ADDITIONAL DATA ON RARE VERTIGINIDAE (MOLLUSCA: GASTROPODA) IN LITHUANIA

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Introduction

Realizing the seriousness of the problem, that many conservation managers, policy makers, or local communities cannot access the biodiversity data they need for informed decision-making on natural resource management (Stephenson & Stengel, 2020), we present data on rare Vertiginidae, listed under Annex II of the Habitats and Species Directive [92/43/EEC], sites found in 2021, supplementing them with unpublished data from previous years.

Three years have passed since the contract by the Lithuanian Fund for Nature with the State Service for Protected Areas under the Ministry of Environment of the Republic of Lithuania No. F4-2018-219 (2018 December 21st) concerning the provision of an inventory and reporting service on a species of Geyer`s whorl snail (*Vertigo geyeri* Lindholm, 1925) was signed and the inventory was started. These studies have been carried out by the Ministry of Environment of the Republic of Lithuania implementing the LIFE Integrated Project "Optimization of Natura 2000 Network Management in Lithuania" No. LIFE16IPE/LT/016 (LIFE-IP PAF-NATURALIT), funded by the European Union for the Environment and Climate Policy Program (LIFE).

In 2019 and 2020, during this inventory, *V. geyeri* was found in 46 localities, of which 43 were new records for Lithuania (Skujienė *et al.,* 2019; 2020). Other Vertiginidae listed under Annex II of the Habitats and Species Directive [92/43/EEC], such as Narrow-mouthed whorl snail (*Vertigo angustior* Jeffreys, 1830) and Desmoulin's whorl snail (*Vertigo moulinsiana* (Dupuy, 1849)), were found in some places during the same study. The 2020 article (Skujienė *et al.,* 2020) announced newly found sites: 23 localities for *V. angustior* and 8 localities for *V. moulinsiana* – all of them were new records for Lithuania.

Since only the data of *V. geyeri* sites were published in the 2019 article (Skujienė *et. al.*, 2019), we present the data for all rare Vertiginidae species found in Lithuania in 2021 and add the data of *V. angustior* and *V. moulinsiana* found in 2019.

Material and Methods

The inventory was approved by the Lithuanian Environment Protection Agency Permission on snail collecting and study (No. 51, 23 08 2019 and No. (26)-SR-101, 13 05 2021). All data have been entered to the Lithuanian Information system of protected species (SRIS) till the end of November, 2021. All collected material is deposited in the

Zoological Museum of Vilnius University.

In total, 39 localities from Kelmė, Mažeikiai, Plungė, Skuodas, Švenčionys, Trakai, Telšiai, Vilnius districts were studied from June to August of 2019 and 20 localities from Alytus, Kazlų Rūda, Kretinga, Lazdijai, Prienai, Radviliškis, Rietavas, Šiauliai, Šilalė, Utena, Varėna, Zarasai districts from August to October of 2021.

Each locality was surveyed according to a standardised monitoring protocol (Moorkens & Killeen, 2011), adapted for Lithuanian conditions. This protocol included assessment of area of occupancy and type of habitat, survey and sampling (0.25 x 0.25 x 0.05 m^3) along linear transects or spot plots, and laboratory analysis of molluscan species (*V. geyeri* and other) from 1–10 (generally 3–5) samples taken from each locality. Field surveys in Lithuania included habitat assessment and data collection using QField – the mobile GIS app, followed by sieving and identification of mollusc species in the laboratory, and adding all information to the QGIS project stored on the server at the State Service for Protected Areas under the Ministry of Environment. Identification of species was based on morphological characteristics of adult shells (Kerney *et al.,* 1983). Individuals were divided into adults and juveniles based on shell development. The snail was considered an adult when the aperture was fully developed (Pokryszko, 1990).

