

Table S1. Sources of the genome sequences and transcripts of the *CENH3* locus genes used for analysis and contig assembly.

Species	Sources of genome sequences	Acc. No.	Coordinates in nucleotides	Sources of transcripts (GenBank, NCBI), Acc. No.
<i>Streptochaeta angustifolia</i>	N/A			SRR12490852, SRR12490853, SRR12490854, SRR12490855, SRR3233339
<i>Panicum virgatum</i>	Pvirgatum_516_v5.0 ¹	Chr03K Chr03N	21160000-21220000 22075000-22150000	SRR1588141, SRR1588141, SRR5838951, SRR5838951, SRR3467191
<i>Zea mays</i>	GCF_000005005.2 ²	NC_024464	159300480-159450593	SRR9020473, SRR10201924, SRR8368670
<i>Oryza sativa</i>	GCF_001433935.1 ²	NC_029260		XP_015638738.1
<i>Raddia distichophylla</i>	QXEO01000121.1 ²	Scaffold559	2010000-2040000	
<i>Nardus stricta</i>	N/A			ERR1744596, ERR1744597, ERR1744598, ERR1744599, ERR1744600, ERR1744601, ERR1744602, ERR1744603
<i>Melica nutans</i>	N/A			SRR6127959, ERR1744588, SRR6127955, SRR6127931
<i>Stipa sibirica</i>	SRR8208359 ²	cenh3-stipa		
<i>Stipa breviflora</i>	N/A			SRR7152929, SRR7152933, SRR7152936
<i>Brachypodium distachyon</i>	GCA_000005505.4 ²	NC_0161323	19100000-19220000	SRR4094488, SRR5279890, SRR6940284, ERR3317433, ERR1744559, ERR1744553, ERR174455
<i>Brachypodium sylvaticum</i>	Bsylvaticum_490_v1.1 ¹	chr8	6974000-7000000	SRR837756, SRR837757, SRR837755, SRR7814888, SRR7814877
<i>Brachypodium stacei</i>	Bstacei_316_v1.0 ¹	chr08	4665000-4689000	DRR090154, SRR4094447, SRR4094449
<i>Avena sativa</i>	Avena sativa v1.0 ³	ctg8808		SRR5097463, SRR5097544, SRR5818212, SRR5818217, SRR6388184, SRR6388185
<i>Dactylis glomerata</i>	QXEO01000121.1 ²	Contig128	1150000-1250000	SRR6659677, SRR6659679, SRR7758699, SRR7758701
<i>Lolium perenne</i>	ERR1333456, ERR1333455 ²	cenh3-lolium		SRR5605275, SRR5605277, SRR10050124, SRR10050125
<i>Hordeum brevisubulatum</i>	N/A			SRR7817916, SRR7817918
<i>Hordeum vulgare</i> , ssp. <i>spontaneum</i>	WB_v0.5 ⁴	WB_00002249 WB_00001651	1-77466 237759-228880	ERR776122, SRR6687590, ERR776119, SRR6687582, SRR6687591, ERR776127,

				SRR6687600, SRR6687581, SRR6687615
<i>Hordeum vulgare</i>	GCA_902498975.1 ²	Chr1H Chr6H	452790000-452920000 155820000-155930000	SRR1577845, SRR3290309, SRR10960787, SRR8426746, SRR6649468, SRR3628913
<i>Secale cereale</i>	FKKI010016211.1 ²	contig_17452		MG384772, MG384780
<i>Triticum urartu</i>	KD187944.1 ²	scaffold30245		KM507184, KM507181
<i>Aegilops speltoides</i>	TGAC_WGS_speltoides_v1 ⁵	contig_196639		ERR420226, ERR420227
<i>Aegilops tauschii</i>	GCF_001957025.1 ²	NW_017909796	535000-597000	SRR6281363, SRR5460240, SRR5460239, ERR2190543
<i>Triticum aestivum</i>	LS992080.1 ²	chr1A chr1B chr1D	498500000-498640000 542100000-542480000 403250000-403380000	SRR8413506, SRR6941181, ERR2174403

¹) Phytozome: <https://phytozome.jgi.doe.gov>

²) NCBI: <https://www.ncbi.nlm.nih.gov>

³) The Oat Genome project: <https://avenagenome.org/>

⁴) NCGR: http://db.ncgr.ac.cn/wild_barley/index.php

⁵) URGI: <http://wheat-urgi.versailles.inra.fr/>

Table S2. Estimates of ω values from all-to-all pair-wise comparison of cCENH3 coding sequences.

