

Supplementary Table S1. Average \pm SD size (estimated as area in mm²) of outer and inner fruits of gynomonoecious, monoecious and hermaphroditic Asteraceae species. FSD – Fruit size difference measured as meta-analytical effect size. ¹Herbarium: Swedish Museum of Natural History (S); Herbarium of University of Coimbra (COI). ²Dist.: major areas where the species is distributed. ³Sexual system: H – Hermaphroditism; GM – Gynomonoecy; M – Monoecy.

Subfamily	Tribe	Species	Herbarium ¹	Herbarium Voucher	Dist. ²	Sexual System ³	Outermost fruits		Innermost fruits		FSD \pm SE
							n	Mean \pm SD	n	Mean \pm SD	
Asteroideae	Anthemideae	<i>Artemisia crithmifolia</i>	COI	Aarão F. de Lacerda, no. 751-780	Europe	M	-	-	-	-	-
		<i>Eriocephalus umbellatus</i>	COI	Heron, s.n.	South Africa	M	1	1.82	-	-	-
		<i>Hippia fruticosa</i>	COI	Lason, no. 10686	South Africa	M	10	1.63 \pm 0.41	-	-	-
		<i>Soliva pterosperma</i>	COI	J. Matos; A Matos & A. Marques, no. 750-4806	South America	M	10	1.55 \pm 0.25	5	1.02 \pm 0.21	2.092 \pm 0.706
	Astereae	<i>Amellus strigosus</i>	S	E. Wall, no. 137	South Africa	GM	33	2.27 \pm 0.16	15	2.14 \pm 0.20	0.738 \pm 0.321
		<i>Calotis erinaceae</i>	S	E.N.S. Jackson, no. 5948	Australia	GM	38	3.24 \pm 0.51	12	3.14 \pm 0.43	0.200 \pm 0.332
		<i>Grindelia arenicola</i>	S	E. K. Balls, no. 10161	North America	GM	54	3.36 \pm 0.45	25	3.86 \pm 0.56	-1.017 \pm 0.256
		<i>Pteronia incana</i>	S	A. & B. Strid, no. 37701	South Africa	H	8	4.41 \pm 0.65	-	-	-
	Athroismeae	<i>Blepharisperrum spinulosum</i>	COI	Cyossmeyer, no. 8059	Central Africa	M	1	4.64	-	-	-
	Calenduleae	<i>Calendula arvensis</i>	COI	J. Nogueirs, no. 757-10962	Europe, Mediterranean Basin	M	6	17.47 \pm 5.02	8	8.98 \pm 0.47	2.438 \pm 0.766

Subfamily	Tribe	Species	Herbarium ¹	Herbarium Voucher	Dist. ²	Sexual System ³	Outermost fruits		Innermost fruits		FSD ± SE
							n	Mean ± SD	n	Mean ± SD	
		<i>Dimorphotheca sinuata</i>	COI	Sange Kloof, no. 8598	South Africa	M	-	-	-	-	-
		<i>Osteospermum hispidum</i>	COI	Elands, no. 9755	South Africa	M	-	-	-	-	-
	Gnaphalieae	<i>Anaxeton arborescens</i>	S	A. Meelbold, no. 13494	South Africa	M	-	-	-	-	-
		<i>Ammobium alatum</i>	S	A. Anderberg & A.L. Anderberg, no. 7148	Australia	H	53	1.25±0.24	88	1.08±0.27	0.652±0.178
		<i>Millotia myosotidifolia</i>	S	F.J. Badman, no. 8397	Australia	H	44	0.84±0.18	21	1.07±0.23	-1.152±0.285
		<i>Ozothamnus diosmifolius</i>	S	A. Anderberg & A.-L. Anderberg, no. 7043	Australia	H	-	-	-	-	-
		<i>Plecostachys serpyllifolia</i>	S	R. D. A. Bayliss, no. 8375	South Africa	GM	10	1.56±0.09	-	-	-
		<i>Rosenia humilis</i>	S	Kare Bremer, no. 164	South Africa	GM	10	2.45±0.32	8	2.23±0.23	0.737±0.494
	Inuleae	<i>Blumea riparia</i>	S	Chieng-Chang Hsu, no. 5201	Eastern Asia	GM	172	0.39±0.05	44	0.34±0.05	0.207±0.166
		<i>Epaltes cunninghamii</i>	S	B. Nordenstam & A. Anderberg, no. 972	Australia	M	16	0.43±0.19	11	0.42±0.08	0.062±0.392
		<i>Inula oculus-christi</i>	S	I. Segelberg, no. 13761/5	Europe	GM	26	0.88±0.14	75	0.97±0.11	-0.755±0.234
		<i>Inula peacockiana</i>	S	K. H. Rechinger, no. 49051	Western Asia	H	16	5.63±0.49	4	5.52±0.43	0.219±0.560
		<i>Pluchea dentex</i>	S	B. Nordenstam & A. Anderberg, no. 325	Australia	M	57	0.18±0.04	81	0.18±0.03	0.000±0.173
		<i>Streptoglossa liatroides</i>	S	A. Strid, no. 4269	Australia	GM	34	1.79±0.21	27	1.86±0.18	-0.350±0.260

