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Note

First record of vivipary in a species of the genus *Sesleria* (*Poaceae*)

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ABSTRACT: We report the occurrence of rootless plantlets in the inflorescence of *Sesleria robusta* Schott, Nyman & Kotschy. cultivated in the Botanical garden "Jevremovac" in Belgrade, Serbia. We assumed it was pseudo-vivipary that had most probably been induced by unfavourable conditions during a flowering that had occurred several months after the normal flowering time. To the best of our knowledge, this is the first record of vivipary *sensu lato* in a *Sesleria* species.

Key words: vivipary, induced pseudo-vivipary, *Poaceae*, *Sesleria*

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Vivipary in flowering plants is defined as the precocious and continuous growth of the offspring when still attached to the maternal parent (Goebel 1905; Arber 1965; Font Quer 1993). Two main types may be distinguished: true vivipary and pseudo-vivipary. Furthermore, some authors recognize a subcategory designated as "induced pseudo-vivipary" (Clay 1986; Philipson 1935; Nygren 1949; Wycherley 1953).

True vivipary refers to the development of sexual offspring; the embryo grows to a considerable size before dispersal. In circumstances of this kind the developing zygote lacks, at a certain period, maternal tissues that mediate its relationship with the environment (Elmqvist & Cox 1996). Viviparous plants are important constituents of the vegetation in areas of Mediterranean and semi-arid climates, in mangroves, though vivipary is also a well-known feature of arctic and alpine vegetation caused by the severity of these regions (Lee & Harmer 1980).

Pseudo-vivipary refers to plants that produce apomictic or asexual propagules such as bulbils or plantlets in an inflorescence, instead of seeds. All other parts of the plant appear normal (Elmqvist & Cox 1996). The phenomenon is known from over 100 species of grasses (*Poaceae*) worldwide (Beetle 1980, Vega & Rúgolo de Agrasar 2006). Plantlets are able to photosynthesize at any stage of their development (Lee & Harmer 1980), and after detaching from the parent plant and following dispersal, may root and establish more rapidly in a short growing season than seeds (Harmer & Lee 1978).

Pseudo-vivipary also occurs in arctic, alpine and arid areas, characterized by large spatial and temporal heterogeneity. In many species it is a constant feature, but it may also be induced in plants by exposure to short-day treatment, or as a result of parasite attack (Philipson 1935, Nygren 1949, Wycherley 1953). There are suggestions that pseudo-vivipary results from hybridization and subsequent sterility (Flovik 1938). Some grasses growing in temperate habitats occasionally show proliferated spikelets as a response to unfavorable conditions during a casual flowering that may occur several months after normal flowering time (Martínez Crovetto 1944, 1945, 1947).

Proliferated pseudoviviparous spikelets have been recorded throughout the *Poaceae* in species of the following genera: *Agrostis* L., *Arrhenatherum* P. Beauv., *Briza* L., *Bromus* L., *Cynosurus* L., *Dactylis* L., *Deschampsia* P.

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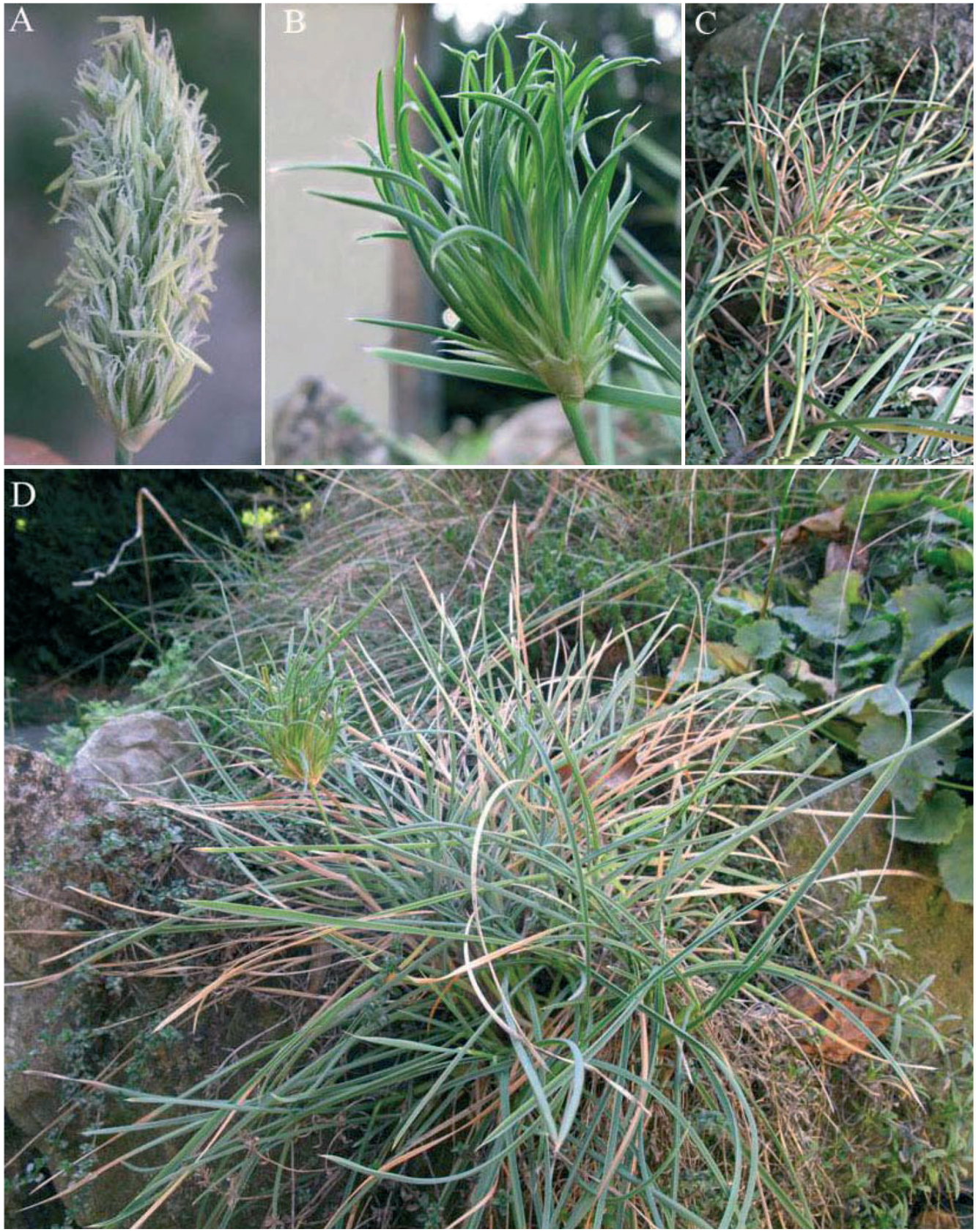

