The paper presents data on the ecological and phytocoenotic conditions of habitats of the *G. conopsea* (L.) R. Br. orchid in the Northeast of European Russia (Komi Republic, Russia). The data include characteristics of the populations of this species on the northern border of its range (size and ontogenetic structure of the populations, density of specimens, phenology), as well as information demonstrating the genetic variability of the species by ISSR-markers that was not included in the main publication. The data presented here supplement our earlier published results O.E.Valuyskikh et al., 2019 and are useful for more detailed analysis of population biology and genetic variability of this rare orchid species. *G. conopsea* is the species of terrestrial orchids widespread in Europe and Asia and characterized by the widest ecological-cenotic amplitude and occurrence in different types of ecotopes. The size of *G. conopsea* populations in different parts of its range is usually small, 25–100 ind. but sometimes increases to 200–1000 ind. Hansen et al., 1999 to Travnichek et al., 2012. In the many regions of the Russian Federation, the *G. conopsea* are subject to protection due to the small number of habitats, long stages of ontogenesis, low population sizes and anthropogenic impact. The complex of *G. conopsea* s.l. included in the Red Data Book of the Komi Republic Taskaev, 2009.

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1. Data

The paper presents data supplementing our study of the morphological variability and genetic diversity of G. conopsea populations in the North-East of European Russia [1]. The fragrant orchid G. conopsea growing in the Komi Republic, near its northern distribution limit, where it occurs mainly on limestone outcrops in river valleys [7]. A comparative analysis of cenopopulations from different parts of the range has shown that their structure is often independent of geographic location but is determined mainly by ecocenotic conditions in habitats [2–6]. The obtained data reflects the ecological and coenotic conditions of the habitats of this species in the middle taiga subzone on limestone outcrops of the Timan Ridge (9 populations) and on the Mezen-Vychegda Plain (1 population). A brief description of the communities where the species can be found is provided in Table 1. It should be noted that species with arctic, arctic-alpine and subarctic types of habitats grow on the “cold” slopes, whereas forest steppe and pine forest species grow on the “warm” slopes. Such qualitative parameters of G. conopsea populations as size, density, shares of specimens at different ontogenetic stages, restoration index are provided in Table 1. The G. conopsea populations located in different ecotopes have different dates of beginning of phenological phases, e.g. blooming (Fig. 1).

The primary matrix of informative ISSR loci for 200 samples from 10 G. conopsea populations using two pairs of primers is shown in Table 2. An analysis of the genetic structure of the samples under study performed by the method of discriminant analysis of principal components (DAPC) made it possible to
**Table 1**

Sample collection sites and characteristics of *G. conopsea* populations.