Species	<i>Z. mays</i>	<i>T. urartu</i>	<i>S. sibirica</i>	<i>S. cereale</i>	<i>S. breviflora</i>	<i>S. angustifolia</i>	<i>R. distichophylla</i>	<i>P. virgatum</i> N	<i>P. virgatum</i> K	<i>O. sativa</i>	<i>N. stricta</i>	<i>M. nutans</i>	<i>L. perenne</i>	<i>H. vulgare</i>	<i>H. spontaneum</i>	<i>H. brevisubulatum</i>	<i>T. aestivum</i> D	<i>D. glomerata</i>	<i>T. aestivum</i> B	<i>B. sylvesticum</i>	<i>B. stacei</i>	<i>B. distachyon</i>	<i>T. aestivum</i> A	<i>A. tauschii</i>	<i>A. spelthodes</i>	<i>A. sativa</i>
<i>Z. mays</i>	-	0.269 / 1.176	0.250 / 1.116	0.240 / 1.402	0.218 / 0.934	0.201 / 1.572	0.219 / 1.032	0.139 / 0.580	0.153 / 0.504	0.207 / 0.917	0.236 / 1.017	0.226 / 1.077	0.269 / 1.146	0.273 / 1.429	0.269 / 1.423	0.237 / 1.242	0.262 / 1.272	0.232 / 1.264	0.249 / 1.315	0.269 / 0.947	0.261 / 0.998	0.266 / 0.885	0.268 / 1.176	0.262 / 1.274	0.249 / 1.368	0.264 / 1.172
<i>T. urartu</i>	0.228 / (1.95e-29)	-	0.276 / 0.721	0.025 / 0.104	0.207 / 0.626	0.240 / 0.992	0.240 / 0.818	0.235 / 0.944	0.255 / 0.833	0.247 / 0.816	0.324 / 0.722	0.250 / 0.759	0.226 / 0.481	0.126 / 0.184	0.122 / 0.173	0.073 / 0.160	0.003 / 0.063	0.214 / 0.524	0.020 / 0.070	0.189 / 0.809	0.195 / 0.686	0.191 / 0.705	8.24e-06 / 0.008	0.003 / 0.063	0.015 / 0.106	0.217 / 0.413
<i>S. sibirica</i>	0.224 / (4.23e-28)	0.373 / (9.55e-11)	-	0.280 / 0.735	0.139 / 0.262	0.267 / 1.381	0.207 / 0.538	0.266 / 1.179	0.272 / 0.894	0.236 / 0.731	0.300 / 0.839	0.218 / 0.557	0.250 / 0.626	0.266 / 0.740	0.264 / 0.763	0.256 / 0.831	0.278 / 0.714	0.171 / 0.722	0.265 / 0.712	0.236 / 0.576	0.225 / 0.546	0.232 / 0.554	0.276 / 0.732	0.278 / 0.714	0.276 / 0.647	0.245 / 0.554
<i>S. cereale</i>	0.171 / (1.67e-40)	0.236 / (0.0004)	0.380 / (3.20e-11)	-	0.210 / 0.617	0.255 / 1.292	0.235 / 0.879	0.219 / 1.041	0.243 / 0.860	0.241 / 0.947	0.327 / 0.825	0.244 / 0.687	0.232 / 0.573	0.125 / 0.187	0.121 / 0.180	0.060 / 0.168	0.022 / 0.115	0.215 / 0.589	0.019 / 0.080	0.191 / 0.828	0.190 / 0.648	0.188 / 0.780	0.025 / 0.113	0.022 / 0.115	0.022 / 0.121	0.213 / 0.487
<i>S. breviflora</i>	0.233 / (5.02e-23)	0.331 / (2.05e-11)	0.531 / (0.0002)	0.340 / (6.79e-11)	-	0.269 / 1.443	0.216 / 0.564	0.230 / 1.137	0.236 / 0.910	0.210 / 0.656	0.287 / 0.740	0.145 / 0.526	0.199 / 0.523	0.228 / 0.703	0.225 / 0.717	0.202 / 0.702	0.209 / 0.618	0.138 / 0.603	0.218 / 0.601	0.172 / 0.561	0.182 / 0.486	0.169 / 0.552	0.208 / 0.638	0.209 / 0.618	0.212 / 0.550	0.202 / 0.480
<i>S. angustifolia</i>	0.128 / (4.74e-50)	0.260 / (1.65e-19)	0.194 / (1.43e-37)	0.197 / (2.85e-34)	0.186 / (2.66e-40)	-	0.224 / 1.116	0.207 / 1.193	0.226 / 1.082	0.224 / 1.291	0.296 / 1.212	0.258 / 1.392	0.226 / 1.166	0.268 / 1.181	0.262 / 1.164	0.246 / 1.077	0.238 / 1.010	0.248 / 1.241	0.238 / 1.070	0.220 / 1.525	0.222 / 1.667	0.210 / 1.314	0.241 / 0.941	0.238 / 1.010	0.234 / 0.939	0.243 / 1.242
