

Table 2. Summary of typically observed variation in leaf metabolism and thermal responses across the vertical gradient and/or between sun and shade leaves

trait	symbol	units	response*	forest type(s) [†]	reference(s) [‡]
Conductance					
boundary-layer conductance	g_b	$\text{mmol m}^{-2} \text{ s}^{-1}$	↑ H	TrB	3
		mm s^{-1}	↑ H	TeN	12
			≈ L	TeN	12
leaf hydraulic conductance	K_{leaf}	$\text{m}^{-2} \text{ s}^{-1} \text{ MPa}^{-1}$	↑ L	TeB	40
cuticle conductance	g_{min}	$\text{mmol m}^{-2} \text{ s}^{-1}$	↑ L	TrB	41
max stomatal conductance	$g_{s \max}$	$\text{mol m}^{-2} \text{ s}^{-1}$	↑ H	TrB, TeB, BoN	1, 2, 4
stomatal conductance limitation	g_s	$\text{mol m}^{-2} \text{ s}^{-1}$	↑ L	TrB, TeB, TeN, BoN	8, 9, 10, 7, 4
			↑ H	TrB, TeN	9, 39, 5, 6, 7
			↑ L	TrB, TeN	9, 39, 7
stomatal conductance at optimal temperature	$g_s \text{ at } T_{opt}$	$\text{mol m}^{-2} \text{ s}^{-1}$	≈↑ H	TeB	11
			↓ H	TrB	39
			≈↑ L	TrB	8
Photosynthesis					
maximum photosynthetic capacity	A_{max}	$\text{mol m}^{-2} \text{ s}^{-1}$	↑ H	TrB, TeB, BoN	14, 11, 15, 4
			≈↓ H	TeB	16
			↑ L	TrB, TeB, TeN, BoN	14, 17, 18, 19, 10, 4
		$\text{nmol g}^{-1} \text{ s}^{-1}$	≈ H	TrB	20, 21
			≈ L	TrB, TeB, TeN	20, 21, 19
			↑ H	TrB, TeB	22, 23
maximum light-saturated net photosynthesis	A_{sat}	$\mu\text{mol m}^{-2} \text{ s}^{-1}$			
A _{sat} at optimum temperature	A_{opt}	$\mu\text{mol m}^{-2} \text{ s}^{-1}$	↑ L	TrB, TeB	8, 23
			≈↑ H	TrB, TeB	13, 11
			↑ H	TrB	39
			↑ L	TrB	8, 13

trait	symbol	units	response*	forest type(s) [†]	reference(s) [‡]
optimum temperature for photosynthesis	T_{opt}	°C	≈ H	TrB, TeB	24, 11, 13
			↓ H	TrB	39
			≈ L	TrB, TeB	9, 8, 11
photosynthetic light compensation point	LCP	μmol m ⁻²	↑ H	TrB, TeB, TeN	25, 16
			↑ L	TrB, TeB, TeN	8, 17, 16
maximal carboxylation rate	V_{cmax}	μmol m ⁻² s ⁻¹	↑ H	TrB, TeB	2, 42, 23, 14
			↑ L	TrB, TeB, BoN	9, 42, 23, 14, 10
		nmol g ⁻¹ s ⁻¹	≈ H	TrB, TeB	2, 23
			≈ L	TrB, TeB	2, 23
		nmol CO ₂ g ⁻¹ s ⁻¹	≈ ↓ L	TeB	26
optimum temperature for V_{cmax}	$V_{cmax}(T_{opt})$	μmol m ⁻² s ⁻¹	≈ ↑ H	TeB	11
			≈ L	TrB	9
electron transport rate	J_{max}	μmol m ⁻² s ⁻¹	↑ H	TrB, TeB	2, 42, 39, 23, 14
			↑ L	TrB, TeB	9, 42, 23, 27, 14
		nmol g ⁻¹ s ⁻¹	≈ H	TrB, TeB	2, 23
			≈ L	TrB, TeB	2, 23
		nmol e ⁻¹ g ⁻¹ s ⁻¹	≈ ↓ L	TeB	26
optimal temperature of J_{max}	T_{optETR}	°C	↓ H	TrB	39
	$J_{max}(T_{opt})$	μmol m ⁻² s ⁻¹	≈ L	TrB	9
high-temperature CO ₂ compensation point	T_{max}	°C	≈ H	TrB	22
			≈ L	TrB	8
Respiration					
respiration rate at 25 °C	R	μmol CO ₂ m ⁻² s ⁻¹	↑ H	TrB, TeB, TeN	39, 31, 32, 33
		μmol CO ₂ kg ⁻¹ s ⁻¹ ₁	≈ H	TrB, TeB, TeN	31, 32
			↑ L	TrB, TeN	31, 33,
light respiration	R_L	μmol m ⁻² s ⁻¹	↑ H	TrB	22
			↑ L	TrB	22