List of localities

No. Locality	Administrative district	Coordinates (LAT, LONG)
1. Didžiulis lake mire	Trakai distr.	54.680048, 25.036915
2. Šilėnai mire	Vilnius distr.	54.733033, 25.030703
3. Bražuolė river mire, near Gratiškės	Trakai distr.	54.715683, 24.881933
4. Bražuolė river mire, near Strazdiškės	Trakai distr.	54.697146, 24.886263
5. Bražuolė river mire, near Vilūniškiai	Trakai distr.	54.751099, 24.868002
6. Levonys mire	Vilnius distr.	55.001986, 25.427188
7. Smirdėlė mire	Kelmė distr.	55.796981, 23.020853
8. Sydeklis lake mire	Telšiai distr.	55.865562, 22.357832
9. Dabeikiai mire	Radviliškis distr.	55.610143, 23.341210
10. Daubėnai mire	Kretinga distr.	55.983562, 21.265180
11. Sauslaukis mire	Šilalė distr.	55.531117, 21.899035
12. Near Metelytė	Lazdijai distr.	54.326148, 23.662464
13. Matuizos mire	Varėna distr.	54.246987, 24.866819
14. Musteika mire	Varėna distr.	53.955091, 24.401679
15. Liepakojai mire	Alytus distr.	54.472847, 23.674510
16. Baluošas lake mire	Utena distr.	55.399110, 26.055980
17. Čiaunas lake mire	Zarasai distr.	55.781540, 25.881891
18. Smalvykštis mire	Zarasai distr.	55.622458, 26.353216
19. Tartokas mire	Prienai distr.	54.655400, 23.975028

Results

In 2019, during inventory three Vertiginidae species listed under Annex II of the Habitats and Species Directive [92/43/EEC] were found: *V. geyeri* – in 23 localities (Skujienė *et. al.*, 2019), *V. angustior* – in 5 localities (Fig. 1, No 1-4, 7) and *V.*

moulinsiana – in 7 localities (Fig. 3, No 1-5, 6, 8). All localities are new records for these species in Lithuania. Although 4 localities overlap for *V. moulinsiana* and *V. angustior* (Fig.1-3, No 1-4) and are quite close to each other compared to other sites, no trends have been seen in the analysis of habitat type – both have been found in three habitats types – 7230 *Alkaline fens*, 7140 *Transition mires and quaking bogs* and 7160 *Fennoscandian mineral-rich springs and springfens*.

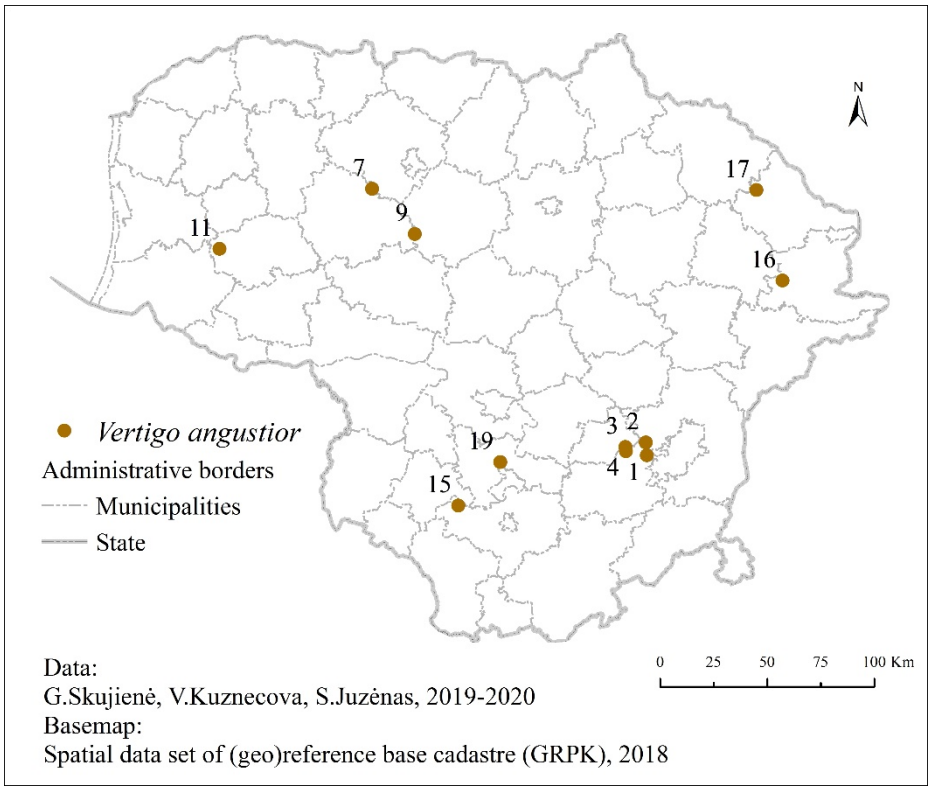

Figure 1. Distribution of 10 localities where *Vertigo angustior* Jeffreys, 1830 was found during inventory in 2019 and 2021. More detailed information on numbers is provided in the List of localities and description of specimens.

