

Supplementary table 1. The list of GC contents and ENC of 194 chloroplast genomes

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Anthoceros formosae</i>	Anthocerotophyta	NC004543	41.6	0.44	0.39	0.22	0.35
<i>Nothoceros aenigmaticus</i>	Anthocerotophyta	NC020259	44.7	0.44	0.38	0.27	0.36
<i>Physcomitrella patens</i> subsp. <i>patens</i>	Bryophyta	NC005087	34.8	0.41	0.35	0.13	0.3
<i>Syntrichia ruralis</i>	Bryophyta	NC012052	35	0.41	0.35	0.13	0.3
<i>Aneura mirabilis</i>	Marchantiophyta	NC010359	47.8	0.46	0.4	0.32	0.39
<i>Marchantia polymorpha</i>	Marchantiophyta	NC001319	34.6	0.43	0.36	0.12	0.3
<i>Pellia endiviifolia</i>	Marchantiophyta	NC019628	45.1	0.44	0.37	0.26	0.36
<i>Ptilidium pulcherrimum</i>	Marchantiophyta	NC015402	40.2	0.43	0.37	0.2	0.33
<i>Huperzia lucidula</i>	Lycopodiophyta	NC006861	44.9	0.46	0.38	0.26	0.37
<i>Isoetes flaccida</i>	Lycopodiophyta	NC014675	47	0.47	0.39	0.28	0.38
<i>Selaginella moellendorffii</i>	Lycopodiophyta	NC013086	54	0.56	0.51	0.45	0.51
<i>Selaginella uncinata</i>	Lycopodiophyta	AB197035	55.4	0.59	0.55	0.49	0.54
<i>Adiantum capillus-veneris</i>	Moniliformopses (core leptosporangiate ferns)	NC004766	52	0.47	0.41	0.37	0.42
<i>Cheilanthes lindheimeri</i>	Moniliformopses (core leptosporangiate ferns)	NC014592	52.2	0.48	0.41	0.38	0.42
<i>Pteridium aquilinum</i> subsp. <i>aquilinum</i>	Moniliformopses (core leptosporangiate ferns)	NC014348	52.1	0.48	0.41	0.36	0.41
<i>Alsophila spinulosa</i>	Moniliformopses (core leptosporangiate ferns)	NC012818	51.3	0.47	0.41	0.34	0.41
<i>Marsilea crenata</i>	Moniliformopses (core leptosporangiate ferns)	KC536646	52.7	0.49	0.41	0.37	0.42
<i>Lygodium japonicum</i>	Moniliformopses (early diverged leptosporangiate ferns)	KF225593	49.7	0.47	0.4	0.36	0.41
<i>Diplopterygium glaucum</i>	Moniliformopses (early diverged leptosporangiate ferns)	KF225594	49.8	0.47	0.41	0.33	0.4
<i>Osmunda cinnamomea</i>	Moniliformopses (early diverged leptosporangiate ferns)	KF225592	46.7	0.47	0.41	0.31	0.4
<i>Angiopteris evecta</i>	Moniliformopses (eusporangiate ferns)	NC008829	43.3	0.45	0.38	0.24	0.36
<i>Ophioglossum californicum</i>	Moniliformopses (eusporangiate ferns)	NC020147	49.3	0.48	0.41	0.35	0.41
<i>Mankyua chejuensis</i>	Moniliformopses (eusporangiate ferns)	NC017006	46	0.46	0.39	0.29	0.38
<i>Psilotum nudum</i>	Moniliformopses (eusporangiate ferns)	NC003386	43.5	0.45	0.38	0.26	0.36
<i>Equisetum arvense</i>	Moniliformopses (eusporangiate ferns)	NC014699	40.1	0.44	0.36	0.21	0.34
<i>Equisetum hyemale</i>	Moniliformopses (eusporangiate ferns)	NC020146	41.2	0.43	0.36	0.22	0.34
<i>Ginkgo biloba</i>	Ginkgophyta	NC016986	47.7	0.48	0.4	0.3	0.39
<i>Ephedra equisetina</i>	Gnetophyta	NC011954	44.7	0.44	0.35	0.26	0.35
<i>Gnetum parvifolium</i>	Gnetophyta	NC011942	48	0.45	0.37	0.3	0.37
<i>Welwitschia mirabilis</i>	Gnetophyta	NC010654	45.5	0.44	0.36	0.27	0.36
<i>Cycas revoluta</i>	Cycadophyta	NC020319	47.9	0.47	0.39	0.3	0.39
<i>Cycas taitungensis</i>	Cycadophyta	NC009618	47.8	0.47	0.39	0.3	0.39
<i>Cathaya argyrophylla</i>	Pinophyta	NC014589	48	0.49	0.4	0.3	0.4
<i>Cedrus deodara</i>	Pinophyta	NC014575	46.6	0.48	0.39	0.31	0.39
<i>Cephalotaxus wilsoniana</i>	Pinophyta	NC016063	46.4	0.45	0.36	0.27	0.36
<i>Cryptomeria japonica</i>	Pinophyta	NC010548	45	0.46	0.37	0.28	0.37
<i>Keteleeria davidiana</i>	Pinophyta	NC011930	46.9	0.48	0.39	0.3	0.39

