

FIG. 1

*CYP71D-A4* cDNA sequence.*CYP71D-A4* cDNA coding sequence

ATGAAGAGTATACTAAAAGCAATGGCACTCTCACTGACCACTTCCATT  
GCTCTTGCAACGATCCTTTTGTTCGTTTACAAGTTTCGCTACTCGTTCC  
AAATCCACCAAAAAAAGCCTTCCTGAGCCATGGCGGCTTCCCATTATT  
GGTCACATGCATCACTTGATTGGTACAACGCCACATCGTGGGGTTAGG  
GATTTAGCCAGAAAGTATGGATCTTTGATGCATTTACAGCTTGGTGAA  
GTTCCAACAATCGTGGTGTATCTCCGAAATGGGCTAAAGAGATTTTG  
ACAACGTACGACATTACCTTTGCTAACAGGCCCGAGACTTTAACTGGT  
GAGATTGTTTTATATCACAATACGGATGTTGTTCTTGACCTTATGGT  
GAATACTGGAGGCAATTACGTAAAATTTGCACATTGGAGCTTTTGAGT  
GTTAAGAAAGTAAAGTCATTTCACTTCGTGAAGAGGAGTGTGG  
AATTTGGTTCAAGAGATTAAAGCTTCAGGTTCAAGGAGACCGGTTAAC  
CTTTCAGAGAATGTTTTCAAGTTGATTGCAACGATACTTAGTAGAGCC  
GCATTTGGGAAAGGGATCAAGGACCAGAAAGAGTTAACGGAGATTGTG  
AAAGAGATACTGAGGCAAACCTGGTGGTTTTGATGTGGCAGATATCTTT  
CCTTCAAAGAAATTTCTTCATCATCTTTTCGGGCAAGAGAGCTCGGTTA  
ACTAGCCTTCGCAAAAAGATCGATAATTTAATCGATAACCTTGTAGCT  
GAGCATACTGTTAACACCTCCAGTAAAATAACGAGACACTCCTCGAT  
GTTCTTTTAAGGCTCAAAGACAGTGCTGAATTTCCCATTAACATCTGAT  
AACATTAAAGCCATCATTTTGGATATGTTTGGAGCAGGCACAGACACT  
TCCTCATCCACAATCGAATGGGCGATTTTCGGAACATATAAAGTGTCCG  
AAAGCAATGGAGAAAGTACAAGCGGAATTGAGGAAAGCATTGAACGGA  
AAAGAAAAGATCCATGAGGAAGACATTCAAGAACTAAGCTACTTGAAC  
ATGGTAATCAAAGAAACATTGAGGTTGCACCCTCCACTACCCTTGGTT  
CTGCCAAGAGAGTGCCGCCAACCAGTCAATTTGGCTGGATACAACATA  
CCCAATAAGACCAAACCTTATTGTCAACGTCTTTGCGATAAATAGGGAC  
CCTGAATATTGGAAAGACGCTGAAGCTTTCATCCCTGAACGATTTGAA  
AATAGTTCTGCAACTGTCATGGGTGCAGAATACGAGTATCTTCCGTTT  
GGAGCTGGGAGAAGGATGTGTCCTGGAGCCGCACTTGGTTTAGCTAAC  
GTGCAGCTCCCGCTCGCTAATATACTATATCATTTCAACTGGAAACTC  
CCCAATGGTGTGAGCTATGACCAGATCGACATGACCGAGAGCTCTGGA  
GCCACGATGCAAAGAAAGACTGAGTTGTTACTCGTTCCAAGTTTCTAG  
(SEQ ID NO:1)

FIG. 2.

Amorphadiene 12-oxidase amino acid sequence  
MKSILKAMALSLTTSIALATILLFVYKFPATRSKSTKKSLPEPWRLPII  
GHMHHLIGTTPHRGVRDLARKYGSLMHLQLGEVPTIVVSSPKWAKEIL  
TTYDITFANRPETLTGEIVLYHNTDVVLAPYGEYWRQLRKICTLELLS  
VKKVKSFQSLREEECWNLVQEIKASGSGRPVNLSENVFKLIATILSRA  
AFGKGIKDQKELTEIVKEILRQTGGFDVADIFPSKKFLHHLSGKRARL  
TSLRKKIDNLIDNLVAEHTVNTSSKTNETLLDVLLRLKDSAEFPLTSD  
NIKAIILDMFGAGTDTSSSTIEWAISELIKCPKAMEKVQAE LRKALNG  
KEKIHEEDIQELSYLNMVIKETLRLHPPPLPLVLPRECRQPVNLAGYNI  
PNKTKLIVNVFAINRDPEYWKDAEAFIPERFENS SATVMGA EYEYLPF  
GAGRRMCPGAALGLANVQLPLANILYHFNWKLPNGVSYDQIDMTESG  
ATMQRKTELLLVPSF (SEQ ID NO:2)

