

FLORA ASPECTS IN THE SLĂNICUL DE BUZĂU WATERSHED

Mihaela Ioana GEORGESCU, Marian MUȘAT, Alexandra Teodora RADU,
Elena SĂVULESCU, Elisabeta DOBRESCU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd,
District 1, 011464, Bucharest, Romania

Corresponding author email: mihaelaigeorgescu@yahoo.com

Abstract

In two valleys of the Slănicul de Buzău watershed were conducted a series of observations on evolution of floristic composition of two meadows under the influence of changes registered in recent years in the rainfall regime and the land uses. The decrease of the anthropogenic intervention, recorded in the last fifteen years, led to changes in floristic composition of meadows and has permitted the installation of two new species, considered rare in the subcarpathian watershed of Slănicul de Buzău: *Gentiana cruciata* and *Echium maculatum*.

Key words: Aldeni, floristic composition, *Gentiana cruciata*, *Echium maculatum*.

INTRODUCTION

The watershed Slănicul de Buzău is a relief unit of the Curvature Subcarpathian. The area, with a continental climate, is regarded as one of the most affected by climate change, by increasing the frequency of extreme weather events such as rainfall torrents that causes violent and rapid high floods (Costache and Fontanine, 2013).

The fragile balance of the lands is affected by gully erosion and landslides that lead to loss of soil, exceeding 30-45 tonnes / ha / year (Știrbu et al., 2010; Mircea and Petrescu, 2011).

Vegetation, represented by secondary meadow, formed as a result of deforestation of deciduous forests, and lands with diverse uses (arable crops, grasslands, vineyards and orchards), plays an important role in diminishing of surfaces affected by runoff and gully erosion (Costache and Fontanine, 2013; Mircea and Petrescu, 2011). Changes, in recent years, on climate regime and land use are detected in vegetation also.

There are few works about flora and vegetation of this area and they are owed, mainly, to V. Ciocârlan (1968, 1969 a, b) and to the authors who have studied the erosion processes in the region (Mușat, 2006).

Two valleys, part of Slănicul de Buzău watershed, and their vegetation were included in our study in order to emphasise any

alteration as a result of environmental changes (rainfall, land uses) and to highlight the importance of these sites in biodiversity preservation.

MATERIALS AND METHODS

Our field studies were located on the right side of the Slănicul de Buzău river, in two valleys – Tătarului and Valea cu Drum, near Aldeni (Buzău county).

In this area, rainfall ranges between 500-600mm/year, distributed unequal over the year - the highest quantity is recorded during the months of April to June. In 2014, the average amount of rainfall was 781.95 l/m, the maximum recorded in April was 135.3 l/m (Table 1, Figure 1).

On the left side of the Tătarului valley with south exposition, the secondary meadow is edified by *Chrysopogon gryllus* while, on the right side of Valea cu Drum valley, with north exposition, the secondary meadows are edified by *Botriochloa intermedium* in the lower and middle part of the slope and, respectively, by *Festuca valesiaca* and *Stipa capillata* in the upper part of slope.

Itinerant method was used to mapping the vegetation. In July, observation territory was crossed in order to note all the plant species encountered. Plant species identification was made with field guides Ciocârlan, 2009 and

Sârbu et al. 2013. The plant lists were supplemented with personal data of the authors from previous autumnal assessments (Georgescu, Muşat – personal data).

Twenty-seven species and four families amongst those encountered in Valea cu Drum aren't in Tătarului valley meadows, while seventeen species and three families are characteristic to Tătarului valley.

