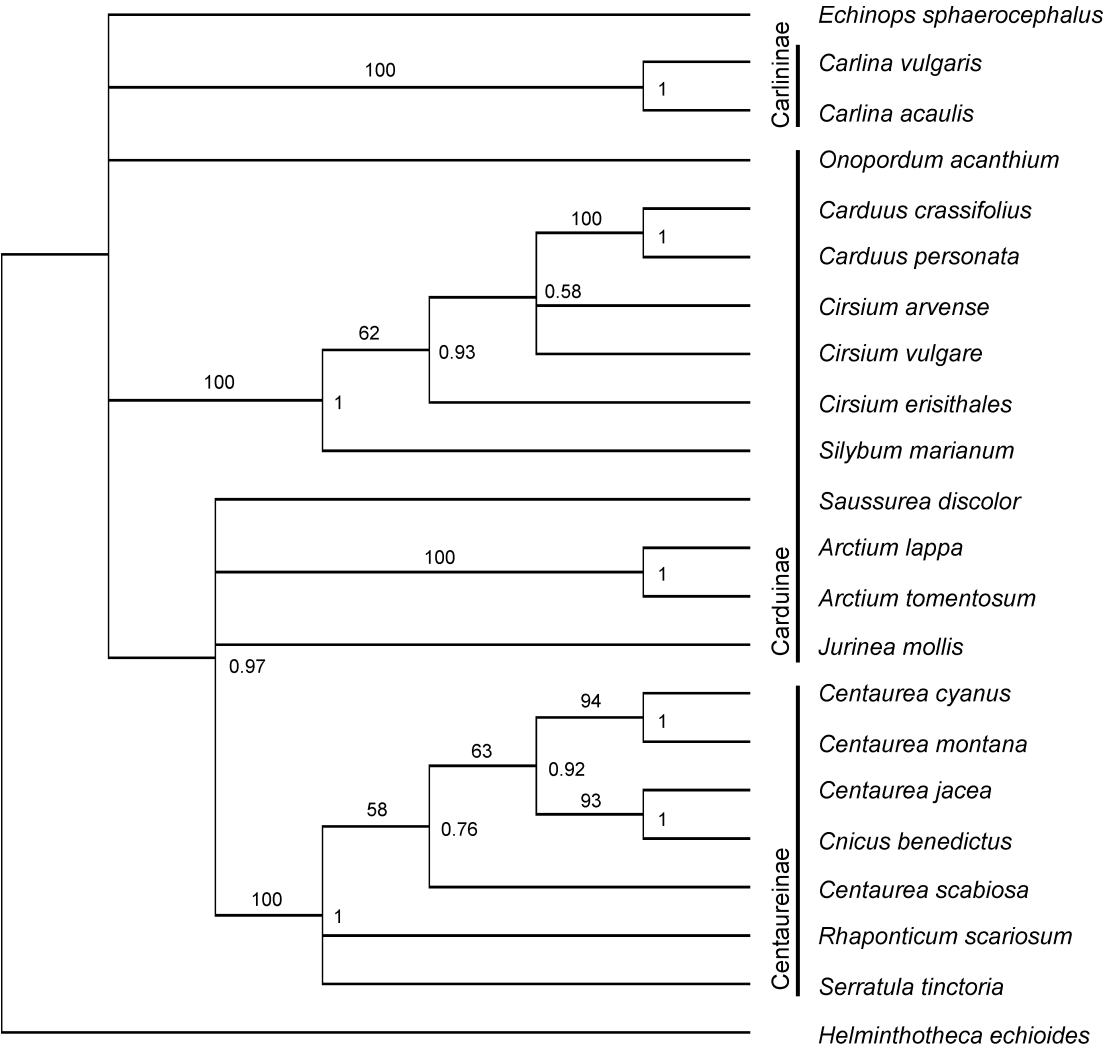
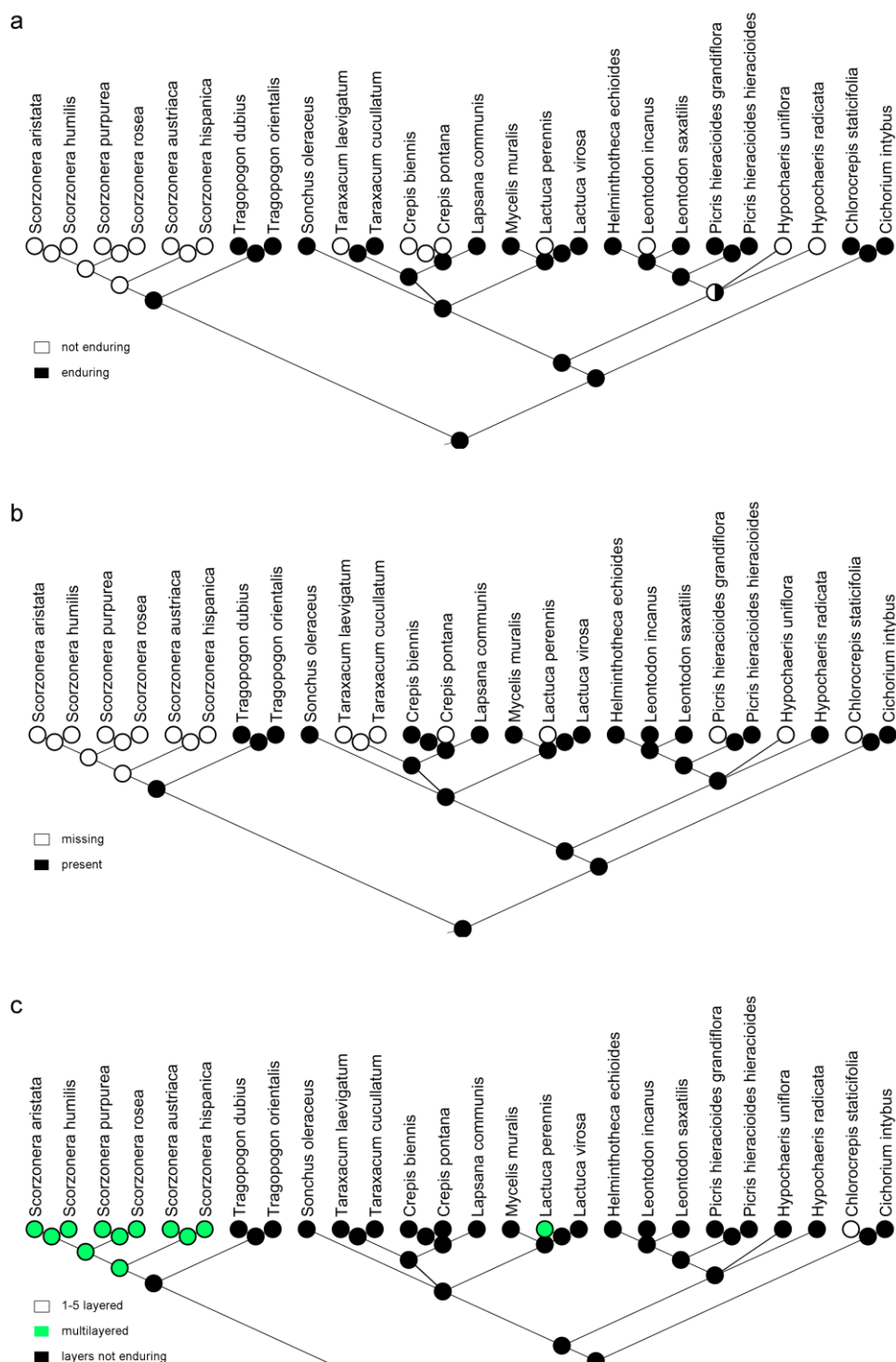


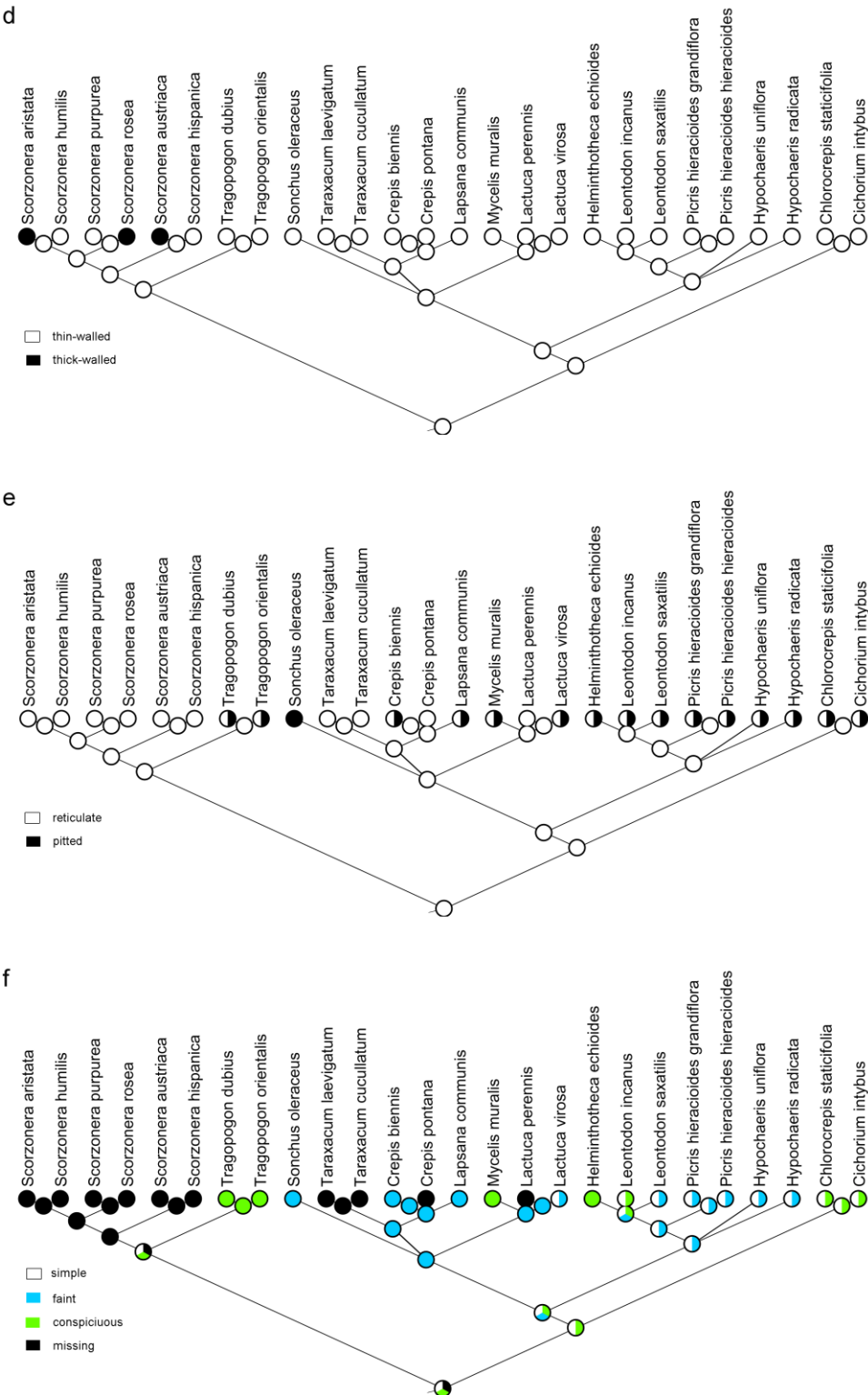
Supplementary Materials: Suitability of Root and Rhizome Anatomy for Taxonomic Classification and Reconstruction