FIG. 3

*Artemisia annua* cytochrome P450 reductase DNA

## AACPR cDNA coding sequence

ATGCAATCAACAACCTCCGTTAAGTTATCTCCCTTCGATCTAATGA  
 CGGCGTTACTTAAACGGCAAGGTATCGTTCGACACATCAAACACATC  
 GGATACGAATATTCCGTTAGCGGTGTTTATGGAGAATCGTGAGCTT  
 TTGATGATTTTAACTACTTCGGTTGCGGTGTTGATCGGATGCGTTG  
 TGGTGCTTGTGTGGAGACGGTCGTCGTCGGCGGCGAAGAAAGCGGC  
 GGAGTCGCGCGGTGATTGTTGTGCCGAAGAAAGTGACGGAGGATGAG  
 GTTGATGACGGACGGAAGAAAGTTACTGTGTTTTTGGAACTCAGA  
 CTGGTACTGCTGAAGGTTTTGCTAAGGCGCTTGTTGAAGAAGCTAA  
 AGCGCGATATGAAAAGGCGGTGTTTAAAGTGATTGATTTGGATGAT  
 TATGCTGCTGAAGATGATGAGTATGAGGAGAAGTTAAAGAAAGAAT  
 CTCCTTGCTTTTTCTTTTTAGCTACGTATGGAGATGGTGAGCCGAC  
 AGATAATGCTGCTAGATTCTATAAATGGTTTTACCGAGGGTGAAGAG  
 AAAGGTGAATGGCTTGACAAGCTTCAATACGCAGTGTGTTGGACTTG  
 GTAACAGACAGTATGAGCATTTCACAAGATTGCGAAGGTGGTCTGA  
 TGAAAAAAGTTGTGGAGCAGGGTGCAAAGCGCCTTGTTCTGTGGC  
 ATGGGAGACGATGATCAATGTATCGAAGACGACTTCACTGCATGGA  
 AAGAGTTGGTGTGGCCTGAGTTGGATCAATTACTTCGTGATGAGGA  
 TGATACATCTGTTGCCACTCCATACACAGCTGCTGTTGGAGAATAC  
 CGTGTTGTGTTCCATGACAAACCAGAGACATATGATCAGGATCAAC  
 TGACAAATGGCCATGCTGTTTCATGATGCTCAACATCCATGCAGATC  
 CAATGTGCTGTCAAAAAGGAGCTCCATTCCCCCTCTATCTGACCGG  
 TCTTGCACTCATTGGAATTTGATATCTCTAATACTGGATTATCGT  
 ATGAAACTGGGGACCATGTTGGAGTCTACGTTGAGAATCTAAGTGA  
 AGTTGTGGACGAAGCTGAAAAATTAATAGGTTTACCGCCGCACACT  
 TATTTCTCAGTACATACTGATAACGAAGACGGGACACCACTTGCTG  
 GAGCCTCTTTGCCACCTCCTTTCCCTCCATGCACTTTAAGAAAAGC  
 ATTGGCTTCCATGCGGATGTTTGGAGCTCTCTAAAGTCAGCT  
 TTGCTTGCTTTAGCTGCTCATGCTACTGATTCTACTGAAGCTGATA  
 GACTGAAATTTTTTGCCTCTCCTGCTGGAAAGGATGAATATGCTCA  
 GTGGATAGTTGCAAGCCACAGAAGTCTCCTTGAGGTCATGGAGCC  
 TTCCCATCAGCTAAGCCTCCGCTTGGTGTTTTTTTTTGCATCTGTG  
 CCCCACGTTTGCAGCCGAGATACTATTCATTTCTTCTTCCCCAAA  
 GTTTGGCCCAAATAGGATTCATGTAAGTTGTGCATTAGTGATGAG  
 CAAACACCATCAGGCCGCGTTCACAAGGGAGTCTGTTCAACATGGA  
 TGAAGAATGCCGTGCCTATGACAGAAAGCCAGGATTCAGTTGGGC  
 CCCAATTTATGTTAGAACATCCAATTCAGACTTCCTTCTGATCCT  
 AAGGTCCCAGTTATCATGATTGGCCCAGGCACTGGATTGGCTCCAT  
 TTAGAGGTTTCCTTCAGGAAAGGTTAGCTCAGAAGGAAGCTGGGAC  
 TGAGCTCGGAACAGCCATCTTATTCTTCGGATGCAGGAATCGCAAA  
 GTGGATTTCATATATGAGGACGAGCTTAATAATTTTCGTGGAGACGG  
 GGGCTCTTCCGAGCTTGTTACGGCCTTCTCTCGTGAAGGTGCCAC  
 TAAGGAGTACGTGCAACACAAGATGACTCAGAAGGCTTCGGATATC  
 TGGAATTTACTCTCTGAGGGAGCATATTTGTATGTTTGCGGTGATG  
 CCAAAGGCATGGCCAAAGATGTACATCGGACTCTGCACACTATTGT  
 GCAAGAACAGGGATCTCTAGACTCCTCAAAGGCGGAGCTCTACGTG  
 AAGAATCTACAAATGGCAGGAAGATATCTCCGTGATGTATGGGTG  
 ACATGGGAACAGAAGTTGATTTCGAAGAAGACCTCGAGTAA (SEQ  
 ID NO:3)

