Weeds in Gwalior and nearby regions and their medicinal properties: A case study

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ABSTRACT

Weeds are normally unwanted plants at wrong place. From the perspective of crop protection, they may have a negative effect on cultivated crop, and thus, their effective management is necessary. From a medicinal perspective, they may be useful in disease management due to their secondary metabolites, affordability, inexpensiveness, accessibility, and use by native peoples. The present study reviews the literature available on weeds of Madhya Pradesh, India (Gwalior and nearby region), with their occurrence in changing environment and reported uses in disease management. A comprehensive literature search was done to get the thorough information on the versatile weeds of Gwalior and nearby regions. Amaranthaceae, Asclepiadaceae, Euphorbiaceae, and Asteraceae are found to be the most prevalent families with plants to treat Prameha, Sandhi sula, Udara sula, and Tvaka roga. The review summarizes the weed plants available in the area under the study with their reported uses, which could be further validated scientifically and could be important from the ethnopharmacological and socioeconomic perspective. This could be the best use of a waste and promote utilization of available resources for the management and treatment of prevalent diseases in the specific area.

1. INTRODUCTION

Weed science is the management of vegetation, while weeds are the plants out of place or the plants which grow by their own without human efforts and compete with cultivated crops for nutrients and natural resources. Weeds dominate for vegetation so affect the crop negatively. However, the word weed sounds negative, and many plants known as weeds may be beneficial. Many of them are edible and can be used in food and as herbals [1].

In the state of Madhya Pradesh, Gwalior is located at 26.22° north latitude and 78.18° east longitude and approximately 197 m above from sea level. Temperature in summer reaches up to 47°C while falls up to 3°C in winter with average rainfall in monsoon only [Figure 1] [2].

Temperature influences many physiological processes such as photosynthesis in plants, absorption of water and nutrients, respiration, and enzymatic activities, which controls and affects germination, inflorescence, viability of pollens, fruit setting, maturation rate, yield, abscission, quality of crop, harvesting period, and shelf life. Plants vary in their temperature requirements, and the variation in temperature affects photosynthesis by increased rates of chemical reactions [3]. It is a common hypothesis that temperate regions have vast phytodiversity [4].

Weeds have greater diversity than plants, and the change in resources due to environmental impact affects their growth and reproductive response [5]. To persist in changing climatic conditions, weeds have to respond these environmental changes and have to choose to migrate to a favorable climate, to acclimatize these changes in climatic conditions, or to adopt these changes, which may result with the evolution of new characteristics. This type of biological adaptation of weeds, driven by natural selection, results in trait shifts. At the population level, it is apparent but is brought by morphological, physiological, and genetic processes at the individual plant level [6,7].

Climatic changes also affect the secondary metabolite profile of plants, and the same plant species growing under different environmental conditions show significant differences in the production and accumulation of the primary and secondary metabolites [8]. This is an attempt to study the weed plants in nearby region with respect to their growth in changing climate and their medicinal importance [Table 1].

2. MATERIALS AND METHODS

A comprehensive literature search was done to get the thorough information on the versatile weeds of Gwalior and nearby regions.
Table 1: List of plants grows as the weed and used as medicine in Gwalior and nearby regions. [9]

