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The hairs in species of *Plantago* L. section *Palaeopsyllium* PILG. (Plantaginaceae)

With 4 Figures and 2 Tables

Summary

The hairs of three representatives of the section *Palaeopsyllium* PILG.: *Plantago palmata* HOOK.f., *P. cornuti* GOUAN and *P. eriopoda* TORR. were studied. The above mentioned taxa contained headed hairs (a unicellular stalk and a vertically divided into two cells) and multicellular headless hairs (web-like) typical of the representatives of the family Plantaginaceae. Taxa of the section *Palaeopsyllium* have similar types of hairs as the sections: *Polyneuron* DECNE., *Micropsyllium* DECNE., *Holopsyllium* PILG., *Lamprosantha* DECNE., *Oliganthos* BARN., *Mesembrynia* DECNE. and *Eremopsyllium* PILG., which may be evidence of affinity of these taxa.

Introduction

Earlier studies on representatives of the family Plantaginaceae show that the knowledge of hair types may have a taxonomic significance for this taxon, especially on the level of section (ANDRZEJSKA-GOLEC 1995).

The literature provides us only with short notes about the hairs of the representatives of section *Palaeopsyllium* sensu PILGER (CUGINI 1877; PILGER 1898; BRATTSTEN 1945; RAHN 1992).

There are only fragmentary studies based solely on small magnifications and oftentimes using only dry material. For example, studies on *P. eriopoda* conducted so far have not led to the determination of any type of headed hairs, what seemed improbable, taking into account their wide occurrence in the Plantaginaceae family.

Zusammenfassung

Die Haare von Arten der Gattung *Plantago* L. section *Palaeopsyllium* PILG. (Plantaginaceae)

Es wurden die Haare von Vertretern der Sektion *Palaeopsyllium* PILG. untersucht: *Plantago palmata* HOOK.f., *P. cornuti* GOUAN und *P. eriopoda* TORR. Bei allen diesen Arten sind die Haare charakteristisch für die Taxa der Plantaginaceae, d. h. es sind Köpfchenhaare mit einzelligem Stiel und zweizelligen Köpfen, daneben treten multizelluläre kopflose Haare auf. Diese Arten besitzen auch kopflose uniseriate Haare: kurze 1–2zellige und mehrzellige. Die Arten der Sekt. *Palaeopsyllium* besitzen ähnliche Haartypen wie die der Sektionen *Polyneuron* DECNE., *Micropsyllium* DECNE., *Holopsyllium* PILG., *Lamprosantha* DECNE., *Oliganthos* BARN., *Mesembrynia* DECNE. und *Eremopsyllium* PILG., was ihre Verwandtschaft belegt.

Materials and methods

The hairs of three representatives of section *Palaeopsyllium* PILG.: 1 *P. cornuti* GOUAN, 2 *P. palmata* HOOK.f., 3. *P. eriopoda* TORR. were studied. The plants were grown in field culture in the Garden of Medical Plants of the Department of Pharmacognosy, Medical University of Łódź from seeds imported from botanical gardens in Cluj (Romania), Copenhagen (Denmark) and Montreal (Canada). *P. cornuti*, occurring in wet, salted places of the Mediterranean and *P. eriopoda*, occurring on saline and alkaline soils of North America grew well in our conditions. However, *P. palmata*, an African tropical species, does not tolerate well our climate. In field conditions I did not succeed, similarly to RAHN (1957) in getting blooming

plants. I have obtained the blooming plants in the greenhouse culture.

The identity of the cultivated plants was checked with the use of descriptions and keys in PILGER's monography (1937), in Flora polska (TACIK 1967) and in Flora Europaea (CHATER & CARTIER 1976). The material was collected in florescens period. Fresh material was used. The leaf, scape, bract, calyx and corolla were examined in light microscopy.

Results

The results of the studies are shown in Table 1 and Figs. 1–3.