Table 1. Climatic data - Aldeni, 2014

	The months of the year												Total and average
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Air temperature – monthly average	-2.7	-0.3	6.9	9.0	14.0	17.4	20.3	19.7	14.8	8.0	2.6	0.2	9.16
Soil temperature – monthly average	0.64	0.17	4.2	7.2	11.0	14.9	17.6	18.3	14.1	8.8	4.4	0.12	8.45
Rainfall – monthly average (l/mp)	55.6	3.55	26.3	135.3	105.7	109.1	68.6	59.3	14.5	54.4	62.2	87.4	781.95

Note: The average rainfall in the winter months (December, January, Febr.) are from melting snow fallen

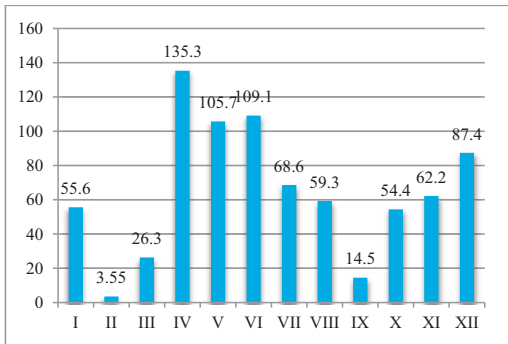


Figure 1. Monthly average rainfall recorded in Control Stationary of the Soil Erosion - Aldeni (Buzau county), 2014

RESULTS AND DISCUSSIONS

Floristic composition analysis

In total, in the two meadows, were recorded eighty-seven plant species. The sixty-seven plant species from Valea cu Drum valley are distributed in twenty-one plant family (Table 2, Figure 2). The Valea Tătarului meadows include sixty plant species, distributed in twenty families (Table 2, Figure 3).

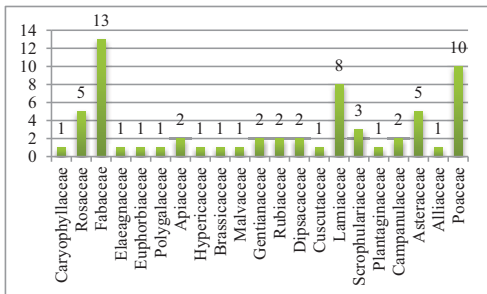


Figure 2. The plant families in Valea cu Drum

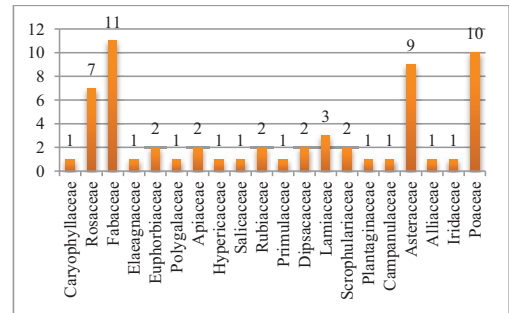


Figure 3. The plant families in Tătarului valley

Two species from Valea cu Drum are for the first time recorded in this area situated in the south of Slănicul de Buzău watershed.

Gentiana cruciata L. (Figure 4) – There are no records for this species in Buzău county in some important works about Romanian flora (Țopa, 1961; Oprea, 2005). In 1968, Ciocârlan has noted the presence of this species in the north part of the Slănicul de Buzău watershed. The species is considered rare in the area. We have identified the plant in a micro-depressions in the middle of the slope.



Figure 4. *Gentiana cruciata* L.

Echium maculatum L. (sin. *E. rubrum* Jacq.) (Figure 5) – About this species Flora RPR volume VI indicates that is common in all country regions in meadows, orchard etc. But in his Phd thesis Ciocârlan, 1968, noted that the species is rare and is found only in the northern part of Slănicul de Buzău watershed, also. We identified it in the upper part of Valea cu Drum valley.



Figure 5. *Echium maculatum* L.

