Bhattacharya A, Bhowmick P, Ganguli S, Mitra A K. Evolutionary Insights into the Enzymes involved in the Biosynthesis of the Volatile Organic Compounds Isoprene and Pinene in Plants. Plant Science Today. 2023; 10(2): 253–262. https://doi.org/10.14719/pst.2115

SUPPLEMENTARY FILES

Evolutionary Insights into the Enzymes involved in the Biosynthesis of the Volatile Organic Compounds Isoprene and Pinene in Plants

SUPPLEMENTARY TABLE 1

List of Plants Emitting VOCs

1. *Acacia leucophloea/ Vachellia leucophloea*
2. *Adhatoda vasica*
3. *Albizia lebbeck*
4. *Atrocarpus heterophyllus*
5. *Azadirachta indica*
6. *Bombax ceiba*
7. *Butea monosperma*
8. *Casuarina equisetifolia*
9. *Citrus limon*
10. *Cocos nucifera*
11. *Dalbergia sissoo*
12. *Diospyros melanoxylon*
13. *Eucalyptus globulus*
14. *Ficus benghalensis*
15. *Ficus religiosa*
16. *Hibiscus rosasinensis*
17. *Lantana camara*
18. *Madhuca longifolia*
19. *Mangifera indica*
20. *Morus alba*
21. *Peltophorum pterocarpum*
22. *Psidium guajava*
23. *Pterocarpus marsupium*
24. *Pterospermum acerifolium*
25. *Schleichera oleosa*
26. *Syzygium jambolanum/ Syzygium cumini*
27. *Tecoma stans*
28. *Tectona grandis*

Name of Plant	Common Name	Family	Type of Plant	VOC produced	Area of growth in West Bengal	Reference
Acacia leucophloea/ Vachellia leucophloea	White Bark Acacia	Mimosaceae	Deciduous	Moderate emitter – Isoprene, pinene, other VOCs	Murshidabad, Birbhum, Bankura, Purba Bardhaman, Paschim Bardhaman, Purba Medinipur, Paschim Medinipur	(1)
Adhatoda vasica	Malabar Nut/ Adulsa/ Vasaka	Acanthaceae	Evergreen	High emitter - Isoprene, α-pinene, other VOCs	Kakrajhore forest in West Medinipur, West Rarrh region, Lower Bengal	(2, 3)
Albizia lebbeck	Shirish	Mimosaceae	Deciduous	Moderate emitter - Isoprene, α-pinene, other VOCs	Plains of West Bengal	(4)
Atrocarpus heterophyllus	Jackfruit	Moraceae	Evergreen tree	High emitter - Isoprene, monoterpenes	Throughout West Bengal	(5, 6)
Azadirachta indica	Neem	Meliaceae	Deciduous	Moderate emitter - Isoprene, α-pinene, other VOCs	Widespread	(7)
Bombax ceiba	Malabar silk cotton tree/ Shimul	Malvaceae	Deciduous	Moderate emitter - Isoprene, monoterpenes	Throughout plains to 800m	(8)
Butea monosperma	Flame of the forest tree/ Palash	Fabaceae	Deciduous	High emitter - Isoprene	Purulia, West Medinipore	(9 – 11)
Casuarina equisetifolia	Australian pine	Casuarinaceae	Evergreen	High emitter - Isoprene, α-pinene, other VOCs	Throughout West Bengal	(12)
Citrus limon	Lemon	Rutaceae	Deciduous	Moderate emitter - Isoprene, α-pinene, other VOCs	Red lateritic zone of West Bengal	(13)
Cocos nucifera	Coconut	Arecaceae	Evergreen	High emitter - Isoprene	Purba Bardhaman,Howrah, 24 Parganas, Midnapore	(14)

Dalbergia sissoo	Shisham	Papilionaceae	Deciduous	High emitter - Isoprene, α-pinene, other VOCs	South West Bengal	(4)
Diospyros melanoxylon	East Indian ebony/ Kendu	Ebenaceae	Deciduous or evergreen, , depending on habitat	Moderate emitter - Isoprene, monoterpenes	South West Bengal	(4)
Eucalyptus globulus	Gum tree/Stringybark	Myrtaceae	Mostly Evergreen	High emitter - Isoprene, α-pinene, other VOCs	Laterite soils of South and South Western Districts	(4)
Ficus benghalensis	Banyan	Moraceae	Evergreen	Moderate emitter – Isoprene, α-pinene, other VOCs	Throughout West Bengal	(15)
Ficus religiosa	Sacredfig	Moraceae	Deciduoustree	High emitter - Isoprene, α-pinene, other VOCs	From the coast up to 1200m, Bankura	(16)
Hibiscus rosasinensis	Hibiscus	Malvaceae	Evergreen	High emitter - Isoprene, α-pinene, other VOCs	Hooghly, Purba and Paschim Bardhaman, Birbhum	(17)
Lantana camara	Lantana	Verbenaceae	Evergreen shrub	High emitter - Isoprene, α-pinene, other VOCs	Howrah, purba and Paschim Bardhaman, Birbhum	(18)
Madhuca longifolia	Mahua	Sapotaceae	Evergreen to semi-evergreen	High emitter - Isoprene	Purulia, Bankura, West Midnapore and Jhargram.	(19)
Mangifera indica	Mango	Anacardiaceae	Evergreen	High emitter - Isoprene, α-pinene, other VOCs	Murshidabad and Malda districts	(20)
Morus alba	White mulberry	Moraceae	Deciduous	High emitter - Isoprene, α-pinene, other VOCs	Birbhum	(21)
Peltophorum pterocarpum	Yellow flame tree/ Radhachura	Fabaceae	Deciduous	High emitter - Isoprene	Birbhum	(22)
Psidium guajava	Guava	Myrtaceae	Evergreen	High emitter - Isoprene, α-pinene, other VOCs	North and South 24 Parganas, Nadia	(23)
Pterocarpus marsupium	Malabar kino/ Venkai	Fabaceae	Deciduous	High emitter - Isoprene, monoterpenes	Wild and also planted in South Bengal	(24)

Pterospermum macerifolium	Kanak Champa	Sterculiaceae	Deciduous	Moderate emitter - Isoprene, α-pinene, other VOCs	Eastern districts of Bengal	(25)
Schleichera oleosa	Kusum	Sapindaceae	Deciduous	Moderate emitter – Isoprene, α-pinene, other VOCs	Found throughout the hotter parts of south West Bengal, in red lateritic soil.	(4)
Syzygium jambolanum / Syzygium cumini	Malabar plum	Myrtaceae	Evergreen	High emitter - Isoprene, α-pinene, other VOCs	Throughout West Bengal	(26)
Tecoma stans	Yellow bells	Bignoniaceae	Semi-evergreen shrub	Moderate emitter – Isoprene, α-pinene, other VOCs	Purba and Paschim Bardhaman	(27)
Tectona grandis	Teak	Lamiaceae	Deciduous	High emitter - Isoprene	Lower Hill forests in North Bengal, Jhargram	(28)

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SUPPLEMENTARY TABLE 2

Data for enrichment profile – MEP Pathway

Name of Enzyme	Number of families common to gene-specific and protein-specific trees	Common families
Isoprene Synthase	5	Salicaceae Euphorbiaceae Fabaceae Lamiaceae Poaceae
Isopentenyl Diphosphate Isomerase	3	Brassicaceae Lamiaceae Nyssaceae
Hydroxymethylbutenyl diphosphate reductase	0	N/A
Hydroxymethylbutenyl diphosphate synthase	0	N/A
Methylerythritol 2,4-cyclodiphosphate synthase	0	N/A
CDP-ME kinase	2	Lamiaceae Solanaceae
Diphosphocytidylyl methyl erythritol synthase	2	Brassicaceae Poaceae
1-deoxyxylulose-5-phosphate reductoisomerase	0	N/A
1-deoxyxylulose 5-phosphate synthase	1	Solanaceae

Data for enrichment profile – MVA Pathway

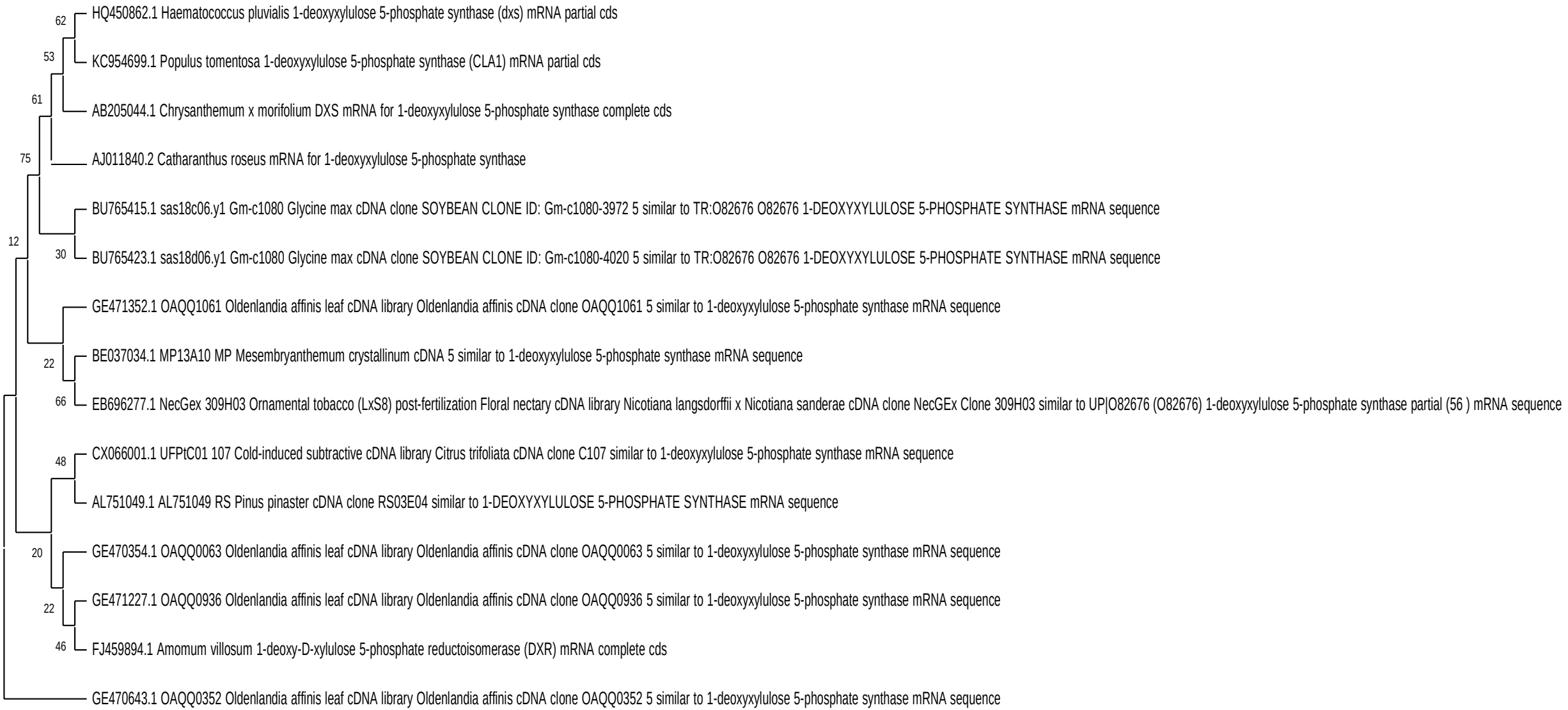
Name of Enzyme	Number of families common to gene-specific and protein-specific trees	Common families
Pinene Synthase	2	Lamiaceae Pinaceae
Geranyl diphosphate synthase	13	Apocynaceae Asteraceae Brassicaceae Cannabaceae Fabaceae Lamiaceae Lauraceae Magnoliaceae Pinaceae Plantaginaceae Rosaceae Solanaceae Vitaceae
Mevalonate pyrophosphate decarboxylase/ Diphosphomevalonate decarboxylase	1	Brassicaceae
Phosphomevalonate kinase	1	Brassicaceae
Mevalonate 5 kinase	1	Brassicaceae
3-hydroxy-3-methylglutaryl-CoA reductase/ HMG CoA reductase	4	Solanaceae Poaceae Brassicaceae Malvaceae
3-hydroxy-3-methylglutaryl-CoA synthase/ HMG CoA synthase	0	N/A
Acetoactyl CoA thiolase	0	N/A

