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PHYLOGENETIC RELATIONSHIPS IN *POLIOMINTHA*
AND RELATED GENERA IN THE MENTHEAE (LAMIACEAE)

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GRANT THOMAS GODDEN

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PHYLOGENETIC RELATIONSHIPS IN *POLIOMINTHA* AND RELATED GENERA IN THE MENTHEAE (LAMIACEAE)

By

Grant Thomas Godden

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ABSTRACT

PHYLOGENETIC RELATIONSHIPS IN *POLIOMINTHA* AND RELATED GENERA IN THE MENTHEAE (LAMIACEAE)

By

Grant Thomas Godden

Poliomintha (Lamiaceae; subfamily Nepetoideae; tribe Mentheae) is a genus of aromatic shrubs from the southwestern United States and northern Mexico. For over 100 years, the circumscription of *Poliomintha* has remained uncertain and taxa have been transferred to and from *Poliomintha* and related genera on the basis of various morphological characters. For my thesis research, sequence data from the nuclear ribosomal ITS and two plastid regions, *trnL-trnL-trnF and rpL32-trnL*, were used to objectively test morphologically-based hypotheses of relationship within *Poliomintha* and among genera in tribe Mentheae. *Poliomintha* is not monophyletic as currently circumscribed and represents at least two distinct lineages: a lineage that includes the type species, *P. incana*, and either (or both) *Rhododon* or *Clinopodium*; and a second lineage that includes the remaining species of *Poliomintha* and species of the allied genus, *Hedeoma*. Shimodaira-Hasegawa tests confirm that *P. incana* is not related to the remaining *Poliomintha* species. Therefore, the genus *Poliomintha* may be best limited to the type species, *P. incana,* pending phylogenetic evidence that determines the relationships of *Poliomintha* species to the other genera with confidence.

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Chapter 1

INTRODUCTION

Poliomintha A. Gray (Lamiaceae) is a small genus comprising seven species with distributions in the deserts and arid regions of northeastern Mexico and the southwestern United States. *Poliomintha* species are characterized by a shrubby habit, tubular and symmetrical calyces, large tubular corollas with two stamens, and oblong nutlets (Epling and Stewart 1939; Irving 1972). None of these characters are unique to *Poliomintha*; rather the combination of characters can be used to distinguish *Poliomintha* from other closely allied genera in family Lamiaceae.

Poliomintha is a member of subfamily Nepetoideae, which is divided into four tribes: Escholtzieae, Lavanduleae, Mentheae, and Ocimeae (Cantino et al. 1992). The genus belongs to a clade of New World Mentheae (Wagstaff et al. 1995; Williams, unpublished data), a group historically viewed as taxonomically difficult because of complex morphological interpretation. Systematists such as Bentham (1834), Briquet (1897), Epling and Stewart (1939), and Irving (1972, 1980) and others circumscribed groups in the tribe based on habit and other morphological characters, but discussed difficulty in assigning characters sufficiently important to distinguish genera. Recognition of some genera in the Mentheae, including *Poliomintha*, has been controversial and an ongoing subject of taxonomic debate. Consequently, the generic status of *Poliomintha* has been questioned multiple times throughout history and its species have been

transferred to and from genera such as *Hedeoma* Pers. and *Hesperozygis* Epling.

Taxonomic History

The genus *Poliomintha* was first proposed by Asa Gray (1870) to accommodate two species, *P. longiflora* A. Gray and *P. incana* (Torr.) A. Gray. However, suggestion of the group came eleven years earlier with Torrey's description of *Hedeoma incanum* (1859). Regarding the classification of his new species, Torrey noted, "It may remain in *Hedeoma* for the present, but, if other species like it should be found, it may be the type of a new genus." During the twenty years after Gray's formation of *Poliomintha*, two species (*Hedeoma molle* Torr. and *Keithia* [*Hesperozygis*] *marifolia* S. Shauer) were transferred by Gray (1872) to *Poliomintha* and two additional species, *P. glabrescens* A. Gray ex. Hemsley (1882) and *P. bicolor* Watson (1890), were described. A fifth name, *P. greggii*, was referenced in Watson's publication, but was not formally described (*nomen nudum*).

Briquet (1897) recognized the inherent difficulties in the taxonomic disposition of the taxa and subsumed *Poliomintha* into *Hedeoma* in his treatment of the Labiateae in *Die Naturlichen Pflanzenfamilien*. However, the work of Epling and Stewart (1939) restored the generic status of *Poliomintha* and informally established two new sections, section *Incanae* to accommodate *P. incana* and section *Saturejoides* to accommodate *P. glabrescens* and *P. longiflora*. As for the other species, Epling and Stewart (1939) placed *P. bicolor* in

synonymy with *P. longiflora* and transferred *P. molle* and *P. marifolia* into *Hedeoma* and *Hesperozygis* respectively. *Poliomintha conjunctrix* was described by Epling and Wiggins in 1940, bringing the genus to a total of four species.

In the most recent revision (Irving 1972) four species of *Poliomintha* were recognized: *P. longiflora* and *P. glabrescens* belonging to section *Saturejoides* R. S. Irving; and *P. conjuntrix* and *P. incana* belonging to section *Poliomintha*. *Poliomintha longiflora var. congesta* also was described by Irving, but more recently has been reduced to synonymy with *Clinopodium dominguense* Urb. and Ekman. Since Irving's revision, three additional species were described; *P. madrensis* by Henrickson (1982) and *P. dendritica* and *P. bustamanta* by Turner (1993). With the latest additions, a total of seven species were recognized for this study (Table 1-1).

Table 1-1: Recognized taxa and nomenclature in previous taxonomic treatments of *Poliomintha*.

Taxonomist	Recognized Taxa
Standley (1923)	*Poliomintha* A. Gray *P. bicolor* *P. glabrescens* *P. incana* *P. longiflora* *P. marifolia* *P. mollis*
Epling and Stewart (1939)	*Poliomintha* A. Gray ***Poliomintha* sect. *Incanae*** (bold text below) *Poliomintha* sect. *Saturejoides* *P. glabrescens* ***P. incana*** *P. longiflora* ..... *P. bicolor* = syn. *Poliomintha longiflora* *P. marifolia* = syn. *Hesperozygis marifolia* *P. mollis* = syn. *Hedeoma molle*
Irving (1972)	*Poliomintha* A. Gray ***Poliomintha* sect. *Poliomintha*** (bold text below) *Poliomintha* sect. *Saturejoides* R. S. Irving ***P. conjunctrix*** *P. glabrescens* ***P. incana*** *P. longiflora var. congesta* *P. longiflora var. longiflora* ..... *P. marifolia* = syn. *Hesperozygis marifolia* *P. mollis* = syn. *Hedeoma molle*
Proposed	*Poliomintha* A. Gray ***Poliomintha* sect. *Poliomintha*** (bold text below) *Poliomintha* sect. *Saturejoides* R. S. Irving *P. bustamanta* ***P. conjunctrix*** *P. dendritica* *P. glabrescens* ***P. incana*** *P. longiflora* *P. maderensis* ..... *P. longiflora var. congesta* = syn. *Clinopodium dominguense* *P. marifolia* = syn. *Hesperozygis marifolia* *P. mollis* = syn. *Hedeoma molle*

Morphology

Poliomintha are small aromatic shrubs with slender, moderately branched, and ascending-erect four-angled stems with minute and usually appressed pubescence. The species have small leaves that are oval, elliptical, or linear in shape and with entire margins. The leaves are opposite and attached to the stem at the base (sessile) or on short petioles. The flowers are solitary or grouped into two-, three-, or five-seven-flowered cymules in the leaf axils of the upper one-half to one-third of the plant. The calyces are characteristically tubular and more or less symmetrical, 13-15-nerved, sometimes hirsute-annulate within, softly pubescent on the margins and inner surfaces, and with subequal teeth that are narrowly deltoid, acute, and connivent to close the orifice. The red, orange-red, purplish, pale lavender, pink, or white corollas of *Poliomintha* are tubular and zygomorphic, with a conspicuous emarginated upper lip and a spreading, three-lobed lower lip. The corollas are pubescent on the outer surface and have a dense ring of pubescence (annulus) within, below the middle of the tube. The flowers have two, slightly exserted fertile stamens that are seated well above the middle of the tubular corolla with glabrous filaments and widely divergent anther sacs on well-developed connectives. The gynobasic style is long exserted and bifid. The fruit is a schizocarp of four oblong nutlets.

Previous taxonomic treatments by Epling and Stewart (1939) and Irving (1972, 1980) distinguished *Poliomintha* from the closely allied genera *Hedeoma* and *Hesperozygis* on the basis of a combination of habit, calyx, and nutlet characters and chromosome counts (Table 1-2).

Table 1-2: Characteristics distinguishing *Poliomintha* from the closely allied genera *Hedeoma* and *Hesperozygis*. Characters adapted from R. S. Irving (1972, 1976, 1980).

Hedeoma	***Poliomintha***	***Hesperozygis***
Habit: Herbaceous, occasionally semishrubs	Habit: Shrubs	Habit: Shrubs
Calyx shape: Gibbous or saccate, but never funnelform	Calyx shape: Tubular	Calyx shape: Funnelform, campanulate
Calyx symmetry: Zygomorphic	Calyx symmetry: Actinomorphic	Calyx symmetry: Actinomorphic
Calyx teeth: Differentiated into upper and lower sets; usually upper deltoid, lower lanceolate	Calyx teeth: Not differentiated into upper and lower sets; deltoid	Calyx teeth: Not differentiated into upper and lower sets; deltoid or lanceolate
Calyx annulus: Well-defined ring at juncture of upper and lower teeth	Calyx annulus: Absent or in an irregular ring	Calyx annulus: Well-defined ring near middle of tube
Fruit: Nutlets oblong, mucilaginous when moistened	Fruit: Nutlets oblong, not mucilaginous when moistened	Fruit: No comparison provided
Chromosome counts†:	Chromosome counts†:	Chromosome counts†:
$2n$ = 34, 36, 44, 72, 144	$2n$ = 36	$2n$ = 44

†Chromosome counts based on cytological studies of 24 species of *Hedeoma* and one species each of *Poliomintha* and *Hesperozygis*, respectively (Irving 1976).

Phylogenetic Relationships

The relationships of *Poliomintha* to other New World genera in the Mentheae are uncertain. The only phylogenetic study that included *Poliomintha* is the molecular study of Wagstaff et al. (1995), who used a phylogenetic analysis of cpDNA restriction site variation to infer relationships among several relevant genera in subfamily Nepetoideae and tribe Mentheae. They included only one species

each of *Poliomintha* and *Hedeoma*; *Poliomintha longiflora* was placed as sister to *Hedeoma drummondii* Benth. in an unresolved clade of species from genera that included *Acinos* Mill., *Blephilia* Raf., *Calamintha* L., *Conradina* A. Gray, *Minthostachys* (Benth.) Spach, *Monardella* Benth., *Piloblephis* Raf., and *Satureja* L. (of which the sampled species have since been transferred to *Clinopodium* L.).

Previous morphologically-based studies have closely examined the relationships among *Poliomintha* and related genera (Epling and Stewart 1939; Irving 1972; and Irving 1980), but not in a modern phylogenetic context. The most recent revision of *Poliomintha* by Irving (1972) suggested that *Poliomintha* is monophyletic and closely allied to the genus *Hedeoma* and some species of *Hesperozygis*. However, it is important to recognize that the definitions of monophyly and phylogeny have evolved with more recent advances in molecular biology (Judd et al. 2002) and a rigorous phylogenetic analysis for *Poliomintha* and related genera has never been performed. Many contemporary studies of the Lamiaceae have employed DNA sequence data and phylogenetic methods to infer relationships among mints at lower taxonomic levels (Wagstaff and Olmstead 1997; Steane et al. 1999; Prather et al. 2002; Jamzad et al. 2003; Trusty et al. 2004; Walker et al. 2004; Braüchler et al. 2005; Trusty et al. 2005; Edwards et al. 2006; Roselló et al. 2006; Walker and Systma 2007; Edwards et al. 2008; and Schmidt-Lebuhn 2008), facilitating the testing of monophyly for several genera and allowing for much-needed revision of existing circumscriptions. The studies have demonstrated that some genera in the Mentheae are not monophyletic—e.g., *Micromeria* Benth. (Braüchler et al. 2005),

Salvia L. (Walker et al. 2004), and *Satureja* (Wagstaff et al. 1995)—and, in some cases, the discovery of paraphyletic or polyphyletic groups has initiated taxonomic revisions at the generic level (Cantino and Wagstaff 1998; Steane et al. 1999; Harley and Granda Paucer 2000; Steane et al. 2004; Braüchler et al. 2006; Ryding 2006; and Pool 2008).

For my thesis research, a molecular phylogenetic study was conducted to examine closely the generic status of *Poliomintha*. The goals of the study were to test the monophyly of the genus, to elucidate interspecific relationships within *Poliomintha* and among taxa from closely related genera in the Mentheae, and to clarify the taxonomy of *Poliomintha* and closely related or ambiguously placed species using phylogenetic data.

Chapter 2

MATERIALS AND METHODS

Plant Material and Taxonomic Sampling

Herbarium specimens from subfamily Nepetoideae and tribe Mentheae (Lamiaceae) were selected for morphological review from the following herbaria: CAS, MI, MO, MSC, NY, US, and TEX/LL. Specimens were evaluated and selected for the phylogenetic analyses to represent morphological and geographical variation within species and major taxonomic groupings within the genera *Poliomintha*, *Hedeoma*, and *Hesperozygis* and tribe Mentheae. Permission for destructive sampling was requested and granted from each herbarium prior to DNA extraction (see Appendix A for voucher information).

Individuals sampled for phylogenetic analyses included six taxa from *Poliomintha*; 23 taxa from *Hedeoma* representing the subgenera *Cilata*, *Poliominthoides*, *Saturejoides*, and *Hedeoma*; and four taxa from *Hesperozygis*. The seventh *Poliomintha* species, *P. maderensis* J. Henrickson, was unavailable for sampling due to its rarity in collections.

Previous revisions of *Hedeoma* by Epling and Stewart (1939) and of *Poliomintha* and *Hedeoma* by Irving (1972 and 1980 respectively) suggested that *Poliomintha* is not only closely allied to genera such as *Hedeoma* and *Hesperozygis*, but also related to several genera in tribe Mentheae and subtribe Melissinae, including two- and four-stamened genera such as *Satureja* section *Gardoquia* (R. and P.) Briq. (now *Clinopodium*), *Cunila* L., *Glechon* Spreng., *Rhabdocaulon* (Benth.) Epling, and *Rhododon* Epling, etc. Therefore, in order to

infer phylogenetic relationships among *Poliomintha* and closely allied genera within the Mentheae, 21 additional taxa were sampled (see Appendix A).

Mentha and *Thymus* were chosen as outgroup genera based on the phylogenetic results of Wagstaff et al. (1995) and Walker and Systma (2007). *Mentha rotundifolia* Huds. and *Thymus mastichina* L., were selected as representatives of the two genera to facilitate use of ITS sequence data previously published by Prather et al. (2002) and plant tissue available at MSC for re-extraction and amplification of selected plastid genomic regions.

DNA Extraction

Genomic DNA was extracted from herbarium tissue using the method of Doyle and Doyle (1987) and the small-scale extraction techniques of Loockerman and Jansen (1996). Approximately 10-20 mg plant tissue from each herbarium specimen was sampled. Tissue was homogenized in 1.7 mL tubes with 400 μL extraction buffer comprised of 100 mM Tris-HCl at pH 8.0, 1.3 M NaCl, 20 mM ethylenediaminetetraacetic acid (EDTA), 2% hexadeclytrimethyl-ammonium bromide (CTAB) at pH 8.0, 0.5% 2-mercaptoethanol and 4% polyvinyl-pyrrolidone (PVP). An additional 400 μL extraction buffer was added to each homogenate, incubated at 60°C for 30 minutes and inverted six times at five-minute intervals. DNA was extracted from each homogenate with the addition of 550 μL chloroform:octanol (24:1) followed by centrifugation at 14,000 rpm for three minutes. The supernatant from each sample was transferred to a new 1.7 mL tube and DNA was precipitated with two-thirds volume ice-cold isopropanol

and overnight storage at -20°C. Precipitated DNA was centrifuged into a pellet at 14,000 rpm for 6 minutes, washed with a layer of 800 µl 76% EtOH/0.01M NH_4OAc for ten minutes, and resuspended in 30-40 µL water. DNA samples that failed to amplify using PCR were suspected of having impurities that inhibited amplification and subsequently purified using the Qiagen DNeasy Plant Mini Kit (Qiagen, Ltd) following the manufacturer protocol.

Marker Choice

Two markers, the nuclear ribosomal internal transcribed spacer (including ITS1, 5.8S, and ITS2 regions) and the combined *trn*L intron and *trn*L-*trn*F intergenic spacer (referred to hereafter as *trnL-trnF*) from the plastid genome, were selected because they have been used successfully in previous systematic studies of the Mentheae (Trusty et al. 2004; Trusty et al. 2005; Edwards et al. 2006; and Walker and Systma 2007). Four additional plastid regions, $trnD^{GUC}$-$trnT^{GGU}$, $trnS^{UGA}$-$trnfM^{CAU}$, *rpl32-trnL,* and *ndhF-rpl32*, recommended by Shaw et al. 2005 and Shaw et al. 2007 were surveyed to identify one additional phylogenetically informative plastid region for the analysis. The regions were compared for their efficient amplification across in-group taxa and the phylogenetic utility of their sequence content as measured by average sequence variability and number of potentially phylogenetically informative characters. The following subset of in-group taxa were used to evaluate and select a region: *Clinopodium mexicanum*, *Hedeoma costata*, *Hedeoma drummondii*, *Hedeoma*

hispida, *Hedeoma molle*, *Hedeoma palmeri*, *Hedeoma patrina*, *Hedeoma pusilla*, *Poliomintha incana*, and *Poliomintha longiflora*. For reasons identified in the results, *rpl32-trnL* was selected as the second plastid marker for the phylogenetic analyses.

Amplification and Visualization

Polymerase chain reaction (PCR) was carried out using an MJ Research PTC-100 thermalcycler and 25 μL reactions containing standard PCR components (Table 2-2), 1 μl DNA template from one of three prepared 1:1, 1:9, or 1:99 dilutions, and universal primers (Table 2-1). Three PCR profiles were used to amplify nuclear and plastid regions (Table 2-3). Bands were resolved by electrophoresis on a 2% agarose gel in 1X Tris-acetate-EDTA (TAE) buffer, stained with ethidium bromide, and visualized with UV illumination. For samples that successfully amplified, PCR was repeated two additional times using a 50 μL reaction to amplify sufficient quantities of DNA for purification.

Table 2-1. Primer sequences used for PCR amplification and sequencing. Forward (F:) and reverse (R:) designates are indicated before each primer name.

Marker 1: ITS
(ITS1, 5.8S, ITS2)

Primer	Primer sequence (5'-3')
F: ITS4 (White et al. 1990)	TCCTCCGCTTATTGATATGC
R: ITS5 (White et al. 1990)	GGAAGTAAAAGTCGTAACAAGG
R: ITS5M (Sang et al. 1996)	GGAAGGAGAAGTCGTAACAAGG

Marker 2: *trnL-trnF*
(*trnL* intron, *trnL-trnF* intergenic spacer)

Primer	Primer sequence (5'-3')
F: TabC (Taberlet et al. 1991)	CGAAATCGGTAGACGCTACG
R: TabF (Taberlet et al. 1991)	ATTTGAACTGGTGACACGAG

Marker 3: *trnD^{GUC}-trnT^{GGU}*
(intergenic spacer, embedded *trnY* and *trnE* genes)

Primer	Primer sequence (5'-3')
F: trnD^{GUC}F (Demesure et al. 1995)	ACCAATTGAACTACAATCCC
R: trnT^{GGU} (Demesure et al. 1995)	CACCACTGAGTTAAAAGGG

Marker 4: *trnS^{UGA}-trnfM^{CAU}*
(intergenic spacer, embedded *trnG*, *ycf9*, and *psbZ* genes)

Primer	Primer sequence (5'-3')
F: trnS^{UGA} (Demesure et al. 1995)	CGAAATCGGTAGACGCTACG
R: trnfM^{CAU} (Demesure et al. 1995)	ATTTGAACTGGTGACACGAG

Marker 5: *rpl32-trnL*
(intergenic spacer)

Primer	Primer sequence (5'-3')
F: rpL32-F (Shaw et al. 2007)	CAGTTCCAAAAAAACGTACTTC
R: trnL$^{(UAG)}$ (Shaw et al. 2007)	CTGCTTCCTAAGAGCAGCGT

Marker 6: *ndhF-rpl32*
(intergenic spacer)

Primer	Primer sequence (5'-3')
F: ndhF (Shaw et al. 2007)	GAAAGGTATKATCCAYGGMATATT
R: rpL32-R (Shaw et al. 2007)	CCAATATCCCTTYYTTTTCCAA

Table 2-2. Components of polymerase chain reactions. Amplification was carried out using AmpliTaq Gold® DNA Polymerase with Buffer II and MgCl2 reagents (Applied Biosystems, Foster City, CA). All plastid regions (*trnL-trnF*, *trnD-trnT*, *trnS-trnfM*, *rpl32-trnL*, *and ndhF-rpl32*) were amplified using the same quantities of reaction components.

Components	ITS	Plastid
Purified distilled H_2O	14.75-16.00 µl	16.50 µl
10X PCR buffer	2.50 µl	2.50 µl
$MgCl_2$	2.50 µl	2.00 µl
0.2 mM dNTPs (Invitrogen™ Life Technologies)	2.00 µl	2.00 µl
20 pM forward primer	0.25 µl	0.25 µl
20 pM reverse primer	0.25 µl	0.25 µl
Dimethyl sulfoxide (DMSO)	1.25-2.50 µl	1.25 µl
Taq DNA polymerase	0.25 µl	0.25 µl
DNA Template	1.00 µl	1.00 µl
TOTAL	25.00 µl	25.00 µl

Table 2-3. PCR profiles for amplification of nuclear and plastid markers.

ITS – following the parameters of Prather and Jansen (1998)			
Step	Temperature (°C)	Time (minutes)	Notes
1	94	5	
2	72	2	
3	94	1	
4	43	1	Cycle to Step 3 for 30 cycles
5	72	7	
6	15	-	Indefinite hold

Table 2-3. Continued

trnL-trnF, *trnD-trnT*, and *trnS-trnfM*

Step	Temperature (°C)	Time (minutes)	Notes
1	80	5	
2	94	1	
3	50	1	
4	72	2	Cycle to Step 3 for 36 cycles
5	72	5	
6	4	-	Indefinite hold

rpl32-trnL and *ndhF-rpl32* – following the parameters of Shaw et al. (2007)

Step	Temperature (°C)	Time (minutes)	Notes
1	80	5	
2	95	1	
3	50	1	
4	65	4	Cycle to Step 3 for 31 cycles
5	65	5	
6	4	-	Indefinite hold

Purification and Sequencing

PCR products were purified using the Qiagen PCR Purification Kit (Qiagen, Ltd) according to the manufacturer's recommendations and sequenced in both directions at the Michigan State University Genomics Technology Support Facility using either the ABI 3730 Genetic Analyzer or ABI Prism 3700 DNA Analyzer (Applied Biosystems, Foster City, CA).

Sequence Alignment and Data Analyses

DNA sequence data were assembled and edited using MEGA4 (Tamura et al. 2007). Sequences were initially aligned using Clustal W and were refined by eye in MEGA4. End regions from each of the three aligned data matrices were excluded from consideration in the phylogenetic analyses, as were regions where sequence homology could not be easily determined (Table 2-4).

Table 2-4. Aligned characters excluded from the phylogenetic analyses.

	Aligned Characters		
Marker	Excluded end regions	Regions of ambiguous alignment	Total excluded
ITS	1-73; 712-779	474-504	172
trnL-trnF	1 - 63; 944 - 1010	n/a	130
rpl32-trnL	1 - 14; 946 - 953	691-702	34

To maximize computational efficiency by eliminating sequence redundancy in the data matrices, analyses of pairwise genetic distance were conducted using the combined plastid and ITS datasets. Multiple accessions with identical plastid sequences were identified within each of the following nine taxa (two accessions each, except where noted): *Acinos arvensis*, *Clinopodium brownei*, *Clinopodium chandleri*, *Hedeoma mandoniana*, *Hedeoma media*, *Hedeoma pulegioides* (four accessions), *Hesperozygis marifolia*, *Poliomintha incana*, and *Rhododon angulatus*. Twenty-two other accessions with identical

plastid sequences were classified into one of two groups (see Results: groups defined in Figures 3-3 A and B). In total, 33 accessions were removed from consideration and a single accession was used in the phylogenetic analysis to represent each of ten groups of identical sequences. No sequences were removed from the ITS matrix.

Analyses of the ITS, combined plastid, and combined ITS plus plastid datasets were conducted in PAUP*4.0.b10 (Swofford 2002) using maximum parsimony (MP) and maximum likelihood (ML) optimality criteria. Branch support for the resulting trees from each analysis was evaluated using bootstrap analyses (Felsenstein, 1985). Gaps and missing data were ignored.

For the MP analysis, a heuristic search was conducted using 1000 random addition replicates with tree bisection and reconnection (TBR) branch swapping, holding one tree during each stepwise addition and saving only the best trees. Bootstrap (BS) support values were obtained for the resulting trees using a heuristic search with TBR branch swapping, 1000 replicates and ten random addition sequences, saving no more than 100 trees per replicate.

For the ML analyses, a hierarchical likelihood ratio test (Goldman 1993; Huelsenbeck and Crandall 1997) as implemented in ModelTest 3.7 (Posada and Crandall 1998) was used to determine the best model of sequence evolution for the ITS, combined plastid, and combined ITS plus plastid datasets (Table 2-5). Model parameter values generated by ModelTest were used in the ML analyses conducted in PAUP and a heuristic search with 100 random replicates and TBR branch swapping was used, saving no more than 100 trees per replicate.

Bootstrap analyses were conducted in PAUP using TBR branch swapping, 100 replicates with ten random additions per replicate, saving no more than 100 trees per replicate.

Table 2-5. Models of sequence evolution and parameters for three datasets analyzed using the maximum likelihood method. Models were determined by a hierarchical likelihood ratio test (Goldman 1993; Huelsenbeck and Crandall 1997) as implemented in ModelTest 3.7 (Posada and Crandall 1998). Parameters estimated by ModelTest are indicated for each model.

Dataset	Model of sequence evolution	Estimated parameters
ITS	**TrN + I + Γ** (Tamura and Nei 1993; Yang 1994)	Base= (0.2187 0.3121 0.2833) Nst=6 Rmat= (1.0000 2.6190 1.0000 1.0000 5.4251) Rates=gamma Shape=0.6195 Pinvar=0.3664
Combined *trnL-trnF* + *rpl32-trnL*	**K81uf + Γ** (Kimura 1981; Yang 1994)	Base=(0.3771 0.1605 0.1354) Nst=6 Rmat=(1.0000 1.6402 0.6516 0.6516 1.6402) Rates=gamma Shape=0.5858 Pinvar=0
Combined *trnL-trnF* + *rpl32-trnL* + ITS	**TrN + I + Γ** (Tamura and Nei 1993; Yang 1994)	Base=(0.3267 0.2085 0.1800) Nst=6 Rmat=(1.0000 2.1232 1.0000 1.0000 3.2821) Rates=gamma Shape=0.7141 Pinvar=0.6149

Congruence and Hypothesis Testing

To test for congruence between ITS and combined plastid data partitions, an Incongruence Length Difference (ILD) Test of Farris et al. (1994) was conducted as implemented in PAUP as the Partition Homogeneity Test (Swofford 2002). For

the ILD analysis, a null hypothesis of congruence was used and the nuclear and plastid datasets were compared using only parsimony informative characters and 1000 replicates ($\alpha = 0.05$). A heuristic search was used with TBR branch swapping, gaps coded as missing data, ten random additions per replicate, saving no more than 100 trees per replicate.

To test alternative hypotheses of phylogeny, the combined ITS and plastid dataset was analyzed in PAUP with an enforced constraint using the MP search strategy outlined above. Trees constrained to one of two topologies (i.e., a monophyletic *Poliomintha* [*Constraint 1*] and a monophyletic *Poliomintha* that excluded *P. conjunctrix* [*Constraint 2*]), were prepared in MacClade 4.1 (Maddison and Maddison 2001). The most likely tree topologies recovered by the unconstrained MP and ML analyses and the constrained MP analyses of the combined dataset were compared using a Shimodaira-Hasegawa (SH) test (Shimodaira and Hasegawa 1999; Shimodaira 2002), as implemented in PAUP with RELL optimization and 1000 bootstrap replicates. A null hypothesis of no difference was used and assessed at $\alpha = 0.05$.

Chapter 3

RESULTS

Marker Choice

Two plastid regions, *trnS*^{UGA}*-trnfM*^{CAU} and *ndhF-rpl32*, failed to amplify consistently for the surveyed taxa and were not used in the study. Of the remaining regions surveyed, analyses of pairwise genetic distances among sampled taxa suggested that *rpl32-trnL* was nearly twice as variable as *trnD-trnT* and more phylogenetically informative (Table 3-1). Therefore, *rpl32-trnL* was identified as the best additional plastid marker for the study.

Table 3-1. Characteristics and phylogenetic utility of sequences from two plastid regions acquired from ten taxa in the Mentheae.

	All accessions			
Region	Total Characters	Parsimony informative characters	Variable, parsimony uninformative characters	Average pairwise uncorrected genetic (p) distance
trnD-trnT	934	0	7	0.00157
rpl32-trnL	857	2	11	0.00364

Phylogenetic Analyses

Sequences from 83 accessions representing 57 taxa were included in the phylogenetic analyses (Appendix A). Of the total, 71 accessions amplified and sequenced successfully for all three regions. The remaining twelve accessions

successfully sequenced for both *trnL-trnF* and *rpl32-trnL* regions of the plastid genome, but failed to yield quality ITS sequences.

ITS Analyses of *Poliomintha* and Related Genera

The data matrix of aligned ITS sequences from 71 accessions included a total of 607 characters, of which 140 were parsimony-informative, 62 were variable but parsimony-uninformative, and 405 were constant (Appendix B; Table 3-2). Parsimony analysis of the ITS data resulted in 97,217 most parsimonious (MP) trees of a length of 485 steps, consistency index (CI) of 0.518, retention index (RI) of 0.722, and rescaled consistency index (RC) of 0.374. In the MP topologies, the ingroup taxa were weakly supported by the bootstrap analysis as a monophyletic clade (BS = 75%), with *Acinos arvensis* weakly supported as sister to the remaining taxa (BS = 74 %; Figures 3-1 A and B). The monophyly of *Poliomintha* was not supported by the ITS data. The type species, *P. incana*, was positioned in the MP topologies as sister to the genus *Rhododon*, as part of a weakly supported *Poliomintha incana* / *Rhododon* clade (BS = 76%). The remaining *Poliomintha* species did not form a monophyletic clade in any of the MP topologies recovered by the heuristic search. The species were distributed among two clades in the strict consensus of MP trees: an unresolved clade with *P. conjunctrix* and three *Hedeoma* species (*H. apiculata, H. drummondii*, and *H. reverchonii*); and an unresolved clade with *P. longiflora* as sister to a group that included *P. bustamanta* and *P. dendritica*. In the randomly selected MP tree, the two clades were part of a polytomy with *H. acinoides* that was positioned in a

large clade referred to here as the "Hedeomintha" clade (for communication purposes) that included most species from *Hedeoma*, but excluded the *Poliomintha incana / Rhododon* clade (Figures 3-1 A and B).

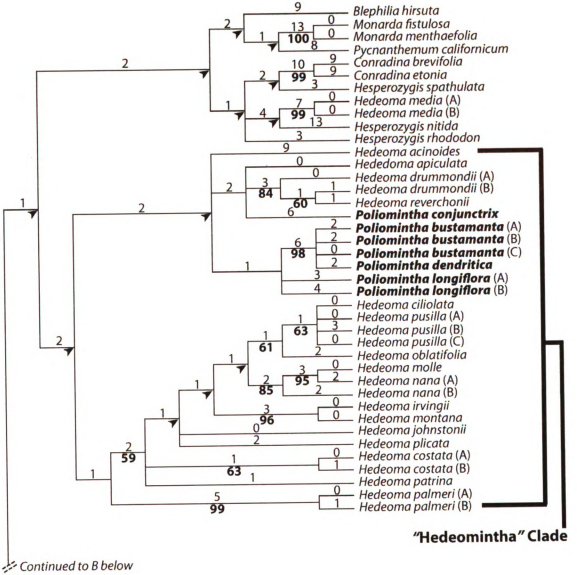
Table 3-2. Sequence characteristics of regions used in phylogenetic analyses.

	All accessions		
Region	Included characters	Parsimony informative characters	Variable, parsimony uninformative characters
ITS	607	140	62
trnL-trnF	880	25	45
rpl32-trnL	919	45	94
Combined *trnL-trnF* + *rpl32-trnL*	1799	70	139
Combined *trnL-trnF* + *rpl32-trnL* + ITS	2406	227†	169

†For nine species, where multiple accessions had identical sequences, each species was represented by a single sequence in the phylogenetic analyses of plastid data matrix (see Chapter 2). However, they were not combined in phylogenetic analyses of the combined plastid + ITS data matrix. The increased number of phylogenetically informative characters reported here for the combined plastid + ITS data is the result of pseudosynapomorphic characters that were autapomorphic within each species in the analyses of plastid data.

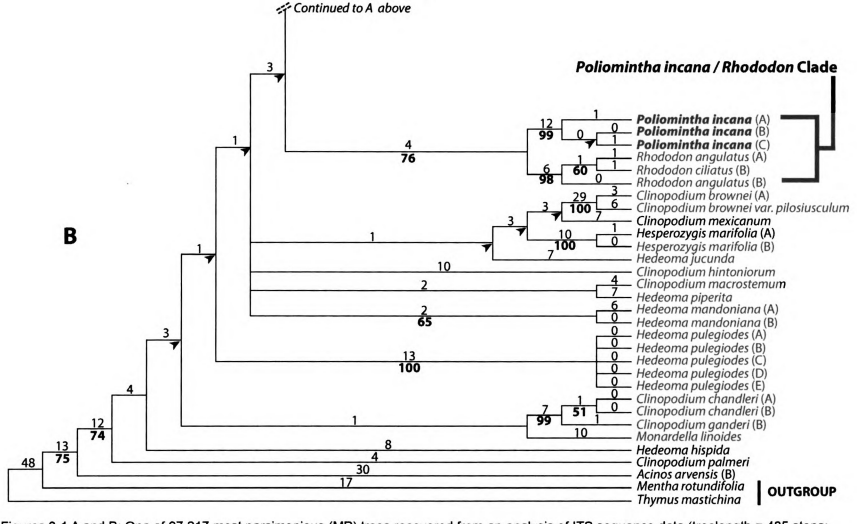
Maximum likelihood (ML) analysis of ITS sequence data recovered one tree with a negative log likelihood (-ln L) of 3524.26454 (Figures 3-2 A and B). The ingroup taxa were monophyletic, but poorly supported by the bootstrap analysis (BS = 63%). The ingroup formed a large polytomy that included *Hedeoma pulegioides* and two unsupported clades comprised of the remaining taxa (Figures 3-1 and 3-2). The monophyly of *Poliomintha* was not supported in the ML topology. *Poliomintha* species were distributed among the

"Hedeomintha" and *Poliomintha incana* / *Rhododon* clades with the same membership described for the MP topologies. However, bootstrap support (BS = 73%) decreased slightly for the *Poliomintha incana* / *Rhododon* clade. While its position was unresolved in the strict consensus of MP topologies, the *Poliomintha incana* / *Rhododon* clade recovered by the ML analysis was positioned within a polytomy that included taxa from genera such as *Blephilia*, *Conradina*, *Monarda*, *Pycnanthemum*, and some taxa from *Hedeoma* and *Hesperozygis* from eastern South America. This polytomy with the *Poliomintha* incana / *Rhododon* clade was positioned as sister to the "Hedeomintha" clade, but without bootstrap support (>50%).


Blephilia hirsuta
Monarda fistulosa
Monarda menthaefolia
Pycnanthemum californicum
Conradina brevifolia
Conradina etonia
Hesperozygis spathulata
Hedeoma media (A)
Hedeoma media (B)
Hesperozygis nitida
Hesperozygis rhododon
Hedeoma acinoides
Hedeoma apiculata
Hedeoma drummondii (A)
Hedeoma drummondii (B)
Hedeoma reverchonii
Poliomintha conjunctrix
Poliomintha bustamanta (A)
Poliomintha bustamanta (B)
Poliomintha bustamanta (C)
Poliomintha dendritica
Poliomintha longiflora (A)
Poliomintha longiflora (B)
Hedeoma ciliolata
Hedeoma pusilla (A)
Hedeoma pusilla (B)
Hedeoma pusilla (C)
Hedeoma oblatifolia
Hedeoma molle
Hedeoma nana (A)
Hedeoma nana (B)
Hedeoma irvingii
Hedeoma montana
Hedeoma johnstonii
Hedeoma plicata
Hedeoma costata (A)
Hedeoma costata (B)
Hedeoma patrina
Hedeoma palmeri (A)
Hedeoma palmeri (B)
"Hedeomintha" Clade
Continued to B below

A

Figure 3-1



Figures 3-1 A and B: One of 97,217 most parsimonious (MP) trees recovered from an analysis of ITS sequence data (treelength = 485 steps; CI = 0.518, RI = 0.722, and RC = 0.374, excluding uninformative characters). The randomly selected MP tree is shown as a rectangular cladogram with branch lengths (above) and bootstrap support values (bold, below) indicated. Branches that collapse in the strict consensus tree are indicated with arrows.