<i>R. distichophylla</i>	0.212 / (1.04e-25)	0.293 / (3.54e-16)	0.385 / (2.65e-08)	0.267 / (0.72e-20)	0.374 / (1.05e-07)	0.200 / (2.77e-29)	-	0.218 / 0.839	0.219 / 0.895	0.188 / 0.611	0.233 / 0.729	0.183 / 0.451	0.213 / 0.649	0.261 / 0.886	0.257 / 0.880	0.220 / 0.994	0.239 / 0.830	0.193 / 0.633	0.238 / 0.729	0.212 / 0.662	0.218 / 0.668	0.204 / 0.879	0.240 / 0.783	0.239 / 0.830	0.239 / 0.728	0.224 / 0.570
<i>P. virgatum</i> N	0.240 / (1.07e-14)	0.249 / (1.44e-23)	0.226 / (1.05e-31)	0.211 / (2.29e-28)	0.202 / (1.79e-32)	0.173 / (6.59e-35)	0.259 / (2.92e-19)	-	0.041 / 0.096	0.175 / 0.826	0.215 / 0.741	0.202 / 0.958	0.263 / 0.955	0.247 / 1.105	0.242 / 1.084	0.212 / 0.968	0.231 / 1.004	0.228 / 0.937	0.227 / 0.955	0.218 / 1.158	0.210 / 1.095	0.214 / 1.037	0.235 / 0.806	0.231 / 1.004	0.219 / 0.962	0.254 / 1.261
<i>P. virgatum</i> K	0.303 / (2.55e-10)	0.306 / (1.09e-16)	0.304 / (4.47e-18)	0.283 / (1.85e-18)	0.269 / (9.67e-22)	0.209 / (1.30e-28)	0.314 / (2.28e-13)	0.429 / (0.0161)	-	0.192 / 0.688	0.239 / 0.718	0.229 / 0.751	0.250 / 0.890	0.265 / 0.978	0.260 / 0.962	0.223 / 0.862	0.250 / 0.885	0.232 / 0.978	0.253 / 0.801	0.234 / 0.869	0.227 / 0.836	0.231 / 0.782	0.255 / 0.803	0.250 / 0.885	0.238 / 0.773	0.263 / 0.983
<i>O. sativa</i>	0.226 / (6.71e-23)	0.303 / (6.52e-16)	0.323 / (1.46e-16)	0.255 / (6.35e-23)	0.320 / (5.49e-13)	0.172 / (1.67e-36)	0.302 / (1.09e-12)	0.188 / (9.21e-28)	0.279 / (1.63e-15)	-	0.219 / 1.035	0.179 / 0.628	0.230 / 0.673	0.223 / 0.942	0.217 / 0.940	0.208 / 0.947	0.246 / 0.902	0.212 / 0.805	0.255 / 0.775	0.203 / 0.661	0.189 / 0.617	0.200 / 0.654	0.248 / 0.832	0.246 / 0.802	0.239 / 0.810	0.211 / 0.699
<i>N. stricta</i>	0.232 / (2.17e-24)	0.448 / (1.45e-08)	0.359 / (1.85e-14)	0.395 / (3.71e-12)	0.387 / (6.57e-11)	0.244 / (4.07e-28)	0.319 / (3.84e-14)	0.290 / (2.24e-15)	0.333 / (2.20e-13)	0.212 / (1.85e-28)	-	0.263 / 0.726	0.268 / 0.764	0.325 / 0.911	0.318 / 0.904	0.297 / 0.769	0.323 / 0.808	0.223 / 0.717	0.325 / 0.777	0.279 / 0.963	0.273 / 0.850	0.278 / 0.824	0.324 / 0.692	0.323 / 0.808	0.327 / 0.780	0.288 / 0.758
<i>M. nutans</i>	0.210 / (5.94e-29)	0.329 / (5.87e-14)	0.392 / (2.84e-08)	0.355 / (4.51e-12)	0.275 / (2.72e-12)	0.185 / (6.66e-38)	0.405 / (1.69e-06)	0.211 / (1.23e-26)	0.306 / (2.60e-15)	0.285 / (7.00e-14)	0.362 / (3.51e-12)	-	0.219 / 0.664	0.266 / 0.707	0.262 / 0.703	0.225 / 0.693	0.252 / 0.749	0.192 / 0.599	0.258 / 0.658	0.185 / 0.619	0.189 / 0.592	0.176 / 0.656	0.251 / 0.773	0.252 / 0.749	0.244 / 0.663	0.224 / 0.556
<i>L. perenne</i>	0.234 / (1.27e-28)	0.469 / (7.53e-06)	0.399 / (2.45e-09)	0.406 / (1.44e-08)	0.381 / (2.81e-08)	0.194 / (5.82e-32)	0.328 / (1.03e-11)	0.275 / (3.29e-21)	0.292 / (7.68e-19)	0.343 / (8.70e-12)	0.351 / (2.92e-13)	0.330 / (7.01e-13)	-	0.243 / 0.621	0.239 / 0.636	0.226 / 0.532	0.239 / 0.518	0.153 / 0.344	0.224 / 0.552	0.182 / 0.533	0.192 / 0.593	0.172 / 0.621	0.227 / 0.493	0.230 / 0.518	0.228 / 0.524	0.124 / 0.298
