

*Zoology*

## **Biodiversity of Oribatid Mites and Nematodes of Machakhela National Park**

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**Machakhela National Park was established in 2012 to preserve the unique biological and landscape diversity and long-term protection of ecosystems created by the Colchis forests. 95% of the park area is covered with forest and impassable shrubs. Invertebrates are widespread above the ground and underground and play an important role in the functioning of ecosystems. Oribatid mites are one of the leading groups of soil arthropods in terms of both numbers and biomass. They have a significant impact on the decomposition of plant wastes in ecosystems and are actively involved in soil-forming processes. Free-living and parasitic forms of nematodes are known in nature. Parasites cause damage of plant organs, while free-living ones play an important role in soil formation. Different groups of soil invertebrates were collected at 24 sampling sites of Machakhela National Park, Georgia, though the paper presents the data only of oribatid mites and nematodes. Sampling methods are similar in both cases. 10 cm diameter x 10 cm depth of soil is placed in bags and transferred to the laboratory. Oribatid mites were extracted using a modified Berlese apparatus. For nematodes extraction Berman's modified method is used. Afterwards temporary slides are done and identifications are made according to the keys used in acarology and nematology. The paper presents primary data on the distribution of oribatid mites and nematodes in Machakhela National Park and surrounding area, sampling sites and vegetation. © 2022 Bull. Georg. Natl. Acad. Sci.**

biodiversity, Machakhela, oribatida mites, nematoda

Machakhela National Park was established in 2012 and is situated in Khelvachauri Municipality of Adjara region. Its area is 12 739 ha, of which 86.2% is covered by forests.

Oribatid mites are poorly investigated in Machakhela National park and only 31 species are revealed [1,2]. There is no data about the distribution of nematodes in the park area.

With the present paper we present the first data of oribatid mites and nematodes from Machakhela National Park and surrounding area.

## Materials and Methods

In 2020-2021 different groups of soil invertebrates were collected at 24 sampling sites of Machakhela National Park, Georgia, though in the present paper we present data only of oribatid mites and nematodes, which includes site ID, coordinates and vegetation cover.

