Journal of Research & Development, Vol 3 (2003).
ISSN 0972-5407

Microclimatic Relations of Loss on Ignition and Soil Moisture Content

G. A. Bhat

Center of Research for Development and Postgraduate Department of Environmental Sciences, The University of Kashmir, Srinagar, Pin- 1900 06 J&K, India.

ABSTRACT

Besides other preliminary edaphic parameters, after surveying five clearly differentiable subhabitats of Grasslands / pasturelands of Dachigam (34° , 04' - 34°, 11' N Latitude and 74° , 54' - 75° , 09' E Longitude) National Park, Kashmir, for assessment of retention of soil moisture content and % loss on ignition, a fairly close relationship between soil moisture content -cum- loss on ignition and microclimate was observed.

Keywords: Microclimate, loss on ignition, soil moisture content.

INTRODUCTION

Grasslands occur on a wide range of soil types. Microclimate in any one grassland kind of ecosystem is never uniform and even relatively low degrees of structural differences in aspect and topography (Duffey *et al*.,1974) and the differences of insolation (Geiger, 1965) in combination with physico- chemical nature of soil types may be of great significance. Although Claridge (1959), Whiteman (1969), and Waloff and Solomon (1973) and many other investigators demonstrated the importance of varied microclimate in ecological niches yet the subject remains understudied. Tansley (1917) studied the relationships of competition between closely related species and their soil preferences. Salisbury (1920) categorized the various soil microclimatic factors as chemical and physical, the latter being determined mainly by water regime. Ecologically it is not the total reserve of soil water which is important but only that amount which is available to the plant. If the water content is too high , as in case of ill drained soils, oxygen supply may be a limiting factor. Wilcox and Splisbury (1941) demonstrated that the wilting coefficient increased with the increase in the clay fraction of the soil and Williams (1968) observed that the moisture content and suction

force, a measure of soil water pollution, were related to the humus colloids of organic matter of the soil. To simplify it his study also concluded that soil moisture content was related to its percent loss on ignition. The present investigation too attempts to demonstrate almost similar phenomenon in grassland habitat under a variety of biotic treatments.

STUDY AREA, STUDY SITES AND CLIMATE

Five clearly distinguishable microhabitats, in the altitudinal range of 1680m and 1800m (amsl), subject to varied kinds of biotic treatments, were identified in the south facing aspects of grasslands and pasturelands of Dachigam (34° , 04' - 34°, 11' N Latitude and 74° , 54' - 75° , 09' E Longitude) National Park. The 100m^2 demarcated plots in each microhabitat were sequentially/ consecutively away from each other (interspersed) by approximately 1km of slightly deep natural gorges with their own characteristic cover of forest trees and forest scrub. The various microhabitats were characterized by the following salient features:

M-1:

This represented the typical overgrazed and degraded microhabitat subject to round the year grazing by hill cattle , sheep, goat and horses. Almost entire herbage was being picked by the livestock grazers and browsers and barring those of unpalatable and obnoxious grasses (e.g. *Stipa siberica*) herbs and forbs very little litter was found to remain on the ground.

M-2:

The microhabitat was a representation of a recently fenced location with a previous ten years history of continuous grazing and with an apparently dominant plant cover of *Stipa siberica, Thymus serpylum* and *Isodon plectranthoides*.

M-3:

This location was being grazed but had escaped for the last few years and appeared to have regenerated to a fair extent. The site suffered an accidental fire during the dry spell of autumn getting burnt of its dominant cover of *Stipa siberica* and re-establishing its original cover of *Themeda anathera* (Nees) along with *Artemisia* sp.

M- 4:

This represented an area in which T. anathera grass was being cut and harvested as hay periodically twice during summer and autumn.

M- 5:

This represented a least interfered area and had reportedly for the last many years, in general, not been subject to any apparent biotic intervention. The overall climate of the study area is temperate-alpine. The temperate zone encounters four different seasons a year: Spring(March_May), Summer(June_August), Autumn(September_November) and Winter(December_February). The usual temperature range in the temperate zone is between -10 °C and 37 °C while annual rain fall varies between 500mm. and 700mm. Of which over 40% is precipitated in the form of snow during winter and early spring.