<i>H. vulgare</i>	0.191 / (1.49e-40)	0.682 / (0.1467)	0.360 / (4.09e-12)	0.665 / (0.1432)	0.324 / (2.66e-13)	0.227 / (1.09e-28)	0.294 / (4.47e-18)	0.223 / (1.24e-28)	0.271 / (1.02e-21)	0.256 / (3.32e-23)	0.356 / (4.84e-15)	0.376 / 1.79e-11	0.393 / (2.30e-09)	-	0.061 / 0.205	0.122 / 0.196	0.220 / 0.533	0.129 / 0.157	0.228 / 0.911	0.228 / 0.763	0.227 / 0.848	0.126 / 0.193	0.122 / 0.197	0.122 / 0.175	0.210 / 0.581	
<i>H. spontaneum</i>	0.189 / (1.46e-40)	0.707 / (0.1913)	0.346 / (2.37e-13)	0.670 / (0.0977)	0.313 / (3.87e-14)	0.225 / (1.23e-28)	0.292 / (2.81e-18)	0.223 / (1.25e-28)	0.270 / (8.32e-22)	0.232 / (1.01e-24)	0.352 / (2.08e-15)	0.371 / (4.5e-11)	0.377 / (2.33e-10)	0.354 / (3.75e5)	-	0.008 / 0.197	0.119 / 0.186	0.216 / 0.566	0.125 / 0.147	0.225 / 0.902	0.225 / 0.757	0.223 / 0.839	0.123 / 0.182	0.119 / 0.186	0.119 / 0.164	0.203 / 0.582
<i>H. brevisubulatum</i>	0.191 / (8.14e-34)	0.456 / (0.0108)	0.309 / (1.08e-15)	0.356 / (0.0008)	0.287 / (8.90e-15)	0.228 / (3.67e-26)	0.243 / (4.21e-22)	0.219 / (2.58e-25)	0.259 / (8.82e-20)	0.220 / (1.81e-25)	0.386 / (2.09e-11)	0.324 / (3.85e-13)	0.425 / (2.21e-07)	0.394 / (0.0005)	0.391 / (0.0008)	-	0.070 / 0.182	0.196 / 0.630	0.076 / 0.194	0.172 / 0.878	0.179 / 0.717	0.169 / 0.768	0.073 / 0.169	0.070 / 0.183	0.070 / 0.205	0.183 / 0.557
<i>T. aestivum</i> D	0.205 / (4.02e-34)	0.050 / (0.0000)	0.389 / (2.04e-10)	0.191 / (6.72e-05)	0.339 / (5.23e-11)	0.236 / (2.28e-28)	0.288 / (1.67e-17)	0.230 / (2.04e-25)	0.283 / (1.4e-19)	0.273 / (6.89e-20)	0.400 / (1.30e-11)	0.337 / (1.29e-13)	0.443 / (1.35e-06)	0.621 / (0.0513)	0.640 / (0.0995)	0.382 / (0.0018)	-	0.217 / 0.528	0.017 / 0.097	0.191 / 0.773	0.198 / 0.656	0.194 / 0.720	0.003 / 0.071	NA / NA	0.112 / 0.098	0.221 / 0.416
<i>D. glomerata</i>	0.184 / (1.88e-35)	0.409 / (2.86e-07)	0.237 / (4.49e-18)	0.366 / (3.16e-09)	0.229 / (9.59e-16)	0.199 / (5.47e-31)	0.304 / (5.09e-12)	0.243 / (7.68e-23)	0.237 / (0.08e-24)	0.263 / (7.95e-18)	0.312 / (1.74e-13)	0.320 / (2.92e-11)	0.446 / (7.94e-05)	0.384 / (1.80e-08)	0.382 / (6.61e-09)	0.311 / (0.51e-12)	0.410 / (2.94e-07)	-	0.205 / 0.526	0.185 / 0.523	0.182 / 0.568	0.181 / 0.577	0.215 / 0.537	0.217 / 0.528	0.217 / 0.532	0.134 / 0.289
<i>T. aestivum</i> B	0.190 / (1.67e-36)	0.284 / (0.0036)	0.372 / (3.56e-11)	0.235 / (0.0010)	0.363 / (7.09e-10)	0.223 / (5.08e-27)	0.327 / (3.49e-13)	0.238 / (1.79e-24)	0.315 / (3.04e-15)	0.329 / (1.78e-14)	0.419 / (1.37e-10)	0.392 / (6.66e-10)	0.406 / (3.69e-08)	0.816 / (0.4184)	0.850 / (0.5109)	0.393 / (0.0007)	0.177 / (7.34e-05)	0.390 / (1.07e-07)	-	0.187 / 0.770	0.190 / 0.648	0.184 / 0.723	0.020 / 0.078	0.017 / 0.097	0.017 / 0.069	0.214 / 0.440
