Leontodon and Scorzoneroides (Asteraceae, Cichorieae) in Italy

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Abstract

Sandro Pignatti’s Flora d’Italia was published in 1982. In this work, the genus Leontodon was edited by the late Helga Pittoni (Graz). Since then, a large amount of new data about the systematics and taxonomy of Leontodon s.l. have been acquired. The most important new aspect is that, based on molecular data, the former subgenera Leontodon and Oporinia are now regarded as separate genera, Leontodon s.str. and Scorzoneroides, respectively. Moreover, new assessments of some critical taxa resulted in some new names as compared to the first edition of the Flora d’Italia. The changes presented here are not only discussed in comparison with the first edition of the Flora d’Italia but also with regard to its predecessor (Fiori 1927) and to Flora Europaea (Finch and Sell 1976). Apart from a discussion of changes in nomenclature and taxon delimitation, identification keys are presented to distinguish between the genera Leontodon and Scorzoneroides, and to identify their Italian members.

Keywords: Leontodon, Scorzoneroides, identification keys, Italian flora, Cichorieae, Asteraceae

Introduction

The new edition of the Flora d’Italia is envisaged to be finished soon. The new edition will include some significant changes in the treatment of Leontodon s.l., the most important one being the reinstatement of the genus Scorzoneroides. This genus includes the former members of Leontodon subgenus Oporinia, i.e. sections Oporinia and Kalbfussia. The change in status was necessitated by recent molecular results by Samuel et al. (2006), which revealed that Leontodon in its traditional circumscription is diphyletic. The new edition of the Flora d’Italia will include a key to distinguish between Leontodon and Scorzoneroides as well as new identification keys to determine species within these genera. The English versions of these keys (Keys 1–3) are presented here. Moreover, changes in Leontodon s.l. in comparison with the last edition of the Flora d’Italia (Pittoni 1982) are discussed. Though the latest molecular results indicate that the genus Hedypnois clusters within Leontodon s.str. (with L. siculus as its sister taxon) (Enke et al., submitted), we refrain for the time being from formally including Hedypnois in Leontodon in the new edition of the Flora d’Italia, because Hedypnois is morphologically well characterized and to guarantee nomenclatural stability until the changes have been widely accepted.

Leontodon and Scorzoneroides each encompass approximately 25 species. Italy is a centre of diversity within the genus Leontodon s.str.; 13 species of Leontodon, encompassing a total of 15 taxa of at least subspecific rank –, and five species of Scorzoneroides, encompassing a total of seven taxa of at least subspecific rank, – occur as native species in Italy. These Italian taxa include the Italian endemics Leontodon anomalus, L. apulus, L. intermedius, L. rosani, and L. siculus. Moreover, the sub-endemic species L. berinii (also occurring in Slovenia), L. tenuiflorus (also occurring in Switzerland), and L. villarsii (main part of the distribution area in France) are part of the Italian flora. In the genus Scorzoneroides, only S. montana subsp. breviscapa is an endemic of Italy.

To distinguish between taxa within Leontodon s.l., two morphological characters are of utmost importance: the shape of the hairs that can be simple or stellate (Pittoni 1974), and the buds of the flowering heads just before anthesis that can be pendulous or erect (Widder 1931). Other important characters to distinguish the sections as defined by Widder (1975) are: roots/rhizomes (vertical taproots vs. horizontal
rhizomes), achenes (homo- vs heterocarpic), and the basic chromosome numbers ($2n = 8, 12, 14, 22$).

Materials and methods

Plant material

Besides first-hand observations of plants in the field and vouchers in the private herbarium of the author, specimens from the herbaria APP (Parco Nazionale del Gran Sasso e Monti della Laga – Università di Camerino), B (Botanischer Garten und Botanisches Museum Berlin-Dahlem, Berlin, Germany), FI (Museo di Storia Naturale, Firenze, Italy), IB (Universität Innsbruck, Innsbruck, Austria), IBF (Tiroler Landesmuseum Ferdinandeum, Innsbruck, Austria), and W (Naturhistorisches Museum, Wien, Austria) were analysed. In order to give the reader a set of reference specimens for comparison, scanned voucher specimens are added as supporting on-line only material (Figures S1–S22). Apart from one voucher (Figure S12, *Leontodon siculus*, which is present at herbarium IB and available as supplementary material at the server of this journal), all specimens and scans are taken from the database of digital specimen images at the Herbarium Berlin-Dahlem (BGBM database). The link to this database comprising vouchers of the herbarium at the B is the following: http://ww2.bgbm.org/herbarium/. In order to unambiguously identify the specimens referred to in this publication, barcode numbers and Image ID numbers of the voucher specimens referred to are indicated in the paragraphs of each species. The format used is the following:

Reference specimen in BGBM database

Direct link: http://ww2.bgbm.org/herbarium/images/B/10/02/71/69/B_10_0271697.jpg/Barcode: B 10 0271697/ImageId: 268498. [Example of *Leontodon anomalus*.]

Literature

All assessments and changes are discussed in comparison with the treatises of Fiori (1927), Finch and Sell (1976), and Pittoni in Pignatti (1982).