FIG. 4

*Artemisia annua* cytochrome P450 reductase  
amino acid sequence  
MQSTTSVKLSPFDLMTALLNGKVSFDTSNTSDTNIPLAVFMENREL  
LMILTTSVAVLIGCVVVLVWRRSSSAKKAAESPVIVVPKKVTEDE  
VDDGRKKVTVFFGTQTGTAEQFAKALVEEAKARYEKAVFKVIDLDD  
YAAEDDEYEEKLKKESLAFFFLATYGDGEPTDNAARFYKWFTEGEE  
KGEWLDKLOYAVFGLGNRQYEHFNKIAKVVDEKLVEQGAQRLVPVG  
MGDDDDQCIEDDFTAWKELVWPELDQLLRDEDDTSVATPYTAAVGEY  
RVVFHDKPETYDQDQLTNGHAVHDAQHPCRSNVAVKKELHSPLSDR  
SCTHLEFDISNTGLSYETGDHVGVIYVENLSEVVDEAEKLIPLPHT  
YFSVHTDNEDGTPLGGASLPPFPCTLRKALASYADVLSSPKKSA  
LLALAAHATDSTEADRLKFFASPAGKDEYAQWIVASHRSLLLEVMEA  
FPSAKPPLGVFFASVAPRLQPRYYSSISSPKFAPNRIHVTCALVYE  
QTPSGRVHKGVCSTWMKNAVPMTESQDCSWAPIYVRTSNFRLPSDF  
KVPVIMIGPGTGLAPFRGFLQERLAQKEAGTELGTAILFFGCRNRK  
VDFIYEDELNNFVETGALSELVTAFSREGATKEYVQHKMTQKASDI  
WNLLSEGAYLYVCGDAKGMADVHRTLHTIVQEQSLDSSKAELYV  
KNLQMACRYLRDVWVDMEQKLISEEDLE (SEQ ID NO:4)

