Supplementary Materials:

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Figure S2. Bayesian posterior predictions of traits across modules of the overall network. Jitters represent raw data, and red lines represent posterior mean.

Figure S3. Principal Coordinates Analysis (PCoA) of floral traits among plant species from different network modules.

Figure S4. Phylogenetic relationships of 12 bird species (right) and 34 native plant species (left).

Figure S5. Phylogenetic clustering of plant species and associated floral traits, including nectar characteristics, flower morphology, and nectar robbing percentage.

Table S1. Matrix of plant-bird interactions recorded in this study.

	Actinodura cyanouroptera	*Aegithalos concinnus*	*Aethopyga gouldiae*	*Carpodacus erythrinus*	*Fulvetta ruficapilla*	*Heterophasia desgodinsi*	*Ixos mcclellandii*	*Phoenicurus auroreus*	*Pomatorhinus ruficollis*	*Pycnonotus aurigaster*	*Pycnonotus xanthorrhous*	*Zosterops palpebrosus*
Rhododendron × duclouxii	3	0	0	0	0	0	0	0	0	0	0	4
Abutilon megapotamicum	0	0	0	0	20	0	0	0	0	0	0	0
Abutilon pictum	0	0	0	0	0	0	0	0	0	0	0	25
Abutilon roseum	0	0	9	0	0	0	0	0	0	0	0	5
Albizia julibrissin	0	0	0	0	0	0	0	0	0	0	0	5
Buddleja officinalis	0	0	38	0	0	0	0	0	0	0	0	223
Callistemon rigidus	9	0	0	0	0	0	0	0	0	0	60	321
Chaenomeles speciosa	0	0	0	0	0	0	16	0	0	41	0	245
Colquhounia coccinea	0	0	0	0	0	0	0	0	0	0	90	140
Docynia delavayi	0	0	29	0	0	0	0	0	37	0	120	220
Elaeagnus pungens	0	0	0	0	0	0	0	0	0	0	110	245
Eriobotrya japonica	0	0	0	0	0	0	0	0	0	0	0	109
Kniphofia uvaria	0	0	0	0	0	0	0	0	0	0	125	45
Leucosceptrum canum	43	0	0	0	0	0	535	0	0	0	64	3003
Lonicera maackii	0	0	68	0	0	0	0	0	0	0	0	5
Mahonia duclouxiana	0	0	0	0	0	0	0	0	0	0	0	1093
Malvaviscus arboreus	0	0	0	0	0	0	0	0	0	0	0	59
Musa basjoo	0	0	6	0	0	0	0	0	0	0	0	0
Musella lasiocarpa	0	0	8	0	0	0	11	0	54	23	0	26
Prunus campanulata	3	1	0	0	0	0	0	0	0	0	43	559
Prunus cerasifera 'Atropurpurea'	0	0	0	0	0	0	0	0	0	0	0	320
Prunus cerasoides	0	0	0	313	0	0	0	4	0	39	30	190
Prunus cerasoides var. rubea	9	0	0	0	0	0	0	0	0	0	0	8
Prunus conradinae	0	0	0	0	0	0	0	0	0	0	74	229
Prunus mume 'Jiang Mei'	0	0	0	0	0	0	0	0	0	0	23	286
Prunus mume f. viridicalyx	0	0	0	0	0	0	0	0	0	0	0	41
Prunus mume f. alphandii	0	0	0	0	3	0	0	0	0	0	8	22
Prunus salicina	0	0	0	0	0	0	0	0	0	0	39	0
Prunus serrulata	0	0	53	0	0	37	0	0	0	0	2	765
Prunus yunnanensis	0	0	9	0	0	0	0	0	0	0	21	707
Rhododendron agastum	145	0	0	0	0	0	139	0	0	0	34	149
Rhododendron delavayi	102	0	0	0	0	0	2	0	0	0	5	130
Rhododendron irroratum	0	0	0	0	0	0	0	0	0	0	2	0
Rhododendron spinuliferum	4	0	0	0	0	0	0	0	0	0	2	129
Rhododendron vialii	0	0	0	0	0	0	0	0	0	0	13	93
Scurrula parasitica	0	0	0	0	0	0	0	0	0	0	0	208
Vallaris indecora	0	0	233	0	0	0	0	0	0	0	0	11
Weigela florida	0	0	90	0	0	0	0	0	0	0	0	0
Woodfordia fruticosa	0	0	34	0	0	0	0	0	0	0	0	541