SUPPLEMENTARY 3
- PHYLOGENETIC TREES

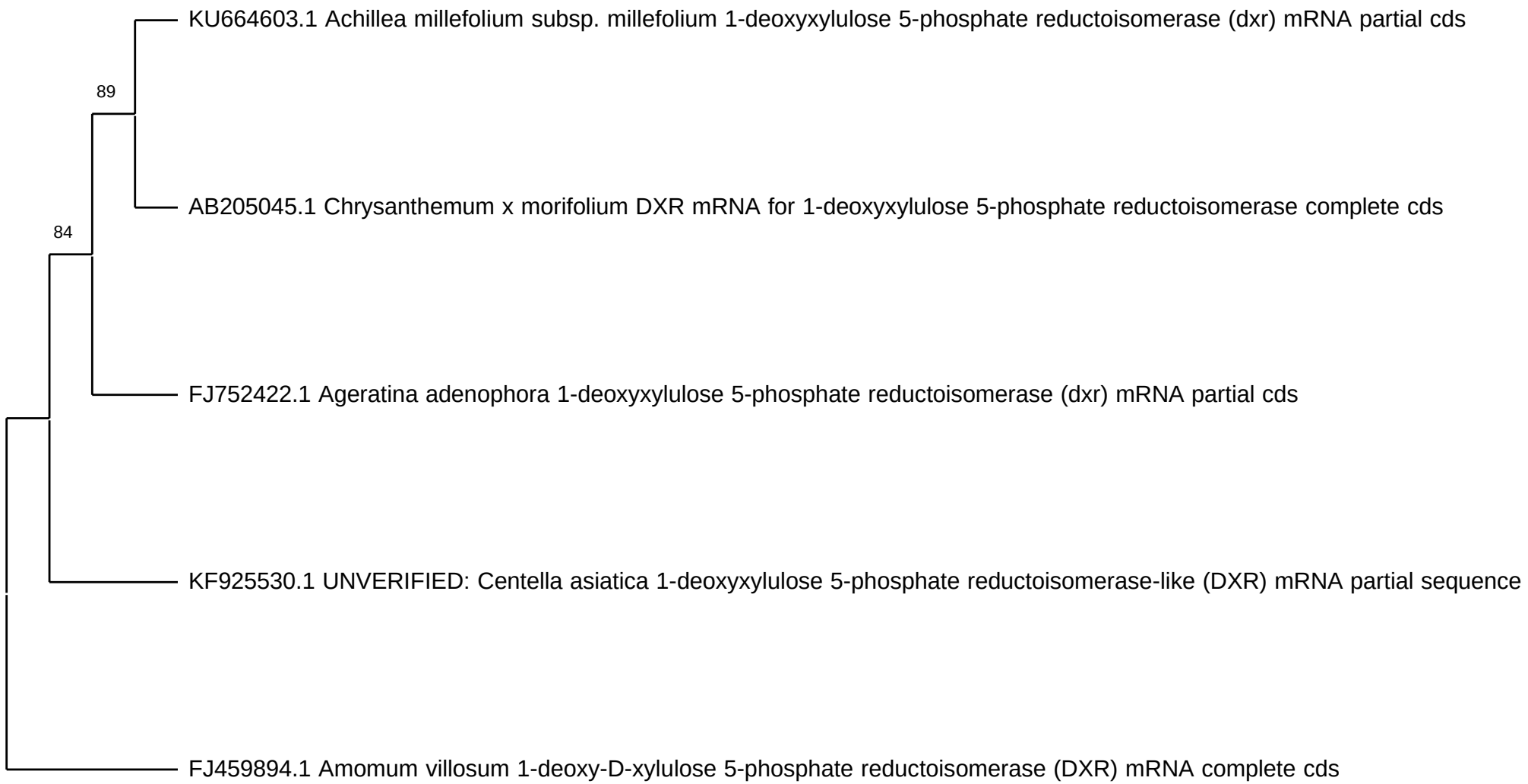
METHYLERYTHRITOL PHOSPHATE (MEP) PATHWAY

GENBANK PHYLOGENETIC TREES

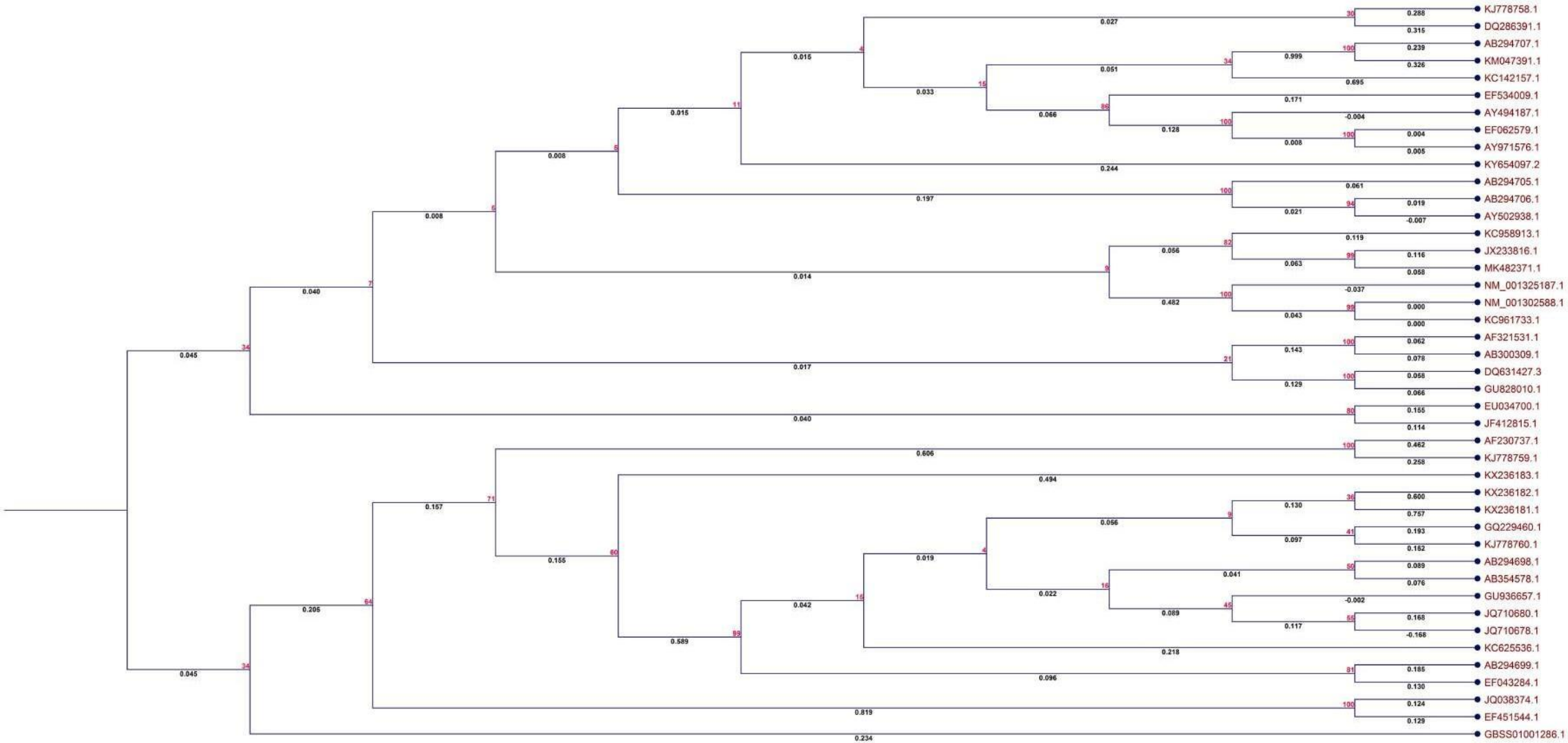
Deoxyxylulose 5-phosphate (DXP) Synthase



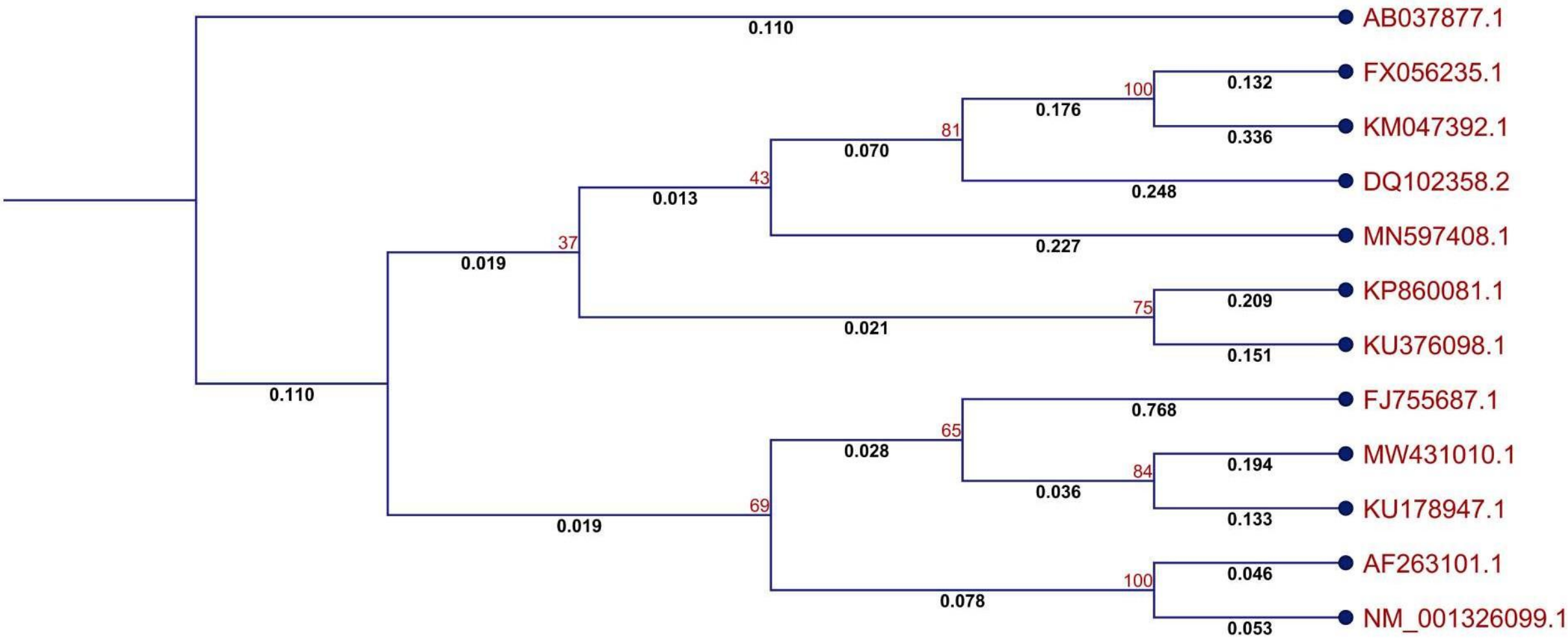
Deoxyxylulose 5-phosphate (DXP) Reductoisomerase



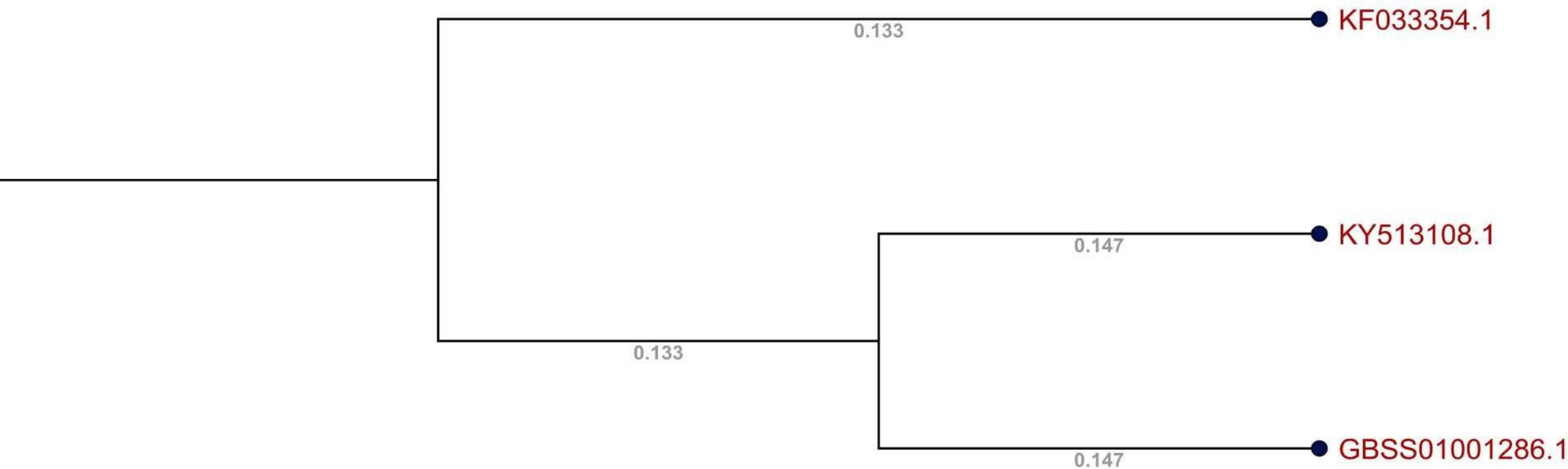
Diphosphocytidylyl methyl erythritol (CDP-ME) Synthase