Figure 1. *Sesleria robusta* Schott, Nyman & Kotschy. cultivated in the Botanical garden "Jevremovac" in Belgrade, Serbia. a – First regular flowering (26th April 2007); b, c – The inflorescence with plantlets (b-21st September 2010, c-10th December 2011); d – Total plant (16th November 2010). Photo: D. Lakušić

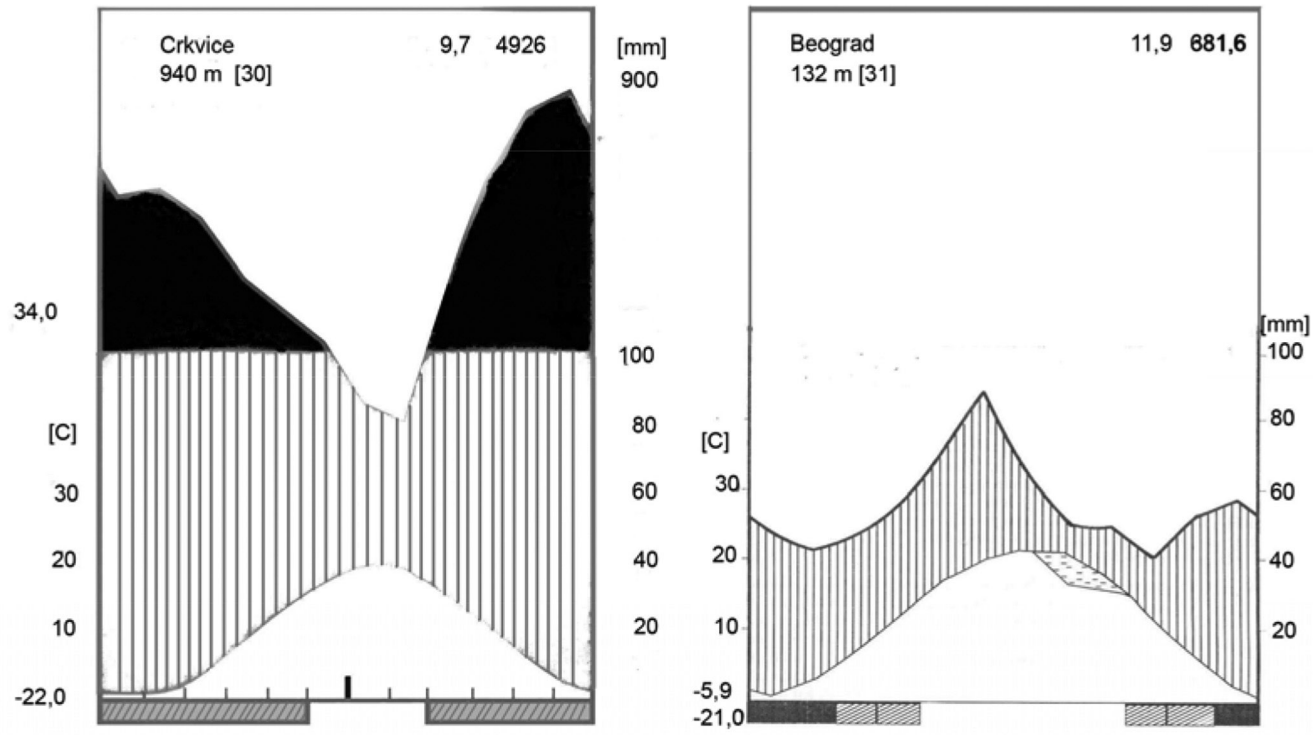

Figure 2. Climadiagrams (according Walter & Leith 1964) of natural habitat in Mt. Orjen (Crkvice) and in the Botanical garden "Jevremovac" in Belgrade