Subfamily	Tribe	Species	Herbarium ¹	Herbarium Voucher	Dist. ²	Sexual System ³	Outermost fruits		Innermost fruits		FSD ± SE
							n	Mean ± SD	n	Mean ± SD	
	Senecioneae	<i>Blennosperma californicum</i>		Lewis S. Rose, no. 9308-33008	North America	M	3	2.25±0.11	-	-	-
		<i>Kleinia longiflora</i>	S	E. Wall, no. 622	Africa	H	8	6.74±1.19	3	7.46±0.28	-0.622±0.697
		<i>Ligularia fischeri</i>	S	M Mizushima, no. 13766	Eastern Asia	GM	11	4.96±0.50	7	4.97±0.65	-0.017±0.484
		<i>Othonna coronopifolia</i>		Iaron, no. 7885	South Africa	M	7	1.85±0.32	-	-	-
		<i>Roldana mexicana</i>	S	Geo. B. Hinton, no 8745	Mexico	H	14	1.42±0.24	5	1.37±0.26	0.195±0.522
		<i>Senecio inornatus</i>	S	DM Hilliard & B.L. Burt, no. 7492	Africa	GM	22	0.66±0.14	7	0.74±0.05	-0.619±0.443
		<i>Senecio subsessilis</i>	S	J.A. Mlangwa , P.B. Phillipson, H. van Vlaenderen & W. Kindeketa, no. 305	Africa	GM	20	3.16±0.35	8	3.38±0.45	-0.563±0.426
Barnadesioideae	Barnadesieae	<i>Barnadesia spinosa</i>	S	H. Humbert, no. 26923	South America	H	12	3.89±0.59	3	5.17±1.78	-1.362±0.708
		<i>Dasyphyllum diacanthoides</i>	S	Mleyer, no. 8161	South America	GM	14	2.56±0.38	4	2.25±0.58	0.695±0.582
		<i>Dasyphyllum ferox</i>	S	C. Hammarlund, no. 534	South America	GM	7	4.10±0.38	5	4.35±0.49	-0.540±0.601
		<i>Doniophyton anomalon</i>	S	F. Barkley & O. Paci, s.n.	South America	GM	31	12.41±1.63	15	13.99±1.47	-0.982±0.332
Carduoideae	Dicomeae	<i>Dicoma anomala</i>	S	H. & HE. Wanntorp, no. 464	Africa	H	9	2.37±0.33	4	2.75±0.43	-0.982±0.644
Cichorioideae	Arctotideae	<i>Hirpicium echinus</i>	S	Lars Erik Kers, no. 2179	South Africa	H	11	2.28±0.44	5	2.24±0.39	0.089±0.540
		<i>Hoplophyllum spinosum</i>	S	P. Goldblatt, no. 4325	South Africa	H	7	4.69±0.76			

