

SEQUENCE LISTING

<110> DCM Shriram Limited and Tamil Nadu Agricultural University

<120> CODON OPTIMIZED SYNTHETIC NUCLEOTIDE SEQUENCES ENCODING CRY2Ai
PROTEIN AND USES THEREOF

<130> PD033499IN-SC

<160> 13

<170> PatentIn version 3.5

<210> 1

<211> 633

<212> PRT

<213> Artificial Sequence

<220>

<223> SEQ ID NO: 1 depicts Amino acid Sequence of Cry2Ai protein (NCBI
GenBank: ACV97158.1)

<400> 1

Met Asn Asn Val Leu Asn Ser Gly Arg Asn Ile Thr Cys His Ala His
1 5 10 15

Asn Val Val Ala His Asp Pro Phe Ser Phe Glu His Lys Ser Leu Asn
20 25 30

Thr Ile Glu Lys Glu Trp Lys Glu Trp Lys Arg Thr Asp His Ser Leu
35 40 45

Tyr Val Ala Pro Ile Val Gly Thr Val Gly Ser Phe Leu Leu Lys Lys
50 55 60

Val Gly Ser Leu Val Gly Lys Arg Ile Leu Ser Glu Leu Gln Asn Leu
65 70 75 80

Ile Phe Pro Ser Gly Ser Ile Asp Leu Met Gln Glu Ile Leu Arg Ala
85 90 95

Thr Glu Gln Phe Ile Asn Gln Arg Leu Asn Ala Asp Thr Leu Gly Arg
100 105 110

Val Asn Ala Glu Leu Ala Gly Leu Gln Ala Asn Val Ala Glu Phe Asn
115 120 125

Arg Gln Val Asp Asn Phe Leu Asn Pro Asn Gln Asn Pro Val Pro Leu
130 135 140

Ala Ile Ile Asp Ser Val Asn Thr Leu Gln Gln Leu Phe Leu Ser Arg
145 150 155 160

Leu Pro Gln Phe Gln Ile Gln Gly Tyr Gln Leu Leu Leu Leu Pro Leu
165 170 175

Phe Ala Gln Ala Ala Asn Leu His Leu Ser Phe Ile Arg Asp Val Ile
180 185 190

Leu Asn Ala Asp Glu Trp Gly Ile Ser Ala Ala Thr Val Arg Thr Tyr
195 200 205

Arg Asp His Leu Arg Asn Phe Thr Arg Asp Tyr Ser Asn Tyr Cys Ile
210 215 220

Asn Thr Tyr Gln Thr Ala Phe Arg Gly Leu Asn Thr Arg Leu His Asp
225 230 235 240

Met Leu Glu Phe Arg Thr Tyr Met Phe Leu Asn Val Phe Glu Tyr Val
245 250 255

Ser Ile Trp Ser Leu Phe Lys Tyr Gln Ser Leu Met Val Ser Ser Gly
260 265 270

Ala Asn Leu Tyr Ala Ser Gly Ser Gly Pro Gln Gln Thr Gln Ser Phe
275 280 285

Thr Ala Gln Asn Trp Pro Phe Leu Tyr Ser Leu Phe Gln Val Asn Ser
290 295 300

Asn Tyr Ile Leu Ser Gly Ile Ser Gly Thr Arg Leu Ser Ile Thr Phe
305 310 315 320

Pro Asn Ile Gly Gly Leu Pro Gly Ser Thr Thr Thr His Ser Leu Asn
325 330 335

Ser Ala Arg Val Asn Tyr Ser Gly Gly Val Ser Ser Gly Leu Ile Gly
340 345 350

Ala Thr Asn Leu Asn His Asn Phe Asn Cys Ser Thr Val Leu Pro Pro
355 360 365

Leu Ser Thr Pro Phe Val Arg Ser Trp Leu Asp Ser Gly Thr Asp Arg
370 375 380

Glu Gly Val Ala Thr Ser Thr Asn Trp Gln Thr Glu Ser Phe Gln Thr
385 390 395 400

Thr Leu Ser Leu Arg Cys Gly Ala Phe Ser Ala Arg Gly Asn Ser Asn
405 410 415

Tyr Phe Pro Asp Tyr Phe Ile Arg Asn Ile Ser Gly Val Pro Leu Val
420 425 430

Ile Arg Asn Glu Asp Leu Thr Arg Pro Leu His Tyr Asn Gln Ile Arg
435 440 445

Asn Ile Glu Ser Pro Ser Gly Thr Pro Gly Gly Ala Arg Ala Tyr Leu
450 455 460

Val Ser Val His Asn Arg Lys Asn Asn Ile Tyr Ala Ala Asn Glu Tyr
465 470 475 480

Gly Thr Met Ile His Leu Ala Pro Glu Asp Tyr Thr Gly Phe Thr Ile
485 490 495