| No  | Code of the population | Location | Ecologic-cenotic conditions | Coordinates | Characteristics of the populations |
|-----|------------------------|----------|------------------------------|-------------|-------------------------------------|
| 1   | N1 South Timan, left bank of the Soiva River. Middle part of the northwestern slope, inclination 40°–45°. | Spruce open stoneberry–moss forest. The crown density is 0.2–0.3. The tree layer consists of *Betula pendula* Roth, *Pinus sylvestris* L. The grasses and dwarf shrubs (total projective cover 25%) are dominated by *Rubus saxatilis* L., *Vaccinium uliginosum* L., *Saussurea alpina* (L.) DC., *Dryas octopetala* L., *Tephrospermum integrifolium* (L.) Holub, *Persicaria vivipara* (L.) Ronse Decr., etc. The mossy-lichen cover makes 45–50%. | 62°44'995" 55°50'468" 161 m a.s.l. | >1000 2005 6.6 18.4 31 32.7 2.0 15.8 5.33 2006 5.1 23.5 41.2 15.68 0 19.6 4.10 2007 15.9 11.2 40.5 28.1 2.2 18.0 4.56 2016 9.7 35.5 34.3 18.3 1.2 10.7 8.4 |
| 2   | L2 South Timan, left bank of the Soiva River. Low floodplain in the river valley. | Lady's mantle-herb meadow. The total projective cover (TPC) makes 85–95%. The grassy cover includes *Trollius europaeus* L., *Briza media* L., *Sanguisorba officinalis* L., *Persicaria vivipara* (L.) Ronse Decr., *Geranium sylvaticum* L., *Dactylorhiza fuchsii* (Druce) Soó, *Alchemilla sp.*, etc. *G. conopsea* is a co-dominant. Green mosses and lichens take 3–4%. | 62°45'129" 55°50'292" 136 m a.s.l. | 200–300 2005 4.5 11.8 5.8 15.7 7.8 58.8 0.70 2006 6.8 2.9 23.5 29.4 13.2 30.8 2.24 2007 10.4 8.6 19.2 16.3 6.7 49.0 1.04 2016 8.9 5.4 10.7 21.4 7.1 55.4 0.8 |
| 3   | M3 South Timan, left bank of the Soiva River. Low floodplain in the river valley at the foot of the slope. | Herb-grass meadow. The TPC is 80–90%. The grassy layer is dominated by *Anthoxanthum odoratum* L., *Trollius europaeus* L., *Elymus caninus* (L.) L., *Filipendula ulmaria* (L.) Maxim., *Sanguisorba officinalis* L., *Stellaria holostea* L., *Lathyrus pratensis* L., *Antennaria dioica* (L.) Gaertn., *G. conopsea*, etc. The mossy-lichen cover (MLC) is less than 10%. | 62°44'880" 55°49'490" 135 m a.s.l. | 200–300 2005 6.2 10.8 24.3 6.1 53.5 0.68 2006 10.4 5.8 20.2 47.2 7.7 19.2 4.20 2007 7.3 1.3 4.0 5.3 12.0 77.3 0.29 2016 8.2 2.8 8.5 11.3 2.8 74.7 0.3 |
| 4   | S4 South Timan, left bank of the Soiva River. Middle part of the southern slope, inclination 45°–50°. | Birch open forest. The crown density is 0.2. Shrubs are represented by *Spiraea media* Schmidt. The TPC of grasses and dwarf shrubs is 25–30% dominated by | 62°44'768" 55°49'036" 150 m a.s.l. | >500 2005 5.4 7.9 33.7 17.6 16.1 24.6 2.78 2006 11.3 6.2 33.8 31.8 9.7 18.6 4.38 2007 8.9 19.2 41.3 28.4 5.5 5.5 17.2 2016 7.6 13.9 25.4 34.8 10.5 15.3 5.1 |

(continued on next page)
Table 1 (continued)

| No Code of the population | Location | Ecologic-cenotic conditions | Coordinates | Characteristics of the populations |
|---------------------------|----------|-----------------------------|-------------|-----------------------------------|
|                           |          |                             |             | No Card of the population*         |
|                           |          |                             |             | Location                           |
|                           |          |                             |             | Ecologic-cenotic conditions        |
|                           |          |                             |             | Coordinates                        |
|                           |          |                             |             | Characteristics of the populations |
|                           |          |                             |             | Number, units                      |
|                           |          |                             |             | Study year                         |
|                           |          |                             |             | Density, inds./m²                  |
|                           |          |                             |             | Ontogenetic spectrum, %            |
|                           |          |                             |             | ln 1                              |
|                           |          |                             |             | ln 2                              |
|                           |          |                             |             | ln j                              |
|                           |          |                             |             | ln im                             |

1. Rubus saxatilis, Festuca ovina L., Aster alpinus L., Lathyrus vernus (L.) Bernh. Встречаются Thymus talijejvii Klokov & Des.-Shost., Epipactis atrorubens (Hoffm.) Besser, Dendranthema zawadskii (Herbich) Tzvel., Adonis sibirica Patrin ex Ledeb., Melica nutans L, etc. The MLC makes 45% and includes Hylocomium splendens (Hedw.) Schimp., Pleurozium schreberi (Willd. ex Brid.) Mitt., etc.

2. Pinus sylvestris, Picea obovata, Betula pendula after-growth. Shrubs are represented by Juniperus communis L. The TPC of grasses and dwarf shrubs is 5 – 20% with abundant Arctostaphylos uva-ursi (L.) Spreng., Festuca ovina, Vaccinium uliginosum. ПеKe Dryas octopetala, Valeriana capitate Pall. ex Link., T. talijejvii, Asplenium viride Huds, G. conopsea, etc. The MLC (TPC 80%) includes Hylocomium splendens, Pleurozium schreberi, Cladonia sp., Cladina sp.

