Review

*Rivea hypocrateriformis* (Desr.) Choisy: A Review of its Ethnomedicinal 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, 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

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 irruption, as anticancer and as an antiarthritic [5-8]. Indigenous populaces 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].

*Argyreia bona-nox* Sweet, *Argyreia 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 boiled 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.

![Flow diagram of research methodology](image)

Figure 1. Flow diagram of research methodology.

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. hypocrateriformis in the India. The shaded area represents its natural habitat.](image)

3.2. Morphological and Microscopical Characteristics

Morphological characterization of *R. hypocrateriformis* 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].

![Figure 3a-d](image)
3.3. Ethnomedicinal Uses

*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.

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

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].

| Plant Part | Extract/Fraction | Total Phenolic Content | Total Flavonoid Content | References |
|------------|------------------|------------------------|-------------------------|------------|
| Aerial     | Polyphenolic     | 0.170 μg TAE/mg fraction | 0.193 μg QAE/mg fraction | [17]       |
| Leaves     | Chloroform       | 1.1 g GAE/100 gm        | ---                     | [45]       |
|            | Acetone          | 2.1 g GAE/100 gm        | ---                     |            |
|            | Methanolic       | 1.1 g GAE/100 gm        | ---                     |            |
|            | Chloroform       | 0.9 g GAE/100 gm        | ---                     |            |
| Stem       | Acetone          | 1.5 g GAE/100 gm        | ---                     | [45]       |
|            | Methanolic       | 1.2 g GAE/100 gm        | ---                     |            |
|            | Chloroform       | 1.6 g GAE/100 gm        | ---                     |            |
| Flower     | Acetone          | 4.2 g GAE/100 gm        | ---                     |            |
|            | Methanolic       | 3.5 g GAE/100 gm        | ---                     |            |

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 oleanandrose (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-Glucopyranosylpilloin (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*.**

| Part used       | Extract/Fraction | Dose tested / Route of administration | Animals/Cell lines | Experimental models | Results                                                                 | Ref  |
|-----------------|------------------|---------------------------------------|--------------------|---------------------|------------------------------------------------------------------------|------|
| **Antiarthritic** |                  |                                       |                    |                     |                                                                        |      |
| Leaves          | Methanolic        | 250 and 500 mg/kg, p.o.                | Wistar albino Rat  | Complete Freund’s (CFA) induced arthritis | Extract showed significant anti-arthritic activity                     | [61] |
| **Antimicrobial** |                  |                                       |                    |                     |                                                                        |      |
| Aerial part     | Au, Ag and Au-Ag alloy NPs | 25-100 μg/mL                           | KP, SA, BS, PA, EC, CA, TR, and CI | Agar Well diffusion method | Green synthesized AgNPs displayed very good antimicrobial Potential compared to AuNPs Ethanol and aqueous extract showed higher antimicrobial potential than other extracts | [62] |
| Aerial part     | Pet. Ether, chloroform, ethanol and aqueous extract | 10000, 5000, 2500, 1250 and 0.625 μg/mL | SA, BS, EC, PA, PV, AN, CA, Af | Agar disk diffusion method | Ethanol and aqueous extract showed higher antimicrobial potential than other extracts | [48] |
| **Anticancer**  |                  |                                       |                    |                     |                                                                        |      |
| Aerial part     | Au, Ag and Au-Ag alloy NPs | 1-100 μg/mL                            | MCF7, S9, Vero     | MTT assay           | Significant cytotoxicity on tested cancer cells in concentration dependent manner Chloroform and ethanolic extracts exhibited strong anticancer activity | [17] |
| Aerial part     | Pet. Ether, chloroform, ethanol and aqueous | 4x10³ cells/ml                        | MCF-7, MCF-15, MOLT-4, HOP-62, prO | SRB assay           |                                                                        | [48] |
| **Anovulatory effect** |          |                                       |                    |                     |                                                                        |      |
| Aerial Part     | Ethanolic         | 200 and 400 mg/kg                      | Wistar albino rat  | in-vivo (Effect on duration of different phases of oestrous cycle) | Significant ↓ in number of graafian follicles and corpora lutea and significant ↑ in number of atretic follicles | [49] |
| **Antioxidant** |                  |                                       |                    |                     |                                                                        |      |
| Aerial Polyphenolic fraction | --- | In vitro                             | Hydroxyl radical scavenging assay | Extracted demonstrated significant antioxidant activity NPs were capable of scavenging DPPH radicals Aqueous extract showed highest DPPH radical scavenging activity | [17] |
| Aerial Polyphenolic fraction | --- | In vitro                             | DPPH assay         |                                                                        | [62] |
| Leaf Aqueous    | 15.51, 62.5, 250 and 1000 μg/ml | In vitro                             | DPPH assay         | Antioxidant activity was highest in MeAA extracts and while | [45] |
### Antifertility activity