Ser Pro Ile His Ala Thr Gln Val Asn Asn Gln Thr Arg Thr Phe Ile
500 505 510

Ser Glu Lys Phe Gly Asn Gln Gly Asp Ser Leu Arg Phe Glu Gln Ser
515 520 525

Asn Thr Thr Ala Arg Tyr Thr Leu Arg Gly Asn Gly Asn Ser Tyr Asn
530 535 540

Leu Tyr Leu Arg Ala Ser Ser Ile Gly Asn Ser Thr Ile Arg Val Thr
545 550 555 560

Ile Asn Gly Arg Ala Tyr Thr Val Ser Asn Val Asn Thr Thr Thr Asn
565 570 575

Asn Asp Gly Val Asn Asp Asn Gly Ala Arg Phe Ser Asp Ile Asn Ile
580 585 590

Gly Asn Ile Val Ala Ser Asp Asn Thr Asn Val Thr Leu Asp Ile Asn
595 600 605

Val Thr Leu Asn Ser Gly Thr Pro Phe Asp Leu Met Asn Ile Met Phe
610 615 620

Val Pro Thr Asn Leu Pro Pro Leu Tyr
625 630

<210> 2
<211> 2041
<212> DNA
<213> Artificial Sequence

<220>
<223> SEQ ID NO: 2 is a full-length DNA sequence codon optimized
synthetic cry2Ai DNA (201M1) encoding the Cry2Ai protein (SEQ ID
NO: 1).

<400> 2
gcgcgccctg caggggccgg ccgtttaaac gcggccgcat ttaaaggtag ctctagacca 60
tggggatcca tgaataacgt cctgaatagt ggccgcaata tcacctgtca cgcccacaac 120
gttgctgcac acgacccttt ctctttcgag cacaaatctc tgaacactat agagaaggag 180

tggaagaat ggaaaagaac cgaccacagt ttgtatgtag cccctatcgt cgggactgtg	240
ggcagttttc tacttaagaa agtgggttcc ctggtcggca agcgtatttt atcagagttg	300
cagaacttga tttttccatc cggctccatc gatttgatgc aggagatcct tcgtgccacg	360
gaacagttca ttaatcagcg gctgaatgcg gacactctgg ggagggtcaa tgcggaactc	420
gccggactgc aagccaacgt agcggagttc aatagacagg tcgataactt cttgaaccct	480
aatcaaaacc cagtcccgt ggcaataatt gactccgtga ataccttgca acaactcttc	540
ctgtcccgtt taccagtt ccaaattcaa ggctaccagt tgctcttgct cccactcttc	600
gcacaagctg caaaccttca cttgtccttt atcagagatg tgatcctcaa cgccgatgag	660
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gactactcaa actattgtat caacacatat caaacagcgt ttcgcggatt gaacacacgc	780
ctgcacgaca tgctggagtt tcggacctac atgtttttga acgttttcga gtacgtgtcc	840
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agcggttcag ggccccagca aacacaatcg ttacagccc aaaactggcc gttcctctac	960
agcctgttcc aggtgaatag caactacatt ctctccggca tttcaggtag acgactttcc	1020
ataactttcc caaacatagg cggcctgccc gggtccacga cgactcactc attaaacagc	1080
gcgagagtga actacagcgg cgggtgtagt tctgggtctca ttggggcaac caacctgaac	1140
cataatttca attgttcgac tgtcctacca cttttaagca ctcccttcgt ccgcagttgg	1200
ctcgattcag gtacggatag ggaaggcgta gctaccagca cgaattggca gacagagagt	1260
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ttccctgact attttatccg taacattagc ggcgctccgc tggtcataag aaatgaggac	1380
ttgactcgac ccctgcacta caatcagata cgcaacatcg aatccccctt gggaacacct	1440
gggggagcac gtgcttacct agtctcagta cacaaccgaa agaacaacat ctacgcggcc	1500
aatgagtacg ggaccatgat ccatctcgct cccgaggact acaccgggtt cacgatttct	1560
ccgatacatg ctaccaggt taataaccaa acccggactt tcatcagcga gaagtccggc	1620
aaccagggag attctctgag atttgagcaa agcaatacca cagctaggta caccctccgg	1680