**MT1:** E 41°49'31.252", N 41°29'38.025", H = 1027; Alder forest (Alnetum)-*Alnus glutinosa* subsp. *barbata*; Underwood is dominated by: *Rhododendron ponticum* and *Rubus hirtus*, *Taxus baccata*. **MF:** E 41°49'38.151", N 41°29'37.760", H = 1027; Beech forest (Fagetum)-*Fagus orientalis*. **MC:** E 41°49'54.579", N 41°29'28.580", H = 979; Chestnut forest (Castanietum)-*Castanea sativa*; Underwood: *Rhododendron ponticum* and *Rubus hirtus*. **MR:** E 41°50'02.718", N 41°29'20.734", H = 838; Rhododendron community (Rhododendretum)-*Rh. Ponticum*. **MA:** E 41°50'21.130", N 41°29'23.070", H = 823; Alder forest (Alnetum)-*Alnus glutinosa* subsp. *barbata*; Underwood: *Rubus hirtus* and *Mateuccia strutiopteris*. **MAB:** E 41°50'43.028", N 41°29'32.477", H = 739; vegetation same as in MA. **KK:** E 41°44'37.226", N 41°31'39.994", H = 788; vegetation same as in MA, Underwood: *Rubus hirtus*, *Mateuccia strutiopteris*, and *Petasites albus*. **KK2:** E 41°44'21.964", N 41°31'36.357", H = 783; vegetation same as in MA, Underwood: *Rubus hirtus*, and *Sambucus ebulus*. **KK3:** E 41°44'11.752", N 41°31'24.415", H = 633; vegetation same as in MA, *Oreopteris limbosperma* and *Sambucus ebulus*. **KK4:** E 41°44'22.253", N 41°31'24.088", H = 663; Mixed forest dominated by *Castanea sativa*; *Fagus orientalis*, *Carpinus betulus*, and *Rhododendron ponticum*. **KK5:** E 41°44'27.857", N 41°31'20.849", H = 609; vegetation same as in KK4. **KK6:** E 41°44'29.861", N 41°31'17.998", H = 519; vegetation same as in KK4. **P1:** E 41°49'24.846", N 41°30'59.399", H = 788; Mixed coniferous and broadleaf forest with *Quercus pontica*, *Castanea sativa*, *Alnus glutinosa* subsp. *barbata*, *Fagus orientalis*, *Dyospiros lotus* and *Picea orientalis*; Underwood dominated with *Rhododendron ponticum*; *Vaccinium Arctostaphylos*, and *Rubus hirtus*. **P2:** E 41°49'27.869", N 41°30'56.765", H = 514; vegetation same as in P1, *Corylus avellana*, *Smilax excelsa* and *Mateuccia strutiopteris*. **P3:** E 41°49'26.193", N 41°30'56.129", H = 503; vegetation same as in P2. **P4:** E 41°49'29.584", N 41°30'52.288", H = 430; vegetation same as in P2. **P5:** E 41°49'26.354", N 41°30'52.483", H = 430; Oak (*Quercus pontica*) stand of the mixed forest. **P6:** E 41°49'25.549", N 41°30'49.663", H = 357; Oak (*Quercus pontica*) stand of the mixed forest. **Q1:** E 41°55'07.212", N 41°30'09.309", H = 1568; Beech forest (Fagetum) – *Fagus orientalis*, *Acer laetum*; Underwood: *Rhododendron ponticum*, *Prunus laurocerasus*, *Vaccinium Arctostaphylos*, *Rubus hirtus*, and *Mateuccia strutiopteris*. **Q2:** E 41°54'18.473", N 41°30'03.527", H = 1470; Beech forest (*Fagus orientalis*) stand of the mixed forests. **Q3:** E 41°53'20.884", N 41°29'47.697", H = 1245; *Picea orientalis*, *Fagus orientalis*, *Carpinus betulus*, *Alnus glutinosa* subsp. *barbata* and *Castanea sativa*; Underwood species: *Corylus avellane*, *Rh. ponticus*, *Rubus hirtus* and *Mateuccia strutiopteris*. **Q4:** E 41°53'03.535", N 41°29'36.055", H = 1156; Pure oriental spruce (*Picea orientalis*) forest stand of the mixed forest. **Q5:** E 41°52'38.079", N 41°29'52.769", H = 1042; Alder (*Alnus glutinosa* subsp. *barbata*) forest, *Fagus orientalis* and *Carpinus betulus*. Underwood: *Corylus avellane*, *Rh. ponticus*, *Rubus hirtus* and *Mateuccia strutiopteris*. **Q6:** E 41°52'37.384", N 41°29'30.434", H = 783. Chestnut (*Castanea sativa*) forest, *Picea orientalis*, *Carpinus betulus*, and *Alnus glutinosa* subsp. *Barbata*, Underwood species: *Corylus avellane*, *Prunus laurocerasus*, *Rh. ponticus*, *Rubus hirtus* and *Mateuccia strutiopteris*.

**Sampling methods, extraction and storage.** At each site, three soil, one litter and one moss samples for oribatid mites and nematodes were taken randomly using a soil core borer with 10 cm diameter x 10 cm depth. Sampled material was placed in bags and labelled before delivering to the laboratory for further

treatment. Oribatid mites were extracted during one week using a modified Berlese apparatus with 40 W light bulbs. For nematodes extraction in the lab conditions 20 cm<sup>3</sup> of soil from each sample was transferred to the metal sieve (Berman's modified method), which was covered with thin cotton layer. This sieve was fixed on the plate full of water and nematode were going out in the water [3].

Temporary slides of oribatid mites were made using cavity slides with specimens immersed in full strength lactic acid for 24 hours at room temperature prior to examination. Temporary slides of nematodes were done using established methods in phytohelminthology [3-5]. All specimens are kept at Ilia State University, Tbilisi, Georgia.

Identifications of oribatid mites were made using keys of [6,7]. Soil nematodes were identified using [8, 9].