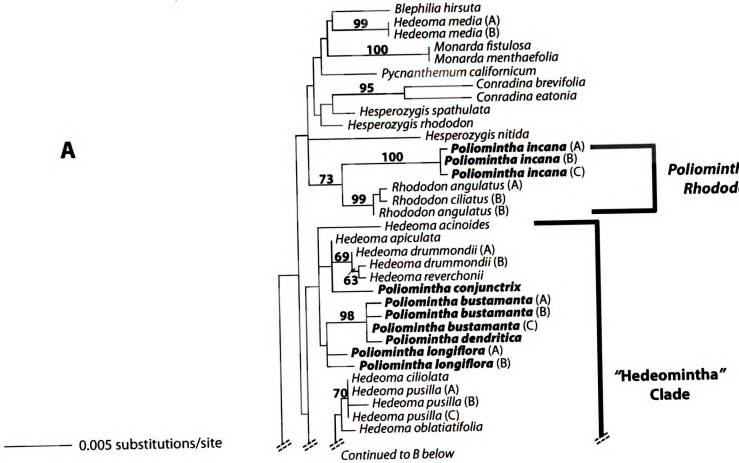
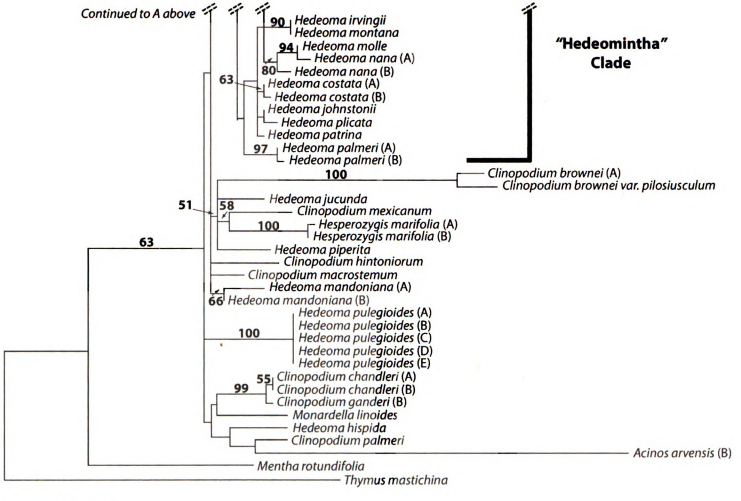

A
Blephilia hirsuta
99
Hedeoma media (A)
Hedeoma media (B)
100
Monarda fistulosa
Monarda menthaefolia
Pycnanthemum californicum
95
Conradina brevifolia
Conradina eatonia
Hesperozygis spathulata
Hesperozygis rhododon
Hesperozygis nitida
Poliomintha incana (A)
100
Poliomintha incana (B)
Poliomintha incana (C)
73
Rhododon angulatus (A)
99
Rhododon ciliatus (B)
Rhododon angulatus (B)
Poliomintha incana / Rhododon Clade
Hedeoma acinoides
Hedeoma apiculata
69
Hedeoma drummondii (A)
Hedeoma drummondii (B)
63
Hedeoma reverchonii
Poliomintha conjunctrix
Poliomintha bustamanta (A)
98
Poliomintha bustamanta (B)
Poliomintha bustamanta (C)
Poliomintha dendritica
Poliomintha longiflora (A)
Poliomintha longiflora (B)
Hedeoma ciliolata
70
Hedeoma pusilla (A)
Hedeoma pusilla (B)
Hedeoma pusilla (C)
Hedeoma oblatiatifolia
"Hedeomintha" Clade
0.005 substitutions/site
Continued to B below

Figure 3-2



Figures 3-2 A and B: Most likely tree recovered from a maximum likelihood (ML) analysis of ITS sequence data from 71 accessions in the tribe Mentheae. Shown here is a phylogram (-ln L = 3524.26454) with branch lengths drawn to scale and bootstrap support (>50%) indicated above the branches.

Plastid Analyses of *Poliomintha* and Related Genera

Plastid sequences (*trnL-trnF* and *rpl32-trnL*) from 50 accessions were aligned for the combined plastid analyses, representing a total of 83 accessions from 57 taxa. The plastid data matrix included 1799 aligned characters, of which 70 were parsimony-informative, 139 were variable but parsimony-uninformative, and 1590 were constant (Appendix B; Table 3-2). Parsimony analyses of the combined plastid datasets recovered 88,000 trees with a length of 248, CI of 0.720, RI of 0.841, and RC of 0.605. In the strict consensus of MP trees (Figures 3-3 A and B), a sister relationship between *Acinos arvensis* and a polytomy that included all remaining ingroup taxa was strongly supported by the bootstrap analysis (BS = 98%). *Poliomintha* species were distributed among two clades. The first clade (Clade I) was marginally supported (BS = 69%) and included *P. incana* and two *Clinopodium* species from Baja California (i.e., *C. chandleri* and *C. ganderi*). The second clade (Clade II) was a weakly supported polytomy (BS = 61%) comprised of *P. bustamanta*, *P. conjunctrix*, *P. dendritica*, *P. glabrescens*, *P. longiflora*, *Clinopodium hintoniorum*, and eighteen *Hedeoma* species. While the relationship between Clade I and Clade II and their position relative to other ingroup taxa was unresolved in the strict consensus, the topology suggests that *Poliomintha* is not monophyletic. However, poor bootstrap support in the topology limits confidence in a formal rejection of monophyly.

Maximum likelihood (ML) analysis of the combined plastid datasets recovered one tree with a negative log likelihood (-ln L) of 4086.57963 (Figures 3-4 A and B). The ingroup taxa were strongly supported (BS = 97%) as a

monophyletic group, with *Acinos arvensis* positioned basally and strongly supported (BS = 99%) as sister to the remaining taxa. The monophyly of *Poliomintha* was not supported in the ML topology. As described above for the parsimony results, *Poliomintha* species were distributed among the same two clades (Clade I and Clade II) in the ML topology. Bootstrap support increased for Clade I (BS = 74%), but slightly decreased for Clade II (BS = 59 %). While unresolved in the MP topologies, Clade II was positioned here as part of a larger, unsupported (BS < 50%) polytomy that included *Hedeoma hispida*, a *Rhododon* clade, and an unsupported (BS < 50%) polytomy that included species of *Blephilia*, *Clinopodium*, *Conradina*, *Dicerandra*, *Monarda*, and *Pycnanthemum*. The relationship of the above polytomy was unresolved relative to the remaining ingroup taxa, which included Clade I, two *Clinopodium* species, two *Hedeoma* species and four other clades of ingroup taxa.

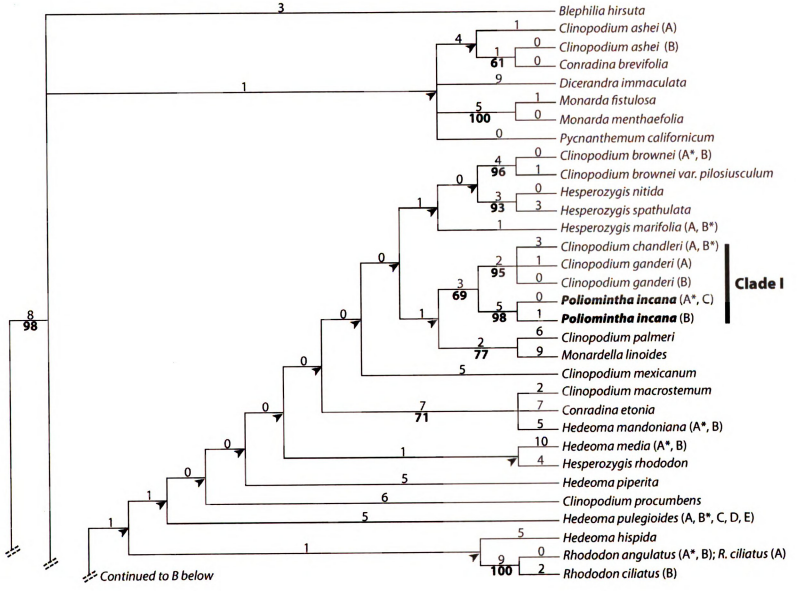
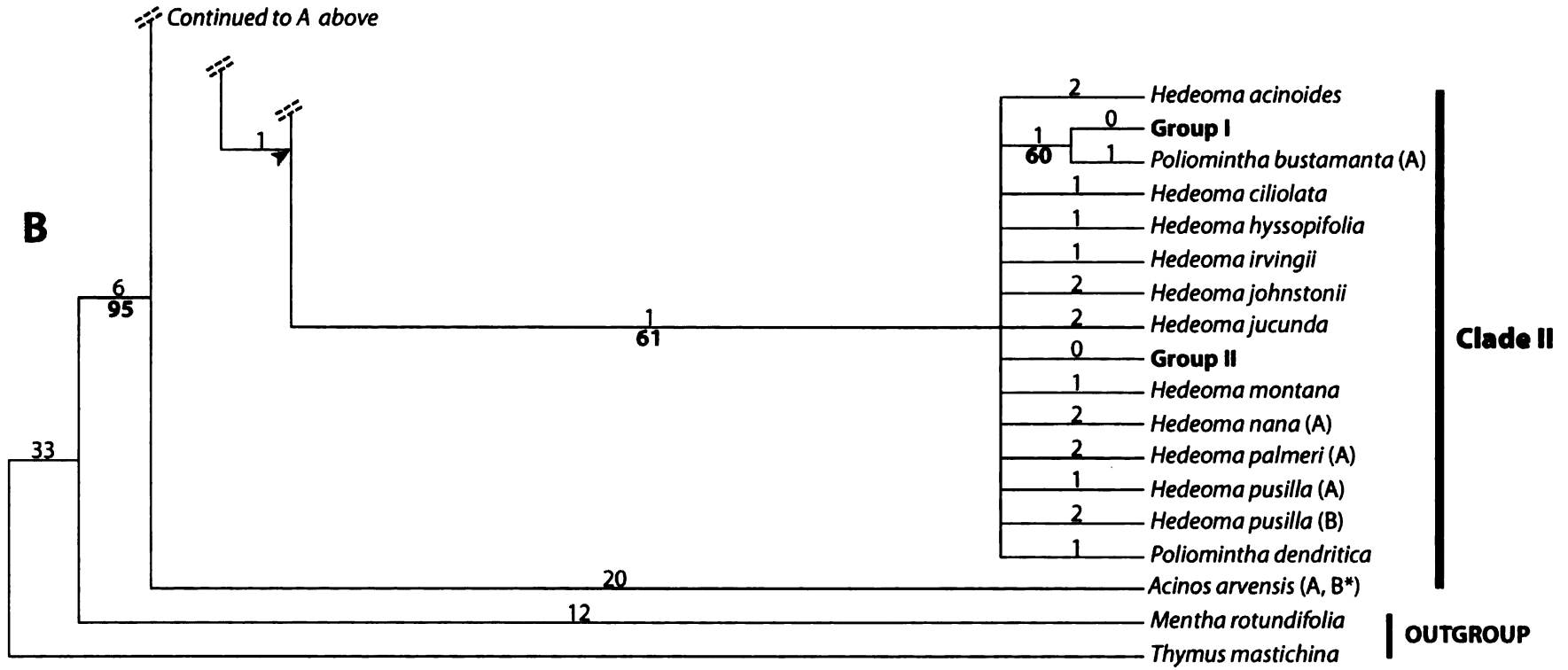

A
Blephilia hirsuta
Clinopodium ashei (A)
Clinopodium ashei (B)
Conradina brevifolia
Dicerandra immaculata
Monarda fistulosa
Monarda menthaefolia
Pycnanthemum californicum
Clinopodium brownei (A*, B)
Clinopodium brownei var. pilosiusculum
Hesperozygis nitida
Hesperozygis spathulata
Hesperozygis marifolia (A, B*)
Clinopodium chandleri (A, B*)
Clinopodium ganderi (A)
Clinopodium ganderi (B)
Poliomintha incana (A*, C)
Poliomintha incana (B)
Clade I
Clinopodium palmeri
Monardella linoides
Clinopodium mexicanum
Clinopodium macrostemum
Conradina etonia
Hedeoma mandoniana (A*, B)
Hedeoma media (A*, B)
Hesperozygis rhododon
Hedeoma piperita
Clinopodium procumbens
Hedeoma pulegioides (A, B*, C, D, E)
Hedeoma hispida
Rhododon angulatus (A*, B); R. ciliatus (A)
Rhododon ciliatus (B)
Continued to B below

Figure 3-3



Figures 3-3 A and B: One of 88,000 most parsimonious (MP) trees recovered from an analysis of combined plastid (trnL-F and rpl32-trnL) sequence data (treelength = 248 steps; CI = 0.887, RI = 0.841, and RC = 0.746, excluding uninformative characters). The randomly selected MP tree is shown as a rectangular cladogram with branch lengths (above) and bootstrap support values (bold, below) indicated. Branches that collapse in the strict consensus tree are indicated with arrows. Accessions used to represent identical groups of sequences are indicated with an asterisk.

Group I:
*Hedeoma apiculata**
Hedeoma drummondii (A)
Hedeoma reverchonii
Poliomintha longiflora (B)

Group II:
Clinopodium hintoniorum
Hedeoma costata (A, B)
Hedeoma drummondii (B)
Hedeoma martirense
*Hedeoma molle**
Hedeoma nana (B)
Hedeoma oblatifolia
Hedeoma palmeri (B)
Hedeoma patrina
Hedeoma plicata
Hedeoma pusilla (C)
Poliomintha bustamanta (B, C)
Poliomintha conjunctrix
Poliomintha glabrescens (A, B)
Poliomintha longiflora (A)

A

Group I:
*Hedeoma apiculata**
Hedeoma drummondii (A)
Hedeoma reverchonii
Poliomintha longiflora (B)

Group II:
Clinopodium hintoniorum
Hedeoma costata (A, B)
Hedeoma drummondii (B)
Hedeoma martirense
*Hedeoma molle**
Hedeoma nana (B)
Hedeoma oblatifolia
Hedeoma palmeri (B)
Hedeoma patrina
Hedeoma plicata
Hedeoma pusilla (C)
Poliomintha bustamanta (B, C)
Poliomintha conjunctrix
Poliomintha glabrescens (A, B)
Poliomintha longiflora (A)

0.001 substitutions/site

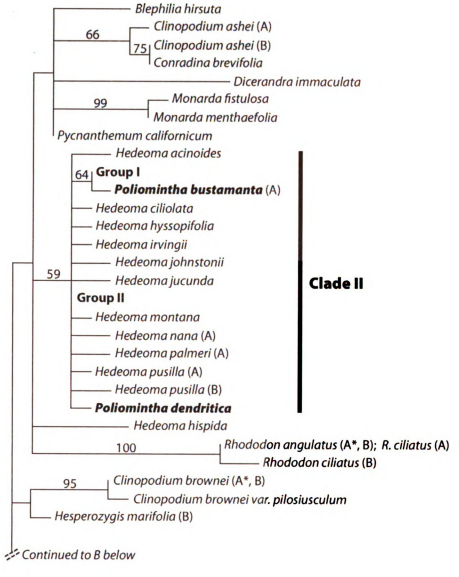
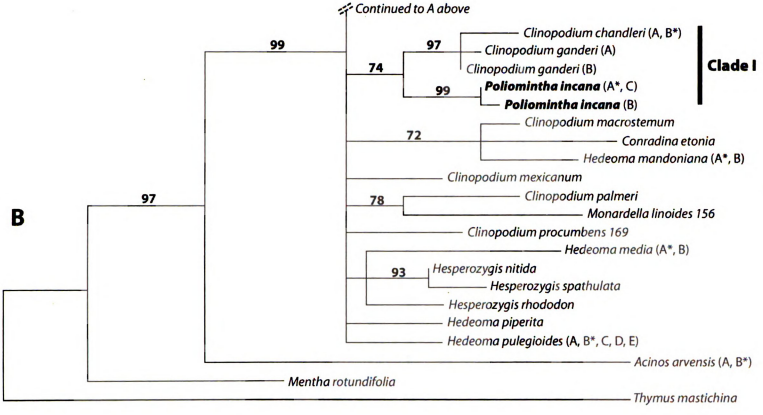


Figure 3-4



Figures 3-4 A and B: Maximum likelihood tree (-ln L = 4086.57963) recovered from an analysis of combined plastid (trnL-F and rpl32-trnL) sequence data for 83 accessions in the tribe Mentheae. Branch lengths are drawn to scale and bootstrap support (>50%) is indicated above the branches. Accessions used to represent identical groups of sequences are indicated with an asterisk.

Combined Analyses of *Poliomintha* and Related Genera

The partition homogeneity test (PHT) of the combined ITS and plastid (*trnL-trnF* and *rpl32-trnL*) datasets recovered a highly significant level of incongruence (P = 0.005). Visual comparison of trees recovered by parsimony and maximum likelihood analyses of the individual ITS and plastid datasets revealed supported topological differences for two taxa. The most important incongruence was observed for the focal taxon, *Poliomintha incana*, which is the type of the genus. *Poliomintha incana* was supported as sister to the genus *Rhododon* in the ITS topologies (*Poliomintha incana / Rhododon* Clade; MP BS = 76%; ML BS = 73%), but was supported as sister to a clade that includes the two *Clinopodium* species, *C. chandleri* and *C. ganderi*, in the plastid topologies (Clade I; MP BS = 69%; ML BS = 74%). The second topological difference was observed for *Conradina etonia*, which was well supported as sister to *Conradina brevifolia* in the ITS topologies (MP BS = 99%; ML BS = 95), but within a weakly supported polytomy that included *Clinopodium macrostemum* and *Hedeoma mandoniana* in the plastid topologies (MP BS = 71%; ML BS = 74%).

The combined nuclear (ITS) and plastid (*trnL-trnF* and *rpl32-trnL*) data matrix for 71 accessions included 2406 characters, of which 227 were parsimony-informative, 169 were variable but parsimony-uninformative, and 2010 were constant (Appendix B; Table 3-2). Parsimony analyses of the combined datasets recovered 43,966 trees with a length of 735 steps, CI of 0.553, RI of 0.749, and RC of 0.414. The topology in the strict consensus of MP trees strongly resembled that reported from the ITS data (Figures 3-5 A and B; Figures

3-1 A and B). The monophyly of the ingroup was strongly supported in the MP trees (BS = 96%), with *Acinos arvensis* positioned basally as sister to the remaining ingroup taxa (BS = 98%). *Poliomintha* was not supported as a monophyletic group. Species of *Poliomintha* were distributed among the "Hedeomintha" and *Poliomintha incana / Rhododon* clades described for the ITS topologies. However, bootstrap support for the *Poliomintha incana / Rhododon* clade was higher for the combined data (BS = 83%) than it was for the ITS data alone. The remaining *Poliomintha* species did not form a monophyletic group within the "Hedeomintha" clade, but were present as part of two subclades within all MP topologies. However, increased resolution and bootstrap support (>50%) among clades with *Poliomintha* in the "Hedeomintha" clade was not improved with the addition of plastid data.

The ML analysis of the combined nuclear and plastid data recovered one tree with a negative log likelihood (-ln L) of 7951.01811 (Figures 3-6 A and B). As described above, the ingroup taxa were supported as a monophyletic group, but bootstrap values decreased slightly in comparison to the MP results (ML BS = 91%; MP BS = 96%). *Acinos arvensis* was positioned basally and strongly supported as sister to the remaining ingroup taxa (BS = 91%). Consistent with previous results, the monophyly of *Poliomintha* was not supported in the ML topology. *Poliomintha* species were distributed among the *Poliomintha incana / Rhododon* and "Hedeomintha" clades as previously described. However, support for the *Poliomintha incana / Rhododon* clade decreased in the ML topology (ML BS = 75%; MP BS = 83%). The position of the *Poliomintha incana / Rhododon*

clade was resolved as sister to another clade that included taxa from genera such as *Blephilia*, *Conradina*, *Monarda*, *Pycnanthemum*, and some taxa from *Hedeoma* and *Hesperozygis* from eastern South America. As for the "Hedeomintha" clade, it was positioned within a polytomy that included *Clinopodium hintoniorum* and *Hedeoma jucunda*. The addition of the two taxa as part of a larger group that included the "Hedeomintha" clade was consistent with relationships observed in ML plastid topology.

A

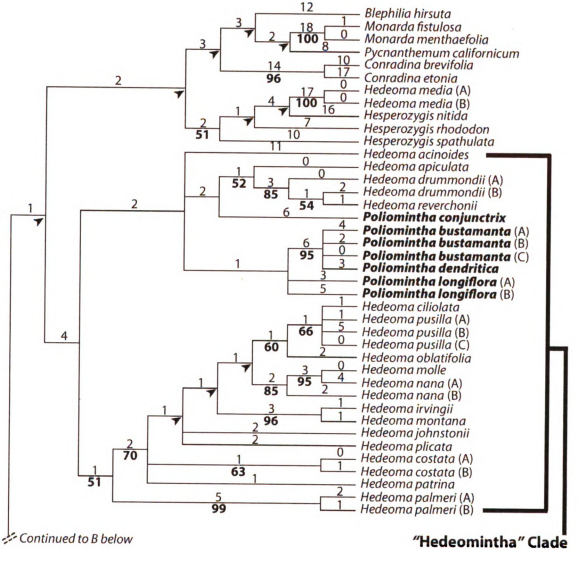
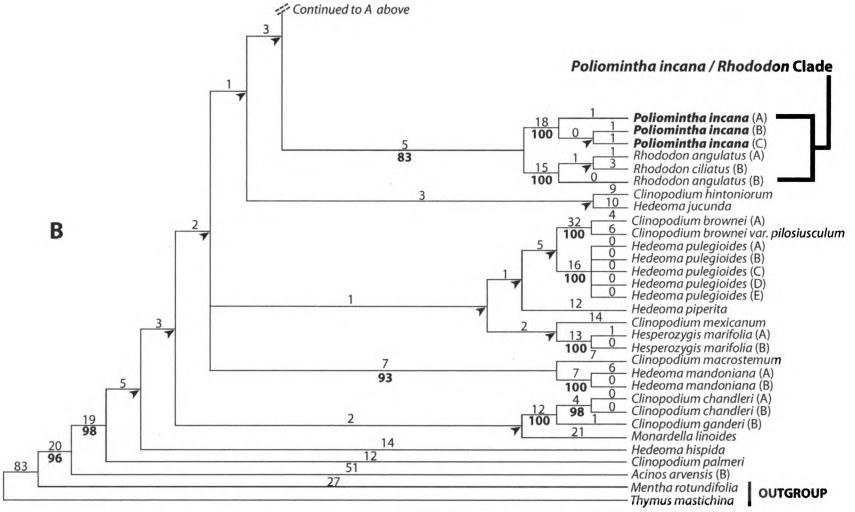

Blephilia hirsuta
Monarda fistulosa
Monarda menthaefolia
Pycnanthemum californicum
Conradina brevifolia
Conradina etonia
Hedeoma media (A)
Hedeoma media (B)
Hesperozygis nitida
Hesperozygis rhodadon
Hesperozygis spathulata
Hedeoma acinoides
Hedeoma apiculata
Hedeoma drummondii (A)
Hedeoma drummondii (B)
Hedeoma reverchonii
Poliomintha conjunctrix
Poliomintha bustamanta (A)
Poliomintha bustamanta (B)
Poliomintha bustamanta (C)
Poliomintha dendritica
Poliomintha longiflora (A)
Poliomintha longiflora (B)
Hedeoma ciliolata
Hedeoma pusilla (A)
Hedeoma pusilla (B)
Hedeoma pusilla (C)
Hedeoma oblatifolia
Hedeoma molle
Hedeoma nana (A)
Hedeoma nana (B)
Hedeoma irvingii
Hedeoma montana
Hedeoma johnstonii
Hedeoma plicata
Hedeoma costata (A)
Hedeoma costata (B)
Hedeoma patrina
Hedeoma palmeri (A)
Hedeoma palmeri (B)
Continued to B below
"Hedeomintha" Clade

Figure 3-5



Figures 3-5 A and B: One of 43,966 most parsimonious (MP) trees recovered from a combined analysis of ITS, trnL-F, and rpl32-trnL sequence data (treelength = 735 steps; CI = 0.553, RI = 0.749, and RC = 0.414, excluding uninformative characters). The randomly selected MP tree is shown as a rectangular cladogram with branch lengths (above) and bootstrap support values (bold, below) indicated. Branches that collapse in the strict consensus tree are indicated with arrows.

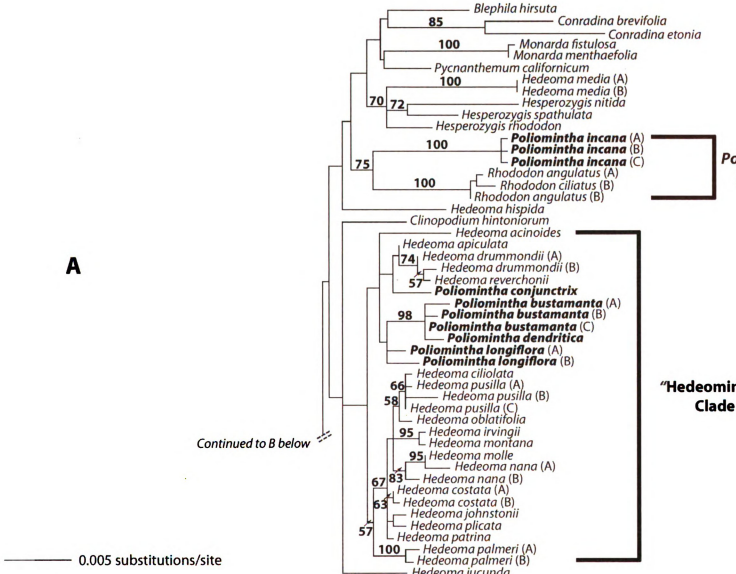
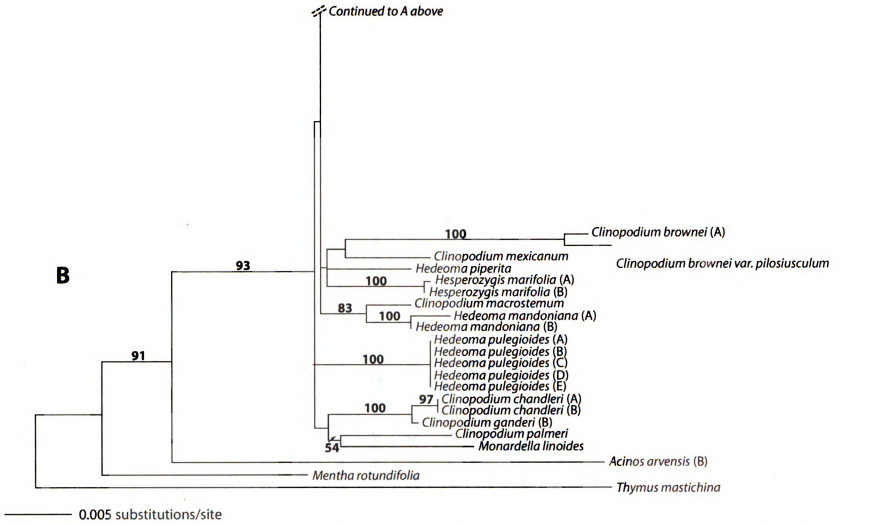

A
Blephila hirsuta
85
Conradina brevifolia
Conradina etonia
100
Monarda fistulosa
Monarda menthaefolia
Pycnanthemum californicum
100
Hedeoma media (A)
Hedeoma media (B)
70
72
Hesperozygis nitida
Hesperozygis spathulata
Hesperozygis rhododon
Poliomintha incana (A)
100
Poliomintha incana (B)
Poliomintha incana (C)
75
Rhododon angulatus (A)
100
Rhododon ciliatus (B)
Rhododon angulatus (B)
Poliomintha incana / Rhododon Clade
Hedeoma hispida
Clinopodium hintoniorum
Hedeoma acinoides
Hedeoma apiculata
74
Hedeoma drummondii (A)
Hedeoma drummondii (B)
57
Hedeoma reverchonii
Poliomintha conjunctrix
Poliomintha bustamanta (A)
98
Poliomintha bustamanta (B)
Poliomintha bustamanta (C)
Poliomintha dendritica
Poliomintha longiflora (A)
Poliomintha longiflora (B)
Hedeoma ciliolata
66
Hedeoma pusilla (A)
58
Hedeoma pusilla (B)
Hedeoma pusilla (C)
Hedeoma oblatifolia
"Hedeomintha" Clade
Continued to B below
95
Hedeoma irvingii
Hedeoma montana
95
Hedeoma molle
Hedeoma nana (A)
67
83
Hedeoma nana (B)
Hedeoma costata (A)
63
Hedeoma costata (B)
Hedeoma johnstanii
Hedeoma plicata
57
Hedeoma patrina
100
Hedeoma palmeri (A)
Hedeoma palmeri (B)
Hedeoma jucunda
0.005 substitutions/site

Figure 3-6



Figures 3-6 A and B: Maximum likelihood tree (-ln L = 7951.01811) recovered from the combined analysis of nuclear (ITS) and plastid (trnL-F and rpl32-trnL) sequence data for 71 accessions in the tribe Mentheae. Branch lengths are drawn to scale and bootstrap support (>50%) is indicated above the branches.

Tests of Alternative Phylogeny

Results from the SH tests supported the conclusion that *Poliomintha* is not monophyletic, regardless of whether or not *P. conjunctrix* was included. Parsimony searches of the combined nuclear and plastid datasets constrained to one of two topologies recovered a total of 232 trees with a monophyletic *Poliomintha* (*Constraint 1*) and 72 trees with a monophyletic *Poliomintha* that excluded *P. conjunctrix* (*Constraint 2*). Based on the TrN + I + Γ model of sequence evolution for the combined data, the most likely tree recovered under *Constraint 1* had a negative log likelihood (-ln L) of 7997.70634, length of 745 steps, CI of 0.543, RI of 0.739, and RC of 0.401. The most likely tree recovered under *Constraint 2* had a -ln L of 7991.02576, length of 743 steps, CI of 0.545, RI of 0.741, and RC of 0.404. The SH tests comparing the mostly likely constraint trees with the most likely unconstrained MP tree (-ln L = 7956.02084) and the ML tree (-ln L = 7951.01811) detected highly significant differences in likelihoods for all pairwise comparisons (Table 3-2). Not reported in Table 3-3 are the results of an SH test comparing the most likely MP tree and the ML tree, of which significant likelihood differences were not detected among the two topologies at the $\alpha = 0.05$ level ($P = 0.382$; difference in –ln L = 5.00273).

Table 3-3: Results of SH tests. Numbers indicate *P* value / difference in negative log likelihood (-ln L) score. Significance at the $\alpha = 0.05$ level is indicated with an asterisk.

	MP no constraint: Most likely tree (-ln L = 7956.02084)	**ML no constraint:** Most likely tree (-ln L = 7951.01811)
MP: Constraint 1 *Poliomintha* monophyly Most likely tree (-ln L = 7997.70634)	0.009* / 41.68551	0.004* / 46.68824
MP: Constraint 2 *Poliomintha* monophyly excluding *P. conjunctrix* Most likely tree (-ln L = 7991.02576)	0.018* / 35.00492	0.012* / 40.00765

Chapter 4

DISCUSSION

The phylogenetic hypotheses presented herein, inferred from over 2,400 base pairs of nuclear and chloroplast DNA sequence data, resurrect a number of systematic issues pertinent to *Poliomintha* previously discussed by some researchers and offer much needed insight into long-standing taxonomic questions and debate over the generic boundaries among *Poliomintha* and closely related genera in the tribe Mentheae. Several important findings from the study and their implications are discussed here, including: (1) phylogenetic relationships among *Poliomintha* and related genera; (2) the importance of morphological characters in delineating genera; and (3) the taxonomy of *Poliomintha*.

Phylogenetic Relationships among *Poliomintha* and Related Genera

The phylogenetic hypotheses consistently suggest that *Poliomintha* is not monophyletic. As currently circumscribed, *Poliomintha* represents at least two distinct lineages; a lineage that includes the type species, *P. incana*, and either (or both) *Rhododon* or two species of the polyphyletic genus *Clinopodium*; and a second lineage that includes the remaining species of *Poliomintha* and most species of *Hedeoma* (e.g., the "Hedeomintha" clade). These results are, in part, consistent with the findings of Wagstaff et al. (1995), who first reported a sister relationship between *Poliomintha* (*P. longiflora*) and *Hedeoma* (*H. drummondii*)

based on a parsimony analysis of cpDNA restriction site variation in subfamily Nepetoideae. The results of my study consistently reveal a close relationship between most species of *Poliomintha* and *Hedeoma*. However, no evidence is available to suggest that the type species of either genus (*P. incana* and *H. pulegioides*) is included in the same clade as the majority of the species from the two genera. In fact, the results of the constraint analyses and SH tests suggest that *P. incana* is not related to the remaining *Poliomintha* species, representing a new and important finding that has taxonomic implications.

Phylogenetic relationships among genera in the Mentheae are difficult to interpret with confidence from the results presented here for several reasons. First, insufficient resolution and low bootstrap support within and among most clades imposes substantial limits on inference of evolutionary relationships among sampled taxa, especially at the generic level. It is possible that the lack of resolution and support is a consequence of either incomplete sampling of taxa or insufficient sequence data, or both (Graybeal 1998). As suggested by my results, several genera included the study may be polyphyletic (Figures 3-1 to 3-6)—e.g., *Clinopodium*, *Hedeoma*, *Hesperozygis*, and *Poliomintha*—and more extensive sampling of taxa within these genera as well as from other genera in the Mentheae such as *Acanthomintha*, *Bystropogon*, *Cunila*, *Dicerandra*, *Eriothymus*, *Glechon*, *Minthostachys*, *Piloblephis*, *Pogogyne*, *Rhabdocaulon*, and *Stachydeoma* may help to better resolve relationships. As for character sampling, additional work is needed to identify informative nuclear and plastid markers. The plastid regions used in this study exhibit low levels of sequence divergence and

contribute less than one-third of the total phylogenetically informative characters to the analyses (Table 3-1). As a result, insufficient resolution is obtained for many groups from analyses of plastid data alone (Figures 3-3 A and B; Figures 3-4 A and B) or in combination with ITS data (Figures 3-5 A and B; Figures 3-6 A and B).

The incongruence among the ITS and plastid datasets represents another challenge to phylogenetic inference of relationships in the Mentheae. The PHT has been demonstrated to be overly sensitive in large datasets such as that used here (Hipp et al. 2004). Therefore, it is possible that the incongruence suggested by the PHT does not represent phylogenetic differences, but instead is an artifact of the overly sensitive nature of the test. In this case, it appears that the incongruence is widespread and involves more than one taxon. The topological differences observed among individual analyses diminish confidence in some relationships, particularly for those involving the focal taxon (*P. incana*). For example, relationships between *P. incana* and either *Rhododon* or species of *Clinopodium* are weakly supported in the phylogenetic analyses of ITS and plastid datasets, as well as in those using total evidence.

Cases of widespread incongruence among ITS and plastid datasets have been documented for other groups in the Mentheae such as *Conradina*, *Clinopodium*, and related scrub mints from the southeastern United States (Edwards et al. 2006; Edwards et al. 2008). In fact, incongruence among different gene trees is a commonly encountered problem in phylogenetic studies, particularly in those involving recently derived and rapidly radiating species

(Buckley et al. 2006). In examples of incongruence between nuclear and plastid data, the patterns of plastid sequence variation may be explained by processes such as introgression or shared ancestral polymorphism lineage sorting (Wendel and Doyle 1998; Schaal and Olsen 2000). However, distinguishing between processes responsible for the patterns is often difficult because of the large variance associated with the coalescent process and the fact that the processes can produce similar phylogenetic patterns (Holder et al. 2001). For some groups in the Mentheae, it may be difficult to reconstruct phylogenetic relationships using DNA sequence data, particularly in cases where taxa are recently derived, hybridization is widespread, or where there is a lack of coalescence (Edwards et al. 2008).

Importance of Morphological Characters in Delineating Genera

For over 100 years systematists have been uncertain about the generic circumscription of *Poliomintha*. Its similar morphology and close relationship to genera such as *Hedeoma* and *Hesperozygis* have been discussed by several researchers, some of whom have questioned its distinction at the generic level. Briquet (1897) first discussed in-depth the inherent complexity of morphological interpretation for these genera, emphasizing the fact that some taxa exhibit character states that appear "intermediate" between those traditionally used to delineate generic boundaries. It seems that Briquet's decision to subsume *Poliomintha* into *Hedeoma* on the basis of insufficient clear-cut differences was, as Epling and Stewart (1939) effectively point out, inappropriate within the

context of a larger Mentheae and would necessitate the inclusion of other genera beyond the scope of those discussed here. Epling & Stewart (1939) argued that "the fact that no single constant point of difference may be brought forward wherewith to distinguish *Hedeoma* and *Poliomintha* is not presumptive of their unity." Characters such as stamen number (two *versus* four), habit (herbaceous *versus* woody), calyx morphology (gibbous, saccate, campanulate, or bilabiate *versus* tubular and symmetrical), and the presence or absence of a well-defined or irregular calyx annulus were defined by Epling and Stewart (1939) and Irving (1972, 1980) for the purposes of delineating boundaries among *Hedeoma*, *Hesperozygis*, and *Poliomintha*. However, in light of my phylogenetic results, it appears that the taxonomic importance of at least some of the characters used by these researchers has been overestimated.

Characters such as habit and calyx morphology do not represent synapomorphies that characterize monophyletic groupings of taxa, but instead are homoplasious within the phylogenetic context presented here. The habit, in particular, is not an ideal diagnostic character by which to distinguish *Poliomintha* from *Hedeoma*. Within the monophyletic "Hedeomintha" clade, one can find numerous examples of *Hedeoma* species that exhibit woody or semi-woody habits. Moreover, species with annual and perennial herbaceous habits as well as species with woody or semi-woody habits can be found in other monophyletic genera in the Mentheae—for example, in *Monarda* (Prather et al. 2002). Without sufficient resolution and bootstrap support within and among most clades, it seems premature to undertake a comprehensive morphological study to uncover

synapomorphies. However, character analyses may be helpful in determining what characters best distinguish monophyletic clades, pending the acquisition of more conclusive phylogenetic evidence.

The Taxonomy of *Poliomintha*

The phylogenetic evidence from this study consistently suggests that *Poliomintha* is not monophyletic as currently circumscribed. In consideration of these results, the genus *Poliomintha* may be best limited to the type species, *P. incana*, pending future phylogenetic and morphological studies that determine the relationships of *P. incana* with confidence. As for the remaining *Poliomintha* species, their taxonomic disposition depends on the relationships among the species of *Hedeoma*. Based on my results, *Hedeoma* is polyphyletic and the type of *Hedeoma*, *H. pulegioides*, is most likely unrelated to the remainder of the genus. However, more evidence is needed to confirm this result. If further phylogenetic evidence suggests that *H. pulegioides* is a member of the "Hedeomintha" clade, the *Poliomintha* species that comprise the clade are best subsumed into the genus *Hedeoma* to reflect their common ancestry. Alternatively, if *H. pulegioides* is excluded from the "Hedeomintha" clade, the *Poliomintha* and *Hedeoma* species comprising the clade should be reclassified into a new genus.

Many genera in family Lamiaceae are not monophyletic as currently circumscribed. In consideration of molecular synapomorphies, many genera are polyphyletic or paraphyletic relative to other genera, including: *Satureja* L.

(Wagstaff et al. 1995); *Clerodendrum* (Steane et al. 1999); *Salvia* L. (Walker and Systma 2004); *Huxleya* (Steane et al. 2004); *Basilicum* Moench, *Endostemon* N. E. Br., *Fuerstia* T. C. E. Fr., *Haumaniastrum* P. A. Duvign and Plancke, *Hemizygia* Briq., *Hoslundia* Vahl, *Hyptis* Jacq., *Platostoma* P. Beauv., *Plectranthus* L. Hér., *Puntia* Hedge, *Ocimum* L., *Orthosiphon* Benth., and *Syncolostemon* E. Mey. (Paton et al. 2004); and *Micromeria* Benth. (Braüchler et al. 2005). Many of these genera, including *Poliomintha*, *Hedeoma*, *and Clinopodium*, will likely necessitate (or have been subject to) taxonomic and nomenclatural revision. Although no nomenclatural changes are recommended based on my results, any future taxonomic revisions that involve nomenclatural changes for *Poliomintha* or other genera should carefully consider the possibility of broader societal impacts.

