Spread, growth and bush structure of *Empetrum nigrum* L. in the Kuršių Nerija spit

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In 1995–1998 the spread, growth and bush structure of *Empetrum nigrum* L. were studied in different ecological zones of the Kuršių Nerija spit. The highest cover percentage of *Empetrum nigrum* was observed on a plain palve – 75% on an average. It grew poorer on a waterlogged palve making a cover of 50%. The cover by *Empetrum nigrum* on the eastern slope of the foredune up to the top reached 65%. Only single patches of *Empetrum nigrum* were found on the parabolic dune, making an average cover of 40%. The biometric parameters of *Empetrum nigrum* in different ecological zones differed slightly. The height of bushes and the length of shoots were found to increase with the distance from seaside.

Key words: *Empetrum nigrum,* spread, cover, growth, bush, ecological zone, spit, Kuršių Nerija, palve, dune

INTRODUCTION

The Kuršių Nerija spit is not only an attractive recreational place of our country, but it is interesting also from a scientific point of view. A specific landscape of this narrow strip of land intervening between the waters of the Baltic Sea and Kuršių Marios Lagoon has been formed by man since the middle of the 19th century. It contains of a sea beach with a foredune, a plain palve overgrown with various grasses, which turns gradually into a forest palve, then elevates and turns into a dune ridge [1]. Works on dune fixation, revegetation, and conservation were resumed after World War II [2, 3] and proceeded later [4–6].

The variety of the Kuršių Nerija plants is predetermined by the specific geographic and climatic conditions of the spit [7, 8]. The flora of Kuršių Nerija was studied by numerous scientists [9–11], but the succession of natural vegetation, the need for evaluation of its state and conservation imply observation of the processes taking place in the flora of Kuršių Nerija [12]. The endangered species *Eryngium maritimum* L. has been studied extensively and the recommendations for its conservation have been prepared [13], while *Empetrum nigrum* L., a widespread species in all ecological zones of the spit and one of the plants growing on drifting dunes, is studied rather poorly. Only a few references are known on its underground part – rhizome [14].

The purpose of this work was to study the distribution, growth and bush structure of *Empetrum nigrum* L. in different ecological zones of the Kuršių Nerija spit.

MATERIALS AND METHODS

Empetrum nigrum L. (fam. *Empetraceae*) was studied in 1995–1998 in the vicinities of Juodkrantė, the central part of the Lithuanian Kuršių Nerija spit, in different ecological zones: on the foredune, plain and waterlogged palve and on the parabolic dune. Descriptions of habitats were made according to Braun-Blanquet [15]. Height of bushes, length of shoots, and number of berries per branch were determined. Data were processed with MS EXCEL and MATHCAD software.

RESULTS AND DISCUSSION

Empetrum nigrum L. is a widespread species in Kuršių Nerija, and it grows closest to the Baltic Sea among all bush species. It occurs on a plain palve frequently and grows on a waterlogged palve and foredune as well while only patches of it are found on the parabolic dune. There is no need to analyse the descriptions of the vegetation of different ecological zones, because they are already published [12].

The foredune is formed of a drifting and poorly fixed light-coloured sand [10], where the *Ammophiletum* communities of grasses are establishing. *Empetrum nigrum* L. grows on the eastern slope of the foredune and sometimes on the top of dunes by patches (0.8; 1.6; 6.0; 24 m^2) with an average cover

of 65% (Fig. 1). The height of bushes of *Empetrum nigrum* L. is 7.5 ± 0.9 to 15.3 ± 2.0 cm, the length of shoots is 2.3 ± 0.9 cm on the top and 5.8 ± ± 1.4 cm on the slope of dunes. Bushes of *Empetrum nigrum* L. growing on the dune ridge are slightly branched and produce shoots of the first order only. In this ecological zone, usually 38 ± 18 stems of *Empetrum nigrum* L. grow per 1 m^2. They yield quite poorly, bearing 1–2 berries per branch on an average.

The soil of the plain palve is soddy poorly to intermediately podzolic gleyic coarse-grained sand [10]. That is a common type of soils in Kuršių Nerija, and it is often located closer to the sea [1]. The lichens and liverworts predominate in this ecological zone [9]. Sand is fixed by the plant communities of *Festuca glauca, Corynephorus canescens*, and *Thymus serpylum* [10]. In the plain palve, an initial formation of thickets of *Empetrum nigrum* L. could be observed, where 1 to 3 stems grow on small plots (0.01–0.10 m^2). However, some larger patches of *Empetrum nigrum* L. could be found covering 1.6; 3; 7; 9; 12; 14; 20 m^2, and sometimes even 47 m^2. The number of stems averages to 160 ± 50 per 1 m^2, and the cover amounts to 75% (Fig. 1). The height of bushes of *Empetrum nigrum* L. reaches 11.2 ± 1.5 cm on the plain palve and even more (23.3 ± 2.1 cm) in the vicinity of the low *Pinus sylvestris* plants. The length of shoots also depends on the site of growth and reaches 2.0 ± 0.8 to 7.7 ± ± 1.8 cm, respectively (Fig. 2). *Empetrum nigrum* L. produces shoots up to the second order and yields quite poorly – only 2.0 ± 1.0 berries per branch.

