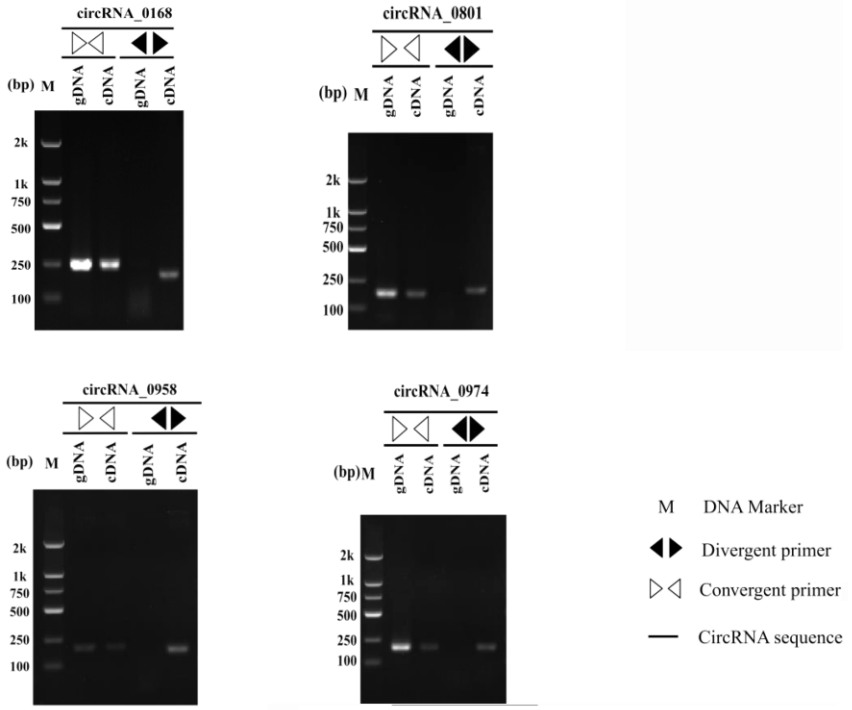

Fig. S1. CircRNAs related to TFs that were successfully amplified in *P.*hl .

Table S1 Sequences of primers were used in qPCR.

RNAs*	Primers	Sequence (5'-3')	Product	Note
18s RNA	Forward	GTGGTGGTGCATGGCCGTTC	80	mRNA
18s RNA	Reverse	TAGCAGGCTGAGGTCTCGTTCG		
circRNA_0168	Forward	AGGCCGAATCATTGGGTTTGA	196	circRNA
circRNA_0168	Reverse	ACCCCAAGCTGTTCCACTGA		
circRNA_0979	Forward	CAGTTCTGAATTTTGCAGCCGC	171	circRNA
circRNA_0979	Reverse	GCAGCAACTGACCGCTACAG		
circRNA_1102	Forward	TGGAGGTGCGTCAATGTCCA	144	circRNA
circRNA_1102	Reverse	TCCACGTTCTACAAGTGCTGGT		
XM_011016290.1	Forward	CTCTCACGGCTGTTGCTGAG	182	mRNA
XM_011016290.1	Reverse	TTTCCTGTGAGGCGGTTTCC		
XM_011016291.1	Forward	GTTGCCAGGCAGGACGGATAAC	161	mRNA
XM_011016291.1	Reverse	TGGATGGTGAAGACGGCAATGATG		
XM_011022483.1	Forward	TAAGCCATTGCCATCTCCACAACC	121	mRNA
XM_011022483.1	Reverse	GGCGTGCCTCTACCAGAATTGTC		
NW_011500067.1	Forward	cgaggcggaTgTagccaagTgga		miRNA
ptc-miR473a-3p	Forward	TGAGGCCTTTGGGGGAGAGTGG		miRNA
ptc-miR160e-5p	Forward	TGCCTGGCTCCCTGAATGCCA		miRNA

RNAs* include mRNA, miRNA and circRNA.

