SUPPLEMENTARY DATA

TABLE S1. Comparison of the morphology and mass of the six types of dispersal units and fruits and of the mass of embryos in *Ceratocarpus arenarius* (mean ± SE). N=50 for morphology of dispersal units and fruits and 10 for mass of 100 dispersal units, of 100 fruits and of 100 embryos. Different superscript lowercase letters within a row indicate significant differences (Tukey's HSD, $P = 0.05$).

				a	b	c	d	e	f
Dispersal unit	Morphology	Length (mm)		6.08 ± 0.01^b	5.23 ± 0.01^a	5.90 ± 0.01^b	6.14 ± 0.01^b	6.41 ± 0.02^b	6.44 ± 0.02^b
		Width (mm)		3.26 ± 0.01^b	2.33 ± 0.01^a	2.58 ± 0.01^a	2.63 ± 0.01^a	2.14 ± 0.01^a	2.43 ± 0.01^a
		Thickness of bracts	Upper (mm)	$0.12\pm0.00^{d**}$	0.09 ± 0.00^c	0.08 ± 0.00^b	0.07 ± 0.00^{ab}	0.07 ± 0.00^{ab}	0.07 ± 0.00^a
			Lower (mm)	0.21 ± 0.01^e	0.18 ± 0.00^d	0.17 ± 0.00^{cd}	0.15 ± 0.00^{bc}	0.14 ± 0.00^{ab}	0.13 ± 0.00^a
		Glochids	Length (mm)	$-$*	0.34 ± 0.00^a	0.86 ± 0.01^b	1.35 ± 0.01^c	3.82 ± 0.02^d	7.55 ± 0.03^e
			Angle (°)	$-$*	50.62 ± 2.47^a	78.22 ± 4.21^b	108.92 ± 4.90^c	128.23 ± 3.32^d	139.76 ± 3.05^e
	Mass (g) of 100 dispersal units			0.44 ± 0.02^b	0.23 ± 0.00^a	0.21 ± 0.01^a	0.21 ± 0.01^a	0.20 ± 0.00^a	0.20 ± 0.00^a
Fruit	Morphology	Length (mm)		3.05 ± 0.01^a	3.16 ± 0.01^a	3.53 ± 0.01^b	3.69 ± 0.01^b	4.20 ± 0.01^c	4.31 ± 0.01^c
		Width (mm)		1.69 ± 0.00^b	1.35 ± 0.01^a	1.37 ± 0.01^a	1.46 ± 0.01^{ab}	1.51 ± 0.01^{ab}	1.59 ± 0.01^{ab}
	Mass (g) of 100 fruits			0.17 ± 0.00^c	0.12 ± 0.00^b	0.12 ± 0.00^b	0.12 ± 0.00^b	0.12 ± 0.00^b	0.11 ± 0.00^a
Embryo	Mass (g) of 100 embryos			0.16 ± 0.00^c	0.12 ± 0.00^b	0.11 ± 0.00^b	0.11 ± 0.00^b	0.11 ± 0.00^b	0.10 ± 0.00^a

*$-$, dispersal unit a without glochids. **SE (± 0.00) was (± < 0.001).

TABLE S2. Fall time (s, mean ± SE) and effect of wind speed on dispersal distance (cm, mean ± SE) of dispersal units and of fruits of *Ceratocarpus arenarius*. Different superscript lowercase letters within a column for dispersal units or for fruits indicate significant differences (Tukey's HSD, P = 0.05). Different superscript uppercase letters indicate significant differences between a type of dispersal unit and fruit.

|		Fall time (s)	Fall rate (cm s^{-1})	Dispersal distance (cm)	
				Wind speed 1 m s^{-1}	Wind speed 4 m s^{-1}
Dispersal Units	a	0.37 ± 0.02^{Ba}	375.71 ± 19.35^{Ac}	23.65 ± 1.54^{Ba}	27.38 ± 1.89^{Ba}
	c	0.42 ± 0.02^{Ba}	314.11 ± 13.45^{Ab}	29.46 ± 2.14^{Bb}	37.96 ± 1.84^{Bb}
	f	0.49 ± 0.02^{Bb}	269.97 ± 12.70^{Aa}	31.24 ± 2.22^{Bb}	43.66 ± 2.58^{Bb}
Fruits	a	0.20 ± 0.01^{Aa}	708.00 ± 43.22^{Bb}	15.84 ± 0.97^{Aa}	20.42 ± 1.31^{Aa}
	c	0.27 ± 0.01^{Ab}	480.80 ± 16.40^{Ba}	19.06 ± 1.44^{Aab}	27.04 ± 1.57^{Ab}
	f	0.28 ± 0.01^{Ab}	467.03 ± 18.83^{Ba}	21.40 ± 1.23^{Ab}	33.68 ± 1.68^{Ac}