Bioform analysis

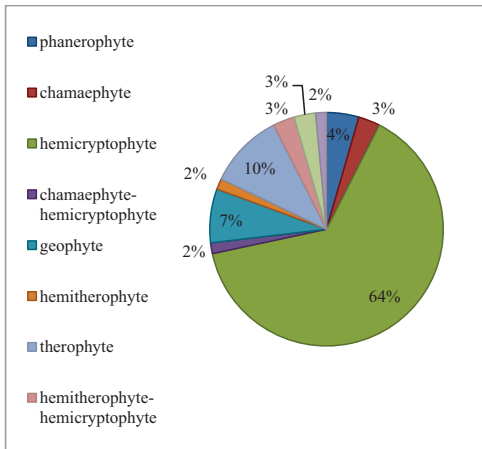


Figure 6. The bioform spectrum in Valea cu Drum

Out of the 67 plant species recorded in Valea cu Drum, thirteen are annual or annual hibernating and three are woody species; the majority of plant species are perennials: forty-three are hemicyrptophytes, three are chamaephytes, and five are geophytes (Table 2). The total number of perennial species recorded in Tătarului valley is forty-two of wich thirty-

five are hemicyrptophyte, three are chamaephyte and four are geophyte. Annual species are represented by thirteen species, in the same number like in Valea cu Drum valley. Also, here there are five woody species (Table 2).

Analysing the bioforms spectrum, we can conclude that the vegetal associations from both meadows are stable. The high percentage of the hemicyrptophyte species (64 % in Valea cu Drum and 58% in Tătarului Valley) and the low percentage in the case of therophyte species (only 10% in both associations) indicate a reduced pressure of antropic factor (Figures 6 and 7).

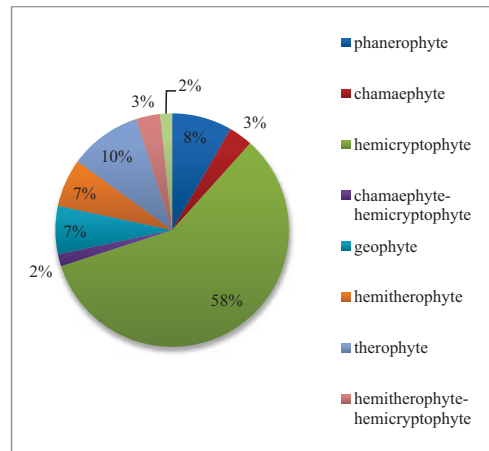


Figure 7. The bioform spectrum in Tătarului valley

Geoelement analysis

Elements of eurasin origin are the most representative among species in terms of geoelements (45% in Valea cu Drum and 44% in Tătarului Valley) (Figures 8 and 9). This is conform geoelements spectrum in our country. Particularly, for the south part of Slănicul de Buzău watershed are species originate from Continental, Pontic, Ponto-Mediterranean, Ponto-Balkanic or Submeriterranean regions emphasizing the silvo-steppic character of meadows encountered in the two valleys (Table 2). Ciocârlan, 1968, shows that the great number of thermophilic elements met in the curvature Subcarpathian region date from the warm postglacial era, representing glacial refugia.