Table S2 Randomly selected primers of circRNAs in *Populus euphratica* Oliv. heteromorphic leaves

circRNAs	Primers	Sequence (5'-3')	product
circRNA_1102	Forward	GGAGGTGCGTCAATGTCCAA	216
circRNA_1102	Reverse	TCCACTGTAAAATACTTGCTGCCA	
circRNA_0168	Forward	ACTTGAGGATTGAAGGCCGAA	213
circRNA_0168	Reverse	TGATACCCCAAGCTGTTCCAC	
circRNA_0958	Forward	GGGGTGGTAGTTGCTGTGAT	230
circRNA_0958	Reverse	ACAGGCATCAGCCATCACTTG	
circRNA_0801	Forward	TGAGCCAAGCAGTCTATGCG	216
circRNA_0801	Reverse	TTTGTCTTGCGGCTGGTTGG	
circRNA_0227	Forward	AATTGGTGGTGCCCTTCCAC	222
circRNA_0227	Reverse	AGCCTTTCCTTCTTCGCAACC	
circRNA_0974	Forward	TGACAAGAAATGACTCTCACATGCT	210
circRNA_0974	Reverse	GTATGTTGGACGGCATACATCCT	

Table S3 Randomly selected primers of RNAs in circRNA-miRNA-TF mRNA regulatory networks

RNAs*	Primers	Sequence (5'-3')	Product	Note
circRNA_1102	Forward	GGAGGTGCGTCAATGTCCAA	216	circRNA
circRNA_1102	Reverse	TCCACTGTAAAATACTTGCTGCCA		
circRNA_0168	Forward	ACTTGAGGATTGAAGGCCGAA	213	circRNA
circRNA_0168	Reverse	TGATACCCCAAGCTGTTCCAC		
circRNA_0958	Forward	GGGGTGGTAGTTGCTGTGAT	230	circRNA
circRNA_0958	Reverse	ACAGGCATCAGCCATCACTTG		
circRNA_0801	Forward	TGAGCCAAGCAGTCTATGCG	216	circRNA
circRNA_0801	Reverse	TTTGTCTTGCGGCTGGTTGG		
circRNA_0227	Forward	AATTGGTGGTGCCCTTCCAC	222	circRNA
circRNA_0227	Reverse	AGCCTTTCCTTCTTCGCAACC		
circRNA_0974	Forward	TGACAAGAAATGACTCTCACATGCT	210	circRNA
circRNA_0974	Reverse	GTATGTTGGACGGCATACATCCT		
ptc-miR156g	Forward	cgcgTTGACAGAAGATAGAGAGCAC		miRNA
NW_011500297.1_28413	Forward	TTTTCTTCCCCTGTTCTCTGCGTG		miRNA
NW_011500300.1_28478	Forward	cgcgAATGAGAACCATCTGACATCC		miRNA
ptc-miR473a-3p	Forward	TGAGGCCTTTGGGGGAGAGTGG		miRNA
ptc-miR396c	Forward	cgcgTTCCACAGCTTTCTTGAACTT		miRNA
ptc-miR319e	Forward	gTTGGACTGAAGGGAGCTCCT		miRNA
XM_011034944.1	Forward	AGAGCGGAACTGGGTCATCCTC	85	mRNA
XM_011034944.1	Reverse	CTTGGTGGCTGCTGGTGCTG		
XM_011031202.1	Forward	TGCGAGGTTCATGCGAAGTCAC	138	mRNA
XM_011031202.1	Reverse	GTGTCCTGCCAAACGCCTACG		
XM_011022862.1	Forward	ACACCTCCTCCTCCTCCTCCTC	85	mRNA
XM_011022862.1	Reverse	GGTTCTTGGATAGCGGGTTCGG		
XM_011016288.1	Forward	GGAACGCCGATTTTGCCAACAG	110	mRNA
XM_011016288.1	Reverse	TCCGTCGCCTTGCATTGTGATC		
XM_011020593.1	Forward	ACCTGCCTCTCCGTTTCAATGC	97	mRNA
XM_011020593.1	Reverse	GCTCCGGCTCCTCCTCTGC		
XM_011037142.1	Forward	AGCCAGAGCCAGAACCAGAACC	109	mRNA
XM_011037142.1	Reverse	GAGCGAGCGACAACCCTGAAC		
XM_011049364.1	Forward	GCTAAGGCTCAGGTTGTGCT	112	mRNA
XM_011049364.1	Reverse	GCCTGCGACAGCTTCTTTTG		