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							n	Mean ± SD	n	Mean ± SD	
Cichorieae		<i>Microseris douglasii</i>	S	Lewis S. Rose, no. 66037B	North America	H	25	2.33±0.14	15	2.19±0.19	0.856±0.342
		<i>Uropappus lindleyi</i>	S	L.S. Rose, no. 63059	North America	H	23	4.54±0.13	9	4.81±0.13	-2.025±0.477
		<i>Warionia saharae</i>	S	E.K. Balls, no. 2530	North Africa	H	21	15.31±2.69	19	15.51±2.49	-0.075±0.317
Liabeae		<i>Liabum bourgeaui</i>	S	Robert Merrill King & Victor Castro, no. 9997	Mesoamerica	GM	52	0.15±0.03	17	0.17±0.03	-0.659±0.285
		<i>Philoglossa peruviana</i>	S	E. Asplund, no. 13735	South America	GM	15	1.10±0.08	4	1.08±0.07	0.244±0.564
		<i>Sinclairia polyantha</i>	S	C. L. Lundell & Elias Contreras, no 20619	Mesoamerica	GM	14	0.43±0.07	4	0.49±0.11	-0.723±0.583
Vernonieae		<i>Baccharoides adoensis</i>	S	M Reekmans, no. 9172	Africa	H	29	4.47±0.55	18	4.57±0.59	-0.174±0.301
		<i>Centrapalus pauciflorus</i>	S	T. Eriksson, V. Kalema & G. Leliyo, no. TE 533	Africa	H	22	3.62±0.28	14	3.73±0.42	-0.316±0.344
		<i>Critoniopsis leiocarpa</i>	S	Ynes Mexia, No. 9119	Mesoamerica	H	-	-	-	-	-
		<i>Cyanthillium cinereum</i>	S	Dick Hummel, s.n	Tropical Asia	H	13	0.70±0.05	6	0.76±0.17	-0.566±0.504
		<i>Ethulia conyzoides</i>	S	H.J. Venter & A. Venter, no. 9677	Africa	H	15	0.88±0.14	7	0.85±0.03	0.244±0.460
		<i>Gymnanthemum amygdalinum</i>	S	Fernandez Casas, no. 11433	Africa	H	7	1.74±0.29	5	1.57±0.19	0.616±0.605
		<i>Lepidaploa tortuosa</i>	S	Llewelyn Williams, s.n.	Mesoamerica	H	22	1.40±0.32	11	1.12±0.31	0.862±0.386
		<i>Linzia glabra</i>	S	E. Lawrence, no. 112	Africa	H	8	4.58±0.61	2	4.36±0.19	0.346±0.797
		<i>Orbivestus cinerascens</i>	S	Lars Erik Kers, no. 593	Africa	H	10	1.22±0.14	5	1.08±0.22	0.781±0.572

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							n	Mean ± SD	n	Mean ± SD	
		<i>Parapolydora fastigiata</i>	S	O.H. Volk, no. 00367	Africa	H	36	2.26±0.55	19	1.66±0.31	1.227±0.308
		<i>Polydora poskeana</i>	S	E.S. Pooley, no. 477	Africa	H	30	1.90±0.22	13	1.91±0.36	-0.037±0.332
		<i>Vernonanthura patens</i>	S	E. Wall, no. 9301	Central and South America	H	9	0.90±0.09	3	0.82±0.14	0.724±0.691
		<i>Vernonanthura alamanii</i>	S	H. Fröderström & E. Hultén, no. 321	Mesoamerica	H	46	4.10±0.69	25	4.43±0.76	-0.456±0.252
		<i>Vernonia angustifolia</i>	S	Ted Bradley, no. 3502	North America	H	13	1.69±0.31	5	1.69±0.23	0.000±0.526
		<i>Vernonia lasiopus</i>	S	T. Erikson, V. Kalerna & G. Leliyo, no. TE 546	Africa	H	10	1.38±0.28	5	0.93±0.24	1.578±0.642
Gymnarrhenoideae	Gymnarrheneae	<i>Gymnarrhena micrantha</i>	COI	A. Grizi, no. 8970-383	Middle East	M	13	1.31±0.40	7	1.60±0.24	-0.783±0.489
Mutisioideae	Mutisieae	<i>Chaptalia nutans</i>	S	E. Wall, no. 729	North and South America	GM	32	2.57±0.37	19	2.90±0.26	-0.973±0.307
	Nassauvieae	<i>Jungia paniculata</i>	S	S.G. Saunders, no. 1244	South America	H	19	0.69±0.12	8	0.62±0.12	0.566±0.430
		<i>Perezia multiflora</i>	S	Kjell von Sneiden, no. A333	South America	H	22	3.78±0.48	24	3.73±0.61	0.089±0.295
	Onoserideae	<i>Onoseris alata</i>	S	J. Olea, s.n.	South America	GM	16	4.42±0.90	9	3.14±0.46	1.596±0.484
		<i>Onoseris odorata</i>	S	Francis W Pennell, no 14468	South America	GM	20	3.41±0.35	10	3.78±0.50	-0.890±0.406
		<i>Plazia argentea</i>	S	E. Carrette, s.n.	South America	H	4	4.55±1.17	1	4.42	-