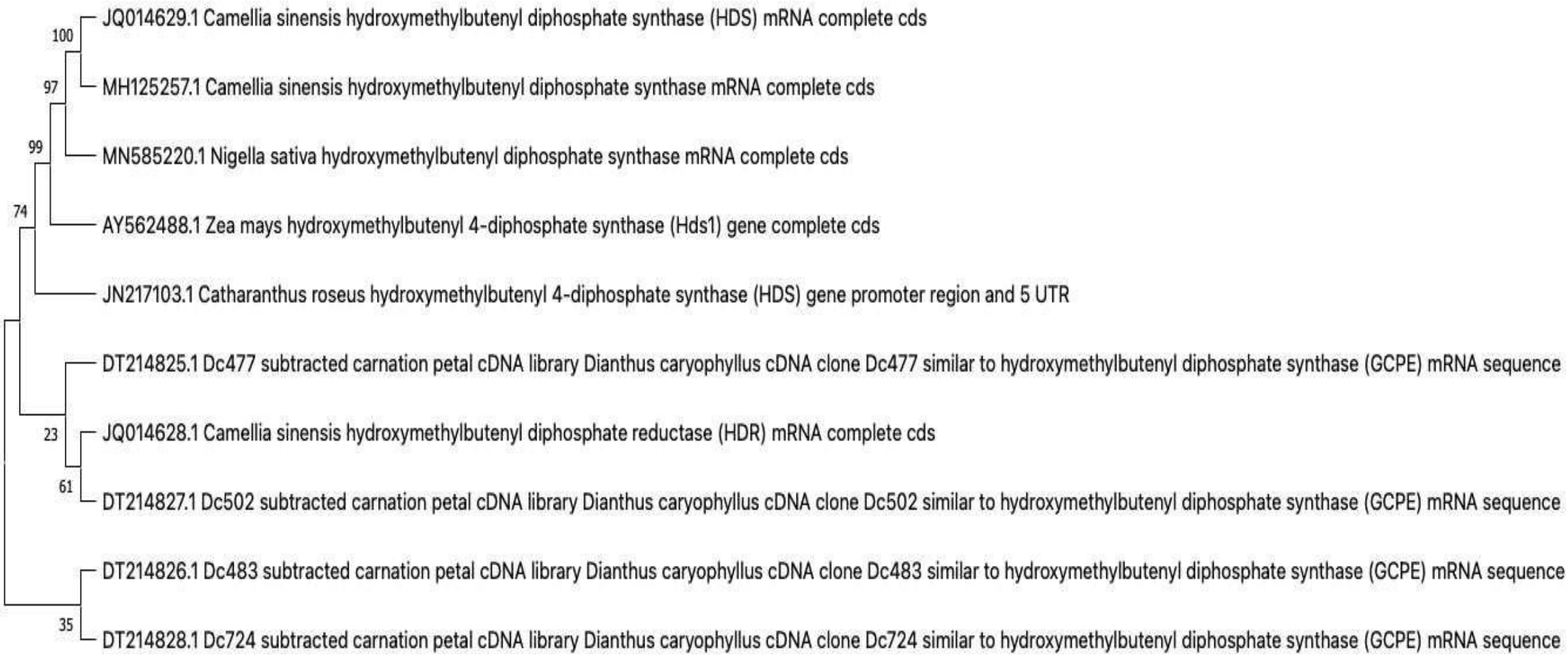
Diphosphocytidylyl methyl erythritol (CDP-ME) Kinase



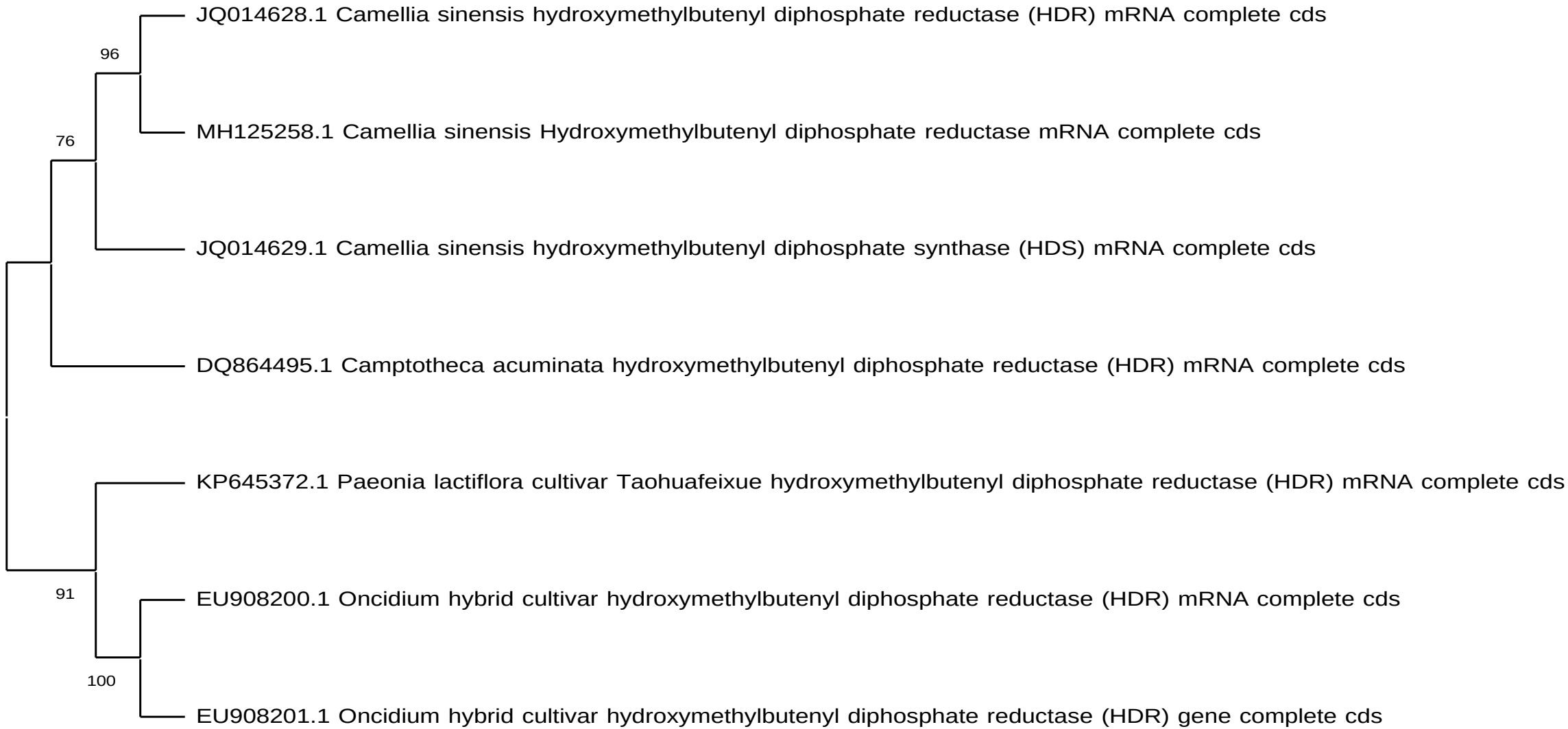
Methylerythritol 2,4-cyclodiphosphate (ME-cPP) Synthase



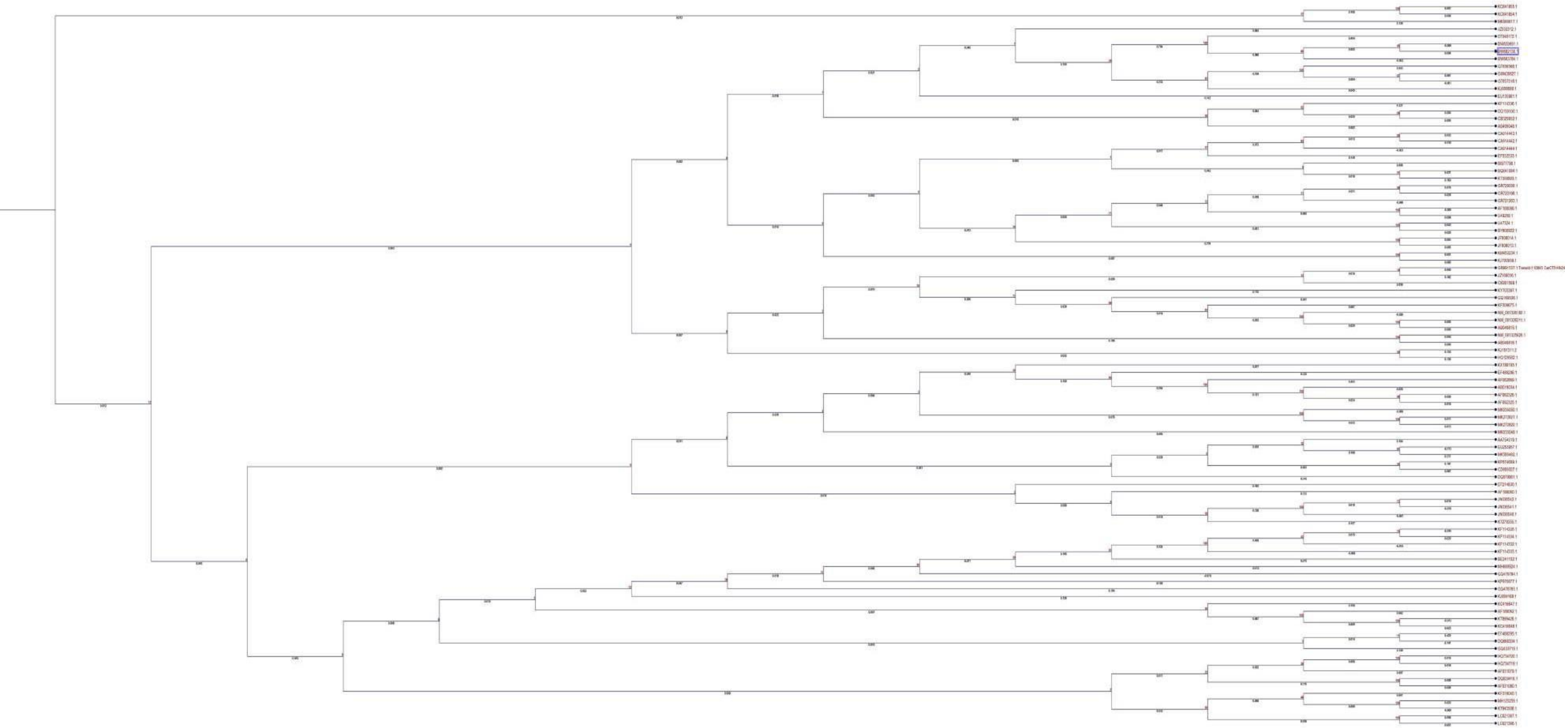
Hydroxymethylbutenyl diphosphate (HMBPP) Synthase