TABLE S3. Adherence of dispersal units and of fruits of *Ceratocarpus arenarius* to soil and sand particles (g, mean ± SE). Different superscript uppercase letters within a row indicate significant differences among dispersal units a, c and f or among fruits a, c and f (Tukey's HSD, P = 0.05). Different superscript lowercase letters within a column indicate significant differences between the dispersal unit or fruit type with and without adhered soil or sand particles by t-test. M_d', before adherence of soil or sand particles; M_s', after adherence of soil or sand particles; M_t', number of times dispersal unit or fruit increased in mass.

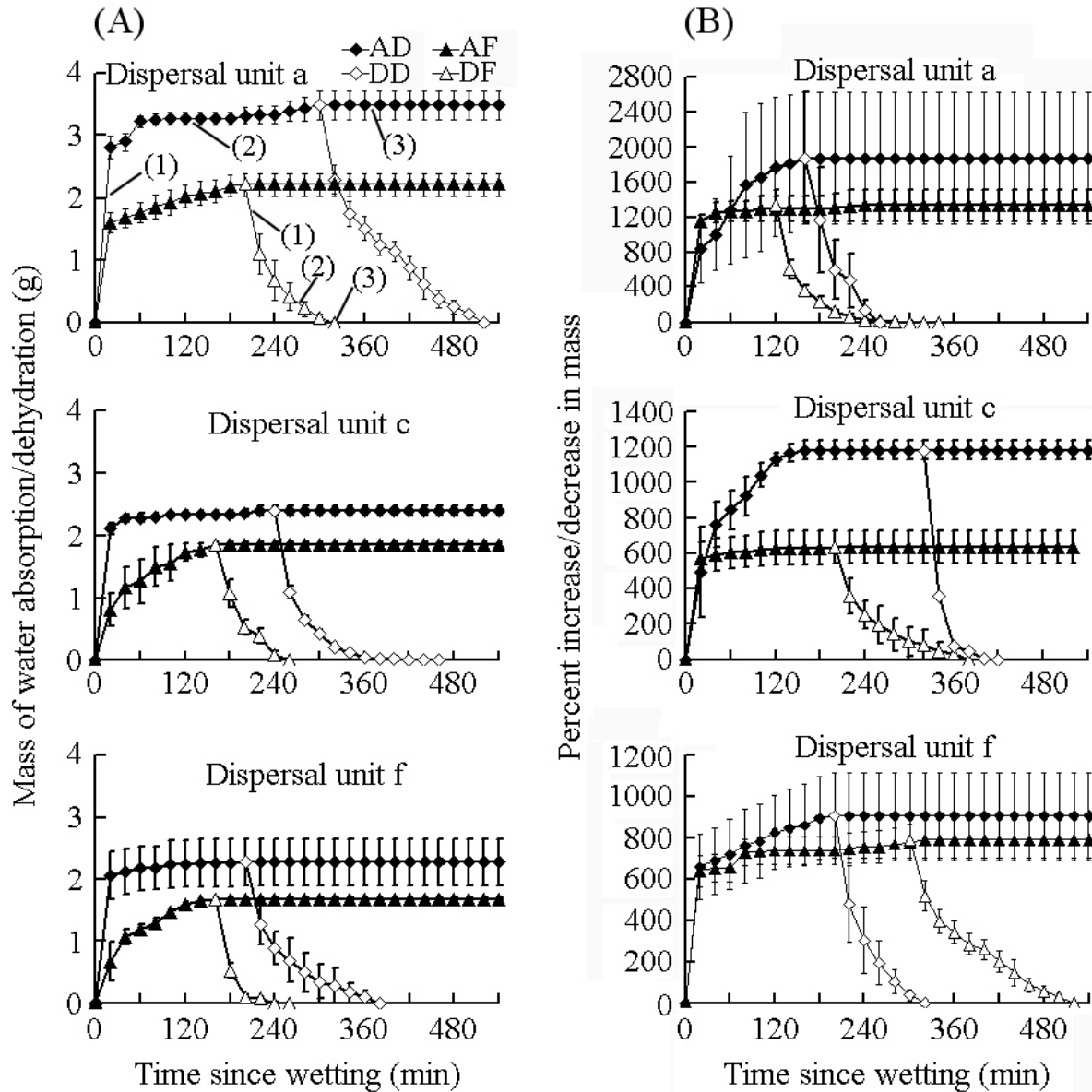|		Dispersal unit			Fruit		