FIG. 5

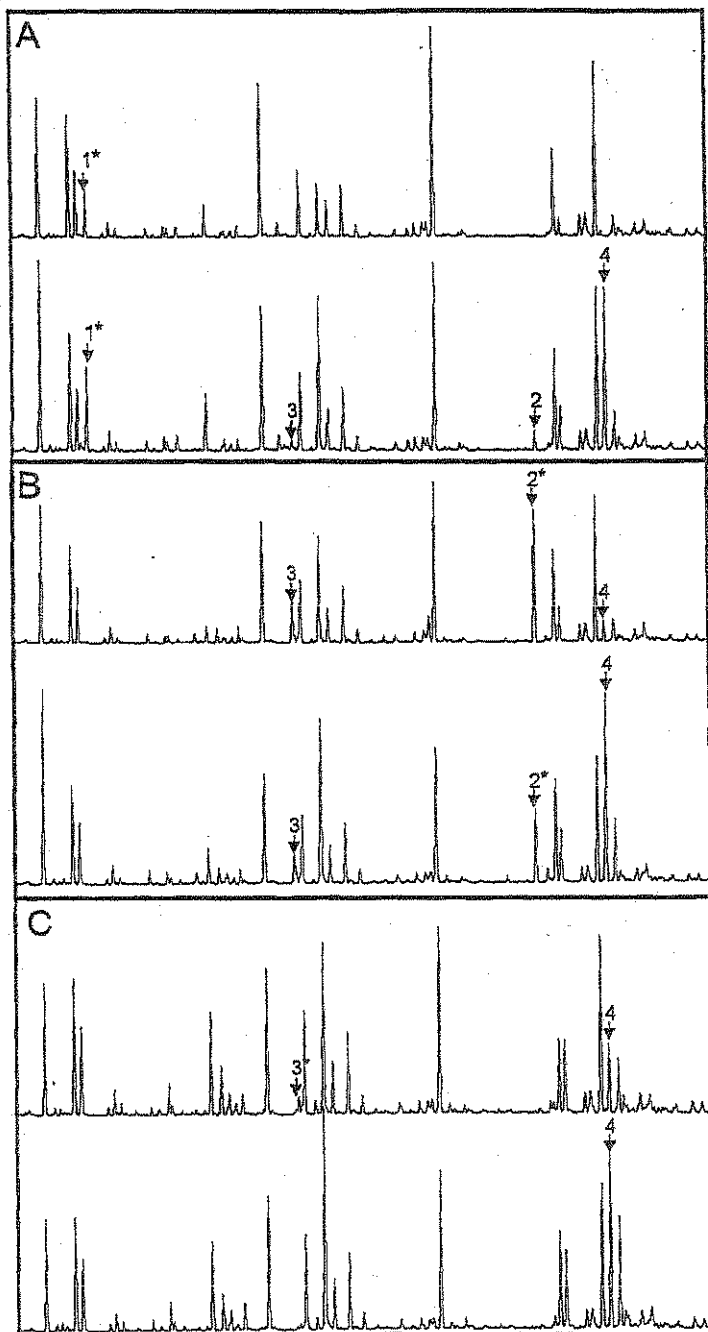


FIG. 6A

Abundance Rt=34.53, Sample, 99% MS match to the authentic standard

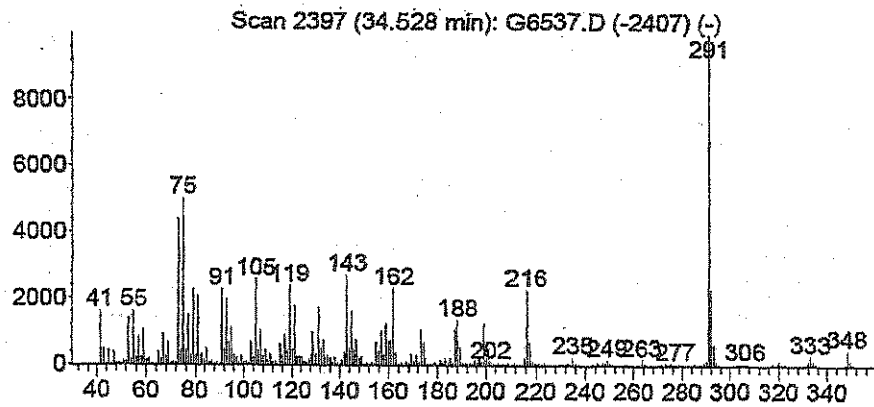


FIG. 6B

m/z--> Abundance Rt=34.57, Authentic standard

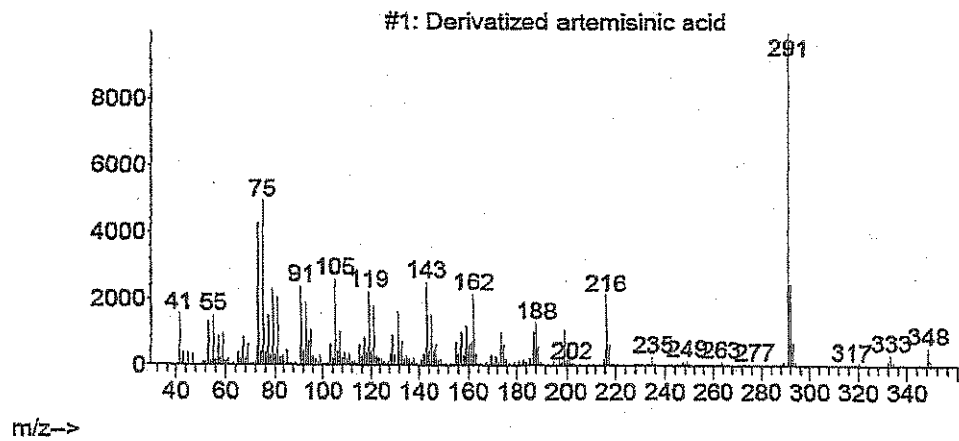


FIG. 7

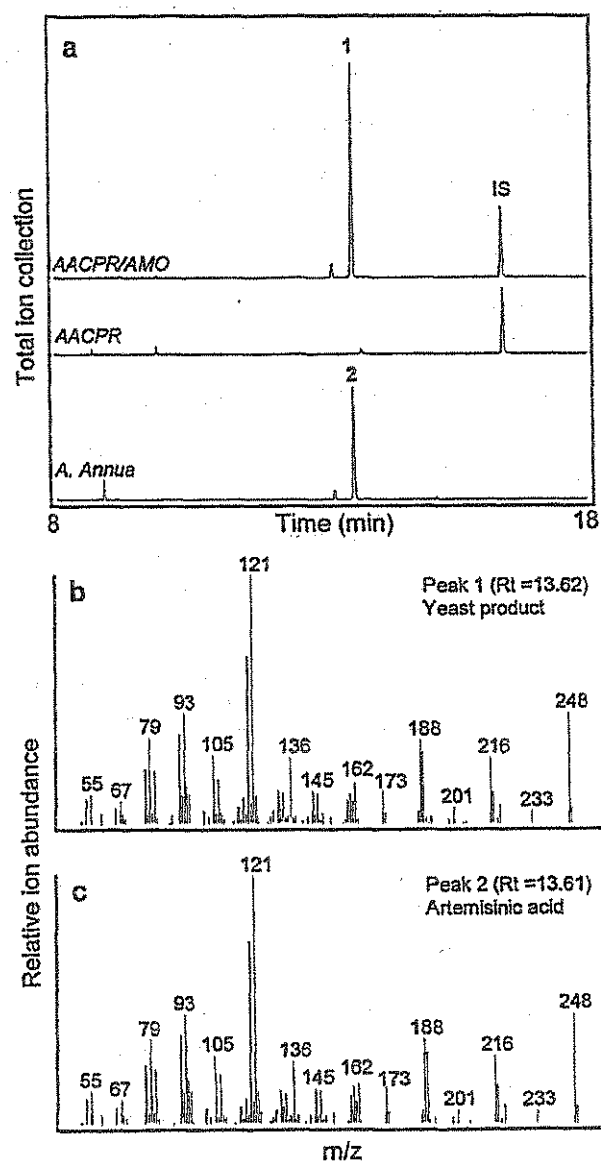


FIG. 8

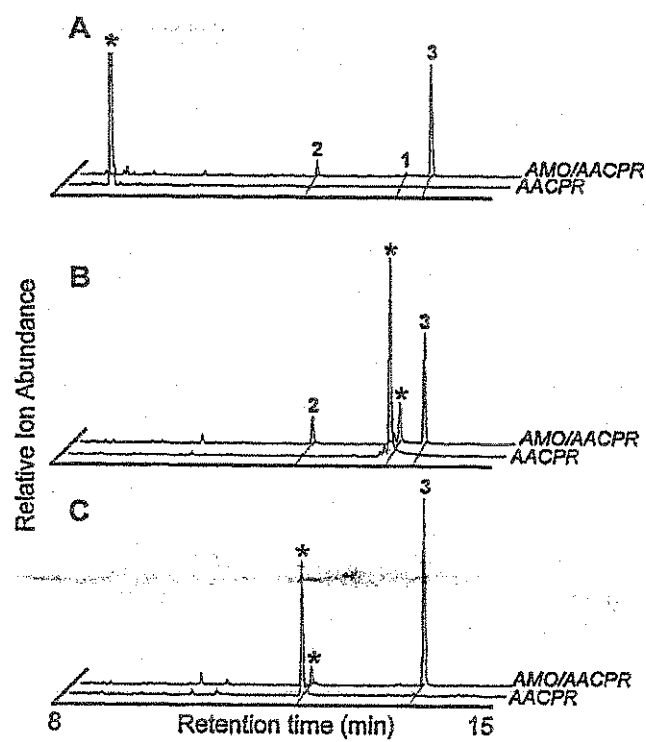


FIG. 9

&gt;71D-B1-nt

ATGGCAGCTTTCAGTGACACCTCCATTGCTCTTGCCACGATCCTTTTCCTCGTAATTTACAAGTTGCGCTAC  
TCGTTCCAAATCCACAAAAACAGCCTTCTTGAGCCATGGCGACTTCCCATTATTGGTCACATGCATCACT  
TGATTGGTACAATACCACATCGTGGGCTTATGGATTTAGCCAGAAAGTATGGATCTTTAATGCATTTACAG  
CTTGGTGAAGTTTCAACAATCGTGGTGTCTCTCCGAAATGGGCTAAAGAGATTTTGACAACGTACGACAT  
TGCCTTTGCTAACAGGCCCTGGACTTTGGCTGGTGAGATTGTTGTATATCGCAATACAAATATTGCTGCTG  
CACCTTATGGTGAATACTGGAGGCGATTACGTAACTTTGCACATCGGAGCTTATGAGTGTTAAGAAAGTA  