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Larix decidua</i>	Pinophyta	NC016058	47.6	0.48	0.39	0.3	0.39
<i>Picea morrissonicola</i>	Pinophyta	NC016069	47.6	0.48	0.39	0.31	0.39
<i>Picea sitchensis</i>	Pinophyta	NC011152	46.6	0.49	0.4	0.3	0.4
<i>Pinus contorta</i>	Pinophyta	NC011153	47.6	0.48	0.39	0.3	0.39
<i>Pinus gerardiana</i>	Pinophyta	NC011154	47.1	0.48	0.39	0.3	0.39
<i>Pinus koraiensis</i>	Pinophyta	NC004677	47	0.48	0.39	0.31	0.39
<i>Pinus krempfii</i>	Pinophyta	NC011155	47.2	0.48	0.39	0.31	0.39
<i>Pinus lambertiana</i>	Pinophyta	NC011156	47	0.48	0.39	0.31	0.39
<i>Pinus monophylla</i>	Pinophyta	NC011158	47.4	0.47	0.39	0.3	0.39
<i>Pinus nelsonii</i>	Pinophyta	NC011159	47.5	0.48	0.39	0.3	0.39
<i>Pinus thunbergii</i>	Pinophyta	NC001631	47.7	0.5	0.4	0.3	0.4
<i>Podocarpus totara</i>	Pinophyta	NC020361	48.2	0.47	0.37	0.3	0.38
<i>Pseudotsuga sinensis</i> var. <i>wilsoniana</i>	Pinophyta	NC016064	47.6	0.48	0.39	0.3	0.39
<i>Taiwania cryptomerioides</i>	Pinophyta	NC016065	45.6	0.45	0.36	0.26	0.36
<i>Taxus mairei</i>	Pinophyta	NC020321	45.8	0.46	0.38	0.27	0.37
<i>Amborella trichopoda</i>	Magnoliophyta (Basal lineages)	NC005086	48.3	0.46	0.39	0.32	0.39
<i>Chloranthus spicatus</i>	Magnoliophyta (Basal lineages)	NC009598	47.1	0.46	0.39	0.32	0.39
<i>Illicium oligandrum</i>	Magnoliophyta (Basal lineages)	NC009600	47.8	0.47	0.39	0.32	0.39
<i>Nuphar advena</i>	Magnoliophyta (Basal lineages)	NC008788	48.4	0.46	0.39	0.32	0.39
<i>Nymphaea alba</i>	Magnoliophyta (Basal lineages)	NC006050	48.1	0.46	0.39	0.32	0.39
<i>Trithuria inconspicua</i>	Magnoliophyta (Basal lineages)	NC020372	48.6	0.47	0.38	0.34	0.4
<i>Ceratophyllum demersum</i>	Ceratophyllales	NC009962	47.5	0.46	0.39	0.31	0.38
<i>Aethionema cordifolium</i>	Eudicotyledons	NC009265	45.6	0.45	0.38	0.29	0.37
<i>Ageratina adenophora</i>	Eudicotyledons	NC015621	47.2	0.46	0.39	0.3	0.38
<i>Anthriscus cerefolium</i>	Eudicotyledons	NC015113	47.6	0.45	0.38	0.3	0.38
<i>Arabidopsis thaliana</i>	Eudicotyledons	NC000932	45.8	0.45	0.38	0.29	0.37
<i>Arabis hirsuta</i>	Eudicotyledons	NC009268	45.8	0.45	0.38	0.29	0.37
<i>Atropa belladonna</i>	Eudicotyledons	NC004561	46.8	0.46	0.38	0.3	0.38
<i>Barbarea verna</i>	Eudicotyledons	NC009269	45.4	0.45	0.38	0.29	0.37
<i>Boea hygrometrica</i>	Eudicotyledons	NC016468	46.9	0.45	0.38	0.3	0.38
<i>Brassica napus</i>	Eudicotyledons	NC016734	45.9	0.45	0.37	0.29	0.37
<i>Buxus microphylla</i>	Eudicotyledons	NC009599	47.8	0.46	0.38	0.31	0.38
<i>California macrophylla</i>	Eudicotyledons	NC019611	47.6	0.48	0.4	0.31	0.4
<i>Camellia sinensis</i>	Eudicotyledons	NC020019	46.4	0.45	0.38	0.29	0.38
<i>Capsella bursa-pastoris</i>	Eudicotyledons	NC009270	45.9	0.45	0.38	0.29	0.37
<i>Capsicum annuum</i>	Eudicotyledons	NC018552	47.2	0.46	0.38	0.31	0.38
<i>Carica papaya</i>	Eudicotyledons	NC010323	46.2	0.46	0.38	0.3	0.38
<i>Castanea mollissima</i>	Eudicotyledons	NC014674	46.6	0.45	0.38	0.3	0.38
<i>Chrysanthemum indicum</i>	Eudicotyledons	NC020320	46.9	0.46	0.38	0.3	0.38
<i>Cicer arietinum</i>	Eudicotyledons	NC011163	46	0.45	0.37	0.27	0.36
<i>Citrus sinensis</i>	Eudicotyledons	NC008334	48.6	0.46	0.38	0.32	0.39
<i>Coffea arabica</i>	Eudicotyledons	NC008535	46.6	0.46	0.38	0.3	0.38
<i>Corynocarpus laevigata</i>	Eudicotyledons	NC014807	46	0.46	0.38	0.29	0.38
<i>Crucihimalaya wallichii</i>	Eudicotyledons	NC009271	46.1	0.45	0.38	0.29	0.37
<i>Cucumis melo</i> subsp. <i>melo</i>	Eudicotyledons	NC015983	45.9	0.45	0.38	0.3	0.38

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCAll
<i>Cuscuta exaltata</i>	Eudicotyledons	NC009963	47.7	0.47	0.39	0.31	0.39
<i>Datura stramonium</i>	Eudicotyledons	NC018117	47.3	0.46	0.38	0.31	0.38
<i>Daucus carota</i>	Eudicotyledons	NC008325	47.3	0.46	0.38	0.3	0.38
<i>Draba nemorosa</i>	Eudicotyledons	NC009272	45.7	0.45	0.38	0.29	0.37
<i>Eleutherococcus senticosus</i>	Eudicotyledons	NC016430	47.5	0.46	0.38	0.31	0.38
<i>Epifagus virginiana</i>	Eudicotyledons	NC001568	44.3	0.41	0.36	0.29	0.35
<i>Erodium carvifolium</i>	Eudicotyledons	NC015083	50.3	0.48	0.4	0.33	0.4
<i>Eucalyptus globulus</i> subsp. <i>globulus</i>	Eudicotyledons	NC008115	46.4	0.45	0.38	0.3	0.38
<i>Fagopyrum esculentum</i> subsp. <i>ancestrale</i>	Eudicotyledons	NC010776	47.6	0.46	0.38	0.31	0.38
<i>Fragaria chiloensis</i>	Eudicotyledons	NC019601	47.2	0.46	0.38	0.3	0.38
<i>Geranium palmatum</i>	Eudicotyledons	NC014573	48.1	0.48	0.4	0.32	0.4
<i>Glycine max</i>	Eudicotyledons	NC007942	45.1	0.44	0.37	0.27	0.36
<i>Gossypium arboreum</i>	Eudicotyledons	NC016712	48	0.46	0.38	0.31	0.38
<i>Guizotia abyssinica</i>	Eudicotyledons	NC010601	46.7	0.46	0.38	0.3	0.38
<i>Helianthus annuus</i>	Eudicotyledons	NC007977	47.2	0.46	0.38	0.3	0.38
<i>Hevea brasiliensis</i>	Eudicotyledons	NC015308	46.4	0.45	0.37	0.29	0.37
<i>Ipomoea purpurea</i>	Eudicotyledons	NC009808	47.9	0.45	0.38	0.3	0.38
<i>Jacobaea vulgaris</i>	Eudicotyledons	NC015543	46.7	0.45	0.38	0.3	0.38
<i>Jasminum nudiflorum</i>	Eudicotyledons	NC008407	47	0.46	0.38	0.31	0.38
<i>Jatropha curcas</i>	Eudicotyledons	NC012224	46.4	0.45	0.38	0.29	0.37
<i>Lactuca sativa</i>	Eudicotyledons	NC007578	46.7	0.46	0.39	0.3	0.38
<i>Lathyrus sativus</i>	Eudicotyledons	NC014063	45.9	0.45	0.37	0.28	0.37
<i>Lepidium virginicum</i>	Eudicotyledons	NC009273	45.6	0.45	0.38	0.29	0.37
<i>Lobularia maritima</i>	Eudicotyledons	NC009274	45.9	0.45	0.38	0.29	0.37
<i>Lotus japonicus</i>	Eudicotyledons	NC002694	45.8	0.44	0.37	0.29	0.37
<i>Manihot esculenta</i>	Eudicotyledons	NC010433	46.6	0.45	0.38	0.28	0.37
<i>Medicago truncatula</i>	Eudicotyledons	NC003119	45	0.45	0.37	0.27	0.36
<i>Megaleranthis saniculifolia</i>	Eudicotyledons	NC012615	46.7	0.46	0.39	0.31	0.38
<i>Millettia pinnata</i>	Eudicotyledons	NC016708	45.8	0.44	0.37	0.27	0.36
<i>Monsonia speciosa</i>	Eudicotyledons	NC014582	49.5	0.49	0.4	0.35	0.41
<i>Morus indica</i>	Eudicotyledons	NC008359	46.1	0.45	0.38	0.29	0.37
<i>Nandina domestica</i>	Eudicotyledons	NC008336	46.4	0.46	0.39	0.31	0.39
<i>Nasturtium officinale</i>	Eudicotyledons	NC009275	45.4	0.45	0.38	0.29	0.37
<i>Nelumbo lutea</i>	Eudicotyledons	NC015605	46.8	0.46	0.39	0.31	0.39
<i>Nicotiana glauca</i>	Eudicotyledons	NC007500	47	0.46	0.38	0.3	0.38
<i>Oenothera argillicola</i>	Eudicotyledons	NC010358	47.4	0.48	0.38	0.33	0.4
<i>Olea europaea</i> subsp. <i>europaea</i>	Eudicotyledons	NC015401	46.8	0.46	0.38	0.3	0.38
<i>Olimarabidopsis pumila</i>	Eudicotyledons	NC009267	46	0.45	0.38	0.29	0.37
<i>Pachycladon ensyisii</i>	Eudicotyledons	NC018565	45.5	0.45	0.38	0.29	0.37
<i>Panax ginseng</i>	Eudicotyledons	NC006290	47	0.46	0.38	0.31	0.38
<i>Parthenium argentatum</i>	Eudicotyledons	NC013553	46.5	0.48	0.41	0.29	0.39
<i>Pelargonium x hortorum</i>	Eudicotyledons	NC008454	48.2	0.47	0.38	0.34	0.4
<i>Pentactina rupicola</i>	Eudicotyledons	NC016921	46.6	0.45	0.38	0.3	0.38
<i>Phaseolus vulgaris</i>	Eudicotyledons	NC009259	44.4	0.44	0.37	0.27	0.36
<i>Pisum sativum</i>	Eudicotyledons	NC014057	45.1	0.45	0.38	0.28	0.37
<i>Platanus occidentalis</i>	Eudicotyledons	NC008335	47.9	0.46	0.39	0.31	0.39
<i>Populus alba</i>	Eudicotyledons	NC008235	46.1	0.45	0.38	0.3	0.38

