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**HILPERTIA VELENOVSKYI (SCHIFFN.) ZANDER AND OTHER
POTTIOID MOSSES (*BRYOPHYTA*) NEW TO ROMANIA.
STUDIES ON THE CRYPTOGAMIC VEGETATION
OF LOESS CLIFFS, IX.**

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Abstract: *Hilpertia velenovskyi*, *Pterygoneurum compactum*, *P. squamosum* and *Crossidium laxefilamentosum* occur in the desertlike vegetation of vertical loess cliffs in Moldavia, Muntenia and in Oltenia. All of these species are new to the bryoflora of Romania. *Hilpertia* is a boreocontinental (Holarctic) xerophyte while the others were previously known only from the dry Mediterranean or Submediterranean areas of southern Spain, of Yugoslavia and of Hungary.

Introduction

Hilpertia velenovskyi was discovered in the Sv. Prokop Valley, in the SW outskirts of the Czech capital, during October 1890 by an amateur bryologist, Joseph Velenovský, professor in Phytopaleontology at the Czech University in Prague, and was described by his professional colleague Victor F. Schiffner [39] under the name of *Tortula velenovskyi*. Already Schiffner recognised and described in details the very special xeromorphic character of this moss: the protection of the assimilatory tissue consisting of densely chlorophyllose, thin walled lamina cells by the recurved and dorsally enrolled, water retaining leaf margin. This adaptation occurs only by a few other pottiaceous mosses, like by certain species of *Pseudocrossidium*. The special growth form and life strategy of this and other desert bryophytes was described much later by Frey *et al.* [10] and by Frey and Kürschner [13].

A half century passed until this rare species was found again in another locality; on the loess cliffs of the northern foothills of Bakony Mts. in Hungary [3]. This was followed by the discovery of the moss at typically loess cliff habitats of the Titel Plateau in northern Yugoslavia [1, 16] and from the Gerecse Mts. and other parts of northern Hungary [2, 4]. From the former Czechoslovakia (Moravia

and Slovakia) was reported by Pilous [35] and Peciar [33], then Waclawska [58], Kuc [22, 23], Karczmarz & Kuc [21] and others reported from many parts of southern and eastern Poland. Karczmarz [20] extended the known area to Ukrainian Podolia, down to Czernychow and Tarnopol. All these localities were found on loess cliffs, even the already extinct type locality near Prague was probably on loess although not stated straightforward so by Schiffner [39]. By the earlier authors the species was considered to be a Pannonian endemic in broad sense, although some of them [2, 3], predicted it's probably occurrence further to the east.

It was a great surprise when the species was discovered - first under the name of *Tortula scotteri* Zander & Steere [51], in the Northwest Territories of Canada, then in British Columbia [26, 27] and even in the arctic desert of Ellesmere Island in north eastern Canada [28]. In the meantime its eastern extension, predicted earlier by Boros, became also known, from Russia in Ciscaucasia, from the Ossetian Autonom Republic [44] and from Siberia [18], from China in Xinjiang and Quinghai Provinces at E edge of the Tibetan Plateau [41, 42, 43]. According to these authors, the species seems to be common in the dry, northern parts of China. Zander [49, 50] established for the two distinct and closely related *Tortula* species (*T. scotteri* and *T. velenovskyi*) the new genus *Hilpertia*, then Than & Zao [42] synonymised the two taxa under the name of *Hilpertia velenovskyi* (Schiffner) Zander and claimed the range of this monotypic genus to be northern boreal.

Unknown localities of *Hilpertia* were reported recently from more parts of Central Europe, as by Pócs [36], south and east Hungary), by Müller [30], Elbe valley in Saxony in south eastern Germany) and by Frahm [9], Rhine-Hessia, south western Germany). The latter is the westernmost occurrence of this continental xerophyte in Europe. The most recent map on the worldwide range of *Hilpertia* is supplied by Müller [30].

