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## ***Plantago cornuti* Gouan, a rare halophyte: sites from Transylvanian Depression (Romania)**

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**Abstract.** This paper is a brief summary on the rare halophile species *Plantago cornuti* Gouan's populations in the Transylvanian Depression (Romania). In this work were listed and characterized a number of sites across the Transylvanian Depression, where *Plantago cornuti* Gouan vegetate. Data were obtained on the physical characteristics of species and chemical composition of soils that are good for species's development. There are also mentioned the countries of Europe in which was reported the presence of this species.

**Key words:** *Plantago cornuti* Gouan, rare halophilic species, Transylvanian Depression.

**Résumé.** Ce travail représente une courte synthèse sur les populations de l'espèce halophile rare *Plantago cornuti* Gouan sur le territoire du Transilvania (Romania). Dans le cadre de ce travail nous avons énuméré et caractérisé quelques sites dans la Plateau de Transylvanie où végète *Plantago cornuti* Gouan. Nous avons obtenu des informations sur les caractéristiques physiques de cette espèce et le component chimique de terre qui sont propre pour le développement de cette espèce. De plus, nous avons mentionné les pays Européennes dans les quels est signalé la présence de cette espèce.

**Mots clés:** *Plantago cornuti* Gouan, plantes halophiles rares, Plateau de Transylvanie.

**Rezumat.** Această lucrare reprezintă o scurtă sinteză asupra populațiilor speciei halofile rare *Plantago cornuti* Gouan de pe teritoriul Depresiunii Transilvanie (Romania). În cadrul acestei lucrări s-au enumerat și caracterizat câteva dintre siturile de pe cuprinsul Depresiunii Transilvanie, în care vegetează *Plantago cornuti* Gouan. Au fost obținute date privind caracteristicile fizice ale speciei în cauză și compoziția chimică a solurilor care sunt propice pentru dezvoltarea acestei specii. De asemenea, sunt menționate țările din Europa în care este semnalată prezența acestei specii.

**Cuvinte cheie:** *Plantago cornuti* Gouan, plante halofile rare, Depresiunea Transilvanie

### **1. Introduction**

The Transylvanian Depression phytocenoses are the most outstanding and endangered ecosystems that contain also the rarest and the most extinction prone species (due to the human activity) from the flora of this region (Bădărău 2005).

*Plantago cornuti* is a rare halophilic species present in the Transylvanian Depression. It was characterized as an halophile but it prefers soils with high humidity and medium salinization (Bădărău 2005).

The name "Gouan" from *Plantago cornuti* Gouan is after the French naturalist and biologist Antoine Gouan.

*Plantago* is one of the largest genera of the *Plantaginaceae*, with about 200 species, and is probably the most widely distributed genus (Albach et al 2005).

*Plantaginaceae* belongs to the *Scrophulariaceae* family, according to Erdtman (1952), or, more recently, to *Plantaginaceae* Juss., also named plantain family (Olmstead 2003).

*Plantago* is often segregated into three genera: *Littorella*, *Bougueria*, and *Plantago*. Recently was shown that *Bougueria* derived from within *Plantago* (Rønsted et al 2002).

Recent studies show that the adaptation mechanisms to different environmental conditions can consist in demographic senescence in natural populations of *Plantago*

(Roach et al 2009) or in phenotype plasticity and in their genetical differentiation (Hammad 2002).

The study on *Plantago* species in their natural environment were linked with the concomitant study of their ecology (Lacey et al 2003), interactions with bacteria, viruses and mycorrhizal fungi (Blaszkowski et al 2004; Roesti et al 2005), with pollutants, ozone (Tonneijck et al 2004) and saline stress (Koyro 2006).

## 2. *Plantago cornuti* Gouan physical features

*Plantago cornuti* is usually 30-50 cm tall, with fleshy short rhizomes. The leaves are succulent, coriaceous, papyraceous or fragile, elliptic or oblong elliptic, narrowed into long stalks (Fig. 1). They have 11-20 cm long and 4-8 cm wide lamina and it is irregularly dotted. Five to seven parallel veins, diverging in the wider part of the leaf, can be seen. Their petioles are 8-20 cm long, dilated at base (Săvulescu 1961).