Table S2. Nectar robbing status of plant and bird species recorded in this study.

species	**Family**	**Robbing percentage (%)**	**Notes**
Vallaris indecora	Apocynaceae	0	native
Kniphofia uvaria	Asphodelaceae	0	non-native
Mahonia duclouxiana	Berberidaceae	0	native
Lonicera maackii	Caprifoliaceae	0	native
Weigela florida	Caprifoliaceae	0	native
Elaeagnus pungens	Elaeagnaceae	31	native
Rhododendron agastum	Ericaceae	12.4	native
Rhododendron delavayi	Ericaceae	3.8	native
Rhododendron spinuliferum	Ericaceae	96.3	native
Rhododendron vialii	Ericaceae	34	native
Rhododendron × duclouxii	Ericaceae	0	native
Rhododendron irroratum	Ericaceae	0	native
Albizia julibrissin	Fabaceae	0	native
Colquhounia coccinea	Lamiaceae	0	native
Leucosceptrum canum	Lamiaceae	0	native
Scurrula parasitica	Loranthaceae	0	native
Woodfordia fruticosa	Lythraceae	0	native
Abutilon megapotamicum	Malvaceae	0	non-native
Abutilon pictum	Malvaceae	92	non-native
Abutilon roseum	Malvaceae	100	native
Malvaviscus arboreus	Malvaceae	100	non-native
Musa basjoo	Musaceae	0	native
Musella lasiocarpa	Musaceae	0	native
Callistemon rigidus	Myrtaceae	0	non-native
Chaenomeles speciosa	Rosaceae	12.3	native
Docynia delavayi	Rosaceae	0	native
Eriobotrya japonica	Rosaceae	0	native
Prunus cerasoides	Rosaceae	55	native
Prunus conradinae	Rosaceae	24.4	native
Prunus salicina	Rosaceae	0	native
Prunus serrulata	Rosaceae	0	native
Prunus yunnanensis	Rosaceae	0	native
Prunus campanulata	Rosaceae	50	native
Prunus cerasifera 'Atropurpurea'	Rosaceae	0	native
Prunus cerasoides var. rubea	Rosaceae	0	native
Prunus mume f. alphandii	Rosaceae	0	native
Prunus mume f. viridicalyx	Rosaceae	0	native
Prunus mume 'Jiang Mei'	Rosaceae	0	native
Buddleja officinalis	Scrophulariaceae	0	native
Aegithalos concinnus	Aegithalidae	0	bird
Carpodacus erythrinus	Fringillidae	100	bird
Actinodura cyanouroptera	Leiothrichidae	1.3	bird
Heterophasia desgodinsi	Leiothrichidae	0	bird
Phoenicurus auroreus	Muscicapidae	100	bird
Aethopyga gouldiae	Nectariniidae	1.6	bird
Fulvetta ruficapilla	Paradoxornithidae	0	bird
Pycnonotus aurigaster	Pycnonotidae	35.9	bird

Pycnonotus xanthorrhous	Pycnonotidae	21.5	bird
Ixos mcclellandii	Pycnonotidae	0	bird
Pomatorhinus ruficollis	Timaliidae	0	bird
Zosterops palpebrosus	Zosteropidae	6.3	bird

Table S3. Effects of floral traits on nectar robbing levels.

Variable	**Estimate**	**SE**	**z value**	***P***	**2.5% CI**	**97.5% CI**
Intercept	-15.997	4.028	-3.971	7.15e-5	-23.892	-8.101
Nectar sugar concentration/%	-0.021	0.006	-3.283	0.001	-0.033	-0.008
Corolla tube length /mm	0.239	0.025	9.45	< 2e-16	0.189	0.289
Corolla tube aperture diameter/mm	-0.146	0.015	-9.427	< 2e-16	-0.176	-0.115
Nectar volume/μl	0.003	0.005	0.645	0.519	-0.007	0.014

Note: random-effect variance: plant species= 82.55; animal species = 45.86. DHARMa residual diagnostics: dispersion = 1.247 (p = 0.512), uniformity KS test D = 0.0117 (p = 0.054). Type II Wald Test are reported in the text.