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Prunus persica</i>	Eudicotyledons	NC014697	47.2	0.45	0.38	0.3	0.38
<i>Pyrus pyrifolia</i>	Eudicotyledons	NC015996	46.9	0.45	0.38	0.3	0.38
<i>Quercus rubra</i>	Eudicotyledons	NC020152	46.8	0.45	0.38	0.31	0.38
<i>Ranunculus macranthus</i>	Eudicotyledons	NC008796	46.9	0.46	0.38	0.3	0.38
<i>Ricinus communis</i>	Eudicotyledons	NC016736	46.6	0.45	0.38	0.3	0.37
<i>Sesamum indicum</i>	Eudicotyledons	NC016433	46.5	0.46	0.39	0.3	0.38
<i>Silene conica</i>	Eudicotyledons	NC016729	46.4	0.45	0.37	0.29	0.37
<i>Solanum bulbocastanum</i>	Eudicotyledons	NC007943	46.7	0.46	0.38	0.31	0.38
<i>Spinacia oleracea</i>	Eudicotyledons	NC002202	46.2	0.46	0.38	0.28	0.37
<i>Tectona grandis</i>	Eudicotyledons	NC020098	46.6	0.46	0.38	0.31	0.38
<i>Theobroma cacao</i>	Eudicotyledons	NC014676	46.9	0.46	0.38	0.3	0.38
<i>Trachelium caeruleum</i>	Eudicotyledons	NC010442	46.5	0.46	0.38	0.31	0.38
<i>Trifolium subterraneum</i>	Eudicotyledons	NC011828	46	0.47	0.38	0.28	0.38
<i>Vaccinium macrocarpon</i>	Eudicotyledons	NC019616	46.5	0.47	0.39	0.28	0.38
<i>Vigna radiata</i>	Eudicotyledons	NC013843	43.8	0.44	0.37	0.27	0.36
<i>Vitis vinifera</i>	Eudicotyledons	NC007957	46.4	0.46	0.38	0.3	0.38
<i>Acidosasa purpurea</i>	Monocotyledons	NC015820	47.8	0.47	0.4	0.31	0.39
<i>Acorus americanus</i>	Monocotyledons	NC010093	48.2	0.47	0.39	0.31	0.39
<i>Agrostis stolonifera</i>	Monocotyledons	NC008591	47.6	0.47	0.4	0.3	0.39
<i>Anomochloa marantoidea</i>	Monocotyledons	NC014062	47.3	0.47	0.39	0.3	0.39
<i>Arundinaria gigantea</i>	Monocotyledons	NC020341	47.9	0.48	0.4	0.31	0.39
<i>Bambusa emeiensis</i>	Monocotyledons	NC015830	48	0.47	0.4	0.31	0.39
<i>Bismarckia nobilis</i>	Monocotyledons	NC020366	47	0.45	0.38	0.3	0.38
<i>Brachypodium distachyon</i>	Monocotyledons	NC011032	48.3	0.47	0.4	0.3	0.39
<i>Calamus caryotoides</i>	Monocotyledons	NC020365	47	0.45	0.38	0.3	0.38
<i>Coix lacryma-jobi</i>	Monocotyledons	NC013273	47.6	0.48	0.4	0.3	0.39
<i>Colocasia esculenta</i>	Monocotyledons	NC016753	45.9	0.46	0.39	0.3	0.38
<i>Dasypogon bromeliifolius</i>	Monocotyledons	NC020367	47.3	0.45	0.38	0.3	0.38
<i>Dendrocalamus latiflorus</i>	Monocotyledons	NC013088	47.7	0.47	0.4	0.31	0.39
<i>Dioscorea elephantipes</i>	Monocotyledons	NC009601	46.3	0.45	0.38	0.3	0.38
<i>Elaeis guineensis</i>	Monocotyledons	NC017602	46.8	0.45	0.38	0.3	0.38
<i>Eloдея canadensis</i>	Monocotyledons	NC018541	47	0.46	0.38	0.29	0.38
<i>Erycina pusilla</i>	Monocotyledons	NC018114	45.2	0.46	0.39	0.3	0.38
<i>Ferocalamus rimosivaginus</i>	Monocotyledons	NC015831	48	0.47	0.4	0.31	0.39
<i>Festuca altissima</i>	Monocotyledons	NC019648	47.9	0.47	0.4	0.3	0.39
<i>Heliconia collinsiana</i>	Monocotyledons	NC020362	47	0.46	0.38	0.3	0.38
<i>Hordeum vulgare</i> subsp. <i>vulgare</i>	Monocotyledons	NC008590	47.8	0.47	0.4	0.3	0.39
<i>Indocalamus longiauritus</i>	Monocotyledons	NC015803	47.8	0.48	0.4	0.31	0.39
<i>Leersia tisserantii</i>	Monocotyledons	NC016677	48.3	0.48	0.4	0.31	0.39
<i>Lemna minor</i>	Monocotyledons	NC010109	45.8	0.45	0.37	0.28	0.37
<i>Lolium multiflorum</i>	Monocotyledons	NC019651	48	0.47	0.4	0.3	0.39
<i>Neottia nidus avis</i>	Monocotyledons	NC016471	45.3	0.41	0.34	0.28	0.34
<i>Oncidium Gower Ramsey</i>	Monocotyledons	NC014056	46.5	0.47	0.39	0.3	0.39
<i>Oryza nivara</i>	Monocotyledons	NC005973	47.9	0.48	0.4	0.31	0.39
<i>Panicum virgatum</i>	Monocotyledons	NC015990	47.5	0.48	0.4	0.31	0.39
<i>Phalaenopsis aphrodite</i> subsp. <i>formosana</i>	Monocotyledons	NC007499	46.5	0.47	0.39	0.3	0.39
<i>Phoenix dactylifera</i>	Monocotyledons	NC013991	46.9	0.45	0.38	0.3	0.38
<i>Phyllostachys edulis</i>	Monocotyledons	NC015817	48	0.48	0.4	0.31	0.39

