

## *Supplementary Material*

**Table S1. Gene with introns in *Z. officinale* chloroplast genome.**

| Gene     | Location | Exon I (bp) | Intron I (bp) | Exon II (bp) | Intron II (bp) | Exon III (bp) |
|----------|----------|-------------|---------------|--------------|----------------|---------------|
| atpF     | LSC      | 144         | 809           | 411          |                |               |
| clpP     | LSC      | 69          | 826           | 296          | 629            | 253           |
| ndhA     | SSC      | 553         | 1061          | 539          |                |               |
| ndhB     | IR       | 777         | 700           | 756          |                |               |
| petB     | LSC      | 6           | 784           | 642          |                |               |
| petD     | LSC      | 8           | 746           | 475          |                |               |
| rpl16    | LSC      | 9           | 1051          | 402          |                |               |
| rpl2     | IR       | 397         | 665           | 431          |                |               |
| rpoC1    | LSC      | 428         | 732           | 1627         |                |               |
| rps7     | IR       | 231         | 540           | 27           |                |               |
| rps12*   | LSC      | 114         | -             | 231          | 541            | 27            |
| rps16    | LSC      | 40          | 732           | 212          |                |               |
| trnA-UGC | IR       | 38          | 801           | 35           |                |               |
| trnG-UCC | LSC      | 23          | 682           | 41           |                |               |
| trnI-GAU | IR       | 42          | 935           | 35           |                |               |
| trnK-UUU | LSC      | 35          | 2591          | 37           |                |               |
| trnL-UAA | LSC      | 35          | 519           | 50           |                |               |
| trnV-UAC | LSC      | 38          | 606           | 37           |                |               |
| trnV-GAC | IR       | 27          | 540           | 231          |                |               |
| ycf3     | LSC      | 127         | 715           | 230          | 806            | 153           |

**Table S2. Codon usage of *Z. officinale* chloroplast genome.**

| Amino acid | Codon | No.  | RSCU | tRNA        | Amino acid | Codon | No.  | RSCU | tRNA     |
|------------|-------|------|------|-------------|------------|-------|------|------|----------|
| Phe        | UUU   | 952  | 1.28 |             | Tyr        | UAU   | 792  | 1.57 |          |
| Phe        | UUC   | 531  | 0.72 | trnF-GAA    | Tyr        | UAC   | 214  | 0.43 | trnY-GUA |
| Leu        | UUA   | 865  | 1.9  | trnL-UAA    | Stop       | UAA   | 49   | 1.71 |          |
| Leu        | UUG   | 575  | 1.26 | trnL-CAA    | Stop       | UAG   | 23   | 0.8  |          |
| Leu        | CUU   | 583  | 1.28 |             | His        | CAU   | 497  | 1.57 |          |
| Leu        | CUC   | 178  | 0.39 |             | His        | CAC   | 138  | 0.43 | trnH-GUG |
| Leu        | CUA   | 374  | 0.82 | trnL-UAG    | Gln        | CAA   | 700  | 1.53 | trnQ-UUG |
| Leu        | CUG   | 157  | 0.34 |             | Gln        | CAG   | 215  | 0.47 |          |
| Ile        | AUU   | 1155 | 1.49 |             | Asn        | AAU   | 984  | 1.55 |          |
| Ile        | AUC   | 420  | 0.54 | trnI-GAU    | Asn        | AAC   | 289  | 0.45 | trnN-GUU |
| Ile        | AUA   | 756  | 0.97 | trnI-CAU    | Lys        | AAA   | 1070 | 1.47 | trnK-UUU |
| Met        | AUG   | 616  | 1    | trn(f)M-CAU | Lys        | AAG   | 381  | 0.53 |          |
| Val        | GUU   | 509  | 1.44 |             | Asp        | GAU   | 881  | 1.66 |          |
| Val        | GUC   | 164  | 0.46 | trnV-GAC    | Asp        | GAC   | 181  | 0.34 | trnD-GUC |
| Val        | GUA   | 547  | 1.54 | trnV-UAC    | Glu        | GAA   | 1063 | 1.5  | trnE-UUC |
| Val        | GUG   | 198  | 0.56 |             | Glu        | GAG   | 355  | 0.5  |          |
| Ser        | UCU   | 600  | 1.73 |             | Cys        | UGU   | 237  | 1.56 |          |
| Ser        | UCC   | 338  | 0.97 | trnS-GGA    | Cys        | UGC   | 66   | 0.44 | trnC-GCA |
| Ser        | UCA   | 419  | 1.21 | trnS-UGA    | Stop       | UGA   | 14   | 0.49 |          |
| Ser        | UCG   | 187  | 0.54 |             | Trp        | UGG   | 456  | 1    | trnW-CCA |
| Pro        | CCU   | 444  | 1.65 |             | Arg        | CGU   | 365  | 1.36 | trnR-ACG |
| Pro        | CCC   | 200  | 0.74 |             | Arg        | CGC   | 88   | 0.33 |          |
| Pro        | CCA   | 307  | 1.14 | trnP-UGG    | Arg        | CGA   | 342  | 1.27 |          |
| Pro        | CCG   | 123  | 0.46 |             | Arg        | CGG   | 110  | 0.41 |          |
| Thr        | ACU   | 531  | 1.58 |             | Arg        | AGA   | 438  | 1.26 | trnR-UCU |
| Thr        | ACC   | 232  | 0.69 | trnT-GGU    | Arg        | AGG   | 103  | 0.3  |          |
| Thr        | ACA   | 421  | 1.25 | trnT-UGU    | Ser        | AGU   | 533  | 1.99 |          |
| Thr        | ACG   | 158  | 0.47 |             | Ser        | AGC   | 173  | 0.64 | trnS-GCU |
| Ala        | GCU   | 615  | 1.81 |             | Gly        | GGU   | 602  | 1.39 |          |
| Ala        | GCC   | 208  | 0.61 |             | Gly        | GGC   | 139  | 0.32 | trnG-GCC |
| Ala        | GCA   | 423  | 1.25 | trnA-UGC    | Gly        | GGA   | 717  | 1.65 | trnG-UCC |
| Ala        | GCG   | 111  | 0.33 |             | Gly        | GGG   | 277  | 0.64 |          |