		a	c	f	a	c	f
Soil particles	M_d'	0.45 ± 0.02^{Ba}	0.21 ± 0.01^{Aa}	0.21 ± 0.00^{Aa}	0.18 ± 0.01^{Ba}	0.11 ± 0.00^{Aa}	0.10 ± 0.00^{Aa}
	M_s'	0.89 ± 0.03^{Bb}	0.28 ± 0.01^{Ab}	0.26 ± 0.01^{Ab}	0.18 ± 0.01^{Ba}	0.11 ± 0.00^{Aa}	0.10 ± 0.00^{Aa}
	M_t'	1.98 ± 0.02^{B}	1.34 ± 0.07^{A}	1.23 ± 0.04^{A}	1.02 ± 0.01^{A}	1.02 ± 0.01^{A}	1.03 ± 0.01^{A}
Sand particles	M_d'	0.44 ± 0.01^{Ba}	0.22 ± 0.02^{Aa}	0.21 ± 0.00^{Aa}	0.18 ± 0.01^{Ba}	0.12 ± 0.01^{Aa}	0.11 ± 0.00^{Aa}
	M_s'	1.28 ± 0.06^{Bb}	0.32 ± 0.02^{Ab}	0.43 ± 0.01^{Ab}	0.19 ± 0.01^{Ba}	0.13 ± 0.01^{Aa}	0.12 ± 0.00^{Aa}
	M_t'	2.90 ± 0.20^{C}	1.48 ± 0.07^{A}	2.01 ± 0.03^{B}	1.10 ± 0.04^{A}	1.04 ± 0.02^{A}	1.03 ± 0.01^{A}