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Pseudophoenix vinifera</i>	Monocotyledons	NC020364	46.9	0.45	0.38	0.3	0.38
<i>Rhizanthella gardneri</i>	Monocotyledons	NC014874	48	0.41	0.35	0.32	0.36
<i>Rhynchozoa subulata</i>	Monocotyledons	NC016718	48	0.48	0.4	0.31	0.39
<i>Saccharum hybrid</i> cultivar NCo 310	Monocotyledons	NC006084	47.4	0.47	0.4	0.3	0.39
<i>Smilax china</i>	Monocotyledons	HM536959	47.6	0.46	0.39	0.31	0.39
<i>Sorghum bicolor</i>	Monocotyledons	NC008602	47.5	0.47	0.4	0.3	0.39
<i>Spirodela polyrhiza</i>	Monocotyledons	NC015891	46.3	0.45	0.38	0.29	0.37
<i>Triticum aestivum</i>	Monocotyledons	NC002762	47.4	0.47	0.4	0.3	0.39
<i>Typha latifolia</i>	Monocotyledons	NC013823	47.1	0.45	0.38	0.29	0.38
<i>Wolffia australiana</i>	Monocotyledons	NC015899	45.3	0.45	0.37	0.28	0.37
<i>Zea mays</i>	Monocotyledons	NC001666	47.7	0.47	0.4	0.3	0.39
<i>Zingiber spectabile</i>	Monocotyledons	NC020363	45.8	0.45	0.38	0.29	0.37
<i>Calycanthus floridus</i> var. <i>glaucus</i>	Magnoliids	NC004993	47.8	0.46	0.39	0.32	0.39
<i>Drimys granadensis</i>	Magnoliids	NC008456	47.3	0.46	0.39	0.32	0.39
<i>Liriodendron tulipifera</i>	Magnoliids	NC008326	48.1	0.46	0.39	0.32	0.39
<i>Magnolia denudata</i>	Magnoliids	NC018357	47.8	0.46	0.39	0.32	0.39
<i>Piper cenocladum</i>	Magnoliids	NC008457	48.2	0.46	0.39	0.32	0.39

Supplemental table 1. List of genes found in chloroplast genome of three species

Group of gene		Common genes	<i>O. cinnamomea</i>	<i>D. glaucum</i>	<i>L. japonicum</i>
RNA genes	Ribosomal RNAs	<i>rrn4.5(x2), rrn5(x2), rrn16(x2), rrn23(x2)</i>			
	Transfer RNAs	<i>trnA-UGC<sup>a</sup>(x2), trnC-GCA, trnD-GUC, trnE-UUC, trnF-GAA, trnFM-CAU, trnG-GCC, trnG-UCC<sup>a</sup>, trnI-CAU, trnI-GAU<sup>a</sup>(x2), trnL-UAG, trnM-CAU, trnN-GUU(x2), trnP-GGG, trnP-UGG, trnQ-UUG, trnR-ACG(x2), trnR-UCU, trnS-GCU, trnS-GGA, trnS-UGA, trnT-GGU, trnV-UAC<sup>a</sup>, trnW-CCA, trnY-GUA</i>	<i>trnH-GUG, trnK-CUU<sup>a</sup>, trnL-CAA, trnL-UAA<sup>a</sup>, trnR-CCG, trnS-CGA, trnT-UGU, trnV-GAC(x2),</i>	<i>trnH-GUG, trnL-CAA(x2), trnL-UAA<sup>a</sup>, trnR-CCG, trnV-GAC,</i>	<i>trnH-GUG(x2), trnL-UAA<sup>a</sup>,</i>
Protein genes	Photosynthesis				
	Photosystem I	<i>psaA, psaB, psaC, psal, psaJ, psaM</i>			
	Photosystem II	<i>psbA, psbB, psbC, psbD, psbE, psbF, psbH, psbI, psbJ, psbK, psbL, psbM, psbN, psbT, psbZ</i>			
	Cytochrome	<i>petA, petB<sup>a</sup>, petD<sup>a</sup>, petG, petL, petN</i>			
	ATP synthase	<i>atpA, atpB, atpE, atpF<sup>a</sup>, atpH, atpI</i>			
	Chlorophyll biosynthesis	<i>chlB, chlL, chlN</i>			
	Rubisco	<i>rbcL</i>			
	NADH dehydrogenase	<i>ndhA<sup>a</sup>, ndhB<sup>a</sup>, ndhC, ndhD, ndhE, ndhF, ndhG, ndhH, ndhI, ndhJ, ndhK</i>			
	ATP-dependent protease subunit P	<i>clpP<sup>a</sup></i>			
	Chloroplast envelope membrane protein	<i>cemA</i>			
Ribosomal proteins	large units	<i>rpl2<sup>a</sup>, rpl14, rpl16<sup>a</sup>, rpl20, rpl21, rpl22, rpl23, rpl32, rpl33, rpl36</i>			
	small units	<i>rps2, rps3, rps4, rps7, rps8, rps11, rps12<sup>a</sup>, rps14, rps15, rps16, rps18, rps19</i>			
Transcription /translation	RNA polymerase	<i>rpoA, rpoB, rpoC2</i>	<i>rpoC1<sup>a</sup></i>	<i>rpoC1<sup>a</sup></i>	<i>rpoC1</i>
	Initiation factor	<i>infA</i>			
	Miscellaneous proteins	<i>accD, ccsA, matK</i>			
	Hypothetical proteins & Conserved reading frame	<i>ycf2, ycf3<sup>a</sup>, ycf4, ycf12</i>	<i>φycf1</i>	<i>ycf1</i>	<i>φycf1</i>
Total			130	128	124

