

CYPSELA MORPHOLOGY OF *GNAPHALIUM* L. AND ITS ALLIED GENERA (GNAPHALIEAE-ASTERACEAE) FROM PAKISTAN

RUBINA ABID AND M. QAISER*

Department of Botany, University of Karachi, Karachi-75270, Pakistan

*Federal Urdu University of Arts, Science & Technology, Karachi, Pakistan.

Abstract

Cypsela morphology of 8 taxa of the genera *Gamochaeta* Wedd., *Gnaphalium* L., *Homognaphalium* Kirp., and *Pseudognaphalium* Kirp., was examined from Pakistan using light and scanning electron microscopy. The cypsela characters are not only found useful for assessing relationship but they are also useful for the delimitation of taxa except that of the genera *Gnaphalium* and *Pseudognaphalium* as they share common cypsela features and both are placed in one cypsela type.

Introduction

Gnaphalium L. (s.l.) belongs to the tribe Gnaphalieae of the family Asteraceae. This is assemblage of four genera viz. *Gamochaeta* Wedd., *Gnaphalium* L., *Homognaphalium* Kirp., and *Pseudognaphalium* Kirp. In all 8 species are recognized from Pakistan (Qaiser & Abid, 2003).

Cypsela characteristics in a series of the family Asteraceae have been used to address the systematic relationship of various taxa from Pakistan such as Abid & Qaiser (2002) studied the cypsela morphology of *Inula* L. (s.l.) and found that cypsela features support the taxonomic decisions. Similarly, Abid & Qaiser (2007a) made a correlation of cypsela morphological characters for taxonomic interpretation in the tribe Plucheeae. While the cypsela characters in the genus *Pulicaria* Gaertn., and some other remaining genera in the tribe Inuleae were studied by Abid & Qaiser (2007b) and Abid & Zehra (2007) respectively. However, in the tribe Gnaphalieae, the cypsela characters were studied only for the genus *Anaphalis* DC. (Abid & Qaiser, 2007c). Presently the genera *Gamochaeta*, *Gnaphalium*, *Homognaphalium* and *Pseudognaphalium* are studied for their cypsela morphology to provide the strength for the recognition of these taxa from Pakistan.

Materials and Methods

Eight taxa assembled in four genera namely, *Gamochaeta*, *Gnaphalium*, *Homognaphalium* and *Pseudognaphalium* were studied for cypsela characters from herbarium specimens (Appendix 1) under stereomicroscope (Nikon XN Model), compound microscope (Nikon Type 102) and scanning electron microscope (JSM-6380A). For scanning electron microscopy mature cypselas were directly mounted on metallic stub using double adhesive tape and coated with gold for a period of 6 minutes in sputtering chamber and observed under SEM.

The following characters were studied

Cypsela: Shape, surface, colour, size

Pappus: Bristle's series, shape, number, degree of fusion, colour, size

Appendix 1. List of the voucher specimens.

Taxa	Collector, Number, Herbarium
<i>Gamochaeta pensylvanica</i>	Abrar Hussain s.n. (KUH); Surayya Khatoon & A. Ghafoor 154A (KUH); Surayya Khatoon 324 (KUH); Y. Nasir s.n. (RAW), R.R. Stewart s.n. (RAW); P.C. Joshi 1 (RAW)
<i>Gnaphalium polycaulon</i>	S.I. Ali 1636 (KUH); S.M.H. Jafri 1571 (KUH); S.I. Ali s.n. (KUH); A. Ghafoor & M. Qaiser 463 (KUH); S. Abedin & Abrar Hussain 9479 (KUH)
<i>Gnaphalium stewartii</i>	I.I. Choudhri 40 (RAW); Inayat 19742 (RAW); Mohindar Nath 442 (RAW); Mohindar Nath 441 (KUH)
<i>Gnaphalium thomsonii</i>	Tahir Ali, M. Qaiser & Ajmal Khan 644 (KUH); Jan Mohammad s.n. (KUH); Walter Koelz 1244 (RAW)
<i>Homognaphalium pulvinatum</i>	A. Ghafoor & M. Qaiser 190 (KUH); S. Abedin & Abrar Hussain 9509 (KUH); E. Nasir s.n. (RAW)
<i>Pseudognaphalium affine</i>	Y. Nasir 6824 (KUH); M. Qaiser & A. Ghafoor 7438 (KUH); S.M. H. Jafri 1637 (KUH); S.I. Ali 1637 (KUH); M.A. Siddiqi & Y.J. Nasir 7354 (RAW)
<i>Pseudognaphalium hypoleucum</i>	R.R. Stewart s.n. (RAW); Gatarace s.n. (RAW)
<i>Pseudognaphalium luteo-album</i>	A. Ghafoor & S. Omer 2503 (KUH); A. Ghafoor & S. Omer 2487 (KUH); R.R. Stewart 9610 (KUH); S.Omer 407(KUH); Rasool Baksh 96 (KUH); Tahir Ali & G.R. Sarwar 2746 (KUH); S. Abedin & Abrar Hussain 9513 (KUH)