In 2021, during inventory the same species were found: *V. geyeri* – in 8 localities (Fig. 2,), *V. angustior* – in 6 localities (Fig. 1, No 9, 11, 15-17, 19) and *V. moulinsiana* – in 1 locality (Fig. 3, No 12). Even 5 localities (Fig. 1-2, No 9, 11, 15, 16, 17) overlaped for *V. geyeri* and *V. angustior* and both species were found in 7140 or 7230 habitats types. Although 6450 *Northern Boreal alluvial meadows* habitats were not selected for study, several malacological samples were taken near Metelytė (Fig. 3-4) while the botanist assessed the habitat, that it is not 7140, but – 6450. *V. moulinsiana* visibly crawled on plants, as shown in the Figure 4. This random location most likely reveals the most potential *V. moulinsiana* habitats in Lithuania, which should be the focus of future inventories of this species.

All localities are new records for Lithuania.

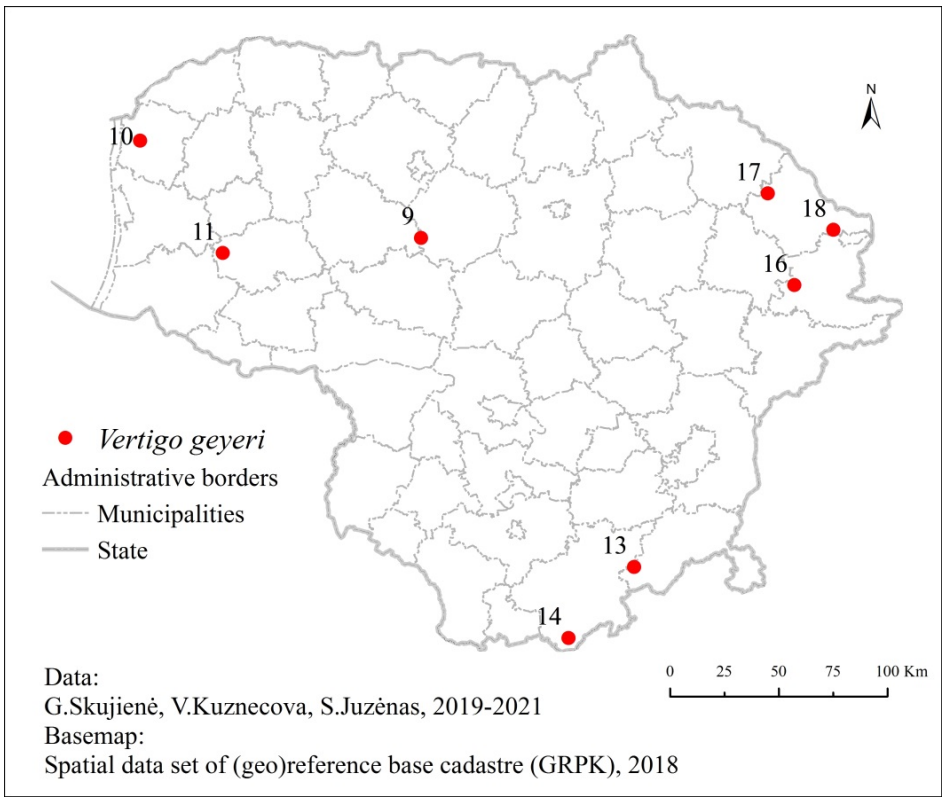

Figure 2. Distribution of 8 localities where *Vertigo geyeri* Lindholm, 1925 was found during inventory in 2021. More detailed information on numbers is provided in the List of localities and description of specimens.