ggaaatggca atagctataa cttgtatctg agggcgtctt caatcggcaa ttcaactatt	1740
agggtgacta ttaacggcag ggcatataca gtttctaata tgaacacaac gactaacaac	1800
gatggcgtaa acgacaatgg ggcacgtttt tctgacatca atataggga catagtcgcc	1860
agtgataaca caaacgtgac actggatatt aacgtcacc tcaactctgg tactccgttc	1920
gatctcatga acatcatgtt cgtaccacaa aaccttcctc cgctttatta gggggctgaa	1980
ttcaagcttg agctctccgg agcgatcgcg agatcgcggc cggccgttta aacatttaaa	2040
t	2041

<210> 3
 <211> 2041
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> SEQ ID NO: 3 is a full-length DNA sequence codon optimized
 synthetic cry2Ai DNA (201M2)
 encoding the Cry2Ai protein (SEQ ID NO: 1).

<400> 3	
gcgcgccctg caggggccgg ccgtttaaac gcggccgcat ttaaaggtag ctctagacca	60
tggggatcca tgaataacgt gctgaacagc ggccgcaata tcacctgtca tgcccacaat	120
gtttagtagccc acgacccttt ttccttcgag cacaaaagct tgaatacgat agagaaggaa	180
tggaaggagt ggaaaagaac cgaccatagt ttgtacgtcg caccaatcgt cgggactgtt	240
ggcagtttcc tacttaagaa agtgggttcc ctggtcggca agcgtatatt atcagagttg	300
cagaacttga tttttccatc cggctccatc gatttgatgc aggagatcct tcgtgccacg	360
gaacagttca ttaatcagcg gctgaatgcg gacactctgg ggagagtcaa tgcgagactt	420
gcaggactcc aagctaacgt cgcagagttc aacagacagg ttgataactt cctcaatccg	480
aatcagaacc cagtcccgt agccattata gactctgtca atactctcca acaactcttt	540
ttgtcccggg tacctcagtt ccaaattcaa ggctaccagc ttttgctgct accactcttt	600
gctcaagctg cgaacctcca cctgtcattc atcagagatg tcatcttgaa cgcggacgag	660

tggggcatat ccgctgcgac ggttcgcacc taccgggatc acctgcgtaa ttttacacga	720
gattacagca actattgcat caacacgtac cagacagcgt tccgaggatt gaacacaaga	780
ctacatgata tgctggagtt ccgaacctat atgtttttga acgtatttga gtatgtctcc	840
atttggtcat tgttcaaata tcaatcgta atggtttctt ctggcgcgaa cctctatgcg	900
agcggcagtg gaccccagca aacacaatcc tttactgccc aaaattggcc gtttctctac	960
tcccttttcc aggtgaatag caactacata ctgtccggca tttcaggcac tcgcctctcg	1020
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gcgaggggta attacagcgg cggagtaagt agcggactca tcggggcgac taacctcaac	1140
cacaacttta actgtagcac tgtgctacca cttttatcaa cacctttcgt gcggagttgg	1200
ctcgactcag gaacagatcg ggaaggcgtc gcgacgagca cgaattggca gactgagtcc	1260
ttccaaacaa ccctatctct ccggtgcggg gcgttttcag cgagaggcaa ctcgaactac	1320
tttcccgatt atttcatacg gaacatttct ggcgcccc tggtcattag aaacgaagat	1380
ttgacgcgcc cactccacta caaccagata aggaacatag agtctccttc agggacacca	1440
ggaggcgctc gtgcgtacct agtctcagta cacaaccgaa agaacaacat ctacgcggcc	1500
aatgagtacg ggaccatgat ccatctcgct cccgaggact acaccgggtt cacgatttct	1560
ccgatacatg ctacccaggt taataaccaa acccggactt tcatcagcga gaagttcggc	1620
aaccagggcg actctctgag atttgagcaa agcaacacca ccgcccgata tacattacgg	1680
ggcaacggca acagttacaa cctctatctg cgtgcgtcct caataggcaa ctcaacgata	1740
agggtgacaa ttaacggtcg ggcgtataca gtgtcgaatg ttaataccac aacaaacaat	1800
gacggcgtca acgacaatgg tgcgcgtttt tctgatatta acattggcaa catcgtcgcc	1860
agtgacaaca ccaacgttac gttagacatc aacgtgacgc ttaactctgg cactcctttc	1920
gatcttatga acatcatgtt cgtgccgacc aatttgccgc cactctacta gggggctgaa	1980
ttcaagcttg agctctccgg agcgatcgcg agatcgcggc cggccgttta aacatttaaa	2040
t	2041