MATERIAL AND METHODS

Simple variables of temperature, pH, moisture content and % loss on ignition were determined for five different microhabitats in the grasslands / pasturelands of Dachigam National Park, Kashmir. The above ground/air temperature was always recorded as an average of five readings at 30 cm above ground surface under shade by using a simple centigrade thermometer while surface soil temperature was recorded with a soil thermometer with its probe buried into the surface soil (5 - 7cm) depth.

Percent loss on ignition was determined for the composite soil samples of the microhabitats by the muffle furnace method prescribed by Hanna (1964) while for soil moisture content (%) and pH methods prescribed by Michael (1984) were followed.

OBSERVATIONS AND DISCUSSION

Most of the parameters recorded at five differing microhabitats were found to exhibit variability both season wise as well as microhabitat wise. Highest above ground temperature of 39°C was recorded at M-3 in summer while 9°C represented the minimum at M-4 in winter (Table 1 a-e). The mean air temperature at various sites was recorded to vary as follows: Lowest of 12°C in second spring and highest of 35°C each in the two summers at M-1; minimum of 12°C in winter and maximum of 35°C during summers at M-2; lowest of 13°C in winter and highest of 39°C in first summer at M-3; lowest of 9°C in winter and highest of 32°C in second spring at M-4 and lowest of 9. 5°C in winter and highest of 32° in second spring at M-5.

Highest surface soil temperature of 40° Cwas also recorded for M-3 during summer while lowest of 2° C was recorded at microhabitat M-2 during winter. In the first spring surface soil temperature was found to be highest of 29°C at the extremely grazed and degraded microhabitat M-1 while it was as lowest of 17°C at M-4. During first summer the

Table 1. Some edaphic features of five different microhabitats during different seasons

S. No.	Season	M-1	M-2	M-3	M-4	M-5
		Mean air temperature degrees celsius				
1	Spring	24. 0	29. 0	29. 0	22. 0	26. 0
2	Summer	35. 0	35. 0	39. 0	30. 0	27. 0
3	Autumn	21. 5	25. 0	25. 5	21. 0	22. 0
4	Winter	14. 0	12. 0	13. 0	9. 0	9. 5
5	Spring	12. 0	19. 0	25. 0	32. 0	32. 0
6	Summer	35. 0	35. 0	27. 0	25. 0	26. 5
		Soil pH				
1	Spring	6. 0	6. 5	6. 0	6. 0	6. 5
2	Summer	6. 0	6. 5	6. 5	6. 5	6. 0
3	Autumn	6. 5	6. 0	6. 5	6. 0	6. 0
4	Winter	6. 0	5. 5	6. 0	6. 0	5. 5
5	Spring	6. 0	6. 0	5. 5	5. 5	5. 5
6	Summer	6. 0	6. 0	6. 0	5. 5	5. 5
		Mean surface soil temperature degrees Céjsius				
1	Spring	29. 0	28. 0	28. 0	17. 0	27. 0
2	Summer	39. 0	35. 0	40. 0	27. 0	24. 0
3	Autumn	26. 0	22. 5	23. 0	20. 0	21. 0
4	Winter	19. 0	18. 0	15. 0	2. 0	8. 5
5	Spring	19. 0	21. 0	23. 0	23. 0	25. 0
6	Summer	31. 0	30. 0	24. 0	24. 0	24. 0
		% Soil moisture content				
1	Spring	6. 00	19. 90	17. 50	18. 40	35. 00
2	Summer	6. 81	20. 95	18. 00	16. 20	19. 00
3	Autumn	7. 00	33. 80	21. 80	29. 30	54. 15
4	Winter	11. 00	28. 20	28. 50	44. 20	50. 60
5	Spring	11. 00	11. 10	16. 70	17. 50	30. 40
6	Summer	6. 30	7. 80	14. 80	11. 60	21. 40
		Loss on ignition of soil samples				
1	Spring	8. 30	11. 20	15. 60	12. 80	19. 11
2	Summer	8. 20	13. 10	9. 20	12. 80	18. 20
3	Autumn	5. 00	13. 10	11. 50	13. 70	16. 39
4	Winter	9. 29	16. 66	13. 10	15. 00	19. 11
5	Spring	8. 20	13. 30	15. 50	13. 50	19. 31
6	Summer	6. 10	14. 20	14. 30	15. 10	19. 20

lowest was of 24° at the least interfered M-5 microhabitat while highest of 40° followed that of 39° were recorded at M-3 and M-1 respectively. In the second summer also soil temperatures were recorded as higher towards M-i and M-2 and lower towards M-4 and M-5 microhabitats (Table 1a). Almost similar situation was found to prevail in winter on the study sites. However, in second spring the trend appeared to be a little reverse with high of 25° at M-5 and low 19° at M-1 most probably because of higher amount of moisture - cum- decomposing organic matter from grass litter together with sun rays which warm the soil surface. While soil fevers at degraded