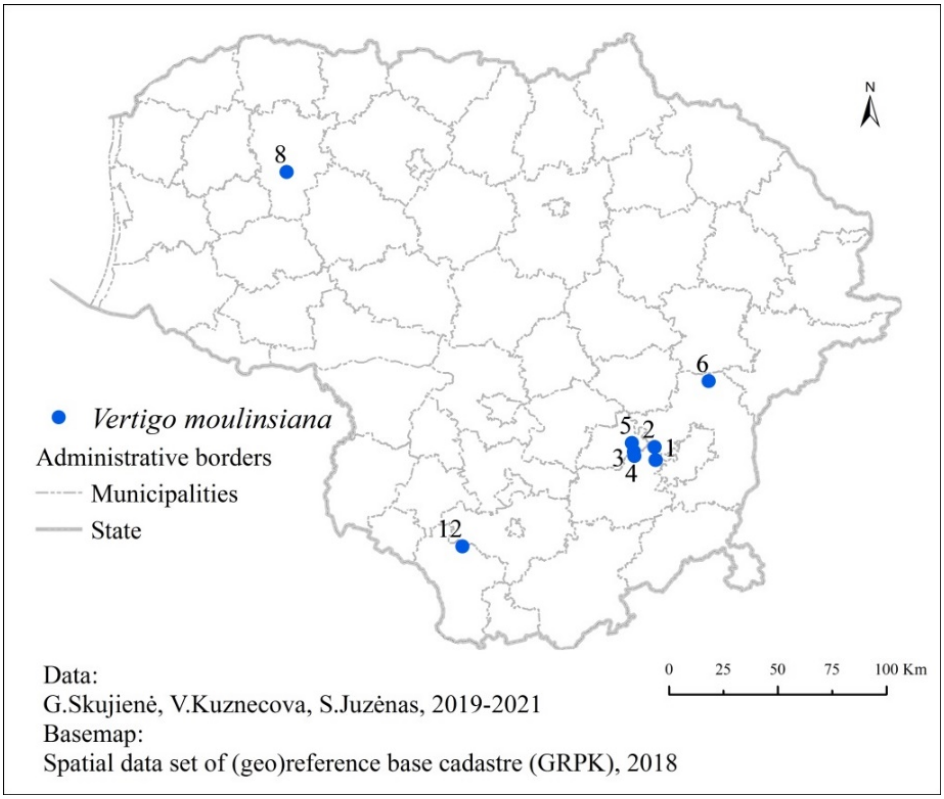

Figure 3. Distribution of 8 localities where *Vertigo moulinsiana* (Dupuy, 1849) was found during inventory in 2019 and 2021. More detailed information on numbers is provided in the List of localities and description of specimens.

Figure 4. *V. moulinsiana* crawling on *Typha latifolia* L. in alluvial meadow near Metelytė, Lazdijai district. Photograph by S. Juzėnas.

List of species

***Vertigo angustior* Jeffreys, 1830 (Fig. 1)**

1. Didžiulis lake mire, 7230 habitat, 26 06 2019, 5 samples, 11 ad., area of occupancy 0.11 ha.
2. Šilėnai mire, 7230 habitat, 04 07 2019, 7 samples, 9 ad., area of occupancy 2.03 ha.
3. Bražuolė river mire, near Gratiškės, 7140 habitat, 26 06 2019, 04 07 2019, 9 samples, 4 ad., area of occupancy 0.90 ha.
4. Bražuolė river mire, near Strazdiškės, the complex of 7140 and 7160 habitats, 04 07 2019, 3 samples, 5 ad., area of occupancy 0.01 ha.
7. Smirdėlė mire, 7140 habitat, 23 08 2019, 3 samples, 1 ad., area of occupancy 0.01 ha.
9. Dabeikiai mire, 7230 habitat, 03 08 2021, 5 samples, 13 ad., 6 juv., area of occupancy 1.18 ha.
11. Sauslaukis mire, 7140 habitat, 04 08 2021, 5 samples, 19 ad., 11 juv., area of occupancy 0.05 ha.
15. Liepakojai mire, wet meadow bordering the 7140 habitat, 15 08 2021, 7 samples, 28 ad., 23 juv., area of occupancy 0.01 ha.
16. Baluošas lake mire, 7230 habitat, 16 08 2021, 3 samples, 10 ad., area of occupancy 0.71 ha.
17. Čiaunas lake mire, 7230 habitat, 16 08 2021, 4 samples, 4 ad., 2 juv., area of occupancy 0.29 ha.
19. Tartokas mire, 7230 habitat, 09 10 2021, 4 samples, 20 ad., 2 juv., area of occupancy 7.93 ha.