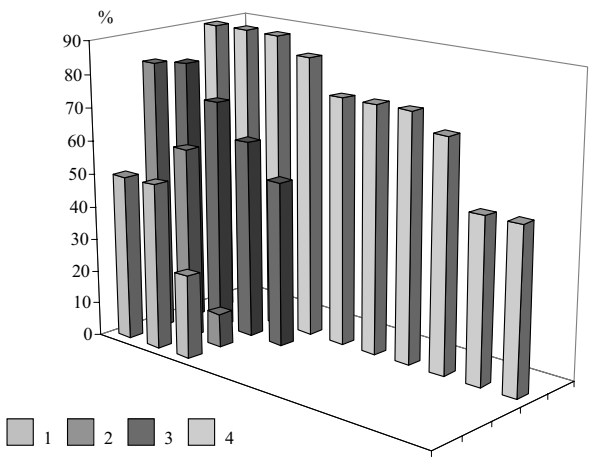

Fig. 1. The cover of *Empetrum nigrum* in different ecologic zones: *1* – parabolic dune, *2* – waterlogged palve, *3* – foredune, *4* – plane palve

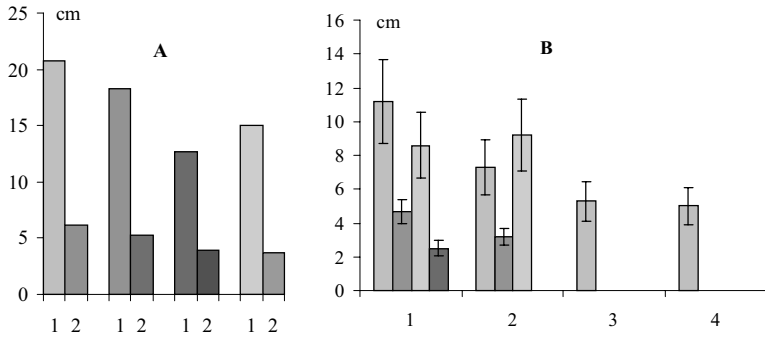

Fig. 2. The structure of *Empetrum nigrum* shrubs in different ecological zones. A: *1* – the height of shrubs, *2* – the average length of branches; B – the length of branches of different order: *1* – branches of first order, *2* – of second order, 3 – of third order, *4* – of fourth order. The ecological zones as in Fig. 1

And only on areas near *Pinus sylvestris* some higher yields could be observed – 5 ± 3 berries per branch.

The soil of the waterlogged palve differs insignificantly from that of the plain palve, but the high groundwater level often makes the direct influence on soil formation [10]. The plant cover in this ecological zone is made of single trees, bushes and mesophyllic grasses [10]. *Empetrum nigrum* L. in the waterlogged palve grows poorer, making thickets of 7 to 12 m^2 in size with an average cover of 50 % (Fig. 1), the height of bushes reaches 20.4 ± 2.7 cm and the length of shoots is 6.0 ± 3.0 cm (Fig. 2, A). Bushes of *Empetrum nigrum* produce branches up to the second order (Fig. 2, B). In this ecological zone, 88 ± 13 to 141 ± 23 stems of the species occur per 1 m^2. Fruiting is better here – 3.8 ± 1.4 berries per branch.

The parabolic dune is formed of light podzolic sand [10]. In this ecological zone more plants characteristic of forest communities are found [12]. On the parabolic dune only single patches of *Empetrum nigrum* L. are found, with an average cover of 40% (Fig. 1). Height of bushes reaches 23.3 ± 2.1 cm, and shoots grow up to 8.4 ± 1.5 cm on an average (Fig. 2, A). Although *Empetrum nigrum* L. occurs on the parabolic dune most rarely, it is the highest as well as the most branched plant one here, producing branches of up to the fourth order (Fig. 2, B). The number of *Empetrum nigrum* L. stems is not high here (68 ± 11 stems per 1 m^2). Not all patches of *Empetrum nigrum* bear yield, producing 4 ± ± 2 berries per branch.

On the continental part of Lithuania, *Empetrum nigrum* L. grows usually in raised bogs and sometimes is found in pinewoods. In Kuršių Nerija this plant is suitable for dune fixation and depositing of drifting sand, because it is adapted to grow in different ecological zones. At the same time it makes an attractive dark-green accent in the landscape predominated by the greyish seaside vegetation.

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EMPETRUM NIGRUM L. PAPLITIMAS, AUGIMAS IR KRŪMOKŠNIO STUKTŪRA KURŠIŲ NERIJOJE

S a n t r a u k a

1995–1998 metais ištirtas varnauogės (*Empetrum nigrum* L.) paplitimas, augimas ir krūmokšnio struktūra Kuršių nerijos ekologinėse juostose. Nustatyta, kad didžiausias padengimas varnauogėmis pastebėtas lyguminėje palvėje (vidutinis padengimas 75%), užpelkėjusioje palvėje jos auga silpniau (vidutinis padengimas 50%), ant apsauginio pajūrio kopagūbrio rytinio šlaito iki jo viršaus padengimas siekia iki 65%, o ant parabolinės kopos pasitaiko tik atskiri varnauogių ploteliai (vidutinis padengimas 40%). Krūmokšnių biometriniai rodikliai skirtingose augimvietėse skiriasi mažai. Pastebėta, kad tolstant nuo jūros varnauogių krūmokšnių aukštis ir ūglių ilgis kiek didėja.

Raktažodžiai: varnauogė (*Empetrum nigrum* L.), paplitimas, padengimas, augimas, krūmokšnis, ekologinė juosta, palvė