APPENDICES

APPENDIX A

APPENDIX A

Voucher Information for Material Used in the Molecular Phylogenetic Analyses

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Acinos arvensis (Lam.) Dandy	A	USA: Michigan	Stephenson s.n. 9/6/84 (MSC)	T, R
Acinos arvensis (Lam.) Dandy	B	USA: Michigan	Stephenson s.n. 7/14/86 (MSC)	I, T, R
Blephilia hirsuta Bentham		USA: Ohio	Prather 1870 (MSC)	I, T, R
Clinopodium ashei (Weath.) Small	A	USA: Georgia	Churchill 89588 (MSC)	T, R
Clinopodium ashei (Weath.) Small	B	USA: Florida	Churchill 85395 (MSC)	T, R
Clinopodium brownei (Sw.) Kuntze	A	México: Chiapas	Lopéz 436 (CAS)	I, T, R
Clinopodium brownei (Sw.) Kuntze	B	México: Chiapas	Chamé & Luna 68 (CAS)	T, R
Clinopodium brownei var. pilosiusculum (A. Gray) Briq.		USA: Florida	Jones 23600 (MSC)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *tmL-tmL-tmF*, and R = *rpl32-tmL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Clinopodium chandleri (Brandegee) P.D.Cantino & S.J.Wagstaff	A	México: Baja California	Moran 17799 (TEX/LL)	I, T, R
Clinopodium chandleri (Brandegee) P.D.Cantino & S.J.Wagstaff	B	México: Baja California	Moran 17799 (MSC)	I, T, R
Clinopodium ganderi (Epling) Govaerts	A	México: Baja California	Webster 21812 (TEX)	T, R
Clinopodium ganderi (Epling) Govaerts	B	México: Baja California	Moran 30484 (CAS)	I, T, R
Clinopodium hintoniorum (B. L. Turner) Govaerts		México: Nuevo León	Hinton *et al.* 23946 (CAS)	I, T, R
Clinopodium macrostemum (Moç. & Sessé ex Benth.) Kuntze		México: Michoacán	Cornejo *et al.* 422 (NY)	I, T, R
Clinopodium mexicanum (Benth.) Govaerts		México: Oaxaca	Cronquist 11850 (NY)	I, T, R
Clinopodium palmeri (A. Gray) Kuntze		México: Isla Guadelupe	Junak 6768 (MSC)	I, T, R
Clinopodium procumbens (Greene) Harley		México: Chiapas	Santíz 536 (CAS)	T, R
Conradina brevifolia Shinners		USA: Florida	Churchill 88720 (MSC)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Conradina etonia Kral & R. B. McCartney		USA: Florida	Churchill 91-200 (MSC)	I, T, R
Dicerandra immaculata Lakela		USA: Florida	Kral 59309 (MSC)	T, R
Hedeoma acinoides Scheele		USA: Texas	M. W. Turner 124 (TEX)	I, T, R
Hedeoma apiculata W. S. Stewart		USA: Texas	Higgins 17367 (NY)	I, T, R
Hedeoma ciliolata (Epling) R. S. Irving		México: Nuevo León	Henrickson 19282 (NY)	I, T, R
Hedeoma costata A. Gray	A	México: Coahuila	Villarreal *et al.* 8748 (NY)	I, T, R
Hedeoma costata A. Gray	B	México: Nuevo León	Hinton *et al.* 24134 (NY)	I, T, R
Hedeoma drummondii Benth.	A	USA: Wyoming	Lichvar 2889 (NY)	I, T, R
Hedeoma drummondii Benth.	B	México: Quérataro	Hernández & Tenorio 7145 (NY)	I, T, R
Hedeoma hispida Pursh		USA: Illinois	Hill 30345 (NY)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Hedeoma hyssopifolia A. Gray		USA: New Mexico	Sanders 3027 (TEX)	T, R
Hedeoma irvingii B. L. Turner		México: Coahuila	Hinton *et al.* 25974 (TEX)	I, T, R
Hedeoma johnstonii R. S. Irving		México: Coahuila	Spellenberg 9958 (TEX)	I, T, R
Hedeoma jucunda Greene		México: Durango	Irving 707 (TEX)	I, T, R
Hedeoma mandoniana Wedd.	A	Bolivia: Murillo	Soloman 17564 (NY)	I, T, R
Hedeoma mandoniana Wedd.	B	Peru: Urubamba	Tapayachi 1035 (NY)	I, T, R
Hedeoma media Epling	A	Uruguay: Dept. de San José	R. & D. Irving U-1 (TEX)	I, T, R
Hedeoma media Epling	B	Uruguay: Dept. de Montevideo	R. & D. Irving U-46 (TEX)	I, T, R
Hedeoma martirense Moran		México: Baja California	Moran 15446 (TEX/LL)	T, R
Hedeoma molle Torr.		USA: Texas	Lott *et al.* 5503 (TEX)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Hedeoma montana Brandegee		México: Coahuila	Henrickson 12159 (NY)	I, T, R
Hedeoma nana (Torr.) Briq.	A	USA: Texas	Lott *et al.* 5531 (TEX)	I, T, R
Hedeoma nana (Torr.) Briq.	B	USA: Texas	B. L. Turner 24-126 (TEX)	I, T, R
Hedeoma oblatifolia Villarreal		México: Coahuila	Villarreal 6580 (TEX)	I, T, R
Hedeoma palmeri Hemsl.	A	México: Nuevo León	Hinton *et al.* 22103 (NY)	I, T, R
Hedeoma palmeri Hemsl.	B	México: Nuevo León	Villarreal 4904 (NY)	I, T, R
Hedeoma patrina W.S. Stewart		México: Chiuahua	Nesom 4909 (TEX)	I, T, R
Hedeoma plicata Torr.		México: Chiuahua	Laferrière 1688 (TEX)	I, T, R
Hedeoma piperita Benth.		México: Distrito Federal	Irving 709 (TEX)	I, T, R
Hedeoma pulegioides (L.) Pers.	A	USA: Arkansas	Thomas *et al.* 125883 (NY)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Hedeoma pulegioides (L.) Pers.	B	USA: Missouri	Magrath 4647 (NY)	I, T, R
Hedeoma pulegioides (L.) Pers.	C	USA: Kentucky	Buddell & Thieret 645 (NY)	I, T, R
Hedeoma pulegioides (L.) Pers.	D	USA: Pennsylvania	Shelter 7 (NY)	I, T, R
Hedeoma pulegioides (L.) Pers.	E	USA: Ohio	Jones 67-8-19-847 (MSC)	I, T, R
Hedeoma pusilla (R. S. Irving) R. S. Irving	A	México: Nuevo León	Nesom 6207 (TEX)	I, T, R
Hedeoma pusilla (R. S. Irving) R. S. Irving	B	México: Nuevo León	Hinton *et al.* 18524 (NY)	I, T, R
Hedeoma pusilla (R. S. Irving) R. S. Irving	C	México: Nuevo León	Ripley & Barneby 13582 (NY)	I, T, R
Hedeoma reverchonii A. Gray		USA: Texas	Holmes 10075 (TEX)	I, T, R
Hesperozygis marifolia (S. Schauer) Epling	A	México: San Luis Potosí	Torres 15619 (TEX)	I, T, R
Hesperozygis marifolia (S. Schauer) Epling	B	México: San Luis Potosí	Breedlove 63288 (CAS)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Hesperozygis nitida (Benth.) Epling		Brazil: Paraná	Poliquesi 442 (NY)	I, T, R
Hesperozygis rhododon Epling		Brazil: Paraná	Hatschbach 23936 (NY)	I, T, R
Hesperozygis spathulata Epling		Brazil: Paraná	Dusén 15165 (MSC)	I, T, R
Mentha rotundifolia Huds.		USA: California	Stevens 1525 (MSC)	I, T, R
Monarda fistulosa L.		USA: Texas	Prather 1837 (MSC)	I, T, R
Monarda menthaefolia		USA: Arizona	Chamberland 1567 (MSC)	I, T, R
Monardella linoides A. Gray		USA: California	Wallace 638 (MSC)	I, T, R
Poliomintha bustamanta B. L. Turner	A	USA: Utah (Cultivated)	Higgins 26826 (TEX)	I, T, R
Poliomintha bustamanta B. L. Turner	B	México: Taumaulipas	Martinez 01574 (TEX)	I, T, R
Poliomintha bustamanta B. L. Turner	C	México: Nuevo León	Hinckley s.n. October 1993 (TEX)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Poliomintha conjunctrix Epling & Wiggins		México: Baja California	Lindsay s.n. 20 June 1937 (CAS)	I, T, R
Poliomintha dendritica B. L. Turner		México: Nuevo León	Prather & Patterson 1469 (TEX)	I, T, R
Poliomintha glabrescens A. Gray ex. Hemsley	A	México: Coahuila	Riskind 23109 (TEX)	T, R
Poliomintha glabrescens A. Gray ex. Hemsley	B	México: Coahuila	Henrickson 22174 (TEX)	T, R
Poliomintha incana (Torrey) A. Gray	A	USA: Texas	Gutierrez 366 (MSC)	I, T, R
Poliomintha incana (Torrey) A. Gray	B	México: Chiuahua	Worthington 12887 (NY)	I, T, R
Poliomintha incana (Torrey) A. Gray	C	USA: Arizona	Rink 3374 (NY)	I, T, R
Poliomintha longiflora A. Gray	A	México: Nuevo León	Henrickson 22797 (TEX)	I, T, R
Poliomintha longiflora A. Gray	B	México: Coahuila	Hinton *et al.* 22073 (TEX)	I, T, R
Pycnanthemum californicum Torr. ex. Dur.-Duq		USA: California	Barclay *et al.* 1513 (MSC)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-trnL-trnF*, and R = *rpl32-trnL*.

Taxon	Specimen	Location	Voucher (Voucher Location)†	Amplified Regions†
Rhododon angulatus (Tharp) B. L. Turner	A	USA: Texas	Carr 15722 (TEX/LL)	I, T, R
Rhododon angulatus (Tharp) B. L. Turner	B	USA: Texas	M. W. Turner *et al.* 47 (TEX)	I, T, R
Rhododon ciliatus (Benth.) Epling	A	USA: Texas	B. & M. MacRoberts 4934 (TEX)	T, R
Rhododon ciliatus (Benth.) Epling	B	USA: Texas	B. L. & M. W. Turner 95-95 (TEX)	I, T, R
Thymus mastichina L.		Spain: La Jaras-Las Villuercas	Ladero s.n. 16 May 1969 (MSC)	I, T, R

†Vouchers are listed by collector and collector number; voucher location is the herbarium where the voucher is deposited. Regions amplified include: I = ITS, T = *trnL-tmL-trnF*, and R = *rpl32-tmL*.