## Actual Materials

### Oribatid mites

1. *Achipteria longisetosa* Murvanidze & Weigmann, 2003 – Without exact locality (Murvanidze, 2004);
2. *Achipteria A. nitens* (Nicolet, 1855) - P2, P3, P4, P5, P6;
3. *Aleurodamaeus setosus* (Berlese, 1883) - P1, P3, P4, P5, P6;
4. *Aleurodamaeus setosus* (Berlese, 1883) - P1, P3, P4, P5, P6;
5. *Amerobelba decedens* Berlese, 1908 - MA;
6. *Amerus troisii* (Berlese, 1883) - P4, MAB, MF;
7. *Arthrodamaeus femoratus* (C. L. Koch, 1840) - P1, P3, P4, P5, P6;
8. *Camisia horrida* (Hermann, 1804) - P3;
9. *Carabodes femoralis* (Nicolet, 1855) - P1, P3, P5, P6;
10. *Ceratozetes colchica* Murvanidze & Weigmann, 2003 - Without exact locality (Murvanidze, 2004);
11. *Ceratozetes laticuspidatus* Menke, 1964 - Without exact locality (Murvanidze, 2004);
12. *Ceratoppia bipilis* (Hermann, 1804) - MA, P1, P2, P3, P4, P5;
13. *Ceratoppia quadridentata* (Haller, 1882) - P6;
14. *Chamobates caucasicus* Shaladybina, 1969 - MA, P3, P4, P5;
15. *Chamobates dentutorii* Shaladybina, 1969 - P3;
16. *Chamobates interpositus* Pschorn-Walcher, 1953 - P1, P2;
17. *Conchogneta dalecarlica* (Forsslund, 1947) - MAB, MA, P6;
18. *Conoppia palmicincta* (Michael, 1884) - P2;
19. *Ctenobelba pilosella* Jeleva 1962 - P1, P3;
20. *Cymbaeremaeus cymba* (Nicolet, 1855) - MF, MA, P1, P2, P3, P4, P5, P6;
21. *Damaeolus ornatissimus* Csiszar, 1962 - MAB, MF, MA, P3, P4, P5, P6;
22. *Dissorhina ornata* (Oudemans, 1900) - Without exact locality (Murvanidze, 2004);
23. *Dorycranosus splendens* (Coggi, 1898) - Without exact locality (Murvanidze, 2004);
24. *Eremobelba geographica* Berlese, 1908 - P1, P4, P5, P6;
25. *Eremulus flagellifer* Berlese, 1908 - P5;
26. *Eueremaeus oblongus* (C. L. Koch, 1835) - P1, P4;
27. *Eupelops torulosus* (C.L. Koch, 1839) - P1, P2, P5;
28. *Eupterotegus ornatissimus* (Berlese), 1908 - P1, P2, P3, P4;
29. *Galumna lanceata* Oudemans, 1900 - P2, P3;
30. *Galumna flagellata* Willmann, 1925 - Without exact locality (Murvanidze, 2004);

31. *Galumna obvia* (Berlese, 1915) - MAB;
32. *Gustavia microcephala* (Nicolet, 1855) - P1, P2, P5;
33. *Gymnodamaeus bicostatus* (C.L. Koch, 1836) - P1, P2, P5, P4;
34. *Hermannia gibba* (C. L. Koch, 1839) - MF;
35. *Hermanniella dolosa* Grandjean 1931 - MAB, MF, P3;
36. *Hermanniella multipora* Sitnikova, 1973 - P1, P2, P3, P5;
37. *Hermanniella punctulata* Berlese, 1908 - MA, P4, P5, P6;
38. *Hoplophthiracarus illinoisensis* (Ewing, 1909) - MAB, MA, P1, P3, P4, P6;
39. *Hydrozetes lacustris f. parisiensis* (Michael, 1882) - P1, P5;
40. *Liacarus breviamellatus* Mihelcic, 1955 - MAB, P3, P4, P6;
41. *Liacarus coracinus* (Koch, 1840) - MAB, P5, P6, P1, P2, P3, P4;
42. *Liacarus subterraneus* (Koch, 1844) - P3, P6;
43. *Liacarus xylariae* (Schränk, 1803) - P3, P5;
44. *Licnobelba alestenensis* Grandjean, 1931 - P3, P4;
45. *Licnodamaeus pulcherrimus* (Paoli, 1908) - P4, P5;
46. *Licnodamaeus undulates* (Paoli, 1908) - P1, P3;
47. *Liebstadia longior* (Berlese, 1908) - P3, P5;
48. *Malaconothrus pygmaeus* Aoki, 1969 - Without exact locality (Murvanidze, 2004);
49. *Mesoplophora caucasica* Krivolutsky, 1975 - P2;
50. *Mesoplophora michaeliana* Berlese, 1904 - P5;
51. *Metabelba italic* (Sellnick, 1931) - Without exact locality (Murvanidze, 2004);
52. *Metabelba filippovae* Bulanova-Zachvatkina, 1965 - MAB;
53. *Metabelba pulverulenta* (C. L. Koch, 1840) - MF, MA;
54. *Microppia minus longisetosa* (Paoli, 1908) - P2;
55. *Microzetes causicus* (Krivolutsky, 1967) - MF;
56. *Minunthozetes pseudofusiger* (Schweizer, 1922) - P2, P3, P4;
57. *Nanhermannia nana* (Nicolet, 1855) - MAB;
58. *Neoliodes (Liodes) theleproctus* (Hermann, 1804) - P1;
59. *Nothrus silvestris* Nicolet, 1855 - MA;
60. *Oppia nitens* C.L. Koch, 1836 - P1, P3;
61. *Oppia tuberculata* (Bulanova-Zachvatkina 1964) - P2;
62. *Oppiella maritima* (Willmann, 1928) - P2;
63. *Oppiella nova* (Oudemans, 1902) - P2, P5;
64. *Oppiella subpectinata* (Oudemans, 1900) - MAB, MF, MA, P3, P4, P5, P6;
65. *Oribatella calcarata* (C.L. Koch, 1835) - P6;
66. *Oribatella colchica* Krivolutsky, 1974 - P3;
67. *Oribatella foliata* Krivolutsky, 1974 - P3;
68. *Oribatella pallida* Banks, 1906 - Without exact locality (Murvanidze, 2004);
69. *Oribatula tibialis* (Nicolet, 1855) - MAB, MF, MA, P1, P4, P5;
70. *Oxioppioides decipiens* (Paoli, 1908) - P6;
71. *Parachipteria georgica* Murvanidze & Weigmann, 2003 - MAB, MF, MA, P1, P2, P3;
72. *Parachipteria nicoleti* (Berlese, 1883) - Without exact locality (Murvanidze, 2004);
73. *Parachipteria punctata* (Nicolet, 1855) - P1;

