

Table S1 Sequences used in Aytoniaceae phylogenetic tree, including taxa, locations, vouchers, and GenBank accession numbers. Newly generated sequences in bold face.  
“---” missing data.

Taxon	Voucher information	Localities	GenBank Accession		
			<i>rbcL</i>	<i>trnL-F</i>	nr 26S
<i>Asterella africana</i>	Schill & Lobos 29 (E)	Portugal	---	GQ910666	GQ910705
<i>A. australis</i>	Glenny 6636 (?)	New Zealand	---	AF264660	---
<i>A. bachmannii</i>	Duckett s.n. (?)	Lesotho	---	AF264658	---
<i>A. bolanderi</i>	Long 27554 (E)	USA	---	AF264657	---
<i>A. cruciata</i> I	Wei et al. 20141204-42 (HSNU)	China, Guangxi	<b>PP566135</b>	<b>PP566159</b>	<b>PP573773</b>
<i>A. cruciata</i> II	Peng et al. 20150130-2 (HSNU)	China, Yunnan	<b>PP566136</b>	<b>PP566160</b>	<b>PP573774</b>
<i>A. cruciata</i> III	Shu & Wei 20151012-7 (HSNU)	China, Sichuan	<b>PP566137</b>	<b>PP566161</b>	<b>PP573775</b>
<i>A. cruciata</i> IV	Bardunov s.n. (KPABG)	Russia	---	KR024222	KR024186
<i>A. cruciata</i> V	Cao & Xiong 20141205-126 (HSNU)	China, Guizhou	<b>PP566138</b>	<b>PP566162</b>	<b>PP573776</b>
<i>A. innovans</i>	Furuki 14274 (?)	USA, Hawaii	---	AF264656	---
<i>A. khasyana</i> I	Long 22420 (E)	India	---	AF264651	---
<i>A. khasyana</i> II	Xiang et al. 20161109-43 (HSNU)	China, Yunnan	<b>PP566134</b>	<b>PP566158</b>	<b>PP573772</b>
<i>A. khasyana</i> III	Zhu et al. 20150824-18 (HSNU)	China, Yunnan	<b>PP566141</b>	<b>PP566165</b>	<b>PP573779</b>
<i>A. khasyana</i> IV	Wang 20160813-1 (HSNU)	China, Yunnan	<b>PP566143</b>	<b>PP566167</b>	<b>PP573781</b>
<i>A. lateralis</i>	Long 29598 (E)	Mexico	---	GQ910671	GQ910710
<i>A. leptophylla</i> I	Bakalin, P-40-24-12 (VBGI, KPABG)	Russia, Primorsky Territory	---	KR024221	KR024185
<i>A. leptophylla</i> II	Zhu & Promma 20160728-44 (HSNU)	China, Liaoning	<b>PP566142</b>	<b>PP566166</b>	<b>PP573780</b>
<i>A. leptophylla</i> III	Long & Furuki 24769 (?)	Japan	---	AF264652	---