Pócs [36] reported from the loess cliffs of Hungary, along new records of *Hilpertia*, the occurrences of two newly described *Pterygoneurum* species. Both *Pterygoneurum compactum* Cano, Guerra & Ros [6] and *Pterygoneurum squamosum* Segarra & Kürschner [40] were described from the arid, semidesertic areas of south eastern Spain, supplying also a key in Spanish to all known European species. There they occur mainly on horizontal surfaces of calcareous, gypsum or on alkaline soils [38]. Their occurrence in the semiarid climate of Hungary, with 440-550 mm annual precipitation was explained by Pócs [36] taking in account the fact that on the near vertical loess cliffs the amount of precipitation is proportional to the cosinus of the degree of inclination. This fact practically means that on the near vertical cliffs desertic microclimate conditions prevail, at least concerning the amount of precipitation. A third *Pterygoneurum* species, *P. crossidioides* Frey, Herrnstadt & Kürschner [11], described from the Judean desert, was supposed also to occur, but this record needs confirmation, as the European specimens are not typical. *Crossidium crassinerve* (De Not.) Jur. was found on the loess cliffs of Hungary [14, 36]. Later even *Crossidium laxefilamentosum* Frey &

Kürschner (1987) [12], described from the Arabian desert, was discovered in Hungary, Yugoslavia, Romania and parallelly in Spain [37].

The vegetation of loess steppes and the semidesertic cliff edge community (*Agropyro cristatae-Kochietum prostratae* Zólyomi 1958) were thoroughly studied in the Pannonian Basin [53] and in the neighbouring countries, but the desert type cryptogamic vegetation of loess cliffs was hitherto quite neglected, except for their lichen communities [15, 16]. From a distance this type of bryophyte and lichen vegetation appears in the form of blackish grey patches on the near vertical, yellow cliff surface. In dry weather conditions the constituents of this desert like vegetation are hardly visible unless we irrigate the surface. In wet weather, after rains one can see much better the tiny, hardly 1-2 mm large moss plantlets, which usually occur in herds of individuals in a distance from each other, often partially sunk in the loess surface. The blackish gray colour is given to this type of vegetation mostly by the species of moss *Aloina* and by the lichen *Endocarpon pusillum*, which occur together with a number of other mosses (see later) and of lichens, for example with several species of *Caloplaca*, *Candelariella*, *Lecanora* and *Verrucaria* [15, 16]. To the mosses and lichens joins several Cyanobacteria (for example *Microcoleus vaginatus* and different *Nostoc* species) and green algae (most commonly *Chroococcum humicolum*) forming this cryptobiotic crust. Between the dark patches of this community there are very large naked surfaces with only scattered signs of life.

A research program to study the cryptogamic vegetation of loess cliffs in the Pannonian Basin was run by Tamás Pócs and Bernard Otto van Zanten, sponsored by OTKA (Hungarian National Research Fund) and by the MÖB (Hungarian Funding Committee) between 1997 and 2000. In 2000 H. Kürschner (Berlin, Dahlem) joined to this research, too, sponsored by DAAD (Deutsche Akademische Austauschdienst). They studied in details the cryptogamic flora and vegetation of Hungarian loess cliffs [36, 45, 46, 47]. The moss communities of loess cliffs in the Pannonian basin are described by Kürschner & Pócs [25]. Their life strategies were first analysed by Orbán [31]. They initiated also comparative studies of the loess cliffs in the neighbouring countries, in co-operation with the concerned colleagues in Yugoslavia, Bulgaria and Romania. In the case of Romania a mutual agreement was established between the Hungarian and Romanian Academies of Sciences to conduct joint research with the co-operation of the Faculty of Biology and Geology of the Babeş–Bolyai University (Cluj-Napoca, Romania) and the Research Group for Bryology of the Hungarian Academy of Sciences at the Eszterházy College (Eger). As the first result of this fruitful co-operation, in the autumn of 2000 a joint research trip was carried out with the participation of the authors of the present paper, kindly guided in Moldavia by Adrian Oprea from the part of the Botanical Garden of the University of Iaşi.

Based on the available geological records, we supposed that on the large loess plateau of the eastern lowland of Moldavia (Podișul Moldovei), along the major rivers there are loess cliffs with cryptogamic vegetation similar to that of the

Pannonian Basin and the neighbouring Ukrainian Podolia, with similar climatic conditions. Our expectation partly came true. While along the main stream and tributaries of the Siret River the loess cliff vegetation was really similarly rich to the Pannonian and Podolian ones, along the Prut the loess vegetation was very poor and atypical. The only nice exception in the latter case was the large loess cliff facing to Jijia stream, ENE of Iași. The reason of these differences is in the physical properties of loess. As Pócs [36] established, rich cryptogamic vegetation can develop only on fine grained (powdery, evenly distributed grain size of 20-50 μm), yellow loess of primary, aeolic origin. Coarse grained, by erosion transferred, so called "derasion" loess, or in water deposited, so called "infusion" loess (in the sense of Pécsi, [34]) very rarely bears typical loess bryophytes or lichens. Along the Prut River and its tributaries the cliffs are formed mostly by coarse grained, sandy loess. On the other hand, the loess cliffs along Siret and its tributaries, the Trotuș and Moldova River (and probably along the other tributaries further to north) are formed of aeolian, fine grained type with a typical cryptogamic plant community.