The pH of the soil samples was in general found to vary in the narrow range of 5.50 and 6.50 and the thus appeared to belong to medium acidic and slightly acidic category (Raychaudhuri, 1981) of soils. Precisely the values of pH of M-1 soil samples ranged between 6. 00 and 6. 50 and thus were of slightly acidic (6.00-6. 50 pH) category; those of M-2, M-3, M-4 and M-5 with values in the range of 5. 5 and 6. 5 were medium acid and slightly acid.

The % soil moisture content at the five microclimatic situations of overall clay loam texture (Bhat *et al*., 2002) showed the following variations. The moisture content of 54. 15 % was found to be the highest retained by the soil samples of the least interfered microhabitat M-5 in autumn, while it was lowest of 6. 00 % at the extremely grazed and degraded microhabitat M-1. Over all also the range of % soil moisture content was observed to be generally higher at the least interfered location M-5 and lower at M-1. This was most probably because of accumulation followed by decomposition of the grass litter at the location. The more the site was being grazed / harvested the less the litter was being accumulated.

The soil samples from five varied microhabitats were observed to suffer % loss on ignition in the following range given in parentheses: M-1 (5. 00 and 9. 29); M-2 (11. 20 and 16. 66); M-3 (9. 20 and 15. 60); M-4 (12. 80 and 15. 10) and M-5 (16. 30 and 19. 30). The % field moisture content, therefore, appeared to be in general related to the % organic matter of the soil which was generally being derived from the grass, herb and forb litter. The graphic representation of the relation is depicted in Fig.1.

ACKNOWLEDGEMENTS

The author records thanks to Director, C.O.R.D., University of Kashmir for providing laboratory facilities and Director, Department of Wildlife Protection, J&K Government, for granting permission to use the study area in the national park.

