Weed Flora Diversity in Cultivated Fields and Calcareous Rocky Habitats During Monsoon Season in Dudhwakhara, Churu, Rajasthan

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***Abstract*—Weeds are an integral part of agro-ecosystems as well as natural landscapes, often competing with crops but also contributing to ecological balance. This study was carried out in Dudhwakhara village of Churu district, Rajasthan, during the monsoon season extending from June to September. The survey covered both cultivated fields and calcareous rocky surfaces, where weed growth is favored by seasonal rainfall. Regular field visits were made to document weed species, and identification was based on morphological characteristics and habitat association.**

Around 93 weed species were recorded during the survey, primarily through field observations and photographic documentation. A clear difference was noted between the weed flora of agricultural lands and that of rocky lime-rich habitats, with several species showing distinct adaptive strategies. The study highlights that weeds, though often regarded as harmful in agriculture, also reflect ecological variations and can provide insights into their medicinal, economic, and environmental significance.

The present work provides baseline information on weed diversity in Dudhwakhara and underlines the importance of adopting management practices that balance agricultural needs with ecological sustainability.

***Key Terms*—Weed flora, Dudhwakhara, Monsoon season, Calcareous rocky habitats, Cultivated fields.**

I. Introduction

Rajasthan, situated in the north-western part of India, is characterized by an arid to semi-arid climate, sandy soils, and highly variable rainfall. These extreme conditions strongly influence the vegetation and promote the survival of species with remarkable adaptive traits. Within Rajasthan, Churu district is located at the northeastern edge of the Thar Desert in Rajasthan, where the geography and climate gradually shift from the extreme arid conditions of the Thar Desert to the relatively less arid conditions of the semi-arid zone. Therefore, Churu is considered a transition zone between the Thar Desert and the semi-arid region. The area exhibits characteristics of both desert and semi-arid ecosystems, making it ecologically and climatically significant. The village of Dudhwakhara, located in this district, has minor limestone rocky patches alongside extensive cultivated fields with mostly sandy soil and occasional loamy patches. Such contrasting habitats provide a natural ground for studying the diversity and adaptability of weeds.

Weeds, commonly perceived as unwanted plants, form an integral component of both agricultural and natural ecosystems. While they are known to compete with crops for essential resources and thereby reduce yield, their role extends beyond this negative aspect. Weeds contribute to biodiversity conservation, protect the soil from erosion, and in rural communities are recognized for their nutritional, medicinal, and cultural value. Many species are consumed as seasonal vegetables, being rich in fibers and proteins, while others are used in household remedies or traditional healthcare.

The presence of diverse weed species in Dudhwakhara during the monsoon season offers a unique opportunity for ecological documentation. The rainy months favor the rapid emergence of weeds, many of which display fascinating morphological and ecological adaptations, such as fibrous stems, succulent leaves, or striking floral features that ensure survival in harsh climates. These traits not only make weeds resilient but also highlight their ecological importance in semi-arid regions.

The present study was therefore undertaken to document the weed flora of Dudhwakhara during the monsoon season, with special emphasis on their diversity across cultivated fields and rocky habitats. In addition to recording their occurrence, this study also considers the traditional knowledge of local farmers, whose experiences provide valuable insights into the practical, nutritional, and medicinal significance of these species.

II. Study Area

Dudhwakhara village, situated in Churu tehsil of Churu district (28.476836° N, 75.086869° E), lies at the eastern edge of the Thar Desert and forms part of the semi-arid agro-climatic zone of Rajasthan. Covering a total geographical area of 4295.85 hectares, the village reflects the characteristic ecological and socio-environmental conditions of arid Rajasthan. The climate is marked by extreme seasonal variations, where summer temperatures frequently rise above 48 °C, while winters may drop to 1–2 °C. The average annual rainfall remains low, at around 300–350 mm.

Habitats and weed distribution

The agricultural landscape of Dudhwakhara is dominated by rain-fed cultivation, as irrigation facilities are absent. Neither wells nor canal systems are used, since groundwater is scarce and crops depend entirely on seasonal rainfall.

a.) Cultivated Fields: The main crops sown during the monsoon season include mung *(Vigna radiata)*, moth *(Vigna aconitifolia)*, guaar (*Cyamopsis tetragonoloba*), bajra *(Pennisetum glaucum)*, chawla (*Vigna unguiculata*), and til *(Sesamum indicum)*. Among

these, til and chawla are cultivated by only a few farmers due to their lower preference, while mung, moth, guaar, and bajra are dominant. Weeds commonly emerge in these fields soon after the onset of rains, taking advantage of the same soil moisture as crops.