<i>B. sylvesticum</i>	0.284 / (1.28e-19)	0.233 / (1.59e-19)	0.410 / (1.79e-07)	0.230 / (3.57e-20)	0.306 / (1.19e-10)	0.144 / (2.67e-48)	0.307 / (1.23e-12)	0.188 / (2.30e-31)	0.269 / (8.61e-19)	0.307 / (2.32e-12)	0.289 / (1.40e-19)	0.299 / (5.71e-13)	0.228 / (3.75e-13)	0.251 / (4.95e-21)	0.249 / (3.38e-21)	0.196 / (1.89e-23)	0.247 / (2.82e-18)	0.353 / (7.54e-09)	0.243 / (1.14e-18)	-	0.022 / 0.068	0.189 / 0.826	0.191 / 0.773	0.191 / 0.708	0.198 / 0.587	
<i>B. stacei</i>	0.262 / (2.74e-22)	0.285 / (2.73e-14)	0.411 / (1.01e-07)	0.293 / (3.92e-13)	0.374 / (1.045e-07)	0.133 / (1.77e-44)	0.326 / (6.02e-12)	0.193 / (4.36e-29)	0.272 / (2.66e-18)	0.305 / (8.74e-12)	0.321 / (1.62e-15)	0.320 / (2.09e-11)	0.323 / (2.28e-13)	0.299 / (2.78e-15)	0.297 / (2.09e-15)	0.249 / (2.78e-16)	0.301 / (2.21e-13)	0.320 / (1.29e-10)	0.293 / (3.92e-13)	0.327 / (0.0098)	-	0.027 / 0.070	0.196 / 0.700	0.198 / 0.666	0.199 / 0.603	0.204 / 0.613
<i>B. distachyon</i>	0.300 / (6.16e-17)	0.271 / (2.75e-15)	0.420 / (3.30e-07)	0.241 / (7.47e-19)	0.306 / (1.24e-10)	0.160 / (5.15e-36)	0.300 / (1.43e-12)	0.306 / (2.61e-27)	0.295 / (1.35e-15)	0.306 / (8.74e-12)	0.337 / (5.74e-14)	0.268 / (7.79e-15)	0.277 / (1.16e-13)	0.268 / (5.35e-19)	0.266 / (4.07e-19)	0.221 / (2.55e-19)	0.269 / (5.88e-16)	0.313 / (3.80e-11)	0.255 / (5.89e-16)	0.253 / (0.0054)	0.381 / (0.0344)	-	0.191 / 0.720	0.194 / 0.720	0.194 / 0.660	0.191 / 0.607
<i>T. aestivum</i> A	0.228 / (1.95e-29)	0.001 / (0.0000)	0.377 / (5.05e-11)	0.218 / (0.0001)	0.325 / (1.04e-11)	0.256 / (6.53e-21)	0.307 / (3.88e-15)	0.260 / (1.02e-21)	0.318 / (3.25e-15)	0.298 / (1.01e-16)	0.468 / (1.21e-07)	0.324 / (1.08e-14)	0.460 / (4.0e-06)	0.653 / (0.1087)	0.674 / (0.1437)	0.432 / (0.0034)	0.043 / (2.67e-05)	0.401 / (1.62e-07)	0.255 / (0.0113)	0.229 / (4.13e-20)	0.279 / (1.25e-14)	0.265 / (1.05e-15)	-	0.003 / 0.071	0.015 / 0.116	0.218 / 0.424
<i>A. tauschii</i>	0.205 / (4.03e-34)	0.050 / (0.0000)	0.389 / (2.04e-10)	0.191 / (6.72e-05)	0.337 / (5.23e-11)	0.236 / (2.28e-23)	0.295 / (1.09e-16)	0.230 / (2.05e-25)	0.282 / (1.4e-19)	0.273 / (6.89e-20)	0.400 / (1.30e-11)	0.337 / (1.29e-13)	0.443 / (1.35e-06)	0.621 / (0.0513)	0.640 / (0.0995)	0.382 / (0.0018)	NA / NA	0.411 / (2.29e-07)	0.177 / (7.34e-05)	0.247 / (2.82e-18)	0.301 / (7.16e-13)	0.269 / (5.88e-16)	0.043 / (9.27e-05)	-	0.012 / 0.098	0.221 / 0.416
<i>A. spelthodes</i>	0.181 / (4.59e-39)	0.137 / (8.78e-06)	0.427 / (3.59e-08)	0.181 / (4.49e-05)	0.384 / (1.86e-08)	0.249 / (4.49e-18)	0.328 / (3.43e-13)	0.228 / (6.23e-25)	0.309 / (3.10e-15)	0.295 / (1.09e-16)	0.419 / (1.43e-10)	0.368 / (1.02e-10)	0.434 / (1.65e-06)	0.696 / (0.1875)	0.722 / (0.2414)	0.341 / (0.0002)	0.118 / (8.61e-06)	0.408 / (2.79e-07)	0.245 / (0.0081)	0.270 / (2.21e-15)	0.329 / (8.10e-11)	0.294 / (3.21e-13)	0.128 / (2.51e-06)	0.118 / (8.61e-06)	-	0.219 / 0.420

