

DATA NOTE

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Sequencing the organelle genomes of *Bougainvillea spectabilis* and *Mirabilis jalapa* (Nyctaginaceae)

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Abstract

Objectives: *Mirabilis jalapa* L. and *Bougainvillea spectabilis* are two *Mirabilis* species known for their ornamental and pharmaceutical values. The organelle genomes are highly conserved with a rapid evolution rate making them suitable for evolutionary studies. Therefore, mitochondrial and chloroplast genomes of *B. spectabilis* and *M. jalapa* were sequenced to understand their evolutionary relationship with other angiosperms.

Data description: Here, we report the complete mitochondrial genomes of *B. spectabilis* and *M. jalapa* (343,746 bp and 267,334 bp, respectively) and chloroplast genomes of *B. spectabilis* (154,520 bp) and *M. jalapa* (154,532 bp) obtained from Illumina NovaSeq. The mitochondrial genomes of *B. spectabilis* and *M. jalapa* consisted of 70 and 72 genes, respectively. Likewise, the chloroplast genomes of *B. spectabilis* and *M. jalapa* contained 131 and 132 genes, respectively. The generated genomic data will be useful for molecular characterization and evolutionary studies.

Keywords: Mitochondrial genome, Chloroplast genome, Phylogenetics, Traditional medicine, Ornamental plants, DNA barcoding

Objective

Organelle genomes such as chloroplast and mitochondrial genomes are highly conserved in plant species except for minor structural rearrangements reported in few species [1]. The conserved nature and rapid evolution rate of organelle genomes play a key role in understanding the evolutionary aspects of different species [2]. Chloroplast genomes generally have a quadripartite structure ranging from 107 to 217 kb [3]. In contrast, mitochondrial genomes are bigger in size (105 kb to 110 Mb) [4]. Compared to the nucleic genome, organelle genomes are ideal for studying phylogenetics [5–9].

The Nyctaginaceae family, known for its ornamental value and pharmaceutical properties, consists of hermaphroditic trees, shrubs, and herbs. *M. jalapa* and *B. spectabilis* originated from tropical America and have been widely adapted as ornamental plants for their vibrant colors, medicinal characteristics, and phytoremediation properties [10–14]. Antioxidative, antimicrobial, antibacterial, and antiviral effects of both species have also been reported [10, 15, 16]. Although both species have been well characterized for their bioactive components, genomic resources for molecular characterization and evolutionary analyses are rare in *M. jalapa* and *B. spectabilis*. In this study, we sequenced the chloroplast and mitochondrial genomes of *M. jalapa* and *B. spectabilis*. The generated datasets will be used to investigate the structural organization of their organelle genomes and the phylogenetic relationship with existing angiosperms.

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Table 1 Overview of data files/data sets

Label	Name of data file/data set	File types (file extension)	Data repository and identifier (DOI or accession number)
Data set 1	Illumina NovaSeq of <i>Bougainvillea spectabilis</i> mitochondrial genome	Fasta file	GenBank NCBI (MW167296) [19]
Data set 2	Illumina NovaSeq of <i>Mirabilis jalapa</i> mitochondrial genome	Fasta file	GenBank NCBI (MW295642) [20]
Data set 3	Illumina NovaSeq of <i>Bougainvillea spectabilis</i> chloroplast genome	Fasta file	GenBank NCBI (MW167297) [21]
Data set 4	Illumina NovaSeq of <i>Mirabilis jalapa</i> chloroplast genome	Fasta file	GenBank NCBI (MW894644) [22]

