

Proposed plant host test list for assessing risk of candidate biological control agents for *Sonchus oleraceus*

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Background

The following proposed plant list for testing candidate biological control agents for *Sonchus oleraceus* (common sowthistle; “target weed” hereafter) was developed based on currently accepted phylogenetic information available in literature (Karis et al. 2009, Keeley and Robinson 2009, Killian et al. 2009; Liu et al. 2013; Tremetsberger et al. 2013) and on the Angiosperm Phylogeny Website (Stevens 2001). *Sonchus oleraceus* belongs to the tribe Cichorieae in the subfamily Cichorioideae of the Asteraceae family.

Test plant species have been selected using the centrifugal phylogenetic method that is based on the phylogenetic relationship of test plants to the target weed (Briese 2003; Gilbert et al. 2013; Wapshere 1974). This method is underpinned by the evidence that specialist candidate biological control agents are evolutionarily more likely to infect or feed upon non-target plant species closely related to the target weed relative to those that are more distantly related. Within this phylogenetic-based framework, selection of representative test species places an emphasis on endemic species, species of economic importance and those that are likely to overlap biogeographically with the target weed. Representatives from the three tribes (Cichorieae, Arctotidinae and Vernonieae) of the Asteraceae subfamily Cichorioideae that are present in Australia¹ have been included in this proposed host-test list for candidate agents of *S. oleraceus*. The phylogenetic grouping of many of the selected genera are presented in the appendix to orient the reader as to the phylogenetic relatedness of the selected genera to the genus *Sonchus*.

Any suggestions for plant species substitutions or additions are welcomed but we kindly ask that they be justified within the phylogenetic framework approach used to develop the plant host test list. Feedback and comments on this proposed plant host test list can be addressed to Dr. Gavin Hunter (gavin.hunter@csiro.au; 02 6218 3658).

¹ No species belonging to Liabeae, the fourth tribe in the Cichorioideae subfamily, exist in Australia.

Proposed plant host test list

Table 1: List of proposed plant species for testing the specificity of candidate biological control agents for the target weed *Sonchus oleraceus*. All these species have an overlapping biogeographic range with the target weed.

SUBFAMILY	TRIBE	SUB-TRIBE	RELATIONSHIP TO THE TARGET WEED	GENUS SPECIES	STATUS IN AUSTRALIA ¹	GENUS NO. ²	
Cichorioideae	Cichorieae	Hyoseridinae	Target weed	<i>Sonchus oleraceus</i>	Target weed		
			Same genus	SONCHUS		1	
				<i>Sonchus asper</i>	Naturalised		
				<i>Sonchus hydrophilus</i>	Native		
			Same sub-tribe	LAUNAEA		2	
				<i>Launaea sarmentosa</i>	Native		
			REICHARDIA		3		
			<i>Reichardia tingitana</i>	Weed			
		<i>Incertae sedis</i>	ACTITES		^		
			<i>Actites megalocarpus</i>	Native			
			Crepidinae	Same-tribe	CREPIS		4
					<i>Crepis capillaris</i>	Weed	
			<i>Crepis foetida</i>	Weed			
			LAPSANA		5		
			<i>Lapsana communis</i>	Weed			
			TARAXACUM		6		
			<i>Taraxacum aristum</i>	Native			
			<i>Taraxacum</i> sect. <i>Hamata</i>	Naturalised			
			<i>Taraxacum</i> sect. <i>Taraxacum</i>	Naturalised			
			YOUNGIA		7		
			<i>Youngia japonica</i>	Native			
		Chondrillinae	CHONDRILLA		8		
			<i>Chondrilla juncea</i>	Weed			
			UROSPERMUM		9		
		Hypochoeridinae	<i>Urospermum picroides</i>	Weed			
			HYPOCHAERIS		10		
			<i>Hypochoeris radicata</i>	Weed			
			HELMINTHOTHECA		11		
			<i>Helminthotheca echioides</i>	Weed			
			PICRIS		12		