3. Floodplain grass-herb meadow. The TPC 62°45'534" is 60 – 70%. The grass stand counts 33 species dominated by Lathyrus pratensis L., Galium boreale L., G. conopsea, Carex flava L., Trifolium pratense L., Ligularia sibirica (L.) Cass., etc. The MLC is well-developed (TPC 30%) and normally consists of green mosses.

4. Spruce-pine open forest. The crown density is 0.1. There are young trees of Picea obovata, Pinus sylvestris, Betula pendula. The projective cover of shrubs makes 5% and includes Juniperus communis, Lonicera pallassii Ledeb., Salix

| No Code of the population | Location | Ecologic-cenotic conditions | Coordinates | Characteristics of the populations |
|---------------------------|----------|-----------------------------|-------------|-----------------------------------|
|                           |          |                             |             | No Card of the population*         |
|                           |          |                             |             | Location                           |
|                           |          |                             |             | Ecologic-cenotic conditions        |
|                           |          |                             |             | Coordinates                        |
|                           |          |                             |             | Characteristics of the populations |
|                           |          |                             |             | Number, units                      |
|                           |          |                             |             | Study year                         |
|                           |          |                             |             | Density, inds./m²                  |
|                           |          |                             |             | Ontogenetic spectrum, %            |
|                           |          |                             |             | ln 1                              |
|                           |          |                             |             | ln 2                              |
|                           |          |                             |             | ln j                              |
|                           |          |                             |             | ln im                             |

5. South Timan, right bank of the Soiva River. Middle part of the northern slope, inclination 45°.

6. South Timan, left bank of the Omra River. Low floodplain in the river valley at the foot of the slope.

7. South Timan, right bank of the Omra River. Middle part of the northern slope, inclination 40° – 45°.
South Timan, left bank of the Omra River. Middle part of the southwestern slope, inclination 30°.

Spruce grass-lichen-moss open forest. The crown density is 0.1. The tree layer holds Pinus sylvestris, Betula pendula. The projective cover of shrubs makes 5% including Juniperus communis, Lonicera pallasii. The layer of grasses and dwarf shrubs with the TPC of 20–25% is dominated by Carex glacialis. The MLC (TPC 60%) is dominated by Hylocomium splendens, Pleurozium schreberi, Cladonia sp., Cladina sp., Peltigera sp., etc.

South Timan, left bank of the Omra River. Upper part of the southwestern slope, large fragmental debris, inclination 40°.

Single Pinus sylvestris trees. Young trees are Picea obovata, Betula pendula, Salix sp. The layer of grasses and dwarf shrubs (TPC 15–20%) is dominated by Vaccinium uliginosum, Dryas octopetala, Arctous alpina, Dendranthema zawadskii, Campanula rotundifolia L., Parnassia palustris L., G. conopsea, Arctostaphylos uva-ursi, etc. The MLC makes 35–40%.

Mezen-Vychegda Plain. Marshy spruce bogbean-sedge-hypnum sphagnum forest. The sparse underwood consists of Salix myrsinifolia Salisb., Betula pubescens Ehrh. The well-developed grassy layer (TPC 80%) is dominated by Carex cespitosa L., Carex rostrata Stokes, Equisetum palustre L., Persicaria bistorta, Caltha palustris L., Parnassia palustris L. The MLC is well-developed (TPC 30%) and normally includes sphagnum mosses (Sphagnum capillifolium (Ehrh.) Hedw., Sphagnum cuspidatum Ehrh. ex Hoffm.).

Note: Populations from the slopes of the northern and northwestern exposure (N1, N5, N7), southern and southwestern exposure (S4, S8, S9), meadows in the river valleys (M2, M3, M6) of the South Timan, and marshy forests from the Mezen-Vychegda Plain (MF10) are described. Keys: In — restoration index.
group the sample selections according to their ecotopes (Fig. 2). Fig. 3 shows the graph of dependence of Delta K on K (K is a hypothetical number of isolated genetic groups in the sample selection under study) that is used to assess the population structure with the Structure 2.3 program [8,9].

