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The Bryophyte Flora of Recep Tayyip Erdoğan University, Zihni Derin Campus (Rize-Turkey)

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Abstract

A study on the bryophyte flora of Zihni Derin Campus (Rize) was carried out between March 2017 and February 2018. One hundred nineteen bryophyte specimens were collected from the campus area and 57 (53 mosses and 4 liverworts) bryophyte taxa belonging to 36 genera (32 of mosses and 4 of liverworts) and 17 families (13 of mosses and 4 of liverworts) were identified. Nine of the determined bryophytes are new records for the province Rize.

Key words: Bryophyte, campus, flora, Rize, Turkey

Recep Tayyip Erdoğan Üniversitesi, Zihni Derin Kampüsü Briyofit Florası (Rize-Türkiye)

Öz

Zihni Derin Kampüsü briyofit florası 2017 Mart ile 2018 Şubat arasında gerçekleştirilmiştir. Kampüs alanından 119 briyofit örneği toplanmış ve 17 familyaya (13'ü karayosunu ve 4'ü ciğerotu) ait 36 cins (32'si karayosunu ve 4'ü ciğerotu) ve bunlara bağlı olarak 57 briyofit taksonu (53 karayosunu ve 4 ciğerotu) teşhis edilmiştir. Teşhis edilen briyofitlerden 9 tanesi Rize ili için yeni kayıttır.

Anahtar kelimeler: Briyofit, kampüs, flora, Rize, Türkiye

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1. Introduction

University campus sites are an important part of urban habitats. The Zihni Derin Campus, which is the study area of the research, is a city campus integrated with the province of Rize. The increase in academic and administrative buildings on university campus over time, and natural and exotic plant species established with new landscaping projects will affect the natural floristics on campus. Therefore, investigating the plant species, especially bryophytes in such areas provides comparing the results of future studies and to monitor the change of the species.

There are few national and international literature on bryophytes in campus areas (Parker, 1931; Alataş et al., 2011; URL1; Erata et al., 2017). The study aimed to determine the bryophyte flora on campus the campus of Recep Tayyip Erdoğan University.

2. Materials and Methods

The bryophyte flora of the campus at the university was investigated between March 2017 and February 2018. Collected specimens were identified with the help of related flora works (Smith, 2004; Paton, 2014). The samples are kept in the private collections of ABAY on campus. Nomenclature of liverworts follows Özenoğlu Kiremit and Keçeli (2009) and Söderström et al., (2016), mosses Ros et al., (2013), Plášek et al., (2015), and Lara et al., (2016). The new taxa for the A4 grid square were determined by Abay et al., (2016) and Batan et al., (2018).

The campus is in the west of Rize and within the square of A4 according to the Henderson's (1961) grid square system (Figure 1).