SUBFAMILY	TRIBE	SUB-TRIBE	RELATIONSHIP TO THE TARGET WEED	GENUS SPECIES	STATUS IN AUSTRALIA ¹	GENUS NO. ²
				<i>Picris</i> spp. ³	Native	
				LEONTODON		13
				<i>Leontodon rhagadioloides</i>	Naturalised	
		Lactucinae		LACTUCA		14
				<i>Lactuca sativa</i>	Crop	
		Hieraciinae		HIERACIUM		15
				<i>Hieracium murorum</i>	Weed	
		Microseridinae		MICROSERIS		16
				<i>Microseris lanceolata</i>	Native	
				CICHORIUM		17
				<i>Cichorium endivia</i>	Crop	
				TOLPIS		18
				<i>Tolpis virgata</i>	Weed	
		Scolyminae		SCOLYMUS		19
				<i>Scolymus hispanicus</i>	Weed	
		Scorzonerinae		SCORZONERA		20
				<i>Scorzonera laciniata</i>	Weed	
				TRAGOPOGON		21
				<i>Tragopogon dubius</i>	Weed	
	Arctotidinae	Arctotidinae	Same sub-family	ARCTOTHECA		22
				<i>Arctotheca calendula</i>	Weed	
				ARCTOTIS		23*
				<i>Arctotis</i> spp. ⁴	Naturalised	
				CYMBONOTUS		24
				<i>Cymbonotus preissianus</i>	Native	
		Gorteriinae		GORTERIA		25
				<i>Gorteria personata</i> ⁵	Native	
				BERKHEYA		26
				<i>Berkheya rigida</i> ⁵	Weed	
				GAZANIA		27
				<i>Gazania rigens</i>	Weed	
	Vernonieae	Centratherinae		CENTRATHERUM		28
				<i>Centratherum riparium</i>	Native	
		Erlangeinae		CYANTHILLIUM		†
				<i>Cyanthillium cinereum</i>	Weed	
				ETHULIA		29

SUBFAMILY	TRIBE	SUB-TRIBE	RELATIONSHIP TO THE TARGET WEED	GENUS SPECIES	STATUS IN AUSTRALIA ¹	GENUS NO. ²
				<i>Ethulia conyzoides</i> ⁵	Weed	
		Elephantopinae		ELEPHANTOPUS		30
				<i>Elephantopus mollis</i> ⁵	Weed	
				PSEUDELEPHANTOPUS		‡
				<i>Pseudelephantopus spicatus</i>	Weed	
		Linziinae		PLEUROCARPAEA		‡
				<i>Pleurocarpaea denticulata</i> ⁵	Native	
		Vernoniinae		VERNONIA		31*
				<i>Vernonia junghuhniana</i> ⁵	Naturalised	
		<i>Incertae sedis</i>		TARLMOUNIA		32
				<i>Tarlmounia elliptica</i> ⁵	Naturalised	

¹: Cultivation information as indicated in Randall (2007) and Australian Plant Names Index (APNI).

²: Bracketed number alongside specific genera indicated on phylogenetic trees in the Appendix.

³: Several native species are present in Australia that could be accessed for inclusion in host-specificity testing. The chosen species will depend on the ability to source plant material.

⁴: Several varieties available through the horticultural trade. The chosen variety will depend on the most accessible varieties.

⁵: Difficult to source due to restricted distribution in Australia. Eventual inclusion in host-specificity testing is not guaranteed and will depend on the ability to source plant material.

[^]: DNA sequence analysis indicates *Actites megalocarpus* likely resides within *Sonchus sensu lato* (Kim et al. 2004, 2007).

^{*}: Genera recognised as polyphyletic within the Cichorioideae.

[‡]: Phylogenetic positioning not indicated in phylogenetic trees of Funk et al. (2009) but their taxonomic position is confirmed in Keeley and Robinson (2009).