trait	symbol	units	response*	forest type(s) [†]	reference(s) [‡]
dark respiration	R_{dark}	$\mu\text{mol m}^{-2} \text{s}^{-1}$	↑ H	TrB, TeB, BoN	22, 14, 34, 23, 38
			↑ L	TrB, TeB, TeN, BoN	22, 14, 23, 17, 10, 38
		$\text{nmol g}^{-1} \text{s}^{-1}$	≈ ↑ H	TrB	2, 35
			≈ L	TrB	2, 35
R_{dark} at reference T	R_{dark} at reference T	$\mu\text{mol m}^{-2} \text{s}^{-1}$	↑ H	TrB, TeB, TeN	22, 14, 34, 32
		$\mu\text{mol (kg leaf)}^{-1} \text{s}^{-1}$	↑ H	TrB, TeB, TeN	22, 14, 34, 32
		$\mu\text{mol (kg N)}^{-1} \text{s}^{-1}$	↑ H	TeB, TeN	34, 32
		$\mu\text{mol m}^{-2} \text{s}^{-1}$	↑ L	TrB, TeB	22, 8, 34.
temperature sensitivity of R_{dark}	Q_{10}	$^{\circ}\text{C}^{-1}$	≈ H	TrB, TeB, TeN	22, 39, 34, 33
		$^{\circ}\text{C}^{-1}$	≈ ↑ H	TeB, TeN	36, 32
			≈ ↓ L	TrB, TeB, TeN	22, 34, 33
			↑ L	TeB	36
activation energy of R_{dark}	E_0	$\text{kJ mol}^{-1} \text{K}^{-1}$	≈ H	TrB, TeB, TeN	22, 37, 32
			≈ L	TrB	22, 8

1. Kafuti et al. 2020; 2. Van Wittenberghe et al. 2012; 3. Roberts et al. 1990; 4. Dang et al. 1997; 5. Marengo et al. 2017; 6. Ambrose et al. 2015; 7. Zweifel et al. 2001; 8. Slot et al. 2019; 9. Hernandez et al. 2020; 10. Urban et al. 2007; 11. Carter and Cavaleri 2018; 12. Martin et al. 1999; 13. Mau et al. 2018; 14. Kosugi et al. 2012; 15. Niinemets et al. 2015; 16. Bachofen et al. 2020; 17. Hamerlynck and Knapp 1994; 18. Coble et al. 2017; 19. Wyka et al. 2012; 20. Rijkers et al. 2000; 21. Ishida et al. 1999; 22. Weerasinghe et al. 2014; 23. Scartazza et al. 2016; 24. Miller et al. 2021; 25. Harris and Medina 2013; 26. Legner et al. 2014; 27. Kitao et al. 2012; 28. Fauset et al. 2018; 29. Rey-Sanchez et al. 2016; 30. Muller et al. 2021; 31. Mier et al. 2001; 32. Turnbull et al. 2003; 33. Araki et al. 2017; 34. Bolstad et al. 1999; 35. Kenzo et al. 2015; 36. Harley et al. 1996; 37. Xu and Griffin 2006; 38. Atherton et al. 2017; 39. Carter et al. 2021; 40. Sack et al. 2003; 41. Slot et al. 2021; 42. Carswell et al. 2000