74. *Phauloppia pilosa* (C.L. Koch, 1841) - P2;
75. *Phthiracarus (P.) boresetosus* Jacot, 1930 - P1;
76. *Phthiracarus laevigatus* (C. L. Koch, 1844) - P1, P2;
77. *Platynothrhus peltifer* (C. L. Koch, 1839) - MAB, MA, P3;
78. *Protoribates capucinus* (Berlese, 1908) - Without exact locality (Murvanidze, 2004);
79. *Punctoribates punctum* (Koch, 1839) - MAB, MF, P2, P5, P6;
80. *Quadroppia monstrosa* Hammer, 1979 - P5;
81. *Ramusella insculpta* (Paoli, 1908) - P1, P5;
82. *Rhyzotritia ardua* (C. L. Koch, 1841) - P1, P2;
83. *St.(Tropacarus) pulcherrimus* (Berlese, 1887) - Without exact locality (Murvanidze, 2004);
84. *Scheloribates laevigatus* (C. L. Koch, 1835) - MAB, MA, P1, P2, P3, P5, P6;
85. *Scheloribates latipes* (C. L. Koch, 1844) - MAB, P4, P5, P6;
86. *Scutovertex minutus* (C.L. Koch, 1836) - P3;
87. *Sphaerozetes piriformis* (Nicolett, 1885) - P2, P3;
88. *Steganacarus carinatus* (C. L. Koch, 1841) - P1, P2, P6;
89. *Steganacarus magnus anomala* (Berlese, 1883) - MAB, MF, P1, P3;
90. *Steganacarus pulcherrimus* (Berlese, 1887) - P5;
91. *Suctobelba trigona* (Michael, 1888) - P2, P5;
92. *Suctobelbella acutidens* (Forsslund, 1941) - P3;
93. *Suctobelbella subcornigera* (Forsslund, 1941) - MAB;
94. *Tectocephus velatus velatus* (Michael, 1880) - MAB, MF, P1, P2, P3, P4, P5, P6;
95. *Tectocephus velatus sarekensis* (Trägårdh, 1910) - Without exact locality (Murvanidze, 2004);
96. *Trichoribates novus* (Sellnick, 1928) - Without exact locality (Murvanidze, 2004);
97. *Xenillus discrepans* Grandjean, 1936 - MAB, P4, P5, P6;
98. *Xenillus tegeocranus* (Hermann, 1804) - MAB, P1, P2, P3, P5;
99. *Zetorchestes micronychus* (Berlese, 1883) - P2, P3, P5;
100. *Zygoribatula exilis* (Nicolet, 1855) - MA, P1, P2, P3, P4, P6;

