials, which will likewise dispose of contaminated and assurance the remedial impact of *R. hypocrateriformis*. It is important that the current examinations on *R. hypocrateriformis* are lacking. The particular systems of activity and material premise of the adequacy are not extremely clear, and its clinical worth has not been totally investigated at this point. Along these lines, the deliberate examinations on *R. hypocrateriformis* ought to be attempted to represent its ethnomedicinal use.

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**References**


