Supporting information to the paper

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Appendix S1: Details on the traits included in the BryForTrait database. Given are trait names, the corresponding abbreviations (Abb.), a short description and used trait attributes or units for numeric traits.

Trait	Abb.	Description	Trait attributes/ unit	
Autecological traits				
Forest species	forest	Information how strong species are bound to forest habitats (Schmidt, Kriebitzsch, & Ewald, 2011)	M1.1	Largely restricted to closed forest
			M1.2	Prefers forest edges and in clearings
			M2.1	Occurs in forests as well as in open land
			M2.2	May occur in forests, but prefers open land
Indicator value: light	ind_L	Occurrence in relation to the relative irradiance intensity at the time when the deciduous plants are full in leaf	1	Plant in deep shade
			3	Shade plant
			5	Semi-shade plant, rarely in full light
			7	Plant generally in well-lit places, but also occurring in partial shade
			9	Plant in full light, found mostly in full sun
			Ind	Indifferent
Indicator value: temperature	ind_T	Occurrence in the temperature gradients from the Artic and the Mediterranean and from the alpine levels to lowlands	1	Cold-indicator plant, found only in high mountains, mostly in alpine and nival levels
			3	Indicator of cool conditions, mainly subalpine
			5	Indicator of fairly warm conditions, from lowland to montane, but especially in the submontane-temperate sites
			7	Warmth indicator, in warm lowland sites and colline levels
			9	Indicator of extremely warm conditions
			Ind	Indifferent

Trait	Abb.	Description	Trait attributes/ unit	
Indicator value: continentality	ind_K	Occurrence in the gradient from the Atlantic coast to the inner parts of Eurasia, especially with regards to temperature ranges	1	Extreme oceanic, in Central Europe only in few outposts
			2	Oceanic, mainly in the West, including western Europe
			4	Suboceanic, mainly in Central Europe, but spreading eastwards
			5	Intermediate, weakly suboceanic to weakly subcontinental
			6	Subcontinental, mainly in the east of Central Europe
			8	Continental, spreading into Central Europe from the east only exceptionally
			9	Extreme continental, virtually absent from western Europe
			Ind	Indifferent
Indicator value: moisture	ind_F	Occurrence in the gradient from dry, shallow-soil rocky slopes to swampy ground	1	Indicator of extreme dryness, restricted to soils that often dry out for some time
			3	Dry-site indicator, more often found on dry ground than in moist places
				Moist-site indicator, mainly on fresh soils of average dampness
			5	Dampness indicator, mainly on constantly moist or damp, but not on wet
			7	soils
			9	Wet-site indicator, often on water-saturated, badly aerated soils
			Ind	Indifferent
Indicator value: reaction	ind_R	Occurrence in the gradient of soil acidity and lime content	1	Indicator of extreme acidity, never found on weakly acid or basic soils
			3	Acidity indicator, mainly on acid soils, but exceptionally also on nearly neutral ones
			5	Indicator of moderately acid soils, only occasionally found on very acid or on neutral to basic soils
			7	Indicator of weakly acid to weakly basic conditions; never found on very acid soils
			9	Indicator of basic reaction, always found on calcareous or other high-pH soils
			Ind	Indifferent
Indicator value: nutrient	ind_N	Occurrence in the gradient of nutrient availability, eutrophication	1	Plants on sites with very low nutrient content
			3	Plants on sites with low nutrient content
			5	Plants on sites with medium nutrient content
			7	Plants on sites rich in nutrients
			8	No bryophytes occur (outcompeted by vascular plants)
			9	No bryophytes occur (outcompeted by vascular plants)
Substrate: soil	sub_soil	Growing on earth/soil	0	Not occurring on substrate
			1	Occurring on substrate

Trait	Abb.	Description	Trait attributes/ unit
Substrate: rock	sub_rock	Growing on rock	0 Not occurring on substrate 1 Occurring on substrate
Substrate: dead wood	sub_wood	Growing on dead wood	0 Not occurring on substrate 1 Occurring on substrate
Substrate: bark	sub_bark	Growing on the bark of living trees	0 Not occurring on substrate 1 Occurring on substrate
Human impact (Hemeroby)	hemeroby	Occurrence in the gradient of background human impact on the ecosystem	1 Absent 2 Absent to weak 3 Weak 4 Weak to moderate 5 Moderate 6 Moderate to strong 7 Strong 8 Strong to very strong 9 Very strong