Headed hairs

In all three taxa there are similarly built hairs with a unicellular stalk and a head vertically divided into two cells (Figs. 1A–H, 2A–K, 3A–E). They are surrounded by 4–6 (7) cells (Fig. 3A). These hairs occur on the upper epidermis (Figs. 1A, B, 2D, E) as well as on the lower epidermis of the leaf lamina (Figs. 1C, D; 2F) and on petiole (Figs. 1E, 2C). They are also present on a scape (Figs. 1F, 2G, 3B, C), a bract (Figs. 1G, 2H, I, 3D) and a calyx (Figs. 1H, 2J, K, 3E). They are absent only on the corolla.

Table 1
Hairs types occurring in the taxa of sectio *Palaeopsyllium* Pilger

Plant name	The investigated part of the plant ^b	Headed hairs	Headless hairs				
			With unicellular stalk and two-celled head	1,2-celled (bristle-shaped)	(2,3) 4–7 (8–9) celled verrucated		Consisting of several cells non-verrucated
					Without small square cell	with small square cell	
<i>P. cornuti</i> GOUAN (Cluj) ^a	L	+	–	+	+	–	+
	S	+	–	–	+	–	+
	B	+	+	+	–	+	–
	C	+	+	–	–	+	–
	R	–	–	–	–	–	–
<i>P. palmata</i> HOOK. fil. (Copenhagen)	L	+	–	+	–	–	+
	S	+	–	+	+	–	+
	B	+	+ ^c	–	–	+	–
	C	+	+ ^c	–	–	+	–
	R	–	–	–	–	–	–
<i>P. eriopoda</i> TORREY (Montreal)	L	+	–	+	–	–	+
	S	+	–	+	+	–	+
	B	+	+	–	–	+	–
	C	+	+	–	–	+	–
	R	–	–	–	–	–	–

a – The origin of seeds in brackets.

b – L – leaf, S – scape, B – bract, C – calyx, R – corolla.

c – Only few hairs occur on the top of the bract and calyx.

d – These hairs occur only on the petiolus of the leaf.

e – These hairs occur only on the base of given parts of the plant.

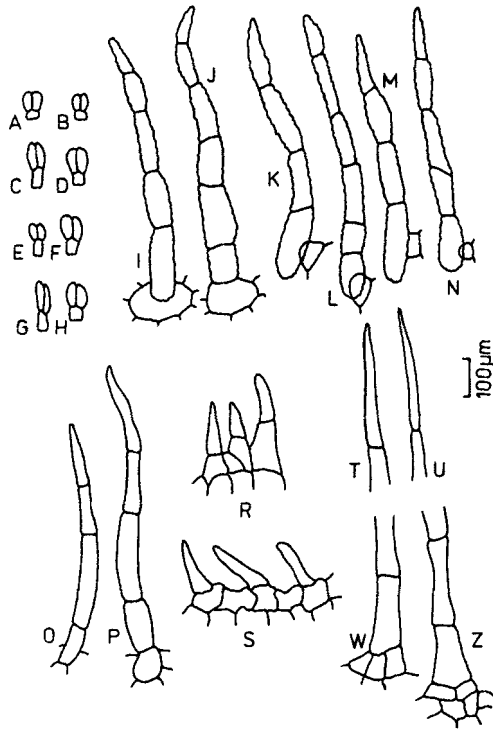


Fig. 1

Plantago cornuti GOUAN, hairs

A-H — the headed hairs: A-D on the leaf lamina from: A, B — upper epidermis; C, D — lower epidermis; E — a petiole; F — a scape; G — a bract, H — a calyx. I-Z — the headless hairs from: I, J — a leaf lamina (lower epidermis); K, L — a petiole; M, N — a scape; O-R — a bract; S — a calyx; T, U — the tip of the hair; W, Z — the base of the hairs

Headless hairs

I have stated the presence of five types of headless hairs in the studied taxa:

1. short bristle hairs, (20) 30–150 (200) μm long, unicellular or two-celled with smooth cuticle on the bract and calyx. In *P. cornuti* the hairs occur densely on the edge of the bract (Fig. 1R) and the calyx (Fig. 1S), while on the bract and the calyx of *P. palmata* only few bristle hairs (Fig. 2T, U) can be observed. In *P. eriopoda* bristle hairs occur on the top of the bract (Fig. 3L) and calyx (Fig. 3M) and only rarely on side-rime of the bract.
2. hairs consisting of (2–3)4–7(8–9) cells, 200 (300–1000) μm long, slightly verrucated on the leaf, in *P. palmata* also on base of the scape (Figs. 1I, J, 2L, M, 3F–H).