| Aerial part | Pet. Ether, chloroform, ethanol and aqueous | 200 and 400 mg/kg | Albino Wistar rats | In-vivo (antiimplantation effect) | Alcohol extract found significant antiimplantation and interruption of early pregnancy. Extract dose 400 mg/kg showed significant antiimplantation potential. |
|-------------|--------------------------------------------|------------------|-------------------|-----------------------------------|--------------------------------------------------------------------------------|
| Whole plant | 95% ethanolic extract | 200 and 400 mg/kg | Albino Wistar rats | In-vivo (antiimplantation effect) | Ethanol extract found significant antiimplantation and interruption of early pregnancy. Extract dose 400 mg/kg showed significant antiimplantation potential. |

### Hepatoprotective

| Aerial part | Polyphenolic fraction | 300 and 600 mg/kg | Wistar albino rat | Paracetamol induced hepatotoxicity | Chloroform and ethanol extracts showed significant hepatoprotective activity. ([17]) |

### Antimitotic activity

| Aerial part | Pet. Ether, chloroform, ethanol and aqueous | 10 mg/ml | Allium cepa root inhibition | Chloroform and ethanol extracts showed significant antimitotic activity. ([48]) |

### Antiproliferative activity

| Aerial part | Pet. Ether, chloroform, ethanol and aqueous | -- | Yeast Saccharomyces cerevisiae model | Chloroform and ethanol extracts showed significant antiproliferative activity. ([48]) |

### Antilithiatic activity

| Leaves | Ethanolic | 2.5 ml OF 0.2 g/ml solution | In-vitro | Extract showed significant inhibition of calcium and phosphate accumulation. ([37]) |

### Antiinflammatory activity

| Leaves | Ethanolic | 200 and 400 mg/kg | Wistar albino rat | Carrageenan induced paw edema | Ethanol extracts showed significant antiinflammatory activity. ([63]) |

### Analgesic activity

| Leaves | Ethanolic | 200 and 400 mg/kg | Wistar albino rat | Radiant Heat Tail Flick method | Ethanol extracts showed significant analgesic activity. ([63]) |

### 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 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 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**