<table>
<thead>
<tr>
<th>Common name</th>
<th>Botanical name</th>
<th>Family</th>
<th>Medicinal use</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changeri</td>
<td>Oxalis corniculata L.</td>
<td>Oxalidaceae</td>
<td>Grahani, Atisara</td>
<td>Abundant</td>
</tr>
<tr>
<td>Bhringaraja</td>
<td>Eclipta alba L. Hassk.</td>
<td>Asteraceae</td>
<td>Sirah, Sula, Svasa</td>
<td>Common</td>
</tr>
<tr>
<td>Kalmegha</td>
<td>Andrographis paniculata (Burm.f.) Nees</td>
<td>Acanthaceae</td>
<td>Jigar roga</td>
<td>Occasional</td>
</tr>
<tr>
<td>Punarvava</td>
<td>Boerhavia diffusa L.</td>
<td>Nyctaginaceae</td>
<td>Sotha, Pandu</td>
<td>Rare</td>
</tr>
<tr>
<td>Prapunnada</td>
<td>Cassia tora L.</td>
<td>Fabaceae</td>
<td>Kastha, Kaphavatajanya Vikar</td>
<td>Common</td>
</tr>
<tr>
<td>Farid-buti</td>
<td>Cocculus hirsutus L. W. Theob.</td>
<td>Menispermaceae</td>
<td>Kapharoga, Vataroga</td>
<td>Occasional</td>
</tr>
<tr>
<td>Asvagandha</td>
<td>Withania somnifera L. Dunal.</td>
<td>Solanaceae</td>
<td>Daurbalya, Vataroga,</td>
<td>Rare</td>
</tr>
<tr>
<td>Atibala</td>
<td>Abutilon indicum L. Sweet</td>
<td>Malvaceae</td>
<td>Raktapitta, Vatarka</td>
<td>Common</td>
</tr>
<tr>
<td>Aparajita</td>
<td>Clitoria ternatea L.</td>
<td>Fabaceae</td>
<td>Kastha, Mutraroga</td>
<td>Occasional</td>
</tr>
<tr>
<td>Dudhi</td>
<td>Euphorbia hirta L.</td>
<td>Eupatoriaceae</td>
<td>Slesmodararoga, Piliroga</td>
<td>Abundant</td>
</tr>
<tr>
<td>Arka</td>
<td>Calotropis procera (Aiton) Dryand.</td>
<td>Asclepiadaceae</td>
<td>Skin diseases</td>
<td>Common</td>
</tr>
<tr>
<td>Madar</td>
<td>Calotropis gigantea L. Dryand.</td>
<td>Asclepiadaceae</td>
<td>Skin diseases</td>
<td>Common</td>
</tr>
<tr>
<td>Kuppi</td>
<td>Acalypha indica L.</td>
<td>Euporiaceae</td>
<td>Slesmodararoga, Piliroga</td>
<td>Abundant</td>
</tr>
<tr>
<td>Apamarg</td>
<td>Achyranthes aspera L.</td>
<td>Amaranthaceae</td>
<td>Sula, Udara Roga, Medoroga</td>
<td>Common</td>
</tr>
<tr>
<td>Jungli choulai</td>
<td>Aamaranthus viridis L.</td>
<td>Amaranthaceae</td>
<td>Analgesic, Anti- pyretic</td>
<td>Common</td>
</tr>
<tr>
<td>Neeli- boot</td>
<td>Anagallis arvensis L.</td>
<td>Primulaceae</td>
<td>Diuretic, Expectorant</td>
<td>Common</td>
</tr>
<tr>
<td>Dhattura</td>
<td>Datura metel L.</td>
<td>Solanaceae</td>
<td>Krimi, Yuka, Liksa</td>
<td>Common</td>
</tr>
<tr>
<td>Hathajori</td>
<td>Heliotropium indicum L.</td>
<td>Boraginaceae</td>
<td>In inflammation, wound healing</td>
<td>Rare</td>
</tr>
<tr>
<td>Pan Bel Laksmana</td>
<td>Ipomeo obscura L. Ker Gawl.</td>
<td>Convolvulaceae</td>
<td>In dysentery and ulcer</td>
<td>Occasional</td>
</tr>
<tr>
<td>Raimuniya</td>
<td>Lantana camara L.</td>
<td>Verbenaceae</td>
<td>For leprosy and scabies</td>
<td>Abundant</td>
</tr>
<tr>
<td>Lunia</td>
<td>Portulaca oleracea L.</td>
<td>Portulaceae</td>
<td>Anti-fungal, anti-rheumatic</td>
<td>Occasional</td>
</tr>
<tr>
<td>Salsabuni</td>
<td>Triantoma portulacastrum L.</td>
<td>Aizoaceae</td>
<td>Anti-inflammatory</td>
<td>Occasional</td>
</tr>
<tr>
<td>Adhahpushpi</td>
<td>Portulaca oleracea L. Leh.</td>
<td>Boraginaceae</td>
<td>In eye diseases</td>
<td>Rare</td>
</tr>
<tr>
<td>Chhota kalpa</td>
<td>Trichodesma indicum L. Leh.</td>
<td>Boraginaceae</td>
<td>Diuretic, deputative</td>
<td>Abundant</td>
</tr>
<tr>
<td>Ghama</td>
<td>Tidax procumbens (L.) L.</td>
<td>Asteraceae</td>
<td>Hair growth promoter</td>
<td>Abundant</td>
</tr>
<tr>
<td>Bhoomi-amalaki</td>
<td>Phyllanthus nirui L.</td>
<td>Euphorbiaceae</td>
<td>Hepatoprotective</td>
<td>Abundant</td>
</tr>
<tr>
<td>Satyanashi</td>
<td>Argemone Mexicana L.</td>
<td>Papaveraceae</td>
<td>Antimicrobial</td>
<td>Common</td>
</tr>
</tbody>
</table>

Literature search was carried out through the scientific engine Google Scholar (http://scholar.google.com), the databases ScienceDirect (http://www.sciencedirect.com), PubMed (http://www.ncbi.nlm.nih.gov/pubmed), Springer (http://www.springer.com), Scopus (http://www.scopus.com), RSC (http://pubs.rsc.org/en/journals), SciFinder (http://www.chem.wisc.edu/eric/scifinder-scholar), and ACS (http://pubs.acs.org/). This review thoroughly investigates the ethnobotanical, phytochemical, and pharmacological studies reported on major weeds found in Gwalior and nearby regions.