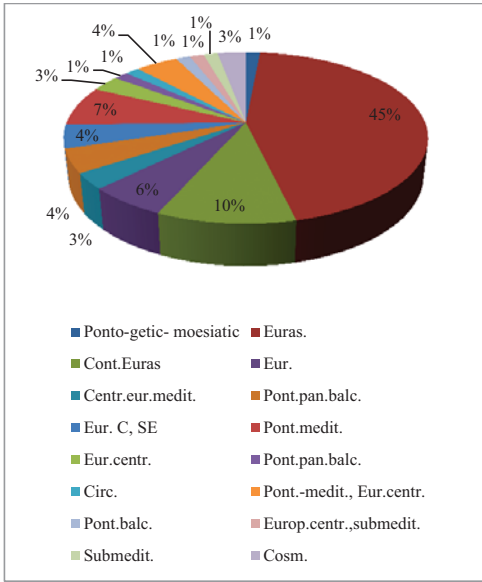


Figure 8. The geoelement spectrum in Valea cu Drum

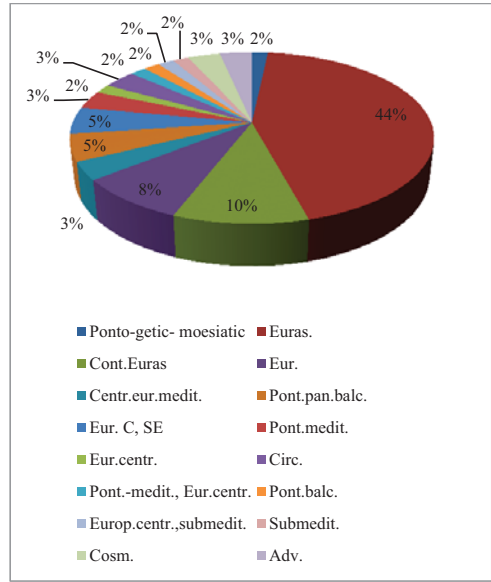


Figure 9. The geoelement spectrum in Tătarului valley

The requirements for soil moisture analysis

In the Valea cu Drum valley the spectrum of requirements for soil moisture is predominated moist soils (23 - mesoxerophytic). Other species are those adapted to dried soil (6 species, xero-xeromesophilic), moderately moist soil (5 species, mesophilic) and those indifferent to the soil moisture (5 species, eurihydric).

The spectrum of requirements for soil moisture in Tătarului valley is made of twenty-two species xeromesophilic, twenty-two mesoxerophilic, four xerophilic, two mesohygrophilic, two hygrophilic and five species indifferent.

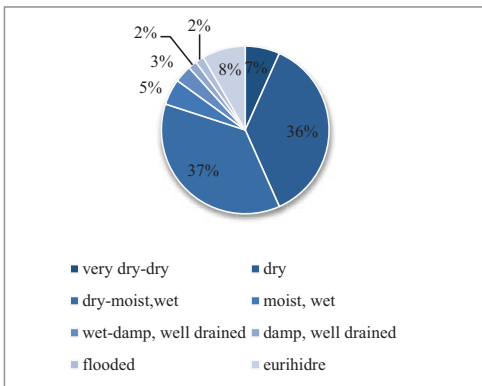


Figure 10. The soil moisture requirements spectrum in Valea cu Drum

The analysis of the species requirements for soil moisture confirms characteristic of the vegetal associations formed on the slopes of the two valleys, those of silvo-steppe meadows - the greatest part of plants species have low requirements for water factors (Figure 10,11).

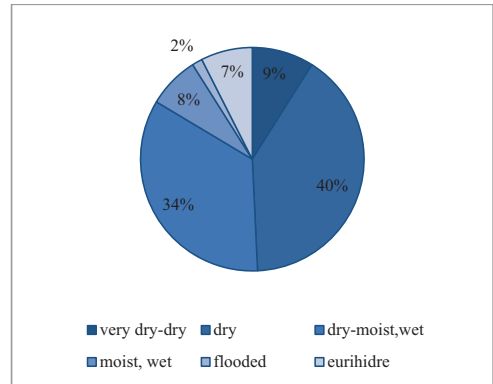


Figure 11. The soil moisture requirements spectrum in Tătarului valley

CONCLUSIONS

The two valleys - Tătarului and Valea cu Drum, are covered with plant associations of silvo-steppe meadows composed by many species of continental, pontic or sub mediterranean origin.

The decrease of the anthropogenic intervention, recorded in the last fifteen years, led to changes in floristic composition of meadows and has permitted the installation of new species, considered rare in the subcarpathian watershed of Slănicul de Buzău.

Although these types of meadow are considered of low conservative value (Doniță, 2005), they have an important role in maintaining the biodiversity by their richness in species, and can provide, also, important information about vegetation evolution.

