Pseudognaphalium undulatum (Asteraceae) in Belgium: another cudweed on the verge of naturalization?

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Abstract. – *In the summer of 2022 a small population of* Pseudognaphalium undulatum *was discovered in Roeselare (province of West-Flanders). Although the original population was almost entirely cleared, in 2023 many dozens of new plants were discovered in the surroundings, some almost half a kilometer away from the source population. It seems that the species is becoming established locally. This (predominantly South-) African weed is naturalized in western France and the Channel Islands (Great Britain) for more than two centuries, and has recently locally established itself elsewhere in Europe as well (Italy, the Netherlands). In Belgium, the species was previously seen only between 1893 and 1906, when it was unintentionally introduced as a rare wool alien in the Vesdre valley. This contribution discusses the morphology and differences compared to other species, and the opportunities for further expansion.*

Samenvatting. – **Pseudognaphalium undulatum *(Asteraceae) in België: opnieuw een inburgerende droogbloem?*** *In de zomer van 2022 werd een kleine populatie van* Pseudognaphalium undulatum *ontdekt in Roeselare (provincie West-Vlaanderen). Hoewel de oorspronkelijke populatie bijna volledig opgeruimd werd, werden in 2023 vele tientallen nieuwe planten ontdekt in de omgeving, sommige op bijna een halve kilometer afstand van de bronpopulatie. Het lijkt erop dat de soort zich lokaal aan het vestigen is. Deze (voornamelijk Zuid-) Afrikaanse soort is al ruim twee eeuwen ingeburgerd in het westen van Frankrijk en de Kanaaleilanden (Groot-Brittannië), en heeft zich onlangs ook elders in Europa lokaal gevestigd (Italië, Nederland). In België werd de soort voordien uitsluitend gezien tussen 1893 en 1906, toen ze onopzettelijk werd ingevoerd met schapenwol in de Vesdervallei. Dit artikel gaat in op de morfologie en verschillen t.o.v. andere soorten, en op de kansen voor verdere uitbreiding.*

Résumé. – **Pseudognaphalium undulatum *(Asteraceae) en Belgique : un autre gnaphale en cours de naturalisation ?*** *Au cours de l'été 2022, une petite population de* Pseudognaphalium undulatum *a été découverte à Roeselare (province de Flandre occidentale). Bien que la population originale ait été presque entièrement détruite, en 2023, plusieurs dizaines de plantes ont été découvertes à proximité, certaines à près d'un demi-kilomètre de la population originale. Il semble que l'espèce soit en train de s'établir localement. Cette espèce (surtout sud-) africaine est naturalisée dans l'ouest de la France et aux îles Anglo-Normandes (Grande-Bretagne) depuis plus de deux siècles, et s'est récemment établie localement ailleurs en Europe (Italie, Pays-Bas). En Belgique, l'espèce n'a été observée qu'entre 1893 et 1906, lorsqu'elle a été introduite fortuitement avec de la laine de mouton dans la vallée de la Vesdre. Cette contribution discute de la morphologie et des différences par rapport à des espèces similaires, ainsi que de la possibilité d'une expansion éventuelle.*

Illustrations:
By the author

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Introduction

With their achenes that bear a hairy pappus, cudweeds (*Gnaphalium* L. s.l.; Asteraceae) are well adapted to be quickly dispersed by wind. Not surprisingly, quite a few species have spread beyond their native distribution ranges and are considered weeds. These include both non-native species such as representatives of the genus *Gamochaeta* Wedd. (Drury 1971, Rocha Afonso 1984, Verloove *et al*. 2023) but just as well native ones, such as *Pseudognaphalium luteoalbum* (L.) Hilliard & B.L. Burtt, a native species that used to be rare but that recently has been increasing significantly. Since many gnaphaloid composites look superficially similar, their establishment and expansion may initially go unnoticed. For example, in the Netherlands, *Gamochaeta subfalcata* (Cabrera) Cabrera had been confused with native *Gnaphalium sylvaticum* L. for several years before its identity was correctly assessed (Verloove *et al*. l.c.); by then, it was already naturalized, including in natural habitats.