Carpopodium: Shape, position, diameter of carpopodium and diameter of foramen of carpopodium were observed under scanning electron microscope.

Observations**General cypselas characters of *Gnaphalium* L. (s.l.)**

Cypselas oblong or oblong–ellipsoid, 0.5–2.0 x 0.25–0.75 mm, yellowish brown, non ribbed, sparsely long papillose or short papillose–clavate or clavate myxogenic hairy or with globose myxogenic twin hairs. Pappus uniseriate bristly, barbellate, free or slightly coherent at base or basally connate in a ring like structure, falling separately or with slight fusion or as a unit, white or cream, 6–12, 2.5 – 5.0 mm long. Carpopodium narrow circular ring without any interruption, subbasal in position, 48–115 µm in diameter. Foramen of carpopodium 32– 80 µm in diameter (Table 1).

Key to the genera

- 1 + Cypselas with sparsely globose myxogenic twin hairs. Pappus bristles connate at base in a ring like structure, falling as a unit *Gamochaeta*
 - Cypselas sparsely papillose or papillose–clavate or clavate myxogenic hairy. Pappus bristles free or slightly coherent at base but never forming a ring like structure, falling separately or with slight fusion 2
- 2 + Cypselas oblanceolate with short clavate myxogenic hairs *Homognaphalium*
 - Cypselas oblong or oblong- oblanceolate, sparsely papillose or papillose-clavate hairy *Gnaphalium* type (*Gnaphalium* & *Pseudognaphalium*)

Fig. 1. Scanning Electron Micrographs. *Gamochaeta pensylvanica* : A, cypsela & pappus; B, surface; C, carpopodium. *Gnaphalium polycaulon*: D, cypsela & pappus; E, surface; F, carpopodium. *G. stewartii*: G, cypsela & pappus; H, surface; I, carpopodium. *G. thomsonii*: J, cypsela with pappus; K, surface; L, carpopodium (Scale bar: A,G,J = 100 μ m; B, E,H,K,I = 20 μ m; D=50 μ m; C,F,L = 10 μ m).

***Gamochaeta* Wedd.**

It is represented by single species i.e. *G. pensylvanica* (Willd.) Cabrera.

Cypselas oblong, 0.5 x 0.25 mm, sparsely globose myxogenic twin hairy. Pappus bristles connate at base in a ring like structure, falling as a unit, cream, 10-12, 2.5 mm long. Carpopodium 48 μ m in diameter. Foramen of carpopodium 38 μ m in diameter (Fig. 1A-C).

Fig. 2. Scanning Electron Micrographs. *Homognaphalium palvinatum*: A, cypsela & pappus; B, surface; C, carpopodium. *Pseudognaphalium affine*: D, cypsela & pappus; E, surface; F, carpopodium. *P. hypoleucum*: G, cypsela & pappus; H, surface; I, carpopodium. *P. leuto-album*: J, cypsela & pappus; K, surface; L, carpopodium (Scale bar: A,J = 100µm; D, G= 50µm; B, C, E, F, H, I, K, L = 10µm).