Trait	Abb.	Description	Trait attributes/ unit	
Morphological traits of the whole plant				
Growth form	growth_form	Morphological growth form	O	Orthotrop: stems stand up vertically from the substrate
			P	Plagiotrop: shoots close to substrate, differentiation into main and lateral shoots; include thalloid bryophytes
Stems	stems	Vertical growing direction of the stems	procumbent	prostrate stems
			decumbent	prostrate with ascending tips
			ascending	growing upwards, often from an older prostrate part
			erect	curved like a bow
			pendent	in a more or less vertical position relative to the substrate
			floating	pendent stems
			thalloid	floating in water
				thallus like growth
Shoot length	shoot_length	Mean shoot length, calculated from literature min and max values. For thallus bryophytes referring to max diameter.		Numeric [cm]
Life form	life_form	Life forms based on Mägdefrau (1969)	annual	The gametophyte stops growing after producing gametangia and dies after the sporogonium has ripened; pioneers on open soil.
			turf	The upright shoots (no or only slight branching), stand close together and grow on after ripening of the sporogonia by means of acrotonous regenerative shoots; open mineral soils and rocks, forest floors in temperate zones.
			cushions	Basal regenerative shoots are produced usually in considerable numbers on the upright shoots. The cushions therefore grow not only upwards but also extend sideways. Pleurocarpous mosses can also form cushions, their main axes remaining short and the lateral axes extending upwards; rocks, bark; usually high light.
			mat	Plagiotropic bryophytes, the main and lateral shoots of which lie close to the substrate and are attached to it by rhizoids; rocks and the bark of trees; hold considerable capillary water.
			weft	Plagiotropic bryophytes, the main and lateral shoots of which grow loosely through one another and form a covering that is easy to lift from the substrate (forest floor, rotten trunks of trees), a new layer growing every year over that of the previous year.

Trait	Abb.	Description	Trait attributes/ unit	
			dendroid	Bryophytes growing on the ground, the negatively geotropic shoots of which bear at the top a tuft of large leaves or many lateral shoots. Their growth form groups them under the creepshoot mosses.
			rosette	Thallus forming rosettes.
Life strategies	life_strat life_strat2	Life strategies according to During (1979); if more than one strategy is known, this is presented as life_strat2	f	Fugitives: species that live in unpredictable environments. Short life span; ephemeral or annual; high sexual reproductive effort; large percent of plant; devoted to spore production; low age of first reproduction (first year); spores small (<20 µm), very persistent and long-lived; no asexual reproduction; innovations absent; open turfs
			c	Colonists: species that live where habitat start is unpredictable, but lasts several years; secondary succession. Moderately short life span; (annual-) pauciennial- pluriennial; high reproductive effort both in asexual and sexual diaspore production; asexual reproduction mostly concentrated in the early life stages, sporophytes later, then frequent; innovations normally present; age of first asexual reproduction low, often a few months; age of first sexual reproduction at least one year, mostly 2-3 yr; spores small, less than 20 µm, and very persistent in most species; asexual propagules much larger; growth form predominantly short turfs.
			a	Annual shuttle: species that require small disturbances that last 1–2 years; survive severe stress periods. Short life span; (ephemeral-) annual-pauciennial ; sexual reproductive effort high, sporophytes very frequent; asexual reproduction absent, innovations mostly absent; age of first reproduction low, normally less than 1 yr; spores large, 25-50 (-200) µm, life span mostly several years; growth form open turf or thalloid mats.
			s	Short-lived shuttle: species that do not avoid periods of severe stress; habitat lasts 2–3 years. Life span longer, pauci-pluriennnial; sexual reproductive effort rather high, sporophytes ± frequent; asexual reproduction rare or absent; innovations normally present; age of first reproduction ca. 2-3 yr; spores large, 25-50 (-100) µm; life span probably several years; growth form short turf or thalloid mats.
			l	Perennial (long-lived) shuttle: species that require stable environments, such as epiphytes, where end of habitat is predictable. Long life span; pluriennial-perennial; sexual reproductive effort moderate, sometimes low to absent; asexual

