Basidiomycota, indicating that fungal terpenoids and TPS genes represent rich but largely untapped natural resources. In addition to the discovery of novel TPS genes and terpenoids, it is also valuable to identify other potentially more efficient TPSs than existing TPSs with the same functions or products. This is due to the various applications of terpenoids and huge commercial interests in terpenoids. In some cases, the production of terpenoids was limited by insufficient activity of terpene synthases. Identification of TPS enzymes with novel products, superior activity and selectivity would greatly benefit the industrial biotechnology society for terpenoid production.

SUMMARY

[0006] In one aspect, there is provided a bacterial strain comprising one or more vectors encoding

a) one or more enzymes to produce one or more terpene precursors; and

b) a fungal terpene synthase (FTPS).

[0006a] In one aspect, there is provided a bacterial strain comprising one or more vectors encoding

a) one or more enzymes to produce one or more terpene precursors; and

b) a fungal terpene synthase (FTPS), wherein the FTPS is an *Agrocybe aegerita* FTPS or a genetically modified *Agrocybe aegerita* FTPS,

wherein the FTPS comprises an amino acid sequence having at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or 100% identity to an amino acid sequence set forth in SEQ ID NO: 1, SEQ ID NO: 20, SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, SEQ ID NO: 29, SEQ ID NO: 30, SEQ ID NO: 31, SEQ ID NO: 32, SEQ ID NO: 33 or SEQ ID NO: 34.

[0007] In another aspect, there is provided a genetically modified 1-deoxyxylulose-5-phosphate synthase (DXS) enzyme, wherein the genetic modification is a mutation at one or more amino acid positions.

[0008] In another aspect, there is provided a genetically modified fungal terpene synthase (FTPS), wherein the genetic modification is a mutation at one or more amino acid positions.

[0009] In another aspect, there is provided a method of producing a terpenoid comprising a) culturing the bacterial strain as described herein in an expression medium, and b) isolating the terpenoid from said expression medium.

[0010] In another aspect, there is provided a method of producing a terpenoid comprising a) culturing a bacterial strain comprising a vector encoding the genetically modified FTPS as described herein in an expression medium and b) isolating the terpenoid from said expression medium.

[0011] In another aspect, there is provided a fungal terpene synthase (FTPS) encoded by a polynucleotide comprising a nucleic acid sequence selected from the group consisting of SEQ ID NO: 35, SEQ ID NO: 36, SEQ ID NO: 37, SEQ ID NO: 38 and SEQ ID NO:39.

[0012] In another aspect, there is provided an isolated nucleic acid molecule comprising a nucleic acid sequence selected from the group consisting of SEQ ID NO: 35, SEQ ID NO: 36, SEQ ID NO: 37, SEQ ID NO: 38 and SEQ ID NO:39.

Claims

1. A bacterial strain comprising one or more vectors encoding

a) one or more enzymes to produce one or more terpene precursors; and

b) a fungal terpene synthase (FTPS), wherein the FTPS is an *Agrocybe aegerita* FTPS or a genetically modified *Agrocybe aegerita* FTPS,

wherein the FTPS comprises an amino acid sequence having at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or 100% identity to an amino acid sequence set forth in SEQ ID NO: 1, SEQ ID NO: 20, SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, SEQ ID NO: 29, SEQ ID NO: 30, SEQ ID NO: 31, SEQ ID NO: 32, SEQ ID NO: 33 or SEQ ID NO: 34.

2. The bacterial strain according to claim 1, wherein the one or more vectors comprise one or more nucleotide sequences encoding the one or more enzymes and the FTPS, operably linked to an inducible promoter.

3. The bacterial strain according to claims 1 and 2, wherein the one or more enzymes to produce the one or more terpene precursors is part of the 1-deoxy-D-xylulose 5-phosphate (DXP) pathway.

4. The bacterial strain according to claim 3, wherein the enzyme is 1-deoxyxylulose-5-phosphate synthase (DXS), isopentenyl diphosphate isomerase (IDI) or both.

5. The bacterial strain according to claim 4, wherein the DXS comprises the amino acid sequence set forth in SEQ ID NO: 6.

6. The bacterial strain according to claim 4, wherein the DXS is genetically modified.

7. The bacterial strain according to claim 6, wherein the genetically modified DXS comprises the amino acid sequence set forth in SEQ ID NO: 24 or 25.

8. The bacterial strain according to claim 5 or 7, wherein the DXS comprises an amino acid sequence having at least 80%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or 100% identity to an amino acid sequence set forth in SEQ ID NO: 6, SEQ ID NO: 24 or 25.

9. The bacterial strain according to any one of claims 1 to 8, wherein the one or more enzymes to produce the one or more terpene precursors is expressed at an elevated level compared to a wild type enzyme.

10. The bacterial strain according to any one of claims 1 to 9, wherein the one or more terpene precursors is farnesyl pyrophosphate (FPP), geranyl pyrophosphate (GPP), geranylgeranyl pyrophosphate (GGPP), or combinations thereof.

11. The bacterial strain according to any one of claims 1 to 10, wherein the FTPS is a monoterpene synthase or a sesquiterpene synthase.

12. The bacterial strain according to any one of claims 1 to 11, wherein the FTPS comprises an amino acid sequence selected from the group consisting of SEQ ID NO: 1, SEQ ID NO: 20, SEQ ID NO: 26, SEQ ID NO:27, SEQ ID NO:28, SEQ ID NO:29, SEQ ID NO: 30, SEQ ID NO:31, SEQ ID NO:32, SEQ ID NO:33 and SEQ ID NO:34.

13. The bacterial strain according to any one of claims 1 to 11, wherein the FTPS is encoded by a nucleic acid sequence selected from the group consisting of SEQ ID NO: 35, SEQ ID NO: 71, SEQ ID NO: 40, SEQ ID NO: 41, SEQ ID NO: 42, SEQ ID NO:43, SEQ ID NO: 44, SEQ ID NO: 45, SEQ ID NO: 46, SEQ ID NO: 47 and SEQ ID NO: 48.

14. The bacterial strain according to claim 13, wherein the FTPS is expressed at a higher level than a wild-type FTPS.

15. The bacterial strain according to any one of claims 1 to 14, wherein the bacterial strain is *Escherichia coli.*

16. A method of producing a terpenoid comprising

a) culturing the bacterial strain according to any one of claims 1 to 15 in an expression medium;

b) isolating the terpenoid from said expression medium.