Taxon included here, though never found in Italy yet

*L. saxatilis* subsp. *rothii* Maire (= *L. taraxacoides* subsp. *longirostris* Finch and P.D. Sell) is traditionally mentioned in Italian floras (Fiori 1927; Pignatti 1982), though it was never actually reported from Italy. *L. saxatilis* subsp. *rothii* is widespread in the western Mediterranean and its area of distribution includes Nice (France), close to the border with Italy (Liguria Region). This taxon might still be found in north-western parts of Italy either as an overlooked native, a species expanding its former range, or as a casual introduction.

Request for feedback

*Leontodon* s.l. is, generally, like most genera of the Cichorieae with predominantly yellow flowering heads, regarded as a “difficult” group, and there are still some gaps in the data on the distribution of some of its taxa. Therefore, reports on sightings of taxa outside the current distribution areas would be useful to the author. These reports should be accompanied by duplicates of voucher specimens. The knowledge on the distribution of the following taxa is particularly scant and, therefore, warrants special attention:

- Distribution of the taxa of the *Leontodon crispus* group, in particular *L. anomalus*, *L. apulus*, and *L. intermedius*.
- Distribution of the taxa of *Leontodon hispidus* sensu latissimo, in particular *L. hispidus* subsp. *dubius* and *L. siculus*.
- Border between the areas of *Leontodon incanus* and *L. tenuiflorus*. According to Prosser et al. (2009), these taxa co-occur in the Lake Garda region.
- Exact distribution of *L. rosani* and *L. villarsii*, especially in NW-Italy, where both species might co-occur (Mariotti Lippi and Garbari 2004).
- Distribution of the subspecies of *Scorzoneroides montana*. The geographic border between the two subspecies of *S. montana* restricted to the Alps – subsp. *melanotricha* (Eastern Alps) and *S. montana* subsp. *montana* (western Alps) – is not as clear-cut as implied by Conti et al. (2005). Individuals to be assigned to the western subspecies *montana* have been observed as far east as the Lienzer Dolomiten (eastern Tyrol, Austria). On the other hand, specimens of the eastern subspecies *melanotricha* were collected as far west as the Grisons (Switzerland).

Keys to genera and species

Key 1: Key to distinguish between the genera *Leontodon* s.str. and *Scorzoneroides* in Italy

1. Plant with slender tubers
2. Inner and outer achenes similar, both bearing a hairy pappus; hairs on leaves simple or leaves glabrous *Scorzoneroides cichoracea*

2. Inner and outer achenes different, outer achenes with a pappus reduced to a short (<0.5 mm) cartilaginous crown (attention: outer achenes often enclosed in involucral bracts and thus easily overlooked); hairs on...
leaves 2- to 7-fid, rarely leaves glabrous
Leontodon tuberosus
1 Plant without tubers
2 Capitulum erect before anthesis – hairs on leaves simple or leaves glabrous Scorzonoides
3 Capitulum nodding before anthesis – hairs on leaves simple, bifid, stellate or leaves glabrous
4 Leaves hairy
5 Leaves with bifid or stellate hairs (branches of these hairs are very short in L. rosani and L. villarsii, therefore these might be mistaken for simple hairs), occasionally also with some simple hairs Leontodon
5 Leaves exclusively with simple hairs Scorzonoides muelleri
4 Leaves completely glabrous
6 Inner and outer achenes similar, both bearing a hairy pappus Leontodon
6 Inner and outer achenes different, outer achenes with a pappus reduced to a short (<0.5 mm) cartilaginous crown or without pappus (attention: outer achenes often enclosed in involucral bracts and easily overlooked), inner achenes bearing a hairy pappus
7 Outer achenes without a pappus – scapes branched or simple Scorzonoides muelleri
7 Outer achenes with a pappus reduced to a short (<0.5 mm) cartilaginous crown – scapes always simple Leontodon saxatilis s.l.