Table 2. The plant species from Valea cu Drum and Tâtarului valleys

Species/ Family Bioforms;Geoelements;soil moisture index	Valea cu Drum	Tâtarului valley
1. <i>Dianthus membranaceus</i> Borbás Caryophyllaceae H;Pont.-getic-moes;3	✓	✓
2. <i>Agrimonia eupatoria</i> L. Rosaceae H;Euras;4	✓	✓
3. <i>Crataegus monogyna</i> Jacq. Ph;Euras;4	-	✓
4. <i>Filipendula vulgaris</i> Moench Rosaceae H;Euras;4	-	✓
5. <i>Fragaria viridis</i> Duchesne Rosaceae H;Euras;3	✓	✓
6. <i>Potentilla recta</i> L. Rosaceae H;Cont.euras;3	✓	✓
7. <i>Prunus spinosa</i> L. Rosaceae Ph;Eur;x	-	✓
8. <i>Rosa canina</i> L. Rosaceae Ph;Eur;4	✓	✓
9. <i>Sanguisorba minor</i> L. Rosaceae H;Euras;3	✓	-
10. <i>Astragalus onobrychis</i> L. Fabaceae H;Cont.euras;3	-	✓
11. <i>Coronilla varia</i> L. Fabaceae H;Centr.eur.-medit;4	✓	✓
12. <i>Cytisus austriacus</i> L. Fabaceae Ph;Pont.-pan.-balt;3	✓	-
13. <i>Dorycnium pentaphyllum</i> Scop. Fabaceae Ch;Eur.cent. s i SE;4	✓	✓
14. <i>Lathyrus tuberosus</i> L. Fabaceae H;Euras;4	✓	-
15. <i>Lotus corniculatus</i> L. Fabaceae H;Euras;4	✓	✓
16. <i>Medicago falcata</i> L. Fabaceae H;Euras;3	✓	✓
17. <i>Medicago lupulina</i> L. Fabaceae T-H;Euras;4	✓	✓
18. <i>Melilotus officinalis</i> (L.) Pall. Fabaceae	✓	✓
Ht;Euras;3		
19. <i>Ononis spinosa</i> L. Fabaceae Ch-H;Eur;x	✓	✓
20. <i>Onobrychis vicifolia</i> Scop. Fabaceae H;Euras;3	✓	✓
21. <i>Trifolium arvense</i> L. Fabaceae T;Euras;3	✓	✓
22. <i>Trifolium pannonicum</i> Jacq. Fabaceae H;Pont.-medit;4	✓	-
23. <i>Trifolium pratense</i> L. Fabaceae H;Euras;x	✓	✓
24. <i>Hippophæe rhamnoides</i> L. Elaeagnaceae Ph;Euras;4	✓	✓
25. <i>Euphorbia cyparissias</i> L. Euphorbiaceae H;Euras;3	✓	✓
26. <i>Euphorbia glareosa</i> Pall. ex M.Bieb. Euphorbiaceae H;Est. centr.-est eur;2	✓	✓
27. <i>Linum flavum</i> L. Linaceae H;Pont.-pan.-balt;4	✓	-
28. <i>Polygala major</i> Jacq. Euphorbiaceae H;Pont.-medit;3	✓	✓
29. <i>Bupleurum rotundifolium</i> L. Apiaceae T;Euras;3	✓	-
30. <i>Daucus carota</i> L. Apiaceae Ht;Euras;4	-	✓
31. <i>Eryngium campestre</i> L. Apiaceae H;Pont.-medit;3	✓	-
32. <i>Ferulago campestris</i> (Besser) Grecescu Apiaceae H;Pont.-medit;3	-	✓
33. <i>Hypericum perforatum</i> L. Hypericaceae H;Euras;4	✓	✓
34. <i>Erysimum repandum</i> L. Brassicaceae T;Euras. Cont;4	✓	-
35. <i>Salix alba</i> L. Salicaceae Ph;Euras;7	-	✓
36. <i>Lavatera thuringiaca</i> L. Malvaceae H;Euras. Cont;5	✓	-
37. <i>Centaurium erythraea</i> Rafn Gentianaceae T-Ht;Eur.cent;5	✓	-
38. <i>Gentiana cruciata</i> L. Gentianaceae H;Euras;3	✓	-
39. <i>Asperula cynanchica</i> L. Rubiaceae H;Centr.eur.-medit;3	✓	✓
40. <i>Galium verum</i> L. Rubiaceae H;Euras;4	✓	✓
41. <i>Primula veris</i> L. Primulaceae H;Euras;4	-	✓
42. <i>Knautia arvensis</i> (L.) Coult. Dipsacaceae H;Eur;4	✓	✓
43. <i>Scabiosa ochroleuca</i> L. Dipsacaceae Ht-H;Euras.cont;3	✓	✓