APPENDIX B

APPENDIX B

Aligned Sequence Matrix 1: Nuclear Ribosomal Internal Transcribed Spacer (ITS1, 5.8S, and ITS2)

```
Thymus mastichina                  -------------------------------------------------- [ 50]
Mentha rotundifolia                -------------------------------------------------- [ 50]
Acinos arvensis                    ----------------------------------------------GGA [ 50]
Blephilia hirsuta                  -------------------------------------------------- [ 50]
Clinopodium brownei A              --------------------ACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium brownei
 var. pilosiusculum                ------------AAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium chandleri A            -GGAAGGA-G--AAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium chandleri B            ------------------TAAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium ganderi B              --------------------AACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium hintoniorum            ------------------TAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium macrostemum            -------------------------------------------------- [ 50]
Clinopodium mexicanum              ------------------GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium palmeri                --------------------ACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium brevifolia             ----------------TCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Clinopodium etonia                 -------------------------------------------------- [ 50]
Hedeoma acinoides                  ------------------GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma apiculata                  ---AAGGA-G--AAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma ciliolata                  -----------------TGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma costata A                  --------------------AACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma costata B                  ---------------GTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma drummondii A               ---------------GTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma drummondii B               -----------AAAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma hispida                    --------------------AACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma irvingii                   ------------------GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
Hedeoma johnstonii                 --------------------AACAAGGTTTCCGTA-GGTGAACCTGCGGA [ 50]
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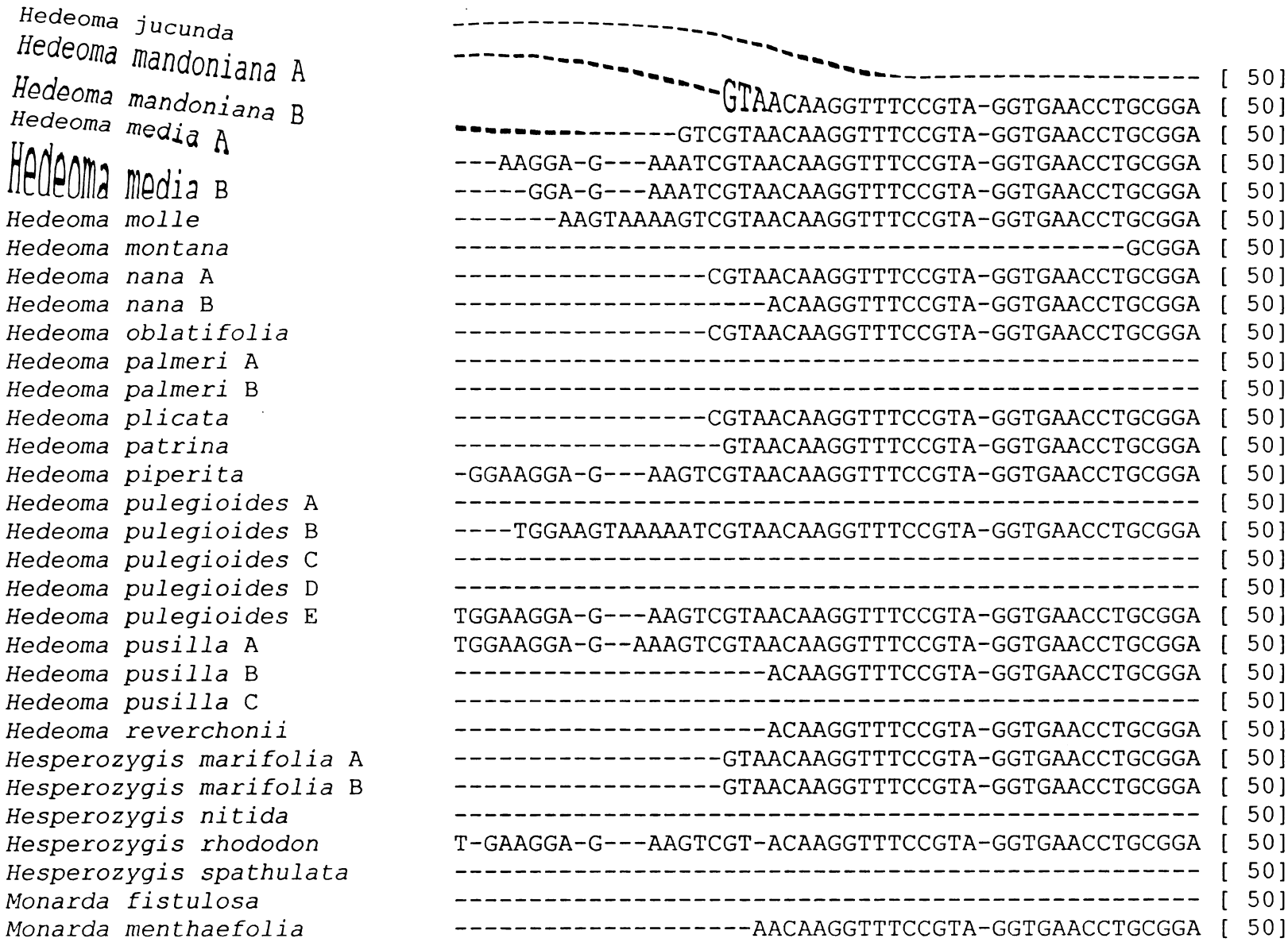
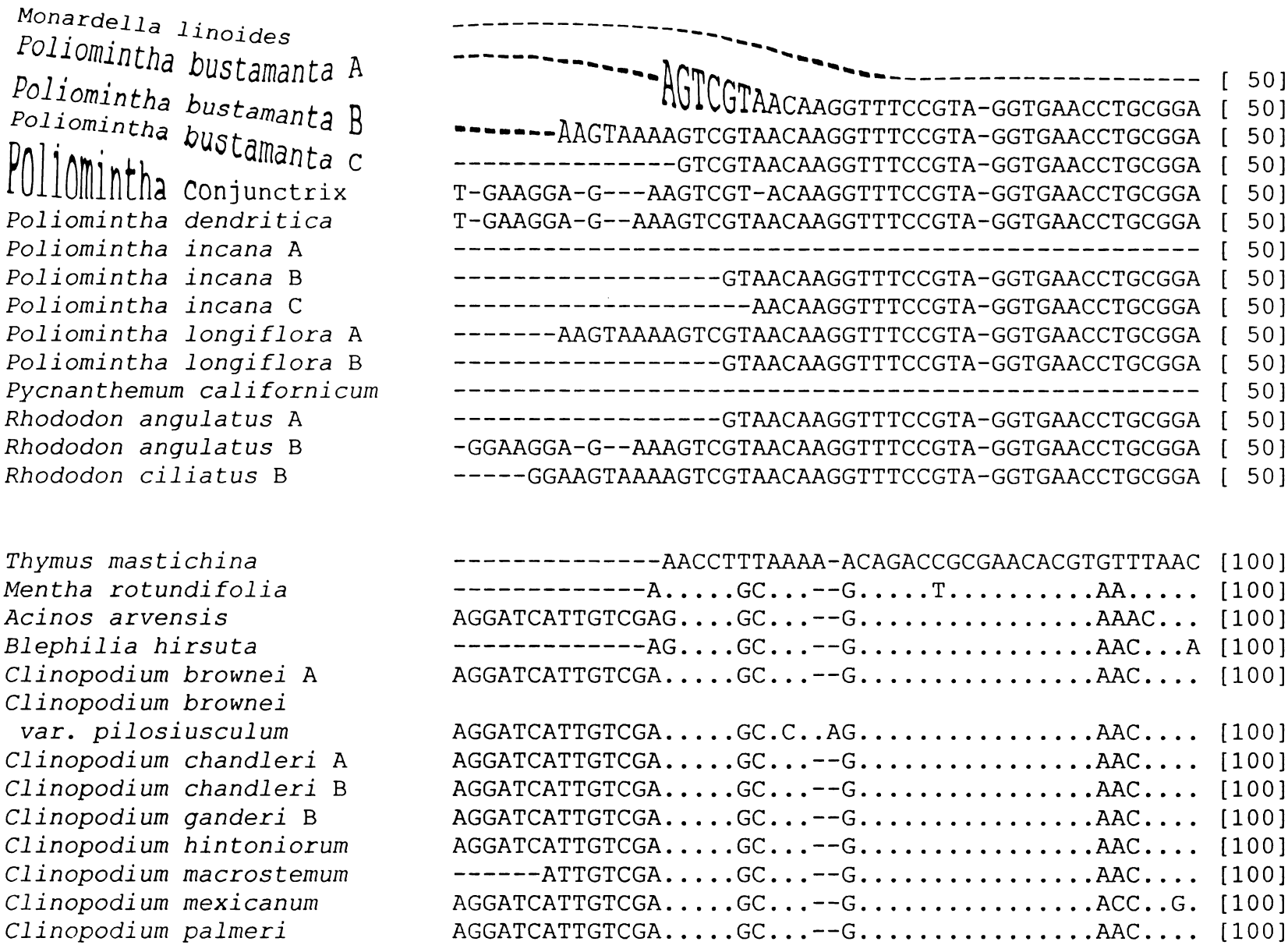

Hedeoma jucunda
Hedeoma mandoniana A
Hedeoma mandoniana B
Hedeoma media A
Hedeoma media B
Hedeoma molle
Hedeoma montana
Hedeoma nana A
Hedeoma nana B
Hedeoma oblatifolia
Hedeoma palmeri A
Hedeoma palmeri B
Hedeoma plicata
Hedeoma patrina
Hedeoma piperita
Hedeoma pulegioides A
Hedeoma pulegioides B
Hedeoma pulegioides C
Hedeoma pulegioides D
Hedeoma pulegioides E
Hedeoma pusilla A
Hedeoma pusilla B
Hedeoma pusilla C
Hedeoma reverchonii
Hesperozygis marifolia A
Hesperozygis marifolia B
Hesperozygis nitida
Hesperozygis rhododon
Hesperozygis spathulata
Monarda fistulosa
Monarda menthaefolia
GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
GTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
---AAGGA-G---AAATCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
-----GGA-G---AAATCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
-------AAGTAAAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
GCGGA [50]
CGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
ACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
CGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
[50]
[50]
CGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
-GGAAGGA-G---AAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
[50]
----TGGAAGTAAAAATCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
[50]
[50]
TGGAAGGA-G---AAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
TGGAAGGA-G--AAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
ACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
[50]
ACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
[50]
T-GAAGGA-G---AAGTCGT-ACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
[50]
[50]
AACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]


Monardella linoides ----------
Poliomintha bustamanta A ----------AGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha bustamanta B -------AAGTAAAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha bustamanta C ---------------GTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha conjunctrix T-GAAGGA-G---AAGTCGT-ACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha dendritica T-GAAGGA-G--AAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha incana A ---------- [50]
Poliomintha incana B ------------------GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha incana C --------------------AACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha longiflora A -------AAGTAAAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Poliomintha longiflora B ------------------GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Pycnanthemum californicum ---------- [50]
Rhododon angulatus A ------------------GTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Rhododon angulatus B -GGAAGGA-G--AAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Rhododon ciliatus B -----GGAAGTAAAAGTCGTAACAAGGTTTCCGTA-GGTGAACCTGCGGA [50]
Thymus mastichina --------------AACCTTTAAAA-ACAGACCGCGAACACGTGTTTAAC [100]
Mentha rotundifolia -------------A.....GC...--G.....T..........AA..... [100]
Acinos arvensis AGGATCATTGTCGAG....GC...--G..............AAAC... [100]
Blephilia hirsuta -------------AG....GC...--G..............AAC...A [100]
Clinopodium brownei A AGGATCATTGTCGA.....GC...--G..............AAC.... [100]
Clinopodium brownei var. pilosiusculum AGGATCATTGTCGA.....GC.C..AG..............AAC.... [100]
Clinopodium chandleri A AGGATCATTGTCGA.....GC...--G..............AAC.... [100]
Clinopodium chandleri B AGGATCATTGTCGA.....GC...--G..............AAC.... [100]
Clinopodium ganderi B AGGATCATTGTCGA.....GC...--G..............AAC.... [100]
Clinopodium hintoniorum AGGATCATTGTCGA.....GC...--G..............AAC.... [100]
Clinopodium macrostemum ------ATTGTCGA.....GC...--G..............AAC.... [100]
Clinopodium mexicanum AGGATCATTGTCGA.....GC...--G..............ACC..G. [100]
Clinopodium palmeri AGGATCATTGTCGA.....GC...--G..............AAC.... [100]

Clinopodium brevifolia	AGGATCATTGTCGAG....GC...--G.............T..AAC....	[100]
Clinopodium etonia	----------AG....GC...--G..............AAC...A	[100]
Hedeoma acinoides	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma apiculata	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma ciliolata	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma costata A	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma costata B	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma drummondii A	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma drummondii B	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma hispida	AGGATCATTGTCGA.....GC...--G..............AAC....	[100]
Hedeoma irvingii	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma johnstonii	AGGATCATTGTCGAT....GC...--G..............AAC....	[100]
Hedeoma jucunda	--GATCATTGTCGA.-...GC...--G..............AAC....	[100]
Hedeoma mandoniana A	AGGATCATTGTCGA.....GC...--G..............AAC....	[100]
Hedeoma mandoniana B	AGGATCATTGTCGA.....GC...--G..............AAC....	[100]
Hedeoma media A	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma media B	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma molle	AGGATCATTGTCGAG....GC...--G.......T........AAC....	[100]
Hedeoma montana	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma nana A	AGGATCATTGTCGAG....GC...--G.......T........AAC....	[100]
Hedeoma nana B	AGGATCATTGTCGAG....GC...--G.......T........AAC....	[100]
Hedeoma oblatifolia	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma palmeri A	----------CGAG....GC...--G...........TT..AAC....	[100]
Hedeoma palmeri B	----------CGAG....GC...--G...........TT..AAC....	[100]
Hedeoma plicata	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma patrina	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma piperita	AGGATCATTGTCGA.....GC...--G..............AAC....	[100]
Hedeoma pulegioides A	----------.--G..............AAC....	[100]
Hedeoma pulegioides B	AGGATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma pulegioides C	---ATCATTGTCGAG....GC...--G..............AAC....	[100]
Hedeoma pulegioides D	---ATCATTGTCGAG....GC...--G..............AAC....	[100]

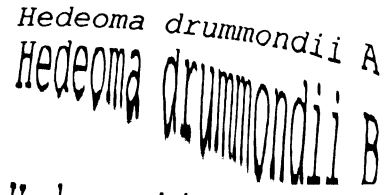
Hedeoma pulegioides E	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Hedeoma pusilla A	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Hedeoma pusilla B	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Hedeoma pusilla C	--------TGTCGAG....GC...--G.....AAC....	[100]
Hedeoma reverchonii	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Hesperozygis marifolia A	AGGATCATTGTCGA.....GC...--G.....AAC....	[100]
Hesperozygis marifolia B	AGGATCATTGTCGA.....GC...--G.....AAC....	[100]
Hesperozygis nitida	----------AG....GC...--G.....T.....AAC....	[100]
Hesperozygis rhododon	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Hesperozygis spathulata	----------AG....GC...--G.....AAC....	[100]
Monarda fistulosa	----------AT....GC...--G.....T.....AAC....	[100]
Monarda menthaefolia	AGGATCATTGTCGAT....GC...--G.....T.....AAC....	[100]
Monardella linoides	----------A.....GC...--G.....AAAC...	[100]
Poliomintha bustamanta A	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Poliomintha bustamanta B	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Poliomintha bustamanta C	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Poliomintha conjunctrix	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Poliomintha dendritica	AGGATCATTGTCGAG....GC...--G.....T...AAC....	[100]
Poliomintha incana A	----------CGT.....GC...--G.....AAC....	[100]
Poliomintha incana B	AGGATCATTGTCGT.....GC...--G.....AAC....	[100]
Poliomintha incana C	AGGATCATTGTCGT.....GC...--G.....AAC....	[100]
Poliomintha longiflora A	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Poliomintha longiflora B	AGGATCATTGTCGAG....GC...--G.....AAC....	[100]
Pycnanthemum californicum	----------AG....GC...--G.....AAC....	[100]
Rhododon angulatus A	AGGATCATTGTCGA.....GC...--G.....AAC....	[100]
Rhododon angulatus B	AGGATCATTGTCGA.....GC...--G.....AAC....	[100]
Rhododon ciliatus B	AGGATCATTGTCGA.....GC...--G.....AAC....	[100]
Thymus mastichina	A-CCGTTGGGGACGGTGCGGGGGGTAACCCTCTGCCGTGTCCCATCTCCT	[150]
Mentha rotundifolia	T-...CG..CC....CA-A.....CG....CT.....TG..C..C	[150]

Acinos arvensis	T-...CG...CG...C.-T.....CG....C.C....C.....G.....C	[150]
Blephilia hirsuta	CA...CG..C.CG.CGC-.....-.G....C.....G.....C	[150]
Clinopodium brownei A	.-.A.CG..A.CG.CGC-.....-CG....C.....G.....	[150]
Clinopodium brownei var. pilosiusculum	.-.A.CG..T.CG.CAC-.....-CG....C.....G.....	[150]
Clinopodium chandleri A	.-.A.CG..C.CG.CGC-.....-C.....C.....C.....G.....	[150]
Clinopodium chandleri B	.-.A.CG..C.CG.CGC-.....-C.....C.....C.....G.....	[150]
Clinopodium ganderi B	.-.A.CG..C.CG.CGC-.....-C.....C.....C.....G.....	[150]
Clinopodium hintoniorum	.-A..CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Clinopodium macrostemum	.-..ACG..C.CG.CGC-.....-CG....C.....G.....	[150]
Clinopodium mexicanum	.-...CG..C.CG.CGT-.....-CG....C.....G.....	[150]
Clinopodium palmeri	.-...GG..C.CG.CGC-.....-CG....C.....C.....G.....C	[150]
Clinopodium brevifolia	G-...CG..A.CG.CGC-.....-CG....C.....G.....C	[150]
Clinopodium etonia	G-...CG..C.CG.CAC-.....-YG....GG.....G.....C	[150]
Hedeoma acinoides	T-...CG..C.CG.CGC-.....-CG....C.....GC....C	[150]
Hedeoma apiculata	T-...CG..C.CG.CGC-.....-CG....C.....G.....C	[150]
Hedeoma ciliolata	.-...CG..CTCG.CGC-.....-CG....C.....G.....	[150]
Hedeoma costata A	.-...CG..C.CG.CGC-.....-CG....C-.....G.....	[150]
Hedeoma costata B	.-...CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hedeoma drummondii A	T-...CG..C.CG.CGC-.....-CG....C.....G.....C	[150]
Hedeoma drummondii B	T-...CG..C.CG.CGC-.....-CG....C.....G.....C	[150]
Hedeoma hispida	G-.G.CG..C.CG.CGC-.....-CG....C.....C.....G.....C	[150]
Hedeoma irvingii	.-.A.CG..CTCG.CGC-.....-CG....C.....G.....	[150]
Hedeoma johnstonii	.-...CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hedeoma jucunda	.-....G..C.CG.CGC-.....-CG....C.....	[150]
Hedeoma mandoniana A	.-...CG..C.CG.CGC-.....-CG....C.C.....GC....C	[150]
Hedeoma mandoniana B	.-...CG..C.CG.CGC-.....-CG....C.....GC.....	[150]
Hedeoma media A	.-...CG..C.CG.CGC-.......G....C-.....G.....C	[150]
Hedeoma media B	.-...CG..C.CG.CGC-.......G....C-.....G.....C	[150]
Hedeoma molle	.-...CG..CTCG.CGC-.....-CG....C.....G.....	[150]
Hedeoma montana	.-.A.CG..CTCG.CGC-.....-CG....C.....G.....	[150]

Hedeoma nana A	.-...CG..CTCG.CGC-.....-CG....C.....G...T..	[150]
Hedeoma nana B	.-...CG..CTCG.CGC-.....-CG....CT.....G.....	[150]
Hedeoma oblatifolia	.-...CG..CTCG.CGC-.....-CG..T.C.....G.....	[150]
Hedeoma palmeri A	.-...CG.SC.CG.C.C-.....-C.....CA.....G.....	[150]
Hedeoma palmeri B	.-...CG..C.CG.C.C-.....-C.....CA.....G.....	[150]
Hedeoma plicata	.-...CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hedeoma patrina	.-...CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hedeoma piperita	.-.TACG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hedeoma pulegioides A	.-.T.CG..C.CG.CGC-.....-CG....C.....C...G.....	[150]
Hedeoma pulegioides B	.-.T.CG..C.CG.CGC-.....-CG....C.....C...G.....	[150]
Hedeoma pulegioides C	.-.T.CG..C.CG.CGC-.....-CG....C.....C...G.....	[150]
Hedeoma pulegioides D	.-.T.CG..C.CG.CGC-.....-CG....C.....C...G.....	[150]
Hedeoma pulegioides E	.-.T.CG..C.CG.CGC-.....-CG....C.....C...G.....	[150]
Hedeoma pusilla A	.-...CG..CTCG.CGC-.....-CG....C.....G.....	[150]
Hedeoma pusilla B	.-...CG..CTCG.CGC-.....-CG....C...T.....G.....	[150]
Hedeoma pusilla C	.-...CG..CTCG.CGC-.....-CG....C.....G.....	[150]
Hedeoma reverchonii	T-...CG..C.CG.CGC-.....-CG....C.....C.....G.....C	[150]
Hesperozygis marifolia A	.-...CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hesperozygis marifolia B	.-...CG..C.CG.CGC-.....-CG....C.....G.....	[150]
Hesperozygis nitida	.-...CG..C.CG.TGC-.....-.G....CT.....G.....	[150]
Hesperozygis rhododon	.-.G.CG..C.CG.CAC-.....-CG....C.....G.....	[150]
Hesperozygis spathulata	.-...CG..C.CG.CGC-.....-C.....C.....G.....	[150]
Monarda fistulosa	.-...CG..C.CG.CGA-....--CG....C-C....C.....G.....C	[150]
Monarda menthaefolia	.-...CG..C.CG.CGA-....--CG....C-C....C.....G.....C	[150]
Monardella linoides	.A...CG..C.CG.TGC-.....-M.....C.....C.....G.....	[150]
Poliomintha bustamanta A	T-...CG..C.CG.CG.-T....-CG....A.C.....G.....C	[150]
Poliomintha bustamanta B	T-...CG..C.CG.CGC-.....-CG....A.C.....G.....C	[150]
Poliomintha bustamanta C	T-...CG..C.CG.CGC-.....-CG....A.C.....G.....C	[150]
Poliomintha conjunctrix	T-..ACG..C.CG.CGC-.....-CG....C.....G.....C	[150]
Poliomintha dendritica	T-...CG..C.CG.CGC-.....-CG....A.C.....G.....C	[150]
Poliomintha incana A	.-...CG..C.CG.CGC-.....-CG.T..C.....G..C...	[150]

Poliomintha incana B	.-...CG..C.CG.CGC-.....-CG.T..C.....G..C...	[150]
Poliomintha incana C	.-...CG..C.CG.CGC-.....-CG.T..C.....G..C...	[150]
Poliomintha longiflora A	T-...CG..C.CG.CGC-.....-CG....C.C.....G.....C	[150]
Poliomintha longiflora B	T-.AACG..C.CG.CGC-.....-CG....C.C.....G.....C	[150]
Pycnanthemum californicum	.-...CG..C.CG.CGC-.....-C.....C.C.....G....TC	[150]
Rhododon angulatus A	.-...CG..CTCG.CAC-.....-CG....C.....G.....	[150]
Rhododon angulatus B	.-...CG..CTCG.CAC-.....-CG....C-..S....K...G.....	[150]
Rhododon ciliatus B	.-.Y.CG..CTCG.CAC-.....-CG....C.....G.....	[150]

Thymus mastichina	GCCGGCGTGTATCT-TCGGGTCAC-GTCGTGCGGGCTAACGAACCCCGGC	[200]
Mentha rotundifolia	.....TC.C-.....-.....	[200]
Acinos arvensis	.....T.C.CTC.C-.....ATG.-.C..C.....	[200]
Blephilia hirsuta	.....CTC.C-.....G.-.C..C.T.....	[200]
Clinopodium brownei A	.....CTC..-.....-.C..C.....	[200]
Clinopodium brownei *var. pilosiusculum*	....A....CTC.C-.....-.C.....	[200]
Clinopodium chandleri A	.T.....CTC.C-.....-.C.....	[200]
Clinopodium chandleri B	.T.....CTC.C-.....-.C.....	[200]
Clinopodium ganderi B	.T...T...CTC.C-.....-.C.....	[200]
Clinopodium hintoniorum	.....CTC.C-.....-.C.....	[200]
Clinopodium macrostemum	....T....CTC.C-.....-.C.....	[200]
Clinopodium mexicanum	.....CTC.C-.....C...-.C.....	[200]
Clinopodium palmeri	.....CTC.C-.....-.C.....	[200]
Clinopodium brevifolia	.....GCC.C--....C.G.-.C.....	[200]
Clinopodium etonia	.....GCC.C--....C.G.-.C.....	[200]
Hedeoma acinoides	.....C.CTC.C-.....GCGC.C..C.....	[200]
Hedeoma apiculata	.....CTC.C-.....-.C..C.....	[200]
Hedeoma ciliolata	.....CTC.A-.....-....C.....	[200]
Hedeoma costata A	.....CTC.C-.....-.A..C.....	[200]
Hedeoma costata B	.....CTC.C-.....-.A..C.....	[200]



	.....CTC.C-C.....-.C..C.....	[200]
	.....CTC.C-C.....-.C..C.....	[200]
Hedeoma hispida	.....CTC.C-.....-.C.....	[200]
Hedeoma irvingii	.....CTC.C-.....-.A.....	[200]
Hedeoma johnstonii	.....CTC.C-.....-.A.....	[200]
Hedeoma jucunda	...T.....CTC.C-.....-.C.....	[200]
Hedeoma mandoniana A	.....CTC.C-.....-.C.....	[200]
Hedeoma mandoniana B	.....CTC.C-.....-.C.....	[200]
Hedeoma media A	.....A..CTC.C-.....-....C.....T.....	[200]
Hedeoma media B	.....A..CTC.C-.....-....C.....T.....	[200]
Hedeoma molle	.....CTC.C-.....-.A..C.....	[200]
Hedeoma montana	.....CTC.C-.....-.A.....	[200]
Hedeoma nana A	.....CTC.C-.....-.A..C.....	[200]
Hedeoma nana B	.....CTC.C-.....-.A..C.....	[200]
Hedeoma oblatifolia	.....CTC.C-.....-....C.....	[200]
Hedeoma palmeri A	.....CTC.C-.....-.A..C.....	[200]
Hedeoma palmeri B	.....CTC.C-.....-.A..C.....	[200]
Hedeoma plicata	.....CTC.C-.....-.A.....	[200]
Hedeoma patrina	.....CTC.C-.....-.A..C.....	[200]
Hedeoma piperita	....A....CTC.C-.....-.C.....	[200]
Hedeoma pulegioides A	.....CCC.CC.....-.C.....	[200]
Hedeoma pulegioides B	.....CCC.C-.....-.C.....	[200]
Hedeoma pulegioides C	.....CCC.C-.....-.C.....	[200]
Hedeoma pulegioides D	.....CCC.C-.....-.C.....	[200]
Hedeoma pulegioides E	.....CCC.C-.....-.C.....	[200]
Hedeoma pusilla A	.....CTC.A-.....-....C.....	[200]
Hedeoma pusilla B	.....CTC.A-.....-....C.....	[200]
Hedeoma pusilla C	.....CTC.A-.....-....C.....	[200]
Hedeoma reverchonii	.....CTC.C-C.....-.C..C.....	[200]
Hesperozygis marifolia A	.....CTC..-.....C...-.G.....	[200]
Hesperozygis marifolia B	.....CTC..-.....C...-.G.....	[200]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Hesperozygis spathulata                 .........CTC.C-.........-.C..C..................... [200]
Monarda fistulosa                       .A.......CTC.C-.........-.C..CT.................... [200]
Monarda menthaefolia                    .A.......CTC.C-.........-.C..CT.................... [200]
Monardella linoides                     .........CCC.C-.........-.C........................ [200]
Poliomintha bustamanta A                .........CTC.C-.........-.C..C..................... [200]
Poliomintha bustamanta B                .........CTC.C-.........-.C..C..................... [200]
Poliomintha bustamanta C                .........CTC.C-.........-.C..C..................... [200]
Poliomintha conjunctrix                 .........CTC.C-.T.......-.C..C..................... [200]
Poliomintha dendritica                  .........CTC.C-.........-.C..C..................... [200]
Poliomintha incana A                    .........CTC.C-.........-.C..C..................... [200]
Poliomintha incana B                    .........CTC.C-.........-.C..C..................... [200]
Poliomintha incana C                    .........CTC.C-.........-.C..C..................... [200]
Poliomintha longiflora A                .........CTC.C-.........-.C..C..................... [200]
Poliomintha longiflora B                .........CTC.C-.........-.C..C..................... [200]
Pycnanthemum californicum               .........CTC.C-.........-.C..C..................... [200]
Rhododon angulatus A                    .........CTC.C-.........-.C........................ [200]
Rhododon angulatus B                    .S...S...STC.C-.........-.C..C.....................S [200]
Rhododon ciliatus B                     .........CTC.C-.........-.C........................ [200]

Thymus mastichina                       GCGGAATGCGCCAAGGAAAACAAAACGAAGCGTTT-CCCCCT-GGCATCC [250]
Mentha rotundifolia                     ......................C...........CC-G....C-....C.. [250]
Acinos arvensis                         ......C..............C....TC....CCC-G....C-...GC.. [250]
Blephilia hirsuta                       ......................C...........CC-G....C-....C.. [250]
Clinopodium brownei A                   ......................CG.T........CCCT....C-....... [250]
Clinopodium brownei
 var. pilosiusculum                     ......................CG.T........CCCT....CC...... [250]
Clinopodium chandleri A                 ......................C............C-G....C-....... [250]
Clinopodium chandleri B                 ......................C............C-G....C-....... [250]
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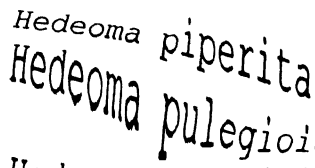
Clinopodium ganderi B	.....C.....C-G....C-.....	[250]
Clinopodium hintoniorum	.....CG.....CC-A....C-.....	[250]
Clinopodium macrostemum	.....CG.....CC-G....C-.....	[250]
Clinopodium mexicanum	.....CG...C.....C.-G....C-.....	[250]
Clinopodium palmeri	.....C.....CG.....CC-G....C-.....	[250]
Clinopodium brevifolia	.....CG.....CG-G....C-.....	[250]
Clinopodium etonia	.....CG.....CC-G....C-.....	[250]
Hedeoma acinoides	.....C.....CC-G....C-.....	[250]
Hedeoma apiculata	.....C.....CG.....CC-G....C-.....	[250]
Hedeoma ciliolata	.....CC-G....C-.....	[250]
Hedeoma costata A	.....CC-G....C-.....	[250]
Hedeoma costata B	.....CC-G....C-.....	[250]
Hedeoma drummondii A	.....C.....CG.....CC-G....C-.....	[250]
Hedeoma drummondii B	.....C.....CG.....CC-G....C-.....	[250]
Hedeoma hispida	.....C.....C.....CC-G....C-.....	[250]
Hedeoma irvingii	.....CC-G....C-.....	[250]
Hedeoma johnstonii	.....CC-G....C-.....	[250]
Hedeoma jucunda	.....CG.....CC---...C-.....	[250]
Hedeoma mandoniana A	.....CG.....CC-G....C-....C..	[250]
Hedeoma mandoniana B	.....CG.....CC-G....C-.....	[250]
Hedeoma media A	.....C.....CC-G....C-.....	[250]
Hedeoma media B	.....C.....CC-G....C-.....	[250]
Hedeoma molle	.....T.....CC-G....C-.....	[250]
Hedeoma montana	.....CC-G....C-.....	[250]
Hedeoma nana A	.....T.....CC-G....C-.....	[250]
Hedeoma nana B	.....CC-G....C-.....	[250]
Hedeoma oblatifolia	.....CC-G....C-.....	[250]
Hedeoma palmeri A	.....CG.....CC-G....C-.....	[250]
Hedeoma palmeri B	.....CG.....CC-G....C-.....	[250]
Hedeoma plicata	.....CC-G....C-.....	[250]
Hedeoma patrina	.....CC-G....C-.....	[250]



Hedeoma piperita	.....CG.....CC-G.....-.....	[250]
Hedeoma pulegioides A	.....C.....C.....CC-G....C-.....	[250]
Hedeoma pulegioides B	.....C.....C.....CC-G....C-.....	[250]
Hedeoma pulegioides C	.....C.....C.....CC-G....C-.....	[250]
Hedeoma pulegioides D	.....C.....C.....CC-G....C-.....	[250]
Hedeoma pulegioides E	.....C.....C.....CC-G....C-.....	[250]
Hedeoma pusilla A	.....CC-G....C-.....	[250]
Hedeoma pusilla B	.....CC-....TC-.....	[250]
Hedeoma pusilla C	.....CC-G....C-.....	[250]
Hedeoma reverchonii	.....C.....CG.....CC-G....C-.....	[250]
Hesperozygis marifolia A	.....W..GG.....CC-G.A..C-.....	[250]
Hesperozygis marifolia B	.....GG.....CC-G.A..C-.....	[250]
Hesperozygis nitida	.....CGT.....T..CC-A....C-.....	[250]
Hesperozygis rhododon	.....CG.....CC-G....C-.....	[250]
Hesperozygis spathulata	.....CG.....CC-G....C-.....	[250]
Monarda fistulosa	.....C..CT.....CC-G....CC.....	[250]
Monarda menthaefolia	.....C..CT.....CC-G....CC.....	[250]
Monardella linoides	.....C....R.....CCC-G....C-.....	[250]
Poliomintha bustamanta A	.....CG.....CCC-G....C-.....	[250]
Poliomintha bustamanta B	.....C.....CCC-G....C-.....	[250]
Poliomintha bustamanta C	.....CG.....CCC-G....C-.....	[250]
Poliomintha conjunctrix	.....C.....C.....C-G....C-.....	[250]
Poliomintha dendritica	.....CG.....CCC-G....C-.....	[250]
Poliomintha incana A	.....G.....C.-G....C-.....	[250]
Poliomintha incana B	.....G.....CC-G....C-.....	[250]
Poliomintha incana C	.....G.....CC-G....C-.....	[250]
Poliomintha longiflora A	.....CG.....CC-T....C-.....	[250]
Poliomintha longiflora B	.....CG.....A..CC-G....C-.....	[250]
Pycnanthemum californicum	.....CG.....CC-G....C-.....	[250]
Rhododon angulatus A	.....G.....CC-G....C-.....	[250]
Rhododon angulatus B	.....S.....G.....S..CC-G....C-..S....	[250]

Rhododon ciliatus B	.....G.....CC-G....C-.....	[250]
Thymus mastichina	CGTTCGCGGAGTGTGCTGGGGG-AGCAGACGTCTA--TCAAA----TGTC	[300]
Mentha rotundifolia	.....C....C.T...-.C.G.C.....--.....----....	[300]
Acinos arvensis	.....G.A....C.....-GC.G.G.....G--.....A---....	[300]
Blephilia hirsuta	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Clinopodium brownei A	.....C....C.C...-.TGG.G.....C--A.G..----....	[300]
Clinopodium brownei var. pilosiusculum	.....C....C.C...-.TGG.G.....C--ATG..----....	[300]
Clinopodium chandleri A	.....C....C.T...-.T.G.G.....--.....----....	[300]
Clinopodium chandleri B	.....C....C.T...-.T.G.G.....--.....----....	[300]
Clinopodium ganderi B	.....C....C.T...-.T.G.G.....--.....----....	[300]
Clinopodium hintoniorum	....T.....C....C.C...-TT.G.G.....--.....----....	[300]
Clinopodium macrostemum	.....C....C.C...-.T.G.G.....--.....----....	[300]
Clinopodium mexicanum	.....C....C.C...-.T.G.G..C...--..G..----....	[300]
Clinopodium palmeri	.....C....C.C...-.T.G.G.....--.....----....	[300]
Clinopodium brevifolia	.....C....C.C...-.T.G.G.....G--.....A---A...	[300]
Clinopodium etonia	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma acinoides	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma apiculata	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma ciliolata	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma costata A	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma costata B	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma drummondii A	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma drummondii B	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma hispida	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma irvingii	.....CT...C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma johnstonii	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma jucunda	.....M....C....C.C...-.T.G.G...A..--.....----....	[300]
Hedeoma mandoniana A	.....C....C.C...-.C.G.G.....G--.....----....	[300]

Hedeoma mandoniana B	..........C....C.C...-.T.G.G.....G--.....----....	[300]
Hedeoma media A	..........C....C.T...-.T.G.G.....--.....----A...	[300]
Hedeoma media B	..........C....C.T...-.T.G.G.....--.....----A...	[300]
Hedeoma molle	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma montana	..........CT...C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma nana A	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma nana B	..........C....C.C...-.TTG.G.....--.....----A...	[300]
Hedeoma oblatifolia	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma palmeri A	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma palmeri B	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma plicata	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma patrina	..........C....C.C...-.T.T.G.....--.....----A...	[300]
Hedeoma piperita	..........C....CAC...-.T.G.G.....--.....----....	[300]
Hedeoma pulegioides A	..........C....C.C...-.TTG.G.....G--.T...----....	[300]
Hedeoma pulegioides B	..........C....C.C...-.TTG.G.....G--.T...----....	[300]
Hedeoma pulegioides C	..........C....C.C...-.TTG.G.....G--.T...----....	[300]
Hedeoma pulegioides D	..........C....C.C...-.TTG.G.....G--.T...----....	[300]
Hedeoma pulegioides E	..........C....C.C...-.TTG.G.....G--.T...----....	[300]
Hedeoma pusilla A	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma pusilla B	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma pusilla C	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hedeoma reverchonii	..........C....C.C...G.T.G.G.....--.....----A...	[300]
Hesperozygis marifolia A	.........GCC....C.C...-.T.G.G...G.CTA.....----....	[300]
Hesperozygis marifolia B	.........GCC....C.C...-.T.G.G...G.CTA.....----....	[300]
Hesperozygis nitida	..........C....C.T...-TT.G.G.....--.....----A..T	[300]
Hesperozygis rhododon	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Hesperozygis spathulata	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Monarda fistulosa	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Monarda menthaefolia	..........C....C.C...-.T.G.G.....--.....----A...	[300]
Monardella linoides	..........C....C.C...-.T.G.G.....--.G...----....	[300]
Poliomintha bustamanta A	..........C....C.C..S-.T.G.G...AC.--.....----A...	[300]

Poliomintha bustamanta B	.....C....C.C...-.T.G.G...AC.--.....----A...	[300]
Poliomintha bustamanta C	.....C....C.C...-.T.G.G...AC.--.....----A...	[300]
Poliomintha conjunctrix	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Poliomintha dendritica	.....C....C.C...-.T.G.G...AC.--.....----A...	[300]
Poliomintha incana A	...A.....C....C.C...-.T.G.....--..G..A---A...	[300]
Poliomintha incana B	...A.....C....C.C...-.T.G.....--..G..A---A...	[300]
Poliomintha incana C	...A.....C....C.C...-.T.G.....--..G..A---A...	[300]
Poliomintha longiflora A	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Poliomintha longiflora B	.....C....C.C...-.T.G.G.....--.....----A...	[300]
Pycnanthemum californicum	.....C....C.T...-GT.G.G.....--.....A---A...	[300]
Rhododon angulatus A	.....C....C.C...-.T.G.G.....--.....AAA-A...	[300]
Rhododon angulatus B	.....C....CSC...-.T.G.G.....--.....AAA-A...	[300]
Rhododon ciliatus B	.....C....C.C...-.T.G.G.....--.....AAA-A...	[300]

Thymus mastichina	AAAACGACTCTCGGCAACGGATATCTCGGCTCTCGCATCGATGAAGAACG	[350]
Mentha rotundifolia	.....	[350]
Acinos arvensis	.....	[350]
Blephilia hirsuta	.....	[350]
Clinopodium brownei A	.....	[350]
Clinopodium brownei var. pilosiusculum	.....	[350]
Clinopodium chandleri A	.....	[350]
Clinopodium chandleri B	.....	[350]
Clinopodium ganderi B	.....	[350]
Clinopodium hintoniorum	.....	[350]
Clinopodium macrostemum	.....	[350]
Clinopodium mexicanum	.....	[350]
Clinopodium palmeri	.....	[350]
Clinopodium brevifolia	.....	[350]
Clinopodium etonia	.....	[350]

Hedeoma pusilla B	.....	[350]
Hedeoma pusilla C	.....	[350]
Hedeoma reverchonii	.....R....	[350]
Hesperozygis marifolia A	.....	[350]
Hesperozygis marifolia B	.....	[350]
Hesperozygis nitida	.T.....	[350]
Hesperozygis rhododon	.....	[350]
Hesperozygis spathulata	.....	[350]
Monarda fistulosa	.....	[350]
Monarda menthaefolia	.....	[350]
Monardella linoides	.....	[350]
Poliomintha bustamanta A	.....	[350]
Poliomintha bustamanta B	.....	[350]
Poliomintha bustamanta C	.....	[350]
Poliomintha conjunctrix	.....	[350]
Poliomintha dendritica	.....	[350]
Poliomintha incana A	.....	[350]
Poliomintha incana B	.....	[350]
Poliomintha incana C	.....	[350]
Poliomintha longiflora A	.....	[350]
Poliomintha longiflora B	.....	[350]
Pycnanthemum californicum	.....	[350]
Rhododon angulatus A	.....	[350]
Rhododon angulatus B	.....	[350]
Rhododon ciliatus B	.....	[350]
Thymus mastichina	TAGCGAAATGCGATACTTGGTGTGAATTGCAGAATCCCGTGAACCATCGA	[400]
Mentha rotundifolia	.....	[400]
Acinos arvensis	.....	[400]
Blephilia hirsuta	.....	[400]

Hedeoma oblatifolia	.....	[400]
Hedeoma palmeri A	.....	[400]
Hedeoma palmeri B	.....	[400]
Hedeoma plicata	.....	[400]
Hedeoma patrina	.....	[400]
Hedeoma piperita	.....	[400]
Hedeoma pulegioides A	.....	[400]
Hedeoma pulegioides B	.....	[400]
Hedeoma pulegioides C	.....	[400]
Hedeoma pulegioides D	.....	[400]
Hedeoma pulegioides E	.....	[400]
Hedeoma pusilla A	.....	[400]
Hedeoma pusilla B	.....	[400]
Hedeoma pusilla C	.....	[400]
Hedeoma reverchonii	..S.....R.....	[400]
Hesperozygis marifolia A	.....	[400]
Hesperozygis marifolia B	.....	[400]
Hesperozygis nitida	.....	[400]
Hesperozygis rhododon	.....	[400]
Hesperozygis spathulata	.....	[400]
Monarda fistulosa	.....	[400]
Monarda menthaefolia	.....	[400]
Monardella linoides	.....	[400]
Poliomintha bustamanta A	.....	[400]
Poliomintha bustamanta B	.....	[400]
Poliomintha bustamanta C	.....	[400]
Poliomintha conjunctrix	.....	[400]
Poliomintha dendritica	.....	[400]
Poliomintha incana A	.....	[400]
Poliomintha incana B	.....	[400]
Poliomintha incana C	.....	[400]

Poliomintha longiflora A	.....	[400]
Poliomintha longiflora B	.....	[400]
Pycnanthemum californicum	.....	[400]
Rhododon angulatus A	.....	[400]
Rhododon angulatus B	.....	[400]
Rhododon ciliatus B	.....	[400]
Thymus mastichina	GTCTTTGAACGCAAGTTGCGCCCGAAGCCATTAGGCCGAGGGCACGTCTG	[450]
Mentha rotundifolia	.....C.....T.....C...	[450]
Acinos arvensis	.....	[450]
Blephilia hirsuta	.....	[450]
Clinopodium brownei A	.....	[450]
Clinopodium brownei var. pilosiusculum	.....	[450]
Clinopodium chandleri A	.....	[450]
Clinopodium chandleri B	.....	[450]
Clinopodium ganderi B	.....	[450]
Clinopodium hintoniorum	.....	[450]
Clinopodium macrostemum	.....	[450]
Clinopodium mexicanum	.....	[450]
Clinopodium palmeri	.....	[450]
Clinopodium brevifolia	.....	[450]
Clinopodium etonia	.....	[450]
Hedeoma acinoides	.....	[450]
Hedeoma apiculata	.....	[450]
Hedeoma ciliolata	.....	[450]
Hedeoma costata A	.....	[450]
Hedeoma costata B	.....	[450]
Hedeoma drummondii A	.....	[450]
Hedeoma drummondii B	.....	[450]

Hedeoma hispida ..... [450]
Hedeoma irvingii ..... [450]
Hedeoma johnstonii ..... [450]
Hedeoma jucunda ..... [450]
Hedeoma mandoniana A ..... [450]
Hedeoma mandoniana B ..... [450]
Hedeoma media A ..... [450]
Hedeoma media B ..... [450]
Hedeoma molle ..... [450]
Hedeoma montana ..... [450]
Hedeoma nana A ..... [450]
Hedeoma nana B ..... [450]
Hedeoma oblatifolia ..... [450]
Hedeoma palmeri A ..... [450]
Hedeoma palmeri B ..... [450]
Hedeoma plicata .....G..... [450]
Hedeoma patrina ..... [450]
Hedeoma piperita ..... [450]
Hedeoma pulegioides A ..... [450]
Hedeoma pulegioides B ..... [450]
Hedeoma pulegioides C ..... [450]
Hedeoma pulegioides D ..... [450]
Hedeoma pulegioides E ..... [450]
Hedeoma pusilla A ..... [450]
Hedeoma pusilla B ..... [450]
Hedeoma pusilla C ..... [450]
Hedeoma reverchonii ..... [450]
Hesperozygis marifolia A ..... [450]
Hesperozygis marifolia B ..... [450]
Hesperozygis nitida ..... [450]
Hesperozygis rhododon ..... [450]

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Hesperozygis spathulata ..................................................... [450]
Monarda fistulosa ........................................................... [450]
Monarda menthaefolia ........................................................ [450]
Monardella linoides ......................................................... [450]
Poliomintha bustamanta A ..........................G........................ [450]
Poliomintha bustamanta B ..........................G........................ [450]
Poliomintha bustamanta C ..........................G........................ [450]
Poliomintha conjunctrix ..................................................... [450]
Poliomintha dendritica ...........................G........................ [450]
Poliomintha incana A ..............................C...................... [450]
Poliomintha incana B ..............................C...................... [450]
Poliomintha incana C ..............................C...................... [450]
Poliomintha longiflora A .................................................... [450]
Poliomintha longiflora B .................................................... [450]
Pycnanthemum californicum ................................................... [450]
Rhododon angulatus A ....................................................... [450]
Rhododon angulatus B ....................................................... [450]
Rhododon ciliatus B ......................................................... [450]

Thymus mastichina          CCTGGGCGTCACGCATCGCGTCG--CCCCCCTTCCC--CGCGCTGAA--- [500]
Mentha rotundifolia ..........................--......A....--.....AC.C--- [500]
Acinos arvensis ..............................--......A....--.....GC.C--- [500]
Blephilia hirsuta ............................--.......A...--.....GTGT--- [500]
Clinopodium brownei A ........................--.....AAC...--.....GCGG--- [500]
Clinopodium brownei
 var. pilosiusculum ..........................--.....AAC...--.....AC..--- [500]
Clinopodium chandleri A ......................--.....TAC...--.....GC.T--- [500]
Clinopodium chandleri B ......................--.....TAC...--.....GC.T--- [500]
Clinopodium ganderi B ........................--......AC...--.....GC.T--- [500]
Clinopodium hintoniorum ......................--......AC...--.....GC.T--- [500]
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Clinopodium macrostemum .....--.....AC...--.T...GC.T--- [500]
Clinopodium mexicanum ......--.....AC...--.....GC.T--- [500]
Clinopodium palmeri ........--.....AC...--.....GC.T--- [500]
Clinopodium brevifolia .....--T.....AC...--.....GCGTCGT [500]
Clinopodium etonia .........--T.....AA..A--.....GCTTCGT [500]
Hedeoma acinoides ..........--.....TAA...CG......CGT--- [500]
Hedeoma apiculata ..........--.....TA....CG......CGT--- [500]
Hedeoma ciliolata ..........--.....TACT..--.....GCTT--- [500]
Hedeoma costata A ..........--.....TAC...--.....GCTT--- [500]
Hedeoma costata B ..........--.....TAC...--.....GCTT--- [500]
Hedeoma drummondii A .......--.....TAA...CG......CGT--- [500]
Hedeoma drummondii B .......--.....TAA...CG......CGT--- [500]
Hedeoma hispida ............--.....AC...--.....GC.T--- [500]
Hedeoma irvingii ...........--.....T.C...--....AGCTT--- [500]
Hedeoma johnstonii .........--.....TAC...--.....GCTT--- [500]
Hedeoma jucunda ........---.....AC...--.....GC.T--- [500]
Hedeoma mandoniana A .......--.....AC...--.....GC.C--- [500]
Hedeoma mandoniana B .......--.....AC...--.....GC.T--- [500]
Hedeoma media A ............--.....TAA...--.....GCGC--- [500]
Hedeoma media B ............--.....TAA...--.....GCGC--- [500]
Hedeoma molle ..............--.....TAC...--.....GATT--- [500]
Hedeoma montana ............--.....T.C...--....AGCTT--- [500]
Hedeoma nana A .............--.....TAC...--.....GATT--- [500]
Hedeoma nana B .............--.....TAC...--.....ATT--- [500]
Hedeoma oblatifolia ........--.....TACT..--.....GCTT--- [500]
Hedeoma palmeri A ..........--.....TA....--.....GCTT--- [500]
Hedeoma palmeri B ..........--.....TA....--.....GCTT--- [500]
Hedeoma plicata ............--.....AC...--.....GCTT--- [500]
Hedeoma patrina ............--.....TAC...--.....GCTT--- [500]
Hedeoma piperita ........---.....AC...--.....GC.T--- [500]
Hedeoma pulegioides A ......--.....C...--.....TGT--- [500]
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Hedeoma pulegioides B  ......................--.......C...--......TGT--- [500]
Hedeoma pulegioides C  ......................--.......C...--......TGT--- [500]
Hedeoma pulegioides D  ......................--.......C...--......TGT--- [500]
Hedeoma pulegioides E  ......................--.......C...--......TGT--- [500]
Hedeoma pusilla A      ......................--.....TACT..--.....GCTT--- [500]
Hedeoma pusilla B      ......................--.....TACT..--.....GCTT--- [500]
Hedeoma pusilla C      ......................--.....TACT..--.....GCTT--- [500]
Hedeoma reverchonii    ......................--.....TAA...CG......CGT--- [500]
Hesperozygis marifolia A ....................--......AC...--.T...GA.T--- [500]
Hesperozygis marifolia B ....................--......AC...--.T...GA.T--- [500]
Hesperozygis nitida    ......................--.....TAC...--....GGC.T--- [500]
Hesperozygis rhododon  ......................--.....TAC...--.....GCGT--- [500]
Hesperozygis spathulata ....................--.....TAC...--.....GC.T--- [500]
Monarda fistulosa      ......................--......ACG..-C.....GAGT--- [500]
Monarda menthaefolia   ......................--......ACG..-C.....GAGT--- [500]
Monardella linoides    ...........R..........--......AC...--.....GC.T--- [500]
Poliomintha bustamanta A ....................--.....AAA...--.....GCGT--- [500]
Poliomintha bustamanta B ....................--.....AAA...--.....GCGT--- [500]
Poliomintha bustamanta C ....................--.....AAA...--.....GCGT--- [500]
Poliomintha conjunctrix ....................--.....TAA...CG......CGT--- [500]
Poliomintha dendritica ....................--.....AAA...CG.....GCGT--- [500]
Poliomintha incana A   ......................--......AC...------------- [500]
Poliomintha incana B   ......................--......AC...------------- [500]
Poliomintha incana C   ......................--......AC...------------- [500]
Poliomintha longiflora A ....................--.....TAA...CG.....GCGT--- [500]
Poliomintha longiflora B ....................--.....TAA...CG.....GCGT--- [500]
Pycnanthemum californicum ...................---......A...--.....GCGW--- [500]
Rhododon angulatus A   ......................---.....AC...------------- [500]
Rhododon angulatus B   ......................---.....AC...------------- [500]
Rhododon ciliatus B    ......................---.....AC...------------- [500]
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Thymus mastichina	TGCCGGGCGATCGGG-GGCGGACATTGGCCTCCCGTGCACCTCCGTGCGC	[550]
Mentha rotundifolia	A.....G.T...-.....G.....G....G.....	[550]
Acinos arvensis	A.....A.G.A...-.....C.....G....G.C....	[550]
Blephilia hirsuta	C.....G.T...-.....C.....G....G.C.T..	[550]
Clinopodium brownei A	C.....G.....-.....C.....T....G...T..	[550]
Clinopodium brownei var. pilosiusculum	C.....G.....-.....C.....T....G...T..	[550]
Clinopodium chandleri A	C.....G.T...-.....C.....G....G...T..	[550]
Clinopodium chandleri B	C.....G.T...-.....C.....G....G...T..	[550]
Clinopodium ganderi B	C.....G.T...-.....C.....G....G...T..	[550]
Clinopodium hintoniorum	C.....G.T...-.....C.....A.G....G.C.T..	[550]
Clinopodium macrostemum	C.....G.T...-.....C....T.....G....G.C.T..	[550]
Clinopodium mexicanum	C.....G.T...-.....C.....T....G.C.T..	[550]
Clinopodium palmeri	C.....G.T...-.....C.....G....G.C....	[550]
Clinopodium brevifolia	C.....G.T...-.....A....A.....G....G.C....	[550]
Clinopodium etonia	C.....G.T...-.....G.A.....A..G....G.C....	[550]
Hedeoma acinoides	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma apiculata	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma ciliolata	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma costata A	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma costata B	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma drummondii A	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma drummondii B	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma hispida	C.....G.T...-.....A.....G....G.C.T..	[550]
Hedeoma irvingii	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma johnstonii	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma jucunda	C.....G.T...-.....C.....G....G.C.T.T	[550]
Hedeoma mandoniana A	C.....G.TC..-.....C.....G....G.C.T..	[550]
Hedeoma mandoniana B	C.....G.T...-.....C.....G....G.C.T..	[550]
Hedeoma media A	C..G.....G.T...-.....A.....G....T.C.T..	[550]
Hedeoma media B	C..G.....G.T...-.....A.....G....T.C.T..	[550]

Hedeoma molle	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma montana	C.....G.T...-.....A.Y.....G....G.C.T..	[550]
Hedeoma nana A	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma nana B	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma oblatifolia	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma palmeri A	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma palmeri B	C.....G.T...-.....A.C.....G....G-C.T..	[550]
Hedeoma plicata	.....G.T...G.....A.C.....G....G.C.T..	[550]
Hedeoma patrina	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma piperita	C.....G.T...-.....C.....G....G.C.T..	[550]
Hedeoma pulegioides A	C.T.....GCT...-.....C.....G....G.C.T..	[550]
Hedeoma pulegioides B	C.T.....GCT...-.....C.....G....G.C.T..	[550]
Hedeoma pulegioides C	C.T.....GCT...-.....C.....G....G.C.T..	[550]
Hedeoma pulegioides D	C.T.....GCT...-.....C.....G....G.C.T..	[550]
Hedeoma pulegioides E	C.T.....GCT...-.....C.....G....G.C.T..	[550]
Hedeoma pusilla A	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma pusilla B	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma pusilla C	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hedeoma reverchonii	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Hesperozygis marifolia A	C.G.....G.T...-.....C.....G....G.C.T..	[550]