Key 2: Key to the Italian members of Leontodon s.str.1

1 Inner and outer achenes different, outer achenes with a pappus reduced to a short (<0.5 mm) cartilaginous crown, inner achenes bearing a hairy pappus, attention: outer achenes often enclosed in involucral bracts and thus easily overlooked – section Thrinicia
2 Plant with slender tubers L. tuberosus
2 Plant without tubers L. saxatilis
1 Inner and outer achenes similar, both bearing a hairy pappus – sections Asterothrix and Leontodon
3 Plants with a long, strong vertical taproot – achenes either with or without short rigid hairs at the top – section Asterothrix
4 Pappus plumose only in immature fruits, towards fruit maturation pappus increasingly composed of simple hairs only; leaves scabrid, leaf hairs (2-)3(-4)-fid, anchor-like with branches inflected towards the hair-stem–rosette leaves weakly sinuate to entire L. anomalus
4 Pappus plumose throughout fruit maturation; leaf hairs either multifid (L. berinii) and hair-
branches in two plains or (all other taxa) leaf hairs 2-4(-6)-fid, branches in one plain and not anchor-like and leaf hair branches not inflected towards the hair-stem
5 Leaves with a farinaceous appearance, densely covered with sessile or shortly stalked (4)-6-16-fid hairs, these hairs usually bearing two layers of branches – scapes simple or (often, i.e. at least some individuals in each larger population) branched L. berinii
5 Hairs on leaves usually 2-5(-6)-fid, branches always in one plain – scapes usually simple
6 Leaves velvety pilose; leaf hairs with (3-)4-5(-6) branches, hair branches as long as or longer than the stem
7 Rosette leaves weakly sinuate to entire L. incanus
7 Rosette leaves pronoucndly dentate or pin-
8 Rosette leaves pinnately divided, lineal-lanceolate; margin of external involucral bracts ciliate with simple (-2-fid) hairs L. apalus
7 Rosette leaves pronouncedly dentate, lanceolate; margin of external involucral bracts pectinate-ciliate with white 2-5-fid hairs L. intermedius
6 Leaves hairy but not with a velvety indumentum; leaf hairs stellate with 2-3(-4) branches, branches shorter (<1/2) than the stem
9 Leaves soft-haired; branches of the hairs about half as long as the stem; leaves entire to weakly dentate L. tenuiflorus
9 Leaves rough-haired; branches of the leaf hairs pronouncedly shorter than their stems (1/4-1/10 of the stem length); leaves pronouncedly dentate to pinnately divided
L. crispus
3 Herbs with an oblique or transversal, usually branched, truncate stock – achenes more or less muricate but not bearing short rigid hairs – section Leontodon
10 Leaf hairs bifid or stellate with long stems, bearing 2-3(-4) very short branches (<1/20 of the hair stem length; these branches are not or barely visible with a hand lens)
11 Leaf hairs verrucous (binocular, magnification ≥20×)² L. villarsii
11 Leaf hairs nearly smooth (binocular, magnification ≥20×)² L. rosani
10 Leaf hairs bifid or stellate, branches of these hairs are longer, as long, or shorter than the hair-stem but always easily visible with a hand lens and always longer than 1/10 of the hair-stem length, or leaves entirely glabrous (if leaves are glabrous, check other plants of the same population for leaf hairs as these are very important characters)
Key 3: Key to the Italian members of *Scorzoneroides*.

1. Plant with slender tubers *S. cichoracea*
2. Inner and outer achenes different, outer achenes without a pappus, inner achenes bearing a hairy pappus *S. muelleri*
3. Scapes undivided with one capitulum (very rarely few individuals in a population have bifid scapes); styles greenish (dark blue-green to black after drying); pappus hairs in one row, all pappus hairs equal and plumose (binocular, magnification ≥20×) – pappus greyish-white *S. autumnalis*
4. Pappus snow-white; involucrum villose (hairs >1 mm) with greyish-white to black hairs; scapes distinctly inflated below the capitulum; diameter of the capitulum 25–35 mm; leaves alate – scape usually about as long as the leaves; scape bearing 0–2 bracts *S. montana*
5. Pappus greyish-white; involucrum with short (<1 mm) black hairs; scape not or only weakly inflated below the capitulum; diameter of the capitulum 20–25 mm; leaves distinctly petiolate – scape usually much longer than the leaves; scape bearing 3-many bracts *S. helveticus*

**Leontodon anomalus Ball**

Finch and Sell (1976) included this Italian endemic in *L. crispus* subsp. *crispus*. Pittoni (1982) treated this taxon as a distinct species. This is congruent with our interpretation of the taxon and also with recent molecular data (Enke et al. 2012). Fiori (1927) included this taxon as a distinct variety in *L. incanus*. According to Pittoni (1982) Fiori’s *L. incanus* var. *finalensis* Bickn. et Fiori is identical with *L. anomalus*.

**Leontodon apulus (Fiori) Brullo**

This critical taxon is not mentioned in Flora Europae (Finch and Sell 1976) itself. However, in their explanatory remarks to the Flora Europaea, Finch and Sell (1975) mentioned *L. crispus* var. *apulus* Fiori as a taxon intermediate between *L. crispus* Vill. subsp. *crispus* sensu Finch and Sell and *L. crispus* subsp. *greacus* (Boiss. and Heldr.) Hayek sensu Finch and Sell (i.e. including *L. intermedius*). *L. apulus* was not mentioned by Pittoni (1982) but implicitly included in *L. intermedius*. Fiori (1927) included this taxon as a distinct variety in *L. crispus*. This author was also the first to describe and name this taxon as a variety of *L. crispus* (Fiori and Paoletti 1904). Data on the morphology and ecology of this taxon are scarce and data on chemistry and DNA sequences are missing. Further studies and observations are, therefore, highly warranted. Until further data are available, we follow Brullo (1988) and regard *L. apulus* as a distinct species. According to Terzi and d’Amico (2008), *L. apulus* is a characteristic element of the *Iberido carnosae-Athamantetum siculi* and the *Piptathero holciformis-Campanuletum versicoloris* plant associations. In some places of the Murgia...
of Matera (Basilicata region) \textit{L. apulus} and \textit{L. intermedius} grow together in the same association (Terzi and d’Amico 2008).

Figure S2. Reference specimen in BGBM database: Direct link: http://ww2.bgbm.org/herbarium/images/B/10/02/71/52/B_10_0271526.jpg/Barcode: B 10 0271526/ImageId: 268452.

\textit{Leontodon berinii} (Bartl.) Roth

Fiori (1927), Finch and Sell (1976), Pittoni (1982) and delimited and named this taxon in the same way as in this account. \textit{L. berinii} is the characteristic species of the \textit{Leontodonto berinii-Chondrilletum} T. Wraber 1965 (\textit{Epilobion fleischeri} G.Br.-Bl. et J.Br.-Bl. 1931) on the river gravel from NE-Italy to Slovenia.