b.) Grasslands and Fallow Lands: Open grazing lands and fallow areas may harbor diverse weed species, intermixed with native grasses. These areas serve as important grazing resources and may also act as reservoirs for weed propagation into cultivated fields.

c.) Rocky Habitats: Approximately 16–17 hectares of village land is occupied by limestone deposits. These rocky areas have thin soil layers and cracks, where almost prostrate or creeping weeds are able to establish. Such species spread close to the ground, anchoring themselves in rock crevices and conserving moisture. Although their diversity is comparatively low, their presence indicates unique adaptations to harsh, shallow-soil habitats.

Commonly observed weeds across these habitats may include: Amaranthus species, Boerhavia species, *Cynodon dactylon*, Cyperus species, Cleome species, and Euphorbia species, which display adaptive traits such as rapid growth after rainfall, fibrous root systems, and morphological modifications suited to arid conditions.

Community and Livelihood Setting

According to the 2011 Census, Dudhwakhara has a population of 6,240 individuals (3,173 males and 3,067 females). Most households depend on agriculture, livestock rearing, and occasional labor. The community retains traditional ecological knowledge that influences land management and crop–weed interactions, providing valuable insights into rural adaptation to semi-arid conditions.

III. Review of Literature

Weeds play an essential role in agro-ecosystems, particularly in semi-arid regions like Rajasthan, where their emergence is closely linked to rainfall and soil conditions. Several studies have highlighted how soil type and texture influence weed germination and establishment. For instance, Verma and Meena (2007) observed that in rain-fed crops of Churu district, sandy soils favored rapid weed emergence, while differences in soil depth affected species abundance and diversity. Similarly, Singh and Joshi (1990) reported that dryland farming systems in Rajasthan are shaped by the seasonal monsoon, with certain species dominating immediately after rainfall events.

The diversity of weeds in semi-arid Rajasthan has also been documented in natural habitats. Bhandari and Mehta (2003) noted that the Thar Desert and adjoining areas host a variety of grasses and creeping weeds, which are well-adapted to sandy and calcareous soils. Singh (2005) further emphasized that these species show unique adaptations to moisture scarcity and high soil alkalinity, demonstrating ecological resilience in harsh conditions. Seasonal studies by Gupta and Jain (2001) reinforced the observation that rainfall patterns are the primary trigger for weed germination, shaping the composition and distribution of weed communities across agricultural and non-cultivated lands. In recent years, technological tools have complemented traditional field surveys. Applications like PlantNet (PlantNet, 2025) and iNaturalist (iNaturalist, 2025) have made it easier to document and identify weed species accurately, enabling researchers to verify field observations and build reliable species records. Alongside ecological studies, research has highlighted the broader significance of weeds beyond agriculture. Sharma et al. (2014) and Yaduraju (2012) pointed out that while weeds are often considered harmful to crops, they also provide food, fodder, and medicinal resources for local communities, underlining their ecological and socio-economic importance.

Overall, these studies suggest that the weed flora of semi-arid Rajasthan is shaped by a combination of soil properties, monsoon-driven moisture availability, and adaptive traits of the species. Integrating traditional field observations with modern identification tools provides a more complete understanding of these plant communities, helping to appreciate both their ecological significance and practical value.

IV. Objectives

1. To document and photographically record the diversity of weeds occurring in rain-fed agricultural fields and adjacent limestone habitats of Dudhwakhara.
2. To compare the growth forms and distribution patterns of weeds between cultivated fields and calcareous patches.
3. To identify the collected weed species accurately, including observations on multiple species within the same genus.
4. To provide baseline information for future ecological, agronomic, or biodiversity studies in the semi-arid regions of Rajasthan.

V. Methodology

Study design and duration

The study was carried out during the monsoon season in Dudhwakhara village, Churu district, focusing on two contrasting habitats: (i) rain-fed cultivated fields and (ii) calcareous rocky lands with limestone deposits. Field visits were made regularly during the active growing period of weeds to ensure systematic documentation of seasonal weed flora.

Field visits and observations

Continuous surveys were undertaken in both cultivated fields and rocky habitats to record weed diversity. In cultivated lands, observations were made along crop boundaries as well as within fields, while in rocky areas, special attention was given to patches dominated by creeping weeds. The presence, abundance, and general growth forms of weeds were noted during each visit.