The generic limits of *Gnaphalium* s.l. have considerably changed in recent years as a result of molecular phylogenetic studies. Three native species that were treated in the Belgian flora (Lambinon & Verloove 2012), i.e. *G. luteoalbum* L., *G. sylvaticum* L. and *G. uliginosum* L., are now often accommodated in three different genera, respectively as *Laphangium luteoalbum* (L.) Tzvelev, *Omalotheca sylvatica* (L.) Sch.-Bip. & F.W. Schultz and *Filaginella uliginosa* (L.) Opiz (e.g. Tzvelev 2002, Stace 2019, Verloove & Van Rossum 2023).

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Yet, even then some boundaries remain controversial: according to some authors *Laphangium* (Hilliard & B. L. Burtt) Tzvelev is better amalgamated with *Pseudognaphalium* Kirp. (Freire *et al*. 2022). Our native species then should be referred to as *P. luteoalbum* (L.) Hilliard & B.L. Burtt although it should be noted that yet other studies had previously placed it in *Helichrysum* as well (Galbany-Casals *et al*. 2004).

A second species of *Pseudognaphalium*, *P. undulatum* (L.) Hilliard & B.L. Burtt, a species from southern Africa, is naturalized in some parts of Europe. It was formerly occasionally recorded as an ephemeral wool alien in Belgium as well but the most recent record dated back to 1906 (Verloove 2006). Since 2022, however, a seemingly stable population has been known from Roeselare (province of West-Flanders). In this paper details about this record are presented and the species is illustrated.

Morphology and differentiation from similar-looking species

Pseudognaphalium undulatum is a bushy annual herb up to c. 60 cm tall. Stems are thinly greyish-white woolly, glabrescent, leafy. Leaves are up to 80 × 12 mm, oblong-lanceolate to lanceolate, the apex is very acute to acuminate, the base is broadly cordate and decurrent (the wings often reach to the node below or even lower), margins are entire, somewhat undulate, the upper surface is glandular (sticky to the touch), green, the lower surface is white-felted. Heads are c. 3 mm long, campanulate, several together in tight clusters, these are arranged in a large, wide-spreading corymbose panicle. Involucral bracts are in c. 4 series, loosely imbricate, whitish, woolly at the base. Flowers c. 36-100, predominantly male, yellowish. Achenes are c. 0,5 mm long, glabrous. Pappus bristles many, free at base (Fig. 1).

Compared with *P. luteoalbum*, it has distinctly decurrent, bicolored leaves with a green upper and white lower surface. In addition, its stems are branched (at least in the upper half) and – on closer examination – pappus hairs are free at base (vs. connate). Due to the glandular leaf indumentum, the entire plant is sticky to the touch and releases an unpleasant smell.

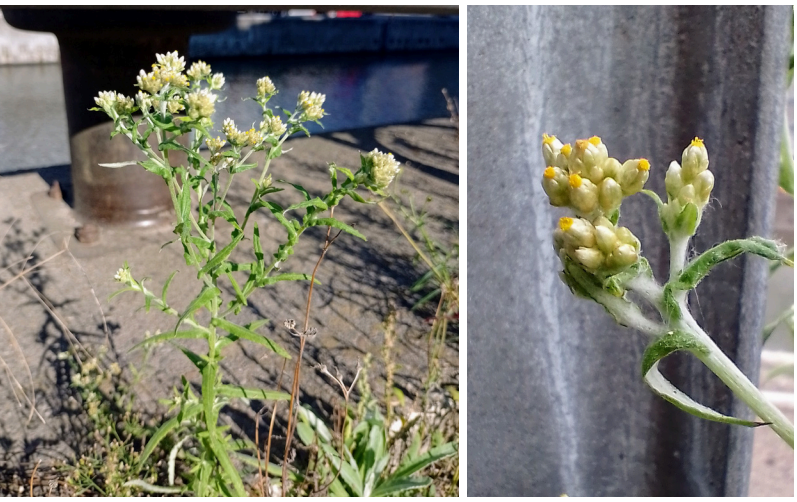

Figure 1. *Pseudognaphalium undulatum*.