Beauv., *Digitaria* Haller, *Eleusine* Gaertn., *Eragrostis* Wolf, *Festuca* L., *Ichnanthus* P. Beauv., *Koeleria* Pers., *Lolium* L., *Melica* L., *Panicum* L., *Paspalum* L., *Phleum* L., *Poa* L., *Sorghum* Moench , *Trisetum* Pers. (Vega & Rúgolo de Agrasar 2006).

While working on enrichment of the living-plant collection in the Botanical garden "Jevremovac", *Sesleria robusta* was brought from the locality Orjenske lokve at Mt. Orjen in Montenegro. Plant material was collected on 11th October 2005 by V. Stevanović and D. Lakušić, and the turfs were planted two days after collecting (13th October), in soil brought together with seedlings from natural habitats from Orjen. *S. robusta* is registered under Coll. No. 251.

The first regular flowering was observed during April 2007 (Fig. 1 a – 26th April 2007).

Five years after transferring, at the end of August 2010 we observed that the inflorescence had proliferated, producing plantlets (Fig 1 b, d). The plantlets were rootless, as in many other grasses produced by pseudo-vivipary.

This last flowering came about several months after the regular flowering that occurs in natural populations. The inflorescence was still immature at that time, so we suppose that the plantlets had developed asexually, and that this pseudo-vivipary was induced by late flowering. Based on our previous knowledge, this is the first record of vivipary *sensu lato* in a *Sesleria* species.

The next year (2011), approximately at the same time, in September, we noticed again that *S. robusta* had an inflorescence with plantlets (Fig 1 c). This flowering also occurred later than normal flowering in a natural population. All seven spikelets that developed on the plant were with plantlets. Some of them developed small roots while they were still attached to the parent plant.

S. robusta was planted in the soil that was brought from its natural habitat, in an area of rocky ground with carbonates, so regarding the geological substrate there were no significant changes in habitat conditions However, significant differences were present in the climatic conditions of Belgrade and Orjen (Fig 2).

S. robusta was brought from Orjen that is part of the Dinaric Mediterranean limestone mountain range which extends in a NW-SE direction in Bosnia and Herzegovina and Montenegro. It is in a perhumid Mediterranean-subMediterranean mountain climate (type V *sensu* Walther & Leith 1964, type 1.2 *sensu* Stevanović & Stevanović 1995). A particularity of the littoral Dinarids is its precipitation regime, as Orjen receives Europe's most heavy precipitation (Crkvice - over 5000 mm). A major disadvantage is that the water infiltrates quickly into the porous rocks, so an overall dryness is characteristic. In Orjen, *S. robusta* occurs in vegetation of high mountain

pastures and rocky crevices.

The type of climate in Belgrade is a transitional subcontinental-semiarid continental climate (type VI 2b/VII *sensu* Walther & Leith 1964, type 2.2/3.1 *sensu* Stevanović & Stevanović 1995), and is determined by its geographical position. Belgrade lies on the border of the Pannonian Plane, so particularly during winter it is influenced by a continental climate from the north and north-east, and this continental influence is strengthened with the dry wind Košava. Frost occurs during winters, while the summers are semi-arid. A decrease of insolation is also present, since Belgrade has the climate typical for big cities.

Thus, we can presume that living in very different climate conditions could induce the occurrence of late flowering, that together with other specific ecological conditions that are present in the town centre of Belgrade where the Botanical garden "Jevremovac" is situated, could induce the occurrence of pseudo-vivipary in this species.

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REZIME

Prva zabeležena viviparija kod vrste roda *Sesleria* (*Poaceae*)

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Saopštavamo pojavljivanje viviparnih biljčica bez korena u klasu *Sesleria robusta* Schott, Nyman & Kotschy. kultivisanoj u Botaničkoj bašti „Jevremovac“ u Beogradu, Srbiji. Pretpostavljamo da je pseudo-viviparija u pitanju, koja je najverovatnije indukovana nepovoljnim uslovima tokom cvetanja koje se javilo nekoliko meseci kasnije od normalnog vremena cvetanja. Na osnovu našeg dosadašnjeg znanja ovo je prvo beleženje viviparije, u širem smislu te reči, kod jedne vrste roda *Sesleria.*

Ključne reči: viviparija, indukovana pseudo-viviparija, *Poaceae*, *Sesleria*