Interaction with local community

Traditional ecological knowledge was documented by interacting with local farmers and villagers through informal discussions and question–answer sessions. These interactions helped in understanding local names, cultural significance, and practical uses of different weed species, especially those consumed as food or used in household remedies.

Identification of weeds

Weed species were identified using a combination of field observations, mobile-based plant identification applications, and morphological features such as stem, leaf, and floral characters. The preliminary names obtained were further cross-checked using regional botanical guides and authoritative plant identification literature. To ensure accuracy, earlier published research papers were consulted, and vernacular names provided by local farmers were also recorded to supplement scientific identification.

Observation documentation and verification

All information gathered during field visits and discussions with local farmers was carefully documented. The recorded data, including weed occurrence, abundance, and traditional uses, were cross-checked with published literature and existing floras to ensure accuracy. Local insights were particularly valuable in confirming species presence and ecological relevance, helping to prepare a reliable list of monsoon-season weeds.

VI. RESULTS

During the survey conducted across agricultural fields and limestone habitats of Dudhwakhara village, approximately 93 weed species were documented. These species showed remarkable variation in growth forms, abundance, and habitat preferences. Agricultural fields were dominated by erect herbaceous weeds, while limestone habitats supported a greater proportion of prostrate and creeping species. Some species were common to both habitats, while others were restricted to either cultivated land or limestone patches.

- **Photographs of recorded species are provided below for reference**

(Cleome brachycarpa)

(Cleome viscosa)

(Solanum virginiaum)

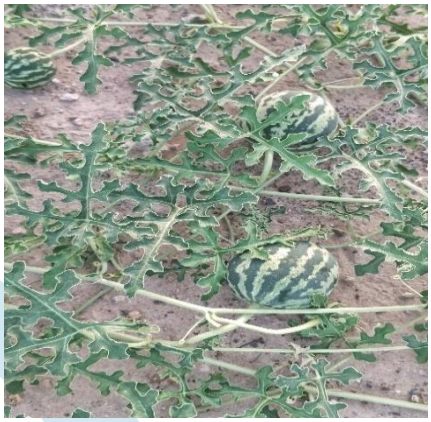
(Eragrostis minor)

(Aerva javanica)

(Cynodon dactylon)

(Diodia species)

(Ipomoea eriocarpa)



(Citrullus colocynthis)

(Launaea nudicaulis)

(Calotropis procera)

(Dactyloctenium aegyptium)

(Achyranthes aspera)

(Euphorbia hirta)

(Corchorus aestuans)

(Argemone maxicana)

(Eragrostis coarctata)

(Sonchus maritimus)

(Boerhavia coccinea)

(Boerhavia diffusa)

(Boerhavia erecta)

(Trianthema portulacastrum)

(Pedalium murex)

(Euploca strigosa)

(Spermacoce hispida)

(Zygophyllum indicum)

(Croton bonplandianus)

(Tribulus terrestris)

(Hypertelis cerviana)

(Digera muricata)

(Amaranthus polygonoides)

(Reichardia tingitana)

(Gisekia pharnaceoides)

(Amaranthus viridis)

(Paramollugo nudicaulis)

(Rhynchosia minima)

(Euphorbia prostrata)

(Euphorbia maculata)

(Portulaca oleracea)

(Phyllanthus maderaspatensis)

(Crotalaria medicaginea)

(Stevia rebaudiana)

(Corchorus tridens)

(Corchorus depressus)

(Phyllanthus amarus)

(Shorghum halepense)

(Digitaria sanguinalis)

(Cenchrus biflorus)

(Indigofera cordifolia)

(Indigofera spicata)

(Indigofera tinctorial)

. *(Cyanthillium cinereum)*

(Eragrostis aspera)

(Cyperus compressus)

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(Portulaca pilosa)

(Xanthium strumarium)

(Sonchus arvensis)

(Eragrostis ciliaris)

(Tridax procumbens)

(Verbesina encelioides)

(Commelina benghalensis)

(Cyprus rotundus)

(Cenchrus ciliaris)

(Portulaca oleracea)

(Amaranthus spinosus)

(Cucumis maderaspatanus)

(Xanthium strumarium)

(Jatropha gossypiifolia)

(Momordica balsamina)

(Sida cordifolia)

(Crotalaria burhia)

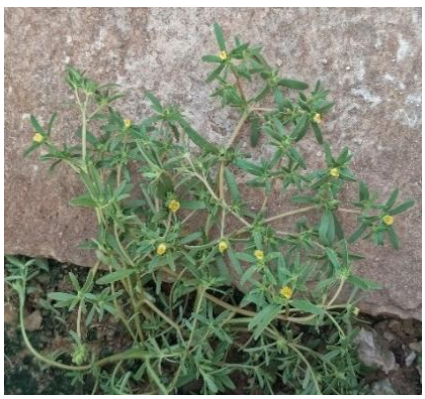
(Credendum phlebitis)