Primary and secondary distribution

Pseudognaphalium undulatum is native to southern Africa: South Africa (Cape Provinces, Free State, KwaZulu-Natal and Northern Provinces), Angola, Botswana, Lesotho and Namibia (POWO 2023). According to Hilliard (1983), it also occurs in southernmost Madagascar. GBIF (2023) further reports it from Cameroon, Eritrea, Ethiopia, Kenya, Nigeria and Tanzania but some of these claims possibly require confirmation (APD 2023 only reports it from Cameroon, Ethiopia and Nigeria in tropical Africa) and it is unclear whether or not these refer to native or naturalized populations. *P. undulatum* is naturalized in Bretagne, Normandie and the Channel Islands (France and Great Britain) since the end of the 18th century (Somerville 1896, Provost 1993, Stace 2019). In France, it was first seen in the Cherbourg area (Manche) at the end of the 18th century, in Finistère around 1850, in Ille et Vilaine in the 1940s and in Morbihan in the 1950s. In the Pays de la Loire region, the plant has been reported since the beginning of the 1980s on the island of Yeu, from 1992 onwards in Loire-Atlantique, then in 1999 in Sarthe. The number of records has been increasing since 2006 (comm. F. Dortel, 08.2023). It subsequently also naturalized in Campania in Italy (Pignatti 1982, Del Guacchio & La Valva 2017, Galasso *et al*. 2018) and it has been known from Wageningen in the Netherlands since 2008 (waarneming.nl). In addition, *P. undulatum* is sometimes observed as an ephemeral wool alien, for instance in Great Britain (Clement & Foster 1994), Germany and Switzerland (Probst 1949) and Belgium (see below and Verloove 2006).

Past and present of *Pseudognaphalium undulatum* in Belgium

In Belgium, this species was formerly collected on a few occasions in the Vesdre valley, more precisely between 1893 and 1906 (Verloove 2006). It was presumably introduced as a contaminant in sheep wool, as were many other species from (mainly) South Africa, Australia and South America (Visé 1942, 1958). Due to, among others, incompatible climatological circumstances, almost none of the hundreds of these so-called wool aliens were able to establish itself, with the notable exception of *Senecio inaequidens* DC. (e.g. Adema & Mennema 1978).

On 19 June 2022, the author found nine individuals of *Pseudognaphalium undulatum* in the Roeselare port area (province of West-Flanders). All were growing in the Trakelweg at or very near to the site of the recently demolished 'Hanekop' animal nutrition manufacturer plant. Four individuals were found on the verge of the demolition site, the others under a crash barrier on the unloading quay of the canal in front of it. In the intervening weeks and months, several additional plants were found (some in all likelihood offspring of the plants that had already flowered and fruited in early summer). In July 2022, at least seven additional individuals were observed at the foot of a wall of a building at the crossing of the Trakelweg and the Veldstraat. All plants grew within a radius of about 30 meters. It should be noted that the species was initially thought to have relatively few opportunities to expand, as its initial location is squeezed between the canal on the one hand and a steep railway embankment on the other. On 11 November 2022, several non-flowering rosettes were seen and by 10 April 2023 the first flowering individuals were already noticed. However, as previously observed in 2022, most plants were regularly weeded, also in 2023. As a result, on 22 June 2023 only eight individuals were counted at the locality where the species was discovered in 2022. Nonetheless, on 21 July 2023 the demolition site itself – which until then had been fenced – was inspected. In this area, where the species was left undisturbed, about fifty plants were observed. In addition, four individuals were found at the crossing of the Guido Gezellelaan and the Veldstraat, i.e. on the other side of the railway. Now that the species had apparently succeeded in crossing the railway, the other side of the railway was examined on 23 July 2023. Between 15 and 20 individuals