Figure S3. Reference specimen in BGBM database: Direct link: http://ww2.bgbm.org/herbarium/images/B/10/02/71/53/B_10_0271530.jpg/Barcode: B 10 0271530/ImageId: 268454.

\textit{Leontodon crispus} Vill. s.str.

Finch and Sell (1976) defined this taxon in a different sense than applied here. On the one hand, these authors included three taxa – \textit{L. anomalus}, \textit{L. apulus} (also see discussion there), and \textit{L. biscutellifolius} DC. (as \textit{L. asper} Waldst. and Kit.3) – which are regarded as distinct species here, in their \textit{L. crispus} subsp. \textit{crispus}. On the other hand, these authors accepted \textit{L. crispus} subsp. \textit{rossianus} (Degen and Lengyel) Hayek as a distinct subspecies. According to Pittoni (1974) the latter does not need to be recognized as a taxon distinct from \textit{L. crispus} s.str., a point of view followed in this account. \textit{L. intermedius} was included by Finch and Sell (1975, 1976) in \textit{L. crispus} subsp. \textit{graeacus} (Boiss. and Heldr.) Hayek. We regard \textit{L. intermedius} as distinct from \textit{L. graeacus} (a taxon not represented in the Italian flora), and assign the species status to both, \textit{L. graeacus} and \textit{L. intermedius}. Based on recent molecular data (Enke et al. 2012) \textit{L. intermedius} is more closely related to \textit{L. crispus} s.str. than to \textit{L. graeacus}.

Figure S4. Reference specimen in BGBM database: Direct link: http://ww2.bgbm.org/herbarium/images/B/10/02/71/53/B_10_0271533.jpg. Barcode: B 10 0271533/ImageId: 268435.

Pittoni’s (1982) circumscription of \textit{L. crispus} equals the one used here. Fiori (1927) distinguishes seven varieties within \textit{L. crispus}. Two of these varieties (\textit{apulus} and \textit{intermedius}) are treated as distinct species here; the rest are included in our circumscription of \textit{L. crispus} and are not given varietal or subspecific rank. Note also that, according to Pittoni (1982) and to our observations, the Italian populations assigned by some authors to \textit{L. crispus} var. \textit{asper} do not belong to the same taxon as \textit{L. crispus} subsp. \textit{asper} [= \textit{L. asper} Waldst. and Kit. (non \textit{L. asper} Forssk.) = \textit{L. biscutellifolius} DC.] from the Balkan peninsula.

\textit{Leontodon incanus} (L.) Schrank. \textit{L. incanus} as delimited here is identical to \textit{L. incanus} subsp. \textit{incanus} sensu Finch and Sell (1976). Note, however, that these authors included \textit{L. tenuiflorus} as a subspecies in \textit{L. incanus}. Pittoni delimited \textit{L. incanus} in the same way as applied here. Fiori (1927) distinguished four varieties in \textit{L. incanus}. Only \textit{L. incanus} var. \textit{incanus} sensu Fiori is included into \textit{L. incanus} in the strict sense applied here. \textit{L. incanus} var. \textit{tenuiflorus} Rchb. sensu Fiori (1927) is regarded as a distinct species (\textit{L. tenuiflorus}), and varieties \textit{finalensis} Bickn. et Fiori and \textit{anomalus} Ball are regarded as belonging to the same taxon, \textit{L. anomalus}, which, like \textit{L. tenuiflorus}, is assigned the species rank here.

Figure S5. Reference specimen in BGBM database: Direct link: /Barcode: B 10 0271292/ImageId: 268425.

\textit{Leontodon intermedius} Huter, Porta and Rigo

Finch and Sell (1976) included this taxon in \textit{L. crispus} subsp. \textit{graeacus} (Boiss. and Heldr) Hayek. We treat this taxon here as distinct from the Central Greek endemic \textit{L. graeacus} Boiss. and Heldr. and assign to it as well as to \textit{L. graeacus} specific rank. Pittoni (1982) also treated \textit{L. intermedius} at specific rank but – based on indirect evidence (determination key, distribution map) – included \textit{L. apulus} into her concept of \textit{L. intermedius}. Fiori (1927) treated \textit{L. intermedius} in the same delimitation as applied here but included it as one of seven varieties in \textit{L. crispus} s.l. \textit{L. intermedius} is a characteristic element of the \textit{Piptathero holciformis-Campanuletum versicoloris} plant association and sympatric with \textit{L. apulus} in some places in the Murgia of Matera (Basilicata region) (Terzi and d’Amico 2008).

Figure S6. Reference specimen in BGBM database: Direct link: /Barcode: B 10 0271294/ImageId: 268427.

\textit{Leontodon tenuiflorus} (Gaudin) Rchb.

Pittoni (1982) regarded \textit{L. tenuiflorus} as a distinct species, an assessment we follow here. Finch and Sell (1976) regarded \textit{L. tenuiflorus} to be a subspecies of \textit{L. incanus} and Fiori (1927) considered it a variety of \textit{L. incanus}. Both infraspecific entities are identical to \textit{L. tenuiflorus} as delimited here. Recently,
L. tenuiflorus, an endemic of the Insubrian region (Pittoni 1982), Friuli (Poldini 2002) and the Julian Alps (Wraber 1969), was reported from Slovenia (Čušin 2009). However, according to the figures of leaf hairs published by Čušin (2009) the plant assigned to L. tenuiflorus was in fact L. hispidus subsp. dubius.

