

**Table S1.** Accession numbers of plastome sequences of asterids included in phylogenetic analyses.

Higher taxa	Order	Family	Taxon <sup>a</sup>	No. of SSRs <sup>b</sup>	Accession No.	Genes absent <sup>c</sup>		
Eurosids II	Brassicales	Brassicaceae	<i>Arabidopsis thaliana</i>	104	NC_000932.1	-		
Caryophyllales	Caryophyllales	Amaranthaceae	<i>Spinacia oleracea</i>	65	NC_002202.1	<i>rpl23</i>		
Basal Asterids	Cornales	Cornaceae	<i>Cornus florida</i> <sup>d</sup>	-	EU002157, EU002175, EU002215, EU002276, EU002311, EU002377, EU002491, GQ998074-GQ998146	-		
Euasterids I	Ericales	Myrsinaceae	<i>Ardisia polysticta</i>	57	KC465962	-		
		Theaceae	<i>Camellia sinensis</i>	69	NC_020019.1	-		
	Garryales	Boraginaceae	<i>Ehretia acuminata</i> <sup>d</sup>	-	GQ997215-GQ997297	-		
		Garryaceae	<i>Aucuba japonica</i> <sup>d</sup>	-	GQ997049-GQ997131	-		
	Gentianales	Apocynaceae	<i>Asclepias syriaca</i> (with two unresolved regions)	≥103	JF433943	<i>accD, clpP, ycfI</i>		
			<i>Catharanthus roseus</i>	56	KC561139	-		
			<i>Nerium oleander</i> <sup>d</sup>	-	GQ997630-GQ997712	-		
		Lamiales	Rubiaceae	<i>Coffea arabica</i>	43	NC_008535.1	-	
			Gesneriaceae	<i>Boea hygrometrica</i>	27	NC_016468.1	-	
				Lamiaceae	<i>Tectona grandis</i>	51	NC_020098.1	-
			Oleaceae	<i>Jasminum nudiflorum</i>	68	NC_008407.1	<i>accD</i>	
				<i>Olea europaea</i> cv. <i>Bianchera</i>	68	NC_013707.2	-	
				<i>Olea europaea</i> subsp. <i>cuspidata</i>	57	NC_015604.1	-	
				<i>Olea europaea</i> subsp. <i>europaea</i> cv. <i>Manzanilla</i>	65	NC_015401.1	-	
				<i>Olea europaea</i> subsp. <i>maroccana</i>	65	NC_015623.1	-	
				<i>Olea woodiana</i> subsp. <i>woodiana</i>	70	NC_015608.1	-	
				Pedaliaceae	<i>Sesamum indicum</i>	35	NC_016433.2	-
				Plantaginaceae	<i>Antirrhinum majus</i> <sup>d</sup>	-	GQ996966-GQ997048	-
			Solanales	Convolvulaceae	<i>Ipomoea purpurea</i>	64	NC_009808.1	-
Solanaceae					<i>Atropa belladonna</i>	60	NC_004561.1	-
Solanaceae				<i>Capsicum annuum</i>	46	NC_018552.1	-	
	<i>Datura stramonium</i>	49		NC_018117.1	-			
	<i>Nicotiana tabacum</i>	60		NC_001879.2	-			
	<i>Nicotiana tomentosiformis</i>	61		NC_007602.1	-			
	<i>Nicotiana glauca</i>	59		NC_007500.1	-			
	<i>Nicotiana undulata</i>	63		NC_016068.1	-			
	<i>Solanum bulbocastanum</i>	56		NC_007943.1	-			
	<i>Solanum lycopersicum</i>	56		NC_007898.2	-			
	<i>Solanum tuberosum</i>	53		NC_008096.2	-			
	Euasterids II	Apiales		Apiaceae	<i>Anthriscus cerefolium</i>	71	NC_015113.1	-
	<i>Crithmum maritimum</i>				75	NC_015804.1	-	
	<i>Daucus carota</i>				67	NC_008325.1	-	
<i>Oxypholis greenmanii</i>	61		NC_015832.1		-			
<i>Petroselinum crispum</i>	60		NC_015821.1		-			
Araliaceae	<i>Eleutherococcus senticosus</i>		42		NC_016430.1	-		
	<i>Hydrocotyle</i> sp.		46		NC_015818.1	-		
	<i>Panax ginseng</i>		37		NC_006290.1	-		
	Aquifoliales		Aquifoliaceae		<i>Ilex cornuta</i> <sup>d</sup>	-	GQ997298-GQ997380	-
Asterales	Asteraceae		<i>Ageratina adenophora</i>		33	NC_015621.1	-	
			<i>Guizotia abyssinica</i>		51	NC_010601.1	-	
			<i>Helianthus annuus</i>	52	NC_007977.1	-		
			<i>Jacobaea vulgaris</i>	58	NC_015543.1	-		
			<i>Lactuca sativa</i>	38	NC_007578.1	-		
			<i>Parthenium argentatum</i>	53	NC_013553.1	-		
			Campanulaceae	<i>Trachelium caeruleum</i>	57	NC_010442.1	<i>accD, clpP, rpl23, ndhK</i>	
			Goodeniaceae	<i>Scaevola aemula</i> <sup>d</sup>	-	EU017139-EU017217	<i>accD, clpP, ycfI, rps11, rpoC2</i>	
			Dipsacales	Caprifoliaceae	<i>Lonicera japonica</i> <sup>d</sup>	-	GQ997381-GQ997463	<i>accD</i>

<sup>a</sup>Taxa included in Figure 4 are in bold.<sup>b</sup>Mono-, di-, tri-, tetra-, penta- and hexanucleotides with a length of at least 10 bp.<sup>c</sup>Genes that are absent in the datasets for Figures 4 and 5.<sup>d</sup>Only sequences of protein-coding and rRNA genes are available.