44. <i>Cuscuta epithymum</i> L. ssp. <i>trifolii</i> (Bab.)Berther Cuscutaceae T;Euras.; x	✓	-
45. <i>Echium maculatum</i> L. Boraginaceae T-Ht;Pont.-pan.; 3	✓	-
46. <i>Clinopodium vulgare</i> L. Lamiaceae H;Circ.;4	✓	✓
47. <i>Salvia nemorosa</i> L. Lamiaceae H;Pont.-medit.-centr.eur.; 4	✓	✓
48. <i>Nepeta cataria</i> L. Lamiaceae H;Euras.; 4	✓	-
49. <i>Nepeta muda</i> L. Lamiaceae H;Euras.cont.;3	✓	-
50. <i>Origanum vulgare</i> L. Lamiaceae H;Euras.; 3	✓	-
51. <i>Phlomis herba-venti</i> L. ssp. <i>pungens</i> (Willd.) Maire ex DeFillips Lamiaceae H;Pont.-medit.; 3	✓	-
52. <i>Stachys recta</i> L. Lamiaceae H;Pont.-medit.-centr.eur.; 3	✓	-
53. <i>Teucrium chamaedris</i> L. Lamiaceae Ch;Eur.cent.; 2	✓	✓
54. <i>Melampyrum arvense</i> L. Scrophulariaceae T;Eur.;3	✓	✓
55. <i>Rhinanthus rumelicus</i> Velen. Scrophulariaceae T;Pont.-pan.-balt.; 5	✓	✓
56. <i>Veronica austriaca</i> L. ssp. <i>austriaca</i> Maly Scrophulariaceae H;Pont.-medit.-centr.eur.; 2	✓	-
57. <i>Plantago lanceolata</i> L. Plantaginaceae H;Euras.;x	✓	✓
58. <i>Campanula glomerata</i> L. Campanulaceae H;Euras.;4	✓	-
59. <i>Campanula persicifolia</i> Campanulaceae H;Euras.;4	✓	-
60. <i>Campanula sibirica</i> L. Campanulaceae Ht;Cont.-euas.;x	-	✓
61. <i>Achillea millefolium</i> L. Asteraceae H;Euras.;4	✓	-
62. <i>Carlina vulgaris</i> L. Asteraceae Ht;Euras.;4	-	✓
63. <i>Centaurea orientalis</i> L. Asteraceae H;Pont.-balt.;3	✓	✓
64. <i>Centaurea stoebe</i> L. ssp. <i>australis</i> (A.Kern.) Greuter Asteraceae Ht-H;Eur.cent.;SE;2	✓	✓
65. <i>Cichorium intybus</i> L. Asteraceae H;Euras.;4	-	✓
66. <i>Erigeron annuus</i> (L.) Desf. Asteraceae T;Adv. (Am. de N);6	-	✓
67. <i>Erigeron canadensis</i> L. Asteraceae T;Adv. (Am. de N);3	-	✓
68. <i>Leucanthemum vulgare</i> (Vaill.)	✓	-