Figure 1. *Plantago cornuti* Gouan

The flowers form on narrow ears, are erect, striped knit. They are polysymmetric. Although the space is narrow the bases of the flowers are loose. The stamens are yellow and the white styles are manifest.

Bracts are 1/3-1/2 of calyx length and are also distinct from the calyx. They are obtuse, broad rounded ovate, 1.5 mm long, glabrous, ciliolate with minimal upper edge with blackish wide hull.

Sepals are equal, round elliptical to elliptical, glabrous, wide and the edges with parchment. The corolla tube is a little out of the calyx (Săvulescu 1961).

The seeds are small, colored black-brown, are also ellipsoidal and reticulate dotted, and they measure 2-3 mm.

The leaves are thick with stomata. The petiole has 3 ridges and pericycle strongly undulated each bump marks a fascicule.

The root has a typical secondary structure. The rhizome contains a central cylinder with fasciculare aspect without sclereids (Ianovici 2009).

## 3. Soil preferred by *Plantago cornuti* Gouan

*Plantago cornuti* is characterized as an halophilic plant, but prefers soils with high humidity and low salinization (Bădărău 2005).

The areas where the species live in the Transilvanian Depression are called Soloncaceac and are common in the steppe and steppe zones, especially in the Pannonian Plain and the Transylvanian Plain on the slow leak valleys found in the vicinity of salt springs (Blaga 2008). This are form on the areas where mineralized groundwater stand on the surface for a long period of time. The higher is the mineralization of the groundwater and the lower is the depth of the pool formed, the higher will be the salinization of the new formed soil (Miclăuș 1991).

Figure 2 presents, as a drawing, the main plants that inhabit the most common saline soils, made by Bădărău. Referring to the species *Plantago cornuti*, Bădărău includes it in the "Plantagineto cornuti" category.

