

# Chapter 8

## Seed Production and Dispersal in the Orobanchaceae

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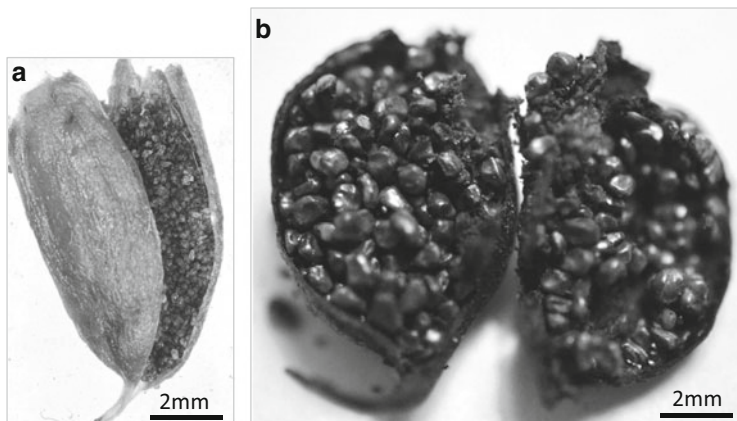
Most facultative hemiparasites of the Orobanchaceae, which develop only lateral haustoria, produce seeds that resemble those of non-parasitic plants. The germination of these facultative parasites is triggered only by seasonal cues. However, the seeds of the majority of obligate parasitic Orobanchaceae, which develop terminal haustoria following germination, are unique in their germination requirements. The following four chapters are dedicated mainly to the unique seeds of the obligate root parasitic Orobanchaceae, which require chemical stimulation from adjacent plant roots for germination. The description of their seeds and seedling is presented in Chap. 9; the stimulation of their germination is dealt with in Chaps. 10 and 12, whereas their germination ecophysiology is discussed in Chap. 11.

The seeds of the obligate parasitic Orobanchaceae are small. In some genera the seeds are dust-like, ranging between 0.2 mm (e.g. in some *Phelipanche*, *Striga* and *Orobanche* species; Figs. 8.1a and 8.2a, b), while in others up to 2 mm (e.g. in *Cistanche* and *Conopholis* species; Fig. 8.1b; Musselman and Dickison 1975; Teryokhin 1997; Baird and Riopel 1986). Only 200 cells comprise the seed of some *Orobanche* species (Joel et al. 1995). Seeds of facultative species can be much larger, e.g. up to 6 mm in *Melampyrum* (Fischer 2004) and 1.5 mm in *Triphysaria* (Fig. 8.2c).

Many obligate parasites produce numerous small seeds. Furthermore, their longevity in soil is often longer than the longevity of facultative parasites (Bekker and Kwak 2005). *Phelipanche aegyptiaca*, for example, often remains viable for several decades in highly infested agricultural fields in Israel when non-host crops (e.g. citrus trees) are grown in the field for a long while. Similarly, *Alectra vogelii* seeds persist in the soil even for 15 years until a host plant is planted in the field (Kroschel 1998). Unlike some facultative hemiparasites, e.g. *Melampyrum* and

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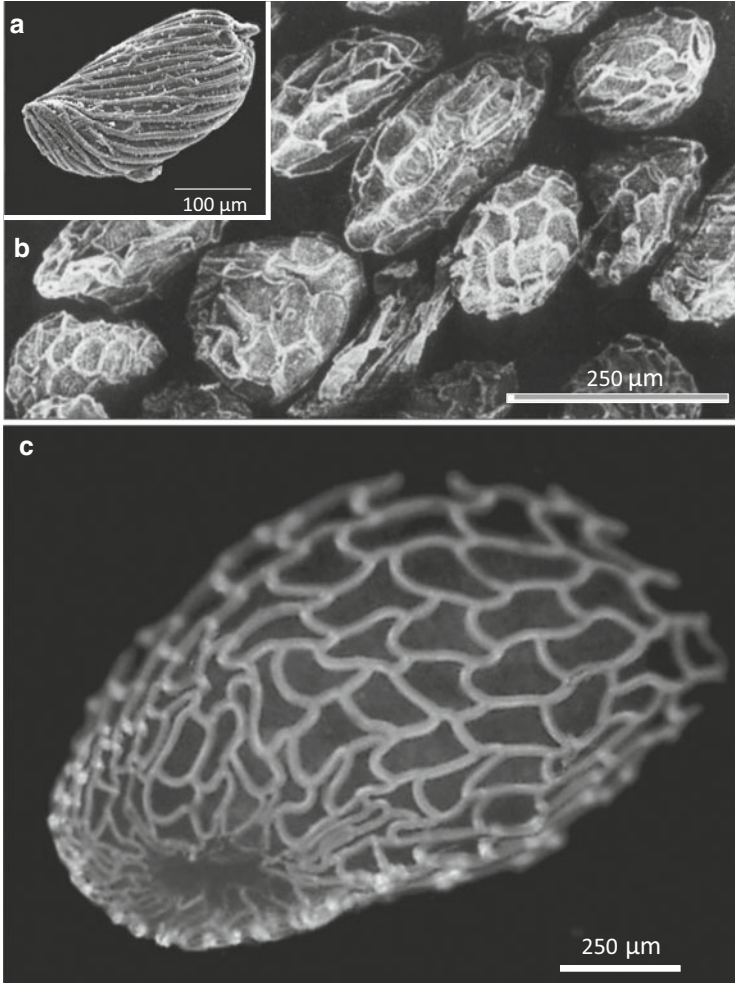
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**Fig. 8.1** Open seed capsules. (a) *Phelipanche aegyptiaca*; (b) *Conopholis americana*

some *Rhinanthus* species, which produce only few seeds per capsule, a single capsule of obligate parasites like *Orobanche*, *Striga*, *Alectra*, *Phelipanche* and *Conopholis* contains around 500 seeds (Fig. 8.1a, b). A single plant can produce annually tens of capsules, sometimes also hundreds, leading to annual dispersal of 10,000–500,000 seeds per single plant (Baird and Riopel 1986; Joel et al. 1995, 2007; Rich and Ejeta 2007). The production of numerous long-living miniscule seeds (microspermy) increases the probability that at least some seeds find a host even when host plants are temporarily and spatially uncommon. This strategy allows survival of the parasites in natural habitats. In agricultural fields, where host plants are abundant, this nature of weedy parasites is a key element in their rapid propagation and consequently also in their serious economic impact, and provides the parasites with genetic adaptability to changes in host availability and host resistance (Rich and Ejeta 2007; see Sect. 22.1.2).

Another strategy that increases the reproductive potential of some obligate Orobanchaceae is apomixis, an asexual reproduction mechanism that allows the development of seeds from unfertilized ovules (Jensen 1951; Greilhuber and Weber 1975; Heckard and Chuang 1975; Teryokhin 1997; Pazy 1998; Plitmann 2002). The flower of some broomrape species has the ability to develop seeds in three different ways: by cross-pollination, by self-pollination and by apomixis. This allows the plant to produce seeds of various genetic compositions even if the flowers have not been visited by pollinators (Teryokhin 1997; see Chap. 19). Interestingly a similar phenomenon is also found in insects, where asexual reproduction occurs among parasitic insects while it is rare in predatory species (Price 1980).



**Fig. 8.2** Seed size of various parasitic Orobanchaceae. (a) *Striga aspera* (SEM from Krause and Weber 1990); (b) *P. aegyptiaca* (SEM); (c) *Triphysaria versicolor* (epifluorescence micrograph)

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