RNAs* include mRNA, miRNA and circRNA.

Table S4 The validation of regulatory relationships between miRNAs, TF mRNAs and circRNAs.

RNAs*	Li1	Li2	Li3	Li4	Mean value	La1	La2	La3	La4	Mean value	Ov1	Ov2	Ov3	Ov4	Mean value	Bo1	Bo2	Bo3	Bo4	Mean value
circRNA_0168	1.01173E-07	9.66046E-08	9.50547E-08	9.75015E-08	9.75835E-08	2.5076E-05	2.4788E-05	2.11351E-05	1.95383E-05	2.26343E-05	7.90614E-05	8.14722E-05	8.16606E-05	8.83343E-05	8.26321E-05	9.22985E-05	9.96111E-05	8.95674E-05	0.00010 1939	9.58541E-05
circRNA_0958	6.27738E-07	5.9525E-07	5.81655E-07	5.63141E-07	5.91946E-07	8.01651E-05	7.6722E-05	6.42178E-05	6.33337E-05	7.11097E-05	4.7998E-05	4.60427E-05	4.70102E-05	5.5008E-05	4.90147E-05	6.85096E-05	7.05986E-05	6.64825E-05	7.60162E-05	7.04017E-05
circRNA_1102	2.80272E-07	2.73239E-07	2.609E-07	2.64542E-07	2.69738E-07	4.83318E-05	4.8109E-05	3.87172E-05	3.75715E-05	4.31824E-05	5.33803E-05	5.0268E-05	5.40005E-05	6.39218E-05	5.53926E-05	0.00027 4039	0.00028 8995	0.00026 5316	0.00030 1965	0.00028 2579
circRNA_0801	2.11634E-06	2.1608E-06	2.03482E-06	1.93845E-06	2.0626E-06	1.1031E-06	1.10056E-06	8.93931E-07	8.81624E-07	9.94804E-07	5.25429E-07	5.30308E-07	5.71002E-07	5.83E-07	5.52435E-07	5.89774E-07	5.17E-07	5.73647E-07	6.99745E-07	5.95042E-07
circRNA_0227	9.59373E-08	9.93205E-08	9.48353E-08	8.78733E-08	9.44916E-08	1.95716E-08	1.98907E-08	1.60446E-08	1.5897E-08	1.7851E-08	3.64375E-08	4.20496E-08	3.65218E-08	3.85151E-08	3.8381E-08	1.71503E-06	1.61131E-06	1.66044E-06	1.85091E-06	1.70942E-06
circRNA_0974	0.00018 4171	0.00018 3746	0.00018 3746	0.00018 8041	0.00018 4926	6.45153E-05	5.96411E-05	5.13242E-05	5.05008E-05	5.64954E-05	6.43664E-05	6.51143E-05	6.21738E-05	7.34268E-05	6.62703E-05	8.43453E-05	7.56658E-05	8.85386E-05	8.10965E-05	8.24116E-05
XM_011034999.1	0.00176 0255	0.00181 8124	0.00188 224	0.00191 7355	0.00184 4494	0.00028 9664	0.00029 9187	0.00023 8014	0.00021 7505	0.00026 1092	0.00028 6999	0.00029 1678	0.00028 7663	0.00031 9182	0.00029 6381	0.00051 8513	0.00048 7154	0.00050 4334	0.00061 5196	0.00053 1299
XM_011031202.1	0.00271 155	0.00271 7822	0.00259 5089	0.00240 4579	0.00260 726	0.00174 4062	0.00169 2455	0.00149 7391	0.00149 7391	0.00160 7825	0.00144 3046	0.00146 6575	0.00139 7115	0.00172 4029	0.00150 7691	0.00293 9935	0.00291 2889	0.00284 6359	0.00310 7564	0.00295 1687
XM_011022862.1	0.00023 6917	0.00022 9376	0.00022 1051	0.00022 1562	0.00022 7226	0.00160 4864	0.00150 4326	0.00126 7909	0.00122 1893	0.00139 9748	0.00248 3631	0.00251 8301	0.00238 7969	0.00278 1348	0.00254 2812	0.00228 5407	0.00230 1303	0.00221 2664	0.00247 2181	0.00231 7889