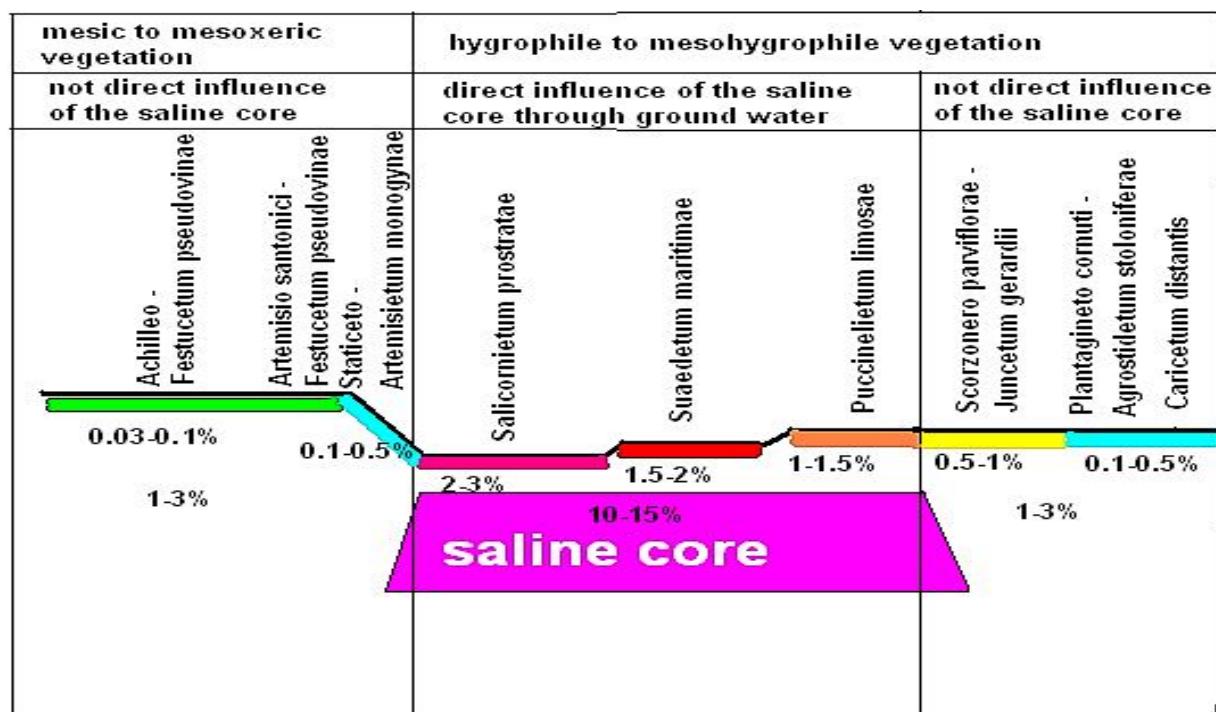


Figure 2. The microzonation of the halophilic vegetation in the Transylvanian Plain. The values from the upper row indicate the NaCl concentration in the first 15 cm of the soil and the ones from the lower row the concentration of NaCl at 1m depth.  
(Bădărău 2005).

#### 4. *Plantago cornuti* Gouan in the Transylvanian Depression

In the Transylvanian Depression, Bădărău (2005) speaks of *Plantago cornuti* as being found often in the Association *Plantagineto cornuti* – *Agrostidetum stoloniferae*. This being a very common association from the slightly saline floodplains.

Alec (2010) describes the presence of the species near the localities: Ploscoş, Valea Sărătă, Buneşti and Hăşdate. She also mentioned Moriştii and Valea Berteleag, areas where the species was found for the first time.

At Moriştii, the species can be found on salty soil called Soloncaceac. The population consists of two groups of individuals that present a high density (15 individuals on square meter) and another separate area with a lower density (3 individuals on square meter). At this location, *Plantago cornuti* lives in the associations *Juncetum gerardii* and *Bolboschoenetum maritime*. The site is preserved very well and the habitat is not deteriorated although in the near by area there were spotted randomly disposed wastes.

Berteleag's *Plantago cornuti* individuals are grouped into a compact population (5 individuals on square meter) and other individuals are living outside the main population area, 200 meters around and even further. The main soil type consists of cambic Chernozem. *P.cornuti* is found here in the next associations: *Triglochineto maritimae* – *Asteretum pannonicci*, *Scorzonero parviflorae* and *Juncetum gerardii*. Unfortunately the site is in a high degradation stage due to sheep overgrazing.

At Ploscoş site, the conditions are almost the same as Berteleag's site regarding the soil type and the main associations that the species can be found in. The main difference consists in size, the site is considerable bigger and the number of individuals is higher, and in the fact that this population is not exposed to grazing activities.

In the Hășdate Valley (Valea Hășdate), individuals of the species can be found all across the valley perimeter, with an high density in the valley bed. The main association types in which it grows are *Poëtum pratensis* and *Scorzonero parviflorae – Juncetum gerardii*. Here, *Plantago cornuti*, being away from human settlements, is well preserved, with no degradation of habitat.

Near Gherla town, at Bunești, *Plantago cornuti* can be found in a compact population accompanied by small groups of individuals. The species can be found in the three main associations mentioned earlier. The main threat consists into small areas occupied by waste disposed randomly by the villagers.

Bădărău (2005) mentions the presence of *Plantago cornuti*, in large numbers, near Cluj-Napoca at Someșeni. Unfortunately this site no longer exists, being destroyed when works at Cluj's detour belt started.

Other sites where it was spotted in Cluj County: Apahida, Someșeni, Dezmir, Boju, Cojocna, Valea Florilor, the Turda salt baths and near Dej.

## **5. *Plantago cornuti* Gouan in Europa and others sites in Romania**

The species of *Plantago* genus present and studied in Romania are the following: *Plantago altissima* L., *Plantago arenaria* Waldst. & Kit., *Plantago argentea* Chaix, *Plantago atrata* Hoppe, *Plantago cornuti* Gouan, *Plantago coronopus* L., *Plantago gentianoides* Sibth. & Sm., *Plantago holosteum* Scop., *Plantago lanceolata* L., *Plantago major* L., *Plantago maritima* L., *Plantago maxima* Juss. ex Jacq., *Plantago media* L., *Plantago schwarzenbergiana* Schur, *Plantago tenuiflora* (Tutin et al, 1964-1993; Ianovici, 2009).

