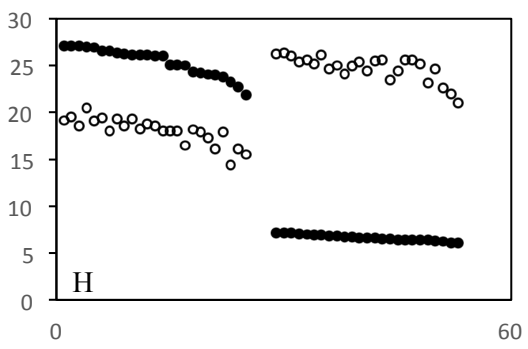
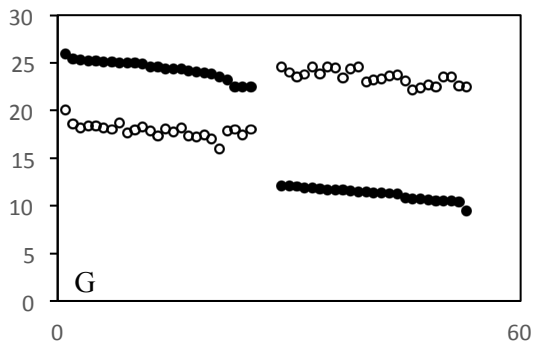
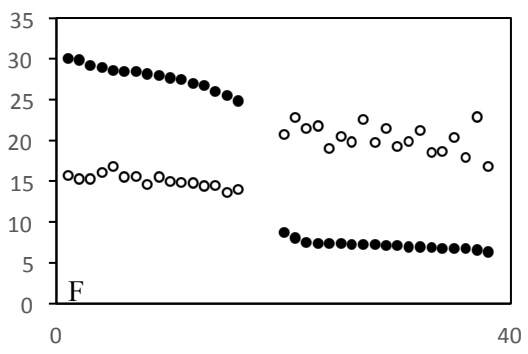
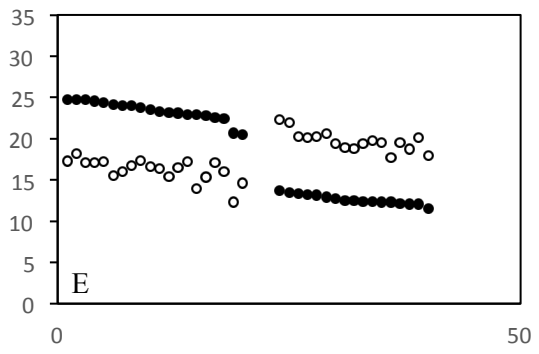
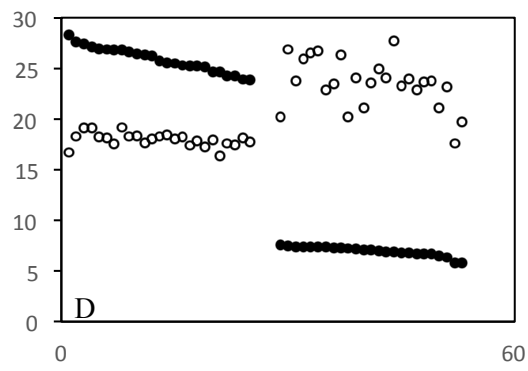
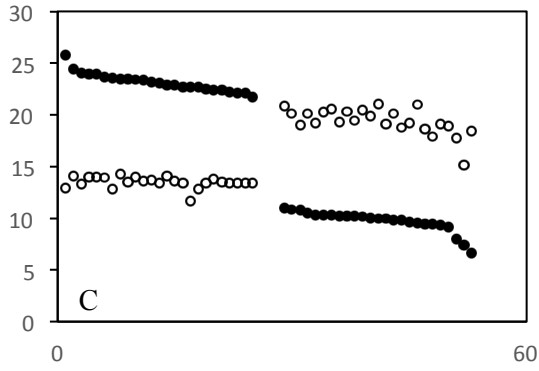
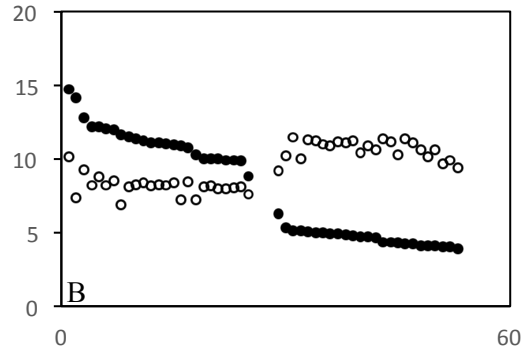
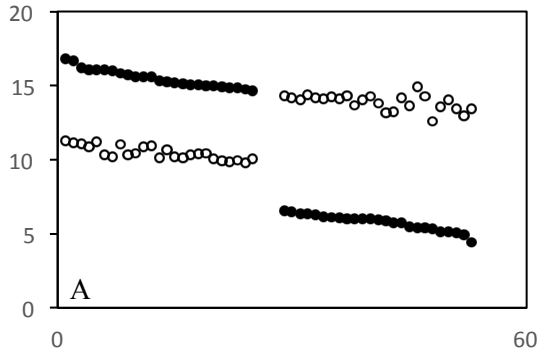