Trait	Abb.	Description	Trait attributes/ unit	
				reproductive effort moderate, rather high in cases with rare or no sexual reproduction; innovations present; age of first asexual reproduction variable, normally exceeding 1-2 yr; age of first sexual reproduction rather high (estimation: more than 5 yr); spores (in regularly sporulating species) large, 25-200 µm, life span often short; asexual diaspores large; growth form cushions, mats or tufts.
			p	Perennial stayers: most frequent in later successional stages. Long life span; perennials; sexual and asexual reproductive effort rather low to nearly absent, sometimes very localized in small areas; age of first reproduction variable, several years at least; spores small, less than 20 µm; life span variable; growth form wefts, dendroids, mats, also large cushions.
Protonema	protonema	Bryophyte with permanent protonema	0	Species without permanent protonema
			1	Species with permanent protonema
Hyalin hairpoint	hyalin_hairp	Bryophyte with (potentially) hyaline hairpoints	0	Species without the potential to form hyaline hairpoints
			1	Species with the potential to form hyaline hairpoints
Dominants	dominants	Potential of a species to dominate the vegetation cover	0	Species not dominating the vegetation cover
			1	Species dominating the vegetation cover
Sexual regeneration traits				
Distribution of gametangia	dist_gamet	Arrangement of the antheridia and archegonia on gametohytes	Dioicous	Gametophytes have antheridia or archegonia, but never both
			Monoicous	Having antheridia and archegonia on the same gametophyte
	dist_gamet2	Arrangement of the antheridia and archegonia on monoicous gametohytes	Autoicous	having antheridia and archegonia borne on different branches of the same plant
			Paroicous	having antheridia in the axils of the leaves immediately below the perichaetium
			Synoicous	Antheridia and archegonia interspersed in the same cluster on the same gametophyte

Trait	Abb.	Description	Trait attributes/ unit	
Seta	seta_length	Length of seta (mean value as classes)	0	seta absent
			1	≤ 0.2 cm
			2	0.2–2 cm
			3	2–5 cm
			4	> 5 cm
Capsules: position	capsule_pos	Position of the capsule on the seta	erect	Erect
			inclined	Inclined (including arcuate, horizontal, cernuous)
			pendulous	Pendulous
			immersed	Immersed
Capsules: peristome	capsule_peris	Capsule with peristome or not	0	Without peristome
			1	With peristome
Mean size of spores	spores	Mean diameter, calculated from the min and max values found in literature	Numeric [µm]	
Spore ornamentation	ornament	Kind of spore surface ornamentation	Flat	No ornamental structures occurring
			Grained	Grained structures occurring
			Papillose	Papillose structures occurring
Fruiting: Frequency	fruit_freq	Frequency of fruiting (subjective estimation)		Very rare
				Rare
				Occasional
				Frequent
				Common
				Very common
Fruiting: Season	fruit_seas	Season of fruiting		Spring
				Summer
				Autumn
				Winter

Trait	Abb.	Description	Trait attributes/ unit
Vegetative dispersal traits			
Vegetative regeneration: tubers	veg_tub	Small, underground resting bud-like structures occurring on rhizoids	0 Unknown 1 Occurring
Vegetative regeneration: gemmae	veg_gem	Multicellular buds on short stalks, formed in gemmae cups or leave axes	0 Unknown 1 Occurring
Vegetative regeneration: bulbils	veg_bulb	Buds budding from gametophyte surfaces	0 Unknown 1 Occurring
Vegetative regeneration: branches	veg_bran	Formation of independent plants by branching of the leafy stem, the formation of stoloniferous branches or specially modified branches	0 Unknown 1 Occurring
Vegetative regeneration: leaves	veg_leav	Caducous leaves from new plants; these may be modified or unmodified leaves	0 Unknown 1 Occurring

References

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