Table S4. Model selection results based on AIC.

Model formula	**AIC**	**ΔAIC**
is_robbing ~ Nectar sugar concentration + Corolla tube length + Corolla tube aperture diameter + Nectar volume + (1|plant_species)+(1|animal_species)	3843.1	0.00
− Nectar sugar concentration	7144.5	3301.4
− Corolla tube length	7146.9	3303.8
− Corolla tube aperture diameter	7422.2	3579.1
− Nectar volume	7439.9	3596.8

Note: Bidirectional stepwise selection. The full model showed the lowest AIC and was selected as optimal.

Table S5. Plant functional trait data for the plant species in this study.

plant species	Nectar Sugar Concentration /%	Nectar Sugar Amount/mg	nectar volume /μL	Flower Length /mm	Corolla Tube Length/mm	Corolla Tube aperture Diameter/mm
Abutilon megapotamicum	21.58±2.40	14.39±9.05	62.28±39.51	42.22±4.61	28.61±1.18	10.77±1.79
Abutilon pictum	26.25±8.91	11.78±12.44	39.93±47.37	48.90±3.86	8.98±3.27	18.49±3.62
Abutilon roseum	25.78±4.94	41.07±24.24	135.95±94.02	34.00±2.33	6.05±2.13	32.45±5.81
Albizia julibrissin	29.50±14.71	0.59±1.15	0.79±1.64	35.57±4.94	6.44±2.91	3.00±4.12
Buddleja officinalis	50.00±0.00	0.05±0.02	0.04±0.04	10.18±0.73	9.13±0.61	1.09±0.18
Callistemon rigidus	26.73±6.25	7.86±3.31	25.85±6.07	25.98±1.68	4.01±0.40	5.26±0.48
Chaenomeles speciosa	18.98±3.45	4.99±5.78	26.00±32.14	23.05±2.43	8.23±1.11	8.49±1.51
Colquhounia coccinea	20.50±2.19	4.04±1.30	18.37±5.11	25.46±2.50	19.87±2.23	6.02±0.74
Docynia delavayi	43.58±12.63	4.93±4.37	11.56±15.34	23.18±3.57	3.48±0.79	5.43±1.40
Elaeagnus pungens	49.80±0.89	0.91±0.39	1.47±0.63	7.89±0.46	5.40±0.40	1.96±0.20
Eriobotrya japonica	36.03±11.32	2.66±1.20	6.92±3.45	10.73±0.79	4.19±0.62	6.56±0.50
Kniphofia uvaria	13.61±0.59	2.03±1.22	13.62±8.62	34.08±3.04	22.64±1.34	5.59±0.74
Leucosceptrum canum	16.48±5.46	2.17±1.18	11.84±5.74	23.24±2.57	8.04±0.62	3.06±0.52
Lonicera maackii	50.00±0.00	0.15±0.05	0.24±0.08	19.12±3.10	6.30±0.82	1.46±0.23
Mahonia duclouxiana	49.85±0.49	1.89±0.73	3.08±1.20	7.37±0.57	0.00±0.00	4.38±0.63