***Vertigo geyeri* Lindholm, 1925 (Fig. 2)**

9. Dabeikiai mire, the complex of 7140 and 7230 habitats, 03 08 2021, 5 samples, 16 ad., area of occupancy 3.86 ha.
10. Daubėnai mire, 7230 habitat, 03 08 2021, 2 samples, 6 ad., area of occupancy 0.01 ha.
11. Sauslaukis mire, 7140 habitat, 04 08 2021, 5 samples, 19 ad., 34 juv., area of occupancy 0.53 ha.
13. Matuizos mire, 7140 habitat, 15 08 2021, 3 samples, 2 ad., area of occupancy 0.29 ha.
14. Musteika mire, 7140 habitat, 15 08 2021, 2 samples, 4 ad., 4 juv., area of occupancy 2.04 ha.
16. Baluošas lake mire, 7230 habitat, 16 08 2021, 3 samples, 4 ad., 2 juv., area of occupancy 0.50 ha.
17. Čiaunas lake mire, 7230 habitat, 16 08 2021, 4 samples, 2 ad., area of occupancy 0.29 ha.
18. Smalvykštis mire, the complex of 7230 and 7140 habitats, 16 08 2021, 6 samples, 20 ad., 10 juv., area of occupancy 39.14 ha.

***Vertigo moulinsiana* (Dupuy, 1849) (Fig. 3,4)**

1. Didžiulis lake mire, 7230 habitat, 26 06 2019, 5 samples, 40 ad., 11 juv., area of occupancy 0.11 ha.
2. Šilėnai mire, 7230 habitat, 04 07 2019, 7 samples, 7 ad., area of occupancy 0.65 ha.
3. Bražuolė river mire, near Gratiškės, 7140 habitat, 26 06 2019, 04 07 2019, 9 samples, 4 ad., area of occupancy 0.90 ha.
4. Bražuolė river mire, near Strazdiškės, the complex of 7140 and 7160 habitats, 04 07 2019, 3 samples, 46 ad., 4 juv., area of occupancy 0.90 ha.
5. Bražuolė river mire, near Vilūniškiai, 7140 habitat, 04 07 2019, 3 samples, 8 ad., 1 juv., area of occupancy 0.51 ha.
6. Levonys mire, 7140 habitat, 24 07 2019, 5 samples, 15 ad., 12 juv., area of occupancy 0.92 ha.
8. Sydeklis lake mire, the complex of 7140 and 7230 habitats, 24 08 2019, 5 samples, 1 ad., 1 juv., area of occupancy 0.01 ha.
12. Near Metelytė, 6450 habitat, 12 08 2021, 2 samples, 75 ad., 38 juv., area of occupancy 0.29 ha.

Discussion

Our research was focused on the inventory of *V. geyeri* in the most probable habitats for this species in Lithuania: 7230 *Alkaline fens* and 7140 *Transition mires and quaking bogs*. Because the sites were selected cartographically (based on Lithuania Habitat data), only after arrival it became clear, what is the type of the habitat in reality. If the habitat was similar to that suitable for Vertiginidae molluscs, investigations were conducted. The best indicator of habitat suitability was the detection of *Carex lepidocarpa*, *Eleocharis quinqueflora, Eriophorum latifolium* and mosses – *Campylium stellatum*, *Drepanocladus revolvens.* Some rare and protected plants as *Carex buxbaumii*, *Cladium mariscus, Liparis loeselii, Pinguicula vulgaris*, *Primula farinosa, Sesleria caerulea*,

Shoenus ferrugineus, *Swertia perennis* were important additional indicators of suitable habitats.

The natural mosaic nature of the habitat plants and the different levels of humidity have in many cases led to the discovery of several species of snails of EU importance, like in other countries (Vavrová *et al.*, 2009). After such targeted searches it is not surprising that the number of sites has increased significantly and it is clear that there are more such sites in Lithuania, as not all potential sites could be explored within three years. We hope that the success of these studies should encourage Regional Park ecologists and biologists to be more attentive and responsible in studies of Vertiginidae in the nearest mires.

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Papildomi duomenys apie retus Vertiginidae (Mollusca: Gastropoda) Lietuvoje

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Santrauka

2021 metais ištyrus 20 potencialiai tinkamų *V. geyeri* rūšiai teritorijų Alytaus, Kazlų Rūdos, Kretingos, Lazdijų, Prienų, Radviliškio, Rietavo, Šiaulių, Šilalės, Varėnos, Utenos ir Zarasų rajonuose, tik 8-iose iš jų buvo rasta *V. geyeri,* 6-iose – *V. angustior* ir tik 1-oje – *V. moulinsiana*. Kadangi po 2019 metų tyrimų buvo publikuotos tik *V. geyeri* radimvietės (Skujienė *et al.,* 2019), čia pateikiami duomenys ne tik apie 2021 metais rastų retų Vertiginidae radimvietes, bet ir apie ankstesniame straipsnyje nepaskelbtas 2019 metais rastų *V. moulinsiana* ir *V. angustior* radimvietes.

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