3. RESULTS AND DISCUSSION

3.1. Major Weeds in the Gwalior and Nearby Regions and their Medicinal Activities

*Oxalis corniculata* L. is a low growing creeping weed grows in tropical and temperate climate often found in gardens, wastelands, hedges, and roadsides. The plant contains tartaric acid, citric acid, malic acid, Vitamin C, and carotenes. It is incorporated in some ayurvedic formulations such as Changeri Ghrita and Amalaki Rasayan [10].

Bhringaraja is a common weed found throughout in India at damp places up to 1700 m. It contains alkaloids ecliptine and nicotine and used as hair growth promoter and in Krimi-Roga and Sotha [11].

As per accepted classification, the *Andrographis* genus belongs to Acanthaceae family and includes 28 species of small shrubs of tropical Asian countries. *Andrographis paniculata* (Burm.f.) Nees is known as the “King of Bitters” because all plant parts are extremely bitter in taste. Flavonoids and diterpenoids are the major groups of secondary metabolites isolated from the plant. The plant possess various pharmacological effects such as antimicrobial, antifungal, antioxidant, anti-inflammatory, anthelmintic, antipyretic, anticancer, and anti diarrheal [12].

Punarvava or Rakta Punarvava consists of matured, dried plant (whole) of *Boerhavia diffusa* L. (Family: Nyctaginaceae), found throughout in India and collected on maturity after rainy season. The herb is diffusely branched having stout rootstock, many long slender, prostrate, or ascending branches. Punarnavine is the chief alkaloidal constituent of plant. This plant is used as hepatoprotective, in the treatment of pandu roga and edema, and is an important ingredient of various ayurvedic formulations [13].

*Cassia tora* L. is a herbaceous annual belongs to the family Fabaceae and occurs as weed throughout the country in plains, ascending 1500 m. in the Central Himalayas. The plant contains anthraquinones and fixed oil and therapeutically used in Ayurveda for the treatment of various ailments [14].
Cocculus hirsutus L. W. Theob. is known as Patalagarudi in Ayurveda. It is used in diseases of the urinary system. It is a well-known herb used as first aid remedy in minor injuries. It alleviates kapha and vata doshas. It is used as deepanee, pachanee, and raktdoshagni and has special potency as a detoxifier. It is also an aphrodisiac and tonic [15].

Ashwagandha consists of dried mature roots of Withania somnifera L. Dunal., belonging to the family Solanaceae. It is found in wasteland, cultivated in field and open grounds throughout in India, and widely cultivated in certain areas of Madhya Pradesh and Rajasthan. It is a perennial shrub, contains alkaloids and withanolides, and is used as a potent adaptogen [16].

Abutilon indicum L. Sweet is found abundantly in temperate regions of India as a common weed on roadsides and other waste places in plains and hills throughout the year. Plant is traditionally used for a range of pharmacological and medicinal activities. Different parts of the plant contain specific phytoconstituents such as asparagine and hence possess different biological activities such as anti-inflammatory, analgesic, and antioxidant [17].

Clitoria ternatea L. is found in all tropical regions of the country, cultivated in gardens everywhere and often found along with hedges and thickets. The main phytoconstituents are tannins, starch, resins, taraxerol, and taraxerone. In Ayurveda, therapeutically it is used for sula, sotha and kustha roga [18].

Euphorbia is the largest genus of medicinal plants distributed through in India as well as in all tropical and subtropical regions as weed. Milky latex of the plant gives it the name “Dudhi.” Chief constituents of the plant are quercetin, myricetin, and gallic acid. Plant possesses anti-inflammatory, antidiabetic, antitumor, wound healing, antiallergic, analgesic, and antioxidant activities and was found effective in renal disorders [19].

Calotropis procera (Aiton) Dryand. found wild, more, or less throughout India. Herb contains glycoside calotropin and used in Ayurvedic formulations such as Mahavisagarbha Taila and Dhanvantara Ghrita. Pharmacologically, it was found active as analgesic, antitumor, antihelminotic, antioxidant, hepatoprotective, antidiarrheal, anticonvulsant, and antimicrobial [20].

Calotropis gigantea L. Dryand., known as Madar in Hindi, is a perennial herb with a long history for its mystical and traditional uses. It is a tall shrub growing throughout in India at dry wastelands. The herbs contain calotropin, α-amyrin, β-amyrin, and glutathione which are the main constituents present in various plant parts and useful in diaphoretic, expectorant, leprosy, eczema, diarrhea, dysentery, cold, and cough and given as febrifuge [21].