Malvaviscus arboreus	28.77±10.99	19.73±14.06	51.29±53.82	66.95±8.18	58.21±5.64	4.72±1.41
Musa basjoo	17.20±0.86	31.03±2.89	172.12±18.63	60.63±1.79	17.81±0.63	0.00±0.00
Musella lasiocarpa	15.28±5.22	2.08±1.58	10.56±9.26	27.11±1.90	23.87±2.66	1.19±1.80
Prunus campanulata	25.06±10.61	4.25±3.10	11.85±10.51	19.82±2.92	9.97±1.58	5.78±0.91
Prunus cerasoides	13.10±3.09	4.73±3.33	32.70±17.45	19.47±0.81	8.90±0.91	6.69±0.81
Prunus conradinae	49.69±1.11	0.14±0.11	0.17±0.17	11.92±0.80	4.91±0.37	2.42±0.31
Prunus salicina	36.60±9.60	0.16±0.17	0.43±0.55	8.66±0.74	2.49±0.42	2.68±0.50
Prunus serrulata	48.78±1.92	0.41±0.34	0.70±0.62	11.76±0.46	3.80±0.28	2.53±0.22
Prunus yunnanensis	33.80±7.61	0.43±0.23	1.13±0.62	11.16±0.45	4.50±0.42	2.10±0.19
Rhododendron agastum	7.40±2.16	6.87±3.71	92.22±49.69	47.22±4.68	30.31±3.29	23.43±3.72
Rhododendron delavayi	8.33±1.60	5.29±2.90	61.70±29.67	43.80±2.45	28.20±4.24	23.29±3.00
Rhododendron irroratum	11.18±1.74	5.90±1.75	50.47±10.95	42.90±3.92	30.12±2.46	27.95±2.59
Rhododendron spinuliferum	11.00±1.12	3.95±2.45	32.63±19.77	29.49±2.91	24.16±1.60	2.09±0.92
Rhododendron vialii	8.38±0.51	4.11±1.63	48.22±18.27	34.51±1.38	22.40±1.02	11.48±1.05
Scurrula parasitica	11.89±6.76	1.49±0.84	12.11±7.35	21.98±2.13	16.59±1.66	1.60±0.40
Vallaris indecora	49.25±2.31	0.75±1.44	1.37±2.77	22.25±2.18	17.61±1.31	18.12±2.27
Weigela florida	50.00±0.00	0.33±0.19	0.49±0.32	24.37±2.10	19.10±1.16	7.10±0.75
Woodfordia fruticosa	15.31±7.67	3.13±3.70	16.88±10.75	20.43±1.08	11.98±0.79	5.26±0.76
Prunus cerasifera 'Atropurpurea'	50.00±0.00	0.11±0.03	0.13±0.07	10.73±0.79	3.35±0.30	2.99±0.36
Prunus cerasoides var. rubea	50.00±0.00	0.30±0.23	0.24±0.36	18.70±2.74	2.08±0.71	20.96±4.53
Prunus mume 'Jiang Mei'	42.83±10.75	1.53±0.58	2.99±0.82	11.32±1.14	2.80±0.40	20.11±3.00
Prunus mume f. viridicalyx	34.63±8.75	0.16±0.25	0.36±0.71	9.83±1.70	2.65±0.60	13.35±2.52
Prunus mume f. alphandii	22.00±16.33	0.16±0.11	0.66±0.79	10.58±1.27	3.22±0.68	16.68±2.52
Rhododendron × duclouxii	34.65±12.94	1.38±1.19	3.82±3.26	26.55±2.54	12.08±1.09	5.89±1.01