During our first joint trip we have investigated more than twenty larger loess cliffs. At the following more interesting localities we have found among others the mosses *Hilpertia velenovskyi* (Schiffner) Zander, *Crossidium laxefilamentosum* Frey & Kürschner, *Pterygoneurum compactum* Cano, Guerra & Ros and *Pterygoneurum squamosum* Segarra & Kürschner. The records new to the country according to Corley *et al.* [7], to Düll [8] and to Mohan [29] are marked by * and their Romanian distribution is summarised on the maps 1 and 2. Latitude and longitude grids were measured by GPS.

Moldavia, Podișul Moldovei

Loc. No. 00191. Loess gorges with 8-14 m high cliffs, 4 km WNW of Roman town, S of the road leading to **Trifești** village, in the dry, W directed, by erosion formed side valleys of Moldova River, at 180-200 m altitude, 46°55.1'N, 26°51.3'E. Date: 12. Oct. 2000.

**Hilpertia velenovskyi* (Schiffner) Zander and *Didymodon cordatus* Jur. were the dominant moss species both on NNE, W and SSW facing cliffs, often forming small cushions or herd like groups. The cryptogamic community, in which it was found, can be classified as *Hilpertio velenovskyi-Pterygoneuretum compacti* Kürschner & Pócs 2002, although * *Pterygoneurum compactum* Cano, Guerra & Ros itself occurs only in small amount on the near vertical part and is more common on the less steep, upper parts of the cliff. Other constituents observed in the community were *Acaulon triquetrum* (Spr.) C. Müll., *Aloina* sp., *Bryum klingraeffii* Schimp., *Phascum cuspidatum* Hedw. and the dominant lichen species *Endocarpon pusillum* Hedw.

In the next side valley a few hundred metres to south **Hilpertia velenovskyi* also occurred in large amount, but here at the base of a N facing cliff accompanied by *Aloina* sp., *Barbula unguiculata* Hedw., *Didymodon cordatus*, *Didymodon* cf.

tophaceus (Brid.) Garov., *Entosthodon fascicularis* (Hedw.) Müll. Hal. and by *Pterygoneurum ovatum* (Hedw.) Dix.