Hesperozygis marifolia B	C.G.....G.T...-.....C.....G....G.C.T..	[550]
Hesperozygis nitida	C.....G.T...-.....G....G.CAT..	[550]
Hesperozygis rhododon	C.....G.T...-.....A.....G....G.C.T..	[550]
Hesperozygis spathulata	C.....G.T...-.....A.....G....G.C.T..	[550]
Monarda fistulosa	C.....G.T...-.....C.....TG....G.C.T..	[550]
Monarda menthaefolia	C.....G.T...-.....C.....TG....G.C.T..	[550]
Monardella linoides	C.....G.T...-.....C.....G....G.C.T..	[550]
Poliomintha bustamanta A	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Poliomintha bustamanta B	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Poliomintha bustamanta C	C.....G.T...-.....A.C.....G....G.C.T..	[550]
Poliomintha conjunctrix	C.....G.T...-.....A.C.....G....G...T..	[550]

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Poliomintha dendritica          C.......TG.T...-......A.C.............G....G.C.T.. [550]
Poliomintha incana A            ----.C.A.G.A...-........C.............G....G.C...T [550]
Poliomintha incana B            ----.C.A.G.A...-........C.............G....G.C...T [550]
Poliomintha incana C            ----.C.A.G.A...-........C.............G....G.C...T [550]
Poliomintha longiflora A        C........G.T...-......A.C.............G....G.C.T.. [550]
Poliomintha longiflora B        C........G.T...-......A.C.............G....G.C.T.. [550]
Pycnanthemum californicum       C........G.T...-......A.C.....C.......G...TG.C.T.. [550]
Rhododon angulatus A            ----.T...G.T...-........C.............G....G.C.... [550]
Rhododon angulatus B            ----.T...G.T...-........C.............G....G.C.... [550]
Rhododon ciliatus B             ----.T...G.T...-........C.............G....G.C.... [550]

Thymus mastichina               GGCTGGCCCAAATG-CGATCCCCGGGCGACTGGCGTCACGACAAGTGGTG [600]
Mentha rotundifolia             ...C..........-..................................... [600]
Acinos arvensis                 ...C..........-G............G........G............ [600]
Blephilia hirsuta               ...C..........-A............G..................... [600]
Clinopodium brownei A           ...C.........T-A............G...T....G..G......... [600]
Clinopodium brownei
 var. pilosiusculum             ...C.........T-A.........A..G...T....G..G......... [600]
Clinopodium chandleri A         ...C..........-A.T.................................. [600]
Clinopodium chandleri B         ...C..........-A.T.................................. [600]
Clinopodium ganderi B           ...C..........-A.T.................................. [600]
Clinopodium hintoniorum         ...C..........-A.................................... [600]
Clinopodium macrostemum         ...C..........-A.............T.......G............ [600]
Clinopodium mexicanum           ...C..........-A..............A.........G......... [600]
Clinopodium palmeri             ...C..........-A.................................... [600]
Clinopodium brevifolia          ...CT.........-A..........T..........G............ [600]
Clinopodium etonia              ...CT.........-A......................G............ [600]
Hedeoma acinoides               ...C..........-A.................................... [600]
Hedeoma apiculata               ...C..........-A.................................... [600]
Hedeoma ciliolata               ...C..........-A.................................... [600]
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Hedeoma costata A      ...C.........-A.................................. [600]
Hedeoma costata B      ...C.........-A.................................. [600]
Hedeoma drummondii A   ...C.........-A.....................G............ [600]
Hedeoma drummondii B   ...C.........-A...........G........G............ [600]
Hedeoma hispida        ...C.........-A...........G...................... [600]
Hedeoma irvingii       ...C.........-A.................................. [600]
Hedeoma johnstonii     ...C.........-A.................................. [600]
Hedeoma jucunda        ...C.........-T.........................G........ [600]
Hedeoma mandoniana A   ...C.........-A.................................. [600]
Hedeoma mandoniana B   ...C.........-A.................................. [600]
Hedeoma media A        ...C.........-A...........G...................... [600]
Hedeoma media B        ...C.........-A...........G...................... [600]
Hedeoma molle          ...C.........-A.................................. [600]
Hedeoma montana        ...C.........-A.................................. [600]
Hedeoma nana A         ...C.........-A.................................. [600]
Hedeoma nana B         ...C.........-A.................................. [600]
Hedeoma oblatifolia    ...C.........-A.................................. [600]
Hedeoma palmeri A      ...C.........-A.................................. [600]
Hedeoma palmeri B      ...C.........-A.................................. [600]
Hedeoma plicata        ...C.........-A.................................. [600]
Hedeoma patrina        ...C.........-A.................................. [600]
Hedeoma piperita       ..............-A..........T...........G......... [600]
Hedeoma pulegioides A  ...C.........-A...........G...................... [600]
Hedeoma pulegioides B  ...C.........-A...........G...................... [600]
Hedeoma pulegioides C  ...C.........-A...........G...................... [600]
Hedeoma pulegioides D  ...C.........-A...........G...................... [600]
Hedeoma pulegioides E  ...C.........-A...........G...................... [600]
Hedeoma pusilla A      ...C.........-A.................................. [600]
Hedeoma pusilla B      ...C.........-A.................................. [600]
Hedeoma pusilla C      ...C.........-A.................................. [600]
Hedeoma reverchonii    ...C.........-AR.....................S.........K. [600]
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Hesperozygis marifolia A      ...C..M.....A-A.............AC......T.G..... [600]
Hesperozygis marifolia B      ...C.........A-A.............AC........G..... [600]
Hesperozygis nitida           ...C..........-A......T.....G.................. [600]
Hesperozygis rhododon         ...C..........-A...........G.................. [600]
Hesperozygis spathulata       ...C..........-A...........G.................. [600]
Monarda fistulosa             ...C..........-A...........G.................. [600]
Monarda menthaefolia          ...C..........-A...........G.................. [600]
Monardella linoides           ...C..........-A.............................. [600]
Poliomintha bustamanta A      ...C..........-A.............................. [600]
Poliomintha bustamanta B      ...C..........-A.............................. [600]
Poliomintha bustamanta C      ...C..........-A.............................. [600]
Poliomintha conjunctrix       ...C..........-A.............................. [600]
Poliomintha dendritica        ...C..........-A.............................. [600]
Poliomintha incana A          ...C..........GA...A........G.................. [600]
Poliomintha incana B          ...C..........GA...A........G.................. [600]
Poliomintha incana C          ...C..........GA...A........G.................. [600]
Poliomintha longiflora A      ...C..........-A.............................. [600]
Poliomintha longiflora B      ...C..........-A.............................. [600]
Pycnanthemum californicum     ...C..........-A...........G.................. [600]
Rhododon angulatus A          ...C..........-AA..........G.................. [600]
Rhododon angulatus B          ...C..........-AA..........G.................. [600]
Rhododon ciliatus B           ...C..........-AA..........G........C.......... [600]

Thymus mastichina             GTTGAACATCTCAATCTCTC-TCGTCGTCGTGC-CGTCCTGT--CGTC-A [650]
Mentha rotundifolia           ....................C...CA.C.....-..C.G...--....CC [650]
Acinos arvensis               ....................-...........-..C.G..C--....CC [650]
Blephilia hirsuta             ....................-..RCG.......-..C.T...--....CC [650]
Clinopodium brownei A         ....................G-.T.CA.C..C..-..G.G...--..G.CC [650]
Clinopodium brownei
 var. pilosiusculum           ....................G-.T.CA.C..C..-..G.G...--..C.CC [650]
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Clinopodium chandleri A      .......T...........-....G.......-..C.G...--....CC [650]
Clinopodium chandleri B      .......T...........-....G.......-..C.G...--....CC [650]
Clinopodium ganderi B        .......T...........-....G.......-..C.G...--....CC [650]
Clinopodium hintoniorum      .......G...........-....G.......-..C.G...--....CC [650]
Clinopodium macrostemum      ....................-....G.......-..C.G...--....CC [650]
Clinopodium mexicanum        ....................-....G.......-..C.G...--....CC [650]
Clinopodium palmeri          ....................-....G.......-..C.G...--....CC [650]
Clinopodium brevifolia       ....................-....G.......-..C.G...--....CC [650]
Clinopodium etonia           ....................-....G.......-..C.G...--....CC [650]
Hedeoma acinoides            ....................-....G.......-..C.....--....CC [650]
Hedeoma apiculata            ....................-....G.......-..C.G...--...YCC [650]
Hedeoma ciliolata            ....................-....G.......-..C.G...--....CC [650]
Hedeoma costata A            ....................-....G.......-..C.G...--T...CC [650]
Hedeoma costata B            ....................-....G.......-..C.G...--T...CC [650]
Hedeoma drummondii A         ....................-....G.......-..C.G...--....CC [650]
Hedeoma drummondii B         ....................-....G.......-..C.G...--....CC [650]
Hedeoma hispida              ....................-....G.......-..C.G...--....CC [650]
Hedeoma irvingii             ....................-...CG.......-..C.G...--....CC [650]
Hedeoma johnstonii           ....................-....G.......-..C.G...--....CC [650]
Hedeoma jucunda              ....................-....G.......-..C.G...--....CC [650]
Hedeoma mandoniana A         ....................-....G.......-..C.G..C--....CC [650]
Hedeoma mandoniana B         ....................-....G.......-..C.G...--....CC [650]
Hedeoma media A              ....................-.T.CG......T-..C.G...--....CC [650]
Hedeoma media B              ....................-.T.CG......T-..C.G...--....CC [650]
Hedeoma molle                ....................-....G.......-T.C.G...--....CC [650]
Hedeoma montana              ....................-...CG.......-..C.G...--....CC [650]
Hedeoma nana A               ....................-....G.......-T.CTG...--....CC [650]
Hedeoma nana B               ....................-....G.......-..C.G...--....CC [650]
Hedeoma oblatifolia          ....................-.G..G.......-..C.G...--....CC [650]
Hedeoma palmeri A            ....................-....G.W.....C..C.G...--....CC [650]
Hedeoma palmeri B            .G..................-....G.......C..C.G...--....CC [650]
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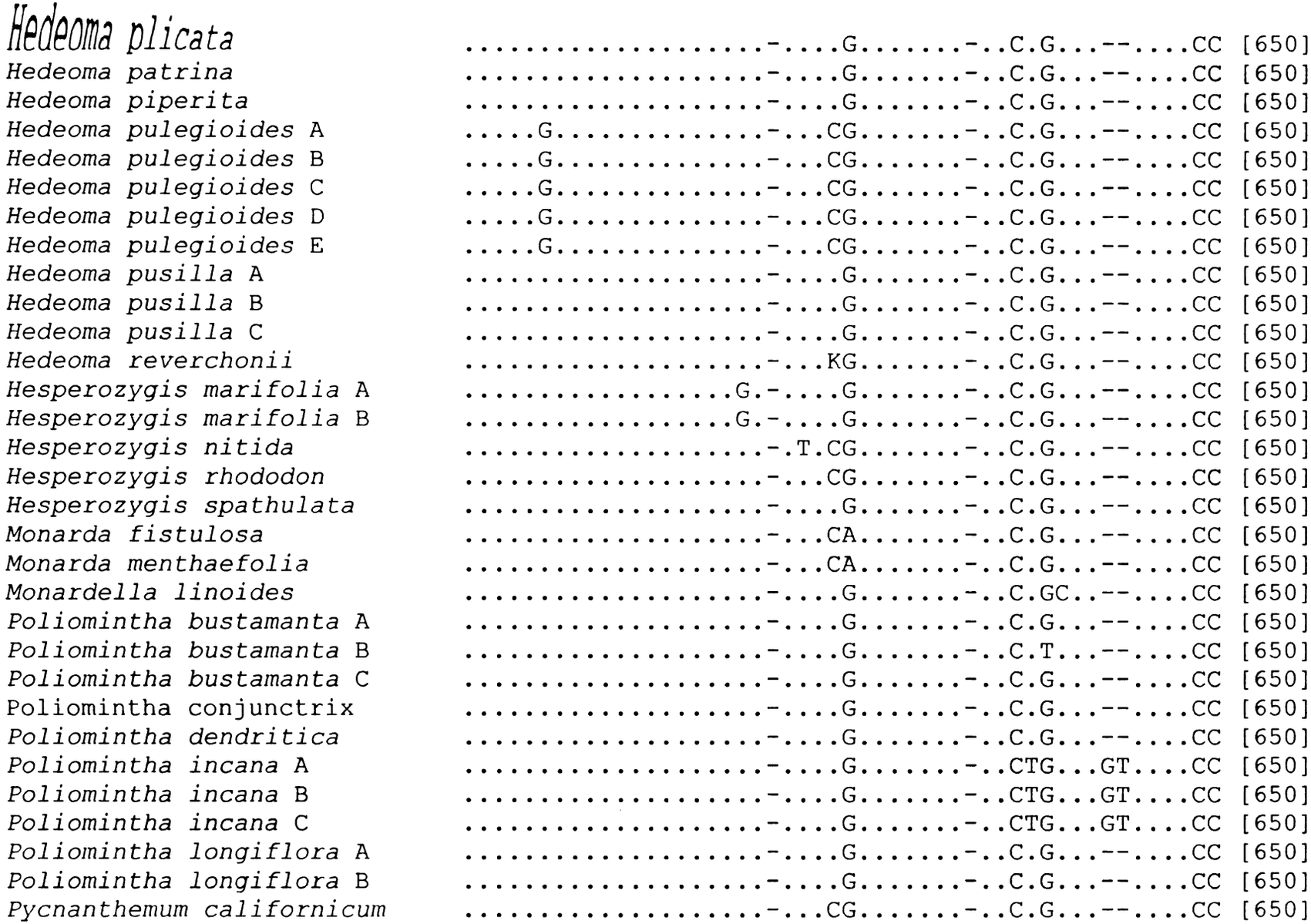
Hedeoma plicata .....-....G.....-..C.G...--....CC [650]
Hedeoma patrina .....-....G.....-..C.G...--....CC [650]
Hedeoma piperita .....-....G.....-..C.G...--....CC [650]
Hedeoma pulegioides A .....G.....-...CG.....-..C.G...--....CC [650]
Hedeoma pulegioides B .....G.....-...CG.....-..C.G...--....CC [650]
Hedeoma pulegioides C .....G.....-...CG.....-..C.G...--....CC [650]
Hedeoma pulegioides D .....G.....-...CG.....-..C.G...--....CC [650]
Hedeoma pulegioides E .....G.....-...CG.....-..C.G...--....CC [650]
Hedeoma pusilla A .....-....G.....-..C.G...--....CC [650]
Hedeoma pusilla B .....-....G.....-..C.G...--....CC [650]
Hedeoma pusilla C .....-....G.....-..C.G...--....CC [650]
Hedeoma reverchonii .....-...KG.....-..C.G...--....CC [650]
Hesperozygis marifolia A .....G.-....G.....-..C.G...--....CC [650]
Hesperozygis marifolia B .....G.-....G.....-..C.G...--....CC [650]
Hesperozygis nitida .....-.T.CG.....-..C.G...--....CC [650]
Hesperozygis rhododon .....-...CG.....-..C.G...--....CC [650]
Hesperozygis spathulata .....-....G.....-..C.G...--....CC [650]
Monarda fistulosa .....-...CA.....-..C.G...--....CC [650]
Monarda menthaefolia .....-...CA.....-..C.G...--....CC [650]
Monardella linoides .....-....G.....-..C.GC..--....CC [650]
Poliomintha bustamanta A .....-....G.....-..C.G...--....CC [650]
Poliomintha bustamanta B .....-....G.....-..C.T...--....CC [650]
Poliomintha bustamanta C .....-....G.....-..C.G...--....CC [650]
Poliomintha conjunctrix .....-....G.....-..C.G...--....CC [650]
Poliomintha dendritica .....-....G.....-..C.G...--....CC [650]
Poliomintha incana A .....-....G.....-..CTG...GT....CC [650]
Poliomintha incana B .....-....G.....-..CTG...GT....CC [650]
Poliomintha incana C .....-....G.....-..CTG...GT....CC [650]
Poliomintha longiflora A .....-....G.....-..C.G...--....CC [650]
Poliomintha longiflora B .....-....G.....-..C.G...--....CC [650]
Pycnanthemum californicum .....-...CG.....-..C.G...--....CC [650]

Rhododon angulatus A	.....G.....-...CG.....-..C.G...--....CC	[650]
Rhododon angulatus B	.....G.....-...CG.....-..C.G...--....CC	[650]
Rhododon ciliatus B	.....G.....-...CG.....-..C.G...--....CC	[650]
Thymus mastichina	TTACGGGAATAGTCATAAACGACCCAACGGTGCCGGTGCTTAACTGCACC	[700]
Mentha rotundifolia	G.....CC--.C.....AC..CGCG..TA..GT.	[700]
Acinos arvensis	G.....C.---AC.....AGT.GCGCG.G.C..GTA	[700]
Blephilia hirsuta	G.G.....C.---AT.....AC.GCG.G...A..GT.	[700]
Clinopodium brownei A	GC.....C.CA---A..GT.....GT..----------	[700]
Clinopodium brownei *var. pilosiusculum*	GC.....C.CC---A..GT.....GT.....AC.GCGCC...A..G..	[700]
Clinopodium chandleri A	G.....C.---A.....AC.GCGCG...A..GT.	[700]
Clinopodium chandleri B	G.....C.---A.....AC.GCGCG...A..GT.	[700]
Clinopodium ganderi B	G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Clinopodium hintoniorum	.....C.---A...T.....G.....AAC.GCGCG.T.A..GT.	[700]
Clinopodium macrostemum	G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Clinopodium mexicanum	G.....C.---A..GT.....AC.GCGCG...A..GT.	[700]
Clinopodium palmeri	G.....C.---A.....T.G.....AC.GCGCG.G.C..GTA	[700]
Clinopodium brevifolia	..G.....C.--.AT.....AC.GCGCG...A..G..	[700]
Clinopodium etonia	G.G.....T.---A.....T.....AC.GCGCA...A..GT.	[700]
Hedeoma acinoides	G.G.....C.---A...T.....AA.GCGCG...A..G..	[700]
Hedeoma apiculata	G.G.....C.--.A.....AC.GCGCG...A..GT.	[700]
Hedeoma ciliolata	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma costata A	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma costata B	G.G.....C.---A...T.....AC.GCGCG..AA..GT.	[700]
Hedeoma drummondii A	G.G.....C.--.A.....AC.GCGCG...A..G..	[700]
Hedeoma drummondii B	G.G.....C.--.A.....AC.GCGCG...A..G..	[700]
Hedeoma hispida	G.....C.---A...T.....C.....ACTGCGCG.G.A..GT.	[700]
Hedeoma irvingii	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma johnstonii	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]

Hedeoma jucunda	G.....CA---A...T.....AC.GCGCG.R.A..GT.	[700]
Hedeoma mandoniana A	G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma mandoniana B	G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma media A	G.G.....C.---A.....AC.GCGCG...A..GT.	[700]
Hedeoma media B	G.G.....C.---A.....AC.GCGCG...A..GT.	[700]
Hedeoma molle	G.G.....C.---A...T.....AT.GCGCG..TA..GT.	[700]
Hedeoma montana	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma nana A	G.G.....C.---A...T.....AT.GCGCG..TA..GT.	[700]
Hedeoma nana B	G.G.....C.---A...T.....AC.GCGCG..TA..GT.	[700]
Hedeoma oblatifolia	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma palmeri A	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma palmeri B	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma plicata	G.G.....CA---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma patrina	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma piperita	G.....C.---A...T.....AC.GCGCG..TA..GT.	[700]
Hedeoma pulegioides A	G.G.....C.---A...T.....AAC.GCGCG...A..GT.	[700]
Hedeoma pulegioides B	G.G.....C.---A...T.....AAC.GCGCG...A..GT.	[700]
Hedeoma pulegioides C	G.G.....C.---A...T.....AAC.GCGCG...A..GT.	[700]
Hedeoma pulegioides D	G.G.....C.---A...T.....AAC.GCGCG...A..GT.	[700]
Hedeoma pulegioides E	G.G.....C.---A...T.....AAC.GCGCG...A..GT.	[700]
Hedeoma pusilla A	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma pusilla B	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma pusilla C	G.G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hedeoma reverchonii	G.G.....C.--.A.....AC.GCGCG...A..G..	[700]
Hesperozygis marifolia A	G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hesperozygis marifolia B	G.....C.---A...T.....AC.GCGCG...A..GT.	[700]
Hesperozygis nitida	G.G.....C.---A..TT.....AC.GCGCG...A..GT.	[700]
Hesperozygis rhododon	G.G.....C.---A.....A.....AC.GCGCG...A..GT.	[700]
Hesperozygis spathulata	G.G.....CA---A.....G.....AC.GCGCG...A..GT.	[700]
Monarda fistulosa	G.G.....CC--.A.....AC.GCGCG..TA..G..	[700]
Monarda menthaefolia	G.G.....CC--.A.....AC.GCGCG..TA..G..	[700]

Monardella linoides	GY.....C.---G...T.....AC.GCGCC...A..G..	[700]
Poliomintha bustamanta A	G.G.....C.---AG..T.....AC.GCGCG...A..GT.	[700]
Poliomintha bustamanta B	G.G.....C.---AG..T.....AC.GCGCG...A..GT.	[700]
Poliomintha bustamanta C	G.G.....C.---AG..T.....AC.GCGCG...A..GT.	[700]
Poliomintha conjunctrix	G.G.....C.--.A....A.....AC.GCGCG...A..GT.	[700]
Poliomintha dendritica	G.G.....C.---AG..T.....AC.GCGCG...A..GT.	[700]
Poliomintha incana A	G.....C.---A...T.....AA.GCGCG...A..GT.	[700]
Poliomintha incana B	G.....C.---A...T.....AA.GCGCG...A..GT.	[700]
Poliomintha incana C	G.....C.---A...T.....TAA.GCGCG...A..GT.	[700]
Poliomintha longiflora A	G.G.....CA---A...T.....TAC.GCGCG...A..GT.	[700]
Poliomintha longiflora B	G.G.....C.---A...T..T.....AC.GCGCG...A..GT.	[700]
Pycnanthemum californicum	G.G.....C.---A.....AC.GCGCG...A..GT.	[700]
Rhododon angulatus A	G.....C.---A...T.....AA.GCGCG..TA..GT.	[700]
Rhododon angulatus B	G.....C.---A...T.....AA.GCGCG...A..GT.	[700]
Rhododon ciliatus B	G.....C.---A...T.....AA.GCGCG...A..GT.	[700]

Thymus mastichina	TCACCTTCGAC----------	[750]
Mentha rotundifolia	.....----------	[750]
Acinos arvensis	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]
Blephilia hirsuta	.....----------	[750]
Clinopodium brownei A	----------	[750]
Clinopodium brownei *var. pilosiusculum*	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]
Clinopodium chandleri A	.....CG-------CGACCCCAGGTCAGGCG----------	[750]
Clinopodium chandleri B	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]
Clinopodium ganderi B	.....CG-------CGACCCCAGGTCA----------	[750]
Clinopodium hintoniorum	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]
Clinopodium macrostemum	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]
Clinopodium mexicanum	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]
Clinopodium palmeri	.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT-	[750]

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Clinopodium brevifolia          ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Clinopodium etonia              ..........---------------------------------------- [750]
Hedeoma acinoides               ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma apiculata               ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma ciliolata               ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma costata A               ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma costata B               ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma drummondii A            ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma drummondii B            C.........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma hispida                 G.........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma irvingii                ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma johnstonii              ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma jucunda                 ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma mandoniana A            ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma mandoniana B            ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma media A                 ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma media B                 ..........CG-------CGACCCCAGGTCA---------------- [750]
Hedeoma molle                   ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma montana                 ......-....---------------------------------------- [750]
Hedeoma nana A                  ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma nana B                  ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma oblatifolia             ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma palmeri A               ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma palmeri B               .......----------------------------------------- [750]
Hedeoma plicata                 ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma patrina                 ..........C--------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma piperita                ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma pulegioides A           ......-....CG-------CGACCCCAG-------------------- [750]
Hedeoma pulegioides B           ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma pulegioides C           ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma pulegioides D           ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCTT [750]
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Hedeoma pulegioides E          ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma pusilla A              ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma pusilla B              ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma pusilla C              ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hedeoma reverchonii            C.........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hesperozygis marifolia A       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hesperozygis marifolia B       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hesperozygis nitida            ..........CG-------CGACCCCAGGTCAGGCGGGATCACCCGCT- [750]
Hesperozygis rhododon          ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Hesperozygis spathulata        ..........---------------------------------------- [750]
Monarda fistulosa              C.........---------------------------------------- [750]
Monarda menthaefolia           C.........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Monardella linoides            ..........---------------------------------------- [750]
Poliomintha bustamanta A       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha bustamanta B       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha bustamanta C       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha conjunctrix        ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha dendritica         ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha incana A           ....-.....CG---------------------------------- [750]
Poliomintha incana B           ....T.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha incana C           ....T.....CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha longiflora A       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Poliomintha longiflora B       ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Pycnanthemum californicum      ..........---------------------------------------- [750]
Rhododon angulatus A           ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Rhododon angulatus B           ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]
Rhododon ciliatus B            ..........CG-------CGACCCCAGGTCAGGCGGGATTACCCGCT- [750]

Thymus mastichina              ---------------------------- [779]
Mentha rotundifolia            ---------------------------- [779]
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Acinos arvensis	GAGTTTAAGCATATCAATAAAGC------	[779]
Blephilia hirsuta	----------	[779]
Clinopodium brownei A	----------	[779]
Clinopodium brownei *var. pilosiusculum*	GAGTTTAAGCATATCAAT----------	[779]
Clinopodium chandleri A	----------	[779]
Clinopodium chandleri B	GAGTTTAAGCATATCAAT----------	[779]
Clinopodium ganderi B	----------	[779]
Clinopodium hintoniorum	GAGTTTAAGCATATC----------	[779]
Clinopodium macrostemum	GAGTTTAAGCATATCA----------	[779]
Clinopodium mexicanum	GAGTTTAAGCATATC----------	[779]
Clinopodium palmeri	GAGTTTAAGCATATC----------	[779]
Clinopodium brevifolia	GAGTTTAAGCATATCA----------	[779]
Clinopodium etonia	----------	[779]
Hedeoma acinoides	GAGTTTAAGCATATC----------	[779]
Hedeoma apiculata	GAGTTTAAGCATATCA----------	[779]
Hedeoma ciliolata	GAGTTTAAGCATATC----------	[779]
Hedeoma costata A	GAGTTTAAGCATATCAAT----------	[779]
Hedeoma costata B	GAGTTTAAGCATATCAATAA-GC------	[779]
Hedeoma drummondii A	GAGTTTAAGCATATC----------	[779]
Hedeoma drummondii B	GAGTTTAAGCATATCAATAA-GCGGAGGA	[779]
Hedeoma hispida	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma irvingii	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma johnstonii	GAGTTTAAGCATAT----------	[779]
Hedeoma jucunda	GAGTTTAAGCATATC----------	[779]
Hedeoma mandoniana A	GAGTTTAAGCATA----------	[779]
Hedeoma mandoniana B	GAGTTTAAGCATATC----------	[779]
Hedeoma media A	GAGTTTAAGCATATC----------	[779]
Hedeoma media B	----------	[779]
Hedeoma molle	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma montana	----------	[779]

Hedeoma nana A	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma nana B	GAGTTTAAGCATATC--------------	[779]
Hedeoma oblatifolia	GAGTTTAAGCATATCAATAA-G-------	[779]
Hedeoma palmeri A	GAGTTT----------------------	[779]
Hedeoma palmeri B	----------------------------	[779]
Hedeoma plicata	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma patrina	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma piperita	GAGTTTAAGCATATCAATA----------	[779]
Hedeoma pulegioides A	----------------------------	[779]
Hedeoma pulegioides B	GAGTTTAAGCATATCA-TA----------	[779]
Hedeoma pulegioides C	GAGTTTAAGCATATCAATAA-GCGGAGGA	[779]
Hedeoma pulegioides D	GAGTTTAAGCATATCAATAA-GCGGA---	[779]
Hedeoma pulegioides E	GAGTTTAAGCATATCA-T-----------	[779]
Hedeoma pusilla A	GAGTTTAAGCATATCAATAA---------	[779]
Hedeoma pusilla B	GAGTTTAAGCATATC--------------	[779]
Hedeoma pusilla C	GAGTTTAAGCATATC--------------	[779]
Hedeoma reverchonii	GAGTTTAAGC------------------	[779]
Hesperozygis marifolia A	GAGTTTAAGCATATCA------------	[779]
Hesperozygis marifolia B	GAGTTTAAGCATATCA-TA----------	[779]
Hesperozygis nitida	GAGTTTAAGCATATCAA-----------	[779]
Hesperozygis rhododon	GAGTTTAAGCATATC--------------	[779]
Hesperozygis spathulata	----------------------------	[779]
Monarda fistulosa	----------------------------	[779]
Monarda menthaefolia	GAGTTTAAGCATATCA-TAAAGCGGA---	[779]
Monardella linoides	----------------------------	[779]
Poliomintha bustamanta A	GAGTTTA-GCAT----------------	[779]
Poliomintha bustamanta B	GAGTTTAAGCATATCAATA----------	[779]
Poliomintha bustamanta C	GAGTTTAAGCATATCAATA----------	[779]
Poliomintha conjunctrix	GAGTTTAAGCATATCAATAA-G-------	[779]
Poliomintha dendritica	GAGTTTAAGCATATCAATAA-GCGGA---	[779]
Poliomintha incana A	----------------------------	[779]

Poliomintha incana B	GAGTTTAAGCATATCAAT----------	[779]
Poliomintha incana C	GAGTTTAAGCATAT--------------	[779]
Poliomintha longiflora A	GAGTTTAAGCATATCAA----------	[779]
Poliomintha longiflora B	GAGTTTAAGCATATC-------------	[779]
Pycnanthemum californicum	----------------------------	[779]
Rhododon angulatus A	GAGTTTAAGCATATCA-----------	[779]
Rhododon angulatus B	GAGTTTAAGCATATCA-TAA-GCGGAGG-	[779]
Rhododon ciliatus B	GAGTTTAAGCATATC-------------	[779]

Aligned Sequence Matrix 2: *trnL* Intron and *trnL-trnF* Spacer of the Chloroplast Genome

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Thymus mastichina                    ----------------------------------------CCAAGTGA [50]
Mentha rotundifolia                  ----------------------------------------.T...... [50]
Acinos arvensis                      ----------------------------------------.T...... [50]
Blephilia hirsuta                    ----------------------------------------.T...... [50]
Clinopodium ashei A                  ------------------------------------------------ [50]
Clinopodium ashei B                  ------------------------------------------------ [50]
Clinopodium brownei A                ----------------------------------------.T...... [50]
Clinopodium brownei
 var. pilosiusculum                  ----------------------------------------.T...... [50]
Clinopodium chandleri B              ----------------------------------------.T...... [50]
Clinopodium ganderi A                ----------------------------------------.T...... [50]
Clinopodium ganderi B                ----------------------------------------.T...... [50]
Clinopodium macrostemum              ------------------------------------------------ [50]
Clinopodium mexicanum                ------------------------------------------------.... [50]
Clinopodium palmeri                  ------------------------------------------------.... [50]
Clinopodium procumbens               ----------------------------------------.T...... [50]
Clinopodium brevifolia               ----------------------------------------.T...... [50]
Clinopodium etonia                   ----------------------------------------.T...... [50]
Dicerandra immaculata                ------------------------------------------------ [50]
Hedeoma acinoides                    ------------------------------------ACTTA.T...... [50]
Group I                              CGCTACGGACTTAAT-GGATTGAGCCTTGGTATGGAAACTTA.T...... [50]
Hedeoma ciliolata                    ----------------------------------------A.T...... [50]
Hedeoma hispida                      ------------------------------------------------.... [50]
Hedeoma hyssopifolia                 ------------------------------------------------ [50]
Hedeoma irvingii                     ----------------------------------------A.T...... [50]
Hedeoma johnstonii                   --------------------------------GGAAACTTA.T...... [50]
Hedeoma jucunda                      ----------------------------------------.T...... [50]
Hedeoma mandoniana A                 ------------------------------------------------ [50]
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Hedeoma media A	----------.T.....	[50]
Group II	----------A.T.....	[50]
Hedeoma montana	----------A.T.....	[50]
Hedeoma nana A	----------.	[50]
Hedeoma palmeri A	----------....	[50]
Hedeoma piperita	----------....	[50]
Hedeoma pulegioides B	----------.T.....	[50]
Hedeoma pusilla A	----------....	[50]
Hedeoma pusilla B	---TACGGACTTAAT-GGATTGAGCCTTGGTATGGAAACTTA.T.....	[50]
Hesperozygis marifolia B	----------.T.....	[50]
Hesperozygis nitida	----------.T.....	[50]
Hesperozygis rhododon	----------.T.....	[50]
Hesperozygis spathulata	----------....	[50]
Monarda fistulosa	----------.T.....	[50]
Monarda menthaefolia	----------.T.....	[50]
Monardella linoides	----------.T.....	[50]
Poliomintha bustamanta A	----------....	[50]
Poliomintha dendritica	----------.T.....	[50]
Poliomintha incana A	----------....	[50]
Poliomintha incana B	----------A.T.....	[50]
Pycnanthemum californicum	----------.T.....	[50]
Rhododon angulatus A	----------.T.....	[50]
Rhododon ciliatus B	----------.T.....	[50]

Thymus mastichina	TAA-CTTTCAAA-TTCAGAGAAACCCCGGAATTAATAAAAATGGGCAATC	[100]
Mentha rotundifolia	...-........-.....	[100]
Acinos arvensis	...-........-.....	[100]
Blephilia hirsuta	.T.-........-.....	[100]
Clinopodium ashei A	-----.......-.....	[100]
Clinopodium ashei B	----------.....	[100]

Clinopodium brownei A	...-.....-.....	[100]
Clinopodium brownei *var. pilosiusculum*	...-.....-.....	[100]
Clinopodium chandleri B	...-.....-.....	[100]
Clinopodium ganderi A	..--.....-.....	[100]
Clinopodium ganderi B	...-.....-.....	[100]
Clinopodium macrostemum	----.....-.....T....	[100]
Clinopodium mexicanum	...-.....-.....	[100]
Clinopodium palmeri	...-.....-.....	[100]
Clinopodium procumbens	...-.....-.....	[100]
Clinopodium brevifolia	...-.....-.....	[100]
Clinopodium etonia	...-.....-.....	[100]
Dicerandra immaculata	----------.....A.....A.....	[100]
Hedeoma acinoides	...-.....-.....	[100]
Group I	...-.....-.....	[100]
Hedeoma ciliolata	...-.....-.....	[100]
Hedeoma hispida	...-.....-.....	[100]
Hedeoma hyssopifolia	----------.....	[100]
Hedeoma irvingii	...-.....-.....	[100]
Hedeoma johnstonii	...-.....-.....	[100]
Hedeoma jucunda	...-.....-.....	[100]
Hedeoma mandoniana A	----.....--.....	[100]
Hedeoma media A	...-.....-.....	[100]
Group II	...-.....--.....	[100]
Hedeoma montana	...-.....-.....	[100]
Hedeoma nana A	...-.....-.....	[100]
Hedeoma palmeri A	...-.....--.....	[100]
Hedeoma piperita	...-.....-.....	[100]
Hedeoma pulegioides B	...-.....-.....	[100]
Hedeoma pusilla A	...-.....-.....	[100]
Hedeoma pusilla B	...-.....-.....	[100]

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Hesperozygis marifolia B      ...-.......-..................................... [100]
Hesperozygis nitida           ...-.......-..................................... [100]
Hesperozygis rhododon         ...-.......-..................................... [100]
Hesperozygis spathulata       ...-.......-..................................... [100]
Monarda fistulosa             ...-.......-..................................... [100]
Monarda menthaefolia          ...A.......-..................................... [100]
Monardella linoides           ...-.......A..................................... [100]
Poliomintha bustamanta A      ...-.......-..................................... [100]
Poliomintha dendritica        ...-.......-..................................... [100]
Poliomintha incana A          ...-.......--.................................... [100]
Poliomintha incana B          ...-.......-..................................... [100]
Pycnanthemum californicum     ...-.......-..................................... [100]
Rhododon angulatus A          ...-.......-..................................... [100]
Rhododon ciliatus B           ...-.......-..................................... [100]

Thymus mastichina             CTGAGCCAAATCCTGTTTTCTCAAAA----------CAAAGG------- [150]
Mentha rotundifolia           ..................C.....----------......TTTCAAA [150]
Acinos arvensis               ......................----------......TTTCAAA [150]
Blephilia hirsuta             ...................T....----------......TTTCAAA [150]
Clinopodium ashei A           ...................T....----------......TTCCAAA [150]
Clinopodium ashei B           ...................T....----------......TTTCAAA [150]
Clinopodium brownei A         ...................T....----------......TTTCAAA [150]
Clinopodium brownei
 var. pilosiusculum           ...................T....----------......TTTCAAA [150]
Clinopodium chandleri B       ...................T....----------......TTTCAAA [150]
Clinopodium ganderi A         ...................T....----------......TTTCAAA [150]
Clinopodium ganderi B         ...................T....----------......TTTCAAA [150]
Clinopodium macrostemum       ...................T....----------......TTTCAAA [150]
Clinopodium mexicanum         ...................T....----------......TTTCAAA [150]
Clinopodium palmeri           ...................T....----------......TTTCAAA [150]
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Clinopodium procumbens ....................T....----------.....TTTCAAA [150]
Clinopodium brevifolia ....................T....----------.....TTTCAAA [150]
Clinopodium etonia ........................T....----------.....TTTCAAA [150]
Dicerandra immaculata .....................T....----------.....TTTCAAA [150]
Hedeoma acinoides .........................T....----------.....TTTCAAA [150]
Group I ...................................T....----------.....TTTCAAA [150]
Hedeoma ciliolata .........................T....----------.....TTTCAAA [150]
Hedeoma hispida ...........................T....----------.....TTTCAAA [150]
Hedeoma hyssopifolia ......................T....----------.....TTTCAAA [150]
Hedeoma irvingii ..........................T....----------.....TTTCAAA [150]
Hedeoma johnstonii ........................T....----------.....TTTCAAA [150]
Hedeoma jucunda ...........................T....----------.....TTTCAAA [150]
Hedeoma mandoniana A ......................T....----------.....TTTCAAA [150]
Hedeoma media A ...........................T....----------.....TTTCAAA [150]
Group II ..................................T....----------.....TTTCAAA [150]
Hedeoma montana ...........................T....----------.....TTTCAAA [150]
Hedeoma nana A ............................T....----------.....TTTCAAA [150]
Hedeoma palmeri A .........................T....----------.....TTTCAAA [150]
Hedeoma piperita ..........................T....----------.....TTTCAAA [150]
Hedeoma pulegioides B .....................T....----------.....TTTCAAA [150]
Hedeoma pusilla A .........................T....----------.....TTTCAAA [150]
Hedeoma pusilla B ..............---------..----------.....TTTCAAA [150]
Hesperozygis marifolia B ..................T....----------.....TTTCAAA [150]
Hesperozygis nitida .......................T....----------.....TTTCAAA [150]
Hesperozygis rhododon .....................T....----------.....TTTCAAA [150]
Hesperozygis spathulata ...................T....----------.....TTTCAAA [150]
Monarda fistulosa .........................T....----------.....TTTCAAA [150]
Monarda menthaefolia ......................T....----------.....TTTCAAA [150]
Monardella linoides .......................T....----------.....TTTCAAA [150]
Poliomintha bustamanta A ..................T....TAAAA------.....TTTCAAA [150]
Poliomintha dendritica ....................T....----------.....TTTCAAA [150]
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Poliomintha incana A                .....................T....----------.....TTTCAAA [150]
Poliomintha incana B                .....................T....----------.....TTTCAAA [150]
Pycnanthemum californicum           .....................T....----------.....TTTCAAA [150]
Rhododon angulatus A                .....................T....----------.....TTTCAAA [150]
Rhododon ciliatus B                 .....................T....----------.....TTTCAAA [150]


Thymus mastichina                   ------------------ATAGGTGCAGAGACTCAATGGAAGCTGTTCTA [200]
Mentha rotundifolia                 AAA-CGAAAAAAA--AGG.............................. [200]
Acinos arvensis                     AAA-CGAAAAAAA--AGG.............................. [200]
Blephilia hirsuta                   AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium ashei A                 AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium ashei B                 AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium brownei A               AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium brownei
 var. pilosiusculum                 AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium chandleri B             AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium ganderi A               AAA-CGAAAAAAAAAAGG.............................. [200]
Clinopodium ganderi B               AAA-CGAAAAAAAAAAGG.............................. [200]
Clinopodium macrostemum             AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium mexicanum               AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium palmeri                 AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium procumbens              AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium brevifolia              AAA-CGAAAAAA---AGG.............................. [200]
Clinopodium etonia                  AAA-CGAAAAAA---AGG.............................. [200]
Dicerandra immaculata               AAA-CGAAAAAA---AGG.............................. [200]
Hedeoma acinoides                   AAA-CGAAAAAA---AGG.............................. [200]
Group I                             AAA-CGAAAAAA---AGG.............................. [200]
Hedeoma ciliolata                   AAA-CGAAAAAA---AGG.............................. [200]
Hedeoma hispida                     AAA-CGAAAAAA---AGG.............................. [200]
Hedeoma hyssopifolia                AAA-CGAAAAAA---AGG.............................. [200]
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Hedeoma irvingii	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma johnstonii	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma jucunda	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma mandoniana A	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma media A	AAA-CGAAAAAA---AGG.....	[200]
Group II	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma montana	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma nana A	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma palmeri A	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma piperita	AAAACGAAAAAA---AGG.....	[200]
Hedeoma pulegioides B	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma pusilla A	AAA-CGAAAAAA---AGG.....	[200]
Hedeoma pusilla B	AAA-CGAAAAAA---AGG.....	[200]
Hesperozygis marifolia B	AAA-CGAAAAAA---AGG.....	[200]
Hesperozygis nitida	AAA-CGAAAAAA---AGG.....	[200]
Hesperozygis rhododon	AAA-CGAAAAAA---AGG.....	[200]
Hesperozygis spathulata	AAA-CGAAAAAA---AGG.....	[200]
Monarda fistulosa	AAA-CGAAAAAA---AGG.....	[200]
Monarda menthaefolia	AAA-CGAAAAAA---AGG.....	[200]
Monardella linoides	AAA-CGAAAAAA---AGG.....	[200]
Poliomintha bustamanta A	AAA-CGAAAAAA---AGG.....	[200]
Poliomintha dendritica	AAA-CGAAAAAA---AGG.....	[200]
Poliomintha incana A	AAA-CGAAAAAA----GG.....	[200]
Poliomintha incana B	AAA-CGAAAAAA----AG.....	[200]
Pycnanthemum californicum	AAA-CGAAAAAA---AGG.....	[200]
Rhododon angulatus A	AAA-CGAAAAAA---AGG.....	[200]
Rhododon ciliatus B	AAA-CGAAAAAA---AGG.....	[200]
Thymus mastichina	ACAAATGGAGTTGACTGCGTTGGTAGAGGAATCTTTCCATCGAAACTTTA	[250]
Mentha rotundifolia	.....C.....G.....	[250]

Acinos arvensis	.....C.....G.....T	[250]
Blephilia hirsuta	.....C.....G.....	[250]
Clinopodium ashei A	.....C.....G.....	[250]
Clinopodium ashei B	.....C.....G.....	[250]
Clinopodium brownei A	.....C.....G.....	[250]
Clinopodium brownei var. pilosiusculum	.....C.....G.....	[250]
Clinopodium chandleri B	.....C.....G.....	[250]
Clinopodium ganderi A	.....C.....G.....	[250]
Clinopodium ganderi B	.....C.....G.....	[250]
Clinopodium macrostemum	.....C.....G.....	[250]
Clinopodium mexicanum	.....C.....G.....	[250]
Clinopodium palmeri	.....C.....G.....	[250]
Clinopodium procumbens	.....C.....G.....	[250]
Clinopodium brevifolia	.....C.....G.....	[250]
Clinopodium etonia	.....C.....G.....	[250]
Dicerandra immaculata	.....C.....G.....	[250]
Hedeoma acinoides	.....C.....G.....	[250]
Group I	.....C.....G.....	[250]
Hedeoma ciliolata	.....C.....G.....	[250]
Hedeoma hispida	.....C.....G.....	[250]
Hedeoma hyssopifolia	.....C.....G.....	[250]
Hedeoma irvingii	.....C.....G.....	[250]
Hedeoma johnstonii	.....C.....G.....	[250]
Hedeoma jucunda	.....C.....G.....	[250]
Hedeoma mandoniana A	.....C.....G.....	[250]
Hedeoma media A	.....C.....A.....G.....	[250]
Group II	.....C.....G.....	[250]
Hedeoma montana	.....C.....G.....	[250]
Hedeoma nana A	.....C.....G.....	[250]
Hedeoma palmeri A	.....C.....G.....	[250]

Hedeoma piperita .....C.....G..... [250]
Hedeoma pulegioides B .....C.....G..... [250]
Hedeoma pusilla A .....C.....G..... [250]
Hedeoma pusilla B .....C.....G..... [250]
Hesperozygis marifolia B .....G..... [250]
Hesperozygis nitida .....C.....G..... [250]
Hesperozygis rhododon .....C.....G..... [250]
Hesperozygis spathulata .....C.....G..... [250]
Monarda fistulosa .....C.....G..... [250]
Monarda menthaefolia .....C.....G..... [250]
Monardella linoides .....C.....G..... [250]
Poliomintha bustamanta A .....C.....G..... [250]
Poliomintha dendritica .....C.....G..... [250]
Poliomintha incana A .....C.....C....G..... [250]
Poliomintha incana B .....C.....C....G..... [250]
Pycnanthemum californicum .....C.....G..... [250]
Rhododon angulatus A .....C.....G..... [250]
Rhododon ciliatus B .....C.....G..... [250]