Supplementary material



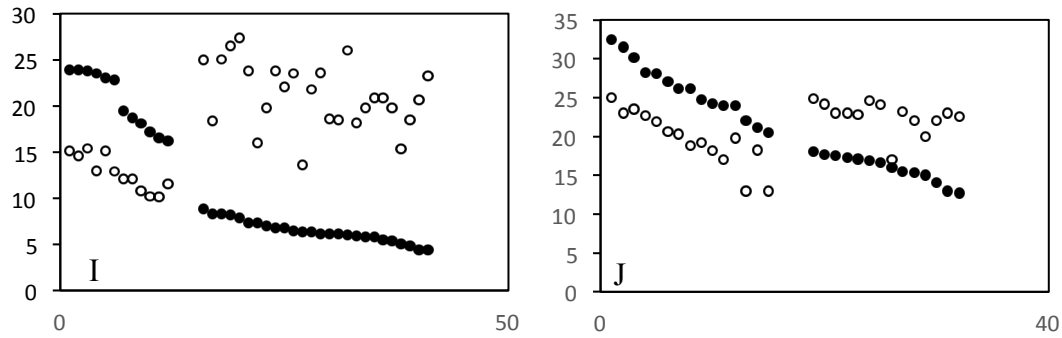
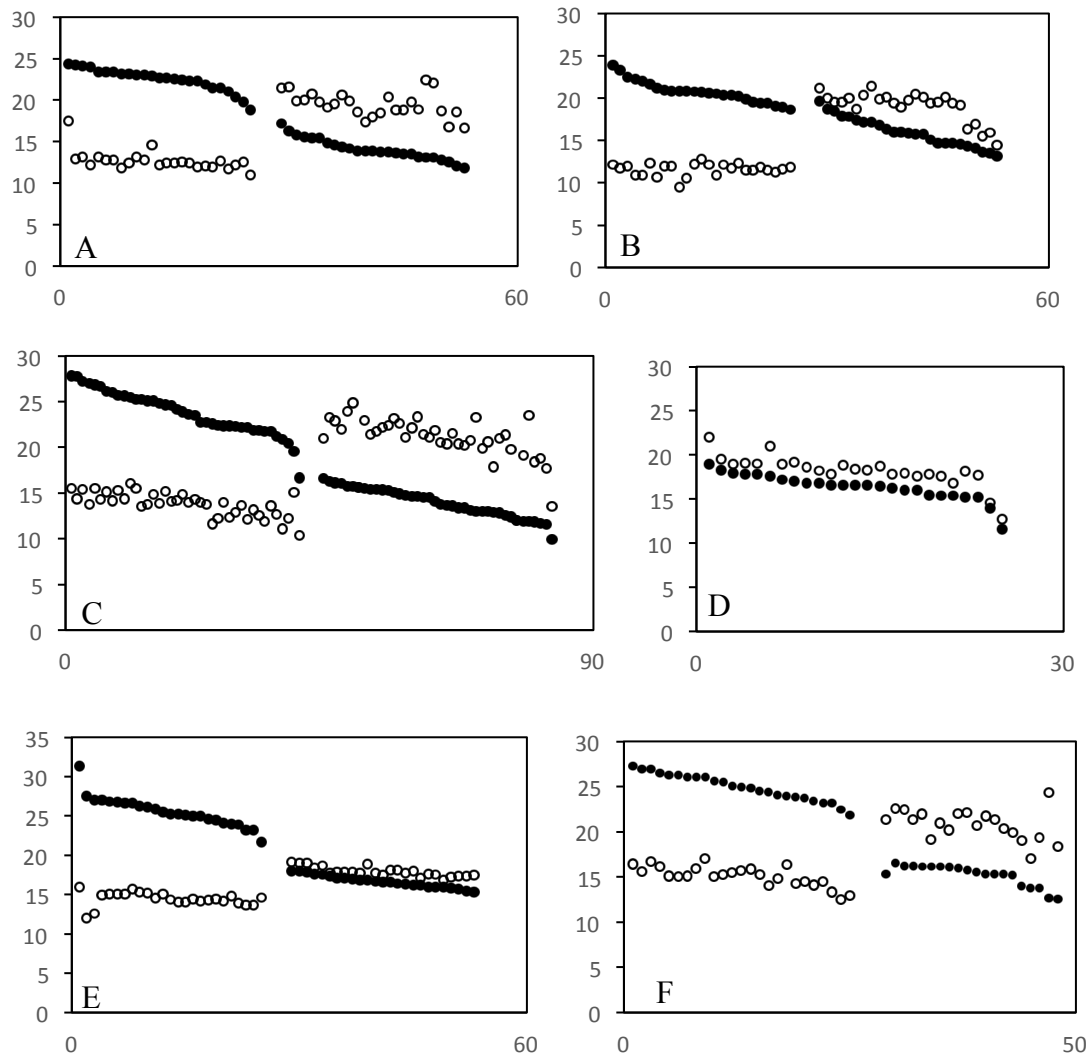