Figure S7. Reference specimen in BGBM database: / Barcode: B 10 0271293/ImageId: 268426.

Leontodon section Leontodon

Leontodon hispidus L.

The infraspecific treatment of L. hispidus applied here differs considerably from the system of Finch and Sell (1975, 1976) who were, in their own words, inclined “to not recognize any subspecies” within L. hispidus. However, “under the pressure from central European colleagues” they provided a system of infra-specific classification based on presence/absence of indumentum, leaf shape, and scape length relative to leaf length, which resulted in six subspecies (Finch and Sell 1975, 1976). The subspecies sensu Finch and Sell are, however, artificial entities of little systematic significance because they are based on characters which are highly variable even within populations of L. hispidus. For example, hairy and glabrous individuals co-occur in many parts of the distribution range, and the ratio of stem length to the length of rosette leaves shows a clinal variation from low altitude sites (relatively longer stems) to high altitude sites (relatively shorter stems). Moreover, stem length differs in the same individuals during the course of the vegetation period, with longer stems being more frequent in mid-summer and shorter stems dominating towards the end of the flowering season. The subspecies sensu Flora Europaea (Finch and Sell, 1975, 1976) are only partially congruent with the taxa accepted as subspecies below. Nonetheless, to enable comparisons between the two systems, subspecies names sensu Finch and Sell (1975, 1976) are indicated in the accounts of the respective subspecies according to the system outlined here. A key to distinguish the three accepted subspecies occurring in Italy is provided below (Key 4).

Key 4: Key to infraspecific taxa within L. hispidus in Italy.

1 Leaves more or less hairy
2 Leaves scabrid, leaf hairs (2-)3(-4)-fid, some to many hairs with branch anchor-like inflected towards the stem – leaf veins never red, outer surface of ligules always pure yellow subsp. dubius
3 Leaves weakly sinuate to pronouncedly dentate – leaf veins usually green subsp. hispidus
4 Leaves more or less deeply pinnatifid – leaf veins often red subsp. hyoseroides
5 Leaves more or less deeply pinnatifid – leaf veins often red subsp. hyoseroides

L. hispidus subsp. dubius (Hoppe) Pawlowska. This taxon occurs on limestone rocks and scree in the eastern and southern Alps (Lippert and Tietz 2000), and in the central Abruzzi (Italy) based on recent observations of vouchers from APP. Specimens of this taxon were formerly often assigned to L. hispidus subsp. pseudocrispus (Sch.Bip. ex Bischoff) Murr sensu Finch and Sell (1975, 1976). Here, L. hispidus subsp. pseudocrispus is included as a hairy form of no systematic value into L. hispidus subsp. hyoseroides. These hairy specimens of L. hispidus subsp. hyoseroides differ from L. hispidus subsp. dubius in having an indumentum composed of 2- or 4-fid hairs with erect or horizontal branches. In contrast, characteristic anchor-like hairs with branches inflected towards the hair-stem are found in L. hispidus subsp. dubius. The shape of these anchor-like hairs found in L. hispidus subsp. dubius is very similar to those of L. anomalus.

Populations of L. hispidus subsp. dubius with narrow leaves are sometimes referred to as L. hispidus subsp. brumatii (Rchb.) Wraber (1998). Specimens revised so far either have the same characteristic hair-shape as subsp. dubius or are entirely glabrous, as also often occurs in subsp. dubius. Moreover, L. hispidus subsp. brumatii seems to inhabit similar ecological niches as subsp. dubius. Therefore, we include L. hispidus subsp. brumatii here as a minor variant without formal rank into L. hispidus subsp. dubius. Populations combining the characteristics of L. hispidus subsp. hyoseroides (dubius.
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dually divided leaves, red leaf veins) and *L. hispidus* subsp. *dubius* (anchor-like hairs) occur in Alto Adige/ Südtirol (Italy). These populations are here included in *L. hispidus* subsp. *dubius*.

Figure S8. Reference specimen in BGBM database: Direct link: http://ww2.bgbm.org/herbarium/images/B/10/00/69/69/B_10_0069694.jpg/Barcode: B 10 0069694/ImageId: 268414.

*L. hispidus* subsp. *hispidus*. This subspecies is outlined here in a much broader sense than by Finch and Sell (1975, 1976). In the present account, *L. hispidus* subsp. *hispidus* includes four of the subspecies *sensu* Finch and Sell (1975, 1976), namely subsp. *alpinus* (Jacq.) Finch and P.D. Sell, subsp. *danubialis* (Jacq.) Simonkai, subsp. *hispidus*, and subsp. *opimus* (Koch) Finch and P.D. Sell. Greuter (2003) coined the new combination *L. hispidus* subsp. *montanus* (Ball) Greuter for the taxon formerly referred to as *L. hispidus* subsp. *alpinus*. Thus, this taxon is also included into *L. hispidus* subsp. *hispidus* here. In conclusion, the present circumscription of *L. hispidus* subsp. *hispidus* includes all taxa of *L. hispidus* predominantly inhabiting meadows, pastures, and dry grasslands. The two other subspecies recognized here are *L. hispidus* subsp. *dubius* and subsp. *hyoseroides*; these differ not only morphologically (see analytical key), but also ecologically in that they inhabit limestone rocks and scree in mountainous regions. However, within their native mountain ranges, the vertical distribution of both subsp. *dubius* and subsp. *hyoseroides* encompasses all altitudinal zones from the colline to the alpine zone.

