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Sharmila Roy
Central Arid Zone Research Institute, India

N. R. Panwar
Central Arid Zone Research Institute, India

C. B. Pandey
Central Arid Zone Research Institute, India

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Soil invertebrates of *Lasiurus sindicus* based grazing lands: impact of management and grazing intensity

Sharmila Roy, NR Panwar and CB Pandey

Central Arid Zone Research Institute, Jodhpur (Rajasthan)-342 003, India
Contact email: roysharmilaigfri@gmail.com

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Introduction

Arid Western plains of India are dominated by pasture and grazing lands. *Lasiurus sindicus* (LS) is the dominant native grass species growing on sandy plains and low dunes under the low rainfall extreme desert climate. Palatability and higher crude protein (8-14% in early vegetative growth, 4-6% in 80-120 days of growth) make this grass a highly preferred grazing species. Since drought is frequent (47%) in this part of the country the LS grasslands are under tremendous grazing pressures and classified under poor or very poor condition for livestock. It is imperative to restore the natural resources on which this grassland depends.

Soil invertebrates especially soil collembola and mites are an integral part of this grassland ecosystem. Their community structure changes in response to the changes in management and other factors, and may serve as a tool for rapid impact assessment of restoration measures. With this background, *Lasiurus sindicus* grazing lands in Jaisalmer District of Western Rajasthan of India were evaluated, to understand the impact of grazing intensity and management practices on the community structure of the soil invertebrates.

Materials and Methods

Sites

Eight sites of LS grassland under different management were evaluated for soil physical, biological and biochemical parameters. These grasslands were: grasslands and shrub lands under exposed and organised grazing schedules; grasslands under no grazing schedules with and without annual harvesting schedule in winters; arable land and silvipastoral management (LS with *Colophospermum mopane* planted at 4 × 4m distance).

Soil and climate of study site

The soil for all sites was sandy and alkaline; pH from 8.5-8.7. May-June were the hottest months with mean maximum air temperature (41.5^{o}C). January was the coldest month with mean minimum air temperature (3.1^{o}C) followed by December (5^{o}C). The study period received maximum annual rainfall (115 mm) in the month of September followed by August (109 mm). Total rainfall received was 266mm in 19 rain days.

Methods

Soil samples were collected at bimonthly interval from each site (up to 30 cm depth) using a 5 cm cylindrical core sampler. The Berlese-Tullgren Funnel method was used with suitable modifications, for extraction of collembola and mites (Woolley 1965). Pitfall traps were used for crawler insects. Soil chemical parameters; pH, EC, Soil organic carbon (SOC), Labile Carbon (LC) and soil enzymes viz., dehydrogenase activity (DHA) and florescent diacetate activity (FDA) were examined. Soil carbon management indexes (CMI), and soil biological quality index (SBQar) were calculated to compare management practices (Parisi 2001).

Results

Lasiurus sindicus based grasslands under various management practices were evaluated for soil biodiversity on the basis of soil physical, biological and biochemical parameters. The carbon management index (CMI = 0.63) dehydrogenase activity (DHA = 4.21) and florescent diacetate activity (FDA = 5.06) were low for the grassland under open grazing. These parameters (CMI = 1.89, DHA = 6.80, FDA = 5.55) were higher for the grassland under grazing management. CMI = 1.44, FDA = 5.59 and DHA = 6.39 were also high for the cultivated grassland under intensive inputs with annual biomass harvesting compared to unmanaged grassland (no management practice).

During the study 10 collembola, 67 mites and 30 other arthropod species were encountered. The Collembolans were represented by six families namely, *Sminthuridae*, *Brachystomellidae*, *Isotomidae*, *Cyphoderidae*, *Poduroidae* and *Entomobryidae*. The *Palaeosomatides*, *Epilohmanniidae*, *Rhodocaridae* and *Nematalysidae* were the dominant mites. Ants and coleopterans were other dominant arthropods. The abundance and diversity of soil micro arthropod fauna varied with different management practices (Fig.1). Higher diversity and abundance was associated with grazing management compared to grassland biomass removal systems by cut and carry practices.

The botanical composition, especially of desirable legumes, from the restorative grazing management was higher than other practices. The density of grass was higher in the controlled grazing experimental field (4040 tussocks/ha) than uncontrolled open grazing site (1060 tussocks/ha). Similarly Importance Values Index of *Lasiurus sindicus* ranged from 100% at controlled grazing in comparison to 46% in uncontrolled open grazing site. Relative Importance Values of *Lasiurus sindicus* was 38% at the protected controlled grazing site and 12% in the open grazing site.

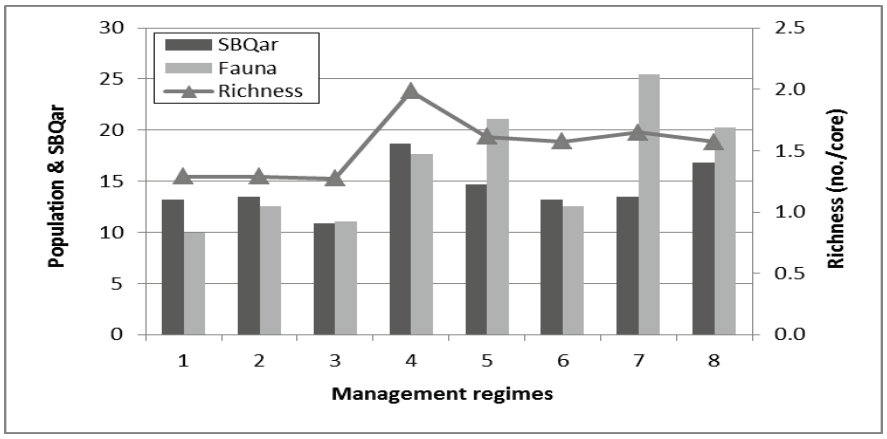

Figure1. Soil biological parameters of *Lasiurus sindicus* grasslands under different management regimes (SBQ_{ar} =Soil Biology Quality Index for micro-arthropods, Population = Abundance ($10^2/m^2$), 1 = silvipastoral, 2 = cultivated grassland with intensive input management, 3 = unmanaged grassland, 4 = grassland under grazing management, 5 = grassland under open grazing, 6 = agriculture land, 7 = shrubland under grazing management, 8 = shrubland under open grazing).

Conclusion

The study indicates that restorative grazing and improved management practices not only improves the botanical composition and soil fertility of the grassland but also the invertebrate diversity and abundance, an indicator of health soil ecosystem.

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