(Ipomoea species)

(lpomoea pes-tigridis)

(Ipomoea species)

(Dicliptera paniculata)



(Portulaca species)

(Arnebia hispidissima)

Figure1. Weed flora captured from cultivated and calcareous habitats

Weeds in Agricultural Fields

The cultivated fields, mainly sown with mung, moth, guar, and bajra, supported the highest weed diversity. Among the recorded flora, most species exhibited an erect growth form, reflecting their adaptation to open, sandy soils and competition with crops.

Dominant weeds included *Spermacoce hispida* (Agio), *Hypertelis cerviana* (Chiri dhaniya), *Digera muricata* (Ghundro), *Phyllanthus niruri* (Gogajanti), and *Paramollugo nudicaulis*.

Field boundaries and moist patches showed a prevalence of grasses such as *Sorghum halepense* (Baru), *Digitaria sanguinalis* (Jhernia ghaas), *Cenchrus biflorus* (Bharunt), and *Eragrostis aspera*. Species like *Rhynchosia minima* and *Tribulus terrestris* (Bhankri) displayed a patchy distribution—dominant in certain fields but sparse in others. In low-lying parts of fields where rainwater accumulated, *Cyperus rotundus* (Motha) was frequently observed in abundance. Overall, weeds were particularly prominent in bajra fields, where they exerted strong competition for soil moisture.

Weeds in Limestone Habitats

In the 16–17 hectare stretch of limestone-rich land, weeds were fewer in number but showed distinct prostrate or creeping growth forms. Leaf size in these species was generally smaller compared to their erect counterparts in cultivated fields.

Trianthema portulacastrum (Safed Sata) was found in higher abundance compared to *Boerhavia diffusa*. Although the two species appear very similar, they can be distinguished by their flowers: *Trianthema portulacastrum* bears white flowers, whereas *Boerhavia diffusa* has reddish-pink ones. Creeping grasses like *Cynodon dactylon* (Doob ghaas) formed dense mats and established local dominance in certain patches. Cyperus rotundus also occurred here, often mixed with limestone depressions where sandy soil had accumulated. Other notable weeds included *Aerva javanica* (Bui), *Eragrostis coarctata*, *Euphorbia prostrata*, and *Euphorbia maculata*.

Some species were found exclusively in limestone areas, such as *Ipomoea eriocarpa*, *Indigofera spicata*, *Cleome brachycarpa*, *Sonchus maritimus*, and *Corchorus depressus*. Rare individuals of Zygophyllum indicum, *Portulaca oleracia* and *Portulaca pilosa* were also observed. Along the margins of water-collecting depressions, *Achyranthes aspera* was particularly abundant.

Morphological and Ecological Variations

A striking observation was that certain weeds exhibited different growth forms in different habitats. For example, some species grew erect in fields but shifted to a creeping habit in limestone patches. Leaves of creeping forms were smaller, likely an adaptation to water scarcity and shallow soils.

The limestone depressions, where sandy material had collected, supported occasional erect species otherwise typical of fields, showing how microhabitats shape vegetation patterns.,

Phenological Stages

The survey conducted during the monsoon season revealed that weeds were present in varied growth and reproductive stages: Some species were still in the vegetative stage and had not flowered, making their identification difficult. Others had completed both vegetative and reproductive phases, with fully matured seeds. A few species were in active flowering, facilitating easier identification.

The diversity in phenological stages reflects the asynchronous germination and survival strategies of weeds under semi-arid conditions.

Ethnobotanical Significance and Uses

Interviews with local farmers highlighted the dual nature of weeds. While many were viewed as highly competitive absorbing the limited rainwater and reducing crop yield, others were valued for their nutritional and medicinal benefits.

Several weed species possess notable nutritional and medicinal properties. *Digera muricata* is rich in minerals and aids digestion while exhibiting antimicrobial effects. *Amaranthus polygonoides* provides vitamins, minerals, and fiber, supporting immunity, digestion, and bone health, and reducing inflammation. *Euphorbia prostrata* is traditionally used for hemorrhoids, wound healing, and as an anti-inflammatory agent, whereas *Euphorbia maculata* offers anti-inflammatory, antimicrobial, and anti-diarrheal benefits, with topical applications for skin ailments. *Citrullus colocynthis* (Tumba) supports urinary and digestive health, and *Boerhavia diffusa* promotes kidney and liver function while showing antioxidant and anti-inflammatory properties. *Trianthema portulacastrum* is valued for its fiber and digestive benefits, and *Tribulus terrestris* serves as a diuretic and anti-inflammatory remedy. Together, these species reflect important ethnobotanical knowledge and highlight their potential as nutritional and medicinal resources.