Lam. Asteraceae H;Euras.;4		
69. <i>Pilosella officinarum</i> Vaill. Asteraceae H;Euras.;4	-	✓
70. <i>Senecio jacobea</i> L. Asteraceae H;Euras.;4	✓	-
71. <i>Senecio vulgaris</i> L. Asteraceae T;Euras.;4	-	✓
72. <i>Taraxacum serotinum</i> (Waldst.et Kit.) Fisch. Asteraceae H;Pont.-pan.-balt.;3	-	✓
73. <i>Xeranthemum annuum</i> L. Asteraceae T;Pont.-medit.;2	✓	-
74. <i>Allium rotundum</i> L. Alliaceae G;Centr.eur.-submedit.;3	✓	✓
75. <i>Iris pumila</i> L. Iridaceae G;Pont.-pan.-balt.;3	-	✓
76. <i>Agrostis stolonifera</i> L. Poaceae H;Circ.;6	-	✓
77. <i>Bromus inermis</i> Leyss. Poaceae H;Cont.euras;4	-	✓
78. <i>Botriochloa ischaemum</i> (L.) Keng Poaceae H;Euras. (submedit.);3	✓	✓
79. <i>Calamagrostis epigejos</i> (L.) Roth Poaceae G;Euras.;x	✓	-
80. <i>Chrysopogon gryllus</i> (L.) Trin. Poaceae G;Submedit.;3	✓	✓
81. <i>Elymus hispidus</i> (Opiz) Melderis Poaceae G;Cont. euras;3	✓	-
82. <i>Dactylis glomerata</i> L. Poaceae H;Euras.;4	✓	✓
83. <i>Festuca valesiaca</i> Schleich. ex Gaudin Poaceae H;Cont. euras.;3	✓	✓
84. <i>Phleum pratense</i> L. Poaceae H;Euras.;5	✓	✓
85. <i>Phragmites australis</i> (Cav.)Trin.ex Steud. Poaceae G;Cosm.;10	✓	✓
86. <i>Poa pratensis</i> L. Poaceae H;Cosm.;5	✓	✓
87. <i>Stipa capillata</i> L. Poaceae H;Euras.;2	✓	✓

REFERENCES

- Ciocârlan V., 1968. Flora și vegetația bazinului subcarpatic al Slănicului de Buzău. Universitatea București, Teză de doctorat, București.
- Ciocârlan V., 1969. Asociații vegetale noi din bazinul subcarpatic al Slănicului de Buzău. Lucr. Șt. Seria A - Agronomie, București, vol 12: 367-372.

- Ciocârlan V., 1969. Asociații vegetale noi din bazinul subcarpatic al Slănicului de Buzău (II). Șt. și Cerc. Biol. Seria Botanică T.21, nr. 6: 419-427.
- Ciocârlan V., 2009. Flora ilustrată a României: Pteridophyta et Spermatophyta. Ed. Ceres, București.
- Costache R., Fontanine Iulia, 2013. Land use changes in subcarpathian area between Buzău and Slănic rivers, during 1990-2006 and their consequences on surface runoff. Riscuri și catastrofe, nr. XII, vol. 13/2: 171-182, Cluj.
- Doniță N., Popescu A., Paucă-Comănescu Mihaela, Mihăilescu Simona, Biriș I.A., 2005. Habitatele din România. Editura Tehnică Silvică, București.
- Gușuleac M., 1960. Familia *Boraginaceae*. Flora RPR, vol. VII. Ed. Acad. RPR, București.
- Mircea S., Petrescu N., 2011. Indicators for gully erosion assesment on agricultural torrential watershed. Annals Food Science and technology, vol. 12/1: 92-96 Târgoviște.
- Mușat M., 2006. Studiul solurilor afectate de eroziune din zona colinară a bazinului hidrografic Slănic - Buzău în vederea stabilirii măsurilor de ameliorare și stăvilire a procesului de eroziune. USAMVB, Teză de doctorat, București.
- Oprea A., 2005. Lista critică a plantelor vasculare. Editura Universității „A.I.Cuza”, Iași.
- Sârbu I., Ștefan N., Oprea A., 2013. Plante vasculare din România: determinant ilustrat de teren. Ed. Victor B Victor, București.
- Știrbu Clara Claudia, Ștefania Iordache, Cezarina Necula, Alexandra Teodora Radu, 2010. The influence of land management on soil erosion from Buzău hillcock area. Proceedings of the 3rd International Conference on Environmental and Geological Science and Engineering, Constanța, p. 32-35.
- Țopa E., 1961. Familia *Gentianaceae*. Flora RPR, vol. VIII. Ed. Acad. RPR, București.