Thymus mastichina ----------TAAAGGATGAAAGATAAACGCATCTATTGAATACT---- [300]
Mentha rotundifolia TTTTA------.....C.....---- [300]
Acinos arvensis ----------C.....---- [300]
Blephilia hirsuta ----------.....ATAT [300]
Clinopodium ashei A ----------.....G.....CTAT [300]
Clinopodium ashei B ----------.....G.....CTAT [300]
Clinopodium brownei A ----------.....---- [300]
Clinopodium brownei var. pilosiusculum ----------.....---- [300]
Clinopodium chandleri B ----------.....---- [300]
Clinopodium ganderi A ----------.....---- [300]

Clinopodium ganderi B	----------.....----	[300]
Clinopodium macrostemum	----------.....----	[300]
Clinopodium mexicanum	----------.....----	[300]
Clinopodium palmeri	----------A.....----	[300]
Clinopodium procumbens	----------.....T.....----	[300]
Clinopodium brevifolia	----------.....G.....CTAT	[300]
Clinopodium etonia	----------.....G.....T.----	[300]
Dicerandra immaculata	----------.....C.....ATAT	[300]
Hedeoma acinoides	----------.....----	[300]
Group I	----------.....----	[300]
Hedeoma ciliolata	----------.....----	[300]
Hedeoma hispida	-----TAATTA.....----	[300]
Hedeoma hyssopifolia	----------.....----	[300]
Hedeoma irvingii	----------.....----	[300]
Hedeoma johnstonii	----------.....----	[300]
Hedeoma jucunda	----------.....----	[300]
Hedeoma mandoniana A	----------.....----	[300]
Hedeoma media A	----------.....----	[300]
Group II	----------.....----	[300]
Hedeoma montana	----------.....----	[300]
Hedeoma nana A	----------.....----	[300]
Hedeoma palmeri A	----------.....----	[300]
Hedeoma piperita	----------.....----	[300]
Hedeoma pulegioides B	----------.....----	[300]
Hedeoma pusilla A	----------.....----	[300]
Hedeoma pusilla B	----------.....----	[300]
Hesperozygis marifolia B	----------.....----	[300]
Hesperozygis nitida	----------.....----	[300]
Hesperozygis rhododon	----------.....----	[300]
Hesperozygis spathulata	----------.....----	[300]
Monarda fistulosa	----------.....ATAT	[300]

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Monarda menthaefolia          ----------.....................................ATAT [300]
Monardella linoides           ----------A.....................................---- [300]
Poliomintha bustamanta A      ----------.....................................---- [300]
Poliomintha dendritica        ----------.....................................---- [300]
Poliomintha incana A          ----------.....................T.............---- [300]
Poliomintha incana B          ----------.....................T.............---- [300]
Pycnanthemum californicum     ----------.....................................ATAT [300]
Rhododon angulatus A          ----------.....................................---- [300]
Rhododon ciliatus B           ----------.....................................---- [300]

Thymus mastichina             ------------------------------ATATCAAATGATTAATGTTG [350]
Mentha rotundifolia           ------------------------------..................... [350]
Acinos arvensis               ------------------------------..................... [350]
Blephilia hirsuta             TCTATTGAATACT-----------------..................... [350]
Clinopodium ashei A           TCTATTGAATACTCTATTCTATTGAATACT..................... [350]
Clinopodium ashei B           TCTATTGAATACTCTATTCTATTGAATACT..................... [350]
Clinopodium brownei A         ------------------------------..................... [350]
Clinopodium brownei
 var. pilosiusculum           ------------------------------..................... [350]
Clinopodium chandleri B       ------------------------------..................... [350]
Clinopodium ganderi A         ------------------------------..................... [350]
Clinopodium ganderi B         ------------------------------..................... [350]
Clinopodium macrostemum       ------------------------------..................... [350]
Clinopodium mexicanum         ------------------------------..................... [350]
Clinopodium palmeri           ------------------------------..................... [350]
Clinopodium procumbens        ------------------------------..................... [350]
Clinopodium brevifolia        TCTATTGAATACTCTATTCTATTGAATACT..................... [350]
Clinopodium etonia            ------------------------------..................... [350]
Dicerandra immaculata         TCTATTGAATACT-----------------..................... [350]
Hedeoma acinoides             ------------------------------..................... [350]
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Group I	----------..	[350]
Hedeoma ciliolata	----------..	[350]
Hedeoma hispida	----------..	[350]
Hedeoma hyssopifolia	----------..A	[350]
Hedeoma irvingii	----------..	[350]
Hedeoma johnstonii	----------..	[350]
Hedeoma jucunda	----------..	[350]
Hedeoma mandoniana A	----------..	[350]
Hedeoma media A	----------..	[350]
Group II	----------..	[350]
Hedeoma montana	----------..	[350]
Hedeoma nana A	----------..	[350]
Hedeoma palmeri A	----------..	[350]
Hedeoma piperita	----------..	[350]
Hedeoma pulegioides B	----------..	[350]
Hedeoma pusilla A	----------..	[350]
Hedeoma pusilla B	----------..	[350]
Hesperozygis marifolia B	----------..	[350]
Hesperozygis nitida	----------.....TA.....	[350]
Hesperozygis rhododon	----------..	[350]
Hesperozygis spathulata	----------.....TA.....	[350]
Monarda fistulosa	TCTATTGAATACT----------..	[350]
Monarda menthaefolia	TCTATTGAATACT----------..	[350]
Monardella linoides	----------..	[350]
Poliomintha bustamanta A	----------..	[350]
Poliomintha dendritica	----------..	[350]
Poliomintha incana A	----------..	[350]
Poliomintha incana B	----------..	[350]
Pycnanthemum californicum	TCTATTGAATACT----------..	[350]
Rhododon angulatus A	----------..	[350]
Rhododon ciliatus B	----------..	[350]

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Thymus mastichina                TCCCGAATCTATTTT-----TTTAATATGAAAATGAAAAAA--------- [400]
Mentha rotundifolia              G.............-----.....................--------- [400]
Acinos arvensis                  G.............-----.....................--------- [400]
Blephilia hirsuta                G.............-----.....................--------- [400]
Clinopodium ashei A              G.............-----.....................--------- [400]
Clinopodium ashei B              G.............-----.....................--------- [400]
Clinopodium brownei A            G.............-----.....................--------- [400]
Clinopodium brownei
 var. pilosiusculum              G.............-----.....................--------- [400]
Clinopodium chandleri B          G.............-----.....................--------- [400]
Clinopodium ganderi A            G.............-----.....................--------- [400]
Clinopodium ganderi B            G.............-----.....................--------- [400]
Clinopodium macrostemum          G.............-----.....................--------- [400]
Clinopodium mexicanum            G.............-----.....................--------- [400]
Clinopodium palmeri              G.............-----.....................--------- [400]
Clinopodium procumbens           G.............-----.....................--------- [400]
Clinopodium brevifolia           G.............-----.....................--------- [400]
Clinopodium etonia               G.............-----.....................--------- [400]
Dicerandra immaculata            G.............-----.....................--------- [400]
Hedeoma acinoides                G.............-----.....................--------- [400]
Group I                          G.............-----.....................--------- [400]
Hedeoma ciliolata                G.............-----.....................--------- [400]
Hedeoma hispida                  G.............-----.....................--------- [400]
Hedeoma hyssopifolia             G.............-----.....................--------- [400]
Hedeoma irvingii                 G.............-----.....................--------- [400]
Hedeoma johnstonii               G.............-----.....................--------- [400]
Hedeoma jucunda                  G.............-----.....................--------- [400]
Hedeoma mandoniana A             G.............-----.....................--------- [400]
Hedeoma media A                  G.............-----.....................--------- [400]
Group II                         G.............-----.....................--------- [400]
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Hedeoma montana G.....-----.....-------- [400]
Hedeoma nana A G.....-----.....-------- [400]
Hedeoma palmeri A G.....-----.....-------- [400]
Hedeoma piperita G..T.....-----.....-------- [400]
Hedeoma pulegioides B G.....-----.....-------- [400]
Hedeoma pusilla A G.....-----.....-------- [400]
Hedeoma pusilla B G.....-----.....-------- [400]
Hesperozygis marifolia B G.....-----.....-------- [400]
Hesperozygis nitida G.....-----.....-------- [400]
Hesperozygis rhododon G.....-----.....-------- [400]
Hesperozygis spathulata G.....-----.....-------- [400]
Monarda fistulosa G.....-----.....-------- [400]
Monarda menthaefolia G.....-----.....-------- [400]
Monardella linoides G.....-----.....-------- [400]
Poliomintha bustamanta A G.....-----.....-------- [400]
Poliomintha dendritica G.....-----.....-------- [400]
Poliomintha incana A G.....-----.....-------- [400]
Poliomintha incana B G.....-----.....-------- [400]
Pycnanthemum californicum G.....-----.....-------- [400]
Rhododon angulatus A G.....-----.....A------- [400]
Rhododon ciliatus B G.....-----.....A------- [400]

Thymus mastichina ----------TGGAAAAATC-GGTGTGAATTTATTTCACGTTGAAGAA [450]
Mentha rotundifolia ----------.....-.....T..... [450]
Acinos arvensis ----------.....-.A..... [450]
Blephilia hirsuta ----------.....-..... [450]
Clinopodium ashei A ----------.....-..... [450]
Clinopodium ashei B ----------.....-..... [450]
Clinopodium brownei A ----------.....-..... [450]
Clinopodium brownei

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 var. pilosiusculum          ----------.........-.......................... [450]
Clinopodium chandleri B      ----------.........-.......................... [450]
Clinopodium ganderi A        ----------.........-.......................... [450]
Clinopodium ganderi B        ----------.........-.......................... [450]
Clinopodium macrostemum      ----------.........A-.......................... [450]
Clinopodium mexicanum        ----------.........-.......................... [450]
Clinopodium palmeri          ----------.........-.......................... [450]
Clinopodium procumbens       ----------.........-.......................... [450]
Clinopodium brevifolia       ----------.........-.......................... [450]
Clinopodium etonia           ----------.........-.......................... [450]
Dicerandra immaculata        ----------.........-.......................... [450]
Hedeoma acinoides            ----------.........-.......................... [450]
Group I                      ----------.........-.......................... [450]
Hedeoma ciliolata            ----------.........-.......................... [450]
Hedeoma hispida              ----------.........-..........C............... [450]
Hedeoma hyssopifolia         ----------.........-.......................... [450]
Hedeoma irvingii             ----------.........-.......................... [450]
Hedeoma johnstonii           ----------.........-.......................... [450]
Hedeoma jucunda              ----------.........-.......................... [450]
Hedeoma mandoniana A         ----------.........-.......................... [450]
Hedeoma media A              ----------.........-.......................... [450]
Group II                     ----------.........-.......................... [450]
Hedeoma montana              ----------.........-.......................... [450]
Hedeoma nana A               ----------.........-.......................... [450]
Hedeoma palmeri A            ----------.........-.......................... [450]
Hedeoma piperita             ----------.........-.......................... [450]
Hedeoma pulegioides B        ----------.........-.......................... [450]
Hedeoma pusilla A            ----------.........-.......................... [450]
Hedeoma pusilla B            ----------.........-.......................... [450]
Hesperozygis marifolia B     ----------.........-.......................... [450]
Hesperozygis nitida          ----------.........-.......................... [450]
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Hesperozygis rhododon          ----------.........-.......................... [450]
Hesperozygis spathulata        ----------.........-.......................... [450]
Monarda fistulosa              ----------.........-.......................... [450]
Monarda menthaefolia           ----------.........-.......................... [450]
Monardella linoides            ----------.........-.......................... [450]
Poliomintha bustamanta A       ----------.........-.......................... [450]
Poliomintha dendritica         ----------.........-.......................... [450]
Poliomintha incana A           ----------.........-.......................... [450]
Poliomintha incana B           ----------.........-.......................... [450]
Pycnanthemum californicum      ----------.........-.......................... [450]
Rhododon angulatus A           ----------.........-.......................... [450]
Rhododon ciliatus B            ----------.........-.......................... [450]

Thymus mastichina              AAAATAGAATATTCATCAACTCATTAACTCCATAATCCGATAGATCTTTT [500]
Mentha rotundifolia            ........................C.....G..G.............. [500]
Acinos arvensis                ........................C........G.............. [500]
Blephilia hirsuta              ........................C......C.G...........GA.. [500]
Clinopodium ashei A            ........................C......C.G...........GA.. [500]
Clinopodium ashei B            ........................C......C.G...........GA.. [500]
Clinopodium brownei A          ........................C......C.G...........GA.. [500]
Clinopodium brownei
 var. pilosiusculum            ........................C......C.G...........GA.. [500]
Clinopodium chandleri B        ........................C......C.G..........AGA.. [500]
Clinopodium ganderi A          ........................C......C.G..........AGA.. [500]
Clinopodium ganderi B          ........................C......C.G..........AGA.. [500]
Clinopodium macrostemum        ........................C......C.G...........GA.. [500]
Clinopodium mexicanum          ........................C......C.G...........GA.. [500]
Clinopodium palmeri            ........................C......C.G...........GA.. [500]
Clinopodium procumbens         ........................C......C.G...........GA.. [500]
Clinopodium brevifolia         ........................C......C.G...........GA.. [500]
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Clinopodium etonia	.....C.....C.G.....GA..	[500]
Dicerandra immaculata	.....C.....C.G.....GA..	[500]
Hedeoma acinoides	.....C.....C.G.....GA..	[500]
Group I	.....C.....C.G.....GA..	[500]
Hedeoma ciliolata	.....C.....C.G.....GA..	[500]
Hedeoma hispida	.....C.....C.G.....GA..	[500]
Hedeoma hyssopifolia	.....C.....C.G.....GA..	[500]
Hedeoma irvingii	.....C.....C.G.....GA..	[500]
Hedeoma johnstonii	.....C.....C.G.....GA..	[500]
Hedeoma jucunda	.....C.....C.G.....GA..	[500]
Hedeoma mandoniana A	.....C.....C.G.....GA..	[500]
Hedeoma media A	.....C.....C.G.....GA..	[500]
Group II	.....C.....C.G.....GA..	[500]
Hedeoma montana	.....C.....C.G.....GA..	[500]
Hedeoma nana A	.....C.....C.G.....GA..	[500]
Hedeoma palmeri A	.....C.....C.G.....GA..	[500]
Hedeoma piperita	.....C.....C.G.....GA..	[500]
Hedeoma pulegioides B	.....C.....C.G.....GA..	[500]
Hedeoma pusilla A	.....C.....C.G.....GA..	[500]
Hedeoma pusilla B	.....C.....C.G.....GA..	[500]
Hesperozygis marifolia B	.....C.....C.G.....GA..	[500]
Hesperozygis nitida	.....C.....C.G.....GA..	[500]
Hesperozygis rhododon	.....C.....C.G.....GA..	[500]
Hesperozygis spathulata	.....C.....C.G.....GA..	[500]
Monarda fistulosa	.....C.....C.G.....GA..	[500]
Monarda menthaefolia	.....C.....C.G.....GA..	[500]
Monardella linoides	.....C.....C.G.....GA..	[500]
Poliomintha bustamanta A	.....C.....C.G.....GA..	[500]
Poliomintha dendritica	.....C.....C.G.....GA..	[500]
Poliomintha incana A	.....C.....C.G.....GA..	[500]
Poliomintha incana B	.....C.....C.G.....GA..	[500]

Pycnanthemum californicum	.....C.....C.G.....GA..	[500]
Rhododon angulatus A	.....C.....C.G.....GA..	[500]
Rhododon ciliatus B	.....C.....C.G.....GA..	[500]
Thymus mastichina	AAAGAACTTTTTAATCGGGCGAGAATAAAGATAGAGTCCCATTCTACATG	[550]
Mentha rotundifolia	.....A.....A.....	[550]
Acinos arvensis	.....A.....A.....	[550]
Blephilia hirsuta	.....A.....A.....	[550]
Clinopodium ashei A	.....A.....A.....	[550]
Clinopodium ashei B	.....A.....A.....	[550]
Clinopodium brownei A	.....A.....A.....	[550]
Clinopodium brownei var. pilosiusculum	.....A.....A.....	[550]
Clinopodium chandleri B	.....A.....A.....	[550]
Clinopodium ganderi A	.....A.....A.....	[550]
Clinopodium ganderi B	.....A.....A.....	[550]
Clinopodium macrostemum	.....A.....A.....	[550]
Clinopodium mexicanum	.....A.....A.....	[550]
Clinopodium palmeri	.....A.....A.....	[550]
Clinopodium procumbens	.....A.....A.....	[550]
Clinopodium brevifolia	.....A.....A.....	[550]
Clinopodium etonia	.....A.....A.....	[550]
Dicerandra immaculata	.....A.....A.....	[550]
Hedeoma acinoides	.....A.....A.....	[550]
Group I	.....A.....A.....	[550]
Hedeoma ciliolata	.....A.....A.....	[550]
Hedeoma hispida	.....A.....A.....	[550]
Hedeoma hyssopifolia	.....A.....A.....	[550]
Hedeoma irvingii	.....A.....A.....	[550]
Hedeoma johnstonii	.....A.....A.....	[550]

Hedeoma jucunda .....A.....A..... [550]
Hedeoma mandoniana A .....A.....A..... [550]
Hedeoma media A .....A.....A..... [550]
Group II .....A.....A..... [550]
Hedeoma montana .....A.....A..... [550]
Hedeoma nana A .....A.....A..... [550]
Hedeoma palmeri A .....A.....A..... [550]
Hedeoma piperita .....A.....A..... [550]
Hedeoma pulegioides B .....A.....A..... [550]
Hedeoma pusilla A .....A.....A..... [550]
Hedeoma pusilla B .....A.....A..... [550]
Hesperozygis marifolia B .....A.....A..... [550]
Hesperozygis nitida .....A.....A..... [550]
Hesperozygis rhododon .....A.....A..... [550]
Hesperozygis spathulata .....A.....A..... [550]
Monarda fistulosa .....A.....A..... [550]
Monarda menthaefolia .....A.....A..... [550]
Monardella linoides .....A.....A..... [550]
Poliomintha bustamanta A .....A.....A..... [550]
Poliomintha dendritica .....A.....A..... [550]
Poliomintha incana A .....A.....A..... [550]
Poliomintha incana B .....A.....A..... [550]
Pycnanthemum californicum .....A.....A..... [550]
Rhododon angulatus A .....A.....A..... [550]
Rhododon ciliatus B .....A.....A..... [550]

Thymus mastichina CTACATATCAATACCGGCAACAATGAAATTTATAGTAAGAGGAAAATCCG [600]
Mentha rotundifolia ..... [600]
Acinos arvensis ..... [600]
Blephilia hirsuta ..... [600]

Hedeoma pusilla A ..... [600]
Hedeoma pusilla B ..... [600]
Hesperozygis marifolia B ..... [600]
Hesperozygis nitida ..... [600]
Hesperozygis rhododon ..... [600]
Hesperozygis spathulata ..... [600]
Monarda fistulosa ..... [600]
Monarda menthaefolia ..... [600]
Monardella linoides ..... [600]
Poliomintha bustamanta A ..... [600]
Poliomintha dendritica ..... [600]
Poliomintha incana A ..... [600]
Poliomintha incana B ..... [600]
Pycnanthemum californicum ..... [600]
Rhododon angulatus A ..... [600]
Rhododon ciliatus B ..... [600]

Thymus mastichina TCGACTTTAAAAATCGTGAGGGTTCAAGTCCCTCTATCCCCAAAAAGCCT [650]
Mentha rotundifolia ..... [650]
Acinos arvensis ..... [650]
Blephilia hirsuta ..... [650]
Clinopodium ashei A ..... [650]
Clinopodium ashei B ..... [650]
Clinopodium brownei A ..... [650]
Clinopodium brownei var. pilosiusculum ..... [650]
Clinopodium chandleri B ..... [650]
Clinopodium ganderi A ..... [650]
Clinopodium ganderi B ..... [650]
Clinopodium macrostemum ..... [650]

Clinopodium mexicanum	.....	[650]
Clinopodium palmeri	.....T.....	[650]
Clinopodium procumbens	.....	[650]
Clinopodium brevifolia	.....	[650]
Clinopodium etonia	.....	[650]
Dicerandra immaculata	....T.....	[650]
Hedeoma acinoides	.....	[650]
Group I	.....	[650]
Hedeoma ciliolata	.....	[650]
Hedeoma hispida	.....	[650]
Hedeoma hyssopifolia	.....	[650]
Hedeoma irvingii	.....	[650]
Hedeoma johnstonii	.....	[650]
Hedeoma jucunda	.....	[650]
Hedeoma mandoniana A	.....	[650]
Hedeoma media A	.....	[650]
Group II	.....	[650]
Hedeoma montana	.....	[650]
Hedeoma nana A	.....	[650]
Hedeoma palmeri A	.....	[650]
Hedeoma piperita	.....	[650]
Hedeoma pulegioides B	.....	[650]
Hedeoma pusilla A	.....	[650]
Hedeoma pusilla B	.....	[650]
Hesperozygis marifolia B	.....	[650]
Hesperozygis nitida	.....	[650]
Hesperozygis rhododon	.....	[650]
Hesperozygis spathulata	.....	[650]
Monarda fistulosa	.....	[650]
Monarda menthaefolia	.....	[650]
Monardella linoides	.....T.....	[650]

Poliomintha bustamanta A	.....	[650]
Poliomintha dendritica	.....	[650]
Poliomintha incana A	.....	[650]
Poliomintha incana B	.....	[650]
Pycnanthemum californicum	.....	[650]
Rhododon angulatus A	.....	[650]
Rhododon ciliatus B	.....	[650]

Thymus mastichina	ATTTGACCCCTAAAATATTTACCCTATCCCCCTTCTTTTTCGTTAACGGT	[700]
Mentha rotundifolia	.....-.....G....	[700]
Acinos arvensis	.....T.....G....	[700]
Blephilia hirsuta	.....T.....A.....G....	[700]
Clinopodium ashei A	.....T.....A.....G....	[700]
Clinopodium ashei B	.....T.....A.....G....	[700]
Clinopodium brownei A	.....T.....G....	[700]
Clinopodium brownei var. pilosiusculum	.....T.....G....	[700]
Clinopodium chandleri B	.....T.....G....	[700]
Clinopodium ganderi A	.....T.....G....	[700]
Clinopodium ganderi B	.....T.....G....	[700]
Clinopodium macrostemum	.....T.....G....	[700]
Clinopodium mexicanum	.....T.....G....	[700]
Clinopodium palmeri	.....T.....G....	[700]
Clinopodium procumbens	.....T.....G....	[700]
Clinopodium brevifolia	.....T.....A.....G....	[700]
Clinopodium etonia	.....T.....A.....G....	[700]
Dicerandra immaculata	.....T.----------.....G....	[700]
Hedeoma acinoides	.....T.....A.....G..A.	[700]
Group I	.....T.....A.....G....	[700]
Hedeoma ciliolata	.....T.....A.....G....	[700]

Hedeoma hispida .....T.....G.A.....G.... [700]
Hedeoma hyssopifolia .....T.....A.....G.... [700]
Hedeoma irvingii .....T.....A.....G.... [700]
Hedeoma johnstonii .....T.....A.....G.... [700]
Hedeoma jucunda .....T.....A.....G.... [700]
Hedeoma mandoniana A .....T.....G.... [700]
Hedeoma media A .....T.....G.... [700]
Group II .....T.....A.....G.... [700]
Hedeoma montana .....T.....A.....G.... [700]
Hedeoma nana A .....T.....A.....G.... [700]
Hedeoma palmeri A .....T.....A.....G.... [700]
Hedeoma piperita .....T.....G.... [700]
Hedeoma pulegioides B .....T.....G.... [700]
Hedeoma pusilla A .....T.....A.....G.... [700]
Hedeoma pusilla B .....T.....A.....G.... [700]
Hesperozygis marifolia B .....T.....G.... [700]
Hesperozygis nitida .....T.....G.... [700]
Hesperozygis rhododon .....T..... [700]
Hesperozygis spathulata .....T.....G.... [700]
Monarda fistulosa .....T.....A.....G.... [700]
Monarda menthaefolia .....T.....A.....G.... [700]
Monardella linoides .....T.....G.... [700]
Poliomintha bustamanta A .....T.....A.....G.... [700]
Poliomintha dendritica .....T.....A.....G.... [700]
Poliomintha incana A .....T.....A.....G.... [700]
Poliomintha incana B .....T.....A.....G.... [700]
Pycnanthemum californicum .....T.....A.....G.... [700]
Rhododon angulatus A .....T.....A.....G.... [700]
Rhododon ciliatus B .....T.....A.....G.... [700]

Thymus mastichina	CCCAAATTCCCTTATCCTTCTGATTCTTTGACAAACGTATTTGGGCGTAA	[750]
Mentha rotundifolia	T.....	[750]
Acinos arvensis	T.....C.....	[750]
Blephilia hirsuta	T.....C.....	[750]
Clinopodium ashei A	T.....C.....	[750]
Clinopodium ashei B	T.....C.....	[750]
Clinopodium brownei A	T.....C.....	[750]
Clinopodium brownei *var. pilosiusculum*	T.....C.....	[750]
Clinopodium chandleri B	T.....C.....	[750]
Clinopodium ganderi A	T.....C.....	[750]
Clinopodium ganderi B	T.....C.....	[750]
Clinopodium macrostemum	T.....C.....	[750]
Clinopodium mexicanum	T.....C.....A...	[750]
Clinopodium palmeri	T.....C.T.....	[750]
Clinopodium procumbens	T.....C.....G.....	[750]
Clinopodium brevifolia	T.....C.....	[750]
Clinopodium etonia	T.....C.....	[750]
Dicerandra immaculata	T.....C.....	[750]
Hedeoma acinoides	T.....C.....	[750]
Group I	T.....C.....	[750]
Hedeoma ciliolata	T.....C.....	[750]
Hedeoma hispida	T.....C.....	[750]
Hedeoma hyssopifolia	T.....C.....	[750]
Hedeoma irvingii	T.....C.....	[750]
Hedeoma johnstonii	T.....C.....	[750]
Hedeoma jucunda	T.....C.....	[750]
Hedeoma mandoniana A	T.....C.....	[750]
Hedeoma media A	T.....C.....	[750]
Group II	T.....C.....	[750]
Hedeoma montana	T.....C.....	[750]

Hedeoma nana A T.....C..... [750]
Hedeoma palmeri A T.....C..... [750]
Hedeoma piperita T.....C..... [750]
Hedeoma pulegioides B T.....C..... [750]
Hedeoma pusilla A T.....C..... [750]
Hedeoma pusilla B T.....C..... [750]
Hesperozygis marifolia B T.....C..... [750]
Hesperozygis nitida T.....C..... [750]
Hesperozygis rhododon T.....C..... [750]
Hesperozygis spathulata T.....C..... [750]
Monarda fistulosa T.....C..... [750]
Monarda menthaefolia T.....C..... [750]
Monardella linoides T.....C..... [750]
Poliomintha bustamanta A T.....C..... [750]
Poliomintha dendritica T.....C..... [750]
Poliomintha incana A T.....C..... [750]
Poliomintha incana B T.....C..... [750]
Pycnanthemum californicum T.....C..... [750]
Rhododon angulatus A T.....C..... [750]
Rhododon ciliatus B T.....C.....C..... [750]

Thymus mastichina ATGACTTTATCTTATCACATGTGATAT-----AGAAT-----ACACA--- [800]
Mentha rotundifolia .....C.....-----.....-----.....--- [800]
Acinos arvensis .....C.....C.....-----.....-----.....--- [800]
Blephilia hirsuta .....C.....C.....-----.....-----.....--- [800]
Clinopodium ashei A .....C.....C.....-----.....-----.....--- [800]
Clinopodium ashei B .....C.....C.....-----G...-----.....--- [800]
Clinopodium brownei A .....C.....C.....-----.....-----.....--- [800]
Clinopodium brownei var. pilosiusculum .....C.....C.....-----.....-----.....--- [800]

Clinopodium chandleri B ........C.........C.......----.....----.....--- [800]
Clinopodium ganderi A ........C.........C.......----.....----.....--- [800]
Clinopodium ganderi B ........C.........C.......----.....----.....--- [800]
Clinopodium macrostemum ........C.........C.......----.....----.....--- [800]
Clinopodium mexicanum ........C.........C.......----.....----.....--- [800]
Clinopodium palmeri ........C.........C.......----.....----.....--- [800]
Clinopodium procumbens ........C.........C.......----.....----.....--- [800]
Clinopodium brevifolia ........C.........C.......-----G....----.....--- [800]
Clinopodium etonia ........C.........C.......----.....----.....--- [800]
Dicerandra immaculata ........C.........C.......----.....----.....--- [800]
Hedeoma acinoides ........C.........C.......----.....----.....--- [800]
Group I ........C.........C.......----.....----.....--- [800]
Hedeoma ciliolata ........C.........C.......----.....----.....--- [800]
Hedeoma hispida ........C.........C.......----.....----.....--- [800]
Hedeoma hyssopifolia ........C.........C.......----.....----.....--- [800]
Hedeoma irvingii ........C.........C.......----.....----.....--- [800]
Hedeoma johnstonii ........C.........C.......----.....----.....--- [800]
Hedeoma jucunda ........C.........C.......----.....----.....--- [800]
Hedeoma mandoniana A ........C.........C.......----.....----.....--- [800]
Hedeoma media A ........C.........C.......----.....----.....--- [800]
Group II ........C.........C.......----.....----.....--- [800]
Hedeoma montana ........C.........C.......----.....----.....--- [800]
Hedeoma nana A ........C.........C.......----.....----.....--- [800]
Hedeoma palmeri A ........C.........C.......----.....----.....--- [800]
Hedeoma piperita ........C.........C.......----.....----.....--- [800]
Hedeoma pulegioides B ........C.........C.......----.....----.....--- [800]
Hedeoma pusilla A ........C.........C.......----.....----.....--- [800]
Hedeoma pusilla B ........C.........C.......----.....----.....--- [800]
Hesperozygis marifolia B ........C.........C.......----.....----.....--- [800]
Hesperozygis nitida ........C.........C.......----.....----.....--- [800]
Hesperozygis rhododon ........C.........C.......----.....AGAAT.....--- [800]

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Hesperozygis spathulata      ........C.........C.......----.....----.....---  [800]
Monarda fistulosa            ........C.........C.......----.....----.....---  [800]
Monarda menthaefolia         ........C.........C.......----.....----.....---  [800]
Monardella linoides          ........C....T....C.......----.....----.....---  [800]
Poliomintha bustamanta A     ........C.........C.......----.....----.....---  [800]
Poliomintha dendritica       ........C.........C.......----.....----.....---  [800]
Poliomintha incana A         ........C.........C.......----.....----.....---  [800]
Poliomintha incana B         ........C.........C.......----.....----.....---  [800]
Pycnanthemum californicum    ........C.........C.......----.....----.....---  [800]
Rhododon angulatus A         ....T...C.........C.......----.....----.....---  [800]
Rhododon ciliatus B          ....T...C.........C.......----.....----.....---  [800]

Thymus mastichina            -TTCCAAATGAAGCAA----TGAATGCCGATATGAATGAATAGCCTTGAA  [850]
Mentha rotundifolia          -..............----.....................A.....  [850]
Acinos arvensis              -..............----.............C.....A.....  [850]
Blephilia hirsuta            -..............----.....................------  [850]
Clinopodium ashei A          -..............----.....................------  [850]
Clinopodium ashei B          -..............----.....................------  [850]
Clinopodium brownei A        -..............----.....................------  [850]
Clinopodium brownei
 var. pilosiusculum          -..............----.....................------  [850]
Clinopodium chandleri B      -..............----.....................------  [850]
Clinopodium ganderi A        -..............----.....................------  [850]
Clinopodium ganderi B        -..............----.....................------  [850]
Clinopodium macrostemum      -..............----.....................------  [850]
Clinopodium mexicanum        -..............----.....T...............------  [850]
Clinopodium palmeri          -..............----.....................------  [850]
Clinopodium procumbens       -..............----.....................------  [850]
Clinopodium brevifolia       -..............----.....................------  [850]
Clinopodium etonia           -..............----.....................------  [850]
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Dicerandra immaculata      -.............----.......................------ [850]
Hedeoma acinoides          -.............----.......................------ [850]
Group I                    -.............----.......................------ [850]
Hedeoma ciliolata          -.............----.......................------ [850]
Hedeoma hispida            -.............----.......................------ [850]
Hedeoma hyssopifolia       -.............----.......................------ [850]
Hedeoma irvingii           -.............----.......................------ [850]
Hedeoma johnstonii         -.............----.......................------ [850]
Hedeoma jucunda            -.............----.......................------ [850]
Hedeoma mandoniana A       -.............----.......................------ [850]
Hedeoma media A            -.............----.......................------ [850]
Group II                   -.............----.......................------ [850]
Hedeoma montana            -.............----.......................------ [850]
Hedeoma nana A             -.............----.......................------ [850]
Hedeoma palmeri A          -.............----.......................------ [850]
Hedeoma piperita           -.............----.......................------ [850]
Hedeoma pulegioides B      -.............----.......................------ [850]
Hedeoma pusilla A          -.............----.......................------ [850]
Hedeoma pusilla B          -.............----.......................------ [850]
Hesperozygis marifolia B   -.............----.......................------ [850]
Hesperozygis nitida        -.............----.......................------ [850]
Hesperozygis rhododon      -.............----.......................------ [850]
Hesperozygis spathulata    -.............----.......................------ [850]
Monarda fistulosa          -.............----.......................------ [850]
Monarda menthaefolia       -.............----.......................------ [850]
Monardella linoides        -.............----.......................------ [850]
Poliomintha bustamanta A   -.............----.......................------ [850]
Poliomintha dendritica     -.............----.......................------ [850]
Poliomintha incana A       -.............----.......................------ [850]
Poliomintha incana B       -.............----.......................------ [850]
Pycnanthemum californicum  -.............----.......................------ [850]
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Rhododon angulatus A      -.............----.........................------ [850]
Rhododon ciliatus B       -.............----.........................------ [850]

Thymus mastichina         ATTACAGGACTCGGAGAAAACTTTGTAATCCCCCGTGTCCCTT----TAA [900]
Mentha rotundifolia       ....................................----...----... [900]
Acinos arvensis           ....................................A.....----... [900]
Blephilia hirsuta         ----.....................A..........A.....----... [900]
Clinopodium ashei A       ----.....................A..........A.....----... [900]
Clinopodium ashei B       ----.....................A..........A.....----... [900]
Clinopodium brownei A     ----.....................AG.........A.....----... [900]
Clinopodium brownei
 var. pilosiusculum       ----.....................AG.........A.....----... [900]
Clinopodium chandleri B   ----.....................A..........A.....----... [900]
Clinopodium ganderi A     ----.....................A..........A.....----... [900]
Clinopodium ganderi B     ----.....................A..........A.....----... [900]
Clinopodium macrostemum   ----.....................A..........A.....----... [900]
Clinopodium mexicanum     ----.....................A..........A...T..----... [900]
Clinopodium palmeri       ----.....................A..........A.A....----... [900]
Clinopodium procumbens    ----.....................A..........A.....----... [900]
Clinopodium brevifolia    ----.....................A..........A.....----... [900]
Clinopodium etonia        ----.....................A..........A.....----... [900]
Dicerandra immaculata     ----.....................A..........A.....----... [900]
Hedeoma acinoides         ----.....................A..........A.....----... [900]
Group I                   ----.....................A..........A.....----... [900]
Hedeoma ciliolata         ----.....................A..........A.....----... [900]
Hedeoma hispida           ----.....................A..........A.....----... [900]
Hedeoma hyssopifolia      ----.....................A..........A.....----... [900]
Hedeoma irvingii          ----.....................A..........A.....----... [900]
Hedeoma johnstonii        ----.....................A..........A.....----... [900]
Hedeoma jucunda           ----.....................A..........A.....----... [900]
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Hedeoma mandoniana A	----.....A.....A.....----...	[900]
Hedeoma media A	----.....A.....A.....----...	[900]
Group II	----.....A.....A.....----...	[900]
Hedeoma montana	----.....A.....A.....----...	[900]
Hedeoma nana A	----.....A.....G..A.....----...	[900]
Hedeoma palmeri A	----.....A.....A.....----...	[900]
Hedeoma piperita	----.....A.....A.....----...	[900]
Hedeoma pulegioides B	----.....A.....A.....----...	[900]
Hedeoma pusilla A	----.....A.....A.....----...	[900]
Hedeoma pusilla B	----.....A.....A.....----...	[900]
Hesperozygis marifolia B	----.....A.....A.....----...	[900]
Hesperozygis nitida	----.....A.....A.....----...	[900]
Hesperozygis rhododon	----.....A.....A.....----...	[900]
Hesperozygis spathulata	----.....A.....A.....----...	[900]
Monarda fistulosa	----.....T.....A.....A.....----...	[900]
Monarda menthaefolia	----.....T.....A.....A.....----...	[900]
Monardella linoides	----.....A.....A.....----...	[900]
Poliomintha bustamanta A	----.....A.....A.....----...	[900]
Poliomintha dendritica	----.....A.....A.....----...	[900]
Poliomintha incana A	----.....A.....A.....----...	[900]
Poliomintha incana B	----.....A.....A.....----...	[900]
Pycnanthemum californicum	----.....A.....A.....----...	[900]
Rhododon angulatus A	----.....A.....A.....----...	[900]
Rhododon ciliatus B	----.....A.....A.....----...	[900]
Thymus mastichina	TTGACATCGACTCCAGTCATCTAATAAAATGAGGGTGGGATGC-TACATT	[950]
Mentha rotundifolia	.....-.....	[950]
Acinos arvensis	.....T.....C.....-.....	[950]
Blephilia hirsuta	.....-.....	[950]
Clinopodium ashei A	.....-.....-	[950]

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Clinopodium ashei B                    .....................................C.....- [950]
Clinopodium brownei A                  .....................................-..... [950]
Clinopodium brownei
 var. pilosiusculum                    .....................................-..... [950]
Clinopodium chandleri B                .....................................-..... [950]
Clinopodium ganderi A                  .....................................-..... [950]
Clinopodium ganderi B                  .....................................-..... [950]
Clinopodium macrostemum                .....................................-..... [950]
Clinopodium mexicanum                  .....................................-.....G [950]
Clinopodium palmeri                    ..................................A.....-.....- [950]
Clinopodium procumbens                 .....................................-..... [950]
Clinopodium brevifolia                 .....................................-..... [950]
Clinopodium etonia                     .....................................-..... [950]
Dicerandra immaculata                  .....................................-..... [950]
Hedeoma acinoides                      .....................................-..... [950]
Group I                                .....................................-..... [950]
Hedeoma ciliolata                      .....................................-..... [950]
Hedeoma hispida                        ..................................A....-..... [950]
Hedeoma hyssopifolia                   .....................................-...-.. [950]
Hedeoma irvingii                       .....................................-.....- [950]
Hedeoma johnstonii                     .....................................-..... [950]
Hedeoma jucunda                        .....................................-..... [950]
Hedeoma mandoniana A                   .....................................-..... [950]
Hedeoma media A                        .....................................-..... [950]
Group II                               .....................................-...C.- [950]
Hedeoma montana                        .....................................-...C.- [950]
Hedeoma nana A                         .G...................................------- [950]
Hedeoma palmeri A                      .....................................-.....- [950]
Hedeoma piperita                       ..................................T.....-..... [950]
Hedeoma pulegioides B                  .....................................-..... [950]
Hedeoma pusilla A                      .....................................G-...C.- [950]
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Hedeoma pusilla B ..... [950]
Hesperozygis marifolia B ..... [950]
Hesperozygis nitida ..... [950]
Hesperozygis rhododon ..... [950]
Hesperozygis spathulata ..... [950]
Monarda fistulosa ..... [950]
Monarda menthaefolia ..... [950]
Monardella linoides ..... [950]
Poliomintha bustamanta A .....- [950]
Poliomintha dendritica .....- [950]
Poliomintha incana A .....- [950]
Poliomintha incana B .....- [950]
Pycnanthemum californicum ..... [950]
Rhododon angulatus A ..... [950]
Rhododon ciliatus B ..... [950]

Thymus mastichina ------GGAAATGGTCGGG---------- [1000]
Mentha rotundifolia ------.....---------- [1000]
Acinos arvensis ------.....---------- [1000]
Blephilia hirsuta ------.....---------- [1000]
Clinopodium ashei A ------.....---------- [1000]
Clinopodium ashei B ------C....---------- [1000]
Clinopodium brownei A ------.....---------- [1000]
Clinopodium brownei var. pilosiusculum ------.....---------- [1000]
Clinopodium chandleri B ------.....---------- [1000]
Clinopodium ganderi A ------.....---------- [1000]
Clinopodium ganderi B ------.....---------- [1000]
Clinopodium macrostemum ------.....ATAGCTCAGCTGGTAGAGCAGAGGACTGAAA [1000]
Clinopodium mexicanum GAAATT.....---------- [1000]

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Clinopodium palmeri                ------.............ATAG--------------------------- [1000]
Clinopodium procumbens             -------...........------------------------------- [1000]
Clinopodium brevifolia             ------............------------------------------- [1000]
Clinopodium etonia                 ------............------------------------------- [1000]
Dicerandra immaculata              ------.........---------------------------------- [1000]
Hedeoma acinoides                  ------.............ATAGCTCAGCTGGTAGAGCAGAGGACT---- [1000]
Group I                            ------.............ATAGCTCAGCTGGTAGAGCAGAGGACTGAAA [1000]
Hedeoma ciliolata                  ------....-........ATAGCTCAGCTGGT----------------- [1000]
Hedeoma hispida                    ------............------------------------------- [1000]
Hedeoma hyssopifolia               ------....-.......------------------------------- [1000]
Hedeoma irvingii                   ------...........------------------------------- [1000]
Hedeoma johnstonii                 ------.............ATAGCTCAGCTGGTAGAGCAGAGGACTGAAA [1000]
Hedeoma jucunda                    ------............-TCGAAATC----------------------- [1000]
Hedeoma mandoniana A               ------.............ATAGCTCAGCTGGTAGAGCAGAGGACT---- [1000]
Hedeoma media A                    ------............------------------------------- [1000]
Group II                           ------.....------------------------------------- [1000]
Hedeoma montana                    ------.....------------------------------------- [1000]
Hedeoma nana A                     ---------------------------------------------- [1000]
Hedeoma palmeri A                  ------.............ATAGCTCAGCTGGT----------------- [1000]
Hedeoma piperita                   ------............-TCGAAATCGG------------------- [1000]
Hedeoma pulegioides B              ------............------------------------------- [1000]
Hedeoma pusilla A                  ------.....------------------------------------- [1000]
Hedeoma pusilla B                  ------.............ATAGCTCAGCTGGTAGAGCAGAGGACTGAAA [1000]
Hesperozygis marifolia B           ------............------------------------------- [1000]
Hesperozygis nitida                ------.............------------------------------- [1000]
Hesperozygis rhododon              ------.............------------------------------- [1000]
Hesperozygis spathulata            ------.............------------------------------- [1000]
Monarda fistulosa                  ------.............ATA--------------------------- [1000]
Monarda menthaefolia               ------............------------------------------- [1000]
Monardella linoides                ------............------------------------------- [1000]
Poliomintha bustamanta A           ------.....------------------------------------- [1000]
```