Fig. A1. Scatterplots of stigma (solid) and anther (hollow) heights in dioecious *Mussaenda* populations arranged by decreasing values of stigma height, dimensions in mm. Horizontal ordinate axis represents individual numbers. (A) *M. pubescens*; (B) *M. pubescens* var. *alba*; (C) *M. erosa*; (D) *M. kwangtunensis*; (E) *M. hirsutula*; (F) *M. hainanensis*; (G) *M. divaricata*; (H) *M. pingbianensis*. (I) *M. kwangsiensis*; (J) *M. mollissima*.



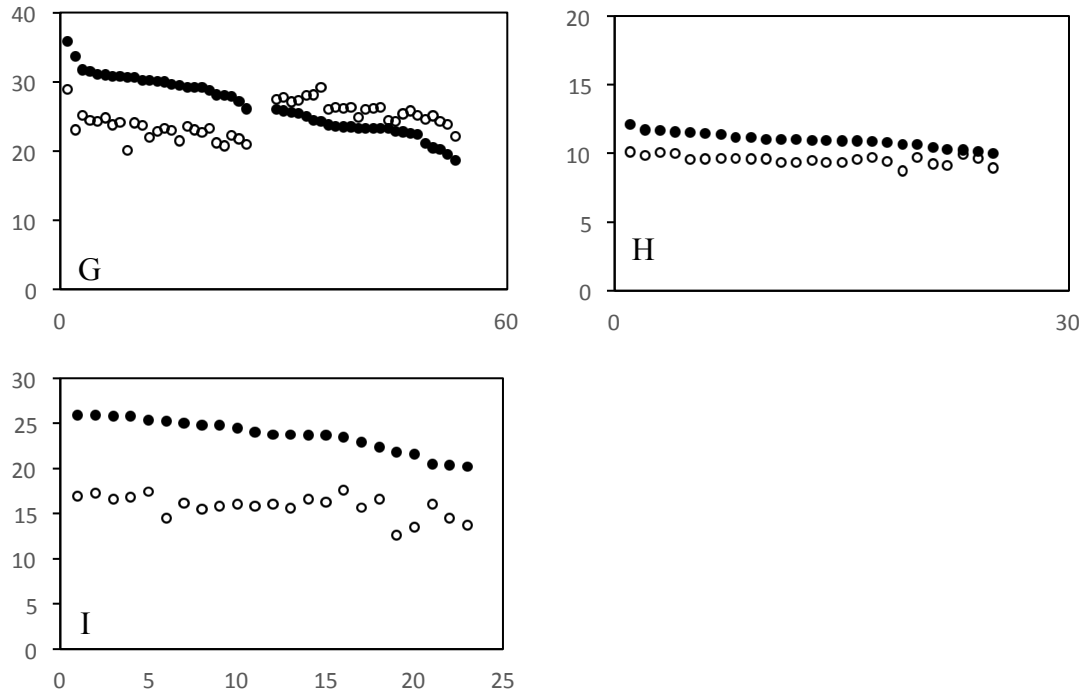


Fig. A2. Scatterplots of stigma (solid) and anther (hollow) heights in distylous and monomorphic *Mussaenda* and *Schizomussaenda* populations arranged by decreasing values of stigma height, dimensions in mm. Horizontal ordinate axis represents individual numbers. (A) *M. macrophylla*; (B) *M. macrophylla*; (C) *M. lancipetala*; (D) *M. lancipetala*; (E) *M. multinervis*; (F) *M. decipiens*; (G) *S. henryi*; (H) *M. shikokiana*; (I) *M. simpliciloba*.

Supplementary material Appendix 1.

Table A1. Details of sampling of *Mussaenda* and *Schizomussaenda* species. "√" and "-" indicate the experiments were carried out or not in given population. Each species has the same sexual system in all populations except for *M. lancipetala* and *M. macrophylla*.