RSCU: Relative Synonymous Codon Usage.

Table S3. Simple sequence repeats (SSRs) in *Z. officinale* chloroplast genome.

| specie             | SSR nr. | SSR type | SSR     | size | start | end   |
|--------------------|---------|----------|---------|------|-------|-------|
| <i>A. villosum</i> | 1       | p2       | (AT)5   | 10   | 2633  | 2642  |
|                    | 2       | p3       | (AAT)4  | 12   | 3437  | 3448  |
|                    | 3       | p1       | (T)11   | 11   | 5487  | 5497  |
|                    | 4       | p1       | (T)10   | 10   | 6535  | 6544  |
|                    | 5       | p1       | (A)11   | 11   | 7091  | 7101  |
|                    | 6       | p1       | (T)10   | 10   | 8391  | 8400  |
|                    | 7       | p4       | (TTAT)3 | 12   | 12508 | 12519 |
|                    | 8       | p1       | (T)10   | 10   | 12692 | 12701 |
|                    | 9       | p3       | (AAT)4  | 12   | 12745 | 12756 |
|                    | 10      | p1       | (T)12   | 12   | 13455 | 13466 |
|                    | 11      | p4       | (TTTA)3 | 12   | 13475 | 13486 |
|                    | 12      | p2       | (AT)7   | 14   | 14568 | 14581 |
|                    | 13      | p4       | (TTAT)3 | 12   | 14695 | 14706 |
|                    | 14      | p4       | (TTAT)3 | 12   | 14715 | 14726 |
|                    | 15      | p2       | (AT)6   | 12   | 14853 | 14864 |
|                    | 16      | p2       | (AT)9   | 18   | 14936 | 14953 |
|                    | 17      | p1       | (A)10   | 10   | 15479 | 15488 |
|                    | 18      | p1       | (T)10   | 10   | 17240 | 17249 |
|                    | 19      | p1       | (T)12   | 12   | 19477 | 19488 |
|                    | 20      | p1       | (A)10   | 10   | 19620 | 19629 |
|                    | 21      | p2       | (AT)5   | 10   | 20848 | 20857 |
|                    | 22      | p1       | (A)10   | 10   | 28502 | 28511 |
|                    | 23      | p1       | (A)13   | 13   | 30841 | 30853 |
|                    | 24      | p4       | (ATTT)3 | 12   | 33169 | 33180 |
|                    | 25      | p2       | (TA)5   | 10   | 33222 | 33231 |
|                    | 26      | p3       | (TCT)4  | 12   | 34486 | 34497 |
|                    | 27      | p1       | (T)10   | 10   | 37629 | 37638 |
|                    | 28      | p2       | (AT)5   | 10   | 37960 | 37969 |
|                    | 29      | p2       | (TA)6   | 12   | 38117 | 38128 |
|                    | 30      | p1       | (T)11   | 11   | 39319 | 39329 |
|                    | 31      | p2       | (TA)7   | 14   | 48482 | 48495 |
|                    | 32      | p2       | (AT)7   | 14   | 49702 | 49715 |
|                    | 33      | p4       | (CAAA)3 | 12   | 49807 | 49818 |
|                    | 34      | p2       | (AT)5   | 10   | 50974 | 50983 |
|                    | 35      | p2       | (AT)5   | 10   | 53497 | 53506 |
|                    | 36      | p4       | (ATTT)3 | 12   | 55438 | 55449 |
|                    | 37      | p1       | (A)11   | 11   | 60047 | 60057 |
|                    | 38      | p2       | (AT)5   | 10   | 62346 | 62355 |
|                    | 39      | p2       | (AT)6   | 12   | 62530 | 62541 |
|                    | 40      | p4       | (CTAA)3 | 12   | 63880 | 63891 |