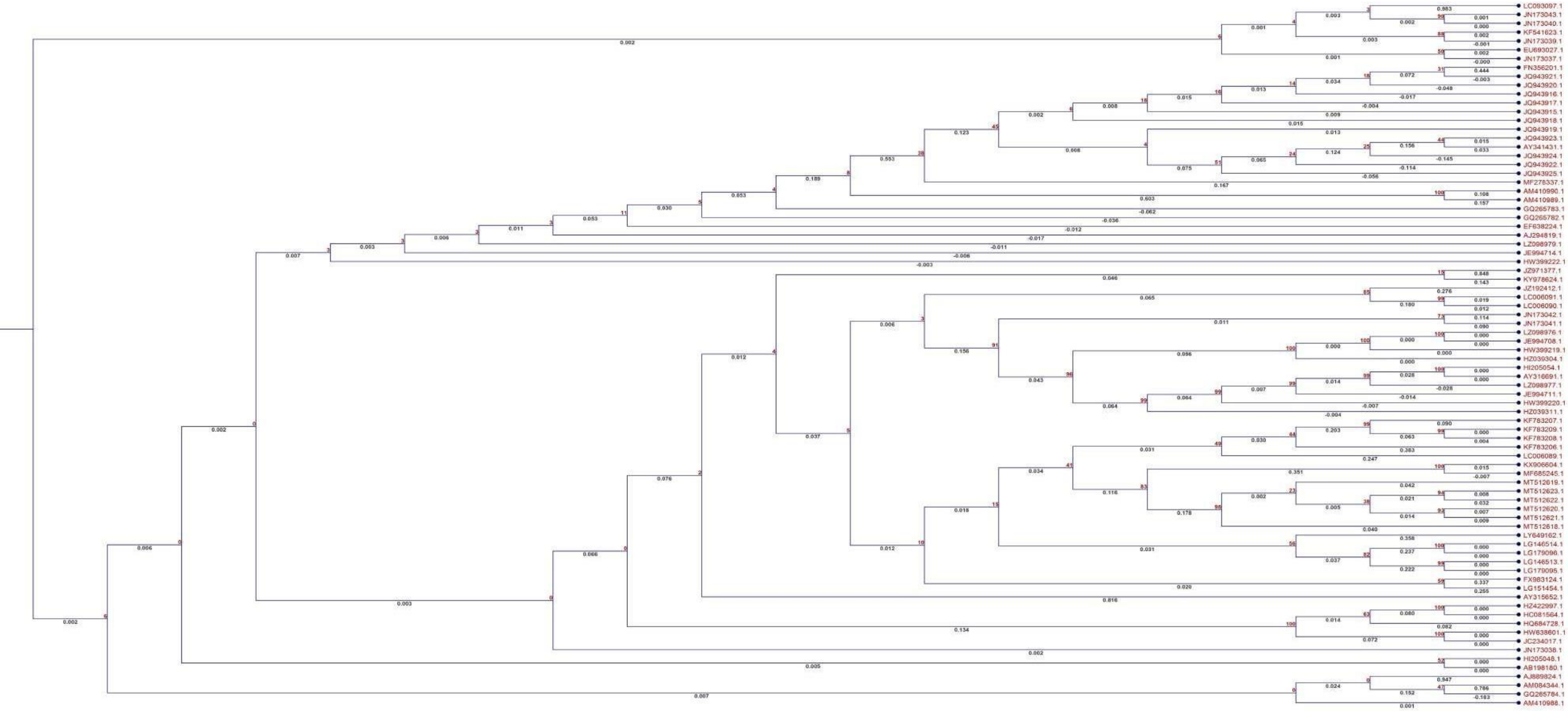
Hydroxymethylbutenyl diphosphate (HMBPP) Reductase



Isopentenyl diphosphate Isomerase

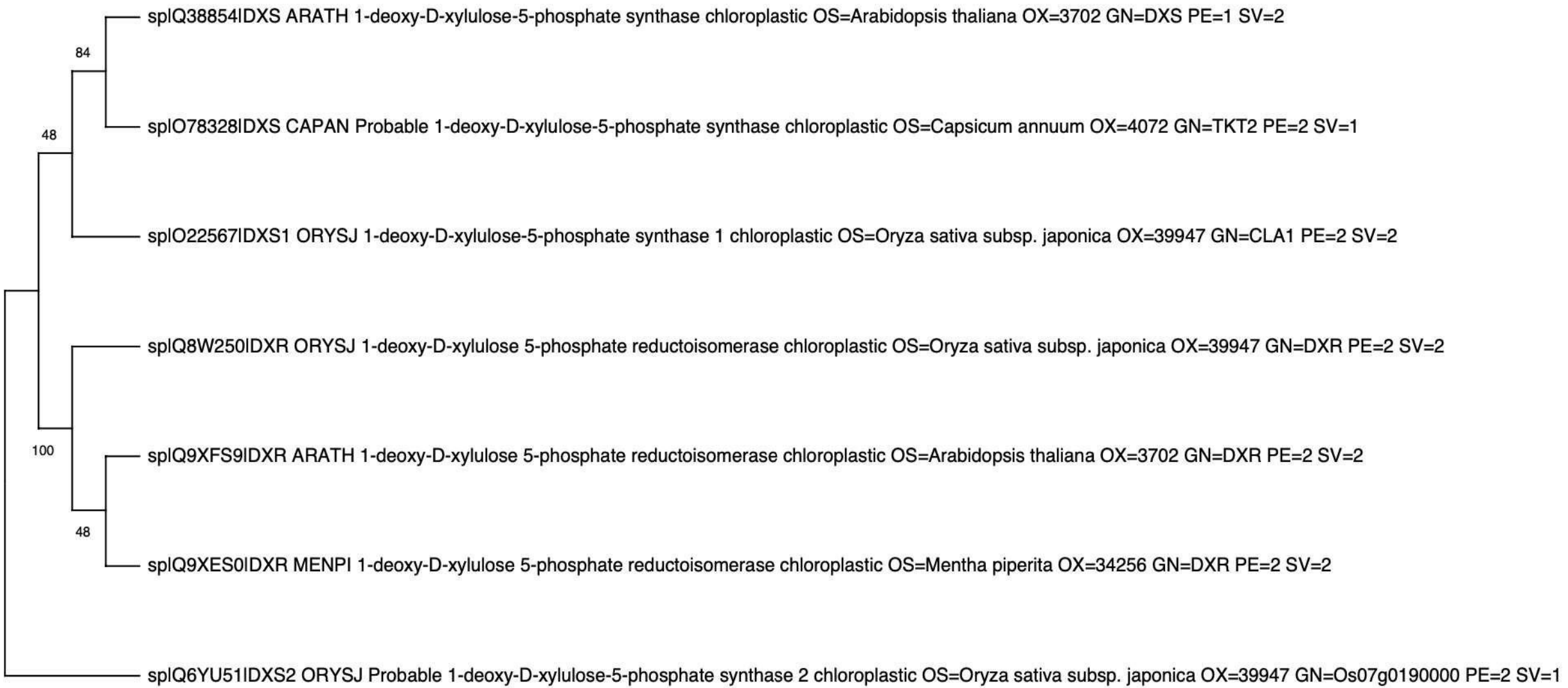


Isoprene Synthase

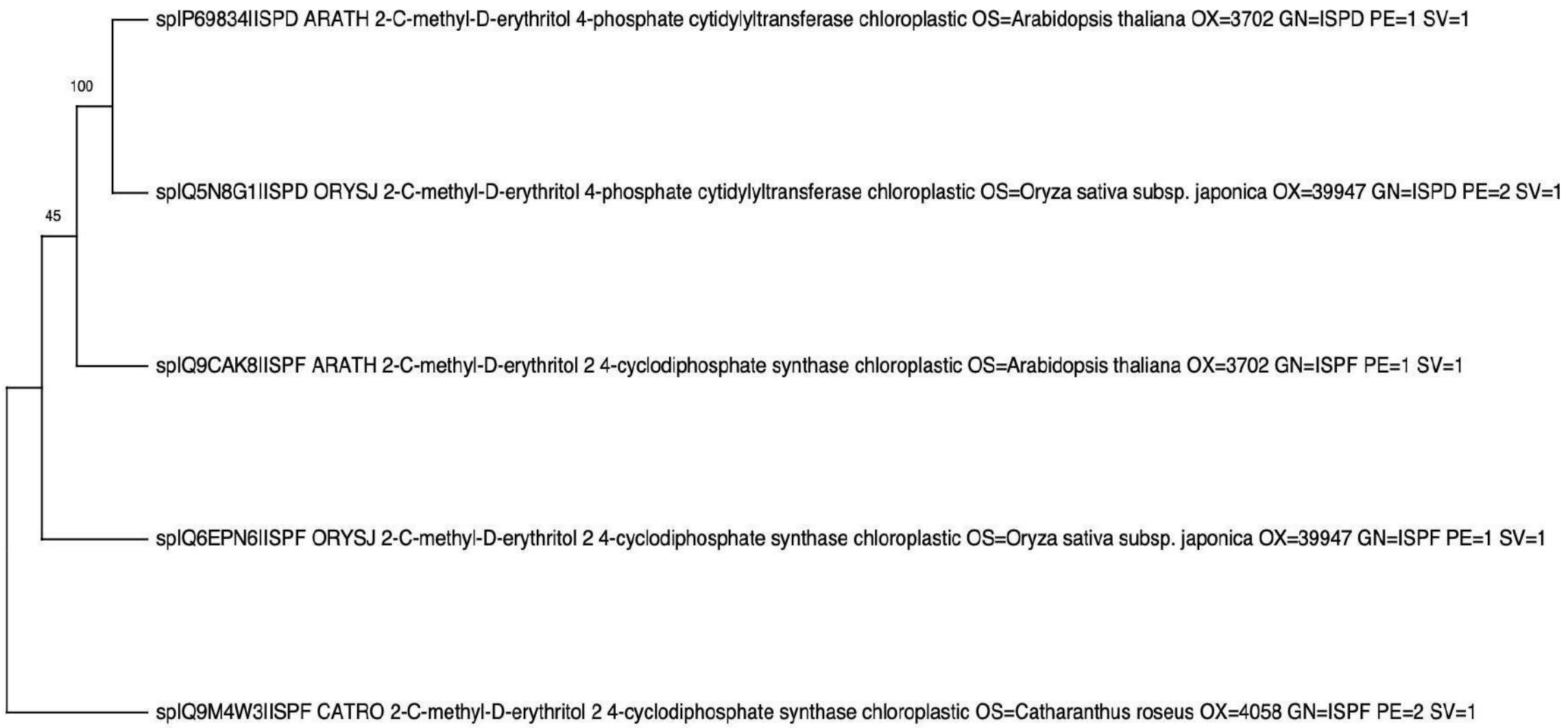


UNIPROT PHYLOGENETIC TREES

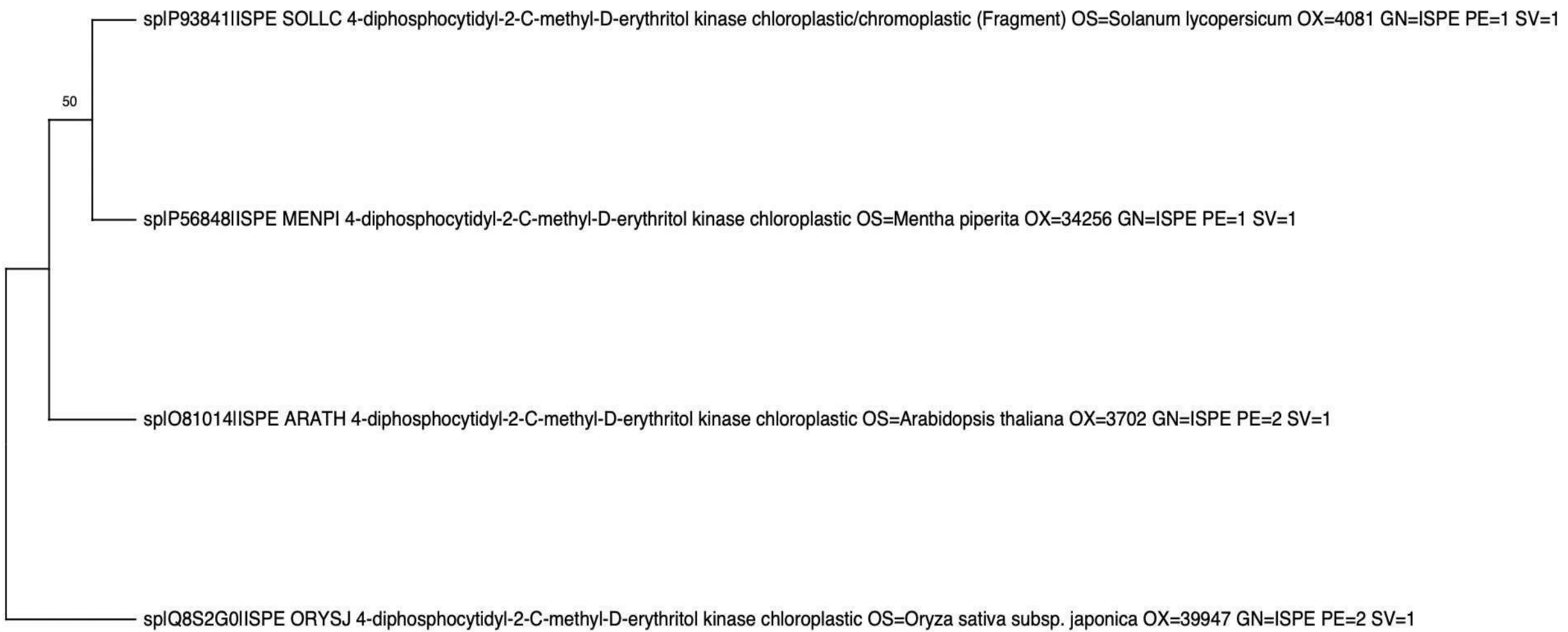
Deoxyxylulose 5-phosphate (DXP) Synthase



