

and life histories from annuals to extremely long-lived perennials (e.g. Desfeux *et al.*, 1996; Forbis & Doak, 2004; Kephart *et al.*, 2006). Within this family, anther-smut disease is most common on the tribe *Sileneae* (Oxelman *et al.*, 2001; Table 2; Thrall *et al.*, 1993). Europe and Asia contain the largest numbers of species in the *Sileneae*, with smaller numbers found in Africa and North America and yet fewer in South America (Heywood, 1978). A suggested phylogeographical history of the genus *Silene* is a Eurasian origin followed by migration into the Americas via the Beringian region (Popp *et al.*, 2005; Popp & Oxelman, 2007). There are no native members of the *Sileneae* in Australia, although some species have become naturalized following introduction.

Herbarium surveys

Specimens were examined from the following plant herbaria (with herbarium abbreviations according to Holmgren & Holmgren, 1998): European: Centro di Ricerche Floristiche dell'Appennino (APP); Botánico de Barcelona (BC); Istituto Museo di Storia Naturale dell'Università, Firenze (FI); Royal Botanical Gardens, Kew (K); Real Jardín Botánico de Madrid (MA); Muséum National d'Histoire Naturelle, Paris (P); North American: Gray Herbarium, Harvard University (GH); Missouri Botanical Garden (MO); New York Botanical Garden (NY); Smithsonian Institution, Washington, DC (US); African: Bolus Herbarium (BOL); South American: Museo Nacional de Historia Natural, Santiago, Chile (SGO); Asian: Jiangsu Institute of Botany, Nanjing (NAS). The survey focused on

the genus *Silene* and other genera in the tribe *Sileneae*. Some members of the subfamilies Caryophylloideae (i.e. *Saponaria*, *Dianthus*, and *Petrorhagia*) and Alsinoideae (i.e. *Stellaria*) were also examined (Table 1), as were North and South American members of the genus *Calandrinia* in the Portulacaceae as a result of the recent discovery of an anther smut on *Calandrinia* that is related to *Microbotryum* on *Silene* (Le Gac *et al.*, 2007). Each herbarium sheet was examined for specimens with diseased flowers, and counts were based on total number of sheets with or without diseased specimens; no attempt was made to distinguish individual plants (see Hood & Antonovics, 2003). Locality information from herbarium labels of the diseased specimens was recorded and used to generate a distribution map of anther-smut disease found in this survey. In no case did we find any annotation indicating that the collector might have noticed that specimens on the sheets were diseased.

To determine how representative the herbarium survey was of the species in the tribe *Sileneae*, a simulation analysis was performed based upon resampling specimens from the compiled data set. Entries were chosen from the data set of over 40 000 *Sileneae* specimens at random and with replacement, and each was assessed for whether the plant species had been sampled previously in the simulation. The expected number of new plant species added for each additional herbarium specimen was determined. After the first 20 000 specimens the rate of new plant species per specimen had reached a relatively constant value of *c.* 0.003. We therefore concluded that the database was sufficiently large and representative to provide a thorough survey of the *Sileneae*.

Table 1 Number of herbarium specimens examined for anther-smut disease classified by plant genus and life-span

Family Caryophyllaceae		Total	Perennial	Annual	Undetermined
Subfamily Caryophylloideae					
Tribe <i>Sileneae</i>	<i>Silene</i>	37 275 (728)	24 136 (514)	13 008 (141)	131 (73)
	<i>Lychnis</i>	1471 (31)	1469 (29)	1 (1)	1 (1)
	<i>Heliosperma</i>	275 (7)	275 (7)	0 (0)	0 (0)
	<i>Viscaria</i>	501 (3)	501 (3)	0 (0)	0 (0)
	<i>Atocion</i>	542 (4)	542 (4)	0 (0)	0 (0)
	<i>Eudianthe</i>	530 (2)	0 (0)	530 (2)	0 (0)
	<i>Agrostemma</i>	6 (1)	0 (0)	6 (1)	0 (0)
Remaining Caryophylloideae	<i>Saponaria</i>	336 (67)	282 (38)	8 (3)	46 (26)
	<i>Dianthus</i>	482 (24)	431 (8)	36 (8)	15 (8)
	<i>Petrorhagia</i>	21 (2)	11 (1)	10 (1)	0 (0)
Remaining Caryophyllaceae	<i>Stellaria</i>	398 (4)	398 (4)	0 (0)	0 (0)
Family Portulacaceae					
Tribe <i>Calandrinia</i>	<i>Calandrinia</i>	772 (72)	311 (21)	425 (40)	36 (11)
	<i>Cistanthe</i>	3 (2)	3 (2)	0 (0)	0 (0)
	<i>Ceraria</i>	20 (4)	20 (4)	0 (0)	0 (0)
	<i>Calyptrorhiza</i>	77 (3)	0 (0)	77 (3)	0 (0)
Total		42 709 (955)	28 379 (636)	14 101 (200)	229 (119)

Numbers of species per genus are shown in parentheses. The tribe *Sileneae* is as defined in Oxelman *et al.* (2001).