Acalypha indica L. is a weed widely distributed throughout the plains of India. It has been reported to be useful in treating pneumatica, asthma, rheumatism, and several other ailments. In Ayurveda, it is used as infusion of root, powder, decoction, cataplasm, succus (juice expressed), tincture, and liquid extract [22].

Achyranthes aspera L. is a common weed found throughout in India in approximately all waste and dry places because of nominal growth requirements. Saponin A, saponins B, oleanolic acid, amino acids, and hentriacontane are the main constituents of the plant. Whole plant ash is a good remedy for bleeding piles and abdominal problems [23].

Amaranthus viridis L. is possibly of Asian origin but now a cosmopolitan weed of tropics and subtropics of the world. This is an ascending, erect, annual, or shot perennial herb of about 1 m length and possesses analgesic and antipyretic properties. It is also used for the treatment of pain and fever in traditional systems of medicine [24].

Anagallis arvensis L. is a weed found throughout in India. It is known as Neeli Booti and poisonous in nature. This mucilaginous, acrid herb lowers the fever and has diuretic and expectorant effects. The drug is used internally for depression, tuberculosis, liver complaints, epilepsy, dropsy, and rheumatism. Extract is used to improve the complexion, especially for freckles externally [25].

Datura metel L. is a well-known devotionally important plant grew wild as weed and used as intoxicant and hallucinogen. The plant is rich in alkaloids, including atropine, scopolamine, and hyoscymamine, and contains flavonoids, phenols, tannins, saponins, amino acids, and sterols. Especially in India, it is used for the treatment of epilepsy, hysteria, heart diseases, cough, convulsions, diarrhea, skin diseases, etc. [26].

The genus Heliotropium comprises about 250 species and is distributed in tropical, subtropical, and warm temperate regions. It is very common throughout in India in sunny localities and on wastelands. The plant is very rich in pyrrolizidine alkaloids and essential oil and showed various biological activities such as antitumor, gastroprotective, antitubercular, anti-inflammatory, and wound healing activities [27].

Ipomoea obscura L. Ker Gawl. is a small climbing vine with cordate leaves and found effective in Ayurveda against dysentery, sores, and pustules [28].

Lantana camara L. is widespread in various habitats ranging from open region without shade, including wastelands, rainforest edges, beachfronts, and forests which due to wide ecological tolerances.

Figure 1: Gwalior and nearby regions.
L. Lehm. is a perennial medicinal herb in various diseases and possesses various pharmacological properties and used in the treatment of asthma, bronchitis, jaundice, diabetes, and spleen. The active phytoconstituents are flavonoids, alkaloids, terpenoids, lignans, polyphenols, tannins, coumarins, and saponins which are found in various parts [34].

Methanolic and ethanolic extracts of leaves and seeds of *Argemone mexicana* L. were tested for possible antimicrobial activity, where ethanolic extracts found more inhibitory against Gram-positive and negative bacteria [Figure 2] [35].

**4. CONCLUSION**

Climatic changes have significant direct and indirect effects on weed biology. The growth of weeds in cultivated medicinal crops is a problem to be treated with suitable herbicide, while a number of weeds are of medicinal importance. The effect of climatic variations on weeds may vary by region, so a thorough understanding of physiological response of plant to such variations is needed to interpret the geographical distribution of weeds and species change.

This article may serve as the basis for further research to explore phytochemical modifications due to climatic changes in studied weeds and so to explore their systematic utilization accordingly in the treatment of prevalent diseases of the region under study.

Metabolomics studies in changing environment can explore more about existing flora and diverse therapeutic uses of above plants and could serve a basis to explore their importance in therapeutics.

**Figure 2:** Photographs of few selected plants grow as the weed and used as medicine in Gwalior and nearby regions. (a) *Boerhavia diffusa* L., (b) *Phyllanthus niruri* L., (c) *Oxalis corniculata* L., (d) *Withania somnifera* L. Dunal., (e) *Argemone Mexicana* L., (f) *Datura metel* L., (g) *Cocculus hirsutus* L. W. Theob., (h) *Acalypha indica* L., (i) *Amaranthus viridis* L., (j) *Euphorbia hirta* L., (k) *Calotropis procera* (Aiton) Dryand., (l) *Calotropis gigantea* L. Dryand., (m) *Achyranthes aspera* L., (n) *Clitoria ternatea* L., (o) *Cassia tora* L., (p) *Tridax procumbens* (L.) L.
5. ACKNOWLEDGMENT

Sincere gratitude is being expressed to Prof. Vd. K. S. Dhiman (Director General, Central Council for Research in Ayurvedic Sciences [CCRAS], Ministry of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy, Government of India) for his huge encouragement and support. The authors are also thankful to RARIDD, Gwalior, M.P. (an peripheral institute of CCRAS), for the library facilities.

6. REFERENCES