1. Govil, C.M. Morphological studies in the family convolvulaceae. *Proc. Indian Acad. Sci.** 1972, 75, 271–282.
2. Mabberley, D.J. *The plant book*. Cambridge University press, Cambridge, United Kingdom. 1987, 56-65.
3. Okereke, C.N.; Iroka, F.C.; Chukwuma, M.O. Assessing the morphological and taxonomic characteristics of some members of convolvulaceae family. *Int. J. Herb. Med.* 2015, 2, 5 38-42.
4. Salehi, B.; Krochmal-Marczak, B.; Skiba, D.; Kumar Patra, J.; Kumar Das, S.; Das, G.; Popović-Djordjević, J.B.; Kostić, A.Z.; Anil Kumar, N.V.; Tripathi, A.; Al-Snafi, A.E.; Arserim-Üçar, D.K.; Alekseevich Konovalov, D.; Csupor, D.; Shukla, I.; Azmi, L.; Prakash Mishra, A.; Sharifi-Rad, J.; Sawicka, B.; Martins, N.; Taheri, Y.; Tsouh Fokou, P.V.; Capasso, R.; Martorell, M. *Convolvulus* plant—A comprehensive review from phytochemical composition to pharmacy. *Phytotherapy Research.* 2020, 34, 315-328.
5. Kirtikar, K.R.; Basu, B.D. *Indian Medicinal plants*. 1st ed. International Book publisher and Distributors, New Delhi, India. 1935.
6. Dhavan, B.N.; Dubey, M.P.; Mehrotra, B.N. Screening of Indian plants for biological activity–IX. *Indian J. Exp. Biol.* 1980, 18, 594-606.
7. Shivalingappa, H.; Biradar, J.S.; Srudresh, K. Antiimplantation activity of alcoholic extract of *Rivea hypocrateriformis*. *Indian J. Pharm. Sci.* 1999, 61, 1309-10.
8. Choudhury, S.; Rahaman, S.H.; Mandal, S.; Ghosh, A. Folk-lore knowledge on medicinal usage of the tribal belts of Birbhum district, West Bengal, India. *Int. J. Botany Stud.* 2013, 3, 43-50.
9. Evans, S.R. *An overview of hallucinogens: the flash of God*. Frust, P.T. Ed. Waveland Press, Long Grove, Illinois, USA. 1990, 3–54.
10. Catalogue of Life: 2020 Annual Checklist. Available online: https://www.catalogueoflife.org/col/details/species/id/2171b6ac0117c2d1cbaa3331b44738dfe (accessed on 10 June 2020).
11. India biodiversity. Available online: https://indiabiodiversity.org/species/show/32310#speciesField6_3 (accessed on 10 June 2020).
12. Shiddamallayya, N.; Rama Rao, V.; Doddamani, S.H.; Venkateshwarlu, G. A glimpse on forest flora and Indian system of medicine plants of Chitradurga district, Karnataka. *Int. J. Herb. Med.* 2016, 4, 25-33.
13. Tropical.theferns.info Available online: http://tropical.theferns.info/viewtropical.php?id=Rivea+hypocrateriformis (accessed on 10 June 2020).
14. Flowers of India. Available online: http://www.flowersofindia.net (accessed on 10 June 2020).
15. Umaramani, M.; Sivakanesan, R. Vitamin C content of commonly green leafy vegetables in fresh and under different storage conditions. *Trop. Plant Res.* 2015, 2, 240-245.
16. Venkata, S.P.; Murali, M.; da Silva, J.A.T.; Raju, B.A.; Sravani, R. Screening the Antimicrobial and Antioxidant Potential of *Vetilago denticulata*, *Scolopia crenata* and *Rivea hypocrateriformis*. *Med. Aromat. Plant Sci. Biotechnol.* 2012, 6, 58-62.
17. Godipurge, S.S.; Biradar, N.J.; Biradar, J.S.; Mahurkar, N. Chemical Composition and Hepatoprotective Effects of Polyphenolic Fraction from *Rivea hypocrateriformis* in Paracetamol. *Int. J. Pharm. Sci.* 2016, 8, 228-234.
18. Borkar, S.D.; Naik, R.; Shukla, V.J.; Acharya, R. Evaluation of phytochemical content, nutritional value and antioxidant activity of *Phaniji-Rivea hypocrateriformis* (Desr.) Choisy leaf. *Int. J. Ayurvedic Med.* 2015, 36, 298-302.
19. Mishra LC. *Scientific Basis for Ayurvedic Therapies*. CRC Press, Boca Raton, Florida, USA. 2004, 1-218.
20. Austin, F.D.; Ghazanfar, S. *Convoleuca-flora of Pakistan*. Nasir, E., Ali, S.I. Eds, Pan Graphics, Islamabad, Pakistan. 1979, 1-64.