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Appendix

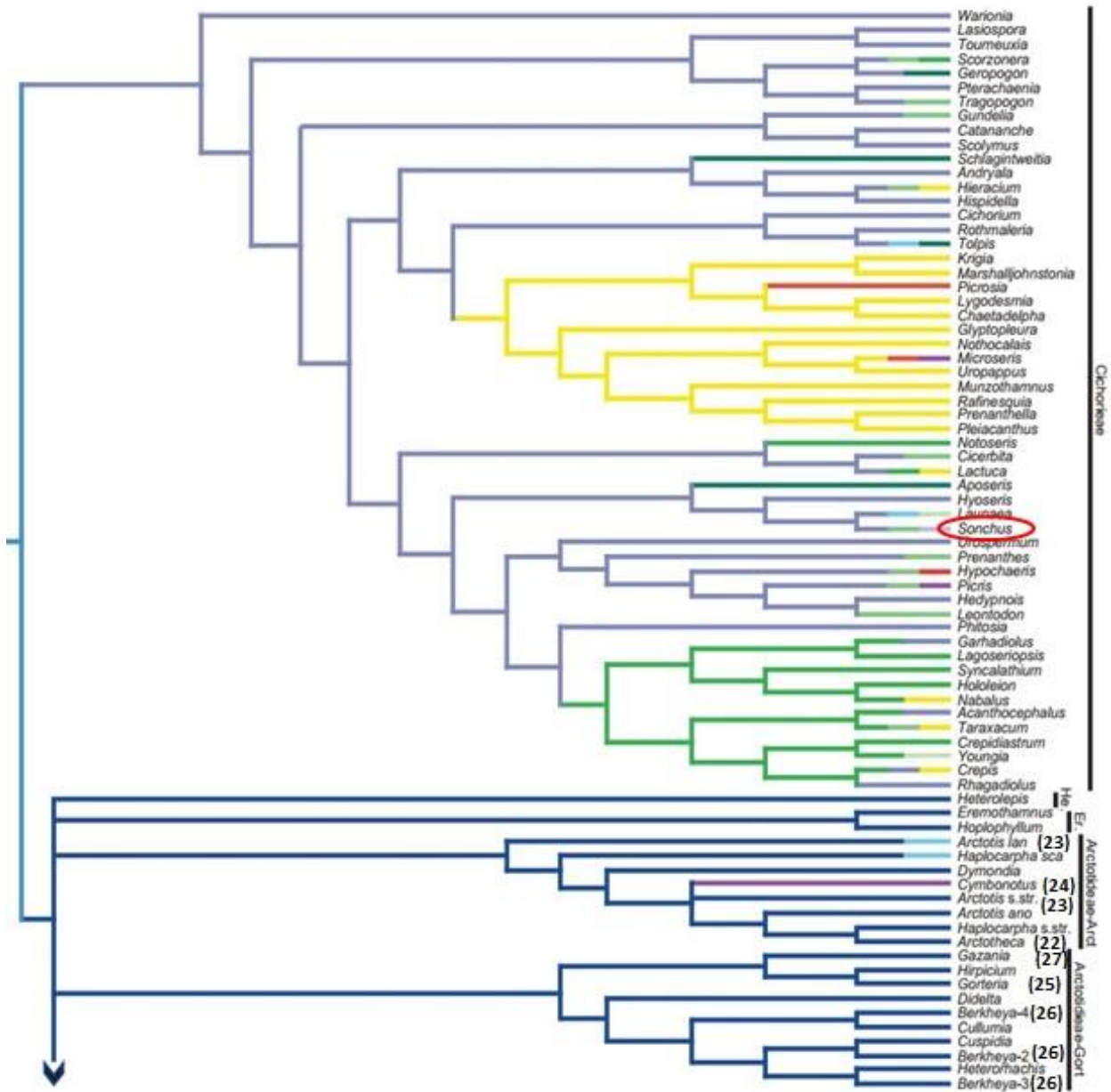


Figure 1: A portion of a summary metatree for Asteraceae as depicted in Funk et al. (2009) indicating the broad phylogenetic relationship of tribe Cichorieae to tribes Hecastocleis (He.), Eremothamneae (Er.) and Arctotideae in the subfamily Cichorioideae. The phylogenetic position of *Sonchus* within the Cichorieae is circled for reference and bracketed numbers next to genera correspond to the numbering in Table 1.