Subfamily	Tribe	Species	Herbarium ¹	Herbarium Voucher	Dist. ²	Sexual System ³	Outermost fruits		Innermost fruits		FSD ± SE
							n	Mean ± SD	n	Mean ± SD	
“Heliantheae alliance”		<i>Trixis antimenorrhoea</i>	S	F.J. Breteler, no. 3502	South America	H	7	1.23±0.04	2	1.21±0.14	0.275±0.806
	Bahieae	<i>Florestina pedata</i>	S	Maury, no.24	Mesoamerica	H	6	2.25±0.28	4	1.85±0.19	1.445±0.767
		<i>Palafoxia arida</i>	S	K. Bremer, no. 2479	North America	H	12	7.95±1.31	5	7.64±1.01	0.238±0.534
	Eupatorieae	<i>Ageratina calaminthaefolia</i>	S	Robert Merrill King & Paul M. Peterson, no. 9957	North America	H	7	1.14±0.18	3	1.33±0.31	-0.781±0.726
		<i>Brickellia chlorolepis</i>	S	Robert Merrill King & Paul M. Peterson, no.9836	North America	H	13	2.10±0.26	9	1.88±0.45	0.607±0.445
		<i>Chromolaena odorata</i>	S	Erik Wall, no.72	North America	H	17	1.36±0.18	13	1.40±0.21	-0.201±0.369
		<i>Liatris aspera</i>	S	D.S. Correll & H. B. Correll, no. 36587	North America	H	17	4.15±0.37	8	4.49±0.36	-0.896±0.450
	Helenieae	<i>Baileya pleniradiata</i>	S	J. Laubert, no 113	North America	GM	100	1.49±0.18	25	1.37±0.14	0.690±0.228
		<i>Marshallia graminifolia</i>	S	C. Ritchie Bell, no. 15744	North America	H	26	3.12±0.32	29	3.61±0.35	-1.437±0.305
	Heliantheae	<i>Rudbeckia fulgida</i>	S	F.T. McFarland, no. 347	North America	H	51	1.15±0.14	32	1.16±0.10	-0.079±0.226
	Madieae	<i>Anisocarpus scabridus</i>	S	M.S. Baker, no 10658	North America	GM	4	11.02±0.70	1	8.81	-
		<i>Arnica lanceolata</i>	S	Galen Smith, no. 2049	North America	GM	43	3.20±0.49	7	4.51±0.48	-2.638±0.492
		<i>Dubautia laxa</i>	S	L.M. Cranwell, no. 3417	Hawaii	H	8	1.24±0.21	2	1.79±0.10	-2.489±1.066
		<i>Hemizonia fasciculata</i>	COI	S.B. & W.F. Parish, no. 9254	North America	M	5	1.67±0.08	-	-	-