of Phylogenetic Relationships in the Tribes Cardueae and Cichorieae (Asteraceae)

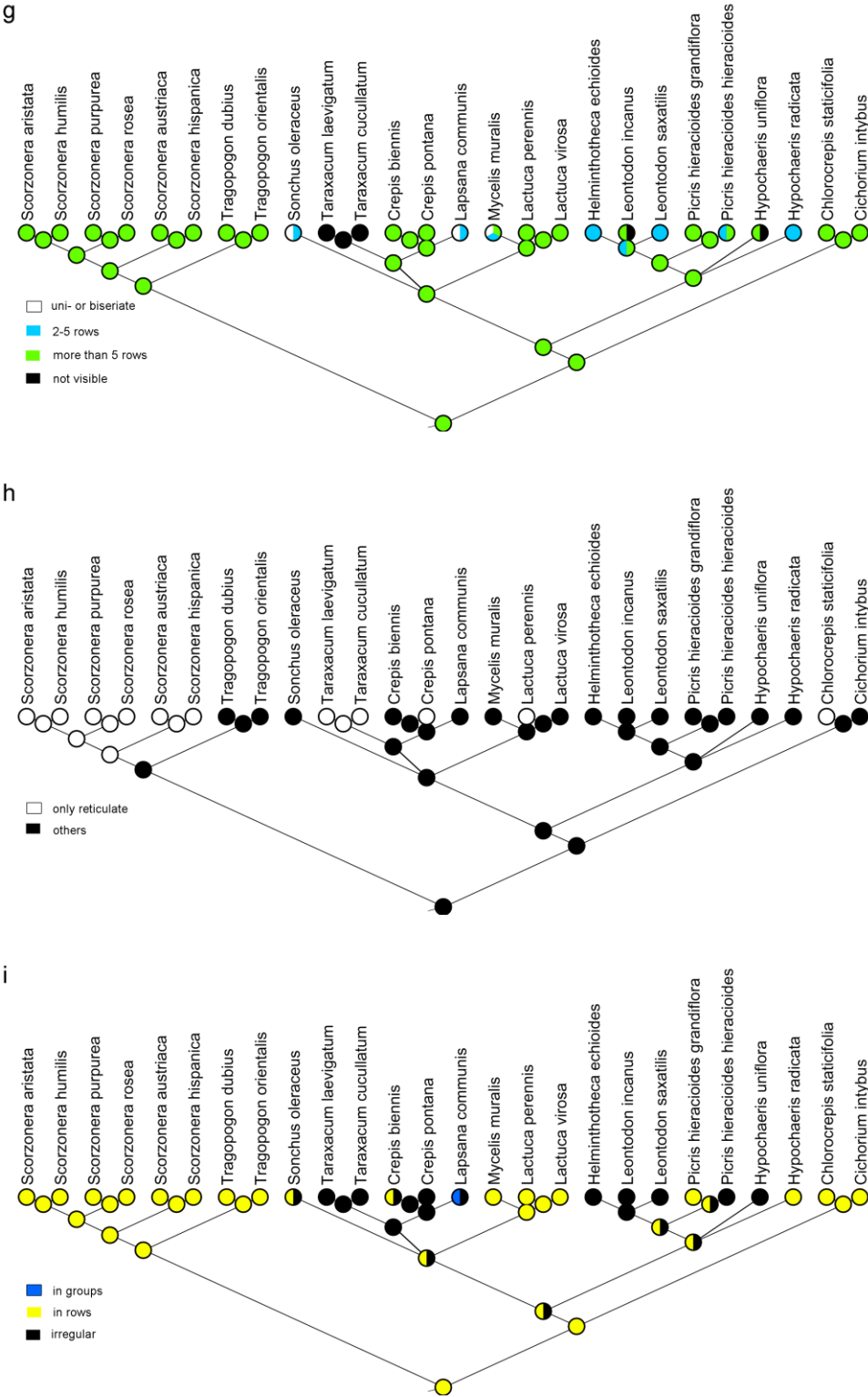
Supplementary figure 1: 50% majority rule consensus tree of three subtribes and 13 genera from the Cardueae based on nrDNA single nucleotide polymorphisms and indel polymorphism. The tree was reconstructed from 7500 retained trees (out of 10,000; burnin = 2500) inferred using MrBayes. Posterior probabilities are given to the right of nodes. Numbers above branches are bootstrap values obtained for taxonomically equivalent clades running an independent maximum parsimony analysis on the same character set and accessions using PAUP (number of bootstrap replicates was 1000).