21. Sekhar, J.; Sudarsanam, G.; Penchala Pratap, G.; Salam, M.A. Macro and Microscopical Studies of the Leaves of *Rivea hypocrateriformis* (Desr.) Choisy. *Indo Am. J. Pharm. Res.* 2013, 3, 2625-2635.
22. Sneha, B.D.; Kattil, G. Raghavendra, N.; Harisha, C.R.; Acharya, R.N. Development of random amplified polymorphic dna markers for authentication of *Rivea hypocrateriformis* (Desr.) Choisy. *Glob. J. Res. Med. Plants Inaug. Med.* 2013, 2, 348–356.
23. Suthari, S.; Sreeramulu, N.; Omkar, K.; Raju, V.S. The climbing plants of northern Telangana in India and their ethnomedicinal and economic uses. *Indian J. Plant Sci.* 2014, 3, 86–100.
24. Suthari, S.; Kanneboyena, O.; Raju, V.S. Ethnomedicinal knowledge of inhabitants from Gundlabrahmeswaram Wildlife Sanctuary (Eastern Ghat) Andhra Pradesh India. *J. Ethnomed.* 2015, 2, 333–46.
25. Félix-Silva, J.; Silva-Junior, A.A.; Zucolotto, S.M.; Fernandes-Pedrosa, M.D.F. Medicinal Plants for the Treatment of Local Tissue Damage Induced by Snake Venoms: An Overview from Traditional Use to Pharmacological. *Evid.-Based Complementary Altern. Med.* 2017, 5748256.
26. Chopra, R.N.; Nayar, S.L.; Chopra, I.C. *Glossary of Indian medicinal plants*. Council of Scientific & Industrial Research (C.S.I.R.), New Delhi, India. 1956, 138-139.
27. Chinnaasamy, P.; Arumugam, R.; Ariyan, S. In silico validation of the indigenous knowledge of the herbal medicines among tribal communities in Sathyamangalam wildlife sanctuary, India. *J. Tradit. Complement. Med.* 2015, 7, 1306-1325.
28. Murthy, E.N.; Madhav, N.V. Enumeration of Medicinal Plants of RamagiriKhilla Forests of Karimnagar District, Telangana, India. *Int. J. Pharm. Life Sci.* 2015, 6, 4405-4416.
29. Kalaiselvan, M.; Gopalan, R. Ethnobotanical studies on selected wild medicinal plants used by irula tribes of bolampatty valley, Nilgiri Biosphere Reserve (NBR), Southern Western Ghat, India. *Asian J. Pharm. Clin. Res.* 2014, 7, 22-26.
30. Ganesan, C.M.; Kumaresan, G. Ethnomedicinal approaches for treating various disease by irulas tribes, konbanur village, anaihatti hills, the western ghat, coimbatore district. *Korg. Res. J.* 2017, 4, 1-8.
31. Jerlin Deletta, G.; Parthipan, B. Studies on curative climbers in select wetlands of Agastheeswararam Taluk, Kanyakumari District, Tamilnadu, Southern India. *Bio. Disc.* 2018, 9, 278-289.
32. Ramarao Naidu B.V.A.; Seetharami Reddy, T.V.V. In *Ethno Medicinal Wealth of Eastern Ghts from Srikkakulam District, Andhra Pradesh with a Note on Conservation*. Proceedings of the National Seminar on Conservation of Eastern Ghts, EPTRI, Hyderabad, India. 2008.
33. Brahmbhatt, M.R.; Patel, J.M.; Patel, V.B.; Saluja, A.K. Analgesic and antiinflammatory activity of leaves of *Rivea hypocra- teriformis*. *J. Pharm. Phytother.* 2010, 1, 1-3.
34. Suthari, S.; Raju, V. S. Antidote Botanicals for Snake Bites from Koyas of Warangal District, Telangana, India. *J. Herbs Spices Med. Plants.* 2016, 22, 57–68.
35. Reddy, S.R.; Reddy, A.M.; Babu, M.S. Traditional Medicinal Plants of Lankamalleswara Wildlife Sanctuary, Kadapa District, Andhra Pradesh, *India. A. J. Ethno.* 2015, 2, 379-391.
36. Baby Shalini, C. Functional group analysis of some ethno-medicinal plants of the *kanikkar* tribe by the Fourier transform infrared (FTIR) spectroscopy. *World J. Pharm. Res.* 2018, 7, 1306-1325.
37. Patel, V.B.; Patel, D.G.; Makwana, A.G.; Patel, J.M.; Brahmhhatt, M.R. Comparative study of Rivea hypocrateriformis, Cynodon dactylon and Balanite aegyptiac using antilibithic activity in vitro. J. Pharm. Sci. Res. 2010, 1, 85-87.
38. Nadvkar, K.M. Indian Materia Medica. 3rd Ed. Popular Book Depot, Mumbai, India, 2002, 878.
39. Reddy, M.B.; Reddy, K.R.; Reddy, M.N. Ethnobotany of Cuddapah district, Andhra Pradesh, India. Int. J. Pharmaco. 1991, 29, 273-280.