<i>A. lindenbergiana</i> I	Long 19989 (E)	Norway	---	AF264653	---
<i>A. lindenbergiana</i> II	Konstantinova, K409-3-12 (KPABG)	Russia: Caucasus	---	KR024216	KR024180
<i>A. lindenbergiana</i> III	Konstantinova, K409-3-12 (KPABG)	Russia: Adygei	---	KR024219	KR024183
<i>A. lindenbergiana</i> IV	Konstantinova, K437-1-07 (KPABG)	Russia: Krasnodar	---	KR024218	KR024182
<i>A. macropoda</i>	Gradstein 9728 (?)	Costa Rica	---	AF264655	---
<i>A. multiflora</i> I	Zhu et al. 20150824-44 (HSNU)	China, Yunnan	PP566133	PP566157	PP573771
<i>A. multiflora</i> II	Peng et al. 20150201-7 (HSNU)	China, Yunnan	PP566144	PP566168	PP573782
<i>A. multiflora</i> III	Zhu et al. 20150824-19 (HSNU)	China, Yunnan	PP566145	PP566169	PP573783
<i>A. multiflora</i> IV	Long 21637 (E)	Nepal	---	AF264654	---
<i>A. mussuriensis</i> subsp. <i>mussuriensis</i> I	Yin et al. 20160707-24 (HSNU)	China, Sichuan	PP566146	PP566170	PP573784
<i>A. mussuriensis</i> subsp. <i>mussuriensis</i> II	Xiang 20160916-9 (HSNU)	China, Yunnan	PP566147	PP566171	PP573785
<i>A. palmeri</i> I	Doyle 11446 (E)	USA, California	KT793554	---	KT793342
<i>A. palmeri</i> II	Long 27557 (E)	USA, California	---	AF264640	---
<i>A. palmeri</i> III	Ma 17-9030 (KUN)	USA, California	PP566125	PP566152	PP573767
<i>A. saccata</i> I	Schill et al. 58 (E)	Switzerland, Valais	---	GQ910672	GQ910711
<i>A. saccata</i> II	Afonina s.n. (LE, KPABG)	Russia, Chukotka	---	KR024220	KR024184
<i>A. syngenesica</i>	Pócs 9415a (?)	Réunion	---	AF264659	---
<i>A. tenella</i> I	Marsh 8995.3 (?)	USA., Arkansas	---	AF264650	---
<i>A. tenella</i> II	Goffinet 8750 (E)	USA, Connecticut	---	GQ910673	GQ910712
<i>A. wallichiana</i> I	Yamaguchi 11384 (?)	Japan, Iriomote	---	AF264648	---
<i>A. wallichiana</i> II	Yamaguchi 11280 (?)	Japan, Okinawa	---	AF264649	---
<i>A. wallichiana</i> III	Zanten 93.11.2334b (?)	Philippines	---	AF264647	---

<i>A. wallichiana</i> IV	Wei & Shu 20151012-41 (HSNU)	China, Sichuan	PP566148	PP566172	PP573786
<i>A. wallichiana</i> V	Wei & Peng 20100913-112 (HSNU)	China, Guangxi	PP566150	PP566174	PP573787
<i>A. wallichiana</i> VI	Long 30251 (E)	Nepal, Lalitpur	---	GQ910674	GQ910713
<i>Asterellopsis grollei</i> I	Long 26964 (E)	China	---	AF264641	---
<i>Asterellopsis grollei</i> II	Long 27203 (E)	China, Qinghai	DQ286000	GQ910670	DQ265771
<i>Asterellopsis grollei</i> III	Xiang 20160925-10 (HSNU)	China, Yunnan	PP566140	PP566164	PP573778
<i>Asterellopsis grollei</i> IV	Zhu 20160815-21B (HSNU)	China, Sichuan	PP566139	PP566163	PP573777
<i>Calasterella californica</i> I	Long 27651 (E)	USA	---	AF264639	---
<i>C. californica</i> II	Schill & Clarke 104 (E)	USA	---	GQ910667	GQ910720
<i>C. californica</i> III	Norris 80914 (?)	USA	---	AF228785	---
<i>Cryptomitrium himalayense</i> I	Xiang & Shen 20190908-25 (HSNU)	China, Sichuan	PP566151	PP566175	PP573788
<i>C. himalayense</i> II	Long 30559 (E)	Nepal, Rasuwa	---	GQ910678	GQ910717
<i>C. tenerum</i>	Long 29748 (E)	Mexico, Querétaro	---	GQ910677	GQ910716
<i>Dumortiera hirsuta</i> I	Wang et al. 20140722-9 (HSNU)	China, Sichuan	KX792412	KX792398	---
<i>Dumortiera hirsuta</i> II	Cheng et al. 20150421-43 (HSNU)	China, Zhejiang	KX792414	KX792400	---
<i>Dumortiera hirsuta</i> III	Wei et al. 20141204-44 (HSNU)	China, Guangxi	KX792413	KX792399	---
<i>Mannia androgyna</i> I	Schill & Lobos 32-2 (E)	Portugal, Madeira	---	GQ910679	GQ910718
<i>M. androgyna</i> II	Schill & Clarke 124 (E)	Namibia, Otjozondjupa	---	GQ910680	GQ910719
<i>M. californica</i> I	Schill & Clarke 164 (E)	India, Uttaranchal	---	GQ910681	GQ910720
<i>M. californica</i> II	Hugonnot s.n. (E)	France, Ardèche	---	GQ910688	GQ910727
<i>M. californica</i> III	Xiang et al. 20160418-21 (HSNU)	China, Yunnan	PP566126	OR689868	OR700027
<i>M. controversa</i> subsp. <i>controversa</i> I	Köckinger s.n. (E)	Austria, Carinthia	---	GQ910689	GQ910728

