Taxonomic Assessment of Grass (Poaceae) Species in Cultivated Agro-ecosystems of Rajasthan, India

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Abstract

The present study undertakes a taxonomic assessment of grass species belonging to the family Poaceae occurring in cultivated agro-ecosystems of Rajasthan, India. Basing its analysis on the secondary data retrieved in the readings on floristic and taxonomic literature, the present study tested the composition of species and diagnostic morphological features related to the identification of grass in agricultural scenery. The study revealed the heterogeneity of crop-related, fodder, and weedy grasses and the significance of reproductive characters in solving taxonomic royalties. The results were useful in improving the knowledge on grass diversity in cultivated systems as well as achieving precise recognition in agronomic and ecological practice.

Keywords: Poaceae; Grass Taxonomy; Agro-ecosystems; Morphological Characters; Weed Flora; Rajasthan; Plant Systematics

Introduction

One of the most ecologically and economically important groups of angiosperms is represented by the members of the family Poaceae. The family comprises major cereal crops, forage species, and numerous wild taxa, which prevalently dominate both natural and managed ecosystems in the world. In any agricultural environment, grasses have dual functions as crops as well as companion plants, which grow in and around crop plots. At that, precise taxonomic examination of grass species is hence invaluable in explaining agro-ecosystem dynamics and managing crops, as well as preserving and enhancing biodiversity and sustainable land use (Clayton and Renvoize, 1986; Judd et al., 2008).

Poaceae is typified by morphological complexity with characteristic (yet usually minor) diagnostic features, including the architecture of the spikelets, glume and lemma morphology, development of awns, and structure of inflorescence. Both phenotypic plasticity (high) and convergent vegetative traits often hamper species recognition, especially in tamed and unstable environments. Therefore, grasses are taxonomically problematic groups that require close study of reproduction traits and use of standardized taxonomic keys (Bor, 1960; Watson and Dallwitz, 1992).

Rajasthan is a site that can be used in carrying out taxonomic research on grasses because of its heterogeneous agroclimatic conditions that comprise arid and semi-arid regions and agro conditions that have been irrigated. State agro-ecosystems consist of cultivated agro-ecosystems, which support a combination of deliberately sown cereal grasses, fodder species, and related wild or weedy taxa. Many grass species are grown as part of field edges, fallows, and food fields, where they also interact with cultivated plants and affect soil attributes, nutrients, and crop production (Bhandari, 1990).

The grass flora of Rajasthan has been reported in regional floras and taxonomic accounts, but this has been mostly concentrated on natural grasslands or on broad floristic using taxonomic accounts. In the developed agro-ecosystems, the agronomic practices like irrigation, tillage, cropping patterns, and weed control determine the grass diversity. These human activities tend to create coexistence of indigenous species and naturalized fauna as well as imported grasses, thus making taxonomic evaluation of the same a crucial and complicated task (Sharma & Tiagi, 1979).

The taxonomic analysis of Poaceae species in agricultural landscapes is not just an academic issue. Proper classification of grass species is needed in order to differentiate between crops and weeds, manage them by the right management strategies, and clarify the behavior of the species to agronomic interventions. A number of grass species normally found in the cultivated fields are morphologically close, particularly at the vegetative stages, and thus they are usually misidentified and managed in a way that is not optimum. Extensive taxonomic evaluation based on credible morphological attributes is therefore ineffective in proper management of agro-ecosystems (Clayton et al., 2006).

In addition, managed agro-ecosystems act as buffer areas between natural and highly managed ecosystems, and they may harbor large amounts of plant diversity. The grasses that grow in such systems may be used as indicators of ecological factors like soil moisture, soil fertility, and extent of disturbance. Describing and indexing species of grasses in agricultural landscapes in this way enriches the knowledge of biodiversity trends during cultivation pressure and helps in preserving the flora that are related to agriculture (Jain & Rao, 1977).