<211> 2041
<212> DNA
<213> Artificial Sequence

<220>

<223> SEQ ID NO: 4 is a full-length DNA sequence codon optimized
synthetic cry2Ai DNA (201M3)

encoding the Cry2Ai protein (SEQ ID NO: 1).

<400> 4

gcgcgccctg caggggccgg ccgtttaaac gcggccgcat tttaaaggtag ctctagacca	60
tggggatcca tgaataatgt gttgaacagt ggccgaaata taacttgcca cgcccacaac	120
gttgtcgcgc acgaccatt ttcgttcgag cacaagagtc tgaatacaat cgagaaggaa	180
tggaaagaat ggaaaaagaac cgaccacagt ctatacgttg cacctattgt cgggactgtg	240
ggtagtttcc tacttaagaa agtgggttcc ctggtcggca agcgtatttt atcagagttg	300
cagaacttga tttttccatc cggctccatc gatttgatgc aggagatcct tcgtgccacg	360
gaacagttca ttaatcagcg gctgaatgcg gacactctgg ggcggtcaa cgccgaacta	420
gcggggcttc aggctaactg cgccgagttc aaccgacaag ttgataactt cctgaatccg	480
aaccagaacc cagtcccgct agctataatc gactccgtga acactttgca acaactattc	540
ctgtcccggg taccgcagtt ccaaattcaa ggctaccagc tactactgct accgctattc	600
gcccagctg caaacctgca cttgagcttc atacgagatg tgatcttgaa tgccgacgag	660
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gattattcta actactgcat caatacttac cagaccgcgt ttcgtggatt aaacacgaga	780
ctccacgata tgctagagtt tcggacctat atgtttttga acgttttcga atacgtgtcc	840
atctgggtcat tgttcaaata ccaatcatta atgggtgtctt ccggcgcgaa tctgtatgct	900
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tccctattcc aagtgaatag caactacatc ctttccggca tttcaggagac tcgcctctcc	1020
atcacgtttc caaacatagg aggcttgccc ggctctacca cgaccactc attgaactca	1080
gcaagagtca attacagcgg tggagtttca tcgggactca tcggggctac caatctgaac	1140
cataatttca actgctcaac tgtgctacca ccattaagca ctctttttgt cagaagttgg	1200

cttgactctg ggacagacag ggaaggagtg gcgacaagca ctaattggca gaccgagtcc	1260
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tttcctgatt acttcattcg caatatctct ggcggtgcctc tggtcataag aaacgaggat	1380
ctcacacgac cactgcacta taaccagata cgcaacattg agtctccgag cggcactccg	1440
ggtggcgctc gtgcatacct agtctcagta cacaaccgaa agaacaacat ctacgcggcc	1500
aatgagtacg ggaccatgat ccatctcgct cccgaggact acaccgggtt cacgatttct	1560
ccgatacatg ctaccaggt taataaccaa acccggactt tcatcagcga gaagtccggc	1620
aaccagggcg acagcctacg atttgagcaa agcaacacca cggctcggta cacactccgg	1680
ggtaacggca attcttacaa cctctatctg cgtgcgtcgt caattggcaa ctcaacaatc	1740
agggtgacta tcaatggtcg ggcttatact gtctctaacg tcaatactac caccaataac	1800
gatggcgtga acgataacgg tgctcgtttc tctgacatca acatcggaaa tatcgtggct	1860
agtgacaaca ccaacgtcac tctcgatatt aacgtaacat tgaactctgg aacacctttc	1920
gatctgatga acattatgtt tggttcctact aacctaccgc cgctttacta gggggctgaa	1980
ttcaagcttg agctctccgg agcgatcgcg agatcgcggc cggccgttta aacatttaaa	2040
t	2041

<210> 5
 <211> 2041
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> SEQ ID NO: 5 is a full-length DNA sequence codon optimized
 synthetic cry2Ai DNA (201M4)

encoding the Cry2Ai protein (SEQ ID NO: 1).