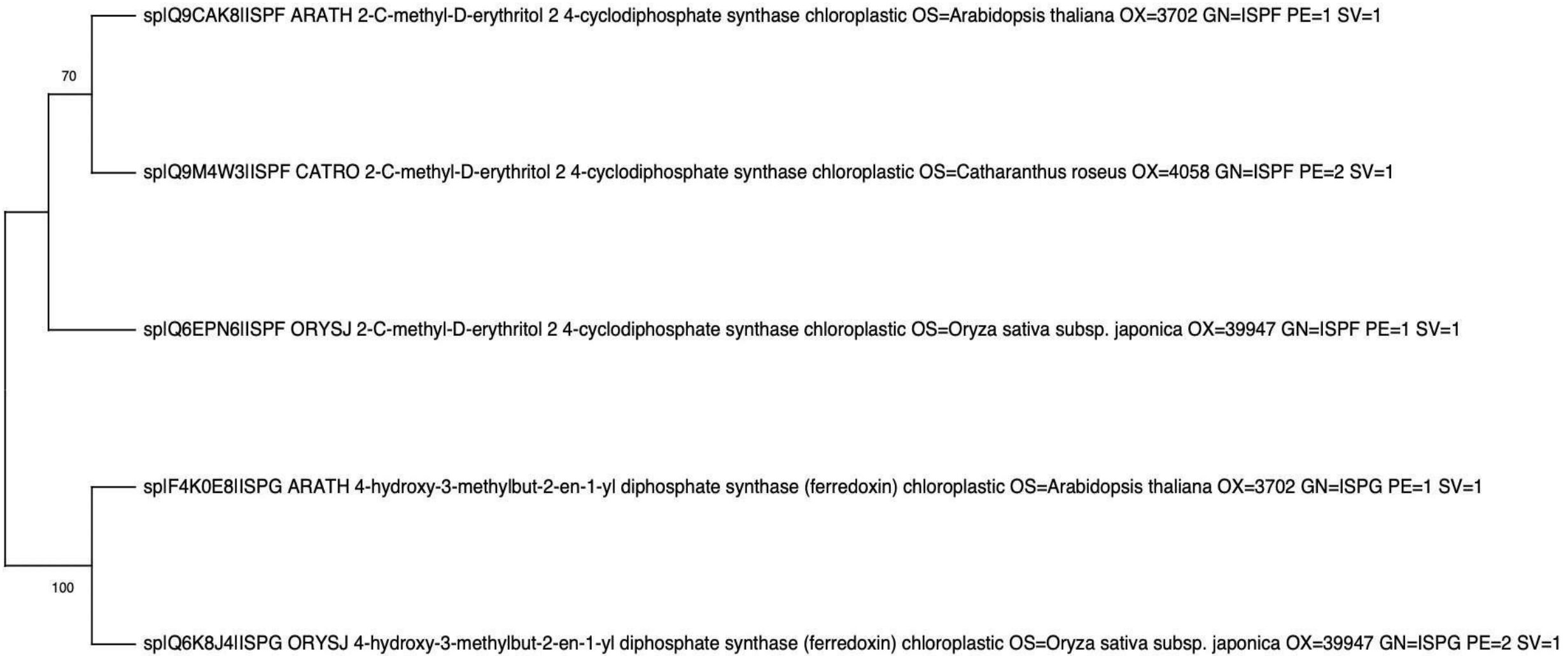
Diphosphocytidylyl methyl erythritol (CDP-ME) Synthase



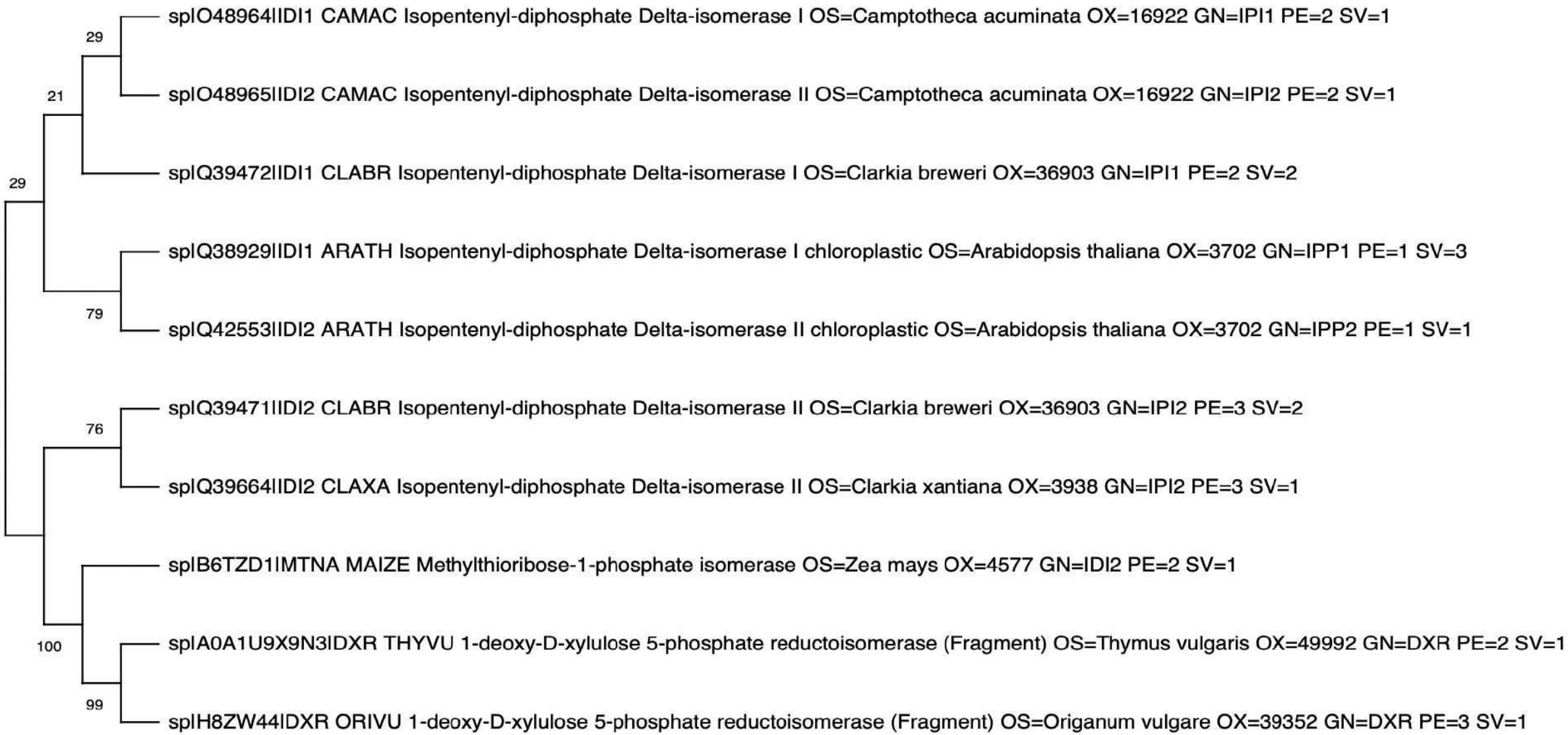
Diphosphocytidylyl methyl erythritol (CDP-ME) Kinase



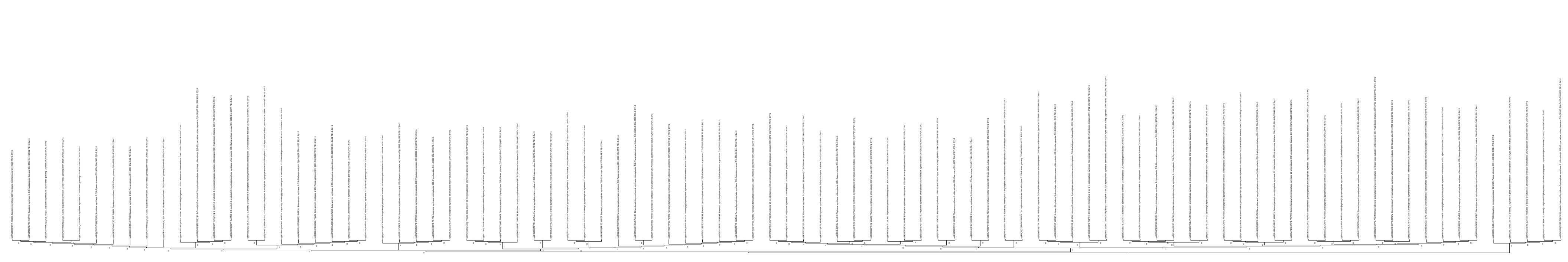
Methylerythritol 2,4-cyclodiphosphate (ME-cPP) Synthase