Figure S9. Reference specimen in BGBM database: Direct link: http://www.bgbm.org/herbarium/images/B/10/00/69/69/B_10_0071700.jpg/Barcode: B 10 0071700/ImageId: 268441.

*L. hispidus* subsp. *hyoseroides* (Welw. ex Reichenb.) Murr. In the present account, this subspecies includes, in contrast to Finch and Sell (1975, 1976), also the hairy individuals (except the ones with anchor-like leaf hairs, included in subsp. *dubius*) with deeply pinnatifid leaves, i.e. *L. hispidus* subsp. *pseudocrispus* (Sch. Bip. ex Bischoff) Murr *sensu* Finch and Sell (1975). As in subsp. *hispidus*, both hairy and glabrous plants co-occur in many populations with the hairy plants being more frequent in drier habitats. Greuter (2003) treats *L. hyoseroides* Welw. ex Rchb. as a species distinct from *L. hispidus* and includes the taxon named *L. hispidus* subsp. *pseudocrispus* (Sch.Bip. ex Bischoff) Murr by Finch and Sell as a subspecies into *L. hyoseroides*. I do not support the assignment of specific status to *L. hyoseroides* because many populations and individ-
Because of the ambiguities related to the interpretation of L. hirtus L., here I follow Pittoni (1982) and apply the name L. villarsii to the taxon at hand.

Finch and Sell (1975) did not distinguish between L. rosani and L. villarsii. Macro-morphologically L. rosani and L. villarsii are nearly indistinguishable. The two species differ, however, in their chromosome number, their indumentum, and their pollen grains. Details are described in Mariotti Lippi and Garbari (2004). L. rosani is an allopolyploid taxon with a chromosome number of 2n = 22. Its basic chromosome number is most probably derived from one parent with 2n = 14 as in Leontodon section Leontodon (e.g. L. hispidus and L. villarsii s.str.) and one with 2n = 8 as in the Leontodon sections Asterothrix (e.g. L. crispus) and Thrincia (e.g. L. saxatilis). Morphologically L. rosani is characterized by tetra-symmetric pollen grains and smooth leaf hairs. In L. villarsii s.str. the basic chromosome number is 2n = 14, the pollen grains are tri-symmetric, and the leaf hairs are, under strong (≥ 20×) magnification, distinctly verrucous. Figures of both pollen grains and leaf hairs are depicted for both species in Mariotti Lippi and Garbari (2004). L. rosani and L. villarsii seem to have nearly non-overlapping areas of distribution, with L. rosani occurring in peninsular Italy and its range reaching only the southern foothills of the Sea Alps. By contrast, L. villarsii s.str. is distributed from the southwestern Alps throughout southern France to the northern Pyrenees. As the decisive publication of Mariotti Lippi and Garbari (2004) is still relatively recent, the exact distribution ranges of the two species and a possible overlap of their areas are still insufficiently known.

There seems to be some controversy about the exact distribution area of L. hispidus subsp. siculus. Pittoni simply mentioned mountain ranges in northern Sicily, whereas Finch and Sell (1976) indicated southwestern Italy and Sicily as the distribution range. Fiori (1927) mentioned, besides Sicily, one site in Calabria (Gerace). In the current Italian checklist (Conti et al. 2005), Sicily is the only Italian region for which L. siculus is indicated. Moreover, in this checklist (Conti et al. 2005) L. hispidus is listed as occurring in all Italian regions except Sardinia, and thus also including Sicily.

Figure S12. Scan from voucher of IB specimen number 33284.

**Leontodon villarsii** (Willd.) Loisel.

Finch and Sell regarded L. hirtus L. to be the correct name for this taxon. L. hirtus is a particularly problematic name, since no type has been designated yet and the name has been variably interpreted (Linnean Plant name Typification Project 2010) by Britten [L. hirtus = Leontodon saxatilis Lam. (as Thrincia nudicaulis (L.) Britten (1907))], Lacaita [L. hirtus = L. villarsii (Lacaita 1918)] and Finch and Sell [L. hirtus = L. villarsii (1975)]. If indeed the interpretations of Lacaita (1918), Finch and Sell (1975), and the Euro+Med Plantbase (Greuter 2006–2009) were correct, the name L. hirtus L. would have priority over L. villarsii (Willd.) Loisel. Because of the ambiguities related to the interpretation of L. hirtus L., here I follow Pittoni (1982) and apply the name L. villarsii to the taxon at hand.