Species	Sexual system	Study sites	Position	Voucher specimens	Sexual system	Floral biometry	P/O ratio
<i>M. caudatiloba</i>	Dioecy	Fangchenggang, Guangxi	21° 40' N, 108° 21' E	Duan T.T. 5	√	-	√
<i>M. decipiens</i>	Distyly	Motuo, Tibet	29° 30' N, 95° 27' E	Huang12952	√	√	√
<i>M. divaricate</i>	Dioecy	Luocheng, Guangxi	24° 45' N, 108° 54' E	Deng X. F. 235	√	-	-
		Jinping, Yunnan	22° 55' N, 103° 07' E	Deng X. F. 355	√	-	-
		Emei, Sichuan	29° 33' N, 103° 26' E	Chen S. 62	√	√	√
		Qifen Mountain, Guangxi	25° 08' N, 110° 35' E	Chen S. 69	√	-	-
<i>M. erosa</i>	Dioecy	Dinghu Mountain, Guangdong	23° 10' N, 112° 33' E	Deng X. F. 3	√	√	√
		Luofu Mountain, Guangdong	23° 14' N, 114° 13' E	Deng X. F. 523	√	-	-
		Nankun Mountain, Guangdong	23° 37' N, 113° 53' E	Deng X. F. 532	√	-	-
		Ledong, Hainan	18° 43' N, 108° 49' E	Deng X. F. 320	√	-	-
		Jinxiu, Guangxi	23° 57' N, 110° 16' E	Deng X. F. 221	√	-	-
		Luocheng, Guangxi	24° 52' N, 109° 02' E	Deng X. F. 233	√	-	-
<i>M. hainanensis</i>	Dioecy	Baoting, Hainan	18° 32' N, 109° 37' E	Deng X. F. 276	√	√	-
		Wanning, Hainan	18° 47' N, 110° 23' E	Deng X. F. 252	√	-	-
		Wuzhi Mountain, Hainan	18° 46' N, 109° 31' E	Deng X. F. 284	√	-	-
		Tongshi, Hainan	18° 30' N, 109° 35' E	Deng X. F. 290	√	-	-
		Ledong, Hainan	18° 44' N, 109° 10' E	Deng X. F. 294	√	-	-