Supplemental table 2. The list of GC contents and ENC of 194 chloroplast genomes

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Anthceros formosae</i>	Anthocerotophyta	NC004543	41.6	0.44	0.39	0.22	0.35
<i>Nothoceros aenigmaticus</i>	Anthocerotophyta	NC020259	44.7	0.44	0.38	0.27	0.36
<i>Physcomitrella patens</i> subsp. <i>patens</i>	Bryophyta	NC005087	34.8	0.41	0.35	0.13	0.3
<i>Syntrichia ruralis</i>	Bryophyta	NC012052	35	0.41	0.35	0.13	0.3
<i>Aneura mirabilis</i>	Marchantiophyta	NC010359	47.8	0.46	0.4	0.32	0.39
<i>Marchantia polymorpha</i>	Marchantiophyta	NC001319	34.6	0.43	0.36	0.12	0.3
<i>Pellia endiviifolia</i>	Marchantiophyta	NC019628	45.1	0.44	0.37	0.26	0.36
<i>Ptilidium pulcherrimum</i>	Marchantiophyta	NC015402	40.2	0.43	0.37	0.2	0.33
<i>Huperzia lucidula</i>	Lycopodiophyta	NC006861	44.9	0.46	0.38	0.26	0.37
<i>Isoetes flaccida</i>	Lycopodiophyta	NC014675	47	0.47	0.39	0.28	0.38
<i>Selaginella moellendorffii</i>	Lycopodiophyta	NC013086	54	0.56	0.51	0.45	0.51
<i>Selaginella uncinata</i>	Lycopodiophyta	AB197035	55.4	0.59	0.55	0.49	0.54
<i>Adiantum capillus-veneris</i>	Pteridophyta (core leptosporangiate ferns)	NC004766	52	0.47	0.41	0.37	0.42
<i>Cheilanthes lindheimeri</i>	Pteridophyta (core leptosporangiate ferns)	NC014592	52.2	0.48	0.41	0.38	0.42
<i>Pteridium aquilinum</i> subsp. <i>aquilinum</i>	Pteridophyta (core leptosporangiate ferns)	NC014348	52.1	0.48	0.41	0.36	0.41
<i>Alsophila spinulosa</i>	Pteridophyta (core leptosporangiate ferns)	NC012818	51.3	0.47	0.41	0.34	0.41
<i>Marsilea crenata</i>	Pteridophyta (core leptosporangiate ferns)	KC536646	52.7	0.49	0.41	0.37	0.42
<i>Lygodium japonicum</i>	Pteridophyta (early diverged leptosporangiate ferns)	KF225593	49.7	0.47	0.4	0.36	0.41
<i>Diplopterigium glaucum</i>	Pteridophyta (early diverged leptosporangiate ferns)	KF225594	49.8	0.47	0.41	0.33	0.4
<i>Osmunda cinnamomea</i>	Pteridophyta (early diverged leptosporangiate ferns)	KF225592	46.7	0.47	0.41	0.31	0.4
<i>Angiopteris evecta</i>	Pteridophyta (eusporangiate ferns)	NC008829	43.3	0.45	0.38	0.24	0.36
<i>Ophioglossum californicum</i>	Pteridophyta (eusporangiate ferns)	NC020147	49.3	0.48	0.41	0.35	0.41
<i>Mankyua chejuensis</i>	Pteridophyta (eusporangiate ferns)	NC017006	46	0.46	0.39	0.29	0.38
<i>Psilotum nudum</i>	Pteridophyta (eusporangiate ferns)	NC003386	43.5	0.45	0.38	0.26	0.36
<i>Equisetum arvense</i>	Pteridophyta (eusporangiate ferns)	NC014699	40.1	0.44	0.36	0.21	0.34
<i>Equisetum hyemale</i>	Pteridophyta (eusporangiate ferns)	NC020146	41.2	0.43	0.36	0.22	0.34
<i>Ginkgo biloba</i>	Ginkgophyta	NC016986	47.7	0.48	0.4	0.3	0.39
<i>Ephedra equisetina</i>	Gnetophyta	NC011954	44.7	0.44	0.35	0.26	0.35
<i>Gnetum parvifolium</i>	Gnetophyta	NC011942	48	0.45	0.37	0.3	0.37
<i>Welwitschia mirabilis</i>	Gnetophyta	NC010654	45.5	0.44	0.36	0.27	0.36
<i>Cycas revoluta</i>	Cycadophyta	NC020319	47.9	0.47	0.39	0.3	0.39
<i>Cycas taitungensis</i>	Cycadophyta	NC009618	47.8	0.47	0.39	0.3	0.39
<i>Cathaya argyrophylla</i>	Pinophyta	NC014589	48	0.49	0.4	0.3	0.4
<i>Cedrus deodara</i>	Pinophyta	NC014575	46.6	0.48	0.39	0.31	0.39
<i>Cephalotaxus wilsoniana</i>	Pinophyta	NC016063	46.4	0.45	0.36	0.27	0.36
<i>Cryptomeria japonica</i>	Pinophyta	NC010548	45	0.46	0.37	0.28	0.37
<i>Keteleeria davidiana</i>	Pinophyta	NC011930	46.9	0.48	0.39	0.3	0.39