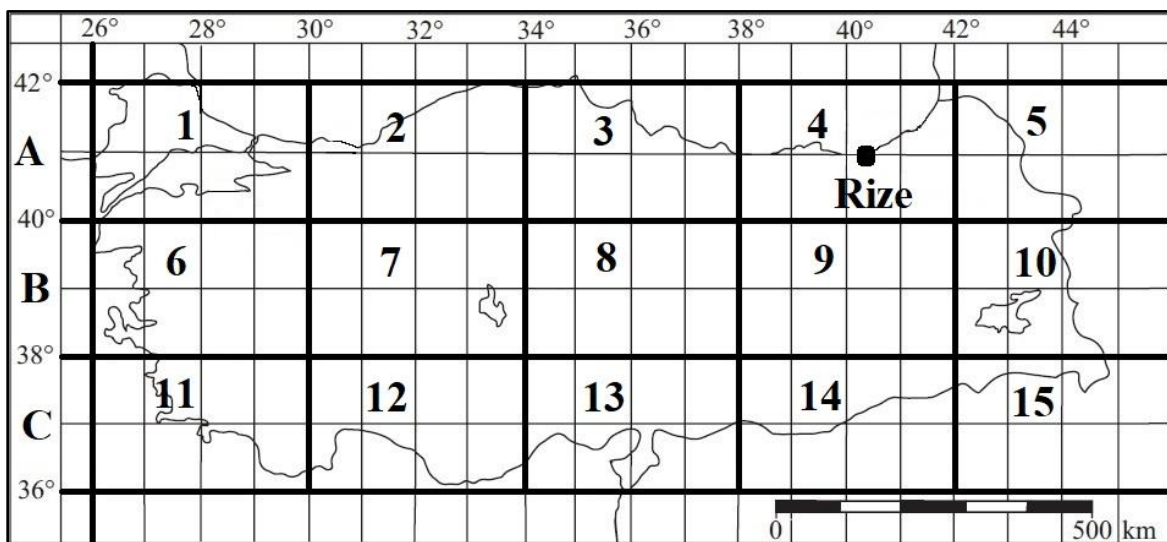


Figure 1. The location of the research area (■) according to the grid system of Turkey (Henderson, 1961)

The floristic list is arranged in alphabetical order together with the current Latin names of the taxa. In addition, the author(s) and the family name, habitat, altitude, coordinates, collection date and the number of the collector are given for each of the taxa in the list. In order to avoid the repetition of knowledge about where the taxon is according to Henderson's grid square (1961), the name of the province and campus were not mentioned in the floristic list.

Abbreviations used in the text;
RTEU – Recep Tayyip Erdoğan University

KTU – Karadeniz Technical University
BEU – Bülent Ecevit University

3. Findings

As a result of the identification of the collected specimens; 17 families (13 of mosses and 4 of liverworts), 36 genera (32 from mosses, 4 from liverworts) and 57 taxa (53 mosses and 4 liverworts) were determined.

3.1. Floristic list

1. *Atrichum angustatum* (Brid.) Bruch & Schimp. (Polytrichaceae)

On soil, 39 m, N 41° 02' 217" E 040° 29' 656",
02.03.2017, ABAY 1734.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1752.

2. *Atrichum tenellum* (Röhl.) Bruch & Schimp. (Polytrichaceae)

On soil, 19 m, N 41° 02' 222" E 040° 29' 713",
02.02.2018, ABAY 1832, 1836.

3. *Atrichum undulatum* (Hedw.) P.Beauv. (Polytrichaceae)

On soil, 10 m, 11 m, 19 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1822, 1833, 1819.

On soil, 32 m, 60 m, N 41° 03' 239" E 040° 29' 720", 15.06.2017, ABAY 1802, 1806, 1808.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1767, 1769.

4. *Barbula unguiculata* Hedw. (Pottiaceae)

On concrete wall, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1818, 1845.

On wall, 17 m, N 41° 02' 222" E 040° 29' 713",
02.02.2018, ABAY 1825.

On rock, 39 m, N 41° 02' 217" E 040° 29' 656",
02.03.2017, ABAY 1735.

On stone, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1763

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1753, 1765.

On stone wall, 32 m, N 41° 02' 216" E 040° 29' 671",
15.06.2017, ABAY 1796.

5. *Bartramia ithyphylla* Brid. (Bartramiaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
02.03.2017, ABAY 1733.

6. *Brachythecium albicans* (Hedw.) Schimp. (Brachytheciaceae)

On soil, 10 m, N 41° 02' 222" E 040° 29' 713",
02.02.2018, ABAY 1826.

7. *Brachythecium mildeanum* (Schimp.) Schimp (Brachytheciaceae)

On concrete wall, 60 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1810.

8. *Brachythecium rivulare* Schimp. (Brachytheciaceae)

On concrete wall, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1762.

9. *Brachythecium rutabulum* (Hedw.) Schimp. (Brachytheciaceae)

Above concrete with soil, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1816.

On soil, 11 m, N 41° 02' 222" E 040° 29' 713",
02.02.2018, ABAY 1838.

On soil, 60 m, N 41° 02' 239" E 040° 29' 720",
02.03.2017, ABAY 1743.

On concrete wall, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1744, 1780.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1770.

10. *Bryum dichotomum* Hedw. (Bryaceae)

On mortar near wall bottom, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1835.

11. *Campylopus pyriformis* (Schultz) Brid. (Dicranaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
02.03.2017, ABAY 1741; 23.03.2017, ABAY 1768.