<i>M. hirsutula</i>	Dioecy	Wanning, Hainan	18° 47' N, 110° 23' E	Deng X. F. 253	√	-	-
		Baoting, Hainan	18° 32' N, 109° 37' E	Deng X. F. 267	√	-	-
		Wuzhi Mountain, Hainan	18° 46' N, 109° 31' E	Deng X. F. 286	√	√	-
		Ledong, Hainan	18° 44' N, 109° 10' E	Deng X. F. 311	√	-	-
<i>M. hossei</i>	Dioecy	Jinghong, Yunnan	21° 29' N, 100° 39' E	Duan T.T. 570	√	-	-
<i>M. kwangtunensis</i>	Dioecy	Nankun Mountain, Guangdong	23° 37' N, 113° 53' E	Deng X. F. 502	√	√	√
		Luofu Mountain, Guangdong	23° 14' N, 114° 13' E	Deng X. F. 43	√	-	-
		Conghua, Guangdong	23° 31' N, 114° 35' E	Deng X. F. 518	√	-	-
<i>M. kwangsiensis</i>	Dioecy	Lingyun, Guangxi	24° 20' N, 116° 33' E	Duan T.T. 191	√	√	-
		Daxin, Guangxi	24° 09' N, 107° 59' E	Duan T.T. 154	√	-	-
		Napo, Guangxi	23° 23' N, 105° 50' E	Duan T.T. 184	√	-	-
<i>M. lancipetala</i>	Distyly	Lvchun, Yunnan	22° 51' N, 101° 58' E	Duan T.T. 515	√	√	√
	S-monomorphi	XTBG, Yunnan	21° 55' N, 101° 16' E	Deng X. F. 462	√	-	-
	c	S-monomorphi	Bakamenglun Reserve, Yunnan	21° 53' N, 101° 18' E	Deng X. F. 410	√	√
<i>M. laxiflora</i>	Dioecy	Jinping, Yunnan	22° 55' N, 103° 07' E	Deng X. F. 359	√	-	√
		Pingbian, Yunnan	22° 59' N, 103° 41' E	Duan T.T. 431	√	-	-
<i>M. macrophylla</i>	S-biased	XTBG, Yunnan	21° 55' N, 101° 16' E	Deng X. F. 408	√	√	√
	Distyly						
	Distyly	Lvchun, Yunnan	22° 51' N, 101° 58' E	Duan T.T. 401	√	-	√
	Distyly	Mengla, Yunnan	21° 53' N, 101° 21' E	Duan T.T. 552	√	-	-
	S-monomorphi	Puer, Yunnan		Duan T.T. 923	√	-	-
<i>M. mollissima</i>	Dioecy	Songshan, Yunnan	23° 06' N, 101° 04' E	Deng X. F. 377	√	-	-
		Puer, Yunnan	23° 53' N, 100° 38' E	Deng X. F. 385	√	√	-