40. Revathi, P.; Parimelazhagan, T.; Manian, S. Ethnomedicinal plants and novel formulations used by Hooralis tribe in Sath-yamangalam forests, Western Ghats of Tamil Nadu, India. J. Med. Plant. Res. 2013, 7, 2083-2097.
41. Pandit, P.K. Inventory of ethno veterinary medicinal plants of Jhargram Division, West Bengal, India. Ind. Forester 2010, 136, 1183.
42. Panda, T.; Pandhy, R.N. Sustainable food habits of the hill dwelling Kandha tribe in Kalanandi district of Orissa. Ind. J. Tradit. Med. 2007, 6, 103-105.
43. Rajyalakshmi, P.; Venkatalakshmi, K.; Venkatalakshmamma, Y.; Jyothisn, K.; Balachandramanidevi, N.; Suneetha, V. Total carotenoid and β-carotene contents of forest green leafy vegetables consumed by tribals of south India. Plant Food Hum. Nutr. 2001, 56, 225-238.
44. Rajyalakshmi, P.; Venkatalakshmi, T.V.N.; Padmavathi, P.; Suneetha, V. Effect of processing on β-carotene content in forest green leafy vegetables consumed by tribals of south India. Plant Food Hum. Nutr. 2003, 58, 1-10.
45. Loganayaki, N.; Rajendrakumaran, D.; Manian, S. Antioxidant Capacity and Phenolic Content of Different Solvent Extracts from Banana (Musa paradisiaca) and Mustai (Rivea hypocrateriformis). Food Sci. Biotechnol. 2010, 19, 1251-1258.
46. Cicco, N.; Lanorte, M.; Paraggio, M.; Viggiano, M.; Lattanzio V. A reproducible, rapid and inexpensive Folin-Ciocalteu micro-method in determining phenolics of plant methanol extracts. Microchem J. 2009, 91, 107-10.
47. Mascarenhas, M.E.; Mandrekar, C.R.; Marathe, P.B.; Morais, L.J. Phytochemical screening of selected species from Convolvulaceae. Int. J. Curr. Pharm. Res. 2017, 9, 94-97.
48. Saboo, S.; Tapadiya, G.G.; Khadabadi, S.S. Antimicrobial and phytochemical analysis of R. hypocrateriformis. Microb. J. 2014, 4, 22-26.
49. Shivalingappa, H.; Satyanarayan, N.D.; Purohit, M.G.; Sharanasabapulla, A.; Patil, S.B. Effect of ethanol extract of Rivea hypocra-teriformis on the estrous cycle of the rat. J. Ethnopharmacol. 2002, 82, 11-17.
50. Dhore, M.N.; Coclhi, B.U.; Tidke, J.A. Amino acid and sugar from floral nectar from some local plants in India. J. Phytol Res. 2001, 13, 171-174.
51. Patel, D.; Pandya, C.; Pandya, A.; Kumbhani, J.; Patel, V.; Patel, Z. LC-MS Analysis of crude extract of root of Rivea hypocrateriformis. J. Ethnopharmacol. 2016, 1769, 1-10.
52. Mann, S.; Satpathy, G.; Gupta, R.K. In vitro evaluation of bioprotective properties of underutilized Myrica esculenta Buch.-Ham. ex D. Don fruit of Meghalaya. Indian J. Nat. Prod. Resour. 2015, 6, 183-188.
53. Goyal, A.K.; Mishra, T.; Bhattacharya, M.; Kar, P.; Sen, A. Evaluation of phytochemical constituents and antioxidant activity of selected ancinorhizal fruits growing in the forests of Northeast India. J. Biosci. 2013, 38, 797-803.
54. Kabra, A.; Sharma, R.; Hano, C.; Kabra, R.; Martins, N.; Baghel, U.S. Phytochemical Composition, Antioxidant, and Antimicrobial Attributes of Different Solvent Extracts from Myrica esculenta Buch.-Ham. ex. D. Don Leaves. Biomolecules 2019, 9, 357.
55. Anonymous. The Wealth of India; Council of Scientific and Industrial Research: New Delhi, India, 1962, 472.
56. Husain, S.R.; Pillar, J.; Pillar, P. Hydroxyl radical scavenging activity of flavonoids. Phytochemistry 1987, 26, 2489-2491.
57. Afanasiev, I.B.; Dorozhko, A.I.; Bordski, A.V. Chelating and free radical scavenging mechanisms of inhibitory action of rutin and quercetin in lipid peroxidation. Biochem. Pharmacol. 1989, 38, 1763-1769.
58. Torel, J.; Cillard, J.; Cillard, P. Antioxidant activity of flavonoids and reactivity with peroxide radical. Phytochemistry 1986, 25, 383–385.