12. *Ceratodon purpureus* (Hedw.) Brid. (Ditrichaceae)

On soil, 20 m, N 41° 02' 222" E 040° 20' 713",
02.02.2018, ABAY 1815.

13. *Cirriphyllum crassinervium* (Taylor) Loesch & M.Fleisch. (Brachytheciaceae)

On concrete, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1814.

14. *Conocephalum conicum* (L.) Dumort. (Conocephalaceae)

On soil, 10 m, N 41° 02' 222" E 040° 29' 713",
02.02.2018, ABAY 1827, 1834.

15. *Cynodontium polycarpon* (Hedw.) Schimp. (Rhabdoweisiaceae)

Above concrete with soil, 10 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1817.

16. *Dicranella heteromalla* (Hedw.) Schimp. (Dicranaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1771.

17. *Dicranella rufescens* (Dicks.) Schimp. (Dicranaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661",
23.03.2017, ABAY 1749.

18. *Didymodon acutus* (Brid.) K.Saito (Pottiaceae)

On concrete, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1846.

19. *Didymodon ferrugineus* (Schimp. ex Besch.) M.O.Hill (Pottiaceae)

On rock, 32 m, N 41° 02' 216" E 040° 29' 671",
15.06.2017, ABAY 1783.

20. *Didymodon topiaceus* (Brid.) Lisa (Pottiaceae)

On rock crevices, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1841.

21. *Ditrichum pallidum* (Hedw.) Hampe. (Ditrichaceae)

On soil, 39 m, N 41° 02' 217" E 040° 29' 656",
02.03.2017, ABAY 1742.

22. *Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen (Brachytheciaceae)

On concrete, 51 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1793.

23. *Fissidens osmundoides* Hedw. (Fissidentaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1776.

24. *Funaria hygrometrica* Hedw. (Funariaceae)

On concrete wall, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1844.

On soil, 37 m, N 41° 02' 231" E 040° 29' 717", 15.06.2017, ABAY 1788.

On sandy soil, 60 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1795.

On sandy concrete, 51 m, N 41° 02' 299" E 040° 29' 720", 15.06.2017, ABAY 1797.

25. *Gyrowesia tenuis* (Hedw.) Schimp. (Pottiaceae)

On concrete wall, 50 m, N 41° 02' 239" E 040° 23' 720", 15.06.2017, ABAY 1807.

26. *Hypnum andoi* A.J.E. Sm. (Hypnaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1754.

27. *Hypnum cupressiforme* Hedw. var. *cupressiforme* (Hypnaceae)

On plum tree trunk, 65 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1786.

28. *Hypnum cupressiforme* Hedw. var. *lacunosum* Brid. (Hypnaceae)

On plum tree trunk, 60 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1799.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1756.

29. *Hypnum cupressiforme* Hedw. var. *filiforme* Brid. (Hypnaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1758.

30. *Imbriobryum mildeanum* (Jur.) J.R.Spence (Bryaceae)

On concrete wall, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1772, 1777.

31. *Lewinskya affinis* (Schrad. ex Brid.) F. Lara Garilleti & Goffinet (Orthotrichaceae)

On plum tree trunk, 65 m, N 41° 02' 217" E 040° 29' 656", 15.06.2017, ABAY 1800, 1803.

32. *Lunularia cruciata* (L.) Dumort. ex Lindb. (Lunulariaceae)

On soil, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1840.

On concrete with soil, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1829.

33. *Marchantia polymorpha* L. (Marchantiaceae)

On sandy soil, 51 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1792, 1784.

On pebble soil, 51 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1804.

34. *Orthotrichum diaphanum* Schrad. ex Brid. (Orthotrichaceae)

On mandarin tree trunk, 51 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1805.

35. *Oxyrrhynchium hians* (Hedw.) Loeske (Brachytheciaceae)

On soil, 20 m, N 41° 02' 222" E 040° 20' 713", 02.02.2018, ABAY 1824.

On concrete with soil, 13 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1831.

On concrete, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1813.

On rock, 39 m, N 41° 02' 217" E 040° 29' 656", 02.03.2017, ABAY 1740.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1766, 1773, 1774.

On wet rock, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1785.