***Homoganaphalium* Kirp.**

It is represented by single species i.e., *H. pulvinatum* (Delile) Fayed & Zareh

Cypselas oblanceolate, 1.5 x 0.5 mm, short clavate myxogenic hairy. Pappus bristles slightly coherent at base, falling with slight fusion, white, 6-8, 2.5 mm long. Carpopodium 56 µm in diameter. Foramen of carpopodium 44 µm in diameter (Fig. 2A-C).

Gnaphalium type: On the basis of cypsela features, the genus *Pseudognaphalium* Kirp., could not be distinguished from the genus *Gnaphalium* L., so both the genera are placed here within *Gnaphalium* type.

Cypselas oblong or oblong-oblancheolate, 1-2 x 0.25 -0.75 mm, sparsely papillose or short papillose-clavate hairy. Pappus bristles free or slightly coherent at base, falling separately or with slight fusion, 6-8, 2.5-5 mm long. Carpodium 54-115 µm in diameter. Foramen of carpodium 32-80 µm in diameter.

Gnaphalium L. is represented by 3 species viz., *G. polycaulon* Pers., *G. stewartii* C.B. Clarke ex Hook f. and *G. thomsonii* Hook f. (Fig. 1D-L).

Key to the species

- 1 + Cypselas oblong, sparsely long papillose, 1.5-2.0 mm long. Carpodium 115 µm in diameter. Foramen of carpodium 80 µm in diameter *G. stewartii*
- Cypselas oblong-oblancheolate, sparsely short papillose-clavate, 1 mm long. Carpodium 54-64µm in diameter. Foramen of carpodium 32-41µm in diameter 2
- 2 + Pappus bristles 2.5 mm long. Carpodium 54µm in diameter. Foramen of carpodium 32 µm in diameter *G. polycaulon*
- Pappus bristles 4-5 mm long. Carpodium 64 µm in diameter. Foramen of carpodium 41 µm in diameter *G. thomsonii*

The genus *Pseudognaphalium* Kirp., comprises 3 species in Pakistan viz., *Pseudognaphalium affine* (D.Don) Anderb., *P. hypoleucum* (DC.) O.M. Hilliard & B.L. Burtt, *P. leuto-album* (L.) O.M. Hilliard & B.L. Burtt (Fig. 2D-L).

Key to the species

- 1 + Pappus bristles white. Carpodium 75 µm in diameter. Foramen of carpodium 50 µm *P. leuto-album*
- Pappus bristles cream. Carpodium 58-62 µm in diameter. Foramen of carpodium 35-39 µm in diameter 2
- 2 + Pappus bristles free, falling separately *P. hypoleucum*
- Pappus bristles slightly coherent at base falling with slight fusion *P. affine*

Results and Discussion

In most of the previous taxonomic treatments the genus *Gnaphalium* L. was treated in a broader sense and rest of the genera like *Gamochaeta* Wedd., *Homognaphalium* Kirp., and *Pseudognaphalium* Kirp., were treated as congeneric with *Gnaphalium* L. (s.l.). Hilliard & Burtt (1981), Fayed & Zareh (1989), Anderberg (1991), Bremer (1994), and Qaiser & Abid (2003) treated them as independent genera and placed them under *Gnaphalium* group. On the basis of cypselas characters the genera *Gamochaeta* and *Homognaphalium* are clearly segregated. Whereas, the two genera *Gnaphalium* and *Pseudognaphalium* could not be separated from each other due to similar cypselas

characters. *Gamochaeta* is characterized by the cypselas with globose myxogenic twin hairs and basally connate bristles in a ring like structure falling as a unit. In the other genera cypselas having papillate or papillate-clavate or clavate myxogenic twin hairs and pappus bristles are free or slightly coherent but never falling as a unit. Amongst them the genus *Homognaphalium* remains distinct due to short clavate myxogenic twin hairs on cypselas. It is also noteworthy that within the *Gnaphalium* type both genera viz., *Gnaphalium* and *Pseudognaphalium* although sharing common cypselas characters but their species can easily be delimited due to their distinct cypselas features. Therefore, the cypselas characters are not only found useful for assessing relationship but they are also useful for the delimitation of taxa of *Gnaphalium* L. (s.l.).

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