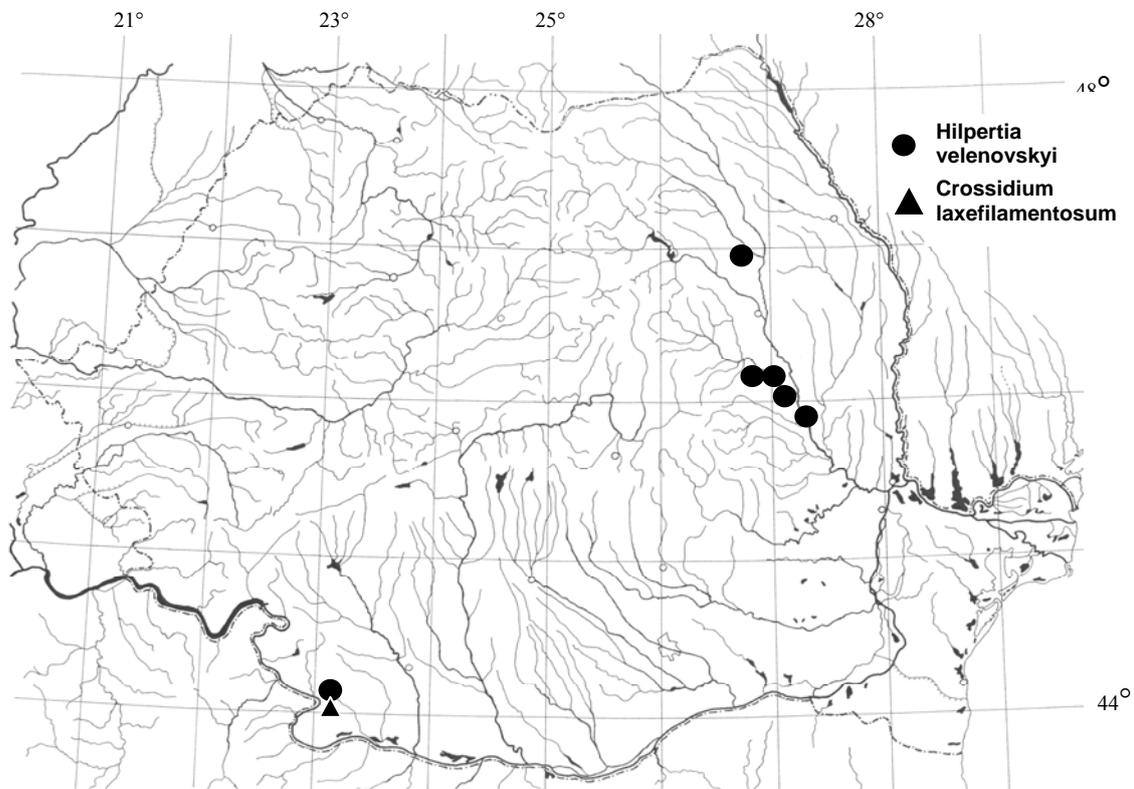


Fig. 1. Distribution map of *Hilpertia velenovskyi* and *Crossidium laxefilamentosum* in Romania

Loc. No. 00206. Long, W facing loess cliff at **Cosmești** (between Mărășești and Tecuci), at the left bank of Siret river, opposite to the E end of the road and railway bridge, 140-180 m alt., 45°51.3'N, 27°18.8'E. Date: 15. Oct. 2000. Very spectacular, bare, high (20-30 m) cliff with only scattered cryptogamic vegetation also classifiable under *Hilpertia velenovskyi*-*Pterygoneurum compacti* Kürschner & Pócs 2002 association.

**Hilpertia velenovskyi* is not as common here, as in the previous locality, but occurs at several places, forming small herd like groups. It is accompanied by large groups of **Pterygoneurum compactum* (here the dominant moss species, covering sometimes 25% of the surface), *Aloina* sp. (codominant), *Bryum argenteum* Hedw., *Pterygoneurum subsessile* (Brid.) Jur., *Pterygoneurum ovatum*, and by the lichen *Endocarpon pusillum*.

Loc. No. 00207. SW industrial outskirts of **Galați** town. Huge, 50 m high, SW facing loess cliffs along the Siret near to its influx to Danube River. Alt. 50-60 m. Date: 16. Oct. 2000.

On the cliffs the semidesertic *Agropyro cristati-Kochietum prostratae* Zólyomi 1958 dwarf bush community alternates with the open cliff surfaces, where *Aloina* sp., **Pterygoneurum compactum*, **Pterygoneurum squamosum* Segarra & Kürschner and *Pterygoneurum subsessile* occurs, accompanied by the lichen *Endocarpon pusillum*.