XM_011016288.1	0.00637 5113	0.00598 9564	0.00636 0401	0.00631 6466	0.00626 0386	0.00749 4251	0.00715 5823	0.00627 2835	0.00641 9456	0.00683 5591	0.01197 9128	0.01149 1147	0.01195 1482	0.01257 469	0.01199 9112	0.01526 8125	0.01610 1438	0.01481 6344	0.01690 1948	0.01577 1964
XM_011020593.1	0.00955 1877	0.00984 3133	0.00957 3972	0.00977 5142	0.00968 6031	0.00988 8723	0.00966 2865	0.00784 8685	0.00756 3834	0.00874 1027	0.00955 1877	0.00984 3133	0.00968 5216	0.01128 0697	0.01009 0231	0.01035 6402	0.00995 7505	0.01000 3625	0.01064 756	0.01024 1273
XM_011037142.1	0.00926 9239	0.00912 053	0.00866 8512	0.00920 5212	0.00906 5873	0.00465 6086	0.00461 3253	0.00363 6249	0.00367 0011	0.00414 3899	0.00415 7696	0.00412 8977	0.00437 4498	0.00509 5125	0.00443 9074	0.00383 471	0.00404 4004	0.00371 2654	0.00452 8765	0.00403 0033
XM_011049364.1	1.01174E-07	9.62046E-08	9.52547E-08	9.74015E-08	9.75E-08	2.5176E-05	2.4988E-05	2.21351E-05	1.93383E-05	2.29E-05	7.95614E-05	8.24722E-05	8.26606E-05	8.85343E-05	8.33E-05	9.25985E-05	9.96311E-05	8.95686E-05	0.00020 1939	1.21E-04
ptc-miR156g	0.00044 0064	0.00044 931	0.00044 931	0.00042 7042	0.00044 1432	0.00022 9906	0.00023 1505	0.00019 4672	0.00018 7174	0.00021 0814	0.00018 6311	0.00018 1216	0.00018 2477	0.00021 451	0.00019 1129	0.00019 648	0.00018 4597	0.00019 0226	0.00020 2471	0.00019 3443
NW_011500297.1_28413	9.51129E-05	9.51129E-05	9.46744E-05	9.53329E-05	9.50582E-05	2.73772E-05	2.71881E-05	2.31815E-05	2.32889E-05	2.52589E-05	8.27199E-06	8.06441E-06	8.31031E-06	9.32801E-06	8.49368E-06	8.76387E-06	8.23386E-06	9.17835E-06	9.07293E-06	8.81225E-06
NW_011500300.1_28478	0.00133 4024	0.00135 8911	0.00132 1751	0.00121 0652	0.00130 6335	0.00068 894	0.00070 5044	0.00058 3357	0.00057 9327	0.00063 9167	0.00044 5177	0.00043 7024	0.00043 3004	0.00049 9694	0.00045 3725	9.6218E-05	9.68873E-05	9.3371E-05	0.00010 4081	9.76394E-05
ptc-miR473a-3p	0.02597 6184	0.02658 3349	0.02621 7368	0.02701 6788	0.02644 8422	0.01332 242	0.01350 8394	0.01130 6791	0.01130 6791	0.01236 1099	0.01774 2257	0.01551 707	0.01770 1311	0.01811 5059	0.01726 8924	0.01481 6344	0.01491 94	0.01434 475	0.01717 7533	0.01531 4507
ptc-miR396c	0.00049 6243	0.00047 4929	0.00045 4531	0.00043 7024	0.00046 5682	0.00141 0087	0.00139 0674	0.00115 5981	0.00114 2703	0.00127 4861	0.00227 487	0.00226 962	0.00227 487	0.00248 9376	0.00232 7184	0.00272 4109	0.00261 9184	0.00264 9618	0.00294 6736	0.00273 4912
ptc-miR3	0.02134	0.02042	0.02005	0.02080	0.02065	0.06871	0.07162	0.06065	0.05995	0.06523	0.06636	0.06792	0.06698	0.07484	0.06902	0.04161	0.04491	0.04029	0.04288	0.04242