Supplementary figure 2: Ancestral character reconstructions based on the 50% majority rule consensus from Figure 2. The character states of ancestral nodes were inferred using Mesquite under the parsimony criterion. (a) cortex durability; (b) fibers in secondary xylem; (c) phellem; (d) phellem cells; (e) vessel perforation; (f) pits of vessels; (g) medullary rays; (h) vessel perforation; (i) vessel arrangement. Character states as indicated by the legend.







Supplementary table 3: Summary of anatomical character states observed in 58 species of the Cardueae and Cichorieae: See Table 2 for definition of states. Superscripts provide links to further reading about the anatomy of underground parts of respective species: numbers see references.

Taxon	Subtribe	1. Subterranean Organ	2. Tissue Dominating In Extension	3. Cortex Durability	4. Endodermis	5. Fibers in Secondary Xylem	6. Fibers in Secondary Phloem	7. Sclereids	8. Endodermal Resin Ducts	9. SG1	10. SG2	11. SG3	12. SG4	13. Secretory Cavities (1 = Missing)	14. Arrangement of Laticifers	15. Phellem	16. Phellem Cells	17. Vessel Perforation	18. Pits of Vessels	19. Medullary Rays	20. Pith Cells	21. Arrangement OF Vessels	22. Crystal Needles
Cardueae																							
<i>Arctium lappa</i> ^{7,8}	Carduinae	3	1	1	1	2	2	1	2	1	1	1	1	1	1	3	1	12	12	3	1	4	1
<i>Arctium tomentosum</i> ^{7,8}	Carduinae	3	1	1	1	2	2	1	2	1	1	1	1	1	1	3	1	12	12	3	1	4	1
<i>Carduus crassifolius</i> ^{7,8}	Carduinae	3	1	2	1	2	2	23	2	1	1	1	1	1	1	3	1	12	2	3	1	1	1
<i>Carduus personata</i> ^{7,8}	Carduinae	1	1	2	1	2	2	234	2	1	1	1	1	1	1	3	1	12	3	3	6	5	1
<i>Cirsium arvense</i> ^{7,8}	Carduinae	123	1	2	1	2	2	23	2	1	5	1	1	1	1	3	1	2	3	23	123	5	1
<i>Cirsium erisithales</i> ^{7,8}	Carduinae	12	1	1	1	2	2	1	2	1	1	1	1	1	1	3	1	12	3	3	2	1	1
<i>Cirsium vulgare</i> ^{7,8}	Carduinae	3	1	2	2	2	2	23	2	1	1	1	1	1	1	3	1	12	123	3	1	5	1
<i>Jurinea mollis</i> ⁸	Carduinae	3	12	2	2	2	2	1	2	1	1	1	1	1	1	3	1	12	12	3	1	4	1
<i>Onopordum acanthium</i> ^{7,8,25}	Carduinae	3	1	2	2	2	2	1	2	1	1	1	1	1	1	3	1	2	3	23	1	5	1
<i>Saussurea discolor</i> ³⁴	Carduinae	5	12	1	1	2	1	1	1	1	23	1	1	1	1	2	1	12	1	4	1	5	1
<i>Saussurea pygmaea</i> ³⁴	Carduinae	5	12	1	1	1	1	1	1	1	23	1	1	1	1	2	1	1	-	4	1	5	1