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							n	Mean ± SD	n	Mean ± SD	
		<i>Holozonia filipes</i>	COI	S.B. & W.F. Parish, no. 9257-486	North America	M	-	-	-	-	-
		<i>Layia platyglossa</i>	COI	William H. Beble, no. 9258	North America	GM	20	1.93±0.17	15	1.98±0.17	-0.287±0.344
		<i>Madia anomala</i>	S	David. D. Keck, no. 2313	North America	GM	-	-	-	-	-
		<i>Monolopia lanceolata</i>	S	E.K. Balls, no. 8547	North America	GM	22	1.05±0.15	10	0.99±0.17	0.374±0.385
	Millerieae	<i>Melampodium leucanthum</i>	COI	W.P. Cottam, no. 9129-10231	North America	M	7	2.58±0.74	-	-	-
	Perityleae	<i>Perityle emoryi</i>	S	M.O. Dillon & D.O. Dillon, no. 4850	North and South America	GM	44	1.63±0.14	23	1.59±0.24	0.219±0.258
	Polymnieae	<i>Polymnia canadensis</i>		Grady L. & Barbara D. Webster, no. 9122-7088	North America	M	4	5.12±0.40	-	-	-
	Tageteae	<i>Oxyppus scaber</i>	S	Mexia, no. 1367	Mesoamerica	GM	22	0.17±0.03	8	0.16±0.02	0.350±0.416
		<i>Porophyllum scoparium</i>	S	K. Bremer, no. 2379	North America	H	39	1.56±0.23	24	1.82±0.21	-1.153±0.280

Supplementary Table S2. Phylogenetic regression between inflorescence size (head diameter), number of flowers and flower density (number of flowers / mm²). All variables were log transformed.

	Inflorescence size			No. of flowers		
	<i>b</i> ± SE	<i>t</i>	<i>P</i>	<i>b</i> ± SE	<i>t</i>	<i>P</i>
No. of flowers	0.72 ± 0.13	5.73	0.000	-	-	-
Flower density	-1.25 ± 0.13	-0.74	0.000	0.24 ± 0.13	1.81	0.073

Supplementary Table S3. Phylogenetic RMA regressions between inflorescence size (head diameter), number of flowers and flower density (number of flowers / mm²). All variables were log transformed. Estimated slopes were tested against the null hypothesis of $b = 1$.

	Inflorescence size				No. of flowers			
	<i>b</i>	<i>t</i>	<i>d.f.</i>	<i>P</i>	<i>b</i>	<i>t</i>	<i>d.f.</i>	<i>P</i>
No. of flowers	1.42	3.94	74.9	0.0002	-	-	-	-
Flower density	-1.65	6.64	69.7	<0.0001	1.17	1.44	85.9	0.153

Supplementary Table S4. Phylogenetic regression between FSD, outer and inner fruit size and inflorescence size (head diameter), number of flowers and flower density (number of flowers / mm²). All variables were log transformed.

	FSD			Outer fruit size			Inner fruit size		
Inflorescence traits	<i>b</i> ± SE	<i>t</i>	<i>P</i>	<i>b</i> ± SE	<i>t</i>	<i>P</i>	<i>b</i> ± SE	<i>t</i>	<i>P</i>
Head diameter (mm)	-1.15 ± 0.40	-3.11	0.003	0.69 ± 0.13	5.43	< 0.001	0.89 ± 0.14	6.54	< 0.001
No. of flowers	-0.14 ± 0.28	-0.50	0.621	- 0.16 ± 0.10	-1.53	0.130	-0.14 ± 0.12	-1.12	0.267
Flower density (no. flowers/mm ²)	0.46 ± 0.19	2.45	0.017	- 0.60 ± 0.05	-10.57	< 0.001	-0.66 ± 0.06	-11.23	< 0.001

Supplementary Table S5. Deviance analysis of the phylogenetic generalized linear model fitting Fruit Size Difference (FSD) as the response of the degree of floral sexual specialization within inflorescence (hermaphroditism, gynodioecy or monoecy), and flower density. FSD is the standardized fruit size difference between outer and inner fruits measured as the meta-analytical effect size. Flower density was log-transformed.

Variables	<i>F</i>	d.f.	<i>P</i>
Intercept	0.77	1, 62	0.385
Degree of floral sexual specialization	0.87	2, 62	0.423
Flower density (no. flowers/mm ²)	4.36	1, 62	0.041