The program allows estimating the genetic structure of populations and the probability of finding each individual as part of a cluster K within which the deviation from Hardy–Weinberg equilibrium would be minimal. The most probable K value (the hypothetical number of isolated genetic groups in the studied sample) was determined by the method proposed in the study of G. Evanno et al. [10]. For a numerical evaluation of the homogeneity (convergence) of the results obtained at independent Structure startups, the CLUMPP version 1.1.2b program [[11], http://clumpak.tau.ac.il/] was used. The obtained graphs (constructed with the DISTRUCT version 1.1 program, https://web.stanford.edu/group/rosenberglab/distruct.html) show the probable population structure for 10 Structure replicates using 200 specimens from 10 to 9 G. conopsea populations (Figs. 4 and 5, respectively).

2. Experimental design, Materials, and Methods

Samples were collected in natural G. conopsea populations (2005–2007, 2016) in the North-East of European Russia in different orographic regions: the South Timan Ridge and Mezen-Vychegda Plain. The studied South Timan populations were located in several types of karst landscapes: on the northern and north-western slopes, on the southern and south-western slopes, as well as on the flattened surfaces in the river valleys (Fig. 6). The names of vascular plants are given according to The Plant List (http://www.theplantlist.org/). The plant communities were cut into transects which were divided into counting sites of 1 m² in size with registration of specimens at different ontogenetic stages (j, im, v1, v2, g). The sites were arranged linearly along a transect 20–30 m long or in parallel as adjacent strips 8–10 m long.

When identifying ontogenetic stages, we used the concept of discrete description of ontogenesis while taking into account the characteristics of individual development of G. conopsea [5,12]. Plants classified as juvenile (j) have a single middle leaf 2.7–13.5 cm long and 0.1–0.6 cm wide. The belowground sphere of such plants is diverse and may be represented by a protocorm alone, a protocorm and the first thickened adventitious root, or one or two adventitious roots and a root-stem tuberoid with several cordlike endings (lobes). The main diagnostic character for attributing a plant to the immature (im) group is the presence of two middle leaves 4.5–16 cm long and 0.2–0.9 cm wide.

![Fig. 1. The share of blooming G. conopsea plants in populations on the slopes with limestone outcrops of different orientations.](image1.png)
Fig. 2. The dispersion diagram plotted from the results of the discriminant analysis of principal components (DAPC) of the matrix of ISSR loci of *G. conopsea* populations (PC = 30): 1 – populations from northern slopes (N1, N5, N7), 2 – populations from southern slopes (S4, S8, S9), 3 - populations from meadows (M2, M3, M6), 4 - population from a boggy forest from the Mezen-Vychegda Plain (MF10).
Such plants usually have a root-stem tuberoid with two to four lobes and two to four adventitious roots (rarely, only one root). Our criterion for the virginile ontogenetic state is readiness for blooming in the next year, which is characteristic of plants with three to five or six assimilating leaves. We distinguish them into two subgroups, taking into account morphological adaptations of the species to a wide range of ecological conditions in the study region. The “young” vegetative subgroup ($v_1$) comprises plants with three assimilating leaves, tuberoid with two to six lobes, and three to six adventitious roots. The leaves are 5.5–15.5 cm long and 0.3–1.2 cm wide, with 5–9 (11) veins. Plants of the “adult” vegetative subgroup ($v_2$) have four to six leaves, tuberoid with three to nine lobes, and four to eight adventitious roots. The leaves are 6.3–16.5 cm long and 0.4–1.3 cm wide, with 5–10 veins. Generative ($g$) plants have a 13.5–51.5 cm tall shoot with 3–6 middle leaves and 3–10 adventitious roots.

The counting unit was a specimen of seed origin. For each population, we determined the number of specimens (units), the mean density of plants (spec./m²), the share of specimens at different developmental stages (%), and restoration index presenting the ratio of young specimens to adult ones. The studies of genetic diversity and structure of 200 samples from 10 $G. \ conopsea$ populations were carried out at the Center for Collective Use “Molecular Biology” of the Institute of Biology of the Komi Scientific Center of the Ural Division of the Russian Academy of Sciences (Syktyvkar). The detailed methodology is described in the work [1].
Fig. 4. Results of cluster analysis of composition of ISSR loci of *G. conopsea* obtained with the Structure program for all 10 populations using the “admixture” model. The numbers on the X-axis indicate the numbers of populations (see Table 1).
Fig. 5. Results of cluster analysis of composition of ISSR-loci of G. conopsea obtained with the Structure program for 9 populations using the "admixture" model. The numbers on the X-axis indicate the numbers of populations (see Table 1).
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Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104161.

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