<400> 5	
gcgcgccctg caggggccgg ccgtttaaac gcggccgcat ttaaaggtag ctctagacca	60
tggggatcca tgaataatgt cttgaacagt ggccgaaata ttacgtgcca cgcccacaat	120
gttgtagcgc atgaccatt ctcgttcgag cacaagagct tgaacactat agagaaggaa	180

tggaagagt ggaaaagaac cgaccacagt ctgtacgtcg ccccatcgt cgggactgtg	240
gggagtttcc tacttaagaa agtgggttcc ctggtcggca agcgtatatt atcagagttg	300
cagaacttga tttttccatc cggctccatc gatttgatgc aggagatcct tcgtgccacg	360
gaacagttca ttaatcagcg gctgaatgcg gacactctgg ggagggtgaa cgccgaactt	420
gccgggctgc aagcgaacgt cgcagagttt aacagacagg tggataattt cctgaaccct	480
aaccagaatc cagtcccgtc tgccatcatt gactccgtta atacgctaca gcaacttttc	540
ctgtcccggc taccgcaatt ccaaattcaa ggctaccaac tcctgttgct cccgctgttt	600
gcacaggctg caaacctcca cctgtcattc attcgcgatg tgatcctgaa cgccgacgaa	660
tggggcatat ccgctgccac cggttcgtaca taccgggacc acctgcgtaa ctttactcgc	720
gattattcta actactgcat taacacatac cagacagcgt ttcggggctt gaataactaga	780
ctccacgata tgctggagtt ccgcacctat atgtttttga acgtattcga atatgtatcc	840
atttggtcct tgttcaaata tcaatcccta atggatatct caggcgcgaa tctgtatgct	900
agcggtagtg ggccccagca aacccaatcc tttacagccc aaaactggcc gtttctgtac	960
agcctcttcc aggtgaatag caactacata ctgtccggca tttcaggaac gcggctcagt	1020
ataactttcc ccaatattgg cgggttgccc gggttctacca caaccattc attgaactca	1080
gctagagtga attacagcgg tggagtgtcg tcggggctca tcggggcgac taatcttaat	1140
cataacttta attgctcaac tgtgtctacca cttttaagca cacctttcgt ccgcagttgg	1200
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ttccagacca cactctcact gcggtgcgga gccttctcag cgagaggga ctctaactac	1320
ttccctgatt actttattag gaacatatct ggcggtcccc tcgtcatcag aaacgaggac	1380
ttgacccgac cattacacta caaccagata cgtaatatag agtctccctc cggtacaccg	1440
ggcgggtcgc gtgcgtacct agtctcagta cacaaccgaa agaacaacat ctacgcggcc	1500
aatgagtacg ggaccatgat ccatctcgct cccgaggact acaccgggtt cacgatttct	1560
ccgatacatg ctacccaggt taataaccaa acccggactt tcatcagcga gaagttcggc	1620
aaccagggag acagcctcag attcgaacaa tccaacacta ccgctagata tacgcttcgc	1680

ggaaacggta atagctacaa cctctatTTTg agggcgtcct caataggcaa ttcaactatc	1740
cgggtgacta tcaatggaag ggcttatacg gtgtccaatg tcaatactac gaccaacaat	1800
gacggcgtca atgacaacgg cgcacgtttc tctgacatta acatcggcaa catcgtcgcg	1860
agtgacaaca caaacgtgac actcgacatc aacgtcacac ttaattctgg cacgccgttc	1920
gatctgatga acatcatgtt tgtccctact aacttacccc cactttacta gggggctgaa	1980
ttcaagcttg agctctccgg agcgatcgcg agatcgggc cggccgttta aacatttaaa	2040
t	2041

<210> 6
 <211> 2041
 <212> DNA
 <213> Artificial Sequence

<220>
 <223> SEQ ID NO: 6 is a full-length DNA sequence codon optimized synthetic cry2Ai DNA (201M5) encoding the Cry2Ai protein (SEQ ID NO: 1).