AAGTCATATCAGTCGCTTCGTGAAGAGGAGTGTTGGAATTTGGTTCAAGAGATTAAAGCTTCAGGTTTCAGG  
GATACCGGTTAACCTTTTCAGAGAACATTTTCAAGTTGATTGCAACGATACCTTGTAGAGCCGCTTTGGAA  
AAGGAGTCAAGGACCAGAAGGAGTGACGGAGATTATGAAAGAGATGTTGAGGGAAGTTGGTGGTTTTGAT  
GTGGCAGATATCTTTCTTCGAAGAAATTTCTTCATCATCTTTCAGGCAAGAGAGCCAGGTTAACTAGCAT  
TCATAAGAAGCTCGATAATTTTATCAATAACCTTGTGCTGAGCATACTTTCAAAACTTCAAGTAAAACTG  
AGGAGACACTTCTTGATGTTCTTCTAAGGCTCAAAGATAGCGCTGAATTTCCCATTAACAGCTGACAATGTT  
AAAGCCATCATTTTGGATATATTTGCAGCAGGGACAGACACTTCATCAACCACAATCGAATGGGCGATTTT  
GGAACTCATAAAGTGTCGAGAGCGATGGAGAAAGTACAAGCAGAAGTGAAGGAAAGCACTTAACGGAAAAG  
AAAAGATCCATGAGGAAGATATTCAAGGACTAAGCTACTTAAACTTGGTAATCAAAGAAACATTAAGGTTG  
CACCTCCACTACCTTGTGGCAAGAGAGTGCCGTGAACCAAGTCAATTTGGCTGGATACGACATACCCAA  
TAAGACAAGACTTATTGTCAACGTCTTTGCGATAAATAGGGACCCAGAATACTGGAAAGACGCTGAAATTT  