		XTBG, Yunnan	21° 55' N, 101° 16' E	Deng X. F. 396	√	-	-
		Mengla, Yunnan	21° 55' N, 101° 14' E	Deng X. F. 413	√	-	-
		Menghai, Yunnan	21° 56' N, 100° 36' E	Deng X. F. 427	√	-	-
<i>M. multinervis</i>	Dioecy	Mengla, Yunnan	21° 53' N, 101° 21' E	Deng X. F. 509	√	√	√
		Lvchun, yunnan	22° 59' N, 102° 23' E	Duan T.T. 464	√	-	-
<i>M. pingbianensis</i>	Dioecy	Pingbian, Yunnan	22° 58' N, 103° 42' E	Deng X. F. 367	√	√	√
		Jinping, Yunnan	22° 55' N, 103° 07' E	Deng X. F. 357	√	-	-
<i>M. pubescens</i>	Dioecy	Maoming, Guangdong	22° 58' N, 111° 16' E	Duan T.T. 631	√	-	-
		Yangjiang, Guangdong	21° 51' N, 111° 59' E	Duan T.T. 671	√	√	√
		Yangchun, Guangdong	22° 11' N, 111° 46' E	Duan T.T. 1	√	-	-
		SCBG, Guangdong	23° 18' N, 113° 36' E	Deng X. F. 83	√	-	-
		Dongxing, Guangxi	21° 32' N, 107° 59' E	Duan T.T. 8	√	-	-
		Ningming, Guangxi	22° 14' N, 107° 07' E	Duan T.T. 11	√	-	-
		Xiamen, Fujian	24° 44' N, 118° 09' E	Duan T.T. 290	√	-	-
		Haikou, Hainan	19° 52' N, 110° 36' E	Duan T.T. 90	√	-	-
		Sanya, Hainan	18° 28' N, 109° 50' E	Duan T.T. 93	√	-	-
<i>M. pubescens</i> var. <i>alba</i>	Dioecy	Dinghu Mountain, Guangdong	23° 10' N, 112° 33' E	Deng X. F. 22	√	√	√
		Luofu Mountain, Guangdong	23° 14' N, 114° 13' E	Deng X. F. 39	√	-	-
		Nankun Mountain, Guangdong	23° 37' N, 113° 53' E	Deng X. F. 54	√	-	-
		Guangzhou, Guangdong	23° 13' N, 113° 24' E	Deng X. F. 500	√	-	-
		Jinxiu, Guangxi	23° 57' N, 110° 16' E	Deng X. F. 230	√	-	-
		GXIB, Guangxi	25° 03' N, 110° 18' E	Deng X. F. 214	√	-	-
		Dongshan, Guangxi	25° 05' N, 107° 56' E	Duan T.T. 9	√	-	-
		Qifen Mountain, Guangxi	25° 05' N, 110° 35' E	Chen S. 70	√	-	-
		Wuyi Mountain, Fujian	27° 43' N, 118° 02' E	Duan T.T. 282	√	-	-
		Longyan, Fujian	25° 16' N, 116° 57' E	Duan T.T. 292	√	-	-

		Jinggang Mountain, Jiangxi	26° 33' N, 114° 10' E	Chen S. 57	√	-	-
<i>M. shikokiana</i>	Homostyly	Qifen Mountain, Guangxi	25° 05' N, 110° 35' E	Chen S. 78	√	√	√
		Huaihua, Hunan	27° 18' N, 110° 17' E	Zhou L. S.	√	-	-
				10076			
		Zhijiang, Hunan	27° 25' N, 109° 41' E	Duan T.T. 280	√	-	-
		Jiangkou, Guizhou	27° 40' N, 108° 51' E	Duan T.T. 263	√	-	-
		Jinggang Mountain, Jiangxi	26° 33' N, 114° 10' E	Chen S. 52	√	-	-
		Jinxiu, Guangxi	23° 57' N, 110° 16' E	Deng X. F. 215	√	-	-
		Tianlin, Guangxi	24° 16' N, 106° 13' E	Guo L. X. 85	√	-	-
		Ruyuan, Guangdong	24° 46' N, 113° 16' E	Bai X. F. 81	√	-	-
		Emei, Sichuan	29° 33' N, 103° 26' E	Chen S. 63	√	-	-
<i>M. simpliciloba</i>	L-monomorphic	Dechang, Sichuan	27° 22' N, 102° 30' E	Duan T.T. 420	√	√	√
		Xinping, Yunnan	24° 04' N, 101° 59' E	Duan T.T. 430	√	-	-
		Shimian, Sichuan	29° 31' N, 102° 10' E	Huang16425	√	-	-
<i>M. treutleri</i>	Dioecy	Fugong, Yunnan	27° 14' N, 98° 53' E	Deng X. F. 343	√	-	√
<i>Schizomussaenda</i>	Distyly	XTBG, Yunnan	21° 55' N, 101° 16' E	Deng X. F. 409	√	√	√
<i>henryi</i>		Bakamenglun Reserve, Yunnan	21° 53' N, 101° 18' E	Deng X. F. 412	√	-	-
		Mengla, Yunnan	21° 53' N, 101° 20' E	Deng X. F. 449	√	-	-
		Hekou, Yunnan	22° 31' N, 103° 56' E	Duan T.T. 444	√	-	-