Data description

The leaf samples from *B. spectabilis* and *M. jalapa* were collected from Qiannan Buyi and Miao Autonomous Prefecture (N: 26° 22 ' 75.63 ", E:107° 62 ' 39.08 "), Guizhou Province, China. The samples were obtained from the wild and no permissions were necessary to collect such samples. The formal identification of the samples was conducted by Prof Xiaozhong Lan and voucher specimens were deposited at Tibet Agriculture and Animal Husbandry University (<http://www.taaas.org>) under the voucher numbers: ZY20-082,503 and ZY20-082,504. The total genomic DNA (gDNA) was isolated from fresh leaf samples with the CTAB method using the Plant Genomic DNA Kit (DP305, TIANGEN, China). After the fragmentation of DNA, 300 bp short insert libraries were constructed. The expected size profile was verified using gel electrophoresis. The gDNA was sequenced on the Illumina NovaSeq 6000 platform at Wuhan bio-mall Biotechnology Co., Ltd (Wuhan, China), following the standard protocols. Quality control was performed using fastqc and NGSQC, and raw data were cleaned for low-quality reads. Chloroplast and mitochondrial genomes were assembled using SPAdes v3.9.0 [17] and MITObim v1.8. The annotation was performed using CpGAVAS [18].

The obtained circular mitochondrial genomes of *B. spectabilis* and *M. jalapa* were 343,746 bp and 267,334 bp long, respectively (Data files 1 and 2). GC contents in *B. spectabilis* and *M. jalapa* mitochondrial genomes were estimated to be 37% and 34.5%, respectively. *B. spectabilis* mitochondrial genome was annotated with 70 genes. Among these, we identified 42 protein-coding genes, 25 tRNA, and three rRNA. *M. jalapa* mitochondrial genome consisted of 72 genes with 40 protein-coding genes, 28 tRNA, and three rRNA. Strong evidence of expression supported most annotated genes.

The sequenced chloroplast genomes of *B. spectabilis* and *M. jalapa* were 154,520 bp (35.9% GC content) and 154,532 bp (35.9% GC content) long, respectively (Data file 3 and 4). The quadripartite structure of *M. jalapa* chloroplast genome contained two inverted repeats

regions (25,428 bp), one large-single copy (85,908 bp), and one small-single copy (17,768 bp). A total of 131 genes were identified, including 86 protein-coding genes, eight rRNA, and 37 tRNA. The chloroplast genome of *B. spectabilis* encoded 132 genes, including 87 protein-coding genes, eight rRNA genes, and 37 tRNA genes. *RPS12* gene had a trans-splicing in the two species. Similarly, in both genomes, a total of 15 genes (*trnKUUU*, *rps16*, *trnG-UCC*, *atpF*, *rpoC1*, *trnL-UAA*, *trnV-UAC*, *petB*, *petD*, *rpl16*, *rpl2*, *ndhB*, *trnI-GAU*, *trnA-UGC*, and *ndhA*) had a single intron while two genes (*clpP* and *ycf3*) had two introns.

The genomic data presented here are the first publicly available organelle genomes of *B. spectabilis* and *M. jalapa*. The datasets can be further exploited to investigate the evolutionary relationship of *B. spectabilis* and *M. jalapa* with existing Nyctaginaceae species and other angiosperms. It can also be used for the development of molecular markers and DNA barcoding applications.

Limitations

Organelle genomes have a lower mutation rate as compared to nucleic genomes. Therefore, organelle genomes are not suitable for studying differentiation within the species (Table 1).

Abbreviations

GC: Guanine-Cytosine; rRNA: Ribosomal ribonucleic acid; tRNA: Transfer ribonucleic acid; CTAB: Cetyltrimethylammonium bromide; DNA: Deoxyribonucleic acid.

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Authors' contributions

FY conceived the project, performed the sampling, bioinformatics analysis and drafted the manuscript. XL conceived the project, guided and supervised the data analysis, provided funding support and revised the first drafts of the manuscript. All authors have read and approved the final version of this manuscript.

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Availability of data and materials

The data sets are openly available in GenBank of NCBI at <https://www.ncbi.nlm.nih.gov/nuccore/MW167296> (data set 1; Bio-project PRJNA682652) [19], <https://www.ncbi.nlm.nih.gov/nuccore/MW295642> (data set 2; Bio-project PRJNA692028) [20], <https://www.ncbi.nlm.nih.gov/nuccore/MW167297> (data set 3; Bio-project PRJNA682652) [21], and <https://www.ncbi.nlm.nih.gov/nuccore/MW894644> (data set 4; Bio-project PRJNA720802) [22].

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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