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|    |    |          |    |        |        |
|----|----|----------|----|--------|--------|
| 41 | p4 | (ATAA)3  | 12 | 65034  | 65045  |
| 42 | p4 | (AGAA)3  | 12 | 66556  | 66567  |
| 43 | p2 | (AT)6    | 12 | 68393  | 68404  |
| 44 | p4 | (GAAA)3  | 12 | 68474  | 68485  |
| 45 | p4 | (GAAA)3  | 12 | 68487  | 68498  |
| 46 | p4 | (TATT)3  | 12 | 69405  | 69416  |
| 47 | p1 | (T)11    | 11 | 69474  | 69484  |
| 48 | p1 | (A)10    | 10 | 71639  | 71648  |
| 49 | p5 | (TTCTA)3 | 15 | 73689  | 73703  |
| 50 | p1 | (T)10    | 10 | 73874  | 73883  |
| 51 | p5 | (AATAA)3 | 15 | 74045  | 74059  |
| 52 | p4 | (ATAA)3  | 12 | 74334  | 74345  |
| 53 | p1 | (T)10    | 10 | 85398  | 85407  |
| 54 | p4 | (TTCT)3  | 12 | 85884  | 85895  |
| 55 | p2 | (GA)5    | 10 | 93505  | 93514  |
| 56 | p1 | (T)13    | 13 | 103019 | 103031 |
| 57 | p1 | (T)10    | 10 | 115466 | 115475 |
| 58 | p4 | (ATTT)3  | 12 | 116237 | 116248 |
| 59 | p4 | (GAAT)3  | 12 | 117021 | 117032 |
| 60 | p2 | (AT)5    | 10 | 119915 | 119924 |
| 61 | p2 | (TA)5    | 10 | 120624 | 120633 |
| 62 | p3 | (TAA)4   | 12 | 120996 | 121007 |
| 63 | p4 | (AATA)3  | 12 | 122777 | 122788 |
| 64 | p2 | (AT)5    | 10 | 124856 | 124865 |
| 65 | p2 | (AT)5    | 10 | 124868 | 124877 |
| 66 | p2 | (TA)6    | 12 | 124995 | 125006 |
| 67 | p1 | (A)10    | 10 | 126206 | 126215 |
| 68 | p4 | (AAAT)3  | 12 | 126408 | 126419 |
| 69 | p3 | (TTA)4   | 12 | 130904 | 130915 |
| 70 | p1 | (T)12    | 12 | 131697 | 131708 |
| 71 | p1 | (T)12    | 12 | 132233 | 132244 |
| 72 | p1 | (T)12    | 12 | 132366 | 132377 |
| 73 | p2 | (AT)5    | 10 | 132801 | 132810 |
| 74 | p4 | (CATT)3  | 12 | 133075 | 133086 |
| 75 | p4 | (AAAT)3  | 12 | 133860 | 133871 |
| 76 | p1 | (A)10    | 10 | 134633 | 134642 |
| 77 | p1 | (A)13    | 13 | 147077 | 147089 |
| 78 | p2 | (TC)5    | 10 | 156594 | 156603 |

**Table S4. Primer sequences at the boundaries between single copy and IR regions of *Z. officinale*.**

| Regions | Forward/Reverse | Primer sequence (5' to 3') |
|---------|-----------------|----------------------------|
| LSC-IRa | F               | TGACAAGTGGGACTTTTATACCAT   |
|         | R               | CTTGGTCTCGGGCATCTACT       |
| IRa-SSC | F               | ATCGCGGTACCCATCCTTTT       |
|         | R               | CCCAATGTGAGTTATTCCGTGG     |
| SSC-IRb | F               | TCAAGTTTGGCACCGATATGT      |
|         | R               | ATATCGCGGTACCCATCCTT       |
| IRb-LSC | F               | TAGTAACTTGGTCTCGGGCA       |
|         | R               | CAGATTCGGCCAAGAGGAAGA      |

**Table S5. GenBank accession numbers of 19 complete chloroplast genome sequences used for ML phylogenetic analyses.**

| GenBank acc. | Species                    | GenBank acc. | Species                                  |
|--------------|----------------------------|--------------|------------------------------------------|
| NC_020363    | <i>Zingiber spectabile</i> | NC_022927    | <i>Ravenala madagascariensis</i>         |
| NC_040852    | <i>Kaempferia elegans</i>  | NC_028439    | <i>Musa balbisiana</i>                   |
| NC_040851    | <i>Kaempferia galanga</i>  | NC_035723    | <i>Musa itinerans</i>                    |
| NC_028729    | <i>Curcuma flaviflora</i>  | NC_022926    | <i>Musa textilis</i>                     |
| NC_022928    | <i>Curcuma roscoeana</i>   | HF677508.1   | <i>Musa acuminata subsp. malaccensis</i> |
| MK919702     | <i>Curcuma longa</i>       | NC_035637    | <i>Musella lasiocarpa</i>                |
| NC_036935    | <i>Amomum krervanh</i>     | NC_020362    | <i>Heliconia collinsiana</i>             |
| NC_036992    | <i>Amomum compactum</i>    | MG267380     | <i>Dioscorea polystachya</i>             |
| NC_035895    | <i>Alpinia oxyphylla</i>   | NC_037717    | <i>Dioscorea collettii</i>               |