TABLE S4. Four-way ANOVA of effects of light, storage time, temperature, dispersal unit type and their interactions on germination of *Ceratocarpus arenarius* dispersal units stored dry at laboratory conditions.

Source	d.f.	SS	MS	*F*-value	*P*-value
Light (L)	1	349.40	349.40	18.35	< 0.05
Storage time (T)	3	96517.86	32172.62	1689.18	< 0.05
Temperature (T′)	4	3075.40	768.85	40.37	< 0.05
Dispersal unit type (D)	2	98421.76	49210.88	2583.75	< 0.05
L×T	3	35.29	11.74	0.62	0.61
L×T′	4	9.09	2.27	0.12	0.98
L×D	2	290.41	145.21	7.61	< 0.05
T×T′	12	1490.72	124.23	6.52	< 0.05
T×D	6	41025.46	6837.58	359.00	< 0.05
T′×D	8	1643.11	205.39	10.78	< 0.05
L×T×T′	12	113.58	9.47	0.50	0.92
L×T×D	6	140.85	23.48	1.23	0.29
L×T′×D	8	40.83	5.10	0.27	0.98
T×T′×D	24	1948.80	81.20	4.26	< 0.05
L×T×T′× D	24	239.39	9.98	0.52	0.97

FIG. S1. (A, C) Effect of 1 m s^{-1} and 4 m s^{-1} wind speeds on detachment of dispersal units c and f from stationary plants and (B, D) 4 m s^{-1} wind speed on detachment of dispersal units c and f from whole-plant rolled for 1 m and 3 m. In (A) and (C), different uppercase letters above bars indicate significant differences for different wind speed in the same dispersal unit type and different lowercase letters significant differences between the two dispersal unit morphs at the same wind speed. In (B) and (D), different uppercase letters above bars indicate significant differences for different dispersal distance in the same dispersal unit type and different lowercase letters significant differences between the two dispersal unit morphs at the same dispersal distance (Tukey's HSD, $P = 0.05$). Bars are ± SE.
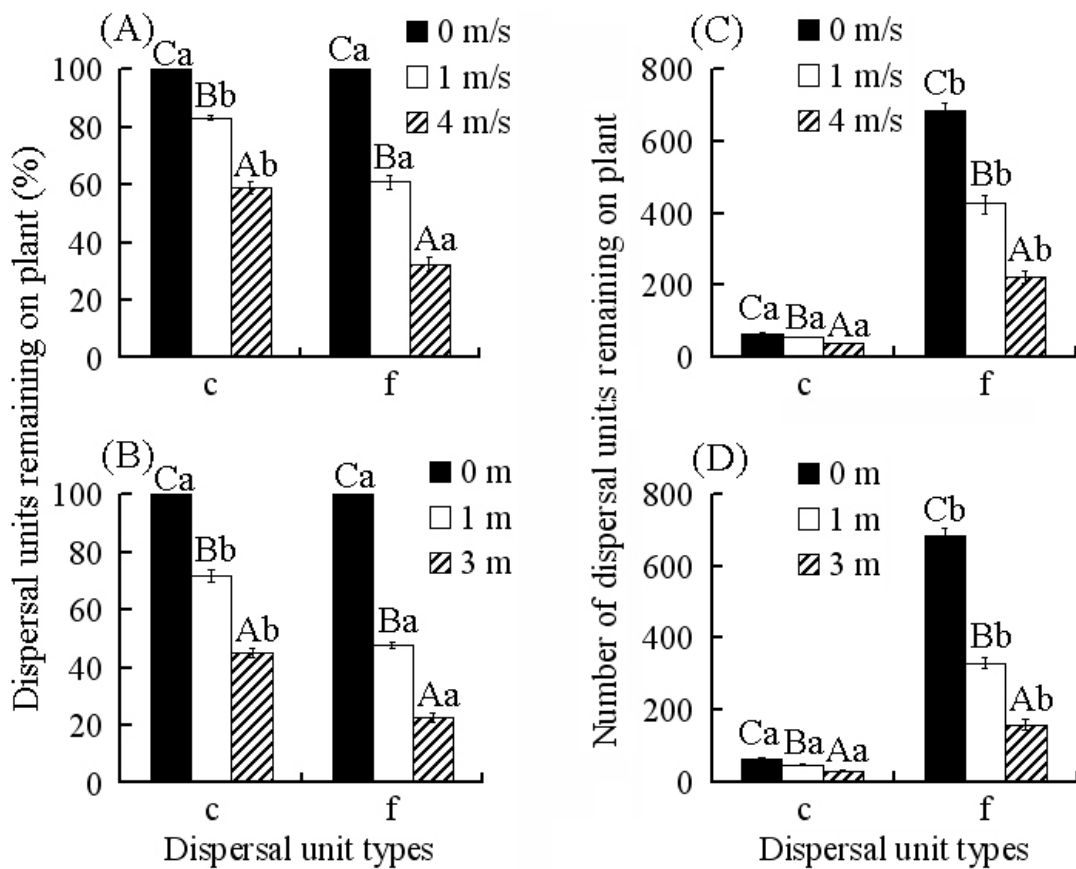
FIG. S2. (A) Time course for mass and (B) percent (mean ± SE) of water absorption and dehydration per 100 dispersal units a, c and f and of their fruits of *Ceratocarpus arenarius*. AD, water absorption by dispersal unit; DD, dehydration of dispersal unit; AF, water absorption by fruit; DF, dehydration of fruit. (1), (2) and (3) indicate three stages of imbibition and dehydration (see text for explanation).

FIG. S3. Final germination percentages (mean ± SE) of dispersal units a, c and f incubated in (A) light/dark (left panels) and (B) constant darkness (right panels) at five temperature regimes following 0-, 2-, 4- and 12-months of dry storage at laboratory conditions. Bars with different lowercase letters are significantly different in multiple range comparison in light/dark or in dark for a given time of storage and within the same dispersal unit type (Tukey's HSD, $P = 0.05$).