Isopentenyl diphosphate Isomerase



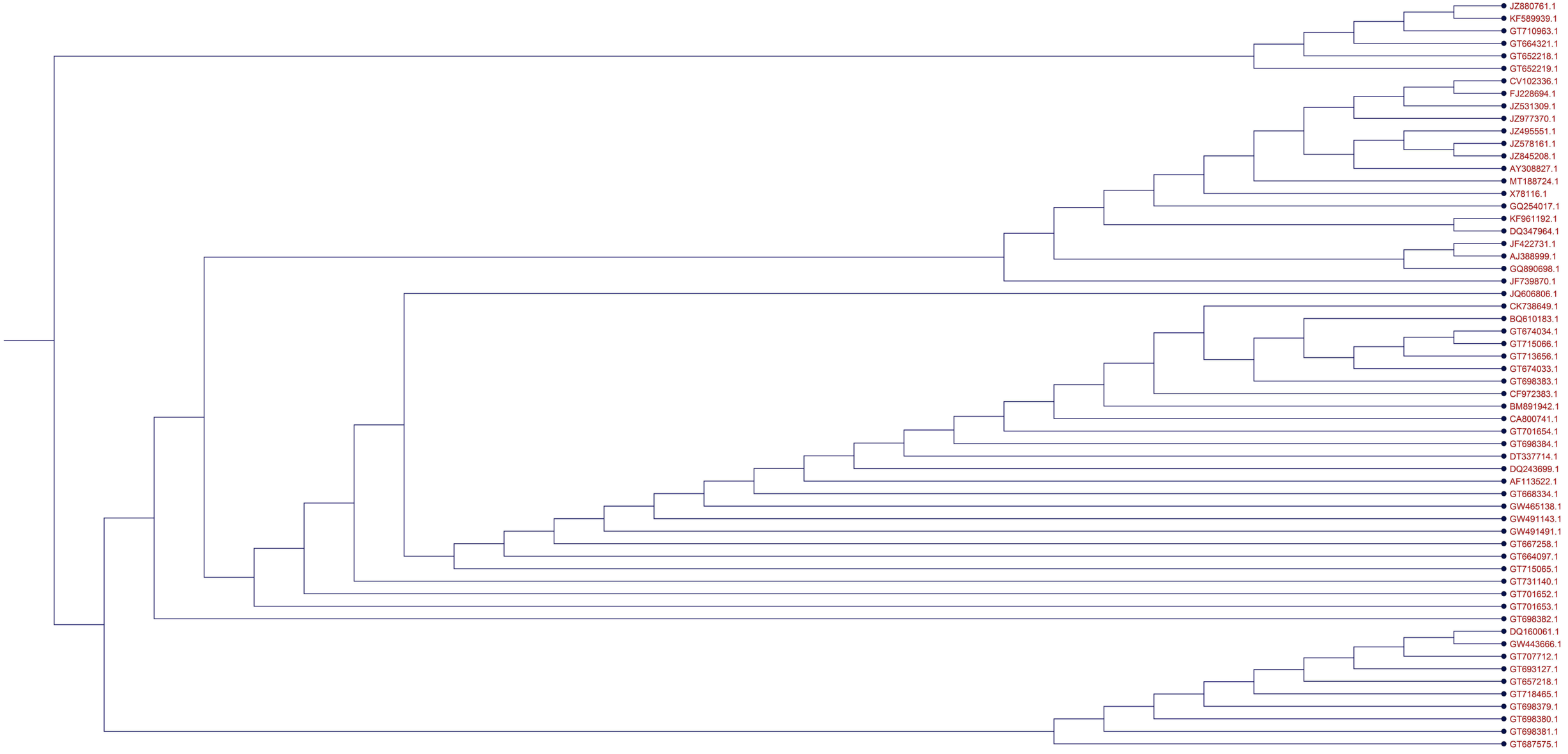
Isoprene Synthase



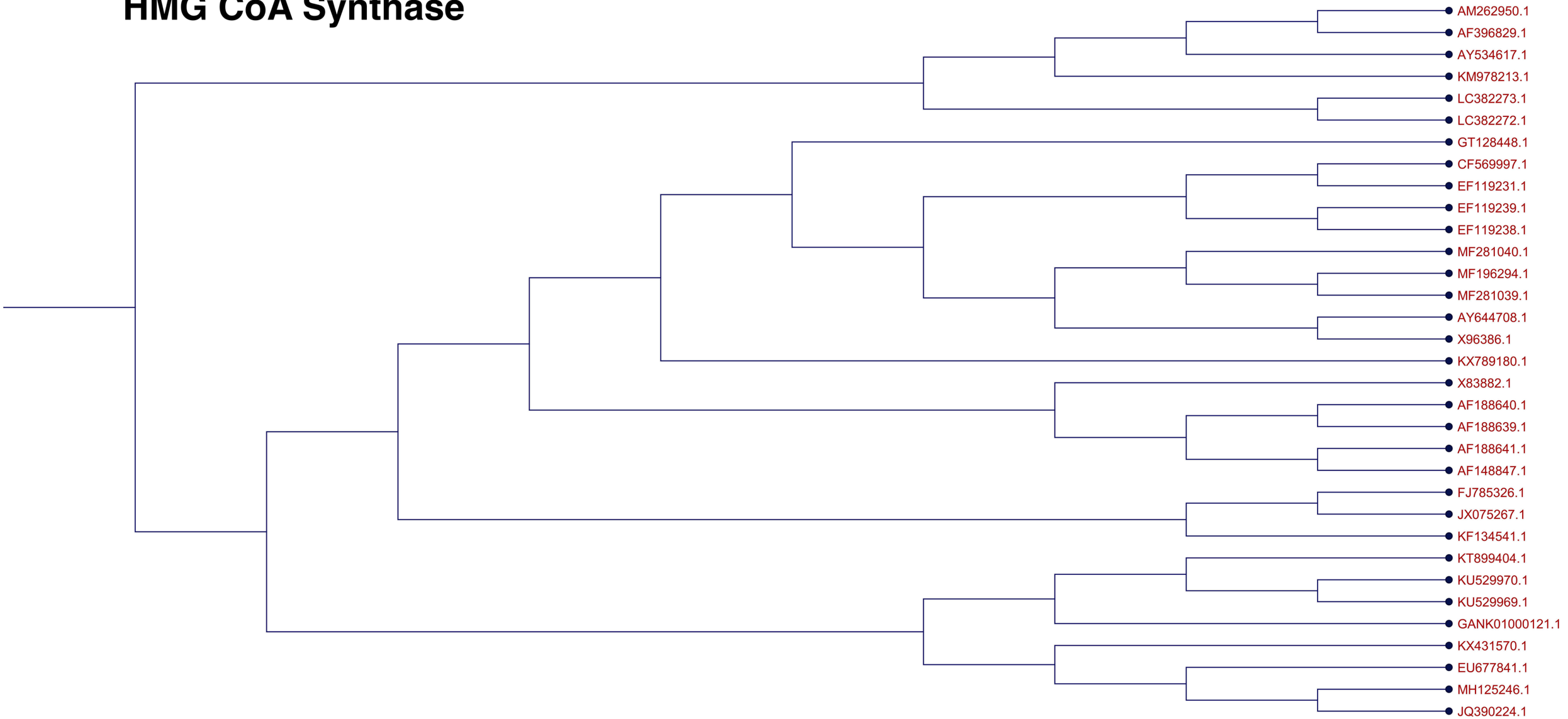
MEVALONIC ACID (MVA) PATHWAY

GENBANK PHYLOGENETIC TREES

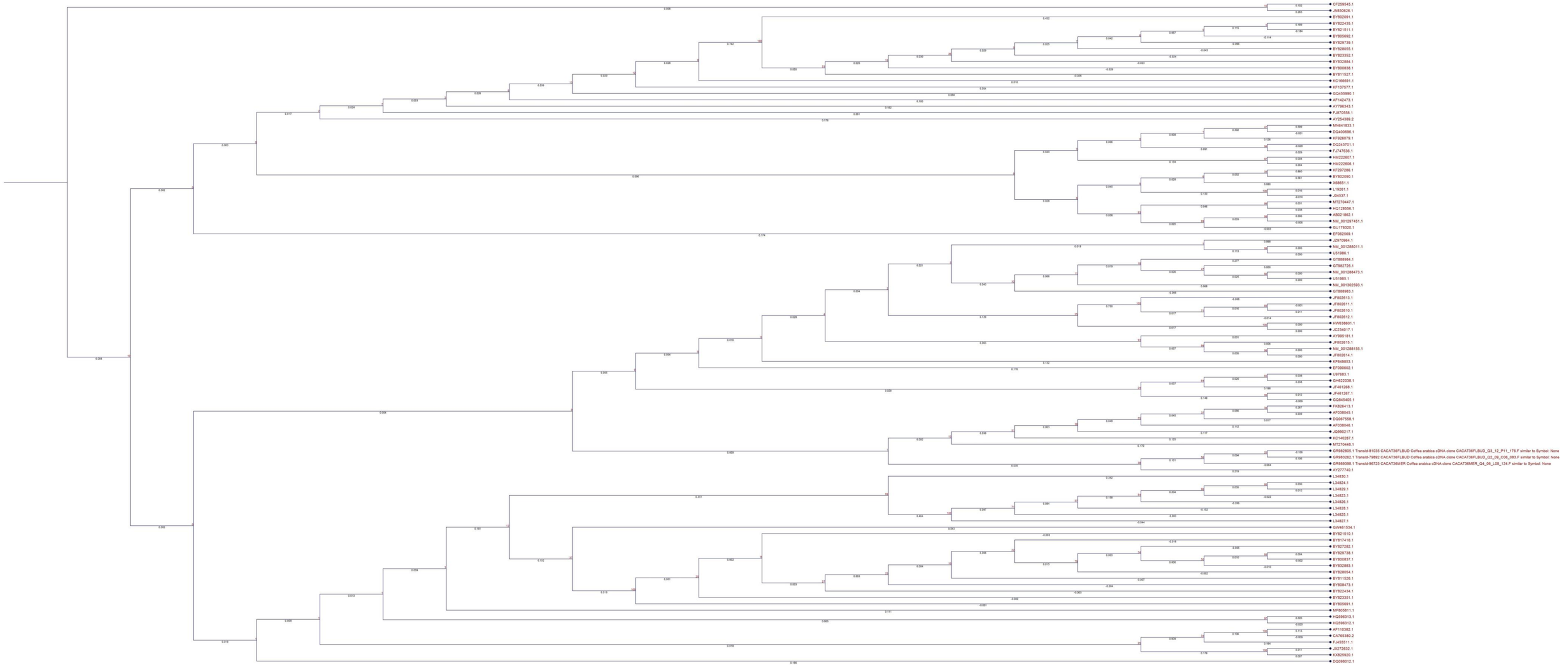
Acetoacetyl CoA thiolase



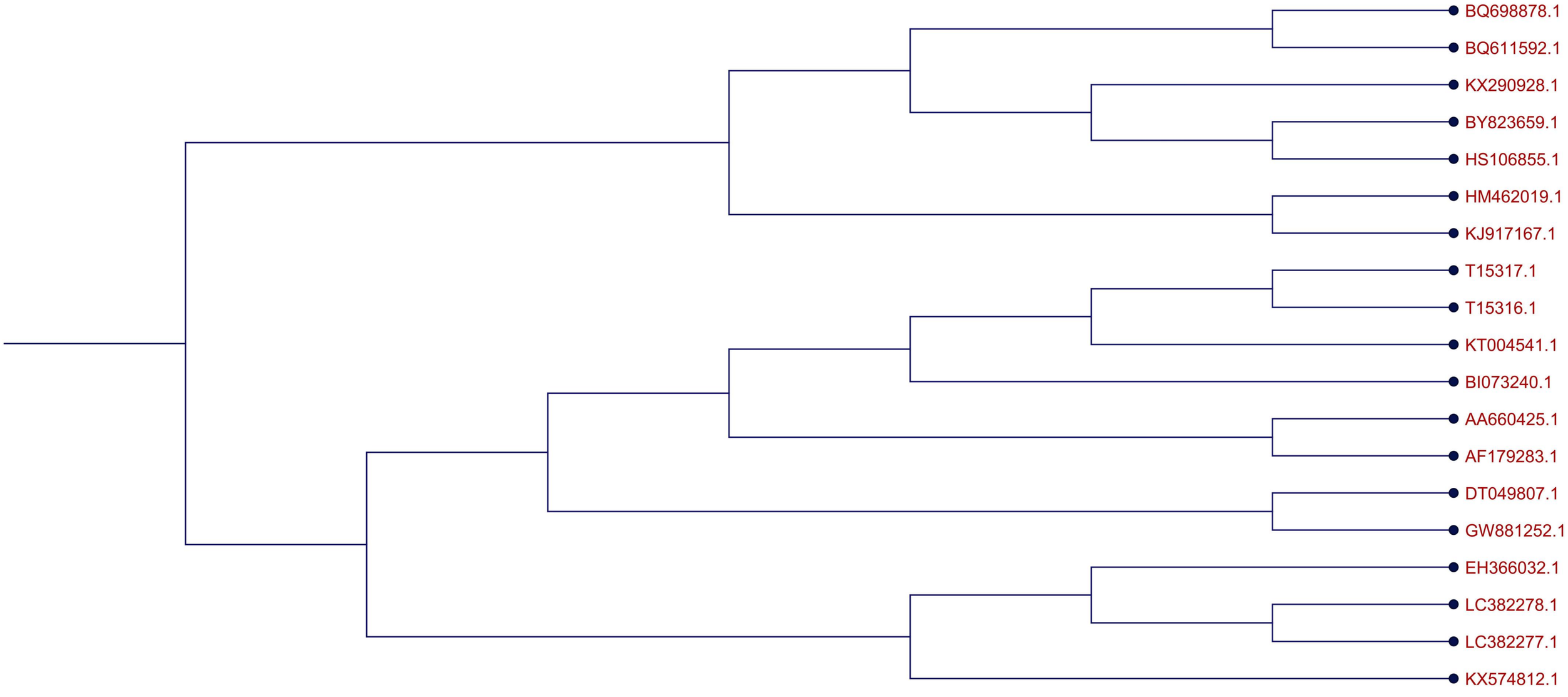
HMG CoA Synthase