In this respect, it is timely and relevant to conduct a taxonomic evaluation of grass species that are present in agro-ecosystems of cultured, thriving lands in Rajasthan. Incorporating all available knowledge on taxonomy and focusing on species related to agricultural lands, the current study aims at elucidation of the composition of species and structures unique to appropriate identification in the family Poaceae. The evaluation will give grounds to further ecological, agronomic, and conservation-based studies of the area.

Objectives

- To document grass (Poaceae) species occurring in cultivated agro-ecosystems of Rajasthan.
- To assess diagnostic morphological characters used in the taxonomic identification of these grass species.
- To evaluate the taxonomic significance of grass diversity within agricultural landscapes.

Research Methodology

The present study is based on secondary data derived from standard floras, taxonomic monographs, regional checklists, and peer-reviewed research articles pertaining to the family Poaceae in India and Rajasthan. Describing accounts of grass species that were present in cultivated fields, field margins, and fallow lands that were systematically screened. Diagnostic morphological characters, especially those related to the structure of the spikelet and inflorescence, were listed and compared. This used a descriptive and comparative method of taxonomy in keeping with the established fixed nomenclature and classification systems of botany so as to evaluate the agro-ecosystem diversity of grass species within the cultivated agro-ecosystems.

Literature Review

Historically, taxonomic research on Poaceae has called significant attention to the role of reproductive morphology in the proper identification of species. Classical grass taxonomists emphasized that floral characters, including arrangement of the spikelet, florets number and type, nature of the glumes and lemmas, awn presence, and type of inflorescence, are more dependable than vegetative ones that are often affected by environmental factors (Bor, 1960; Clayton and Renvoize, 1986). These ideals are especially relevant to managed agro-ecosystems whereby grasses are subjected to frequent disturbance, irrigation, and nutrient supply that increases morphological plasticity.

In India, regional floras and monographs have been used to give comprehensive taxonomic descriptions of grasses. The way that Bor treated Indian grasses is still covered, as it provides a descriptiveness and key to identifying issued species in many habitats (Bor, 1960). Later literature, as by Sharma and Tiagi, augmented the local information through sketches of species of grass in the farming field and semi-disturbed regions (Sharma and Tiagi, 1979). Indeed, the results of these studies have found that the cultivated field and its margins support a complex of crop species, fodder grasses, and weeds.

Agro-ecosystems in the State of Rajasthan have unique conditions of diversity of grass owing to the variances in rainfall, soil type, and irrigation. According to Bhandari, grasses constitute an important part of the flora in the state, and some of the species are accustomed to arid and subarid agro-systems (Bhandari, 1990). Cultivated lands are other places where Echinochloa, Cynodon, Dactyloctenium, and Setaria are likely to flourish in cycles of wet and nutrient-rich soils as a result of cropping practices. Their frequentness led to taxonomic interest due to the close morphological relationship and agronomic value to them.

The analyses of the weed flora present in the farmland have assisted through the taxonomy of farmland grasses. As pointed out by Jain and Rao (1977), accurate identification of the grass weeds is necessary since many species exhibit very similar vegetative morphological forms in early development stages. The inability to properly determine these taxa may lead to control mechanisms and subsequent yield losses in crops. Based on this, taxonomic evaluations based on reproductive characters have been greatly recommended in the agro-ecosystem.

(a) (b) (c)

Figure 1. Representative grass species identified in the agro-ecosystems of Rajasthan: (a) *Echinochloa* sp., (b) *Cynodon* sp., and (c) *Setaria* sp.

Recent taxonomic texts have come to appreciate agro-ecosystems that are under cultivation and become ideal locations of grass diversity.

Clayton et al. (2006) point out that agricultural environments allow the coexistence of native grass species and introduced grass species; most of them are able to survive due to their adaptive nature of fast growth rate, high seed production, and resistance to disturbance. These features make delimiting of these taxa difficult but also highlight the ecological importance of grasses in forestry backdrops.