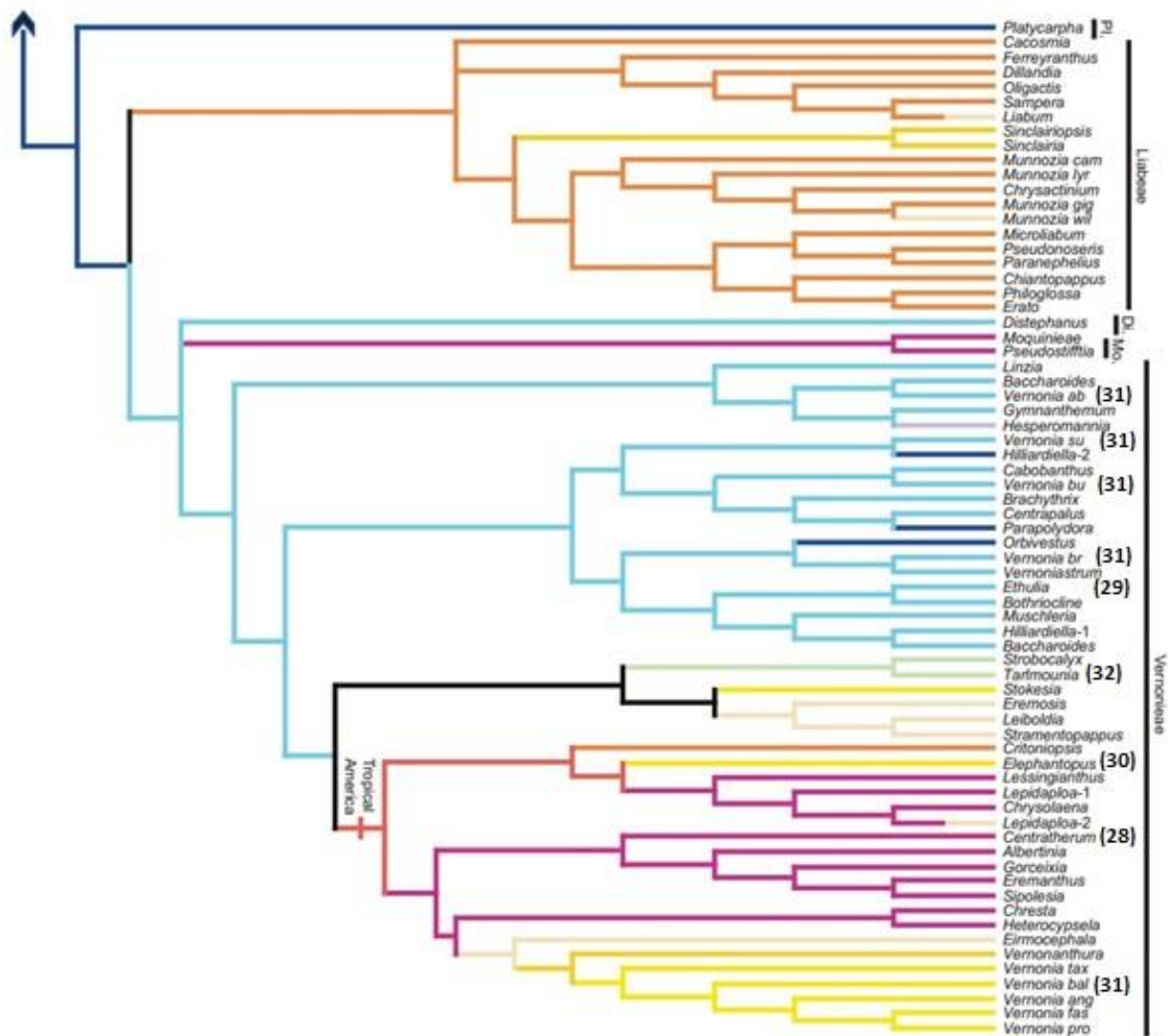


Figure 2: A portion of a summary metatree for Asteraceae as depicted in Funk et al. (2009) indicating the phylogenetic position of tribe Veronieae in relation to tribes Arctotideae and Cichorieae in the subfamily Cichorioideae (Fig. 1). Note that no species belonging to Liabeae, the fourth tribe in Cichorioideae subfamily, exist in Australia. Bracketed numbers next to genera correspond to the numbering used in Table 1.