Table S3. Estimates of ω values from all-to-all pair-wise comparison of β CENH3 coding sequences.

Species	<i>T. urartu</i>	<i>S. sibirica</i>	<i>S. cereale</i>	<i>S. breviviflora</i>	<i>L. perenne</i>	<i>H. vulgare 6H</i>	<i>H. vulgare 1H</i>	<i>H. spontaneum 6H</i>	<i>H. spontaneum 1H</i>	<i>H. brevisubulatum</i>	<i>T. aestivum D</i>	<i>D. glomerata</i>	<i>T. aestivum B</i>	<i>B. sylvaticum</i>	<i>T. aestivum A</i>	<i>A. tauschii</i>	<i>A. speltoides</i>	<i>A. sativa 2</i>	<i>A. sativa 1</i>
<i>T. urartu</i>	—	0.186/0.756	0.033/0.128	0.263/0.775	0.193/0.534	0.195/0.277	0.196/0.237	0.195/0.277	0.195/0.219	0.053/0.116	0.019/0.086	0.218/0.448	0.030/0.105	0.275/0.700	0.000/0.013	0.019/0.086	0.047/0.082	0.207/0.445	0.211/0.431
<i>S. sibirica</i>	0.246(0.73E-15)	—	0.188/0.895	0.134/0.366	0.253/0.785	0.286/1.191	0.284/0.838	0.286/1.191	0.282/0.811	0.213/0.877	0.192/0.875	0.283/0.745	0.201/0.892	0.177/0.578	0.187/0.771	0.192/0.875	0.205/0.769	0.273/0.766	0.284/0.815
<i>S. cereale</i>	0.258(0.001165)	0.210(6.85E-21)	—	0.260/0.918	0.193/0.516	0.181/0.358	0.191/0.297	0.181/0.358	0.190/0.280	0.050/0.172	0.029/0.110	0.225/0.504	0.030/0.122	0.277/0.907	0.033/0.141	0.029/0.110	0.058/0.074	0.203/0.467	0.208/0.451
<i>S. breviviflora</i>	0.339(8.90E-12)	0.367(5.40E-06)	0.283(4.75E-17)	—	0.306/0.855	0.360/1.456	0.327/0.807	0.360/1.456	0.325/0.777	0.271/0.834	0.250/0.913	0.311/0.792	0.251/0.898	0.272/0.547	0.264/0.789	0.250/0.913	0.279/0.795	0.358/0.606	0.373/0.637
<i>L. perenne</i>	0.361(1.05E-07)	0.323(1.02E-12)	0.374(4.17E-07)	0.358(1.85E-12)	—	0.275/0.682	0.285/0.473	0.275/0.682	0.279/0.457	0.183/0.599	0.181/0.527	0.131/0.327	0.185/0.511	0.256/1.031	0.193/0.548	0.181/0.527	0.212/0.563	0.125/0.344	0.128/0.339
<i>H. vulgare 6H</i>	0.705(0.167867)	0.240(2.83E-23)	0.507/0.003461	0.247(4.78E-28)	0.403(1.72E-07)	—	—	—	0.201/0.226	0.207/0.204	0.196/0.341	0.196/0.316	0.313/0.577	0.191/0.271	0.347/1.078	0.196/0.294	0.196/0.316	0.202/0.341	0.285/0.588
<i>H. vulgare 1H</i>	0.829/0.474312	0.339(2.62E-10)	0.643/0.083173	0.405(5.52E-08)	0.602/0.010539	0.890/0.70384	—	0.201/0.226	0.006/0.015	0.162/0.272	0.182/0.276	0.362/0.413	0.176/0.248	0.381/0.695	0.198/0.254	0.182/0.276	0.207/0.279	0.294/0.411	0.312/0.417
<i>H. spontaneum 6H</i>	0.705(0.167867)	0.240(2.83E-23)	0.507/0.003461	0.247(4.78E-28)	0.403(1.72E-07)	1.013(0.999995)	0.890(0.70384)	—	0.207/0.204	0.196/0.341	0.196/0.316	0.313/0.577	0.191/0.271	0.347/1.078	0.196/0.294	0.196/0.316	0.202/0.341	0.285/0.570	0.285/0.570
<i>H. spontaneum 1H</i>	0.889(0.585155)	0.347(6.18E-10)	0.678/0.117377	0.418(1.21E-07)	0.611/0.015234	1.013(0.999995)	0.422(0.082035)	0.103(0.999995)	—	0.163/0.254	0.181/0.259	0.369/0.392	0.176/0.230	0.382/0.689	0.196/0.236	0.181/0.259	0.194/0.257	0.297/0.389	0.304/0.393