Poliomintha dendritica ------.....TC---------- [1000]
Poliomintha incana A ------.....ATA---------- [1000]
Poliomintha incana B ------.....---------- [1000]
Pycnanthemum californicum ------.....---------- [1000]
Rhododon angulatus A ------.....---------- [1000]
Rhododon ciliatus B ------.....---------- [1000]

Thymus mastichina ---------- [1010]
Mentha rotundifolia ---------- [1010]
Acinos arvensis ---------- [1010]
Blephilia hirsuta ---------- [1010]
Clinopodium ashei A ---------- [1010]
Clinopodium ashei B ---------- [1010]
Clinopodium brownei A ---------- [1010]
Clinopodium brownei
var. pilosiusculum ---------- [1010]
Clinopodium chandleri B ---------- [1010]
Clinopodium ganderi A ---------- [1010]
Clinopodium ganderi B ---------- [1010]
Clinopodium macrostemum ATC------- [1010]
Clinopodium mexicanum ---------- [1010]
Clinopodium palmeri ---------- [1010]
Clinopodium procumbens ---------- [1010]
Clinopodium brevifolia ---------- [1010]
Clinopodium etonia ---------- [1010]
Dicerandra immaculata ---------- [1010]
Hedeoma acinoides ---------- [1010]
Group I ATCCTCGTG- [1010]
Hedeoma ciliolata ---------- [1010]
Hedeoma hispida ---------- [1010]

Hedeoma hyssopifolia	----------	[1010]
Hedeoma irvingii	----------	[1010]
Hedeoma johnstonii	ATCCTCGTGT	[1010]
Hedeoma jucunda	----------	[1010]
Hedeoma mandoniana A	----------	[1010]
Hedeoma media A	----------	[1010]
Group II	----------	[1010]
Hedeoma montana	----------	[1010]
Hedeoma nana A	----------	[1010]
Hedeoma palmeri A	----------	[1010]
Hedeoma piperita	----------	[1010]
Hedeoma pulegioides B	----------	[1010]
Hedeoma pusilla A	----------	[1010]
Hedeoma pusilla B	ATCCTCGTGT	[1010]
Hesperozygis marifolia B	----------	[1010]
Hesperozygis nitida	----------	[1010]
Hesperozygis rhododon	----------	[1010]
Hesperozygis spathulata	----------	[1010]
Monarda fistulosa	----------	[1010]
Monarda menthaefolia	----------	[1010]
Monardella linoides	----------	[1010]
Poliomintha bustamanta A	----------	[1010]
Poliomintha dendritica	----------	[1010]
Poliomintha incana A	----------	[1010]
Poliomintha incana B	----------	[1010]
Pycnanthemum californicum	----------	[1010]
Rhododon angulatus A	----------	[1010]
Rhododon ciliatus B	----------	[1010]

Aligned Sequence Matrix 3: *rpl32–trnL* Spacer of the Chloroplast Genome

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Thymus mastichina                -----AAATTTTTGGAAAGGAAAGGTTATTGGGCGGCGTTAAAAGCAT  [48]
Mentha rotundifolia              -----.....................C.....................  [48]
Acinos arvensis                  ATCGA.....................C................G....  [48]
Blephilia hirsuta                -----.....................C.....................  [48]
Clinopodium ashei A              -----.....................C.....................  [48]
Clinopodium ashei B              -----.....................C.....................  [48]
Clinopodium brownei A            --CGA.....................A.C.....................  [48]
Clinopodium brownei
 var. pilosiusculum              ------------------------------------------------  [48]
Clinopodium chandleri B          --CGA.....................C.....................  [48]
Clinopodium ganderi A            --------.................C.....................  [48]
Clinopodium ganderi B            --CGA.....................C.....................  [48]
Clinopodium macrostemum          -----..................-..C.....................  [48]
Clinopodium mexicanum            ----A.....................C.....................  [48]
Clinopodium palmeri              --CGA.....................C.....................  [48]
Clinopodium procumbens           -------------............C.....................  [48]
Clinopodium brevifolia           -------------............C.....................  [48]
Clinopodium etonia                    ----A.....................C.....................
[48]
Dicerandra immaculata            -----.....................C.....................  [48]
Hedeoma acinoides                -----.....................C.....................  [48]
Group I                          --CGA.....................C.....................  [48]
Hedeoma ciliolata                --CGA.....................C.....................  [48]
Hedeoma hispida                  -----.....................C.....................  [48]
Hedeoma hyssopifolia             ---------.................C.....................  [48]
Hedeoma irvingii                 -TCGA.....................C.....................  [48]
Hedeoma johnstonii               ----------................C.....................  [48]
Hedeoma jucunda                  -----.....................C.....................  [48]
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Hedeoma mandoniana A -----.....C..... [48]
Hedeoma media A ---CG.....C..... [48]
Group II -------.....C..... [48]
Hedeoma montana --------.....C..... [48]
Hedeoma nana A --CGA.....C..... [48]
Hedeoma palmeri A --CGA.....C..... [48]
Hedeoma piperita -----.....C..... [48]
Hedeoma pulegioides B ------.....C..... [48]
Hedeoma pusilla A --CGA.....C..... [48]
Hedeoma pusilla B -----.....C..... [48]
Hesperozygis marifolia B ----------.....C..... [48]
Hesperozygis nitida ----------.....C..... [48]
Hesperozygis rhododon -----.....C..... [48]
Hesperozygis spathulata ----A.....C..... [48]
Monarda fistulosa --CGA.....A.....C..... [48]
Monarda menthaefolia ---CG.....A.....C..... [48]
Monardella linoides ----------.....C..... [48]
Poliomintha bustamanta A --------.....C..... [48]
Poliomintha dendritica --------.....C..... [48]
Poliomintha incana A --------.....C..... [48]
Poliomintha incana B --------.....C..... [48]
Pycnanthemum californicum -----.....C..... [48]
Rhododon angulatus A -----.....C..... [48]
Rhododon ciliatus B -TCGA.....C..... [48]

Thymus mastichina TTTCTTTAGGTAAATCTCTTTCTACGGGGACTTCAAAAAGTTTTTTTG [96]
Mentha rotundifolia .....C..... [96]
Acinos arvensis .....T..... [96]
Blephilia hirsuta .....C..... [96]
Clinopodium ashei A .....C..... [96]

Clinopodium ashei B	.....C.....	[96]
Clinopodium brownei A	.....C.....	[96]
Clinopodium brownei var. pilosiusculum	----------.....C.....	[96]
Clinopodium chandleri B	.....C.....A	[96]
Clinopodium ganderi A	.....C.....	[96]
Clinopodium ganderi B	.....C.....	[96]
Clinopodium macrostemum	.....C.....	[96]
Clinopodium mexicanum	.....AC.....	[96]
Clinopodium palmeri	.....G.....C.....	[96]
Clinopodium procumbens	.....G..C.....	[96]
Clinopodium brevifolia	.....C.....	[96]
Clinopodium etonia	.....C.....	[96]
Dicerandra immaculata	.....C.....	[96]
Hedeoma acinoides	.....C.....	[96]
Group I	.....C.....	[96]
Hedeoma ciliolata	.....C.....	[96]
Hedeoma hispida	.....C.....	[96]
Hedeoma hyssopifolia	.....C.....	[96]
Hedeoma irvingii	.....C.....	[96]
Hedeoma johnstonii	.....C.....	[96]
Hedeoma jucunda	.....C.....	[96]
Hedeoma mandoniana A	.....C.....	[96]
Hedeoma media A	.....C.....	[96]
Group II	.....C.....	[96]
Hedeoma montana	.....C.....	[96]
Hedeoma nana A	.....C.....	[96]
Hedeoma palmeri A	.....C.....	[96]
Hedeoma piperita	.....C.....	[96]
Hedeoma pulegioides B	.....C.....	[96]
Hedeoma pusilla A	.....C.....	[96]

Hedeoma pusilla B	.....C.....	[96]
Hesperozygis marifolia B	.....C.....	[96]
Hesperozygis nitida	.....C.....	[96]
Hesperozygis rhododon	.....C.....	[96]
Hesperozygis spathulata	.....C.....	[96]
Monarda fistulosa	.....C.....	[96]
Monarda menthaefolia	.....C.....	[96]
Monardella linoides	.....C.....	[96]
Poliomintha bustamanta A	.....C.....	[96]
Poliomintha dendritica	.....C.....	[96]
Poliomintha incana A	.....C.....	[96]
Poliomintha incana B	.....C.....	[96]
Pycnanthemum californicum	.....C.....	[96]
Rhododon angulatus A	.....C.....	[96]
Rhododon ciliatus B	.....C.....	[96]

Thymus mastichina	TGCGACAAACAAATAAAATAAAAAAA-TAAGTTATTAAGAAATAAAGC	[144]
Mentha rotundifolia	.....C.....-.....	[144]
Acinos arvensis	...A.....C.....-.....	[144]
Blephilia hirsuta	...A.....C.....-.....	[144]
Clinopodium ashei A	...A.....C.....-.....	[144]
Clinopodium ashei B	...A.....C.....-.....	[144]
Clinopodium brownei A	...A.....-.....	[144]
Clinopodium brownei var. pilosiusculum	...AG.....-.....	[144]
Clinopodium chandleri B	...A.....C.....-.....	[144]
Clinopodium ganderi A	...A.....C.....-.....	[144]
Clinopodium ganderi B	...A.....C.....-.....	[144]
Clinopodium macrostemum	...A.....C.....-.....	[144]
Clinopodium mexicanum	...A.....C.....-.....	[144]

Clinopodium palmeri	...A.....C.....-.....	[144]
Clinopodium procumbens	...A.....C.....-.....	[144]
Clinopodium brevifolia	...A.....C.....-.....	[144]
Clinopodium etonia	...A.....C.....-.....	[144]
Dicerandra immaculata	...A.....C.....-.....	[144]
Hedeoma acinoides	...A.....C.....-.....	[144]
Group I	...A.....C.....-.....	[144]
Hedeoma ciliolata	...A.....C.....-.....	[144]
Hedeoma hispida	...A.....C.....-.....	[144]
Hedeoma hyssopifolia	...A.....C.....-.....	[144]
Hedeoma irvingii	...A.....C.....-.....	[144]
Hedeoma johnstonii	...A.....C.....-.....	[144]
Hedeoma jucunda	...A.....C.....-.....	[144]
Hedeoma mandoniana A	...A.....C.....-.....	[144]
Hedeoma media A	...A.....C.....-.....	[144]
Group II	...A.....C.....-.....	[144]
Hedeoma montana	...A.....C.....-.....	[144]
Hedeoma nana A	...A.....C.....-.....	[144]
Hedeoma palmeri A	...A.....C.....-.....	[144]
Hedeoma piperita	...A.....C.....-.....	[144]
Hedeoma pulegioides B	...A.....C.....-.....	[144]
Hedeoma pusilla A	...A.....C.....-.....	[144]
Hedeoma pusilla B	...A.....C.....-.....	[144]
Hesperozygis marifolia B	...A.....-.....	[144]
Hesperozygis nitida	...A.....-.....	[144]
Hesperozygis rhododon	...A.....C.....-.....	[144]
Hesperozygis spathulata	...A.....-.....A.	[144]
Monarda fistulosa	...A.....C.....-.....	[144]
Monarda menthaefolia	...A.....C.....A.....	[144]
Monardella linoides	...A.....-.....	[144]
Poliomintha bustamanta A	...A.....C.....-.....	[144]

Poliomintha dendritica ...A.....C.....-..... [144]
Poliomintha incana A ...A.....C.....-..... [144]
Poliomintha incana B ...A.....C.....-..... [144]
Pycnanthemum californicum ...A.....C.....-..... [144]
Rhododon angulatus A ...A.....C.....-..... [144]
Rhododon ciliatus B ...A.....C.....-..... [144]

Thymus mastichina GAAAAACCTTAGAACAATCTAAATCGACCTGACTCAAAAATTGAA--- [192]
Mentha rotundifolia AG.....C.....--- [192]
Acinos arvensis AG.....C.....--- [192]
Blephilia hirsuta AG....T....T.....C.....--- [192]
Clinopodium ashei A AG.....T.....C.....--- [192]
Clinopodium ashei B AG.....T.....C.....--- [192]
Clinopodium brownei A AG.....T.....C.....--- [192]
Clinopodium brownei
var. pilosiusculum AG.....T.....C.....--- [192]
Clinopodium chandleri B AG.....T.....C.....--- [192]
Clinopodium ganderi A AG.....T.....C.....--- [192]
Clinopodium ganderi B AG.....T.....C.....--- [192]
Clinopodium macrostemum AG.....T.....C.....--- [192]
Clinopodium mexicanum AG.....T.....C.....--- [192]
Clinopodium palmeri AG.....T.....C.....--- [192]
Clinopodium procumbens AG.....T.....C.....--- [192]
Clinopodium brevifolia AG.....T.....C.....--- [192]
Clinopodium etonia AG.....T.....C.....--- [192]
Dicerandra immaculata AG.....G..T.....C.....--- [192]
Hedeoma acinoides AG.....T.....C.....--- [192]
Group I AG.....T.....C.....--- [192]
Hedeoma ciliolata AG.....T.....C.....--- [192]
Hedeoma hispida AG.....T.....C..C.....--- [192]

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Hedeoma hyssopifolia          AG.........T.............C..................--- [192]
Hedeoma irvingii              AG.........T.............C..................--- [192]
Hedeoma johnstonii            AG.........T.............C..................--- [192]
Hedeoma jucunda               AG.........T.............C..................--- [192]
Hedeoma mandoniana A          AG.........T...........A.C..................--- [192]
Hedeoma media A               AG.........T.............C..................--- [192]
Group II                      AG.........T.............C..................--- [192]
Hedeoma montana               AG.........T.............C..................--- [192]
Hedeoma nana A                AG.........T.............C..................--- [192]
Hedeoma palmeri A             AG.........T.............C..................--- [192]
Hedeoma piperita              AG.........T.............C..................--- [192]
Hedeoma pulegioides B         AG.........T.............C..................--- [192]
Hedeoma pusilla A             AG.........T.............C..................--- [192]
Hedeoma pusilla B             AG.........T.............CG.................--- [192]
Hesperozygis marifolia B      AG.........T.............C..................--- [192]
Hesperozygis nitida           AG.........T.............C..................--- [192]
Hesperozygis rhododon         AG.........T.............C..................--- [192]
Hesperozygis spathulata       AG.........T.............C..................--- [192]
Monarda fistulosa             AG.........T.............C..................--- [192]
Monarda menthaefolia          AG.........T.............C..................--- [192]
Monardella linoides           AG.........T.............C..................--- [192]
Poliomintha bustamanta A      AG.........T.............C..................--- [192]
Poliomintha dendritica        AG.........T.............C..................--- [192]
Poliomintha incana A          AG.........T.............C..................--- [192]
Poliomintha incana B          AG.........T.............C..................--- [192]
Pycnanthemum californicum     AG.........T.............C..................--- [192]
Rhododon angulatus A          AG.........T.............C..................CTT [192]
Rhododon ciliatus B           AG.........T.............C..................CTT [192]

Thymus mastichina             -CCCTTCCTTTTT----CA-------AAAAGAAAATTCCCCAATTCCA [240]
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Mentha rotundifolia	-.....-----..------.....	[240]
Acinos arvensis	-.....-----..CTTTTCA.....	[240]
Blephilia hirsuta	-.....-----..------.....	[240]
Clinopodium ashei A	-.....-----..------.....	[240]
Clinopodium ashei B	-.....-----..------.....	[240]
Clinopodium brownei A	-.T...-----..------.....	[240]
Clinopodium brownei var. pilosiusculum	-.T...-----..------.....	[240]
Clinopodium chandleri B	-.....-----..------.....	[240]
Clinopodium ganderi A	-.....-----..------.....	[240]
Clinopodium ganderi B	-.....-----..------.....	[240]
Clinopodium macrostemum	-.....-----..------.....	[240]
Clinopodium mexicanum	-.....-----..------.....	[240]
Clinopodium palmeri	-.....-----..-------...T.....	[240]
Clinopodium procumbens	-.....-----..------.....	[240]
Clinopodium brevifolia	-.....-----..------.....	[240]
Clinopodium etonia	-.....-----..------.....	[240]
Dicerandra immaculata	-.....-----..------.....	[240]
Hedeoma acinoides	-.....-----..------.....	[240]
Group I	-.....-----..------.....	[240]
Hedeoma ciliolata	-.....-----..------.....	[240]
Hedeoma hispida	-.....-----..------.....	[240]
Hedeoma hyssopifolia	-.....-----..------.....	[240]
Hedeoma irvingii	-.....-----..------.....	[240]
Hedeoma johnstonii	-.....-----..------.....	[240]
Hedeoma jucunda	-.....-----..------.....	[240]
Hedeoma mandoniana A	-.....-----..------.....	[240]
Hedeoma media A	-.....-----T.------.....	[240]
Group II	-.....-----..------.....	[240]
Hedeoma montana	-.....-----..------.....	[240]
Hedeoma nana A	-.....-----..------.....	[240]

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Hedeoma palmeri A                -.........-----..------..................... [240]
Hedeoma piperita                 -.........-----..------..................... [240]
Hedeoma pulegioides B            -.........-----..------.........T.......... [240]
Hedeoma pusilla A                -.........-----..------..................... [240]
Hedeoma pusilla B                -.........-----..------..................... [240]
Hesperozygis marifolia B         -.........-----..------..................... [240]
Hesperozygis nitida              -.........-----..------..................... [240]
Hesperozygis rhododon            -.........-----..------..................... [240]
Hesperozygis spathulata          -.........-----..------..................... [240]
Monarda fistulosa                -.........-----..------..................... [240]
Monarda menthaefolia             -.........-----..------..................... [240]
Monardella linoides              -.........-----..------..................... [240]
Poliomintha bustamanta A         -.........-----..------..................... [240]
Poliomintha dendritica           -.........-----..------..................... [240]
Poliomintha incana A             -.........-----..------..................... [240]
Poliomintha incana B             -.........-----..------..................... [240]
Pycnanthemum californicum        -.........-----..------..................... [240]
Rhododon angulatus A             T.------...-----..------..................... [240]
Rhododon ciliatus B              T.------...-----..------..................... [240]

Thymus mastichina                TTTCCTAGTGAATTAATCCATAGGAAATGGAATTCTTCTGTTT----A [288]
Mentha rotundifolia              .........................................----. [288]
Acinos arvensis                  .........................................----. [288]
Blephilia hirsuta                .........................................----. [288]
Clinopodium ashei A              .........................................----. [288]
Clinopodium ashei B              .........................................----. [288]
Clinopodium brownei A            .........................................----. [288]
Clinopodium brownei
 var. pilosiusculum              .........................................----. [288]
Clinopodium chandleri B          .........................................----. [288]
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Clinopodium ganderi A          ..........................................----. [288]
Clinopodium ganderi B          ..........................................----. [288]
Clinopodium macrostemum        .......TG..T.A.T..AC......................----. [288]
Clinopodium mexicanum          ..........................................----. [288]
Clinopodium palmeri            ..........................................----. [288]
Clinopodium procumbens         ..........................................----. [288]
Clinopodium brevifolia         ..........................................----. [288]
Clinopodium etonia             .......TG..T.A.T..AC......................----. [288]
Dicerandra immaculata          ..........................................----. [288]
Hedeoma acinoides              ..........................................----. [288]
Group I                        ..........................................----. [288]
Hedeoma ciliolata              ..........................................----. [288]
Hedeoma hispida                ..........................................----. [288]
Hedeoma hyssopifolia           ..........................................----. [288]
Hedeoma irvingii               ..........................................----. [288]
Hedeoma johnstonii             ....................................C.....----. [288]
Hedeoma jucunda                ..........................................----. [288]
Hedeoma mandoniana A           .......TG..T.A.T..AC......................----. [288]
Hedeoma media A                ..........................................----. [288]
Group II                       ..........................................----. [288]
Hedeoma montana                ..........................................----. [288]
Hedeoma nana A                 ..........................................----. [288]
Hedeoma palmeri A              ..........................................----. [288]
Hedeoma piperita               ..........................................----. [288]
Hedeoma pulegioides B          ..........................................----. [288]
Hedeoma pusilla A              ..........................................----. [288]
Hedeoma pusilla B              ....................................B.....----. [288]
Hesperozygis marifolia B       ..........................................----. [288]
Hesperozygis nitida            ..........................................----. [288]
Hesperozygis rhododon          ..........................................----. [288]
Hesperozygis spathulata        ..........................................----. [288]
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Monarda fistulosa .....----. [288]
Monarda menthaefolia .....----. [288]
Monardella linoides .....C.....----. [288]
Poliomintha bustamanta A .....----. [288]
Poliomintha dendritica .....GTTT. [288]
Poliomintha incana A .....----. [288]
Poliomintha incana B .....----. [288]
Pycnanthemum californicum .....----. [288]
Rhododon angulatus A .....----. [288]
Rhododon ciliatus B .....----. [288]

Thymus mastichina CTTTGGCCGAATTCAAACAAAGTGTTTTTTTGTTAAAAAAA-CA-CAA [336]
Mentha rotundifolia .....T.....--..-... [336]
Acinos arvensis .....-.....-..T... [336]
Blephilia hirsuta .....-.....-..-... [336]
Clinopodium ashei A .....-.....-..-... [336]
Clinopodium ashei B .....-.....-..-... [336]
Clinopodium brownei A .....-.....-..-... [336]
Clinopodium brownei var. pilosiusculum .....-.....-..-... [336]
Clinopodium chandleri B .C.....AAC.....--..-... [336]
Clinopodium ganderi A .....AAC.....--..-... [336]
Clinopodium ganderi B .....AAC.....--..-... [336]
Clinopodium macrostemum .....-.....-..-... [336]
Clinopodium mexicanum .....-.....-..-... [336]
Clinopodium palmeri .....-.....-..-... [336]
Clinopodium procumbens .....-.....-..-... [336]
Clinopodium brevifolia .....-.....-..-... [336]
Clinopodium etonia .....-.....-..-... [336]
Dicerandra immaculata .....-.....-..-... [336]

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Hedeoma acinoides                .....-.....-..-... [336]
Group I                          .....-.....-..-... [336]
Hedeoma ciliolata                .....-.....-..-... [336]
Hedeoma hispida                  .....-.....-..-... [336]
Hedeoma hyssopifolia             .....-.....-..-... [336]
Hedeoma irvingii                 .....-.....-..-... [336]
Hedeoma johnstonii               ......S....-.....-..-... [336]
Hedeoma jucunda                  .....-.....-..-... [336]
Hedeoma mandoniana A             .....-.....-..-... [336]
Hedeoma media A                  .....T.....-.....-..-... [336]
Group II                         .....-.....-..-... [336]
Hedeoma montana                  .....-.....-..-... [336]
Hedeoma nana A                   .....-.....-..-... [336]
Hedeoma palmeri A                .....-.....-..-... [336]
Hedeoma piperita                 .......G....-.....-..-... [336]
Hedeoma pulegioides B            .....-.....-..-... [336]
Hedeoma pusilla A                .....-.....-..-... [336]
Hedeoma pusilla B                .....-.....-..-... [336]
Hesperozygis marifolia B         .....-.....-..-... [336]
Hesperozygis nitida              .....-.....-..-... [336]
Hesperozygis rhododon            .....-.....-..-... [336]
Hesperozygis spathulata          .....-.....-..-... [336]
Monarda fistulosa                .....-.....A..-... [336]
Monarda menthaefolia             .....-.....A..-... [336]
Monardella linoides              .....-.....-..-... [336]
Poliomintha bustamanta A         .....-.....-..-... [336]
Poliomintha dendritica           .....-.....-..-... [336]
Poliomintha incana A             .....AAC.....--..-... [336]
Poliomintha incana B             .....AAC.....--..-... [336]
Pycnanthemum californicum        .....-.....-..-... [336]
Rhododon angulatus A             .....-.....-..-... [336]
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Rhododon ciliatus B             .............................-.........-..-... [336]
Thymus mastichina               GATACTCTATTTTATTTTTAATATTTTTTAGGA-----GTCTTATTTT [384]
Mentha rotundifolia             ............-------T.-C...CC....CAGGA..........  [384]
Acinos arvensis                 ............-------T.-C...CC....CAGGA.....T....  [384]
Blephilia hirsuta               ............-------T.TC...CC....CAGGA....G.....  [384]
Clinopodium ashei A             ............-------T.-C...CC....CAGGA..........  [384]
Clinopodium ashei B             ............-------T.-C...CC....CAGGA..........  [384]
Clinopodium brownei A           ............-------T.-C...CC....CAGGA..........  [384]
Clinopodium brownei
 var. pilosiusculum             ............-------T.TC...CC....CAGGA..........  [384]
Clinopodium chandleri B         ............-------T.-C...CC....CAGGA.....T....  [384]
Clinopodium ganderi A           ............-------T.-C...CC....CAGGA.....T....  [384]
Clinopodium ganderi B           ............-------T.-C...CC....CAGGA.....T....  [384]
Clinopodium macrostemum         ............-------T.TC...CC....CAGGA..........  [384]
Clinopodium mexicanum           ............-------T.TC...CC....CAGGA..........  [384]
Clinopodium palmeri             ............-------T.-C...CC....CAGGA.....T....  [384]
Clinopodium procumbens          ............-------T.TC...CC....CAGGA..........  [384]
Clinopodium brevifolia          ............-------T.-C...CC....CAGGA..........  [384]
Clinopodium etonia              ............-------T.-C...CC....CAGGA..........  [384]
Dicerandra immaculata           ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma acinoides               ............-------T.TC...CC....CAGGA..........  [384]
Group I                         ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma ciliolata               ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma hispida                 ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma hyssopifolia            ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma irvingii                ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma johnstonii              ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma jucunda                 ............-------T.TC...CC....CAGGA..........  [384]
Hedeoma mandoniana A            ............-------T.-C...CC....CAGGA..........  [384]
Hedeoma media A                 ........CC..C-------T.TC...CC....CAGGA..........  [384]
Group II                        ............-------T.TC...CC....CAGGA..........  [384]
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Hedeoma montana                .............-------T.TC...CC....CAGGA..... [384]
Hedeoma nana A                 .............-------T.TC...CC....CAGGA..... [384]
Hedeoma palmeri A              .............-------T.TC...CC....CAGGA..... [384]
Hedeoma piperita               .............-------T.-C...CC....CAGGAA.... [384]
Hedeoma pulegioides B          .............-------T.TC...CC....CAGGA..... [384]
Hedeoma pusilla A              .............-------T.TC...CC....CAGGA..... [384]
Hedeoma pusilla B              .............-------T.TC...CC....CAGGA..... [384]
Hesperozygis marifolia B       .............-------T.TC...CC....CAGGA..... [384]
Hesperozygis nitida            .............-------T.TC...CC....CAGGA..... [384]
Hesperozygis rhododon          .............-------T.TC...CC....CAGGA..... [384]
Hesperozygis spathulata        ........-------T.TC...CC....CAGGA..... [384]
Monarda menthaefolia           .............-------T.TC...CC....CAGGA..... [384]
Monardella linoides            .............-------T.TC...CC....CAGGA.....T.... [384]
Poliomintha bustamanta A       .............-------T.TC...CC....CAGGA..... [384]
Poliomintha dendritica         .............-------T.TC...CC....CAGGA..... [384]
Poliomintha incana A           .............-------T.-C...CC....CAGGA..... [384]
Poliomintha incana B           .............-------T.-C...CC....CAGGA..... [384]
Pycnanthemum californicum      .............-------T.TC...CC....CAGGA..... [384]
Rhododon angulatus A           ......T......-------T.TC...CC....CAGGA.....-.... [384]
Rhododon ciliatus B            ....G.T......-------T.TC...CC....CAGGA.....-.... [384]

Thymus mastichina              T-CCCATCAACCTATTT-------------AAAGATTTTCTTTTTTGT [432]
Mentha rotundifolia            .-..............GTACTATAAAA-A.................. [432]
Acinos arvensis                .-..............GTACTATAAAA----.C.............. [432]
Blephilia hirsuta              .-..............GTACTATAAAA-----.............. [432]
Clinopodium ashei A            .-..............GTACTATAAAA-----......A........ [432]
Clinopodium ashei B            .-..............GTACTATAAAA-----......A........ [432]
Clinopodium brownei A          .-..............GTACTATAAAA----.............. [432]
Clinopodium brownei
 var. pilosiusculum            .-..............GTACTATAAAA----.............. [432]
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Clinopodium chandleri B      .-..............GTACTATAAAA-----..............  [432]
Clinopodium ganderi A        .-..............GTACTATAAAA-----..............  [432]
Clinopodium ganderi B        .-..............GTACTATAAAA-----..............  [432]
Clinopodium macrostemum      .-..............GTACTATAAAA-----..............  [432]
Clinopodium mexicanum        .-..............GTACTATAAAA-----..............  [432]
Clinopodium palmeri          .-..............GTACTATAAAA----..............  [432]
Clinopodium procumbens       .-..............GTACTATAAAA----..............  [432]
Clinopodium brevifolia       .-..............GTACTATAAAA-----.....A........  [432]
Clinopodium etonia           .-..............GTACTATAAAA-----.....A........  [432]
Dicerandra immaculata        .-....C.........GTACTATAAAA-----..............  [432]
Hedeoma acinoides            .-..............GTACTATAAAA-----..............  [432]
Group I                      .-..............GTACTATAAAA-----..............  [432]
Hedeoma ciliolata            .-..............GTACTATAAAA-----..............  [432]
Hedeoma hispida              .-..............GTACTAT----GA..................  [432]
Hedeoma hyssopifolia         .-..............GTACTATAAAA-----..............  [432]
Hedeoma irvingii             .-..............GTACTATAAAA-----..............  [432]
Hedeoma johnstonii           .C..............GTACTATAAAA-----..............  [432]
Hedeoma jucunda              .-..............GTACTATAAAA-----..............  [432]
Hedeoma mandoniana A         .-..............GTACTATAAAA-----..............  [432]
Hedeoma media A              .-..............GTACTATAAAA-----..............  [432]
Group II                     .-..............GTACTATAAAA-----..............  [432]
Hedeoma montana              .-..............GTACTATAAAA-----..............  [432]
Hedeoma nana A               .-..............GTACTATAAAA-----..............  [432]
Hedeoma palmeri A            .-..............GTACTATAAAA-----..............  [432]
Hedeoma piperita             .-..............GTACTATAAAA-----..............  [432]
Hedeoma pulegioides B        .-..............GTACTATAAAA-----..............  [432]
Hedeoma pusilla A            .-..............GTACTATAAAA-----..............  [432]
Hedeoma pusilla B            .-..............GTACTATAAAA-----..............  [432]
Hesperozygis marifolia B     .-..............GTACTATAAAAGA..................  [432]
Hesperozygis nitida          .-..............GTACTATAAAA-----..............  [432]
Hesperozygis rhododon        .-..............GTACTATAAAA----..............  [432]
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Hesperozygis spathulata .-.....GTACTATAAAA-----..... [432]
Monarda fistulosa .-.....GTACTATAAAA-----..... [432]
Monarda menthaefolia .-.....GTACTATAAAA----..... [432]
Monardella linoides .-.....GTACTATAAAA-----A.....A..... [432]
Poliomintha bustamanta A .-.....GTACTATAAAA-----..... [432]
Poliomintha dendritica .-.....GTACTATAAAA-----T..... [432]
Poliomintha incana A .-.....GTACTATAAAA-----..... [432]
Poliomintha incana B .-.....GTACTATAAAA-----..... [432]
Pycnanthemum californicum .-.....GTACTATAAAA-----..... [432]
Rhododon angulatus A .-.....GTACTATAAAA-----..... [432]
Rhododon ciliatus B .-.....GTACTATAAAA-----..... [432]

Thymus mastichina ACAACTTTCTTACTTTTTTATTTTCTATAAATTCTTATATATA----- [480]
Mentha rotundifolia .....TCT..----- [480]
Acinos arvensis .....A.....C...GTAATA [480]
Blephilia hirsuta .....----- [480]
Clinopodium ashei A .....----- [480]
Clinopodium ashei B .....----- [480]
Clinopodium brownei A .....----- [480]
Clinopodium brownei
var. pilosiusculum .....----- [480]
Clinopodium chandleri B .....----- [480]
Clinopodium ganderi A .....----- [480]
Clinopodium ganderi B .....----- [480]
Clinopodium macrostemum .....----- [480]
Clinopodium mexicanum .....----- [480]
Clinopodium palmeri .....----- [480]
Clinopodium procumbens .....----- [480]
Clinopodium brevifolia .....----- [480]
Clinopodium etonia .....----- [480]

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Dicerandra immaculata      .....................----.....................----- [480]
Hedeoma acinoides          ..........................................----- [480]
Group I                    C.........................................----- [480]
Hedeoma ciliolata          ..........................................----- [480]
Hedeoma hispida            ..........................................----- [480]
Hedeoma hyssopifolia       ..........................................----- [480]
Hedeoma irvingii           ..........................................----- [480]
Hedeoma johnstonii         ..........................................----- [480]
Hedeoma jucunda            ..........................................----- [480]
Hedeoma mandoniana A       ..........................................----- [480]
Hedeoma media A            ..........................................----- [480]
Group II                   ..........................................----- [480]
Hedeoma montana            ..........................................----- [480]
Hedeoma nana A             ..........................................----- [480]
Hedeoma palmeri A          ........T.................................----- [480]
Hedeoma piperita           ..........................................----- [480]
Hedeoma pulegioides B      ............T.............................----- [480]
Hedeoma pusilla A          ..........................................----- [480]
Hedeoma pusilla B          ..........................................----- [480]
Hesperozygis marifolia B   ..........................................----- [480]
Hesperozygis nitida        ..........................................----- [480]
Hesperozygis rhododon      ..........................................----- [480]
Hesperozygis spathulata    ..........................................----- [480]
Monarda fistulosa          ..........................................----- [480]
Monarda menthaefolia       ..........................................----- [480]
Monardella linoides        ..........................................----- [480]
Poliomintha bustamanta A   C.........................................----- [480]
Poliomintha dendritica     ..........................................----- [480]
Poliomintha incana A       ..........................................----- [480]
Poliomintha incana B       ..........................................----- [480]
Pycnanthemum californicum  ..........................................----- [480]
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Rhododon angulatus A      .....-----  [480]
Rhododon ciliatus B       .....-----  [480]

Thymus mastichina         --------GCCGATATATCTCTCGCCATCAATTCACGCAAAAATACTT  [528]
Mentha rotundifolia       --TATATA.....................................C....  [528]
Acinos arvensis           TATATATA...A........A.......................C....  [528]
Blephilia hirsuta         --------...A................................C....  [528]
Clinopodium ashei A       --------...A................................C....  [528]
Clinopodium ashei B       --------...A................................C....  [528]
Clinopodium brownei A     --------...A................................C....  [528]
Clinopodium brownei
 var. pilosiusculum       --------...A................................C....  [528]
Clinopodium chandleri B   --------...A................................C....  [528]
Clinopodium ganderi A     --------...A................................C....  [528]
Clinopodium ganderi B     --------...A................................C....  [528]
Clinopodium macrostemum   --------...A................................C....  [528]
Clinopodium mexicanum     --------...A................................C....  [528]
Clinopodium palmeri       --------...A................................C....  [528]
Clinopodium procumbens    --------...A................................A....  [528]
Clinopodium brevifolia    --------...A................................C....  [528]
Clinopodium etonia        --------...A................................C....  [528]
Dicerandra immaculata     --------...A.....................G........C....  [528]
Hedeoma acinoides         --------...A.........................A......C....  [528]
Group I                   --------...A.........................A......C....  [528]
Hedeoma ciliolata         --------...A.........................A......C....  [528]
Hedeoma hispida           --------...A................................C....  [528]
Hedeoma hyssopifolia      --------...A.........................A......C....  [528]
Hedeoma irvingii          --------...A.........................A......C....  [528]
Hedeoma johnstonii        --------...A.........C...............A......C....  [528]
Hedeoma jucunda           --------...A.........................A......C....  [528]
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Hedeoma mandoniana A --------...A.....C...A [528]
Hedeoma media A --------...A.....A.....C.... [528]
Group II --------...A.....A.....C.... [528]
Hedeoma montana --------...A.....A.....C.... [528]
Hedeoma nana A --------...A.....A.....C.... [528]
Hedeoma palmeri A --------...A.....A.....C.... [528]
Hedeoma piperita --------...A.....C.... [528]
Hedeoma pulegioides B --------...A.....C.... [528]
Hedeoma pusilla A --------...A.....A.....C.... [528]
Hedeoma pusilla B --------...A.....GA.....C.... [528]
Hesperozygis marifolia B --------...A.....C.... [528]
Hesperozygis nitida --------...A.....C.... [528]
Hesperozygis rhododon --------...A.....C.... [528]
Hesperozygis spathulata --------...A.....C.... [528]
Monarda fistulosa --------..TA.....C.... [528]
Monarda menthaefolia --------..TA.....C.... [528]
Monardella linoides --------...A.....GC.... [528]
Poliomintha bustamanta A --------...A.....A.....C.... [528]
Poliomintha dendritica --------...A.....A.....C.... [528]
Poliomintha incana A --------...A.....C.... [528]
Poliomintha incana B --------...A.....C.... [528]
Pycnanthemum californicum --------...A.....C.... [528]
Rhododon angulatus A --------...A.....T.....C.... [528]
Rhododon ciliatus B --------...A.....T.....C.... [528]

Thymus mastichina -AATGAAAATATT----------CTAGATAAATATGTGTGAA [576]
Mentha rotundifolia -..........----------.....T..... [576]
Acinos arvensis -..........-------CTAGATAAA..... [576]
Blephilia hirsuta -..........----------..... [576]
Clinopodium ashei A -..........----------..... [576]