Table A2. Heights of anthers and stigma, and floral tube length of *Mussaenda* and *Schizomussaenda* populations (M ± SE). NS: Not significant (p > 0.05), * = p < 0.05, ** = p < 0.01, *** = p < 0.001.

Species	Population	Samples of each morph		Anther height-L (mm)	Stigma height-L (mm)	Anther height-S (mm)	Stigma height-S (mm)	Floral tube length-L (mm)	Floral tube Length-S (mm)	t-test of tube length between morphs
		L	S							
<i>M. decipiens</i>	Motuo	25	21	15.08±0.23	24.92±0.30	20.30±0.49	15.34±0.42	26.90±0.25	26.13±0.41	1.59
<i>M. divaricata</i>	Emei	25	25	17.91±0.15	24.37±0.19	23.48±0.15	11.23±0.13	24.52±0.15	24.39±0.15	0.62
<i>M. erosa</i>	Dinghu Mountain	25	25	13.49±0.11	23.14±0.18	19.38±0.26	9.72±0.21	20.45±0.18	23.61±0.23	-10.79***
<i>M. hainanensis</i>	Baoting	20	25	15.32±0.31	27.04±0.58	20.62±0.41	7.06±0.11	24.84±0.29	25.36±0.43	-0.99
<i>M. hirsutula</i>	Wuzhi Mountain	20	17	16.19±0.31	23.36±0.27	19.74±0.29	12.64±0.14	23.96±0.29	25.85±0.35	-4.16***
<i>M. kwangsiensis</i>	Lingyun	12	25	12.73±0.53	20.84±0.97	21.16±0.68	6.44±0.23	24.57±0.77	24.57±0.77	-3.77***
<i>M. kwangtunensis</i>	Nankun Mountaing	25	25	17.97±0.13	25.86±0.25	23.49±0.50	6.95±0.09	27.80±0.18	28.36±0.39	-3.65***
<i>M. lancipetala</i>	Lvchun	40	40	13.76±0.21	23.74±0.38	20.78±0.42	13.93±0.25	26.75±0.44	28.49±0.49	-2.63*
	Bakamenglun	-	25	-	-	18.03±0.23	13.27±0.36	-	27.87±0.36	-
<i>M. macrophylla</i>	XTBG	25	25	11.60±0.14	20.74±0.26	19.05±0.35	16.00±0.34	21.92±0.23	26.44±0.50	-7.80***
	LC	25	25	12.68±0.23	22.47±0.27	19.47±0.26	14.07±0.26	22.37±0.25	26.06±0.40	-7.67***
<i>M. mollissima</i>	Puer	15	14	19.62±0.90	26.01±0.93	22.59±0.54	15.90±0.46	24.59±0.97	27.74±0.67	-2.64*
<i>M. multinervis</i>	Mengla	25	25	14.45±0.18	25.53±0.37	17.93±0.12	16.66±0.16	24.52±0.25	25.38±0.11	-3.10**
<i>M. pingbianensis</i>	Pingbian	25	25	18.03±0.28	25.39±0.30	24.73±0.27	6.63±0.06	25.40±0.27	28.06±0.19	-8.08***
<i>M. pubescens</i>	Yangjiang	25	25	10.46±0.09	15.49±0.12	13.88±0.10	5.75±0.11	14.23±0.10	15.24±0.10	-7.26***
<i>M. pubescens</i> var. <i>alba</i>	Dinghu Mountain	25	25	8.15±0.13	11.21±0.27	10.64±0.13	4.65±0.11	11.27±0.21	12.15±0.13	-3.51**
<i>M. shikokiana</i>	Qifen Mountain	25	-	9.54±0.07	10.98±0.10	-	-	11.09±0.10	-	-
<i>M. simpliciloba</i>	Dechang	23	-	15.81±0.26	23.76±0.37	-	-	26.64±0.41	-	-