36. *Oxyrrhynchium speciosum* (Brid.) Warnst. (Brachytheciaceae)

On soil, 10 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1837, 1839, 1849, 1851.

On concrete, 12 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1828.

On wall, 17 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1812.

37. *Pellia endiviifolia* (Dicks.) Dumort. (Pelliaceae)

On soil, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1830, 1843.

38. *Philonotis caespitosa* Jur. (Bartramiaceae)

On concrete mortar, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1781.

39. *Philonotis calcarea* (Bruch & Schimp.) Schimp. (Bartramiaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1747.

40. *Pogonatum aloides* (Hedw.) P.Beauv. (Polytrichaceae)

On soil, 10, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1811, 1820.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1750, 1760.

41. *Pogonatum urnigerum* (Hedw.) P.Beauv. (Polytrichaceae)

On soil, 51 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1798, 1790.

42. *Pseudoamblystegium subtile* (Hedw.) Vanderp. & Hedenäs (Amblystegiaceae)

On mortar, 19 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1847.

43. *Pseudocrossidium hornschuchianum* (Schultz) R.H.Zander (Pottiaceae)

On wall, 17 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1850.

44. *Ptychostomum capillare* (Hedw.) Holyoak & N.Pedersen (Bryaceae)

Between stonewall, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1842.

On concrete wall, 60 m, N 41° 02' 239" E 040° 29' 720", 15.06.2017, ABAY 1794, 1809.

On soil, 39 m, N 41° 02' 239" E 040° 29' 656", 02.03.2017, ABAY 1736, 1737.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1746, 1761, 1778.

45. *Ptychostomum rubens* (Mitt.) Holyoak & N.Pedersen (Bryaceae)

On concrete wall, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1751.

46. *Ptychostomum torquescens* (Bruch & Schimp.) Ros & Mazimpaka (Bryaceae)

On stone, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1782.

47. *Rhynchostegium confertum* (Dicks.) Schimp. (Brachytheciaceae)

On rock, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1748.

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1764, 1775.

On stone, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1759.

48. *Rhynchostegium megapolitanum* (Blandow ex F.Weber & D.Mohr) Schimp. (Brachytheciaceae)

On rock with soil, 11 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1848.

49. *Rhynchostegium riparioides* (Hedw.) Cardot (Brachytheciaceae)

On concrete mortar, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1791.

50. *Sciuro-hypnum populeum* (Hedw.) Ignatov & Huttunen (Brachytheciaceae)

On concrete mortar, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1787.

51. *Sciuro-hypnum reflexum* (Starke) Ignatov & Huttunen (Brachytheciaceae)

On stone, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1801.

52. *Tortella tortuosa* (Hedw.) Limpr. (Pottiaceae)

On mortar, 32 m, N 41° 02' 216" E 040° 29' 671", 15.06.2017, ABAY 1789.

53. *Tortula brevissima* Schiffn. (Pottiaceae)

Between stonewall, 20 m, N 41° 02' 222" E 040° 29' 713", 02.02.2018, ABAY 1821, 1823.

54. *Tortula canescens* Mont. (Pottiaceae)

On concrete mortar, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1745.

55. *Tortula muralis* Hedw. (Pottiaceae)

On concrete wall, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1755, 1757.

56. *Trichostomum crispulum* Bruch. (Pottiaceae)

On rock, 39 m, N 41° 02' 217" E 040° 29' 656", 02.03.2017, ABAY 1739.

On concrete wall, 39 m, N 41° 02' 217" E 040° 29' 656", 02.03.2017, ABAY 1738.

57. *Weissia controversa* Hedw. (Pottiaceae)

On soil, 37 m, N 41° 02' 217" E 040° 29' 661", 23.03.2017, ABAY 1779.

4. Results and Discussion

One hundred nineteen specimens were collected from the study area and 57 taxa (53 mosses and 4 liverworts) belonging to 36 genera (32 of mosses and 4 of liverworts) and 17 families (13 of mosses and 4 of liverworts) were identified. *Brachytheciaceae* with 13 taxa and *Pottiaceae* with 12 taxa are the largest families within the bryoflora of the campus area. However, the liverwort families have one species each. The largest genera of mosses were found to be *Brachythecium* and *Hypnum* with four taxa each, while the liverwort genera have one species each.