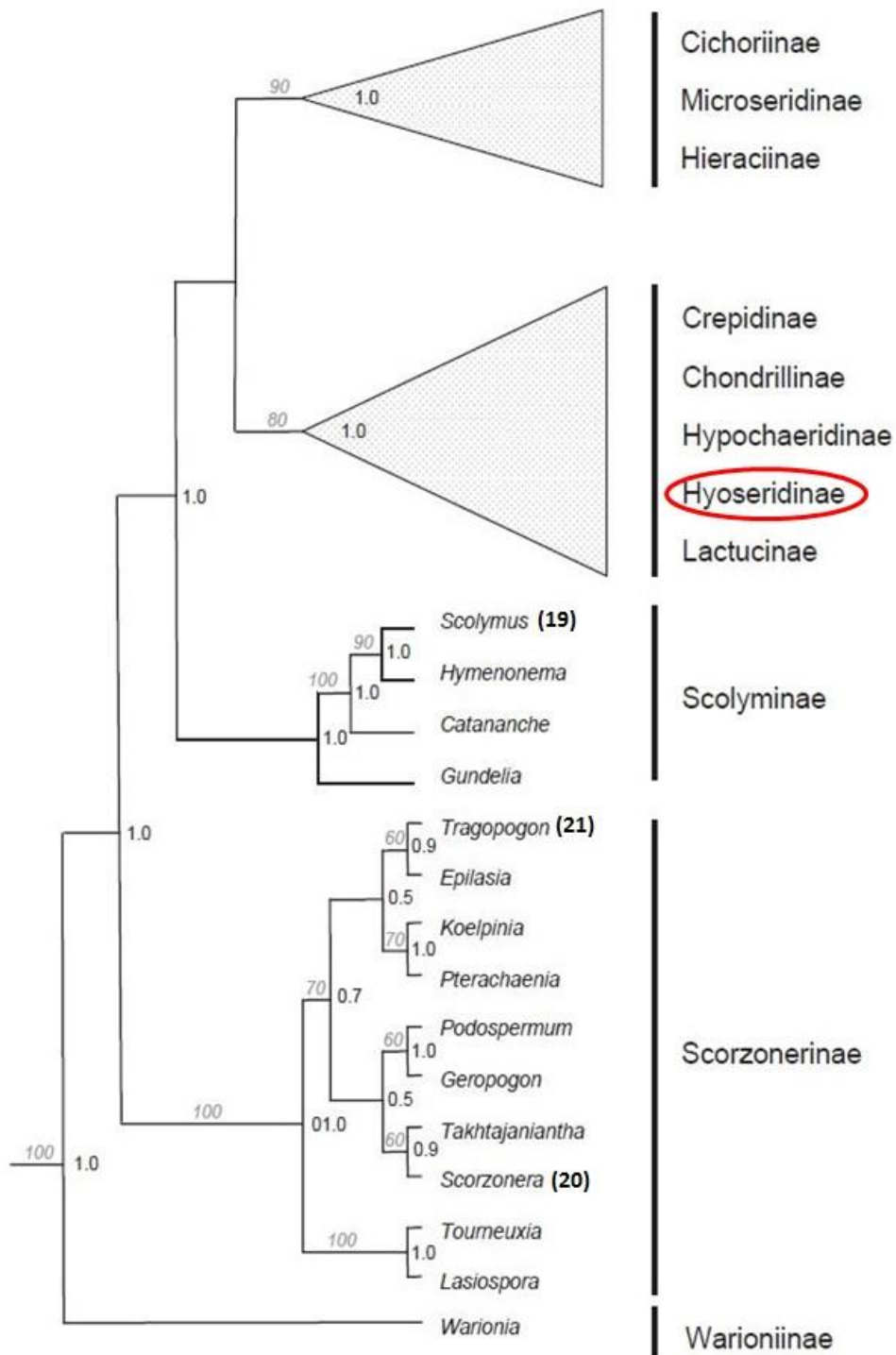


Figure 3: The molecular phylogeny of tribe Cichorieae within the Cichorioideae subfamily indicating the phylogenetic grouping of subtribes as presented in Kilian et al. (2009). *Sonchus* is accommodated within subtribe Hyoseridinae (circled). Bracketed numbers next to genera correspond to the numbering used in Table 1.