19e	4379	7644	353	8739	8573	0132	796	0639	4007	5685	9613	0929	5841	2419	9701	7477	4757	2822	6478	7884

Mean value represented the fold changes between the randomly selected experimental group genes and 18S RNA as the control gene by three technical replicates and four biological replicates.

Table S5 qPCR validation of the regulatory relationship of circRNAs-miRNAs-TF mRNAs in *Populus euphratica* Oliv. heteromorphic leaves

Correlation coefficien1(CC1)	**circRNAs**	**miRNAs**	**TF mRNAs**	**Correlation coefficien2(CC2)**
-0.5255	circRNA_1102	ptc-miR156g	XM_011034**44**.1	0.3545
-0.5255	circRNA_1102	ptc-miR156g	XM_011031202.1	-0.6504
-0.5255	circRNA_1102	ptc-miR156g	XM_011049364.1	-0.7278
-0.8399	circRNA_0168	NW_011500297.1_28413	XM_011031202.1	-0.5904
-0.8399	circRNA_0168	NW_011500297.1_28413	XM_011049364.1	-0.6039
-0.7703	circRNA_0168	ptc-miR156g	XM_011031202.1	0.382
-0.7703	circRNA_0168	ptc-miR156g	XM_011034944.1	-0.3545
-0.7703	circRNA_016**8**	ptc-miR156g	XM_011049364.1	-0.7278
-0.3948	circRNA_0168	ptc-miR39**6c**	XM_011034**44**.1	-0.2904
-0.3948	circRNA_0168	ptc-miR39**6c**	XM_011031202.1	-0.3461
-0.3948	circRNA_0168	ptc-miR39**6c**	XM_011049364.1	-0.5628
-0.9124	circRNA_0958	NW_011500300.1_28478	XM_011022862.1	-0.7576
0.6515	circRNA_0227	ptc-miR396c	XM_011020593.1	0.5914
-0.3253	circRNA_0227	ptc-miR156g	XM_011034**44**.1	-0.3427
-0.4411	circRNA_0801	ptc-miR473a-3p	XM_011016288.1	-0.4634
0.9769	circRNA_080**1**	ptc-miR156g	XM_011016288.1	-0.633
-0.5255	circRNA_1102	ptc-miR156g	XM_011031202.1	0.382
-0.0214	circRNA_1102	ptc-miR319e	XM_011034999.1	-0.9221
-0.9202	circRNA_0974	ptc-miR396c	XM_011034999.1	-0.7148
0.9717	circRNA_0974	ptc-miR156g	XM_011016288.1	-0.633
-0.9202	circRNA_0974	ptc-miR319e	XM_011037142.1	0.8202

CC1 and CC2 represent the correlation coefficient between circRNAs and miRNAs, TF mRNAs and miRNAs, respectively. The red represents the positive correlation coefficient.