<i>Schizomussaenda</i>	XTBG	25	25	22.19±0.33	28.27±0.48	25.61±0.23	22.88±0.25	29.42±0.45	28.27±0.32	2.05*
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henryi

Table A3. Student's t-test of distance between stigma and anthers of flowers in all dimorphic populations ($M \pm SE$). NS = not significant ($p > 0.05$), **** = $p < 0.001$.

	Species	Distance between stigma and stamen in L-morph (mm)	Distance between stigma and stamen in S-morph (mm)	t-test
	<i>M. decipiens</i>	9.82±0.18	5.61±0.37	9.92****
	<i>M. lancipetala</i> (LC)	10±0.27	6.84±0.33	7.29****
	<i>M. macrophylla</i> (LC)	9.79±0.25	5.40±0.27	11.56****
Distyly	<i>M. macrophylla</i> (ML)	9.14±0.29	3.08±0.26	15.11****
	<i>M. multinervis</i>	11.07±0.36	1.27±0.09	25.86****
	<i>Schizomussaenda henryi</i>	6.89±0.26	2.81±0.20	12.19****
	<i>M. divaricate</i>	6.46±0.16	12.25±0.10	-29.78****
	<i>M. erosa</i>	9.64±0.19	9.66±0.18	-0.06NS
	<i>M. hainanensis</i>	12.71±0.24	13.11±0.34	-0.92NS
	<i>M. hirsutula</i>	7.17±0.21	7.09±0.19	0.24NS
	<i>M. kwangsiensis</i>	7.85±0.45	14.72±0.63	-8.59****
Dioecy	<i>M. kwangtunensis</i>	7.89±0.23	16.53±0.45	-16.71****
	<i>M. mollissima</i>	6.39±0.39	7.12±0.41	-1.24NS
	<i>M. pingbianensis</i>	7.36±0.16	18.10±0.23	-37.87****
	<i>M. pubescens</i>	5.02±0.07	8.13±0.11	-23.85****
	<i>M. pubescens</i> var. <i>alba</i>	3.05±0.23	6.08±0.12	-11.3****

Table A4. Coefficient of variability of sexual organ height between morphs of all dimorphic *Mussaenda* species and *Schizomussaenda henryi*.

Species	Coefficient of variability stigma heights	Coefficient of variability of anther heights	Distance of average stigma heights between morphs (mm)	Distance of average anther heights between morphs (mm)
<i>M. decipiens</i>	0.249	0.180	9.58	5.22
<i>M. divaricata</i>	0.376	0.141	13.14	5.57
<i>M. erosa</i>	0.417	0.190	13.42	5.89
<i>M. hainanensis</i>	0.639	0.175	19.98	5.3
<i>M. hirsutula</i>	0.298	0.124	10.72	3.55
<i>M. kwangsiensis</i>	0.629	0.268	14.40	8.42
<i>M. kwangtunensis</i>	0.585	0.160	18.91	5.52
<i>M. lancipetala</i> (Lvchun)	0.283	0.237	9.81	7.02
<i>M. macrophylla</i> (Lvchun)	0.241	0.228	8.40	6.79
<i>M. macrophylla</i> (XTBG)	0.156	0.261	4.78	7.45
<i>M. mollissima</i>	0.277	0.153	10.11	2.97
<i>M. multinervis</i>	0.223	0.118	8.87	3.48
<i>M. pingbianensis</i>	0.596	0.171	18.76	6.7
<i>M. pubescens</i>	0.466	0.147	9.74	3.42
<i>M. pubescens</i> var. <i>alba</i>	0.437	0.151	6.56	2.49
<i>Schizomussaenda henryi</i>	0.151	0.089	5.39	3.42