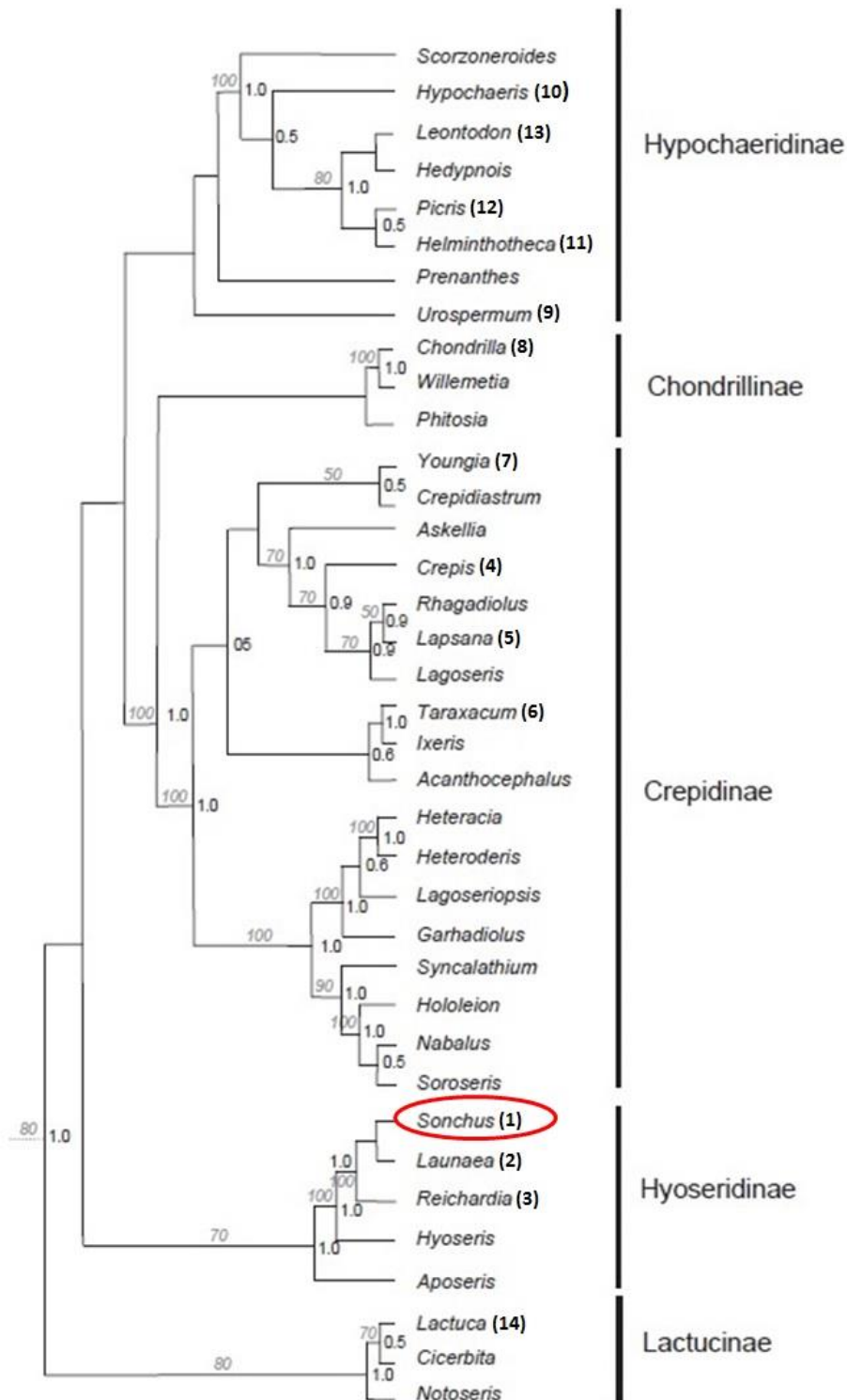


Figure 4: Molecular phylogeny of tribe Cichorieae indicating the phylogenetic grouping of several genera within each subtribe as presented in Kilian et al. (2009). *Sonchus* is circled within subtribe Hyoseridinae to indicate its phylogenetic relationship to other genera within the subtribe. Bracketed numbers next to genera correspond to the numbering used in Table 1.