Finch and Sell (1975) did not distinguish between L. rosani and L. villarsii. Macro-morphologically L. rosani and L. villarsii are nearly indistinguishable. The two species differ, however, in their chromosome number, their indumentum, and their pollen grains. Details are described in Mariotti Lippi and Garbari (2004). L. rosani is an allopolyploid taxon with a chromosome number of 2n = 22. Its basic chromosome number is most probably derived from one parent with 2n = 14 as in Leontodon section Leontodon (e.g. L. hispidus and L. villarsii s.str.) and one with 2n = 8 as in the Leontodon sections Asterothrix (e.g. L. crispus) and Thrincia (e.g. L. saxatilis). Morphologically L. rosani is characterized by tetra-symmetric pollen grains and smooth leaf hairs. In L. villarsii s.str. the basic chromosome number is 2n = 14, the pollen grains are tri-symmetric, and the leaf hairs are, under strong (≥ 20×) magnification, distinctly verrucous. Figures of both pollen grains and leaf hairs are depicted for both species in Mariotti Lippi and Garbari (2004). L. rosani and L. villarsii seem to have nearly non-overlapping areas of distribution, with L. rosani occurring in peninsular Italy and its range reaching only the southern foothills of the Sea Alps. By contrast, L. villarsii s.str. is distributed from the southwestern Alps throughout southern France to the northern Pyrenees. As the decisive publication of Mariotti Lippi and Garbari (2004) is still relatively recent, the exact distribution ranges of the two species and a possible overlap of their areas are still insufficiently known.

Figure S13. Reference specimen in BGBM database: Direct link: http://ww2.bgbm.org/herbarium/images/B/10/00/69/95/B_10_0069953.jpg/Barcode: B 10 0069953/ImageId: 268370.

**Leontodon saxatilis** Lam. [= L. taraxacoides (Vill.) Mérat]. Finch and Sell (1976) named this species L. taraxacoides. In the present account, I follow Fuchs-Eckert (1980) and regard L. taraxacoides (Vill.) Mérat as a later synonym of L. saxatilis Lam. However, the subspecies taraxacoides was delimited in the same way by Finch and Sell (1976) as L. saxatilis Lam. subsp. saxatilis in this account. In Pittoni (1982) this taxon was named L. leysseri (Wallr.) Beck, and in Fiori (1927) it was referred to as L. hirtus L. [also compare the entry for L. villarsii (Willd.) Loisel.].

Currently, only L. saxatilis subsp. saxatilis is known from Italy. However, the area of the western Mediterranean subspecies rothii Maire (Greuter
2003) [= *L. longirostris* (Fich and P.D.Sell) Talavera = *L. saxatilis* subsp. *longirostris* (Finch and P.D.Sell) P.Silva = *L. taraxacoides* subsp. *longirostris* Finch and P.D.Sell] extends to Nice in SE France, and native and/or adventitious populations are possible in Italy, too. *L. saxatilis* subsp. *rothii* differs from the type subspecies by its annual life form and the inner achenes, which bear a beak of 2-3 mm length (type subspecies: perennial or biennial and inner achenes with a beak of 1 mm length). Pittoni (1982) used the synonym *L. leysseri* (Wallr.) Beck for *L. saxatilis* and regarded *L. rothii* Ball [= *L. longirostris* (Fich and P.D.Sell)] Talavera as a distinct species.

Figure S14. Reference specimen in BGBM database: /Barcode: B 10 0271291/ImageId: 268424.

*Leontodon tuberosus* L.

Finch and Sell (1976), Pittoni (1982), and Fiori (1927) delimited and named this taxon in the same way as in this account. Fiori distinguished two varieties based on the density of the indumentum (sparsely setose for the typical variety and densely setose for *L. tuberosus* var. *olivieri* Fiori).

Figure S15. Reference specimen in BGBM database: /Barcode: B 10 0271298/ImageId: 268337.

**Discussion of Italian taxa of Scorzoneroides (formerly Leontodon subgenus Oporinia)**

The subgeneric structure in *Leontodon* s.l., including the part currently comprised in the genus *Scorzoneroides* (formerly *Leontodon* subgenus Oporinia), was described by Widder (1975). According to Widder *S. autumnalis*, *S. helvetica*, and *S. montana* are part of section Oporinia and *S. cichoracea* and *S. muelleri* are part of section Kalbfussia. As the available molecular data (Samuel et al. 2006; Enke et al. 2012) do not support these subgeneric entities, I refrain, for the time being, from formally accepting any sections within the genus *Scorzoneroides*.

*Scorzoneroides autumnalis* (L.) Moench

Apart from the fact that the taxon was included in the genus *Leontodon* (as *L. autumnalis* L.), this taxon is delimited here in the same way as by Finch and Sell (1976). Pittoni (1982) and Fiori (1927) also delimited the species (both as *L. autumnalis* L.) as is done here. Based on the number of flowering heads per stem, the size of the capitula, and the indumentum of the capitula (glabrous versus light-coloured vs black hairs), a number of varieties or subspecies were distinguished (*autumnalis*; large capitula, light-coloured indumentum of involucral bracts, many capitula per stem; *palustris*, small capitula, involucral bracts glabrous, many capitula per stem; *pratensis*, large capitula, dark indumentum of involucral bracts, few capitula per stem; *taraxaci*, large capitula, dark indumentum of involucral bracts, one capitulum per stem] by various authors.

However, while acknowledging the extreme variability of the species, I refrain, for the time being, from accepting any infraspecific taxa. The most important reasons for this decision are lack of detailed morphological and molecular studies, the high intra-populational variation of the enumerated characters, and the fact that the characters used to define the infraspecific taxa seem to vary independently from each other.

Figure S16. Reference specimen in BGBM database: /Barcode: B 10 0066617/ImageId: 209508.