TCATCCCCGAACGATTTGAAAATAGTTCTACAACCTCATGGGTGCAGAATATGAGTATCTTCCGTTTGG  
GCTGGGAGAAGGATGTGTCTGGAGCCGCACTTGGTTTAGCCAACGTGCAGCTACCGCTCGCTAATATACT  
ATATCATTTCAACTGGAAACTCCCCAACGGTGCGAGCTATGATCAGATCGACATGACCGAGAGGTTTGGAA  
TCTCGGTTGAAAGAAAGACTCAGTTGTTACTCGTACCAAGTTTCTAG (SEQ ID NO:5)

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FIG. 10

>71D-B1-aa

MALSLTTSIALATILFFVIYKFATRSKSTKNSLPEPWRLPIIGHMHHLIGTIPHRGLMDLARKYGSLMHLQ  
LGEVSTIVVSSPKWAKEILTYYDIAFANRPWTLAGEIVVYRNTNIAAAPYGEYWRRLRKLCTSELMSVKKV  
KSYQSLREEECWNLVQEIKASGSGIPVNLSNIFKLIATILCRAAFGKGVDQKECTEIMKEMLREVGGF  
VADIFPSKKFLHHLGKRRLTSIHKKLDNFINNVAEHTFKTSSKTEETLLDVLLRLKDSAEFPLTADNV  
KAIILDIFAAGTDTSSSTTIEWAISELIKPRAMEKVQAE LRKALNGKEKIHEEDIQGLSYLNLVIKETLRL  
HPPLPLLPRECREPVNLGYDIPNKTRLIVNVFAINRDPEYWKDAE IFIPERFENSSTTLMGAEEYLPFG  
AGRRMCPGAALGLANVQLPLANILYHFNWKL PNGASYDQIDMTERFGISVERKTQLLLVP SF (SEQ ID  
NO:6)