<i>M. controversa</i> subsp. <i>asiatica</i> II	Schill & Clarke 163 (E)	India, Uttaranchal	---	GQ910696	GQ910735
<i>M. fragrans</i> I	Schill & Clarke 162 (E)	India, Uttaranchal	---	GQ910690	GQ910729
<i>M. fragrans</i> II	Schill et al. 51 (E)	Switzerland, Valais	---	GQ910692	GQ910731
<i>M. fragrans</i> III	Itouga s.n. (E)	Japan, Honshu	---	GQ910691	GQ910730
<i>M. fragrans</i> IV	Xiang 20160925-8 (HSNU)	China, Sichuan	PP566127	OR689869	OR700028
<i>M. gracilis</i> I	Hugonnot s.n. (E)	France, Haute-Loire	---	GQ910669	GQ910708
<i>M. gracilis</i> II	Dulin MVD-1113 (KPABG)	Russia: Komi	---	KR024198	KR024172
<i>M. gracilis</i> III	Stefanut B3497 (E)	Romania, Bucegi	---	GQ910668	GQ910707
<i>M. pilosa</i> I	Schill et al. 84 (E)	Austria, Carinthia	---	GQ910693	GQ910732
<i>M. pilosa</i> II	Schill et al. 85 (E)	Austria, Carinthia	---	GQ910694	GQ910733
<i>M. pilosa</i> III	Dulin, s.n. (KPABG)	Russia: Komi	---	KR024205	KR024175
<i>M. sibirica</i>	Long & Schill 35669 (E)	USA, Minnesota	---	GQ910695	GQ910734
<i>M. triandra</i> I	Long & Schill 35668 (E)	USA, Minnesota	---	GQ910697	GQ910737
<i>M. triandra</i> II	Schill et al. 87 (E)	Austria, Carinthia	---	GQ910698	GQ910736
<i>Plagiochasma appendiculatum</i>	Wei & Shu 20151012-53 (HSNU)	China, Sichuan	PP566132	PP566156	---
<i>P. rupestre</i>	Schill 5 (E)	Portugal, Madeira	---	GQ910700	GQ910739
<i>P. wrightii</i>	Long 29636 (E)	Mexico, Veracruz	---	GQ910701	GQ910740
<i>Reboulia hemisphaerica</i> I	Zhang et al. 20150830-182 (HSNU)	China, Fujian	PP566128	OR689873	OR700031
<i>R. hemisphaerica</i> II	Zhang et al. 20150830-181 (HSNU)	China, Fujian	PP566149	PP566173	---
<i>R. hemisphaerica</i> III	Shi 20150920-37 (HSNU)	China, Anhui	---	PP566153	PP573768
<i>R. hemisphaerica</i> IV	Borovichev BE13-6-07 (KPABG)	Russia, Murmansk	---	KR024212	KR024178
<i>R. hemisphaerica</i> V	Bakalin Kh-72-22-09 (VBGI, KPABG)	Russia, Perm Territory	---	KR024213	KR024179

<i>R. hemisphaerica</i> VI	<i>Xiang 20160218-1</i> (HSNU)	China, Hunan	<b>PP566129</b>	OR689874	OR700032
<i>R. hemisphaerica</i> VII	<i>Schill et al. 46</i> (E)	Switzerland, Valais	---	GQ910702	GQ910741
<i>Targionia hypophylla</i>	<i>Zhu et al. 20150824-32</i> (HSNU)	China, Yunnan	<b>PP566130</b>	<b>PP566154</b>	<b>PP573769</b>
<i>Wiesnerella denudata</i>	<i>Xiang et al. 20160418-6</i> (HSNU)	China, Yunnan	<b>PP566131</b>	<b>PP566155</b>	<b>PP573770</b>