Of the 57 identified bryophyte taxa, 9 were registered as new records for the province Rize (Abay et al., 2016; Batan et al., 2018). They are *Bryum dichotomum*, *Cynodontium polycarpon*, *Dicranella rufescens*, *Fissidens osmundoides*, *Pseudocrossidium hornschuchianum*, *Ptychostomum rubens*, *Rhynchostegium megapolitanum*, *Tortula brevissima* and *Tortula canescens*.

Approximately 32% of the mosses identified in the study area are pleurocarps and 68% are acrocarps. The excess of acrocarp species can be explained by man-made habitats in the campus area and the intensive presence of such as stone, rock, concrete and mortar materials.

The families and their taxa numbers are given in Table 1 and the genera and their taxa numbers in Table 2.

Table 1. Families and their taxa numbers

Families	Number of Taxa
<i>Brachytheciaceae</i>	13
<i>Pottiaceae</i>	12
<i>Bryaceae</i>	5
<i>Polytrichaceae</i>	5
<i>Hypnaceae</i>	4
<i>Bartramiaceae</i>	3
<i>Dicranaceae</i>	3
<i>Ditrichaceae</i>	2
<i>Orthotrichaceae</i>	2
<i>Lunulariaceae</i>	1
<i>Pelliaceae</i>	1
<i>Amblystegiaceae</i>	1
<i>Conocephalaceae</i>	1
<i>Fissidentaceae</i>	1
<i>Funariaceae</i>	1
<i>Marchantiaceae</i>	1
<i>Rhabdoweisiaceae</i>	1

Table 2. Genera and their taxa numbers

Genera	Number of Taxa
<i>Brachythecium</i>	4
<i>Hypnum</i>	4
<i>Atrichum</i>	3
<i>Didymodon</i>	3
<i>Ptychostomum</i>	3
<i>Rhynchostegium</i>	3
<i>Tortula</i>	3
<i>Dicranella</i>	2
<i>Oxyrrhynchium</i>	2
<i>Philonotis</i>	2
<i>Pogonatum</i>	2
<i>Sciuro-hypnum</i>	2
<i>Barbula</i>	1
<i>Bartramia</i>	1
<i>Bryum</i>	1
<i>Campylopus</i>	1
<i>Ceratodon</i>	1
<i>Cirriphyllum</i>	1
<i>Conocephalum</i>	1
<i>Cynodontium</i>	1
<i>Ditrichum</i>	1
<i>Eurhynchiastrum</i>	1
<i>Fissidens</i>	1
<i>Funaria</i>	1
<i>Gyroweisia</i>	1
<i>Imbricbryum</i>	1
<i>Lewinskya</i>	1
<i>Lunularia</i>	1
<i>Marchantia</i>	1
<i>Orthotrichum</i>	1
<i>Pellia</i>	1
<i>Pseudoamblystegium</i>	1
<i>Pseudocrossidium</i>	1
<i>Tortella</i>	1
<i>Trichostomum</i>	1
<i>Weissia</i>	1

When the results of the present study compared to the similar studies (Alataş et al., 2011; Erata et al., 2017); the families *Brachytheciaceae* and *Pottiaceae* with the maximum number of taxa in our study shared the first two places on KTU Kanuni Campus (Erata et al., 2017) and Zonguldak BEU (Alataş et al., 2011). This can be explained as follows; the members of the families *Brachytheciaceae* and *Pottiaceae* are well acclimated to various substrates (including rock, tree bark, and soil) and varying climatic conditions in different geographical regions.

The most common species in our research area are *Oxyrrhynchium hians* and *Barbula unguiculata*. Erata et al. (2017) are also listed *O. hians* as one of the most common taxa in their own study. Two of 9 taxa (*Bryum dichotomum* and *Dicranella rufescens*) which are new registrations for the province Rize are the common records of Karadeniz Technical University Kanuni campus (Erata et al., 2017).

As a conclusion, determination of flowering and cryptogamic plants is a very important step in the full understanding of plant biodiversity. In particular, it is important to investigate sensitive plant groups such as bryophytes as soon as possible before the settlement can show an increase over time.

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