*Scorzoneroides cichoracea* (Ten.) Greuter

Apart from the fact that the taxon was included in *Leontodon* [as *L. cichoraceus* (Ten.) Sanguin.], this taxon is delimited here as in the accounts of Finch and Sell (1976), Pittoni (1982), and Fiori (1927). *S. cichoracea* has erect buds of flowering heads. This fact was not clearly stated by Widder (1975) who included this taxon in section Kalbfussia and tentatively postulated nodding buds of flowering heads for all members of this section. However, as stated above section Kalbfussia sensu Widder is not supported by molecular data.

Figure S17. Reference specimen in BGBM database: /Barcode: B 10 0271699/ImageId: 268500.

*Scorzoneroides helvetica* (Mérat) Holub

*L. helveticus* Mérat em. Widder was included as a subspecies in *L. pyrenaicus* Gouan by Finch and Sell (1976). Apart from the change in rank and the transfer to the genus *Scorzoneroides*, this taxon was delimited in the same way by Finch and Sell (1976) as *S. helvetica* is in this account. Pittoni (1982) treated *S. helvetica* (as *L. helveticus*) as a species distinct from *S. pyrenaica* (as *L. pyrenaicus*). Fiori (1927) named the Italian populations of *S. pyrenaica* s.l. (= *L. pyrenaicus* s.l.) as *L. pyrenaicus* and distinguished between three varieties. All three varieties [typicus = *pyrenaicus*, croceus (Haenke) Fiori; cadubricus Pamp.] have, according to current taxonomical usage and systematic knowledge, to be regarded as members of *S. helvetica*. It is, however, important to note that Fiori’s equalization of Italian specimens of *L. pyrenaicus* s.l. (i.e.
S. helvetica in current nomenclature) bearing saffron-yellow ligules (a taxonomically insignificant form occurring rarely throughout the geographic range of the species group) with Haenke’s L. croceus [today named S. crocea (Haenke) Holub] was erroneous. In fact, S. crocea, a species of the Austrian and Slovenian (the latter recently discovered by Dakskobler et al. 2010) eastern Alps and of the eastern Carpathians is not, and never was, part of the Italian flora.

Figure S18. Reference specimen in BGBM database: /Barcode: B 10 0271680/ImageId: 268489.

Scorzoneroides montana (Lam.) Holub

Finch and Sell (1976) defined this taxon in a broader sense than applied here and included S. pseudotaraxaci (Schur) Holub [= L. pseudotaraxaci Schur] and S. montaniformis (Widder) Gutermann (= L. montaniformis Widder), which we regard as distinct species, in their circumscription of L. montanus (today S. montana). Moreover, they used a different and, in my view, misleading infrageneric system of L. montanus. Details on the system for the entire S. montana group are discussed in Zidorn (2008). In Italy, S. montana s.l. encompasses three taxa occurring in different geographic regions: subspecies montana in the western Alps, subsp. melanotricha (Vierh.) Gutermann in the eastern Alps, and subsp. breviscapa (DC.) Greuter in the Abruzzi Region (Italy).

These three Italian subspecies can be identified with the following key (Key 5).

Key 5: Key to infraspecific taxa within S. montana in Italy.

1 Indumentum of the involucrum light grey to white – Western Alps **subsp. montana**
2 Indumentum of the involucrum black
3 Ligules gold-yellow (like Leontodon hispidus L.), plant height 10-15 cm – Eastern Alps **subsp. melanotricha**
4 Ligules saffron-yellow (like Carthamus tinctorius L.), plant height 5-10 cm – Central Abruzzi **subsp. breviscapa**

Scorzoneroides montana subsp. breviscapa

Figure S19. Reference specimen in BGBM database: /Barcode: B 10 0271692/ImageId: 268460.

Scorzoneroides montana subsp. melanotricha

Figure S20. Reference specimen in BGBM database: /Barcode: B 10 0271694/ImageId: 268462.

Conclusions

Though molecular analyses have provided new and partially unexpected insights into the relationships between the members of the former genus Leontodon s.l., a number of open questions for future research remain. On the one hand, the knowledge about the distribution of some newly accepted systematic entities (for example L. apulus, L. rosani/L. villarsii, and L. hispidus subsp. dubius) remains sketchy at best. Moreover, possible infraspecific entities within S. autumnalis still need further morphological, ecological, and molecular investigations. The aim of the present paper is to address and contribute towards solving these questions.

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Notes

1. Unequaled drawings of hairs of most of the taxa discussed here are provided in Pittoni (1974).
2. Electron-microscopic pictures of the hairs of both species are provided by Mariotti Lippi and Garbari (2004). In order to unambiguously assign both species with a reflected-light microscope, it is recommended using a set of authenticated reference specimens for comparison.
3. Note on L. biscutellifolius DC.: L. biscutellifolius is the taxon traditionally named L. aper (Waldst. and Kit.) Poiret. This
taxon has an area of distribution ranging from the Balkans to Crimea and thus does not occur in Italy. The traditional name *L. asper* is, however, not available at the species level, because there is an earlier homonym by Forsskål (1775), which refers to a different taxon. Based on our studies, the earliest valid name at the species rank available for the former *L. asper* (Waldst. and Kit.) Poir. in the genus *Leontodon* is *L. bicallosifolius* DC.

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