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Clinopodium ashei B                -..........----------.......... [576]
Clinopodium brownei A              -..........----------.......... [576]
Clinopodium brownei
 var. pilosiusculum                -..........----------.......... [576]
Clinopodium chandleri B            -...T.......-------CTAGATAAA..... [576]
Clinopodium ganderi A              -...T.......-------CTAGATAAA..... [576]
Clinopodium ganderi B              -...T.......-------CTAGATAAA..... [576]
Clinopodium macrostemum            -..........----------.......... [576]
Clinopodium mexicanum              -..........----------A......... [576]
Clinopodium palmeri                -.........G.----------.......... [576]
Clinopodium procumbens             -..........----------.......... [576]
Clinopodium brevifolia             -..........----------.......... [576]
Clinopodium etonia                 -..........----------.......... [576]
Dicerandra immaculata              -..........----------.......... [576]
Hedeoma acinoides                  -..........----------.......... [576]
Group I                            -..........----------.......... [576]
Hedeoma ciliolata                  -..........----------.......... [576]
Hedeoma hispida                    -..........----------.......... [576]
Hedeoma hyssopifolia               -..........----------.......... [576]
Hedeoma irvingii                   -..........----------.......... [576]
Hedeoma johnstonii                 -..........----------.......... [576]
Hedeoma jucunda                    -..........----------A......... [576]
Hedeoma mandoniana A               -..........----------A.........A.. [576]
Hedeoma media A                    -..........----------.......... [576]
Group II                           -..........----------.......... [576]
Hedeoma montana                    -..........----------...A...... [576]
Hedeoma nana A                     -..........----------.......... [576]
Hedeoma palmeri A                  -..........----------.......... [576]
Hedeoma piperita                   -..........----------.......... [576]
Hedeoma pulegioides B              -..........----------.......... [576]
Hedeoma pusilla A                  -..........----------.......... [576]
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Hedeoma pusilla B -.....----------..... [576]
Hesperozygis marifolia B -.....----------..... [576]
Hesperozygis nitida -.....----------..... [576]
Hesperozygis rhododon -.....AAATATT---------..... [576]
Hesperozygis spathulata -.....----------..... [576]
Monarda fistulosa T.....----------..... [576]
Monarda menthaefolia T.....----------..... [576]
Monardella linoides -.....----------..... [576]
Poliomintha bustamanta A -.....----------..... [576]
Poliomintha dendritica -.....----------..... [576]
Poliomintha incana A -.....----------..... [576]
Poliomintha incana B -.....----------..... [576]
Pycnanthemum californicum -.....----------..... [576]
Rhododon angulatus A -T.....----------..... [576]
Rhododon ciliatus B -T.....----------..... [576]

Thymus mastichina TTTTTAATAATCTAAAA-ATTTTTTTGTTCATTGATAAAAATAAAACT [624]
Mentha rotundifolia .....T.....------.. [624]
Acinos arvensis .....T.....A.....------.. [624]
Blephilia hirsuta .....T.....------.. [624]
Clinopodium ashei A .....T.....------.. [624]
Clinopodium ashei B .....T.....------.. [624]
Clinopodium brownei A .....T.....------.. [624]
Clinopodium brownei var. pilosiusculum .....T.....------.. [624]
Clinopodium chandleri B .....T.....A.....------.. [624]
Clinopodium ganderi A .....T.....------.. [624]
Clinopodium ganderi B .....T.....------.. [624]
Clinopodium macrostemum .....T.....------.. [624]
Clinopodium mexicanum .....T.....------.. [624]

Clinopodium palmeri .....T.....------.. [624]
Clinopodium procumbens .....T.....------.. [624]
Clinopodium brevifolia .....T.....------.. [624]
Clinopodium etonia .....T.....------.. [624]
Dicerandra immaculata .....T.....------.. [624]
Hedeoma acinoides .....T.....------.. [624]
Group I .....T.....------.. [624]
Hedeoma ciliolata .....T.....------.. [624]
Hedeoma hispida .....T.....------.. [624]
Hedeoma hyssopifolia .....T.....------.. [624]
Hedeoma irvingii .....G.....------.. [624]
Hedeoma johnstonii .....T.....------.. [624]
Hedeoma jucunda .....T.....------.. [624]
Hedeoma mandoniana A .....T.....------.. [624]
Hedeoma media A .....T.....G.....------.. [624]
Group II .....T.....------.. [624]
Hedeoma montana .....T.....------.. [624]
Hedeoma nana A .....T.....------.. [624]
Hedeoma palmeri A .....T.....------.. [624]
Hedeoma piperita .....T.....------.. [624]
Hedeoma pulegioides B .....T.....------.. [624]
Hedeoma pusilla A .....T.....------.. [624]
Hedeoma pusilla B .....T.....------.. [624]
Hesperozygis marifolia B .....T.....------.. [624]
Hesperozygis nitida .....T.....------.. [624]
Hesperozygis rhododon .....T.....------.. [624]
Hesperozygis spathulata .....T.....------.. [624]
Monarda fistulosa .....T.....------.. [624]
Monarda menthaefolia .....T.....------.. [624]
Monardella linoides .....T.....---------- [624]
Poliomintha bustamanta A .....T.....------.. [624]

Poliomintha dendritica .....T.....------.. [624]
Poliomintha incana A .....T.....------.. [624]
Poliomintha incana B .....T.....------.. [624]
Pycnanthemum californicum .....T.....------.. [624]
Rhododon angulatus A .....T.....------.. [624]
Rhododon ciliatus B .....T.....------.. [624]

Thymus mastichina TATTTTTTTGGTTGCACTTTTTA-AAATCAAATAAATCAAAACGGT-- [672]
Mentha rotundifolia G.....-.....-.....AA [672]
Acinos arvensis .....-.....-.....AA [672]
Blephilia hirsuta G.....-.....-.....G.....AA [672]
Clinopodium ashei A .....-.....-.....G.....AA [672]
Clinopodium ashei B .....-.....-.....G.....AA [672]
Clinopodium brownei A G.....-.....-.....G.....AA [672]
Clinopodium brownei
var. pilosiusculum G.....-.....C.....G.....AA [672]
Clinopodium chandleri B G.....-.....-.....G.....AA [672]
Clinopodium ganderi A G.....-.....-.....G.....AA [672]
Clinopodium ganderi B G.....-.....-.....G.....AA [672]
Clinopodium macrostemum G.....-.....-.....G.....AA [672]
Clinopodium mexicanum G.....-.....-.....G.....AA [672]
Clinopodium palmeri G.....-.....-.....G.....AA [672]
Clinopodium procumbens G.....-.....-.....G.....AA [672]
Clinopodium brevifolia .....-.....-.....G.....AA [672]
Clinopodium etonia .....-.....-.....G.....AA [672]
Dicerandra immaculata G.....-.....-.....G.....AA [672]
Hedeoma acinoides G.....-.....-.....G.....A..AA [672]
Group I G.....-.....-.....G.....AA [672]
Hedeoma ciliolata G.....-.....-.....G.....AA [672]
Hedeoma hispida G.....-.....-.....G.....G.....AA [672]

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Hedeoma hyssopifolia          G.......-.............-.....G.............AA [672]
Hedeoma irvingii              G.......-.............-.....G.............AA [672]
Hedeoma johnstonii            G.......-.............-.....G.......M.....AA [672]
Hedeoma jucunda               G.......-.....T.......-.....G.............AA [672]
Hedeoma mandoniana A          G.......-.............-.....G...........----AA [672]
Hedeoma media A               .......-.............-.....G.............AA [672]
Group II                      G.......-.............-.....G.............AA [672]
Hedeoma montana               G.......-.............-.....G.............AA [672]
Hedeoma nana A                G.......-.............-.....G.............AA [672]
Hedeoma palmeri A             G.......-.............-.....G.............AA [672]
Hedeoma piperita              G.......-.............-.....G.............AA [672]
Hedeoma pulegioides B         G.......-.............-.....G.............AA [672]
Hedeoma pusilla A             G.......-.............-.....G.............AA [672]
Hedeoma pusilla B             G.......-.............-.....G.............AA [672]
Hesperozygis marifolia B      G.......-.............-.....G.............AA [672]
Hesperozygis nitida           G.......-.............-.....G.............AA [672]
Hesperozygis rhododon         G.......-.............-...C.G.............AA [672]
Hesperozygis spathulata       G.......-.............-.....G.............AA [672]
Monarda fistulosa             G.......-.............-.....G...........T...AA [672]
Monarda menthaefolia          G.......-.............-.....G...........T...AA [672]
Monardella linoides           ---------.............-.....G.............C.AA [672]
Poliomintha bustamanta A      G.......-.............-....AG.............AA [672]
Poliomintha dendritica        G.......-.............-.....G.............AA [672]
Poliomintha incana A          G.......-.............-.....G.............AA [672]
Poliomintha incana B          G.......-.............-.....G.............AA [672]
Pycnanthemum californicum     G.......-.............-.....G.............AA [672]
Rhododon angulatus A          G.......-....A.........-.....G..A..........AA [672]
Rhododon ciliatus B           G.......-....A.........-.....G..A..........AA [672]

Thymus mastichina             ---CAAAAATTGTTTTTTTTTTTTTTTGGAGGGGCT----------- [720]
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Mentha rotundifolia	ATAA.....A.....---G..G.....TAATT------	[720]
Acinos arvensis	ATAA.....-.....--------GG.....TAATT------	[720]
Blephilia hirsuta	AAAA...---.....--------G.....TAATT------	[720]
Clinopodium ashei A	ATAA.....-.....--------G.....TAATT------	[720]
Clinopodium ashei B	ATAA.....-.....--------G.....TAATT------	[720]
Clinopodium brownei A	ATAA.....-.....---------..G.....TAATT------	[720]
Clinopodium brownei *var. pilosiusculum*	ATAA.....-.....---------..G.....TAATT------	[720]
Clinopodium chandleri B	ATAA....--.....--------G..G.....TAATT------	[720]
Clinopodium ganderi A	ATAA.....-.....--------G..G.....TAATT------	[720]
Clinopodium ganderi B	ATAA.....-.....--------G..G.....TAATT------	[720]
Clinopodium macrostemum	ATAA.....-.....---------..G.....TAATT------	[720]
Clinopodium mexicanum	ATAA.....-.....---------..G.....TAATT------	[720]
Clinopodium palmeri	ATAA.....-.....------GG..G.....TAATT------	[720]
Clinopodium procumbens	ATAA.....-.....---------..G.....TAATT------	[720]
Clinopodium brevifolia	ATAA.....-.....--------G.....TAATT------	[720]
Clinopodium etonia	ATAA.....-.....--------G.....TAATT------	[720]
Dicerandra immaculata	ATAA.....-.....--------G.....TAATT------	[720]
Hedeoma acinoides	ATAA.....-.....----------....TAATT------	[720]
Group I	ATAA.....-.....-----..G.....TAATT------	[720]
Hedeoma ciliolata	ATAA.....-.....-GGGG..G.....TAATT------	[720]
Hedeoma hispida	ATAA.....-.....--------G..G.....TAATT------	[720]
Hedeoma hyssopifolia	ATAA.....-.....-----..G.....TAATT------	[720]
Hedeoma irvingii	ATAA.....-.....-------..G.....TAATT------	[720]
Hedeoma johnstonii	ATAA.....-.....-----GG..G.....TAATT------	[720]
Hedeoma jucunda	ATAA.....-.....-----G..G.....TAATT------	[720]
Hedeoma mandoniana A	----------.....-------G..G.....TAATT------	[720]
Hedeoma media A	ATAA.....-.....---------..G.....TAATT------	[720]
Group II	ATAA.....-.....------..G.....TAATT------	[720]
Hedeoma montana	ATAA.....-.....------G..G.....TAATT------	[720]
Hedeoma nana A	ATAA.....-.....------..G.....TAATT------	[720]

Hedeoma palmeri A ATAA.....-.............---GG..G......TAATT------ [720]
Hedeoma piperita ATAA.....-.........---------..G......TAATT------ [720]
Hedeoma pulegioides B ATAA.....-..........-------..G......TAATT------ [720]
Hedeoma pusilla A ATAA.....-............------..G......TAATT------ [720]
Hedeoma pusilla B ATAA.....-............----GG..G......TAATT------ [720]
Hesperozygis marifolia B ATAA.....-.........---------..G......TAATT------ [720]
Hesperozygis nitida ATAA.....-.........--------G..G......TAATTCATAAT [720]
Hesperozygis rhododon ATAA....--.C.......---------..G......TAATT------ [720]
Hesperozygis spathulata ATAA.....-........---------G..G...A..TAATTCATAAT [720]
Monarda fistulosa ATAA.....-.........--------G.........TAATT------ [720]
Monarda menthaefolia ATAA.....-.........--------G.........TAATT------ [720]
Monardella linoides AAAA.....-........--------GG..G......TAATT------ [720]
Poliomintha bustamanta A ATAA.....-.............----G..G......TAATT------ [720]
Poliomintha dendritica ATAA.....-..........-------..G......TAATT------ [720]
Poliomintha incana A ATAA.....-.........--------G..G......TAATT------ [720]
Poliomintha incana B ATAA.....-.........--------G..G......TAATT------ [720]
Pycnanthemum californicum ATAA.....A.........--------G.........TAATT------ [720]
Rhododon angulatus A ATAA.....-............------..G......TAATTCTTAAT [720]
Rhododon ciliatus B ATAA.....-............----GG..G......TAATTCTTAAT [720]

Thymus mastichina -CATAATAAGACTGACTGGTTTTAGAAGAGCTCAAGTGGAGAAGAGTC [768]
Mentha rotundifolia -....G........G.C.............................. [768]
Acinos arvensis -....G........GTC..................C........... [768]
Blephilia hirsuta -....G........G.C..................C........... [768]
Clinopodium ashei A -....G........G.C..................C........... [768]
Clinopodium ashei B -....G........G.C..................C........... [768]
Clinopodium brownei A -....G........G.C..................C........... [768]
Clinopodium brownei
var. pilosiusculum -....G........G.C..................C........... [768]
Clinopodium chandleri B -....G........G.C..................C........... [768]

Clinopodium ganderi A	-....G.....G.C.....CA.....	[768]
Clinopodium ganderi B	-....G.....G.C.....C.....	[768]
Clinopodium macrostemum	-....G.....G.C.....C.....	[768]
Clinopodium mexicanum	-....G.....G.C.....C.....	[768]
Clinopodium palmeri	-....G.....G.C.....C.....	[768]
Clinopodium procumbens	-....G.....G.C.....C.....	[768]
Clinopodium brevifolia	-....G.....G.C.....C.....	[768]
Clinopodium etonia	-....G.....G.C.....C.....	[768]
Dicerandra immaculata	-....G.....G.C.....AC.....	[768]
Hedeoma acinoides	-....G.....G.C.....C.....	[768]
Group I	-....G.....G.C.....C.....	[768]
Hedeoma ciliolata	-....G...T....G.C.....C.....	[768]
Hedeoma hispida	-....G.....G.C.....C.....	[768]
Hedeoma hyssopifolia	-....G.....G.C.....C.....	[768]
Hedeoma irvingii	-....G.....G.C.....C.....	[768]
Hedeoma johnstonii	-....G.....G.C.....C.....	[768]
Hedeoma jucunda	-....G.....G.C.....C.....	[768]
Hedeoma mandoniana A	-....G.....GAC.....C.....	[768]
Hedeoma media A	-....G.....T.C.....C.....	[768]
Group II	-....G.....G.C.....C.....	[768]
Hedeoma montana	-....G.....G.C.....C.....	[768]
Hedeoma nana A	-....G.....G.C.....C.....	[768]
Hedeoma palmeri A	-....G.....G.C.....C.....	[768]
Hedeoma piperita	-....G.....G.C.....C.....	[768]
Hedeoma pulegioides B	-....G.....AG.C.....C.....	[768]
Hedeoma pusilla A	-....G.....G.C.....C.....	[768]
Hedeoma pusilla B	-....G.....G.C.....C.....	[768]
Hesperozygis marifolia B	-....G.....G.C.....C.....	[768]
Hesperozygis nitida	T....G.....G.C.....C.....	[768]
Hesperozygis rhododon	-....G.....G.C.....	[768]
Hesperozygis spathulata	T....G.....G.C.....C.....	[768]

Monarda fistulosa -....G.....G.C.....C..... [768]
Monarda menthaefolia -....G.....G.C.....C..... [768]
Monardella linoides -....G.....G.C.....C..... [768]
Poliomintha bustamanta A -....G.....G.C.....C..... [768]
Poliomintha dendritica -....G.....G.C.....C..... [768]
Poliomintha incana A -....G.....G.C.....C..... [768]
Poliomintha incana B -....G.....G.C.....C..... [768]
Pycnanthemum californicum -....G.....G.C.....C..... [768]
Rhododon angulatus A T....G.....G.C.A.....C..... [768]
Rhododon ciliatus B T....G.....G.C.A.....C..... [768]

Thymus mastichina TAAAATCCACAATAAAA-----CTAAAACCCTAAACTAAAA-AATGAA [816]
Mentha rotundifolia .....-----.....T..... [816]
Acinos arvensis .....-----.....C....T..... [816]
Blephilia hirsuta .....-----.....T..... [816]
Clinopodium ashei A .....-----.....T..... [816]
Clinopodium ashei B .....-----.....T..... [816]
Clinopodium brownei A .....-----.....T..... [816]
Clinopodium brownei var. pilosiusculum .....-----.....T..... [816]
Clinopodium chandleri B .....-----.....T..... [816]
Clinopodium ganderi A .....TAAAA.....T..... [816]
Clinopodium ganderi B .....-----.....T..... [816]
Clinopodium macrostemum .....-----.....T..... [816]
Clinopodium mexicanum .....-----.....T..... [816]
Clinopodium palmeri .....-----.....T..... [816]
Clinopodium procumbens .....-----.....A..... [816]
Clinopodium brevifolia .....-----.....W.....T..... [816]
Clinopodium etonia .....-----.....T..... [816]
Dicerandra immaculata .....-----.....T..... [816]

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Hedeoma acinoides                .................-----.....................T..... [816]
Group I                          .................-----.....................T..... [816]
Hedeoma ciliolata                .................-----.....................T..... [816]
Hedeoma hispida                  .................-----.....................T..... [816]
Hedeoma hyssopifolia             .................-----.....................T..... [816]
Hedeoma irvingii                 .................-----.....................T..... [816]
Hedeoma johnstonii               .................-----.....................T..... [816]
Hedeoma jucunda                  .................-----.....................T..... [816]
Hedeoma mandoniana A             .................-----.....................T..... [816]
Hedeoma media A                  .................-----.....................T..... [816]
Group II                         .................-----.....................T..... [816]
Hedeoma montana                  .................-----.....................T..... [816]
Hedeoma nana A                   .................-----.....................T..... [816]
Hedeoma palmeri A                .................-----.....................T..... [816]
Hedeoma piperita                 .................-----.....................T..... [816]
Hedeoma pulegioides B            .................-----.....................T..... [816]
Hedeoma pusilla A                .................-----.....................T..... [816]
Hedeoma pusilla B                .................-----.....................T..... [816]
Hesperozygis marifolia B         .................-----.....................T..... [816]
Hesperozygis nitida              .................-----.....................T..... [816]
Hesperozygis rhododon            .................-----.....................T..... [816]
Hesperozygis spathulata          .................-----.....................T..... [816]
Monarda fistulosa                .................-----.....................T..... [816]
Monarda menthaefolia             .................-----.....................T..... [816]
Monardella linoides              ........M........-----.....................T..... [816]
Poliomintha bustamanta A         .................-----.....................T..... [816]
Poliomintha dendritica           .................-----.....................T..... [816]
Poliomintha incana A             .................-----.....................T..... [816]
Poliomintha incana B             .................-----.....................T..... [816]
Pycnanthemum californicum        .................-----.....................T..... [816]
Rhododon angulatus A             .................-----.....................T..... [816]
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Rhododon ciliatus B                .....-----.....................T..... [816]
Thymus mastichina                  CCTTCAA-GTACATATTTGAACAAATTTTTATTCATCCATTTGAATCT [864]
Mentha rotundifolia                .......-..................................... [864]
Acinos arvensis                    .......-.........................T.......... [864]
Blephilia hirsuta                  .......-..................................... [864]
Clinopodium ashei A                .......-..................................... [864]
Clinopodium ashei B                .......-..................................... [864]
Clinopodium brownei A              .......-..................A.................. [864]
Clinopodium brownei
 var. pilosiusculum                .......-..................A.................. [864]
Clinopodium chandleri B            .......-..................................... [864]
Clinopodium ganderi A              .......-..................................... [864]
Clinopodium ganderi B              .......-..................................... [864]
Clinopodium macrostemum            .......-..................................... [864]
Clinopodium mexicanum              .......-..................................... [864]
Clinopodium palmeri                .......-..................................... [864]
Clinopodium procumbens             .......-..........A........................... [864]
Clinopodium brevifolia             .......-.....................................W..... [864]
Clinopodium etonia                 .......-..................................... [864]
Dicerandra immaculata              .......-.....................................A..... [864]
Hedeoma acinoides                  .......-..................................... [864]
Group I                            .......-..................................... [864]
Hedeoma ciliolata                  .......-..................................... [864]
Hedeoma hispida                    .......-..................................... [864]
Hedeoma hyssopifolia               .......-..................................... [864]
Hedeoma irvingii                   .......-..................................... [864]
Hedeoma johnstonii                 .......-..................................... [864]
Hedeoma jucunda                    .......-..................................... [864]
Hedeoma mandoniana A               .......-..................................... [864]
Hedeoma media A                    .......-..................................... [864]
Group II                           .......-..................................... [864]
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Hedeoma montana                  .......-..................................... [864]
Hedeoma nana A                   .......-..................................... [864]
Hedeoma palmeri A                .......-..................................... [864]
Hedeoma piperita                 .......-.....A............................... [864]
Hedeoma pulegioides B            .......-..............................C...... [864]
Hedeoma pusilla A                .......-..................................... [864]
Hedeoma pusilla B                .......-..................................... [864]
Hesperozygis marifolia B         .......-..................................... [864]
Hesperozygis nitida              .......A..................................... [864]
Hesperozygis rhododon            .......-..................................... [864]
Hesperozygis spathulata          .......-..................................... [864]
Monarda fistulosa                .......-..................................... [864]
Monarda menthaefolia             .......-..................................... [864]
Monardella linoides              .......-..................................... [864]
Poliomintha bustamanta A         .......-..................................... [864]
Poliomintha dendritica           .......-..................................... [864]
Poliomintha incana A             .......-..................................... [864]
Poliomintha incana B             .......-..................................... [864]
Pycnanthemum californicum        .......-..................................... [864]
Rhododon angulatus A             .......-..................................... [864]
Rhododon ciliatus B              .......-..................................... [864]

Thymus mastichina                TTCCTAGAAAATATTGGACCCAATTGAATTCTTAAATCTAGACTATTT [912]
Mentha rotundifolia              ..............C.........................G.... [912]
Acinos arvensis                  ......T.........C.........................G.... [912]
Blephilia hirsuta                ..............C.........................G.... [912]
Clinopodium ashei A              ..............C.........................G.... [912]
Clinopodium ashei B              ..............C.....................------------ [912]
Clinopodium brownei A            ..............C.........................G.... [912]
Clinopodium brownei
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var. pilosiusculum .....C.....G.... [912]
Clinopodium chandleri B .....C.....G.... [912]
Clinopodium ganderi A .....C.....G.... [912]
Clinopodium ganderi B .....C.....G.... [912]
Clinopodium macrostemum .....C.....G.... [912]
Clinopodium mexicanum .....C.....G.... [912]
Clinopodium palmeri .....C.....G.... [912]
Clinopodium procumbens .....C.....G.... [912]
Clinopodium brevifolia .....C.....---------- [912]
Clinopodium etonia .....C.....A.... [912]
Dicerandra immaculata .....C.....G.... [912]
Hedeoma acinoides .....C.....G.... [912]
Group I .....C.....G.... [912]
Hedeoma ciliolata .....C.....G.... [912]
Hedeoma hispida .....C.....G.... [912]
Hedeoma hyssopifolia .....C.....G.... [912]
Hedeoma irvingii .....C.....G.... [912]
Hedeoma johnstonii .....C.....G.... [912]
Hedeoma jucunda .....C.....G.... [912]
Hedeoma mandoniana A .....C.....G.... [912]
Hedeoma media A .....C.....A.....G.... [912]
Group II .....C.....G.... [912]
Hedeoma montana .....C.....G.... [912]
Hedeoma nana A .....C.....G.... [912]
Hedeoma palmeri A .....C.....G.... [912]
Hedeoma piperita .....C.....G.... [912]
Hedeoma pulegioides B .....C.....G.... [912]
Hedeoma pusilla A .....C.....G.... [912]
Hedeoma pusilla B .....C.....G.... [912]
Hesperozygis marifolia B .....C.....G.... [912]
Hesperozygis nitida .....C.....A.....G.... [912]

Hesperozygis rhododon .....C.....A.....G.... [912]
Hesperozygis spathulata .....C.....CA.....G.... [912]
Monarda fistulosa .....C.....A.....G.... [912]
Monarda menthaefolia .....C.....A.....G.... [912]
Monardella linoides .....C.....G.... [912]
Poliomintha bustamanta A .....C.....G.... [912]
Poliomintha dendritica .....C.....G.... [912]
Poliomintha incana A .....C.....G.A.. [912]
Poliomintha incana B .....C.....G.A.. [912]
Pycnanthemum californicum .....C.....G.... [912]
Rhododon angulatus A .....C.....G...A [912]
Rhododon ciliatus B .....C.....G...A [912]

Thymus mastichina ATTAAAAATA----GGTTATTATGGGG-TCAAGACAAGCCG [953]
Mentha rotundifolia T..T.T....----.....-..... [953]
Acinos arvensis .....T....----.....-..... [953]
Blephilia hirsuta .....T....----.....-..... [953]
Clinopodium ashei A T....T....----.....-..... [953]
Clinopodium ashei B ----------[953]
Clinopodium brownei A T....T....----.....-.....--- [953]
Clinopodium brownei
var. pilosiusculum T....T....----.....-.....------- [953]
Clinopodium chandleri B T....T....----.....-..... [953]
Clinopodium ganderi A T....T....----.....-.....---- [953]
Clinopodium ganderi B T....T....----.....-.....--- [953]
Clinopodium macrostemum T....T....----.....-....--------- [953]
Clinopodium mexicanum T....T....----.....-..... [953]
Clinopodium palmeri T....T....----.....-.....---- [953]
Clinopodium procumbens T....T....----.....---------- [953]
Clinopodium brevifolia ----------[953]

Clinopodium etonia T....T....----.....-.....------ [953]
Dicerandra immaculata T....T....----.---------- [953]
Hedeoma acinoides .....T....----.....-..... [953]
Group I .....T....----.....-..... [953]
Hedeoma ciliolata .....T....----.....-..... [953]
Hedeoma hispida T....T....----.....-.....------ [953]
Hedeoma hyssopifolia .....T....----.....-.....----- [953]
Hedeoma irvingii .....T....----.....-..... [953]
Hedeoma johnstonii .....T....----.....-.....-..... [953]
Hedeoma jucunda .....T....----.....-.....----- [953]
Hedeoma mandoniana A T....T....----.....-.....-- [953]
Hedeoma media A T....T....----.....-..... [953]
Group II .....T....----.....-.....------ [953]
Hedeoma montana .....T....----.....-.....- [953]
Hedeoma nana A .....T....----.....-.....---- [953]
Hedeoma palmeri A ..A..T....----.....-..... [953]
Hedeoma piperita T....T....----.....-.....------ [953]
Hedeoma pulegioides B T....T....----.A.....-..... [953]
Hedeoma pusilla A .....T....GGTA.....-..... [953]
Hedeoma pusilla B .....T....----.....---------- [953]
Hesperozygis marifolia B T....T....----.....-.....------ [953]
Hesperozygis nitida T....T...---------- [953]
Hesperozygis rhododon T....T....----.....-..... [953]
Hesperozygis spathulata T....T....----.....-..... [953]
Monarda fistulosa T....T....----.....C.....-.....--- [953]
Monarda menthaefolia T....T....----.....-..... [953]
Monardella linoides T....T....----.....C.---------- [953]
Poliomintha bustamanta A .....T....----.....-..... [953]
Poliomintha dendritica .....T....----.....-..... [953]
Poliomintha incana A T....T....----.....-.....------ [953]
Poliomintha incana B T....T....----.....-.....- [953]

Pycnanthemum californicum T....T....----...---------------------- [953]
Rhododon angulatus A T....T....----.........A..-..........-- [953]
Rhododon ciliatus B T....T....----.........A..-.......... [953]

REFERENCES

LITERATURE CITED

Bentham, G. 1834. *Labiatarum Genera et Species*. James Ridgway, London, UK. Pp. 1-783.

Bräuchler, C., Meimberg, H., Abele, T., and Heubl, G. 2005. Polyphyly of the genus *Micromeria* (Lamiaceae) – evidence from cpDNA sequence data. *Taxon* 54: 639-650.

Bräuchler, C., Meimberg, H., and Heubl, G. 2006. New names in Old World *Clinopodium*—the transfer of the species of *Micromeria* sect. *Pseudomelissa* to *Clinopodium*. Taxon 55: 977-981.

Bremer, K. 1988. The limits of amino acid sequence data in angiosperm phylogenetic reconstruction. *Evolution* 42: 795-803.

Briquet, J. 1897. Labiatae. *In* A. Engler and E. K. Prantl, *Die Natürlichen Pflanzenfamilien* 4(3a): 183-375.

Buckley, T. R., Cordeiro, M., Marshall, D. C., and Simon, C. 2006. Differentiating between hypotheses of lineage sorting and introgression in New Zealand alpine cicadas (Maoricicada Dugdale). *Systematic Biology* 55(3): 411-425.

Cantino, P.D., Harley, R. M., and Wagstaff, S. J. 1992. Genera of Labiatae: status and classification. Pp. 551-552 in *Advances in Labiatae Science*, ed. R. M. Harley and T. Reynolds. Kew: Royal Botanical Gardens Press.

Cantino, P.D., and Wagstaff, S. J. 1998. A reexamination of North American Satureja s.l. (Lamiaceae) in light of molecular evidence. *Brittonia* 50: 63-70.

Demesure, B., Sodzi, N., and Petit, R. J. 1995. A set of universal primers for amplification of polymorphic non-coding regions of mitochondrial and chloroplast DNA in plants. *Molecular Ecology* 4: 129-131.

Donoghue, M. J., and Sanderson, M. J. 1992. The suitability of molecular and morphological evidence in reconstructing plant phylogeny. Pp. 340-368 in *Molecular Systematics of Plants*, eds. Soltis, P. S., Soltis, D. E., and Doyle, J. J.. Chapman and Hall, New York, USA.

Doyle, J. J. and Doyle, J.A. 1987. A rapid DNA isolation procedure for small quantities of fresh leaf tissue. *Phytochemical Bulletin* 19: 11-15.

Edwards, C. E., Soltis, D. E., and Soltis, P. S. 2006. Molecular phylogeny of *Conradina* and other scrub mints (Lamiaceae) from the southeastern USA:

evidence for hybridization in Pleistocene refugia? *Systematic Botany* 31: 183-207.

El Oualidi, J., Verneau, O., Puech, S., and Dubuisson, J. 1999. Utility of rDNA ITS sequences in the systematics of *Teucrium* section *Polium* (Lamiaceae). *Plant Systematics and Evolution* 215: 49-70.

Epling, C. and Stewart, W. S. 1939. A revision of *Hedeoma* with a review of allied genera. *Repertorium Specierum Novarum Regni Vegetabilis Beihefte* 115: 1-49.

Epling, C., and Wiggins, L. 1940. A new *Poliomintha* from Baja California. *Contributions from the Dudley Herbarium* 3: 85-86.

Felsenstein, J. 1985. Phylogenies and the comparative method. *American Naturalist* 125: 1-15.

Gray, A. 1870. *Proceedings of the American Academy* 8: 295-296.

Gray, A. 1872. *Proceedings of the American Academy* 8: 365.

Hemsley, W. B. 1882. *Labiatae*. Pp. 541-574 in *Biologia Centrali-Americana*, eds.

Godman, F. D. and Salvin, O. R. H. Porter and Dulau and Company, London, UK.

Graybeal, A. 1998. Is it better to add taxa or characters to a difficult phylogenetic problem? *Systematic Biology* 47: 9-17.

Harley, R. M., and Granda Paucar, A. 2000. List of species of tropical American *Clinopodium* (Labiatae), with new combinations. *Kew Bulletin* 55: 917-927.

Henrickson, J. 1982. A new species of *Poliomintha* (Lamiaceae) from the Chihuahuan Desert Region. *Sida* 9: 290-292.

Hipp, A. L., Hall, J. C., and Systma, K. J. 2004. Phylogenetic accuracy, congruence between data partitions, and performance of the ILD. *Systematic Biology* 53: 81-89.

Holder, M. T., Anderson, J. A., and Holloway, A. K. 2001. Difficulties in detecting hybridization. *Systematic Biology* 50: 978-982.

Irving, R. S. 1972. A revision of the genus *Poliomintha* (Labiatae). *Sida* 5:8-22.

Irving, R. S. 1976. Chromosome numbers of *Hedeoma* (Labiatae) and related genera. *Systematic Botany* 1: 46-56.

Irving, R. S. 1980. The systematics of *Hedeoma* (Labiatae). *Sida* 8: 218-295.

Jamzad, Z. M., Chase, M. W., Ingrouille, M., Simmonds, M. S. J., and Jalili, A. 2003. Phylogenetic relationships in *Nepeta* L. (Lamiaceae) and related genera based on ITS sequence data. *Taxon* 52: 21-32.

Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., and Donoghue, M.J. 2002. *Plant Systematics: A Phylogenetic Approach*. Sunderland: Sinauer Associates, Inc.

Kimura, M. 1981. Estimation of evolutionary distances between homologous nucleotide sequences. *Proceedings of the National Academy of Sciences* 78: 454-458.

Loockerman, D. J. and Jansen, R. K. 1996. The use of herbarium material for DNA studies. Pp. 205-220 in *Sampling the green world*, eds. Stuessy, T. F. and Sohmer, S. H. New York: Columbia University Press.

Pool, A. 2008. A new combination in *Clinopodium* (Lamiaceae) from Mesoamerica and Cuba. *Novon* 18(4): 508-510.

Paton, A. J., Springate, D., Suddee, S., Otieno, D., Grayer, R. J., Harley, M. M., Willis, F., Simmonds, M. S. J., Powell, M. P., and Savolainen, V. 2004. Phylogeny and evolution of basils and allies (Ocimeae, Labiatae) based on three plastid DNA regions. *Molecular Phylogenetics and Evolution* 31: 277-299.

Prather, L. A., Monfils, A. K., Posto, A. L., and Williams, R. A. 2002. Monophyly and phylogeny of *Monarda* (Lamiaceae): evidence from the internal transcribed spacer (ITS) region of nuclear ribosomal DNA. *Systematic Botany* 27: 127-137.

Ramamoorthy, T. P. and Elliott, M. 1993. Mexican Lamiaceae: Diversity, distribution, endemism, and evolution. Pp. 513-539 in *Biological Diversity of Mexico: Origins and Distribution*, eds. Ramamoorthy, T. P., Bye, R., Lot, A., and Fa, J. New York: Oxford University Press.

Rosselló, J. A., Cósin, R., Boscaiu, M., Vicente, O., Martínez, I., and Soriano, P. 2006. Intragenomic diversity and phylogenetic systematics of wild rosemaries (*Rosmarinus officinalis* L. s.l., Lamiaceae) assessed by nuclear ribosomal DNA sequences (ITS). *Plant Systematics and Evolution* 262: 1-12.

Ryding, O. 2006. Revision of the *Clinopodium abyssinicum* group (Labiateae). *Botanical Journal of the Linnean Society* 150: 391-408.

Sang, T., Crawford, D. J., and Stuessy, T. F. 1995. Documentation of reticulate evolution in peonies (*Paeonia*) using internal transcribed spacer sequences of nuclear ribosomal DNA: Implications for biogeography and concerted evolution. *Proceedings of the National Academy of Sciences* 92: 6813-6817.

Schaal, B. A. and Olsen, K. M. 2000. Gene genealogies and population variation in plants. *Proceedings of the National Academy of Sciences* 97: 7024-7029.

Schmidt-Lehbun, A. N. 2008. Monophyly and phylogenetic relationships of *Minthostachys* (Labiatae, Nepetoideae) examined using morphological and nrITS data. *Plant Systematics and Evolution* 270: 25-38.

Shaw, J., Lickey, E. B., Schilling, E. E., and Small, R. L. 2007. Comparison of whole chloroplast genome sequences to choose noncoding regions for phylogenetic studies in angiosperms: The tortoise and the hare III. *American Jounral of Botany* 94: 275-288.

Standley, P.C. 1923. Trees and Shrubs of Mexico. *Contributions from the United States National Herbarium* 23: 1270-1271.

Steane, D. A., Scotland, R. W., Mabberley, D. J., and Olmstead, R. G. 1999. Molecular systematics of *Clerodendrum* (Lamiaceae): ITS sequences and total evidence. *American Journal of Botany* 86: 98-107.

Steane, D. A., de Kok, R. P. J., and Olmstead, R. G. 2004. Phylogenetic relationships between *Clerodendrum* (Lamiaceae) and other Ajugoid genera inferred from nuclear and chloroplast DNA sequence data. *Molecular Phylogenetics and Evolution* 32: 39-45.

Taberlet, P., Gielly, L., Pautou, G., and Bouvet, J.. 1991. Universal primers for amplification of three non-coding regions of chloroplast DNA. *Plant Molecular Biology* 17: 1105-1109.

Tamura, K. and Nei, M. 1993. Estimation of the number of nucleotide substitutions in the control region of mitochondrial DNA in humans and chimpanzees. *Molecular Biology and Evolution* 10: 512-526.

Torrey, J. 1859. Botany of the Boundary. Vol. 2, Part 1 in *Report on the United States and Mexican boundary survey, made under the direction of the secretary of the Interior* ed. Emory, W.H., Washington D.C., USA.

Trusty, J. L., Olmstead, R. G., Bogler, D. J., Santos-Guerra, A., and Francisco-Ortega, J. 2004. Using molecular data to test a biogeographic connection

of the Macronesian genus *Bystropogon* (Lamiaceae) to the new world: a case of conflicting phylogenies. *Systematic Botany* 29: 702-715.

Turner, B. L. 1993. Two new species of *Poliomintha* (Lamiaceae) from northeastern Mexico. *Phytologia* 74: 164-167.

Watson, S. 1890. *Proceedings of the American Academy* 25: 160.

Wagstaff, S. J., Olmstead, R.G., and Cantino, P.D. 1995. Parsimony analysis of cpDNA restriction site variation in subfamily Nepetoideae (Labiatae). *American Journal of Botany* 87: 886-892.

Wagstaff, S. J. and Olmstead, R.G. 1997. Phylogeny of Labiatae and Verbenaceae inferred from rbcL sequences. *Systematic Botany* 22: 265-274.

Walker, J. B., Systma, K. J., Treutlein, J., and Wink, M. 2004. *Salvia* (Lamiaceae) is not monophyletic: implications for the systematics, radiation, and ecological specializations of *Salvia* and tribe Mentheae. *American Journal of Botany* 91: 1115-1125.

Wendel, J. F. and Doyle, J. J. 1998. Phylogenetic incongruence: window into genome history and molecular evolution. Pp. 265-296 in *Molecular Systematics of Plants II: DNA sequencing*, eds. D. E. Soltis, P. S. Soltis, and J. J. Doyle. Boston: Kluwer Academic Publishers.

White, T. J., Bruns, T., Lee, S., and Taylor, J. 1990. Amplification and direct sequencing of fungal ribosomal RNA genes for phylogenetics. Pp. 315-322 in *PCR Protocols: A guide to methods and applications*, eds. Innis, M., Gelfrand, D., Sinsky, J. and White, T. Academic, San Diego, USA.

Yang, Z. 1994. Maximum-likelihood phylogenetic estimation from DNA sequences with variable rates over sites: approximate methods. *Journal of Molecular Evolution* 39: 306-314.