FIG. 11

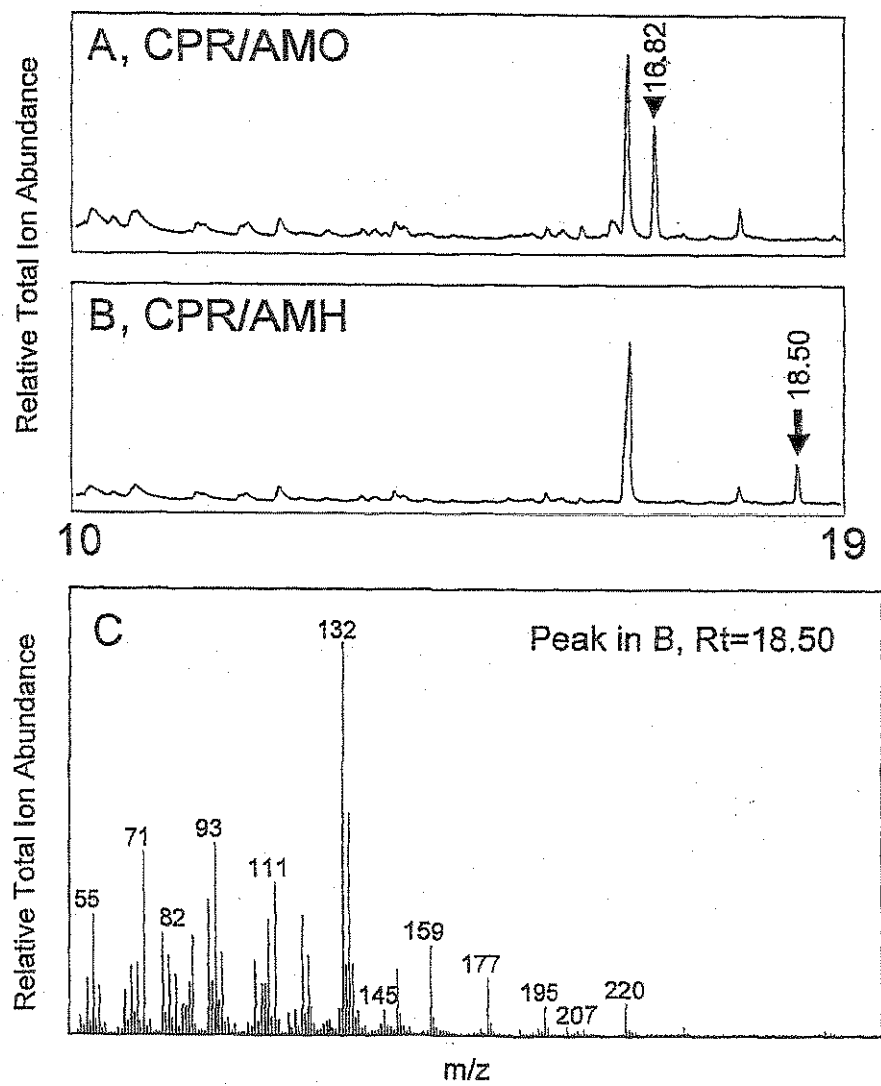


FIG. 12

&gt;71D-C1-nt

GCCCTTCGAGCCGTATGGGGATTACTGGCGGCAATTACGTAAACTTTGCACATTGGAGCTTTTGAGTGCTA  
AGAAAGTAGAGTCATATCAGTCGCTTCGTGAAGAGGAGTGTTGGAATTTAGTTCAAGAGATTAAAGCTTCA  
GGTTCAGGGATACCGGTTAACCTTTCAGAGAATATTTACAAGTTGGTTGCAATGATACTTAGTAGAGCTGC  
GTTTGGGAAAAGAATCAAGGACCATAAGGAGTTTACGGAGCTTGTGGAACAGATGTTGAGGGAACCTTGGTG  
GTTTTGATGTGGCAGATATCTTTCCTTCGCAGAAATTTCTACATCATATTTCGGGCAAGAGATCTAGGTTA  
ACTAGCATTCACAAAAGCTCGATAATTTAATCAATAACCTTGTGCTGAGCATATTGTTGAAGCCTCAAG  
TAAACTAAGGAGACGCTCCTTGATGTTCTTCTAAGGCACAAAGATAGCCTTGAATTCCTTACAGCTG  
ATAACGTTAAAGCCATCATTTTGGTATGAATTAATCCAATATATTTTTTTTTTCAAAGGCCATAATAGTG  
TTAAACAAGCTTGAAATTTTTTATAACTAAGTACATGCACTAAGCTTAGTACTCGTGAAAATATAATGAGT  
CATCATAGGGGTTCCATGAAATATACAGGACATGTTTACAGCAGGCACAGACACTTCGTCAACCACAATCG  
AATGGGTGATTTCCGAACTCATAAAGTGTCGAGAGCTATGGAGAAAATACAAGCGGAAGCTGAGGAAAGCA  
CTTAACGGAAAAGAAAAGATCCACGAGGAAGACATCCAAGAACTAAGCTACTTAAACTTGGTAATCAAAGA  
AACATTAAGGTTGCACCTCCACTACCTTGGTTTTGCCACGAGAGTGCCGTCAACCAGTCAATTTGGCTG  
GATATGACATACCCAATAAGACCAAACCTTATGTCAACGTCTTTGCCGATAAATAGGGACCTGAATACTGG  
AAAGACGCTGAATCTTTCATCCCAGAGCGCTCTTAACCTCTGGT (SEQ ID NO:7)