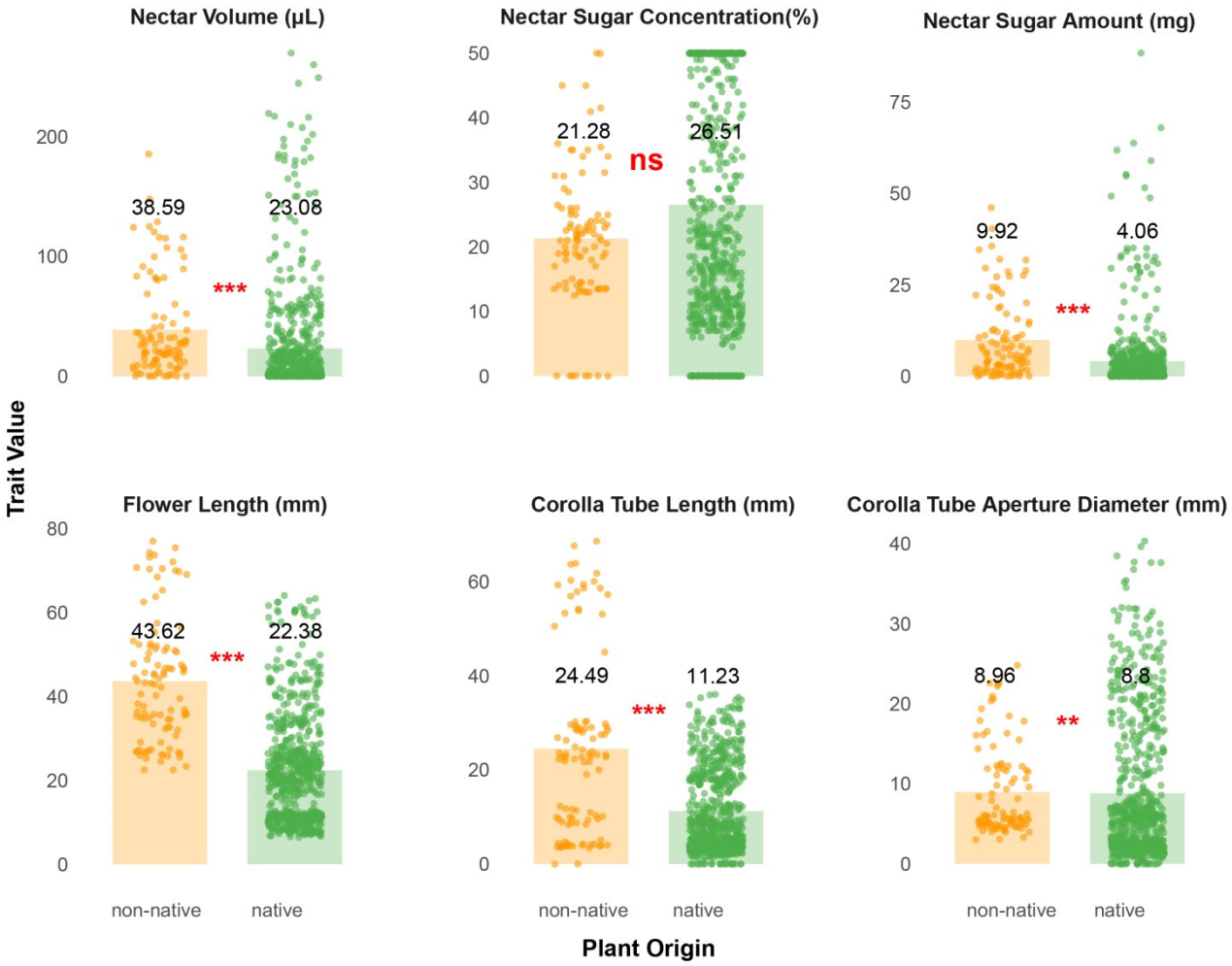


Figure S1. Comparison of floral traits between native and non-native plants at flower level. Values in the figure represent the mean value of each group. In total, 5 non-native and 34 native plant species were included, with approximately 20 replicated measurements per species. Group differences were tested by Welch's t-tests or Wilcoxon rank-sum tests based on Shapiro–Wilk normality results.