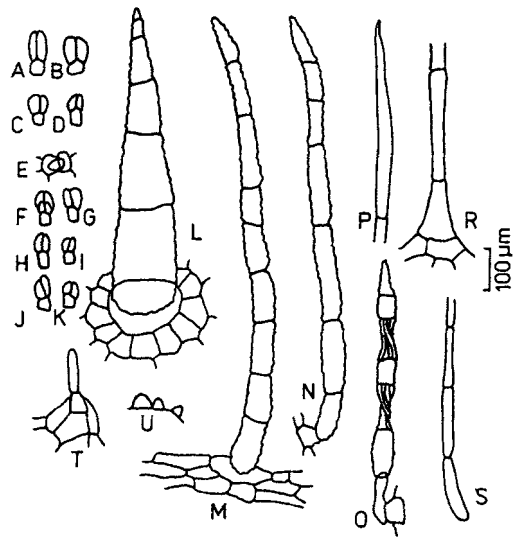


Fig. 2

Plantago palmata HOOK.f., hairs

A-K — the headed hairs from: A, B — a leaf base; C — a petiole; D, E — upper epidermis of the leaf lamina (E — view from above); F — lower epidermis; G — a scape; H, I — a bract; J, K — a calyx. L-U — the headless hairs from: L — a leaf lamina; M-S — a scape: M — a base of the scape; N, O — a top of the scape; P-S — the fragments of multicellular (web-like) hairs from a base of scape. T — a hair from the bract. U — the hair from a calyx

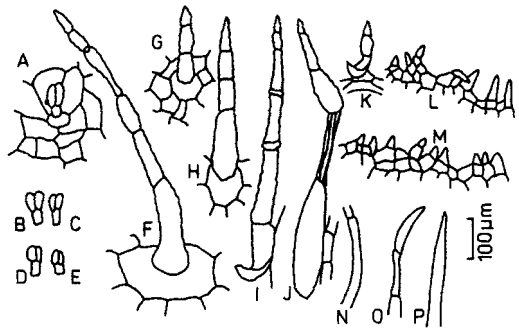


Fig. 3

Plantago eriopoda TORR., hairs

A-E — the headed hairs from: A — a leaf lamina; B, C — a scape; D — a bract; E — a calyx. F-O — the headless hairs from: F-H — a leaf lamina. I-K — a scape; L — top of the bract; M — bristle-shaped hairs on the top of a calyx; N — fragment of web-like hair from a scape; O, P — fragments of non-verrucated hair consisting of several cells from the base: O — of a bract, P — of a calyx

3. like 2., but they have a small square cell on a scape (Figs. 1 M, N, 2 N, O, 3 I, J) and on a petiole of *P. cornuti* (Fig. 1 K, L).
4. non-verrucated hairs consisting of several (3–4) cells, 500–900 µm long – on the bract and calyx bases (Figs. 1 O, P, 3 O, P).
5. multicellular (arachnoid, web-like) hairs composed of 14–40 cells, 5–15 µm long – on base of the leaf (Fig. 1 T–Z) and of the scape (Figs. 2 P–S; 3 N).