*P. cornuti*'s areal extends from the coast of Bulgaria and Romania to the west coast In the central region it is found at the border between France and Italy, more specifically in the Ligurian Gulf (Bădărău 2005). Countries where the species exists across the Europe can be seen in Figure 3.

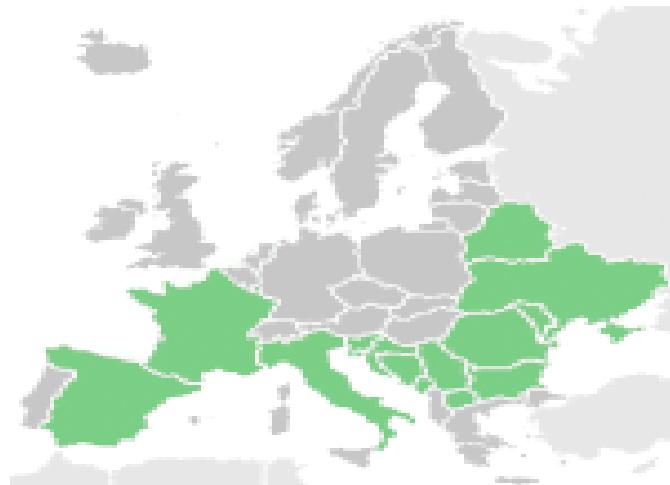


Figure 3. *Plantago cornuti* in Europe (\*)

*Plantago cornuti* can be found on a large areal in Romania, but it is formed out of small islands.

The populations found are situated mainly in the eastern part of Romania and in the Transylvanian Depression. In the first region mentioned, the population habitat is not so good preserved due to human activities.

The so called small islands of *Plantago cornuti* are threatened by extinction due to human activities and mainly to cattle overgrazing (Bădărău 2005).

Sites all over Romania, where *Plantago cornuti* was spotted: the sites mentioned from Cluj County, Ocna Mureș, Sovata, Lueta (near Odorhei), Brașov County, Sibiu County at Ocna Sibiu, Hunedoara County, Prahova County, in Buzău Mountains; in

Bucharest area (Cotorcea), in Dobrogea region (from Constanța to Mamaia, Techirghiol, Tuzla, Caraorman in the Danube Delta, Galați County, Bacău County (Târgu Ocna), Iași County (Chiriței pond, Mărzești, Cotnari, Hârlău) (Bădărău 2005).

## 6. Legislation regarding this species in Romania

We think that *Plantago cornuti* fits in Natura 2000's habitats at \*1530 - Pannonian salt steppes and marshes, due to the fact that is a rare halophilic plant, represented by a small number of individuals and with an areal formed of small islands.

Natura 2000 is the most known ecological network in Romania which consists of protected areas in the territory of the European Union and includes and protects the most seriously threatened habitats and species across Europe (\*\*).

Unfortunately, to this date there is no law (at the Romanian country level) that can protect the species *P. cornuti*. Also, until today, the species mentioned wasn't included in lists of ecological networks.

## 7. Conclusions

*Plantago cornuti* is a rare halophilic species of the Romania's flora. In spite of this, until today, there is no Romanian law to properly protect the species and also punish those who, with or without knowledge, are leading to its disappearance.

The number of individuals of the *Plantago cornuti* is low in all the sites mentioned. Such a number makes those populations very vulnerable to any changes coming from the natural environment and especially to an anthropical cause.

The main threats come from human activities, illegal random disposal of waste, mowing and from overgrazing.

For future preservation of the species, we think that *Plantago cornuti* should be included in Natura 2000's list at \*1530 - Pannonian salt steppes and marshes (\*\*\*, \*\*\*\*). Also, at country level, a law that will punish the ones who destroy the habitats of rare species is needed.

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- \*\* [http://www.coe.int/t/dg4/cultureheritage/nature/econetworks/default\\_en.asp](http://www.coe.int/t/dg4/cultureheritage/nature/econetworks/default_en.asp)
- \*\*\* <http://www.natura2000.ro/>
- \*\*\*\* <http://www.scribd.com/doc/36283190/Manual-de-Interpretare-a-Habitatelor>

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