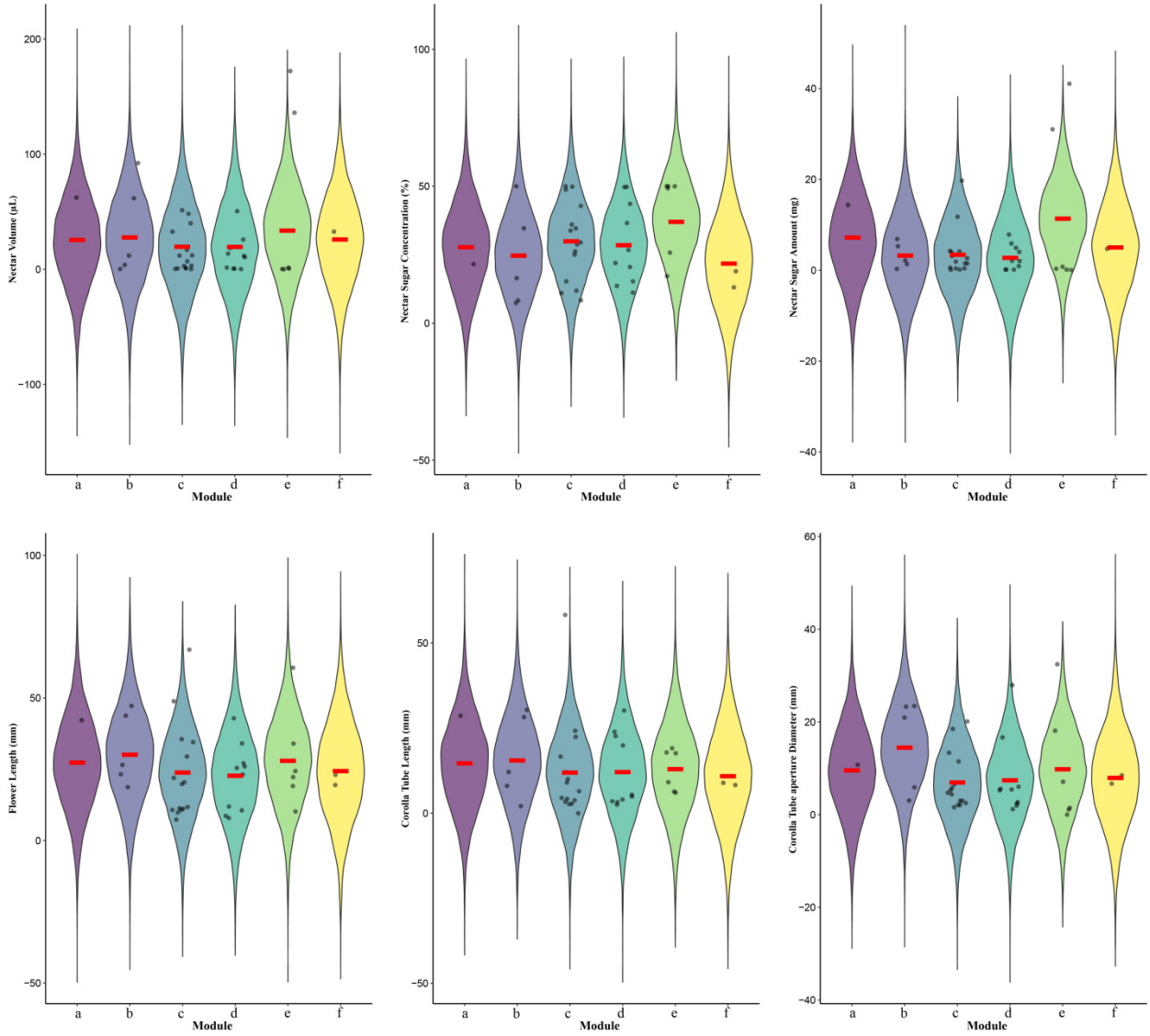


Figure S2. Bayesian posterior predictions of traits across modules of the overall network. Jitters represent raw data, and red lines represent posterior mean.