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Larix decidua</i>	Pinophyta	NC016058	47.6	0.48	0.39	0.3	0.39
<i>Picea morrissonicola</i>	Pinophyta	NC016069	47.6	0.48	0.39	0.31	0.39
<i>Picea sitchensis</i>	Pinophyta	NC011152	46.6	0.49	0.4	0.3	0.4
<i>Pinus contorta</i>	Pinophyta	NC011153	47.6	0.48	0.39	0.3	0.39
<i>Pinus gerardiana</i>	Pinophyta	NC011154	47.1	0.48	0.39	0.3	0.39
<i>Pinus koraiensis</i>	Pinophyta	NC004677	47	0.48	0.39	0.31	0.39
<i>Pinus krempfii</i>	Pinophyta	NC011155	47.2	0.48	0.39	0.31	0.39
<i>Pinus lambertiana</i>	Pinophyta	NC011156	47	0.48	0.39	0.31	0.39
<i>Pinus monophylla</i>	Pinophyta	NC011158	47.4	0.47	0.39	0.3	0.39
<i>Pinus nelsonii</i>	Pinophyta	NC011159	47.5	0.48	0.39	0.3	0.39
<i>Pinus thunbergii</i>	Pinophyta	NC001631	47.7	0.5	0.4	0.3	0.4
<i>Podocarpus totara</i>	Pinophyta	NC020361	48.2	0.47	0.37	0.3	0.38
<i>Pseudotsuga sinensis</i> var. <i>wilsoniana</i>	Pinophyta	NC016064	47.6	0.48	0.39	0.3	0.39
<i>Taiwania cryptomerioides</i>	Pinophyta	NC016065	45.6	0.45	0.36	0.26	0.36
<i>Taxus mairei</i>	Pinophyta	NC020321	45.8	0.46	0.38	0.27	0.37
<i>Amborella trichopoda</i>	Magnoliophyta (Basal lineages)	NC005086	48.3	0.46	0.39	0.32	0.39
<i>Chloranthus spicatus</i>	Magnoliophyta (Basal lineages)	NC009598	47.1	0.46	0.39	0.32	0.39
<i>Illicium oligandrum</i>	Magnoliophyta (Basal lineages)	NC009600	47.8	0.47	0.39	0.32	0.39
<i>Nuphar advena</i>	Magnoliophyta (Basal lineages)	NC008788	48.4	0.46	0.39	0.32	0.39
<i>Nymphaea alba</i>	Magnoliophyta (Basal lineages)	NC006050	48.1	0.46	0.39	0.32	0.39
<i>Trithuria inconspicua</i>	Magnoliophyta (Basal lineages)	NC020372	48.6	0.47	0.38	0.34	0.4
<i>Ceratophyllum demersum</i>	Ceratophyllales	NC009962	47.5	0.46	0.39	0.31	0.38
<i>Aethionema cordifolium</i>	Eudicotyledons	NC009265	45.6	0.45	0.38	0.29	0.37
<i>Ageratina adenophora</i>	Eudicotyledons	NC015621	47.2	0.46	0.39	0.3	0.38
<i>Anthriscus cerefolium</i>	Eudicotyledons	NC015113	47.6	0.45	0.38	0.3	0.38
<i>Arabidopsis thaliana</i>	Eudicotyledons	NC000932	45.8	0.45	0.38	0.29	0.37
<i>Arabis hirsuta</i>	Eudicotyledons	NC009268	45.8	0.45	0.38	0.29	0.37
<i>Atropa belladonna</i>	Eudicotyledons	NC004561	46.8	0.46	0.38	0.3	0.38
<i>Barbarea verna</i>	Eudicotyledons	NC009269	45.4	0.45	0.38	0.29	0.37
<i>Boea hygrometrica</i>	Eudicotyledons	NC016468	46.9	0.45	0.38	0.3	0.38
<i>Brassica napus</i>	Eudicotyledons	NC016734	45.9	0.45	0.37	0.29	0.37
<i>Buxus microphylla</i>	Eudicotyledons	NC009599	47.8	0.46	0.38	0.31	0.38
<i>California macrophylla</i>	Eudicotyledons	NC019611	47.6	0.48	0.4	0.31	0.4
<i>Camellia sinensis</i>	Eudicotyledons	NC020019	46.4	0.45	0.38	0.29	0.38
<i>Capsella bursa-pastoris</i>	Eudicotyledons	NC009270	45.9	0.45	0.38	0.29	0.37
<i>Capsicum annuum</i>	Eudicotyledons	NC018552	47.2	0.46	0.38	0.31	0.38
<i>Carica papaya</i>	Eudicotyledons	NC010323	46.2	0.46	0.38	0.3	0.38
<i>Castanea mollissima</i>	Eudicotyledons	NC014674	46.6	0.45	0.38	0.3	0.38
<i>Chrysanthemum indicum</i>	Eudicotyledons	NC020320	46.9	0.46	0.38	0.3	0.38
<i>Cicer arietinum</i>	Eudicotyledons	NC011163	46	0.45	0.37	0.27	0.36
<i>Citrus sinensis</i>	Eudicotyledons	NC008334	48.6	0.46	0.38	0.32	0.39
<i>Coffea arabica</i>	Eudicotyledons	NC008535	46.6	0.46	0.38	0.3	0.38
<i>Corynocarpus laevigata</i>	Eudicotyledons	NC014807	46	0.46	0.38	0.29	0.38
<i>Crucihimalaya wallichii</i>	Eudicotyledons	NC009271	46.1	0.45	0.38	0.29	0.37
<i>Cucumis melo</i> subsp. <i>melo</i>	Eudicotyledons	NC015983	45.9	0.45	0.38	0.3	0.38



Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCAll
<i>Cuscuta exaltata</i>	Eudicotyledons	NC009963	47.7	0.47	0.39	0.31	0.39
<i>Datura stramonium</i>	Eudicotyledons	NC018117	47.3	0.46	0.38	0.31	0.38
<i>Daucus carota</i>	Eudicotyledons	NC008325	47.3	0.46	0.38	0.3	0.38
<i>Draba nemorosa</i>	Eudicotyledons	NC009272	45.7	0.45	0.38	0.29	0.37
<i>Eleutherococcus senticosus</i>	Eudicotyledons	NC016430	47.5	0.46	0.38	0.31	0.38
<i>Epifagus virginiana</i>	Eudicotyledons	NC001568	44.3	0.41	0.36	0.29	0.35
<i>Erodium carvifolium</i>	Eudicotyledons	NC015083	50.3	0.48	0.4	0.33	0.4
<i>Eucalyptus globulus</i> subsp. <i>globulus</i>	Eudicotyledons	NC008115	46.4	0.45	0.38	0.3	0.38
<i>Fagopyrum esculentum</i> subsp. <i>ancestrale</i>	Eudicotyledons	NC010776	47.6	0.46	0.38	0.31	0.38
<i>Fragaria chiloensis</i>	Eudicotyledons	NC019601	47.2	0.46	0.38	0.3	0.38
<i>Geranium palmatum</i>	Eudicotyledons	NC014573	48.1	0.48	0.4	0.32	0.4
<i>Glycine max</i>	Eudicotyledons	NC007942	45.1	0.44	0.37	0.27	0.36
<i>Gossypium arboreum</i>	Eudicotyledons	NC016712	48	0.46	0.38	0.31	0.38
<i>Guizotia abyssinica</i>	Eudicotyledons	NC010601	46.7	0.46	0.38	0.3	0.38
<i>Helianthus annuus</i>	Eudicotyledons	NC007977	47.2	0.46	0.38	0.3	0.38
<i>Hevea brasiliensis</i>	Eudicotyledons	NC015308	46.4	0.45	0.37	0.29	0.37
<i>Ipomoea purpurea</i>	Eudicotyledons	NC009808	47.9	0.45	0.38	0.3	0.38
<i>Jacobaea vulgaris</i>	Eudicotyledons	NC015543	46.7	0.45	0.38	0.3	0.38
<i>Jasminum nudiflorum</i>	Eudicotyledons	NC008407	47	0.46	0.38	0.31	0.38
<i>Jatropha curcas</i>	Eudicotyledons	NC012224	46.4	0.45	0.38	0.29	0.37
<i>Lactuca sativa</i>	Eudicotyledons	NC007578	46.7	0.46	0.39	0.3	0.38
<i>Lathyrus sativus</i>	Eudicotyledons	NC014063	45.9	0.45	0.37	0.28	0.37
<i>Lepidium virginicum</i>	Eudicotyledons	NC009273	45.6	0.45	0.38	0.29	0.37
<i>Lobularia maritima</i>	Eudicotyledons	NC009274	45.9	0.45	0.38	0.29	0.37
<i>Lotus japonicus</i>	Eudicotyledons	NC002694	45.8	0.44	0.37	0.29	0.37
<i>Manihot esculenta</i>	Eudicotyledons	NC010433	46.6	0.45	0.38	0.28	0.37
<i>Medicago truncatula</i>	Eudicotyledons	NC003119	45	0.45	0.37	0.27	0.36
<i>Megaleranthis saniculifolia</i>	Eudicotyledons	NC012615	46.7	0.46	0.39	0.31	0.38
<i>Millettia pinnata</i>	Eudicotyledons	NC016708	45.8	0.44	0.37	0.27	0.36
<i>Monsonia speciosa</i>	Eudicotyledons	NC014582	49.5	0.49	0.4	0.35	0.41
<i>Morus indica</i>	Eudicotyledons	NC008359	46.1	0.45	0.38	0.29	0.37
<i>Nandina domestica</i>	Eudicotyledons	NC008336	46.4	0.46	0.39	0.31	0.39
<i>Nasturtium officinale</i>	Eudicotyledons	NC009275	45.4	0.45	0.38	0.29	0.37
<i>Nelumbo lutea</i>	Eudicotyledons	NC015605	46.8	0.46	0.39	0.31	0.39
<i>Nicotiana glauca</i>	Eudicotyledons	NC007500	47	0.46	0.38	0.3	0.38
<i>Oenothera argillicola</i>	Eudicotyledons	NC010358	47.4	0.48	0.38	0.33	0.4
<i>Olea europaea</i> subsp. <i>europaea</i>	Eudicotyledons	NC015401	46.8	0.46	0.38	0.3	0.38
<i>Olimarabidopsis pumila</i>	Eudicotyledons	NC009267	46	0.45	0.38	0.29	0.37
<i>Pachycladon ensyisii</i>	Eudicotyledons	NC018565	45.5	0.45	0.38	0.29	0.37
<i>Panax ginseng</i>	Eudicotyledons	NC006290	47	0.46	0.38	0.31	0.38
<i>Parthenium argentatum</i>	Eudicotyledons	NC013553	46.5	0.48	0.41	0.29	0.39
<i>Pelargonium x hortorum</i>	Eudicotyledons	NC008454	48.2	0.47	0.38	0.34	0.4
<i>Pentactina rupicola</i>	Eudicotyledons	NC016921	46.6	0.45	0.38	0.3	0.38
<i>Phaseolus vulgaris</i>	Eudicotyledons	NC009259	44.4	0.44	0.37	0.27	0.36
<i>Pisum sativum</i>	Eudicotyledons	NC014057	45.1	0.45	0.38	0.28	0.37
<i>Platanus occidentalis</i>	Eudicotyledons	NC008335	47.9	0.46	0.39	0.31	0.39
<i>Populus alba</i>	Eudicotyledons	NC008235	46.1	0.45	0.38	0.3	0.38