<400> 6	
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tggggatcca tgaataacgt cctgaatagt ggccgcaata tcacctgtca cgccacaac	120
gttgtcgcac acgacccttt ctctttcgag cacaaatctc tgaacactat agagaaggag	180
tggaaagaat ggaaaagaac cgaccacagt ttgtatgtag cccctatcgt cgggactgtg	240
ggcagttttc tacttaagaa agtgggttcc ctggtcggca agcgtatTTT aagcgagctc	300
cagaacttga ttttcccatc cggctccatc gatttgatgc aggaaatact tcgtgcgact	360
gagcaattca ttaatcagcg gctgaatgcg gatactttgg gcagggtcaa tgcggaactc	420
gccggactgc aagccaacgt agcggagttc aatagacagg tcgataactt cttgaaccct	480
aatcaaaacc cagtcccgt ggcaataatt gactccgtga atacctgca acaactcttc	540
ctgtcccggg taccacagtt ccaaattcaa ggctaccagt tgctcttgct cccactcttc	600
gcacaagctg caaaccttca cttgtccttt atcagagatg tgatcctcaa cgccgatgag	660
tggggcatat cggctgctac ggttcggacc taccgggacc acctgcgcaa cttcacacgg	720

gactactcaa actattgtat caacacatat caaacagcgt ttcgcggatt gaacacacgc	780
ctgcacgaca tgctggagtt tcggacctac atgtttttga acgttttcga gtacgtgtcc	840
atatggtcct tgttcaaata tcaatcacta atgggtctctt ctggcgctaa tctctatgcc	900
agcggttcag ggccccagca aacacaatcg tttacagccc aaaactggcc gttcctctac	960
agcctgttcc aggtgaatag caactacatt ctctccggca tttcaggtac acgactttcc	1020
ataactttcc caaacatagg cggcctgccc ggttccacga cgactcactc attaaacagc	1080
gcgagagtga actacagcgg cggtgttagt tctgggtctca ttggggcaac caacctgaac	1140
cataatttca attgttcgac tgtcctacca cttttaagca ctcccttcgt ccgcagttgg	1200
ctcgattcag gtacggatag ggaaggcgta gctaccagca cgaattggca gacagagagt	1260
ttccaaacca ctctctccct ccgctgcgga gcgttttcag cacgaggcaa cagcaactat	1320
ttccctgact attttatccg taacattagc ggcggtccgc tggtcataag aaatgaggac	1380
ttgactcgac ccctgcacta caatcagata cgcaacatcg aatccccctt gggaacacct	1440
gggggagcac gtgcttacct agtctcagta cacaaccgaa agaacaacat ctacgcggcc	1500
aatgagtacg ggaccatgat ccatctcgct cccgaggact acaccgggtt cacgatttct	1560
ccgatacatg ctaccaggt taataaccaa acccggaactt tcatcagcga gaagttcggc	1620
aaccagggag atttcttgag atttgagcaa agcaatacca cagctaggta caccctccgg	1680
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agggtgacta ttaacggcag ggcatataca gtttctaata tgaacacaac gactaacaac	1800
gatggcgtaa acgacaatgg ggcacgtttt tctgacatca atatagggaa catagtcgcc	1860
agtgataaca caaacgtgac actggatatt aacgtcaccc tcaactctgg tactccgttc	1920
gatctcatga acatcatggt cgtacccaca aaccttcctc cgctttatta gggggctgaa	1980
ttcaagcttg agctctccgg agcgatcgcg agatcgcggc cggccgttta aacatttaaa	2040
t	2041

<210> 7
 <211> 2041
 <212> DNA

<213> Artificial Sequence

<220>

<223> SEQ ID NO: 7 is a full-length DNA sequence codon optimized synthetic cry2Ai DNA (201M6) encoding the Cry2Ai protein (SEQ ID NO: 1).

<400> 7

gcgcgccctg caggggccgg ccgtttaaac gcggccgcat ttaaaggtag ctctagacca	60
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