1 Calculation of the concentration of organic carbon in the xylem sap of the hemiparasite necessary to compensate the carbon loss through respiration.

$0.55\ \mu mol$ C lost for the release of $1\ mmol$ water in the form of guttation drops and stomatal transpiration.

The molar concentration of organic carbon can be calculated as

$$c(C) = \frac{n(C)}{V}$$

where $n(C)$ is the amount of organic carbon and V is the volume of mixture.

Taking into account that

$$M(H_2O) \simeq 18\ g\ mol^{-1} = 18\ mg\ mmol^{-1} \simeq 0.018\ mL\ mmol^{-1}$$
$$n(C) = 0.55\ \mu mol$$
$$V(1\ mmol\ H_2O) = 0.018\ mL$$

where $M(H_2O)$ is the molar mass of water. We get the molar concentration of organic carbon in the xylem sap of the hemiparasite necessary to compensate the carbon loss through respiration:

$$c(C) = \frac{0.55}{0.018} = 30.56\ \mu mol\ mL^{-1} = 30.56\ mmol\ L^{-1} \doteq 31 mM$$

2 Calculations evaluating the effect of water secretion on carbon balance of hemiparasites based on the published chemical composition of hemiparasite or potential host xylem sap.

For all calculations, we assumed 5 C atoms per amino acid molecule, $a(AA) = 5$; 4 C atoms per organic acid molecule, $a(OA) = 4$; 6 C atoms per sugar molecule for the study by Seel and Jeschke (1999) and Escher *et al.* (2004) (sum hexose units), $a(S) = 6$; 8 C atoms per sugar molecule for the study by Furukawa *et al.* (2011), $a(S) = 8$; and 12 C atoms per sugar molecule for the study by Canny and McCully (1988) and Schill *et al.* (1996), $a(S) = 12$.

If multiple values were reported within a single study, we used the lowest total C concentration measured to obtain a conservative estimate of the effect on parasite carbon balance.

Govier *et al.* (1967)

The concentration of organic carbon (in the form of amino acids) in the root xylem of hemiparasitic *Odontites verna* is

$$c_1(C) = c_1(AA) \cdot a(AA) = 1.82 \cdot 5 = 9.1 \; mmol \; L^{-1}$$

As $c_1(C) < c(C)$, which corresponds to the molar concentration of organic carbon in the xylem sap of the hemiparasite necessary to compensate the carbon loss through respiration, the effect of water secretion on carbon balance of hemiparasites would be moderately negative. However, the calculation comprises only organic carbon in the form of amino acids.

Alvarez *et al.* (2008)

The concentration of organic carbon (in the form of amino and organic acids) in the xylem sap of maize is

$$\begin{aligned} c_2(C) &= c_2(AA) \cdot a(AA) + c_2(OA) \cdot a(OA) \\ &= 4.53 \cdot 5 + 0.103 \cdot 4 = 23.06 \; mmol \; L^{-1} \end{aligned}$$

As $c_2(C) < c(C)$, the effect of water secretion on carbon balance of hemiparasites would be moderately negative. However, the calculation comprises only organic carbon in the form of amino and organic acids. To achieve positive carbon balance, sugars have to be in the sap in relatively high concentrations and their filtering has to be very efficient.

Seel and Jeschke (1999)

The concentration of organic carbon (in the form of amino, organic acids, and sugars) in the xylem sap of hemiparasitic *Rhinanthus minor* attached to *Hordeum vulgare* is

$$\begin{aligned} c_3(C) &= c_3(AA) \cdot a(AA) + c_3(OA) \cdot a(OA) + c_3(S) \cdot a(S) \\ &= 7.5 \cdot 5 + 0.2 \cdot 4 + 0.09 \cdot 6 = 38.84\, mmol\ L^{-1} \end{aligned}$$

As $c_3(C) > c(C)$, the effect of water secretion on carbon balance of hemiparasites would be moderately positive only under very high efficiency of carbon filtering.

Canny and McCully (1988)

The concentration of organic carbon (in the form of amino acids, organic acids, and sugars) in the xylem sap of maize is

$$\begin{aligned} c_4(C) &= c_4(AA) \cdot a(AA) + c_4(OA) \cdot a(OA) + c_4(S) \cdot a(S) \\ &= 1.8 \cdot 5 + 18.3 \cdot 4 + 5.4 \cdot 12 = 147\, mmol\ L^{-1} \end{aligned}$$

As $c_4(C) > c(C)$, the effect of water secretion on carbon balance of hemiparasites would be positive. The efficiency of carbon filtering has to be less than 21% for carbon balance to be negative.

Escher *et al.* (2004)

The concentration of organic carbon (in the form of sugars) in the xylem sap of *Populus eu-americana* from spring to autumn varied between

$$c_5(C) = c_5(S) \cdot a(S) = 9 - 138.6\, mmol\ L^{-1}$$

Schill *et al.* (1996)

The concentration of organic carbon (in the form of sugars) in the xylem sap of *Acer platanoides* seasonally varied between

$$c_6(C) = c_6(S) \cdot a(S) = 12 - 300\, mmol\ L^{-1}$$

Although the concentration of sugars in xylem sap of *Populus* and *Acer* significantly varied between seasons, the effect of water secretion on carbon balance of *Lathraea* species growing on these trees would be positive when assuming year averages of sugar concentrations.

Heizmann *et al.* (2001)

The concentration of organic carbon (in the form of sugars) in the xylem sap of oak saplings is

$$c_7(C) = c_7(S) \cdot a(S) = 50 - 500\, mmol\ L^{-1}$$

As $c_7(C) >> c(C)$, the effect of water secretion on carbon balance of *Lathraea* species growing on trees would be highly positive.

Furukawa *et al.* (2011)

The concentration of organic carbon (in the form of amino acids, organic acids, and sugars) in the xylem sap of *Populus nigra* is regardless the time of xylem collection

$$\begin{aligned} c_8(C) &= c_8(AA) \cdot a(AA) + c_8(OA) \cdot a(OA) + c_8(S) \cdot a(S) \\ &< 10\, mmol\ L^{-1} \end{aligned}$$

As $c_8(C) < c(C)$, the effect of water secretion on the carbon balance of *Lathraea* species growing on trees would be negative.