<i>H. brevisubulatum</i>	0.458(0.023422)	0.242(3.98E-18)	0.292(0.000838)	0.326(4.81E-13)	0.306(5.07E-10)	0.575(0.025668)	0.594(0.041908)	0.575(0.025668)	0.641(0.097414)	—	0.051/0.158	0.221/0.531	0.042/0.143	0.271/0.693	0.053/0.129	0.051/0.158	0.067/0.141	0.209/0.529	0.221/0.516
<i>T. aestivum D</i>	0.219(0.002016)	0.220(1.86E-19)	0.263(0.002915)	0.274(1.60E-17)	0.344(8.47E-08)	0.619(0.059954)	0.659(0.150227)	0.619(0.059954)	0.699(0.203857)	0.322(0.000982)	—	0.218/0.484	0.019/0.071	0.263/0.834	0.019/0.100	NA/NA	0.045/0.052	0.207/0.455	0.211/0.440
<i>D. glomerata</i>	0.487(0.000228)	0.379(1.55E-09)	0.446(1.72E-05)	0.392(2.91E-10)	0.401(7.91E-05)	0.543(0.000817)	0.878(0.457688)	0.543(0.000817)	0.941(0.655677)	0.416(6.38E-06)	0.451(4.70E-05)	—	0.239/0.443	0.303/0.841	0.218/0.464	0.218/0.464	0.245/0.477	0.117/0.317	0.117/0.316
<i>T. aestivum B</i>	0.288(0.005036)	0.225(1.17E-19)	0.244(0.002085)	0.279(9.76E-17)	0.362(5.30E-07)	0.705(0.164893)	0.704(0.200989)	0.705(0.164893)	0.765(0.271277)	0.295(0.001401)	0.273(0.009704)	0.541(0.001916)	—	0.239/0.812	0.030/0.120	0.019/0.071	0.032/0.048	0.212/0.420	0.225/0.405
<i>B. sylvaticum</i>	0.393(4.32E-08)	0.306(4.09E-10)	0.305(1.02E-14)	0.497(0.000129)	0.248(9.45E-21)	0.322(7.27E-15)	0.549(0.001035)	0.322(7.27E-15)	0.555(0.001135)	0.391(4.31E-08)	0.315(6.18E-13)	0.360(2.78E-11)	0.239/0.812	—	0.276/0.721	0.263/0.834	0.272/0.738	0.297/0.703	0.300/0.743
<i>T. aestivum A</i>	0.001(0.00)	0.242(1.18E-15)	0.235(0.000429)	0.335(4.52E-12)	0.353(5.33E-08)	0.667(0.083757)	0.780(0.283665)	0.667(0.083757)	0.830(0.473999)	0.412(0.011117)	0.189(0.000633)	0.471(0.000138)	0.030/0.120	0.383(9.56E-09)	—	0.019/0.100	0.048/0.096	0.207/0.460	0.212/0.445
<i>A. tauschii</i>	0.219(0.002016)	0.220(1.86E-19)	0.263(0.002915)	0.274(1.60E-17)	0.344(8.47E-08)	0.619(0.059954)	0.659(0.150227)	0.619(0.059954)	0.699(0.203857)	0.322(0.000982)	NA/NA	0.451(4.70E-05)	0.019/0.071	0.315(6.18E-13)	0.189(0.000633)	—	0.045/0.052	0.207/0.455	0.211/0.440
<i>A. speltoides</i>	0.577(0.139224)	0.267(1.10E-14)	0.774(0.592871)	0.351(1.08E-11)	0.376(2.32E-07)	0.590(0.030127)	0.742(0.232205)	0.590(0.030127)	0.752(0.220748)	0.474(0.030474)	0.851(0.534215)	0.513(0.000507)	0.032/0.048	0.369(1.70E-09)	0.494(0.088112)	0.851(0.534215)	—	0.243/0.431	0.254/0.421
<i>A. sativa 2</i>	0.464(0.000151)	0.357(1.83E-10)	0.435(3.55E-05)	0.590(0.000762)	0.363(3.11E-05)	0.485(0.000142)	0.717(0.115983)	0.500(0.000232)	0.765(0.209335)	0.396(1.27E-06)	0.455(0.000121)	0.370(7.07E-05)	0.212/0.420	0.422(1.35E-07)	0.450(9.01E-05)	0.455(0.00012)	0.564(0.003107)	—	0.011/0.044
<i>A. sativa 1</i>	0.490(0.000514)	0.349(3.92E-11)	0.461(0.000128)	0.585(0.000555)	0.378(6.83E-05)	0.500(0.000232)	0.749(0.161979)	0.500(0.000232)	0.774(0.209577)	0.428(8.04E-06)	0.480(0.000354)	0.371(7.52E-05)	0.225/0.405	0.404(1.21E-08)	0.476(0.000324)	0.480(0.000354)	0.602(0.012896)	0.250(0.011066)	—