<i>Silybum marianum</i> ^{7,8,25}	Carduinae	3	1	2	1	2	2	1	2	1	1	1	1	1	1	3	1	2	3	23	1	24	1
<i>Carlina acaulis</i> ^{7,8,25}	Carlininae	3	12	1	1	2	2	1	2	35	1	1	1	1	1	3	1	2	13	23	1	35	2
<i>Carlina vulgaris</i> ^{7,8,25}	Carlininae	3	1	2	2	2	1	1	2	1	23	1	1	1	1	3	1	2	3	1	1	5	1
<i>Centaurea jacea</i> ^{7,8}	Centaureinae	14	12	2	2	2	2	23	2	23	1	1	3	1	1	3	1	12	12	13	3	5	1
<i>Centaurea scabiosa</i> ^{7,8}	Centaureinae	3	12	1	1	2	2	23	2	2	2	2	1	1	1	3	1	12	3	3	1	1	1
<i>Cnicus benedictus</i> ^{7,8}	Centaureinae	3	1	2	2	2	2	1	2	1	1	1	1	1	1	3	1	2	3	3	1	5	1
<i>Centaurea montana</i> ⁸	Centaureinae	4	13	2	2	2	1	1	2	23	1	1	2	1	1	3	1	12	2	3	2	45	1
<i>Centaurea cyanus</i> ^{7,8}	Centaureinae	3	1	2	2	2	1	1	2	1	2	1	1	1	1	3	1	12	3	12	1	15	1
<i>Rhaponticum scariosum</i> ^{7,8}	Centaureinae	123	12	2	1	2	2	1	2	1	245	1	1	1	1	3	1	1	-	3	12	5	1
<i>Serratula tinctoria</i> ⁸	Centaureinae	4	3	2	2	2	1	1	2	1	1	1	1	1	1	-	-	2	12	4	1	2	1
<i>Echinops sphaerocephalus</i> ^{8,25}	Echinopsidinae	1234	12	2	1	2	2	3	2	1	1	1	1	2	1	3	1	12	3	23	12	15	1
Cichorieae																							
<i>Chondrilla juncea</i>	Chondrillinae	1	1	1	1	2	1	1	1	1	1	1	1	1	4	2	1	2	2	13	6	5	1
<i>Willemetia stipitata</i>	Chondrillinae	1	3	2	2	2	1	1	1	1	1	1	1	1	4	3	1	12	23	23	2	5	1
<i>Chlorocrepis staticifolia</i>	Cichoriinae	3	12	2	2	1	1	1	1	1	1	1	1	1	4	1	1	12	13	3	1	4	1
<i>Cichorium intybus</i> ^{8,25}	Cichoriinae	3	12	2	1	2	1	1	1	1	1	1	1	1	3	3	1	12	13	3	1	3	1

<i>Crepis aurea</i>	Crepidinae	1	3	2	2	1	1	4 5 6	1	1	1	1	1	1	4	3	1	12	2	23	34	5	1
<i>Crepis biennis</i>	Crepidinae	4	12	1	1	2	1	1	1	1	1	1	1	1	2	3	1	12	2	3	1	35	1
<i>Crepis pontana</i> ⁹	Crepidinae	3	12	1	1	1	1	1	1	1	1	1	1	1	2	3	1	1	-	3	1	5	1
<i>Lapsana communis</i> ²⁵	Crepidinae	3	1	2	1	2	1	1	1	1	1	1	1	1	4	3	1	12	2	12	1	25	1
<i>Taraxacum cucullatum</i> ^{6,9}	Crepidinae	3	2	2	1	1	1	1	1	1	1	1	1	1	2	3	1	1	-	4	1	5	1
<i>Taraxacum laevigatum</i> ⁹	Crepidinae	3	2	1	1	1	1	1	1	1	1	1	1	1	2	3	1	1	-	4	1	5	1
<i>Hieracium murorum</i>	Hieraciinae	1	3	2	2	2	1	1	1	1	1	1	1	1	4	3	1	12	12	3	2	5	1
<i>Hieracium pilosella</i>	Hieraciinae	1	3	2	1	2	2	1	1	1	1	1	1	1	4	3	1	12	12	23	2	5	1
<i>Apocynis foetida</i> ^{6,9}	Hyoseridinae	1	2	2	1	1	1	1	1	1	1	1	1	1	4	3	1	12	1	3	5	5	1