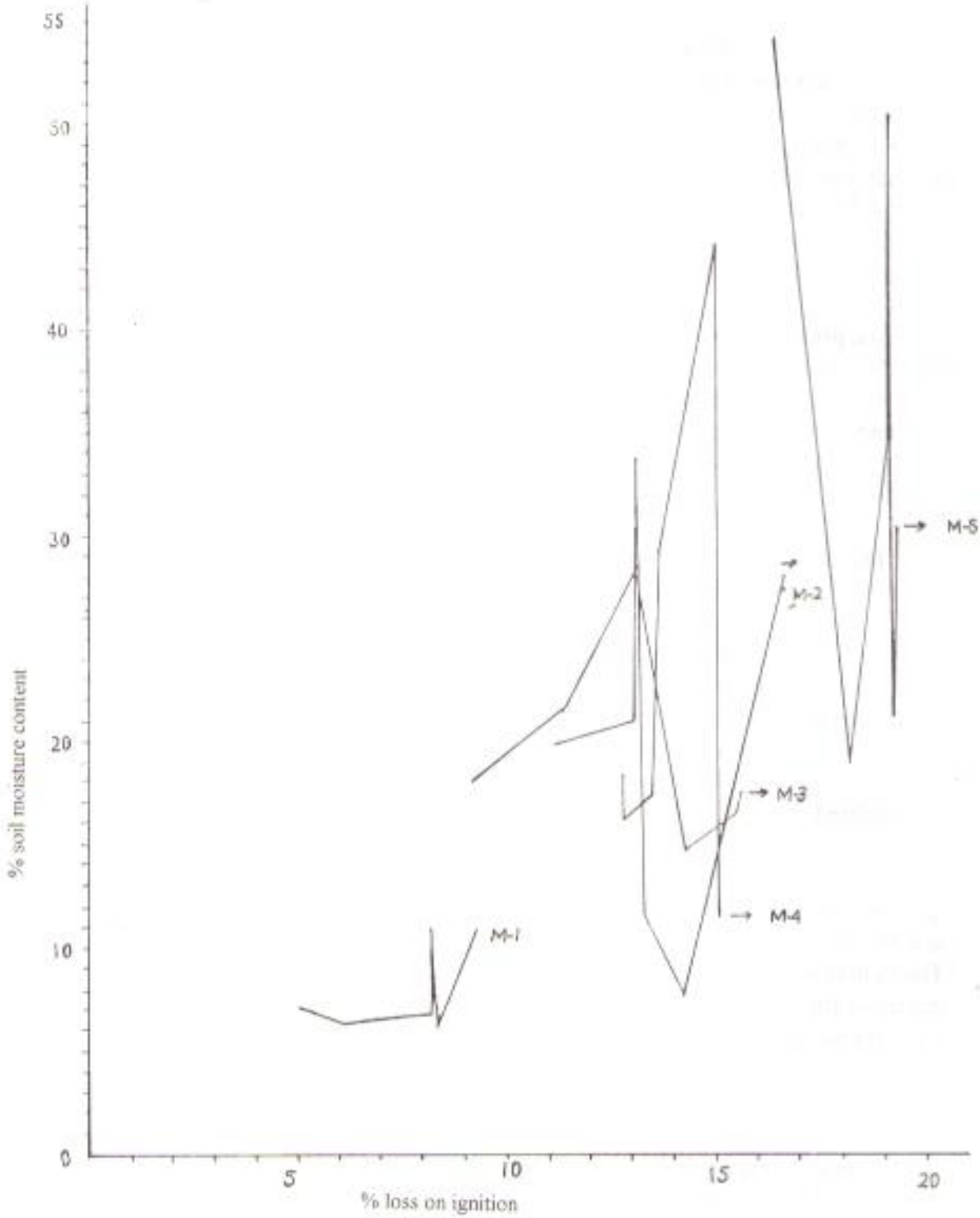

Fig. 1 Relationship between % loss on ignition and % soil moisture content at five differently treated grassland microhabitats in six consecutive seasons

REFERENCES

Bhat, G.A., Qadri, M.Y. and Zutshi, D.P. 2002. An ecological survey of Dachigam park,Kashmir, with emphasis on grasslands. p. 341-76 In: *Natural Resources of Western Himalaya* (Ashok K. Pandit, ed.). Valley Book House,Srinagar-6, J&K.

Claridge, M.F.1959. The identity of Eurytoma appendigaster (Hymn., Eurytomidae),with descriptions of some closely allied species bred from Gramineae, Entomologist's mon. *Mag.*, **95**: 2-13.

Duffey,E., Morris, M. G., Sheail, J., Ward, Lena K., Wells, D.A., and Wells,T.C.E. 1974. *Grassland ecology* and *wildlife management*. Chapman and Hall, London.

Geiger, R.1965. *The climate near the ground*, Harvard University Press, Cambridge,Mass.

Hanna, W. J.1964. Methods for chemical analysis of soils. In: *Chemistry of the soil* (Firman E.Beas, ed.). Oxford and IBH Pub.Comp.

Michael, P. 1984. *Ecological methods for field and laboratory investigations*. Tata Mc graw Hill Pub. Comp. Ltd.

Raychaudhury,S.P.1981. *Land and soil*. National Book Trust India, New Delhi.

Salisbury, E.J. 1920.The significance of the calcicolous habit, *J. Ecol.*: **8**, 202-15.

Tansley, A.G. 1917.Competition between *Galium saxitile* and *G. sylvestre*, *J. Ecol.*, **5**: 173-79.

Waloff, N. and Solomon, M.G.1973.Leaf hoppers (Auchenorhyncha Homoptera) of acid grassland, *J. appl. Ecol.*,10: 189-212.

Whiteman, W.C.1969. Microclimate and its importance in grassland ecosystems. In: The *grassland ecosystem: a preliminary synthesis* (R.L. Dix, and R.G. Beidelman, eds.). Colorado State University, Colorado.

Wilcox, J.C. and Spilsbury, R. H. 1941. Soil moisture studies. *Scient. Agric.*, **21**, 459-472.

Williams, J. T.1968. The nitrogen relationsand ecological investigations on wet fertilized meadows. *Veroff. geobot. Inst. Zurich*, **41**: 70-193