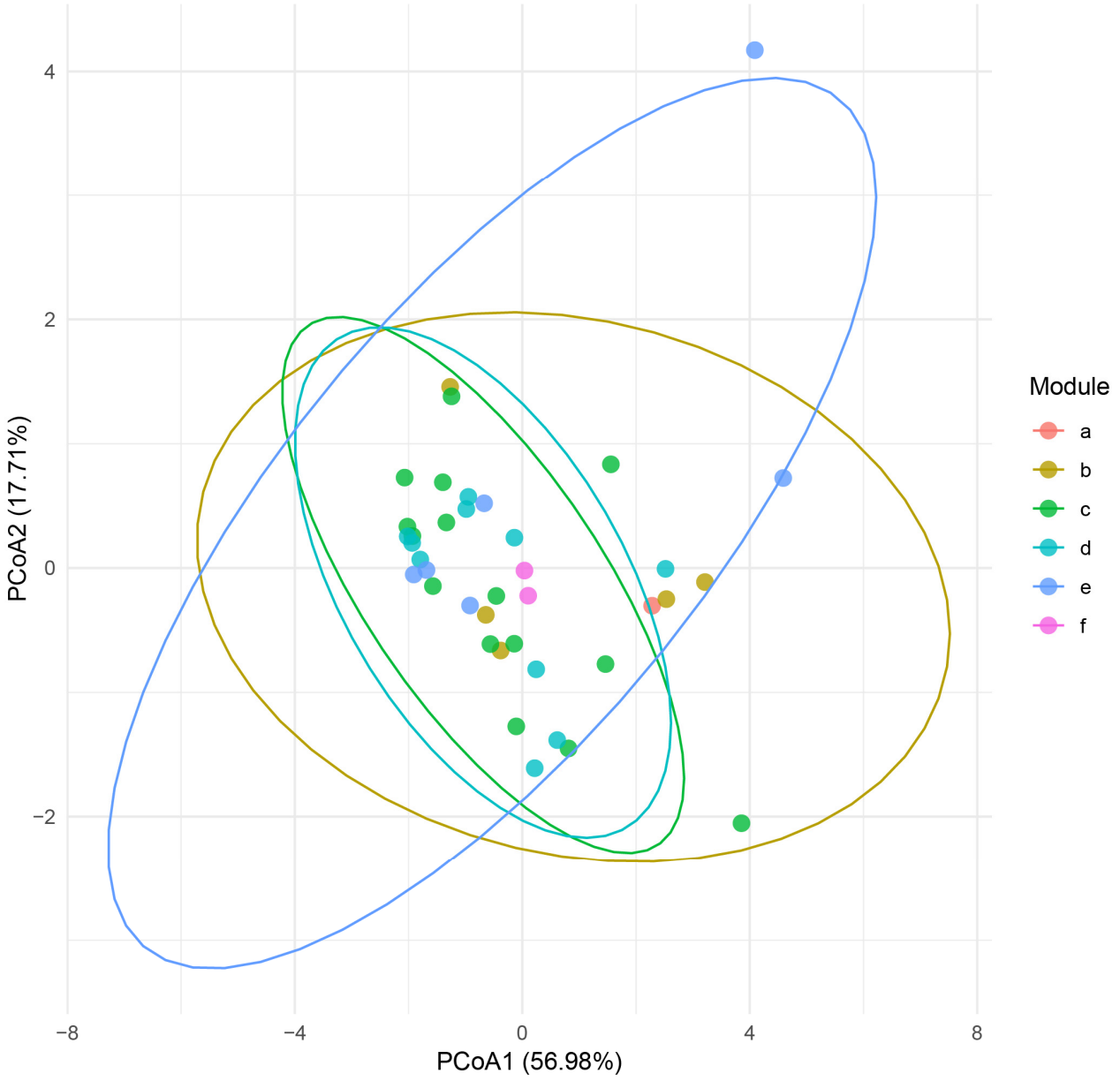


Figure S3. Principal Coordinates Analysis (PCoA) of floral traits among plant species from different network modules. The first two principal coordinate axes (PCoA1 and PCoA2) explained 56. 98% and 17. 71% of the total variation in floral traits, respectively. Ellipses represent 95% confidence intervals for modules with ≥ 3 species; ellipses were not generated for modules a due to insufficient sample size (n = 1). No clear separation of modules was observed, consistent with the non-significant MRPP result.