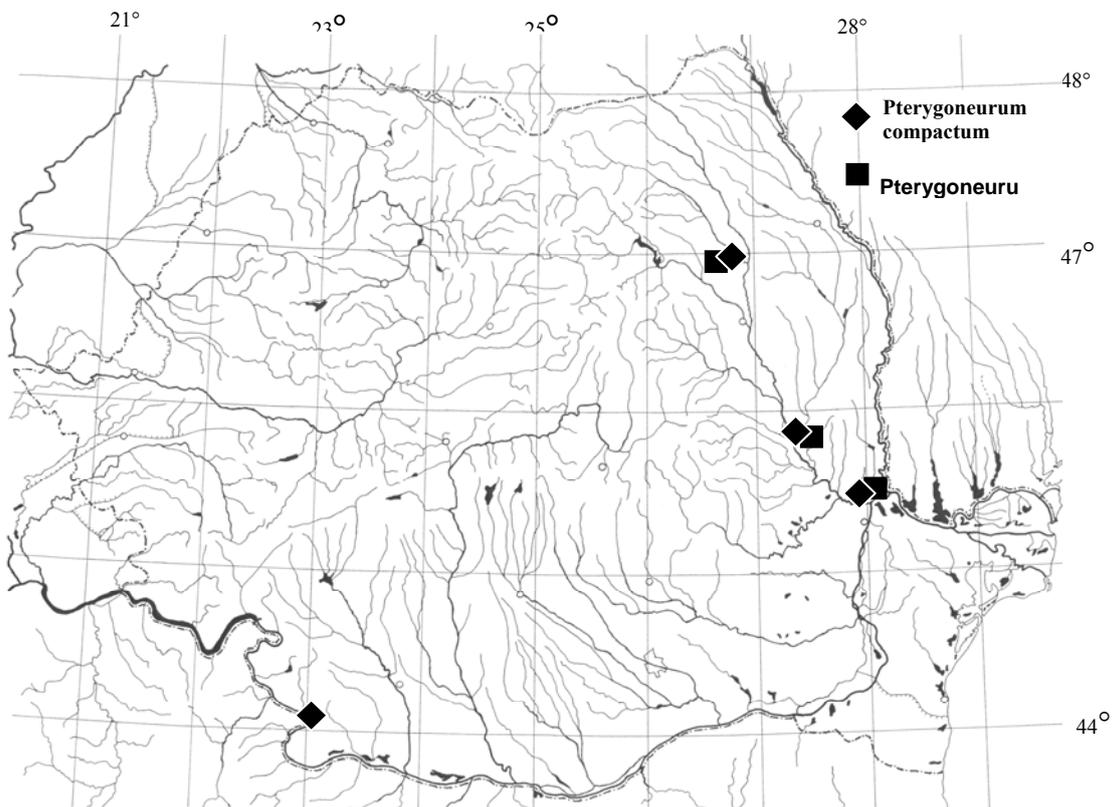


Fig. 2. Distribution map of *Pterygoneurum compactum* and *Pterygoneurum squamosum* in Romania

Moldavia, Trotuș Valley S of Bacău, Culmea Pietricica (foothills of Eastern Carpathians).

Loc. No. 00204. N facing small (4-6 m high) loess cliff at the SE ends of Căiuți village near the petrol station, at 290 m alt. 46°10.86'N, 26°56.06'E. Date: 15. Oct. 2000.

Here **Hilpertia velenovskyi* occurs in an impoverished community called by Kürschner & Pócs 2002, as *Didymodon cordatus-Grimaldion fragrantis* base community. Probably this locality is at the altitudinal limit of occurrence. Along **Hilpertia velenovskyi* an *Aloina* sp. is the codominant and only *Barbula unguiculata*, *Didymodon cordatus* and *Endocarpon pusillum* occur.

Loc. No. 00203. Relatively high loess cliffs in a small northeastern side valley of Trotuș behind Urechești village, at 260 m alt. 46°08.4'N, 27°05.5'E. Date: 15. Oct. 2000.

NW facing cliffs with rare, patchy occurrence of **Hilpertia velenovskyi*, accompanied by *Aloina* sp., *Didymodon* sp., *Hypnum cupressiforme* s.l. and by the lichen *Endocarpon pusillum*.

Loc. No. 00205. NE facing, 30 m high, mostly forest covered loess cliffs S of **Adjud** town, near the confluence of Trotuş and Siret rivers. Alt. 200-230 m. 46°04.6'N, 27°10.25'E. Date: 15. Oct. 2000.

Near the upper edge of the NE exposed escarpment there are naked patches, where in small areas the above mentioned, impoverished loess cryptogamic community develops with **Hilpertia velenovskyi* (here and there dominant with 20% coverage!), *Aloina* sp. (codominant), *Barbula unguiculata* (codominant), *Bryum argenteum*, *Didymodon cordatus* and with the lichen *Endocarpon pusillum*.

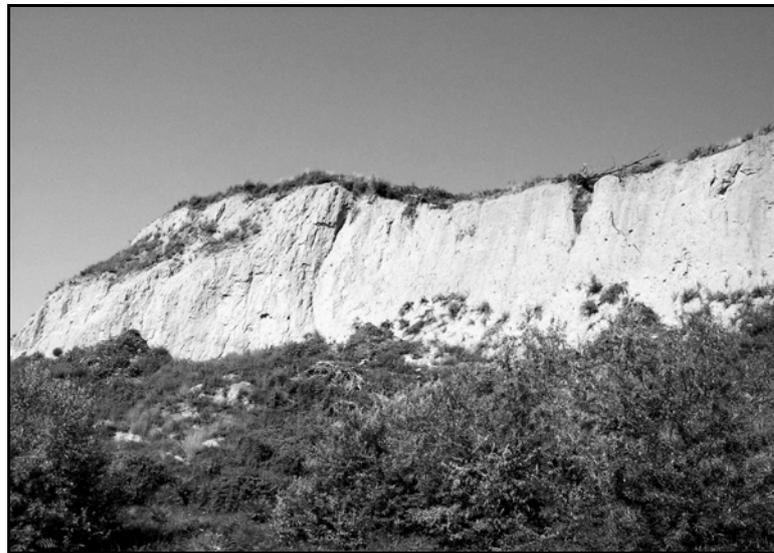


Fig. 3: The gigantic W facing loess cliffs along Siret River below Cosmeşti village with desert type moss and lichen vegetation.