Discussion

The types of headed hair observed by me and other authors (see Introduction) in taxa of section *Palaeopsyllium* occur commonly in representatives of the family Plantaginaceae (RAHN 1992; ANDRZEJEWSKA-GOLEC 1995, 1998). They are absent in some sections of this family: *Arnoglossum* DECNE., *Coronopus* (DC.) H. DIETR. and in annual species of section

Table 2
Trichomes on the leaf lamina of the representatives of the family Plantaginaceae

Genus	Sectio ^a	Headed hairs ^c									Headless hairs ^c		
		A	B	C	D	E	F	G	H	I	J	K	L
<i>Plantago</i>	<i>Polyneuron</i> DECNE.	+											+
	<i>Micropsyllium</i> DECNE. ^c	+											+
	<i>Palaeopsyllium</i> PILGER	+											+
	<i>Holopsyllium</i> PILGER ^c	+											+
	<i>Oliganthos</i> BARN. ^c	+											+
	<i>Microcalyx</i> PILGER	+		+									+
	<i>Coronopus</i> ^b (DC.) H. DIETR.								+				+
	<i>Maritima</i> H. DIETR.	+				+	+	+					+
	<i>Novorbis</i> DECNE.		+										+
	<i>Mesembrynia</i> DECNE.	+											+
	<i>Lamprosantha</i> DECNE.	+											+
	<i>Eremopsyllium</i> PILGER	+											+
	<i>Oreades</i> DECNE.	+				+							+
	<i>Gentianoides</i> PILGER ^d												+
	<i>Bauphula</i> DECNE.	+		+	+	+							+
	<i>Anoglossum</i> DECNE.							+					+
	<i>Leucopsyllium</i> DECNE.	+											+
<i>Hymenopsyllium</i> PILGER	+											+	
<i>Psyllium</i> (JUSS.) BARN.	+								+	+		+	
<i>Littorella</i>		+											+

The data in Table 2 from my earlier publications (ANDRZEJEWSKA-GOLEC 1991, 1992a, b, 1995, 1998; ANDRZEJEWSKA-GOLEC & ŚWIĄTEK 1993; ANDRZEJEWSKA-GOLEC & ŚWIĘTOŚŁAWSKI 1987, 1988, 1989a, b, 1991, 1993), data about sectio *Eremopsyllium* – ANDRZEJEWSKA-GOLEC – unpublished.

a – sections according to PILGER (1937)

b – the division of section *Coronopus* DC. into 2 separate sections made by DIETRICH (1975)

c – the data after RAHN (1992)

d – non studied

e – types of the hairs in Fig. 4

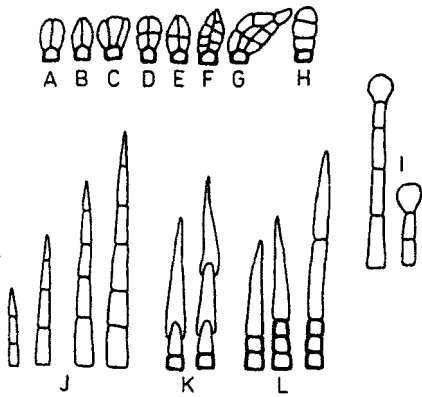


Fig. 4
Types of hairs on the leaf lamina of the representatives of the family Plantaginaceae

A-I — headed hairs; J-L — headless hairs (to Table 2)

Psyllium (JUSS.) BARN. They are plesiomorphic form of headed hairs in the family Plantaginaceae (RAHN 1996). Also multicellular hairs known as arachnoid or web-like hairs are built like arachnoid hairs of taxa of other sections of the Plantaginaceae family (ANDRZEJEWSKA-GOLEC 1991, 1998).

Taxa of section *Palaeopsyllium* have similar types of hairs as sections: *Polyneuron*, *Micropsyllium*, *Holopsyllium*, *Oliganthos*, *Mesembrynia*, *Lamprosantha* and *Eremopsyllium* (Table 2). It may be evidence of affinity of these taxa. It confirms the rightness of decision of RAHN (1996) to include sections *Polyneuron*, *Palaeopsyllium*, *Holopsyllium*, *Lamprosantha* and *Eremopsyllium* in the paraphyletic section *Plantago*.

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