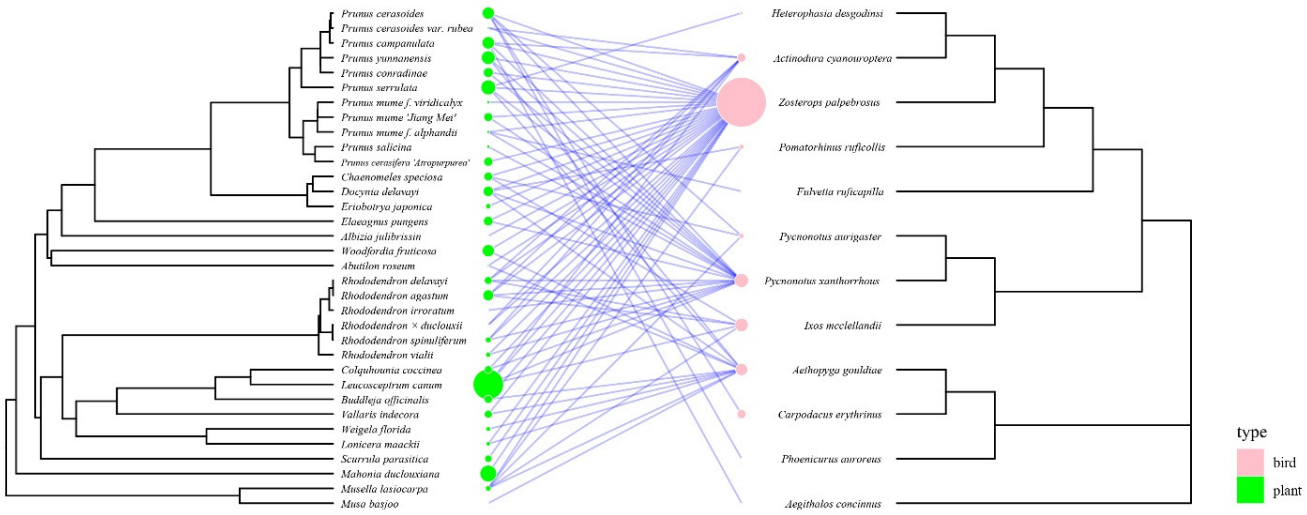


Figure S4. Phylogenetic relationships of 12 bird species (right) and 34 native plant species (left). The blue links indicate interactions between birds and plants. The size of the circles (pink for birds, green for plants) represents the interaction frequency.

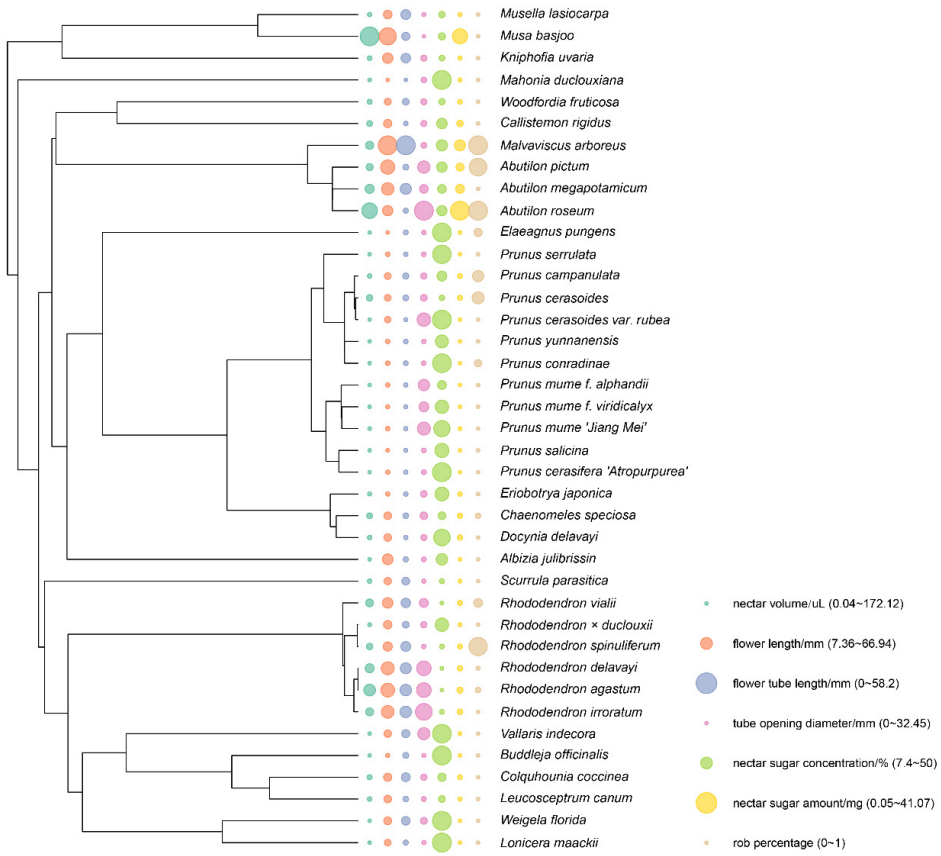


Figure S5. Phylogenetic clustering of plant species and associated floral traits, including nectar characteristics, flower morphology, and nectar robbing percentage.