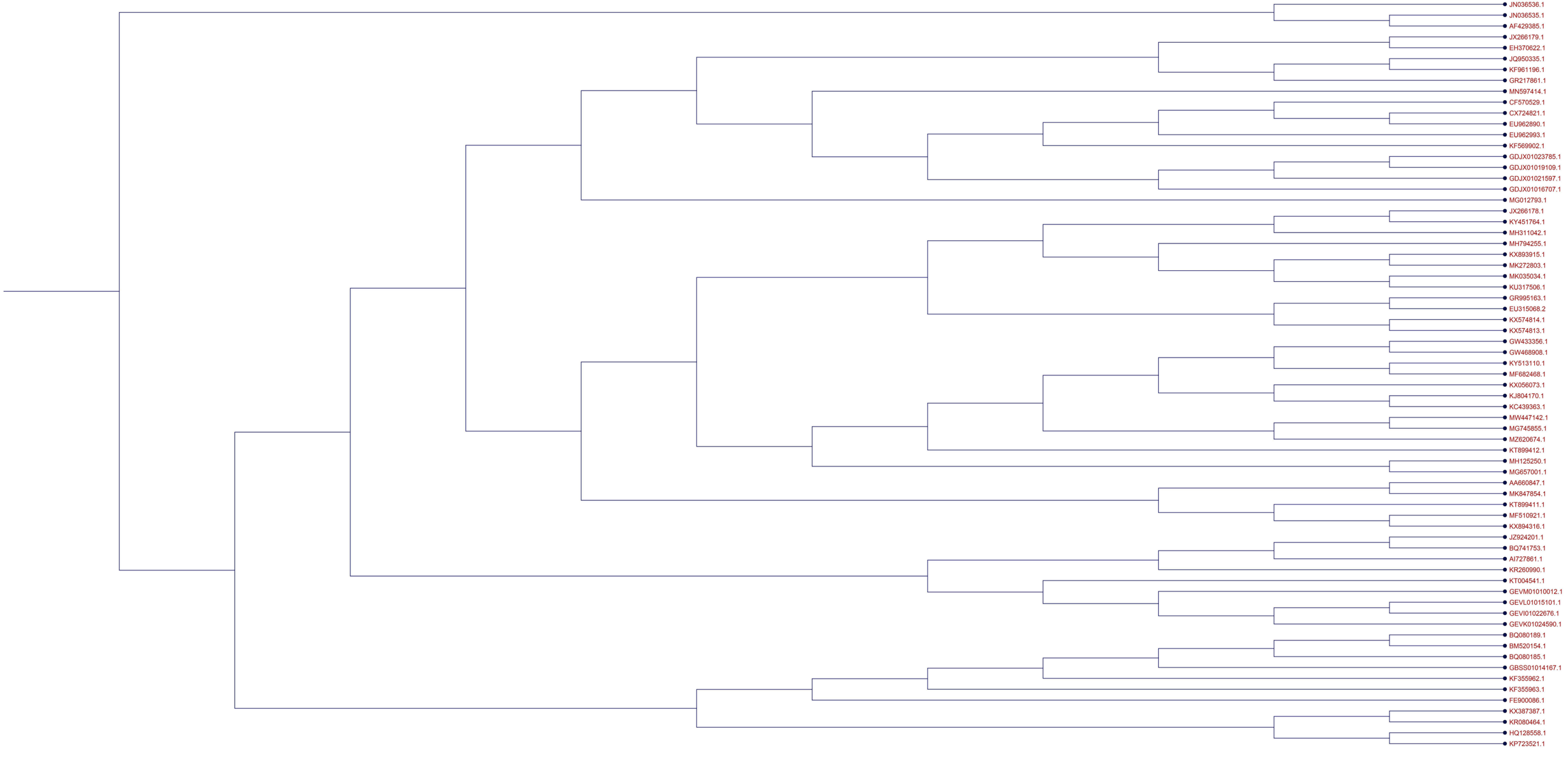
HMG CoA reductase



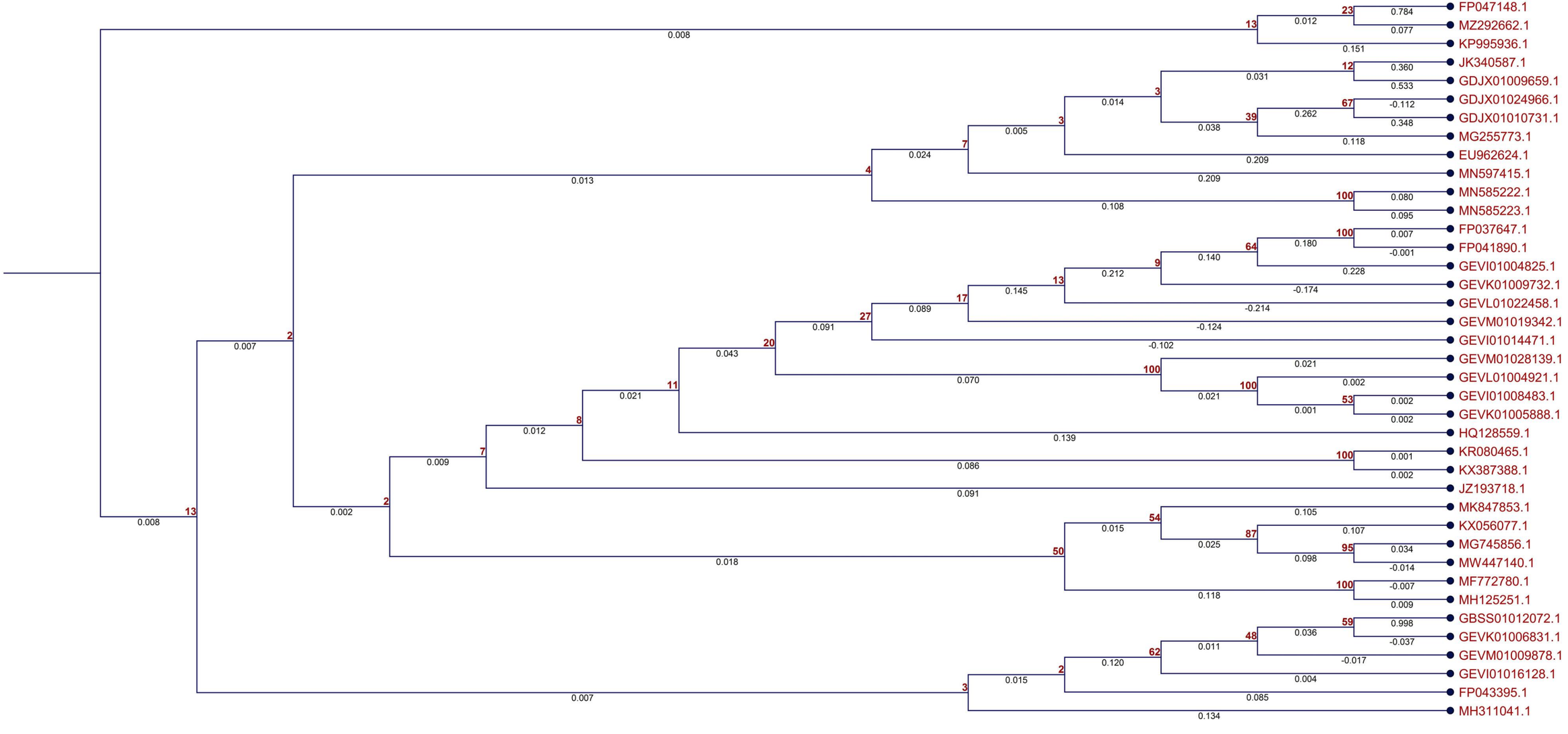
Mevalonate 5 kinase



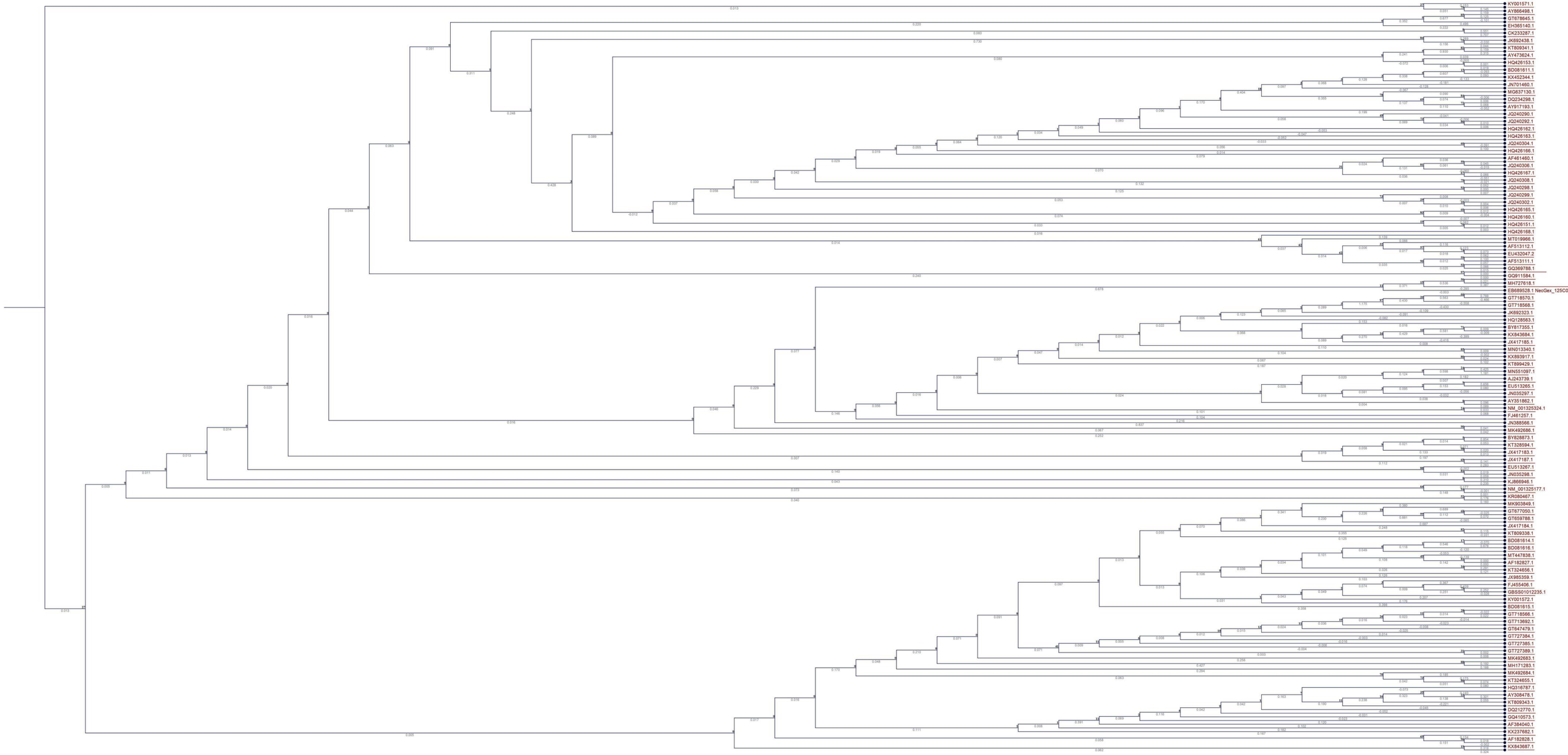
Phosphomevalonate Kinase



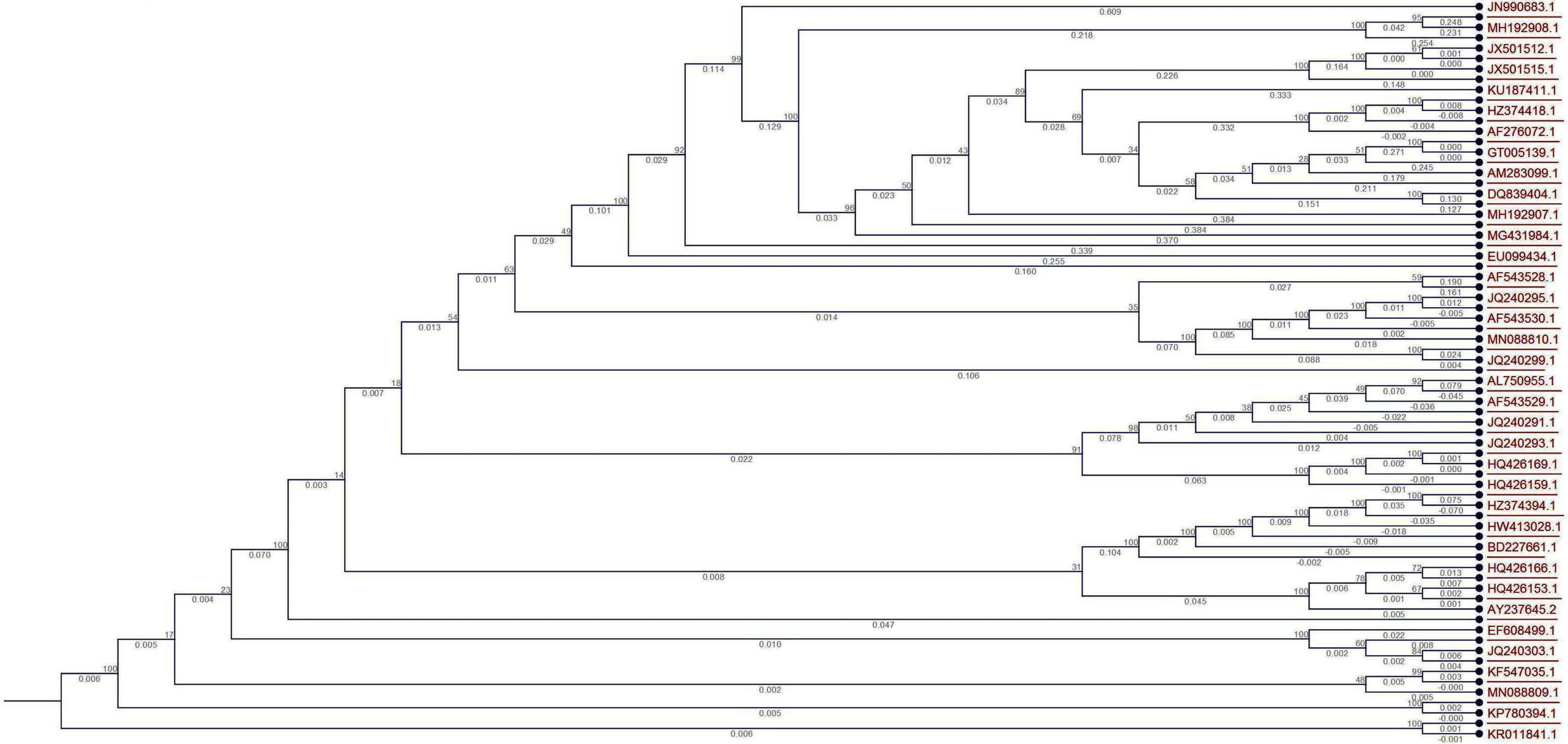
Diphosphomevalonate decarboxylase



Geranyl diphosphate synthase

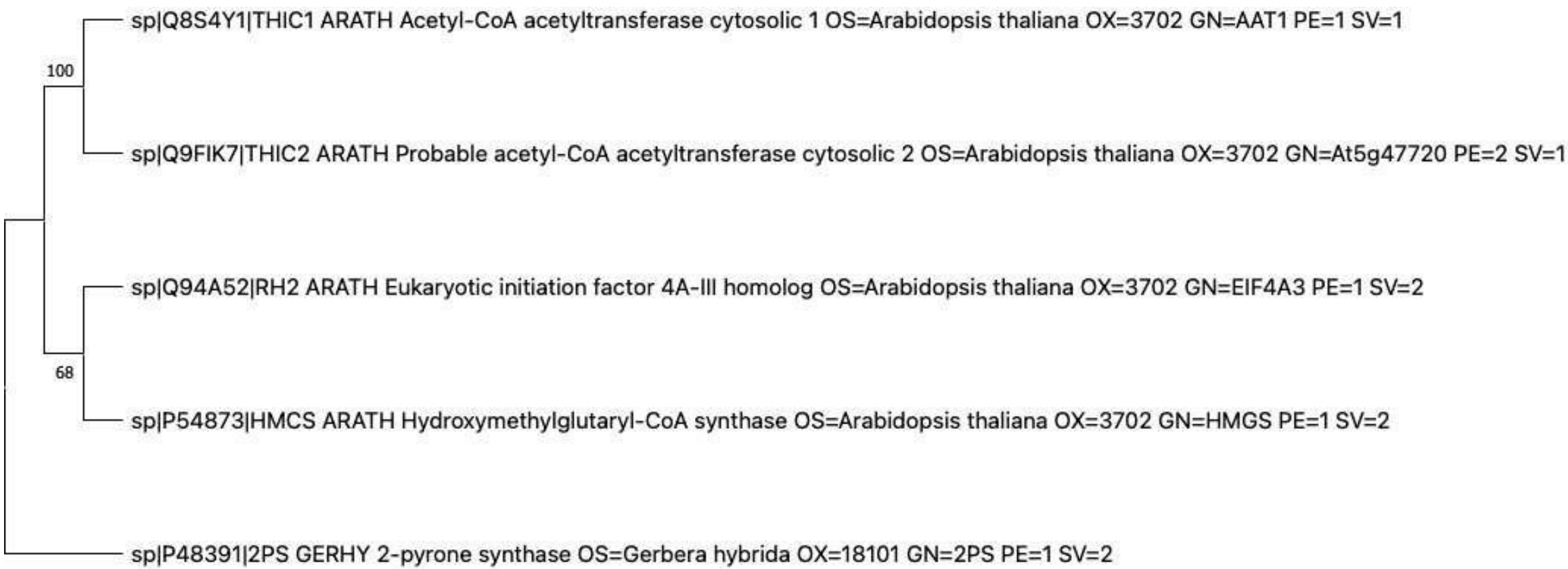


Pinene synthase