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Prunus persica</i>	Eudicotyledons	NC014697	47.2	0.45	0.38	0.3	0.38
<i>Pyrus pyrifolia</i>	Eudicotyledons	NC015996	46.9	0.45	0.38	0.3	0.38
<i>Quercus rubra</i>	Eudicotyledons	NC020152	46.8	0.45	0.38	0.31	0.38
<i>Ranunculus macranthus</i>	Eudicotyledons	NC008796	46.9	0.46	0.38	0.3	0.38
<i>Ricinus communis</i>	Eudicotyledons	NC016736	46.6	0.45	0.38	0.3	0.37
<i>Sesamum indicum</i>	Eudicotyledons	NC016433	46.5	0.46	0.39	0.3	0.38
<i>Silene conica</i>	Eudicotyledons	NC016729	46.4	0.45	0.37	0.29	0.37
<i>Solanum bulbocastanum</i>	Eudicotyledons	NC007943	46.7	0.46	0.38	0.31	0.38
<i>Spinacia oleracea</i>	Eudicotyledons	NC002202	46.2	0.46	0.38	0.28	0.37
<i>Tectona grandis</i>	Eudicotyledons	NC020098	46.6	0.46	0.38	0.31	0.38
<i>Theobroma cacao</i>	Eudicotyledons	NC014676	46.9	0.46	0.38	0.3	0.38
<i>Trachelium caeruleum</i>	Eudicotyledons	NC010442	46.5	0.46	0.38	0.31	0.38
<i>Trifolium subterraneum</i>	Eudicotyledons	NC011828	46	0.47	0.38	0.28	0.38
<i>Vaccinium macrocarpon</i>	Eudicotyledons	NC019616	46.5	0.47	0.39	0.28	0.38
<i>Vigna radiata</i>	Eudicotyledons	NC013843	43.8	0.44	0.37	0.27	0.36
<i>Vitis vinifera</i>	Eudicotyledons	NC007957	46.4	0.46	0.38	0.3	0.38
<i>Acidosasa purpurea</i>	Monocotyledons	NC015820	47.8	0.47	0.4	0.31	0.39
<i>Acorus americanus</i>	Monocotyledons	NC010093	48.2	0.47	0.39	0.31	0.39
<i>Agrostis stolonifera</i>	Monocotyledons	NC008591	47.6	0.47	0.4	0.3	0.39
<i>Anomochloa marantoidea</i>	Monocotyledons	NC014062	47.3	0.47	0.39	0.3	0.39
<i>Arundinaria gigantea</i>	Monocotyledons	NC020341	47.9	0.48	0.4	0.31	0.39
<i>Bambusa emeiensis</i>	Monocotyledons	NC015830	48	0.47	0.4	0.31	0.39
<i>Bismarckia nobilis</i>	Monocotyledons	NC020366	47	0.45	0.38	0.3	0.38
<i>Brachypodium distachyon</i>	Monocotyledons	NC011032	48.3	0.47	0.4	0.3	0.39
<i>Calamus caryotoides</i>	Monocotyledons	NC020365	47	0.45	0.38	0.3	0.38
<i>Coix lacryma-jobi</i>	Monocotyledons	NC013273	47.6	0.48	0.4	0.3	0.39
<i>Colocasia esculenta</i>	Monocotyledons	NC016753	45.9	0.46	0.39	0.3	0.38
<i>Dasypogon bromeliifolius</i>	Monocotyledons	NC020367	47.3	0.45	0.38	0.3	0.38
<i>Dendrocalamus latiflorus</i>	Monocotyledons	NC013088	47.7	0.47	0.4	0.31	0.39
<i>Dioscorea elephantipes</i>	Monocotyledons	NC009601	46.3	0.45	0.38	0.3	0.38
<i>Elaeis guineensis</i>	Monocotyledons	NC017602	46.8	0.45	0.38	0.3	0.38
<i>Eloдея canadensis</i>	Monocotyledons	NC018541	47	0.46	0.38	0.29	0.38
<i>Erycina pusilla</i>	Monocotyledons	NC018114	45.2	0.46	0.39	0.3	0.38
<i>Ferocalamus rimosivaginus</i>	Monocotyledons	NC015831	48	0.47	0.4	0.31	0.39
<i>Festuca altissima</i>	Monocotyledons	NC019648	47.9	0.47	0.4	0.3	0.39
<i>Heliconia collinsiana</i>	Monocotyledons	NC020362	47	0.46	0.38	0.3	0.38
<i>Hordeum vulgare</i> subsp. <i>vulgare</i>	Monocotyledons	NC008590	47.8	0.47	0.4	0.3	0.39
<i>Indocalamus longiauritus</i>	Monocotyledons	NC015803	47.8	0.48	0.4	0.31	0.39
<i>Leersia tisserantii</i>	Monocotyledons	NC016677	48.3	0.48	0.4	0.31	0.39
<i>Lemna minor</i>	Monocotyledons	NC010109	45.8	0.45	0.37	0.28	0.37
<i>Lolium multiflorum</i>	Monocotyledons	NC019651	48	0.47	0.4	0.3	0.39
<i>Neottia nidus avis</i>	Monocotyledons	NC016471	45.3	0.41	0.34	0.28	0.34
<i>Oncidium Gower Ramsey</i>	Monocotyledons	NC014056	46.5	0.47	0.39	0.3	0.39
<i>Oryza nivara</i>	Monocotyledons	NC005973	47.9	0.48	0.4	0.31	0.39
<i>Panicum virgatum</i>	Monocotyledons	NC015990	47.5	0.48	0.4	0.31	0.39
<i>Phalaenopsis aphrodite</i> subsp. <i>formosana</i>	Monocotyledons	NC007499	46.5	0.47	0.39	0.3	0.39
<i>Phoenix dactylifera</i>	Monocotyledons	NC013991	46.9	0.45	0.38	0.3	0.38
<i>Phyllostachys edulis</i>	Monocotyledons	NC015817	48	0.48	0.4	0.31	0.39