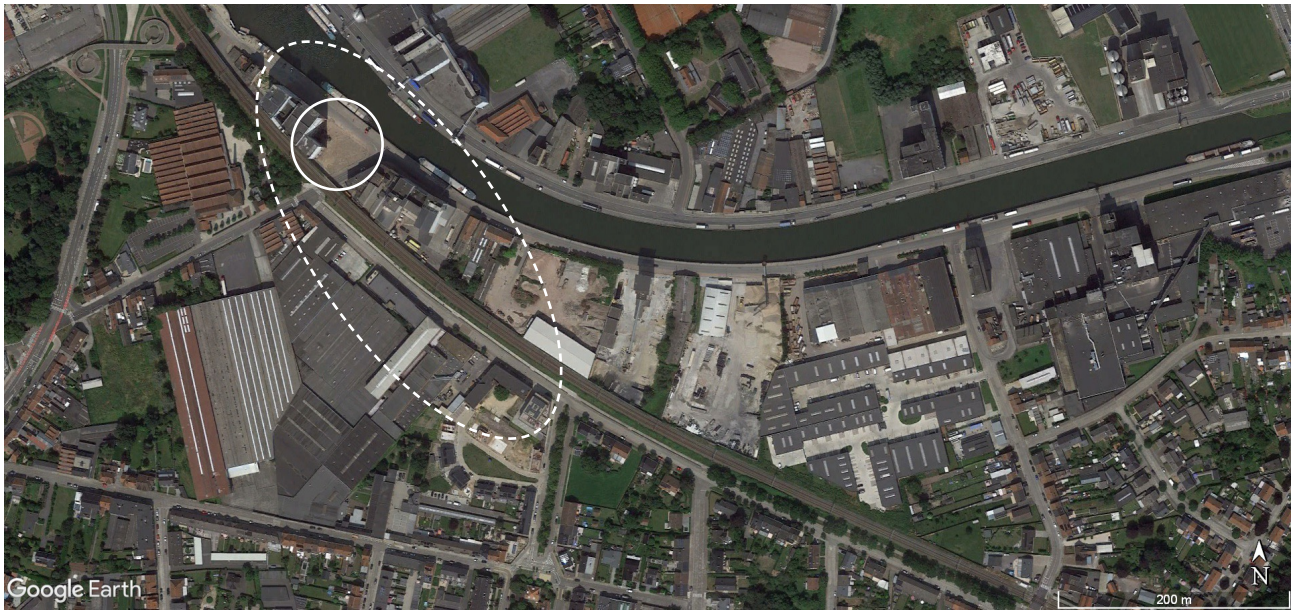

Figure 2. Distribution of *Pseudognaphalium undulatum* in Roeselare in 2022 (solid line) and 2023 (broken line).

were found in the Guido Gezellelaan in the direction of Rumbeke. On rough ground in a recently developed residential area, at the corner of the Azalealaan and Madeliefjesplein, around 30 additional flowering and fruiting plants were observed, as a crow flies at about 400 meters from the initial locality (Fig. 2).

If the species continues to spread at this rate, a future naturalization is very likely.

Herbarium collections:

Roeselare, port area, Trakelweg (IFBL D1.58.12), demolition site, 19.06.2022, *F. Verloove* 14347 (BR); Roeselare, port area, Trakelweg (IFBL D1.48.34), demolition site of former Hanekop mill, a few dozens, 21.07.2023, *F. Verloove* 14817 (BR); Roeselare, corner Azalealaan × Madeliefjesplein (IFBL D1.58.12), rough ground, several dozens, 23.07.2023, *F. Verloove* 14821 (BR).

Habitat preferences and ecology

In South Africa, *Pseudognaphalium undulatum* favors damp places, particularly around rock outcrops or on scree, stream- and river-banks, or near forest margins (Hilliard 1983). In its secondary area, it usually grows in marginal, anthropogenic habitats such as roadsides (including central reservations of motorways), rough grounds, etc. This also applies to the habitats in which it is currently found in Belgium. In the British Isles, however, it is also found on cliffs (Stace 2019) and according to Giulio *et al*. (2021) it can be locally abundant in coastal dunes although in Italy it is more often found in disturbed habitats such as near buildings and ruins, hedges and meadows (Del Guacchio & La Valva 2017). In July 2023, *P. undulatum* was discovered on the verge of a quarry in Berg in Zuid-Limburg in the Netherlands (waarneming.nl), in a semi-natural habitat (wood margin). In western France, mass occurrences are regularly observed in burnt heathlands (Des Abbayes 1948; comm. Fabien Dortel, Julien Geslin and Cécile Mesnage, 08.2023); it is considered to be potentially invasive in Bretagne as a result of reduced frost periods due to global warming (Liste de plantes envahissantes de Bretagne; accessed August 2023). *P. undulatum* was treated as an invasive species by Weber (2017), although it does not meet all criteria for listing as invasive in the sense of Richardson *et al.* (2000) (Pyšek *et al.* 2020).