In research work carried out in Rajasthan and other similar agro-climatic areas, some species of grass are repeatedly found in cultivated fields and other related habitats. These include grasses associated with crops and fodder species besides common weeds, which are always prevalent in all seasons. To compile the level of information on the species level as was reported in the literature, an overview of the most commonly observed Poaceae species in the cultivated agro-ecosystems at Rajasthan has been summarized in Table 1 with major diagnostic characters reflected to identify a species.

Botanical name	**Subfamily**	**Inflorescence type**	**Key diagnostic characters**	**Occurrence in agro-ecosystems**
Cynodon dactylon (L.) Pers.	Chloridoideae	Digitate spikes	Creeping stolons, flattened spikes	Fields, field margins
Echinochloa colona (L.) Link	Panicoideae	Panicle	Awnless spikelets, broad leaves	Paddy fields, moist soils
Dactyloctenium aegyptium (L.) Willd.	Chloridoideae	Digitate spikes	Crow-foot spikes, compressed spikelets	Cultivated fields
Setaria viridis (L.) P. Beauv.	Panicoideae	Spikelike panicle	Bristly inflorescence, green spikelets	Crop fields, fallows
Eleusine indica (L.) Gaertn.	Chloridoideae	Digitate spikes	Narrow spikes, flattened rachis	Irrigated fields
Sorghum halepense (L.) Pers.	Panicoideae	Panicle	Robust culms, hairy nodes	Field margins
Panicum repens L.	Panicoideae	Panicle	Rhizomatous habit, spreading panicle	Irrigated agro-fields

Table 1. Common grass (Poaceae) species reported from cultivated agro-ecosystems of Rajasthan

The literature review suggests that cultivated agro-ecosystems in Rajasthan harbor a rich pool of different types of grass species with ecological functions and taxonomic complexity in their ecological functions. A gradual recording and a comparative study of morphological taxa are thus required to solve problems in identifications and improve upon knowledge of grass diversity in agro-ecosystems.

Conclusion

The current research highlights the validity of taxonomic evaluation of grass species that are present in agro-ecosystems existing in cultivated lands in Rajasthan. The literature evidences that there is a diverse mixture of crops, fodder, and weedy grasses in these landscapes to the extent that many of them are closely morphologically similar. Diagnostic reproductive character analysis can be identified as an effective strategy of species identification in Poaceae. The synthesis of available taxonomic data and the focus on the most common species make the study achieve the desired goals and underline the topicality of grass taxonomy in agro-ecosystem management, the documentation of biodiversity, and prospective research in botanics in Rajasthan.

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References

1. Bhandari, M. M. (1990). Flora of the Indian Desert. Scientific Publishers.
2. Bor, N. L. (1960). The grasses of Burma, Ceylon, India and Pakistan. Pergamon Press.
3. Clayton, W. D., & Renvoize, S. A. (1986). Genera graminum: Grasses of the world. Royal Botanic Gardens, Kew.
4. Clayton, W. D., Vorontsova, M. S., Harman, K. T., & Williamson, H. (2006). GrassBase – The online world grass flora. Royal Botanic Gardens, Kew.
5. Jain, S. K., & Rao, R. R. (1977). A handbook of field and herbarium methods. Today & Tomorrow's Printers and Publishers.
6. Judd, W. S., Campbell, C. S., Kellogg, E. A., Stevens, P. F., & Donoghue, M. J. (2008). Plant systematics: A phylogenetic approach (3rd ed.). Sinauer Associates.
7. Sharma, B. D., & Tiagi, B. (1979). Flora of north-eastern Rajasthan. Kalyani Publishers.
8. Watson, L., & Dallwitz, M. J. (1992). The grass genera of the world. CAB International.
9. Gould, F. W., & Shaw, R. B. (1983). Grass systematics (2nd ed.). Texas A&M University Press.
10. Hooker, J. D. (1896). The flora of British India (Vol. 7 – Gramineae). L. Reeve & Co.
11. Veldkamp, J. F. (1994). Poaceae. In E. Kalkman et al. (Eds.), Flora Malesiana (Series I, Vol. 11). Rijksherbarium.