Less-Reported and Undetermined Species

During the survey, a *Portulaca* species was observed with long, thick, succulent leaves, visible stem, and yellow flowers, with all major morphological traits clearly observable. Despite these visible characteristics, plant identification applications were unable to determine its exact identity, suggesting that it may represent a new or less-documented species, although this cannot be confirmed at this stage. According to local farmers, this species appears every year, but in very low numbers and often restricted to certain areas, which may explain why it has not been widely documented.

Several other species also could not be confirmed to the species level. These undetermined species were mostly in the vegetative stage, lacking flowers or fruits required for accurate identification.

- Photographs of the Undetermined species are provided below. All photos show plants in the vegetative stage or with unclear identifying traits, and identification may be possible once flowering or fruiting occurs.












Figure2. Undetermined weed species recorded in cultivated fields and calcareous areas

VII. Conclusion

The present study provides a detailed account of the weed diversity in Dudhwakhara village of Churu district, Rajasthan, an area characterized by arid climatic conditions and rainfall-dependent agriculture. A total of nearly 93 weed species were recorded from agricultural fields and lime-affected habitats, reflecting the rich yet challenging vegetation of this region. The survey clearly demonstrated that weeds are not uniformly distributed but are strongly influenced by habitat conditions. In cultivated fields, the majority of species were erect in growth form, whereas in lime-affected areas, most species displayed creeping or prostrate forms, suggesting that edaphic factors play a major role in determining plant architecture and survival strategies.

The local agricultural system is largely rainfed, with major crops including bajra, moth, mung, and guar, while til and chawla are cultivated only in limited patches. Because no irrigation facilities are available, the farmers depend entirely on monsoon rains, making crop yields vulnerable to both climatic variations and weed infestations. Weeds compete directly with crops for scarce soil moisture, sunlight, and nutrients, which often results in reduced productivity. Farmers therefore rely on traditional hand-weeding practices (nirai-gurai), particularly after rainfall events, to minimize crop loss. Observations during the survey revealed that weeds such as *Spermacoce hispida*, *Digera muricata*, *Tribulus terrestris*, *Phyllanthus niruri*, and *Cyperus rotundus* are highly dominant in cultivated fields, while grasses like *Sorghum halepense* and *Cenchrus biflorus* were abundant along field boundaries.

In contrast, the lime-affected soils of the area, which cover nearly 16–17 hectares, showed an entirely different spectrum of vegetation. Due to the hard substratum, poor fertility, and limited water-holding capacity, crop cultivation is practically impossible in these soils. However, certain creeping weeds such as *Trianthema portulacastrum*, *Euphorbia prostrata*, and *Cynodon dactylon* were able to establish themselves successfully, often dominating patches and indicating their adaptation to stressful conditions. Other species like *Euphorbia prostrata*, *Euphorbia maculata*, *Corchorus depressus*, and *Cleome brachycarpa* were restricted to these habitats, highlighting the unique ecological niches created by lime substrata. Such findings emphasize the importance of weeds not only as competitors but also as bioindicators of soil health and habitat type.

Another significant outcome of this study is the recognition that weeds are not uniformly harmful. While some species adversely affect crops by absorbing rainwater and preventing seedling growth, others possess ethnobotanical importance. Local farmers reported the medicinal value of several species, such as *Boerhavia diffusa*, *Citrullus colocynthis*, *Euphorbia prostrata*, and *Tribulus terrestris*, which are traditionally used to treat ailments or provide nutritional support. A few species also serve as fodder during scarcity, offering resilience in the face of frequent drought conditions. Such dual roles of weeds highlight the need for a balanced understanding that considers both their negative impact on crop production and their potential benefits to rural communities.

Thus, the study provides a baseline record of the weed flora of Dudhwakhara, highlighting the differences between agricultural and lime-affected habitats. The photographs and field observations form a valuable dataset for future reference, while the noted unidentified species indicate the scope for further investigation.

VIII. References

The literature cited below highlights key research on weed diversity, distribution, and uses in rain-fed agricultural systems of Rajasthan.

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