<i>Sonchus oleraceus</i>	Hyoseridinae	3	12	2	2	2	1	1	1	1	1	1	1	1	34	3	1	2	2	12	1	35	1
<i>Helminthotheca echioides</i>	Hypochaeridinae	4	12	2	2	2	1	1	1	1	1	1	1	1	3	3	1	12	3	2	1	5	1
<i>Hypochaeris radicata</i> ^{6,9}	Hypochaeridinae	4	2	1	1	2	1	1	1	1	1	1	1	1	23	3	1	12	12	2	1	34	1
<i>Hypochaeris uniflora</i> ^{6,9}	Hypochaeridinae	1 2 3	2	1	1	1	1	1	1	1	1	1	1	1	2	3	1	12	12	34	12	5	1
<i>Leontodon hispidus</i> ^{6,9}	Hypochaeridinae	1	3	2	2	2	1	1	1	1	1	1	1	1	4	3	1	12	12	3	23	5	1
<i>Leontodon incanus</i> ^{6,9}	Hypochaeridinae	3	2	1	1	2	1	1	1	1	1	1	1	1	2	3	1	12	13	34	1	5	1
<i>Leontodon saxatilis</i>	Hypochaeridinae	4	3	2	2	2	1	1	1	1	1	1	1	1	2	3	1	12	12	2	1	5	1
<i>Picris hieracioides</i> subsp. <i>Grandiflora</i>	Hypochaeridinae	4	12	2	2	1	1	1	1	1	1	1	1	1	2	3	1	12	12	3	1	3	1
<i>Picris hieracioides</i> subsp. <i>Hieracioides</i>	Hypochaeridinae	4	1	2	1	2	2	2 3 4 5 6	1	1	1	1	1	1	4	3	1	12	12	23	1	5	1
<i>Prenanthes purpurea</i>	Hypochaeridinae	1	1	2	2	2	1	1	1	1	1	1	1	1	4	2	1	2	3	3	2	5	1
<i>Scorzoneroides autumnalis</i> ^{6,9}	Hypochaeridinae	1	3	2	1	1	1	1	1	1	1	1	1	1	4	3	1	12	12	3	2	4	1
<i>Scorzoneroides helvetica</i> ^{6,9}	Hypochaeridinae	1	3	2	1	2	1	1	1	1	1	1	1	1	4	3	1	12	12	3	2	4	1
<i>Cicerbita alpina</i>	Lactucinae	1	12	2	2	2	1	1	1	1	1	1	1	1	4	1	1	2	3	3	2	5	1
<i>Mycelis muralis</i>	Lactucinae	1 3 4	1	2	2	2	1	1	1	1	1	1	1	1	4	3	1	12	3	12 3	12	3	1
<i>Lactuca perennis</i>	Lactucinae	3	12	1	1	1	1	1	1	1	1	1	1	1	3	2	1	1	-	3	1	4	1
<i>Lactuca virosa</i>	Lactucinae	3	12	2	1	2	1	1	1	1	1	1	1	1	34	3	1	12	12	3	1	3	1
<i>Scorzonera aristata</i> ⁹	Scorzonerinae	12 3	12	1	1	1	1	1	1	1	1	1	1	1	3	2	2	1	-	3	12	4	1
<i>Scorzonera austriaca</i> ⁹	Scorzonerinae	6	4	1	1	1	1	1	1	1	1	1	1	1	3	2	2	1	-	3	1	3	1
<i>Scorzonera hispanica</i> ⁹	Scorzonerinae	12 3	12	1	1	1	1	1	1	1	1	1	1	1	3	2	1	1	-	3	2	3	1
<i>Scorzonera humilis</i> ⁹	Scorzonerinae	12 3	12	1	1	1	1	5	1	1	1	1	1	1	3	2	1	1	-	3	2	34	1
<i>Scorzonera purpurea</i> ⁹	Scorzonerinae	3	12	1	1	1	1	1	1	1	1	1	1	1	3	2	1	1	-	3	1	3	1
<i>Scorzonera rosea</i> ⁹	Scorzonerinae	3	12	1	2	1	1	1	1	1	1	1	1	1	3	2	2	1	-	3	1	34	1
<i>Tragopogon dubius</i> ⁹	Scorzonerinae	3	12	2	2	2	1	1	1	1	1	1	1	1	3	3	1	12	3	3	1	3	1
<i>Tragopogon orientalis</i> ⁹	Scorzonerinae	3	12	2	2	2	1	1	1	1	1	1	1	1	3	3	1	12	3	3	1	3	1