Taxa	Group	GenBank	ENC (mean)	GC1	GC2	GC3	GCall
<i>Pseudophoenix vinifera</i>	Monocotyledons	NC020364	46.9	0.45	0.38	0.3	0.38
<i>Rhizanthella gardneri</i>	Monocotyledons	NC014874	48	0.41	0.35	0.32	0.36
<i>Rhynchoryza subulata</i>	Monocotyledons	NC016718	48	0.48	0.4	0.31	0.39
<i>Saccharum hybrid</i> cultivar NCo 310	Monocotyledons	NC006084	47.4	0.47	0.4	0.3	0.39
<i>Smilax china</i>	Monocotyledons	HM536959	47.6	0.46	0.39	0.31	0.39
<i>Sorghum bicolor</i>	Monocotyledons	NC008602	47.5	0.47	0.4	0.3	0.39
<i>Spirodela polyrhiza</i>	Monocotyledons	NC015891	46.3	0.45	0.38	0.29	0.37
<i>Triticum aestivum</i>	Monocotyledons	NC002762	47.4	0.47	0.4	0.3	0.39
<i>Typha latifolia</i>	Monocotyledons	NC013823	47.1	0.45	0.38	0.29	0.38
<i>Wolffia australiana</i>	Monocotyledons	NC015899	45.3	0.45	0.37	0.28	0.37
<i>Zea mays</i>	Monocotyledons	NC001666	47.7	0.47	0.4	0.3	0.39
<i>Zingiber spectabile</i>	Monocotyledons	NC020363	45.8	0.45	0.38	0.29	0.37
<i>Calycanthus floridus</i> var. <i>glaucus</i>	Magnoliids	NC004993	47.8	0.46	0.39	0.32	0.39
<i>Drimys granadensis</i>	Magnoliids	NC008456	47.3	0.46	0.39	0.32	0.39
<i>Liriodendron tulipifera</i>	Magnoliids	NC008326	48.1	0.46	0.39	0.32	0.39
<i>Magnolia denudata</i>	Magnoliids	NC018357	47.8	0.46	0.39	0.32	0.39
<i>Piper cenocladum</i>	Magnoliids	NC008457	48.2	0.46	0.39	0.32	0.39

Supplementary table 2. List of genes found in chloroplast genome of three species

Group of gene		Common genes	<i>O. cinnamomea</i>	<i>D. glaucum</i>	<i>L. japonicum</i>
RNA genes	Ribosomal RNAs	<i>rrn4.5(x2), rrn5(x2), rrn16(x2), rrn23(x2)</i>			
	Transfer RNAs	<i>trnA</i> -UGC <sup>a</sup> (x2), <i>trnC</i> -GCA, <i>trnD</i> -GUC, <i>trnE</i> -UUC, <i>trnF</i> -GAA, <i>trnFM</i> -CAU, <i>trnG</i> -GCC, <i>trnG</i> -UCC <sup>a</sup> , <i>trnI</i> -CAU, <i>trnI</i> -GAU <sup>a</sup> (x2), <i>trnL</i> -UAG, <i>trnM</i> -CAU, <i>trnN</i> -GUU(x2), <i>trnP</i> -GGG, <i>trnP</i> -UGG, <i>trnQ</i> -UUG, <i>trnR</i> -ACG(x2), <i>trnR</i> -UCU, <i>trnS</i> -GCU, <i>trnS</i> -GGA, <i>trnS</i> -UGA, <i>trnT</i> -GGU, <i>trnV</i> -UAC <sup>a</sup> , <i>trnW</i> -CCA, <i>trnY</i> -GUA	<i>trnH</i> -GUG, <i>trnK</i> -CUU <sup>a</sup> , <i>trnL</i> -CAA, <i>trnL</i> -UAA <sup>a</sup> , <i>trnR</i> -CCG, <i>trnS</i> -CGA, <i>trnT</i> -UGU, <i>trnV</i> -GAC(x2),	<i>trnH</i> -GUG, <i>trnL</i> -CAA(x2), <i>trnL</i> -UAA <sup>a</sup> , <i>trnR</i> -CCG, <i>trnV</i> -GAC,	<i>trnH</i> -GUG(x2), <i>trnL</i> -UAA <sup>a</sup> ,
Protein genes	Photosynthesis				
	Photosystem I	<i>psaA, psaB, psaC, psal, psaJ, psaM</i>			
	Photosystem II	<i>psbA, psbB, psbC, psbD, psbE, psbF, psbH, psbI, psbJ, psbK, psbL, psbM, psbN, psbT, psbZ</i>			
	Cytochrome	<i>petA, petB<sup>a</sup>, petD<sup>a</sup>, petG, petL, petN</i>			
	ATP synthase	<i>atpA, atpB, atpE, atpF<sup>a</sup>, atpH, atpI</i>			
	Chlorophyll biosynthesis	<i>chlB, chlL, chlN</i>			
	Rubisco	<i>rbcL</i>			
	NADH dehydrogenase	<i>ndhA<sup>a</sup>, ndhB<sup>a</sup>, ndhC, ndhD, ndhE, ndhF, ndhG, ndhH, ndhI, ndhJ, ndhK</i>			
	ATP-dependent protease subunit P	<i>clpP<sup>a</sup></i>			
	Chloroplast envelope membrane protein	<i>cemA</i>			
Ribosomal proteins	large units	<i>rpl2<sup>a</sup>, rpl14, rpl16<sup>a</sup>, rpl20, rpl21, rpl22, rpl23, rpl32, rpl33, rpl36</i>			
	small units	<i>rps2, rps3, rps4, rps7, rps8, rps11, rps12<sup>a</sup>, rps14, rps15, rps16, rps18, rps19</i>			
Transcription /translation	RNA polymerase	<i>rpoA, rpoB, rpoC2</i>	<i>rpoC1<sup>a</sup></i>	<i>rpoC1<sup>a</sup></i>	<i>rpoC1</i>
	Initiation factor	<i>infA</i>			
	Miscellaneous proteins	<i>accD, ccsA, matK</i>			
	Hypothetical proteins & Conserved reading frame	<i>ycf2, ycf3<sup>a</sup>, ycf4, ycf12</i>	<i>φycf1</i>	<i>ycf1</i>	<i>φycf1</i>
Total			130	128	124