UNIPROT PHYLOGENETIC TREES

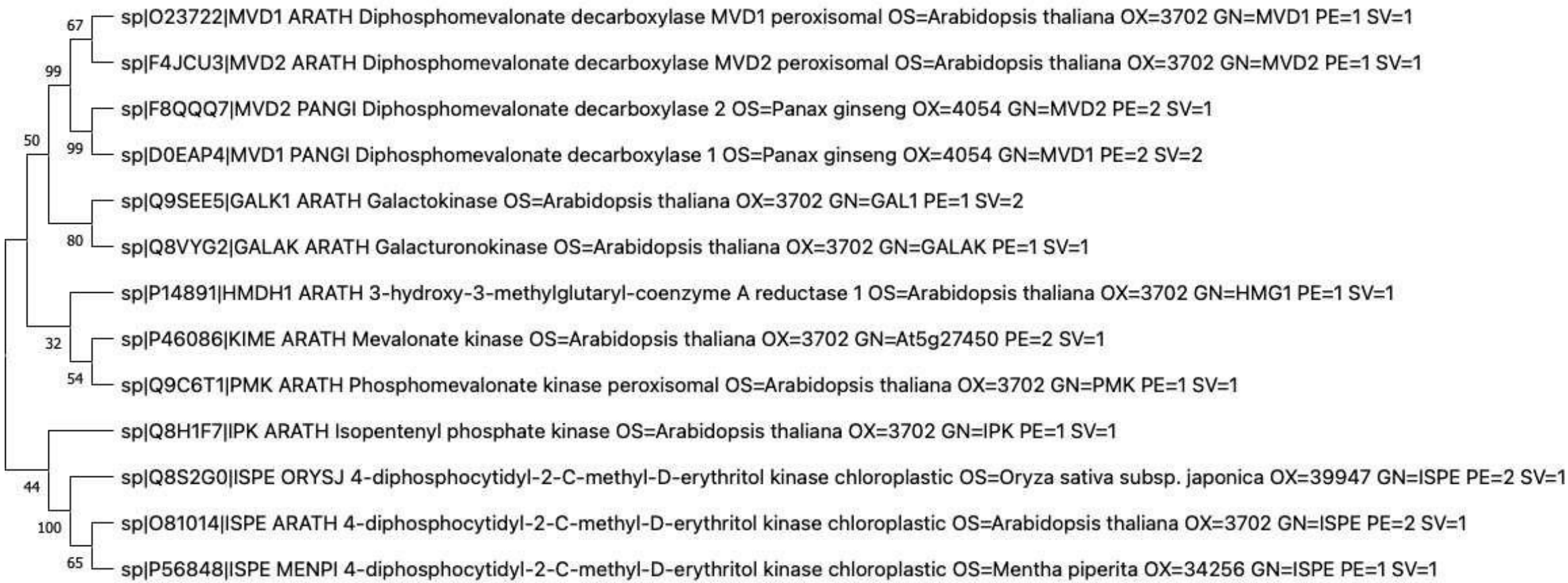
Acetoacetyl CoA thiolase



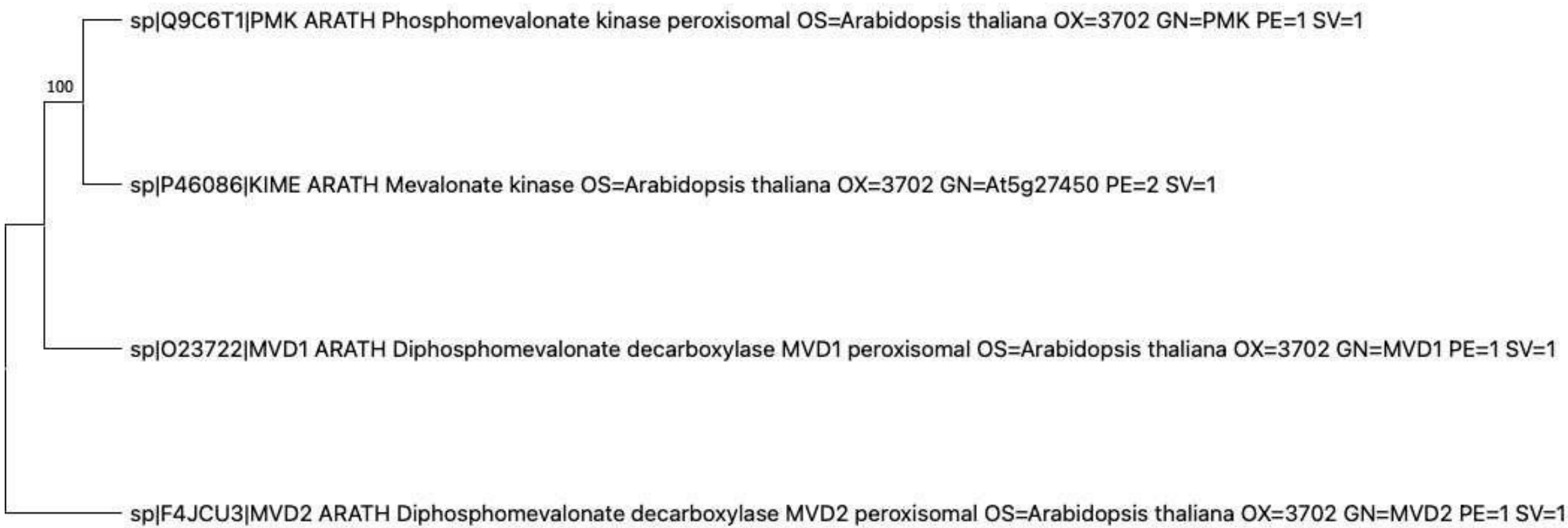
HMG CoA synthase

HMG CoA reductase

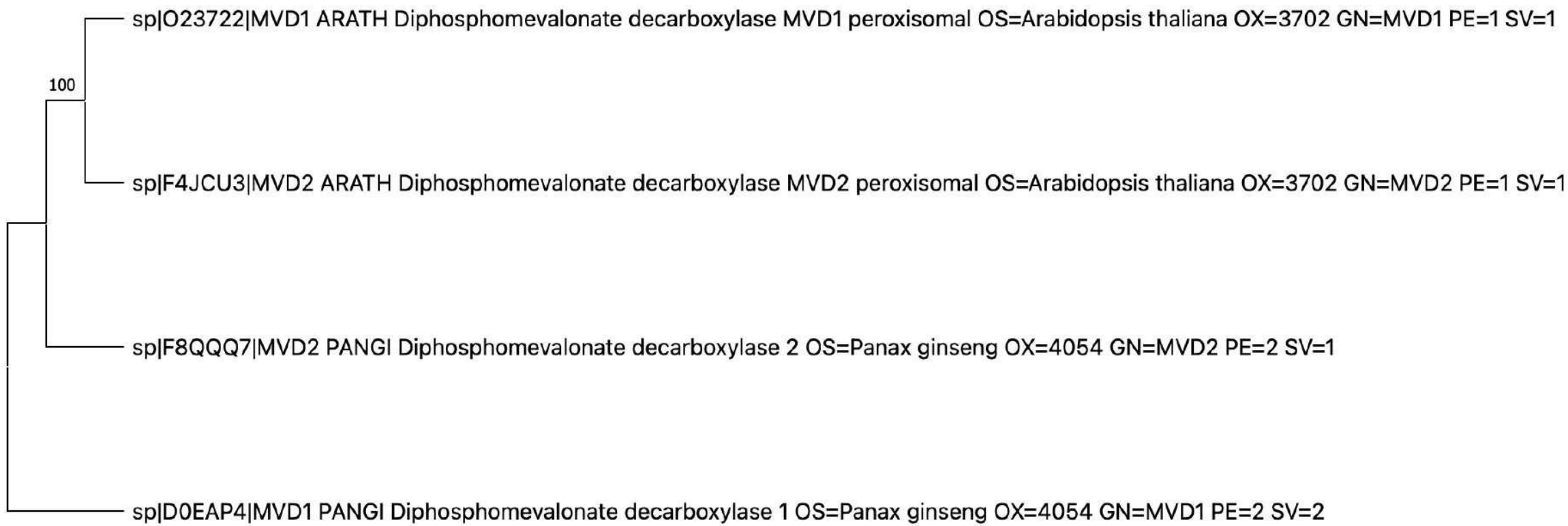
Mevalonate 5 kinase



Phosphomevalonate kinase



Diphosphomevalonate decarboxylase



Geranyl diphosphate synthase

Pinene synthase