FIG. 13

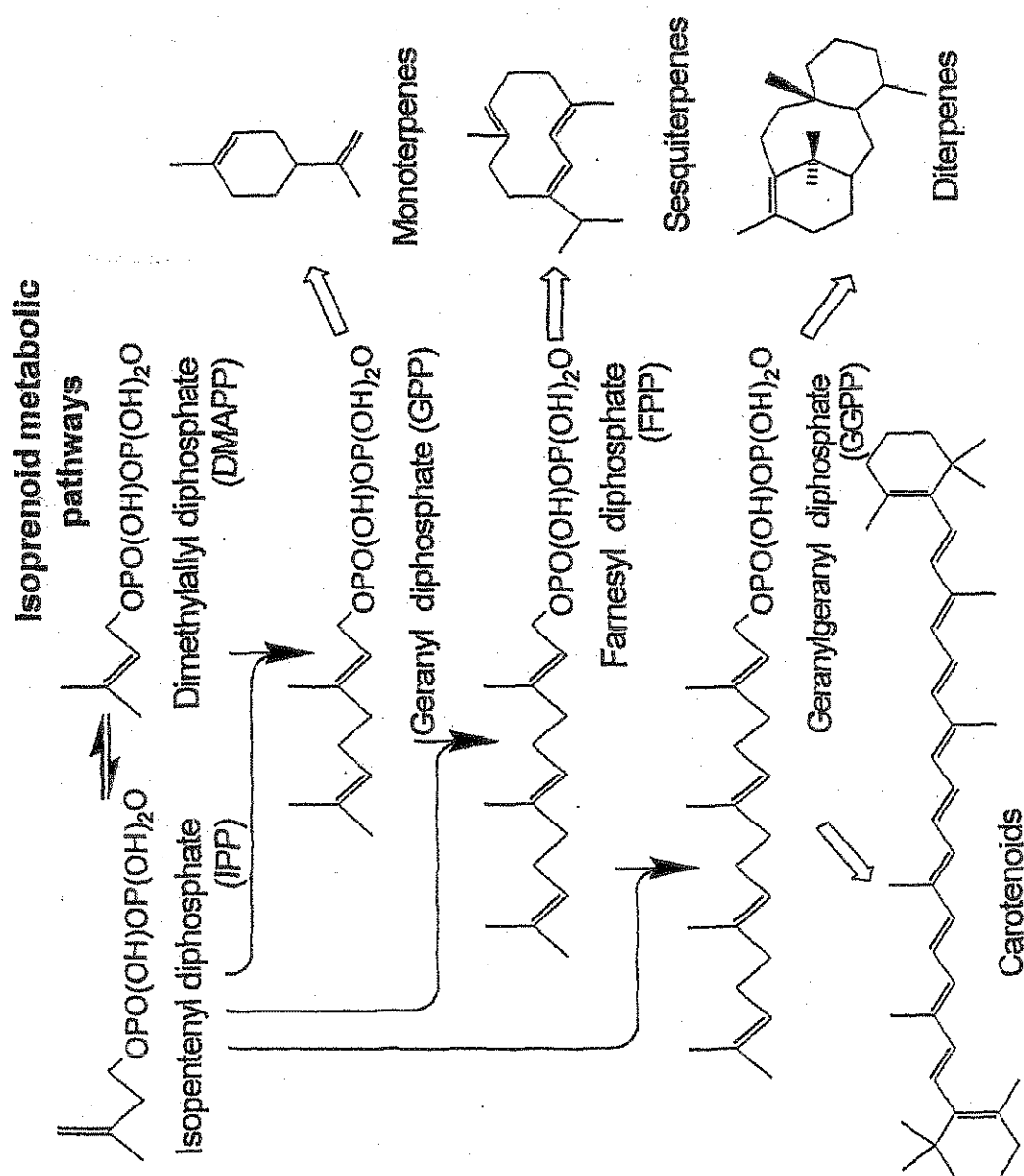


FIG. 14

## Mevalonate pathway