Vector of introduction

Based on historical records from various European countries (see before), at least some records of *Pseudognaphalium undulatum* seem to be associated with the introduction of sheep wool, probably directly from South Africa, as the species does not appear to occur in other major wool-producing areas such as Australia or South America. The mode of introduction of the naturalized European populations is much less obvious, not to say that it is completely unknown. According to some internet sources, the species is sometimes grown as an ornamental but then apparently not widely so: it is not treated in the European Garden Flora (Tebbitt 2011) nor in the RHS Dictionary (Huxley 1999) and it is apparently not offered for sale in Belgium and the Netherlands (Plantago 2023). In fact, it has no ornamental value whatsoever.

In Roeselare, *P. undulatum* was found on and near a demolition site of an abandoned mill. In such conditions, interesting grain aliens are sometimes found that germinated from the long-buried seed bank (pers. obs. author; see also Clement 1977). However, this species is not a weed of agricultural fields and thus rather unlikely to occur as a grain alien. Moreover, its seeds are probably short-lived, as usually encountered in composites (Baskin & Baskin 2023). It seems most likely that the species ended up in Roeselare by chance, perhaps through transport or other human activities. There is probably no direct link with the original area of origin, i.e. it was in all likelihood introduced from its secondary area, most likely in France or the Netherlands.

Epilogue: which alien cudweed will be next?

As already mentioned, cudweeds are adapted for rapid wind dispersal. In recent years, the unexpected spread of a rare native species, *Pseudognaphalium luteoalbum*, has been observed in Belgium (Remacle 2008). In particular since around 2010, the number of records has exponentially increased, especially in Flanders (comm. W. Van Landuyt, October 2023). Until recently, this species was nearly confined to coastal areas where it was found in sand-dunes. In its natural habitat, it is much declining throughout most of Europe (e.g. Tison & de Foucault 2014, Gudžinskas & Taura 2022). Paradoxically, it is much increasing lately in anthropogenic habitats in western Europe, especially as an urban weed, in port areas, along railway infrastructure, etc. The sudden

increase of a rare native species evidently raises questions: is the genuine, native species involved or rather a non-native lookalike? Or, if indeed the same species, then perhaps a different infraspecific taxon or another genetic or geographic 'race' that is better adapted to grow in highly disturbed habitats?

There are in fact some weedy lookalikes of *P. luteoalbum* that should be looked for. *P. stramineum* (Kunth) Anderb. is the New World counterpart of *P. luteoalbum*. It is probably native from South America to western North America and adventive in sandy fields on the Atlantic coastal plain. It is found in various natural and anthropogenic habitats such as roadsides, fields and moist disturbed places (Nesom 2006). It is much reminiscent of *P. luteoalbum* and differs from it by its slightly longer involucres (4-6 mm vs. 3-4 mm) with more numerous bisexual florets (mostly 18-28 vs. 5-10) and its smooth cypselae (not papillate from globular trichomes) (Nesom l.c., Pruski & Robinson 2018). It is usually said to have evenly yellowish corollas whereas these are red-tipped in *P. luteoalbum*. However, in the latter, corollas can be entirely yellow as well, at least temporarily, as can be seen in e.g. a record from Schoten (waarnemingen.be; observation 282678994) that, based on achene morphology, unequivocally belongs with *P. luteoalbum*, not *P. stramineum*.

Pseudognaphalium affine (D. Don) Anderb. is an Asian lookalike that is sometimes treated as a subspecies of *P. luteoalbum*, subsp. *affine* (D. Don) Hilliard & B.L. Burtt. It is a common weed of wastelands and cultivated fields and thus likely to be found as an introduction outside of its native range. It has been reported as an established alien from Georgia and Turkey (Euro+Med Plantbase 2023). *P. affine* mostly differs from *P. luteoalbum* by its brighter, shiny yellow phyllaries (Kirpicznikov 1959, Chen & Bayer 2010).

These two congeners (and perhaps yet others) should be looked for in disturbed habitats, unless they are already present...

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