Note. Values of Ka and Ks are shown above the diagonal. The ω values are shown below the diagonal followed by P-values in brackets.

Values $\omega > 1$ are highlighted in bold.

Table S4. The presence of the most well-represented transposable element families in ISs in Triticeae species.

Species	<i>Copia</i> families	<i>Gypsy</i> families	DNA transposons	LINES
<i>H. spontaneum</i>	13919 bp <i>Inga</i> , 84.2%, 3fr <i>BARE1</i> , 12.9%, 2fr	10921 bp <i>Sabrina</i> , 87.0%, 4fr	3817 bp <i>Mutator</i> , 73.3%, 6fr <i>Mariner</i> , 18.3%, 4fr	2676 bp <i>Nadine</i> , 100%, 1fr
<i>H. vulgare</i>	47163 bp <i>BARE1</i> , 40.6%, 7fr <i>Maximus</i> , 34.2%, 6fr <i>Inga</i> , 25.1%, 4fr	12047 bp <i>Sabrina</i> , 59.8%, 2fr <i>Surya</i> , 39.8%, 2fr	2742 bp <i>Mutator</i> , 98.4%, 5fr	2676 bp <i>Nadine</i> , 100%, 1fr
<i>T. urartu</i>	7570 bp <i>WIS</i> , 77.9%, 5fr <i>Angela</i> , 21.8%, 1fr	4148 bp <i>Sabrina</i> , 53.0%, 2fr <i>Egug</i> , 24.1%, 1fr <i>Latidu</i> , 22.9%, 1fr		3660 bp unnamed, 100%, 2fr
<i>T. aestivum</i> , A genome	10395 bp <i>WIS</i> , 83.7%, 2fr <i>Angela</i> , 15.9%, 2fr	30792 bp <i>Fatima</i> , 62.0%, 3fr* <i>Egug</i> , 25.7%, 2fr <i>Sabrina</i> , 5.0%, 1fr <i>Latidu</i> , 4.4%, 3 fr		3660 bp unnamed, 100%, 1fr
<i>T. aestivum</i> , B genome	63449 bp <i>WIS</i> , 41.3%, 4fr** <i>Barbara</i> , 29.3%, 2fr** <i>Angela</i> , 23.9%, 3fr*	98009 bp <i>Egug</i> , 23.9%, 6fr** <i>Laura</i> , 14.3%, 1fr* <i>Sabrina</i> , 13.6%, 4fr <i>Romani</i> , 11.2%, 1fr* <i>Vilma</i> , 10.3%, 1fr* <i>WHAM</i> , 9.7%, 2 fr <i>Lila</i> , 8.9%, 2fr <i>Lisa</i> , 5.5%, 1fr	20068 bp <i>CACTA</i> , 87.4%, 46fr <i>En-Spm</i> , 11.0%, 4fr	14104 bp <i>Karin</i> , 60.4%, 4fr unnamed, 24.8%, 1fr <i>L1</i> , 14.1%, 3fr
<i>Ae. tauschii</i>	12272 bp <i>Angela</i> , 86.3%, 4fr <i>WIS</i> , 13.5%, 1fr	23409 bp <i>Sabrina</i> , 61.1%, 3fr* <i>WAHM</i> , 36.7%, 1fr	871 bp <i>Harbinger</i> , 76.9%, 3fr	
<i>T. aestivum</i> , D genome	12272 bp <i>Angela</i> , 86.3%, 4fr <i>WIS</i> , 13.5%, 1fr	23416 bp <i>Sabrina</i> , 61.1%, 3fr* <i>WAHM</i> , 36.3%, 1fr	291 bp <i>Harbinger</i> , 100%, 1fr	

Note: The total number of base pairs for given superfamily of transposable elements is shown in bold. The values after the family names are (1) the percentage abundance of the family fragments in the superfamily and (2) the numbers of the family fragments. The number of asterisks (*) represents the number of full-length copies of the element.