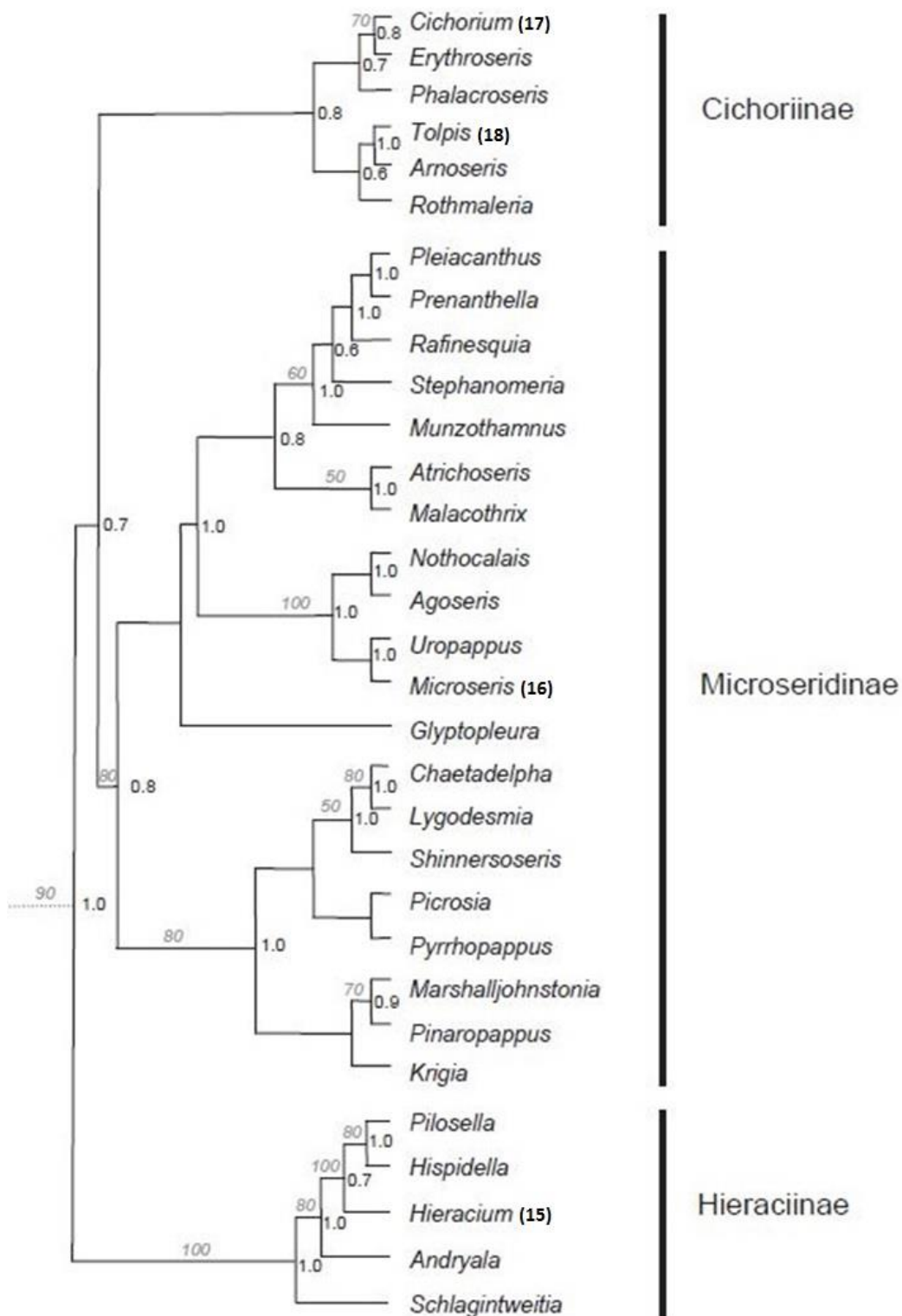


Figure 5: Molecular phylogeny of tribe Cichorieae indicating the phylogenetic grouping of several genera within subtribes Cichoriinae, Microseridinae and Hieraciinae as presented in Kilian et al. (2009). Bracketed numbers next to genera correspond to the numbering used in Table 1.

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