### Nematodes

1. *Aporcelaimus* sp. - MT1, MC, P1, P3;
2. *Aporcelaimellus* sp. - MT1, MF, MC, MR, MAB, KK, KK2, KK3, KK4, KK5, KK6, P1, P3, P4, P5, P6, Q1, Q2, Q3, Q4, Q5, Q6;
3. *Aporcelaimellus obtusicaudatus* (Bastian, 1865) Altherr, 1968 - MF, MC, KK, KK3, KK4, KK5, KK6, P2, P3, P4, P5, P6, Q1, Q3, Q4;
4. *Aporcelaimellus obscurus* (Thorne et Swanger, 1936) Heyns, 1965 - MA;
5. *Aporcelaimellus capitatus* (Thorne et Swange, 1936) Heyns, 1965 - KK3;
6. *Aporcelaimellus krigeri* (Ditlevsen, 1928), Heyns, 1965 - MAB, P4, Q4;
7. *Aporcelaimellus stilus* (Kirjanova, 1951) Andrassy, 1986 - P2;
8. *Axonchium* sp. - Q1;
9. *Clarcus papillatus* (Bastian, 1865) Jairajpuri, 1970 - MT1, MA, KK4, KK6, P5;
10. *Mononchus* sp. - MT1, MR, MAB, KK2, KK4, P1, P5, Q1, Q2, Q3, Q4;
11. *Mezodorylaimus* sp. - MT1, MR, MA, KK, KK2, P1, P2, Q4;
12. *Mezodorylaimus bastiani* (Biitshli, 1873) Andrassy, 1959 - MA;

13. *Longidorus* sp. - MC, MR;
14. *Tylenchus* sp. - MC, MR, KK, KK5, KK6, Q3, Q4;
15. *Tylencholaimus* sp. - MR, MA;
16. *Prionchulus muscorum* (Dujardin, 1845) Wu et Hoeppli, 1929 - MA;
17. *Prionchulus* sp. - MAB;
18. *Rhabditis* sp. - MA, KK, KK4, KK6, P2, P4, P5, Q1, Q2;
19. *Eudorylaimus* sp. - MAB, KK4, KK6, P3, P4, P5, Q1, Q3, Q4, Q5.

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### ზოლოგია

## ორიბატიდა ტკიპებისა და ნემატოდების ბიომრავალფეროვნება მაჭახელას ეროვნულ პარკში

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(წარმოდგენილია აკადემიის წევრის დ. მიქელაძის მიერ)

მაჭახელას ეროვნული პარკი შეიქმნა 2012 წელს, მისი შექმნის მთავარ მიზანს უნიკალური ბიოლოგიური და ლანდშაფტური მრავალფეროვნების შენარჩუნება და კოლხური ტყეებით შექმნილი ეკოსისტემების გრძელვადიანი დაცვა წარმოადგენს. პარკის ტერიტორიის 95% ტყით და გაუვალი ბუჩქნარით არის დაფარული. უხერხემლო ცხოველები ფართოდ არიან გავრცელებული როგორც მიწისზედა, ისე მიწისქვეშა ეკოსისტემებში და მნიშვნელოვანი ადგილი უკავიათ ეკოსისტემების ფუნქციონირებაში. ორიბატიდები ერთ-ერთი წამყვანი ჯგუფია ნიადაგის ართროპოდებს შორის როგორც რიცხოვნობის, ისე ბიომასის მხრივ. ისინი მნიშვნელოვან გავლენას ახდენენ ეკოსისტემებში მცენარეული ნარჩენების დაშლაზე და აქტიურად მონაწილეობენ ნიადაგწარმომქმნელ პროცესებში. ნემატოდებიდან ცნობილია თავისუფლადმცხოვრები და პარაზიტული ფორმები. პარაზიტულები იწვევენ მცენარეების ორგანოების დაზიანებას, ხოლო თავისუფლადმცხოვრები ნემატოდები მნიშვნელოვან როლს ასრულებენ ნიადაგის ფორმირების პროცესში. სტატიაში წარმოდგენილია პირველადი მონაცემები ორიბატიდების და ნემატოდების გავრცელების შესახებ მაჭახელას ეროვნულ პარკსა და მის შემოგარენში, მასალის მოპოვების კოორდინატები და მცენარეული საფარის აღწერილობა, რაც მეტად ღირებული მონაცემებია საქართველოს ბიომრავალფეროვნების კვლევის საკითხში.

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