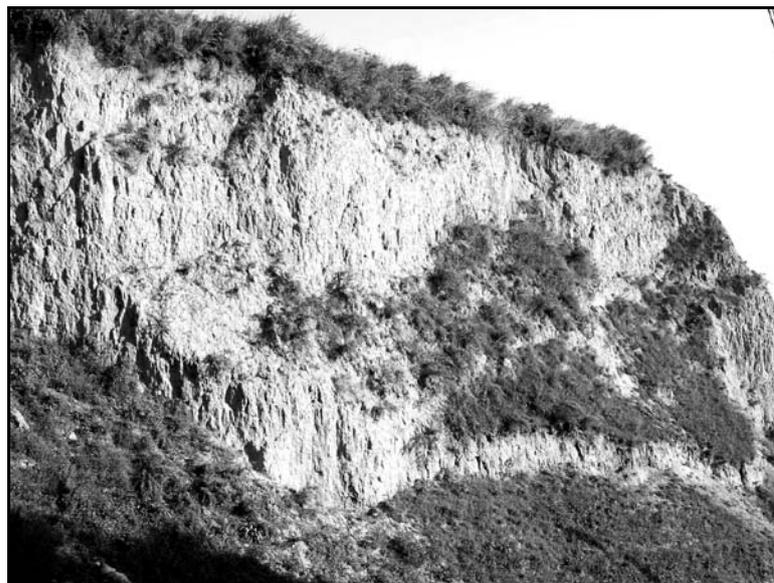


Fig. 4: North facing cliff with patches of more closed *Agropyro-Kochietum* semidesert vegetation in a side valley of the above. (Photos made by A. Sass-Gyarmati)

Oltenia, Jud. Dolj (county), Danube lowland.

Loc. No. 00210. 30 m high loess cliffs facing to the Danube, below **Cetatea** village, 18 km NE of Calafat. Alt. 50-80 m. 44°00'N, 22°49'E. Date: 17. Oct. 2000.

Rich occurrence of *Hilpertio velenovskyi*-*Pterygoneuretum compacti* Kürschner & Pócs 2002 association, with **Hilpertia velenovskyi*, *Aloina* spp., *Bryum argenteum*, *Bryum bicolor* Dicks., **Crossidium laxefilamentosum* Frey & Kürschner, *Didymodon cordatus*, **Pterygoneurum compactum*, *Pterygoneurum ovatum* and with the lichen *Endocarpon pusillum*. Doubtless *Crossidium laxefilamentosum* is the most interesting among these species. It was described by Frey and Kürschner [12] from the Arabian Peninsula and revised by Cano, Guerra & Ros (1994). Since it was found in Spain, Hungary, Yugoslavia and Romania. Its distribution and taxonomic relations are discussed in a separate paper [37]. Anyway the Romanian occurrence is an important link between the Arabian and the other European localities. We suppose that the seemingly wide gap in its distribution is the consequence of incomplete knowledge on this recently described taxon and it will be found in other parts of Romania, in Bulgaria and in Turkey as well.

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***HILPERTIA VELENOVSKYI* (SCHIFFN.) ZANDER ȘI ALTE *POTTIACEAE*
(*BRYOPHYTA*) NOI PENTRU ROMÂNIA. STUDII ALE VEGETAȚIEI
CRIPTOGAMICE DE PE PEREȚII DE LOESS, IX.**

(Rezumat)

Hilpertia velenovskyi, *Pterygoneurum compactum*, *P. squamosum* and *Cossidium laxefilamentosum* formează comunități vegetale cu aspect deșertic ce se instalează pe pereții de loess în Moldova, Muntenia și Oltenia. Toate aceste specii sunt noi pentru brioflora României. *Hilpertia* este o xerofită boreo - continentală (Holarctică) în timp ce celelalte specii erau cunoscute din zone uscate mediteraneene sau submediteraneene din Spania, Iugoslavia și Ungaria.