Formal synthesis of (–)-pereniporin B and (–)-cinnamosmolide

Alexandru Ciocarlan^{ab*}, Aculina Aricu^a, Nikon Ungur^a, Andrei Biriia^a,
Mihai Coltsa^a, Alina Nicolescu^{bc}, Calin Deleanu^{bc}, Nicoleta Vornicu^d

^a*Institute of Chemistry, Academy of Sciences of Moldova, Academiei street 3, MD-2028 Chisinau,
Republic of Moldova*

^b*“Petru Poni” Institute of Macromolecular Chemistry of the Romanian Academy, Aleea Grigore Ghica
Voda 41A, RO-700487 Iasi, Romania*

^c*“Costin D. Nenitescu” Centre of Organic Chemistry. Romanian Academy, Splaiul Independentei 202B,
PO Box 35-98, RO-060023 Bucharest, Romania*

^d*Metropolitan Center of Research T.A.B.O.R., Closca 9, RO-700066 Iasi, Romania*

*Corresponding author, Tel./fax: + 373-22-739-775; Email: algcicarlan@yahoo.com

The paper describes a new pathway for an efficient synthesis of natural and bioactive drimanic compounds (–)-pereniporin B (**1**) and (–)-cinnamosmolide (**2**) from ketodiol **7**, an intermediate obtained before from accessible labdane diterpenoid (+)-larixol (**3**). The key step involves allylic bromination of acetate **8** with *N*-bromosuccinimide. The *in vitro* antimicrobial and antifungal activity of all compounds are also reported. Their structures were confirmed by both spectroscopic data and chemical transformations.

Keywords: (–)-Pereniporin B; (–)-cinnamosmolide; (+)-larixol; formal synthesis.

Parameter Set: 0H1-BBI.
 Registry No.:3641
 Proba AC-46
 VM/Rep.Moldova/Alex Ciocirlan

Current Data Parameters
 DU D:\Veronica\RepMoldova\A
 USER AC-46
 NAME h
 EXPNO 2
 PROCNO 1

F2 - Acquisition Parameters
 Date
 Time 13.42
 INSTRUM AvanceDRX400
 PROBHD 5 mm Multinu
 PULPROG zg0
 TD 51280
 SOLVENT CDCl3
 NS 16
 DS 2
 SW 16.0203 ppm
 FIDRES 0.125005 Hz
 AQ 3.9998901 sec
 RG 181
 DW 78.000 usec
 DE 6.00 usec
 TE 300.0 K
 D1 0.03000000 sec
 NUC1 1H
 P0 3.00 usec
 PL1 0.00 dB
 SFO1 400.1328009 MHz

F2 - Processing Parameters
 SI 65536
 SF 400.1300081 MHz
 WDW EM
 SSB 0
 LB 0.00 Hz
 GB 0
 PC 1.40
 OFFSET 14.990 ppm
 PH_mod pk

Parameter Set: 0C13-CPD-BBI.
Registry No.:3641
Proba AC-46
VM/Rep.Moldova/Alex Ciocirlan

Current Data Parameters
DU D:\Veronica\RepMoldova\Ale
USER AC-46
NAME c
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_
Time 10.57
INSTRUM AvanceDRX400
PROBHD 5 mm Multinu
PULPROG zgpg
TD 65536
SOLVENT CDCl3
NS 9167
DS 2
SW 316.4919 ppm
FIDRES 0.485949 Hz
AQ 1.0289652 sec
RG 2298.8
DW 15.700 usec
DE 6.00 usec
TE 300.0 K
D1 0.03000000 sec
d11 0.03000000 sec
d12 0.00002000 sec
NUC1 13C
P0 4.60 usec
PL1 -6.00 dB
SFO1 100.6254358 MHz
CPDPRG2 waltz16
NUC2 1H
PCPD2 120.00 usec
PL2 0.00 dB
PL12 24.00 dB
PL13 24.00 dB
SFO2 400.1316005 MHz

F2 - Processing Parameters
SI 65536
SF 100.6127690 MHz
WDW EM
SSB 0
LB 3.00 Hz
GB 0
PC 1.00
OFFSET 284.162 ppm
PH_mod pk

Parameter Set: OH1-BBI.
 Registry No.: 4609
 OC/Chisinau/Alex Ciocarlan
 Proba: AC-68 (10 mg)

Current Data Parameters
 DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
 USER ProbaAC68
 NAME h
 EXPNO 1
 PROCNO 1

F2 - Acquisition Parameters

Date_ 12.41
 INSTRUM AvanceDRX400
 PROBHD 5 mm Multinu
 PULPROG zg0
 TD 51280
 SOLVENT CDCl3
 NS 16
 DS 2
 SW 16.0203 ppm
 FIDRES 0.125005 Hz
 AQ 3.9998901 sec
 RG 90.5
 DW 78.000 usec
 DE 6.00 usec
 TE 300.0 K
 D1 0.03000000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P0 3.00 usec
 PL1 0.00 dB
 SFO1 400.1328009 MHz

F2 - Processing Parameters
 SI 65536
 SF 400.1300149 MHz
 WDW EM
 SSB 0
 LB 0.00 Hz
 GB 0
 PC 1.00
 OFFSET 14.973 ppm
 PH_mod pk

Current Data Parameters
DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
USER ProbaAC68
NAME c
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters

Date_
Time 12.51
INSTRUM AvanceDRX400
PROBHD 5 mm Multinu
PULPROG zgpg
TD 65536
SOLVENT CDC13
NS 438
DS 2
SW 316.4919 ppm
FIDRES 0.485949 Hz
AQ 1.0289652 sec
RG 1024
DW 15.700 usec
DE 6.00 usec
TE 300.0 K
D1 0.03000000 sec
d11 0.03000000 sec
d12 0.00002000 sec

===== CHANNEL f1 =====
NUC1 13C
P0 4.60 usec
PL1 -6.00 dB
SFO1 100.6254358 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 120.00 usec
PL2 0.00 dB
PL12 24.00 dB
PL13 24.00 dB
SFO2 400.1316005 MHz

F2 - Processing Parameters
SI 65536
SF 100.6127737 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
OFFSET 284.116 ppm
PH_mod pk

Parameter Set: 0C13-CPD-BBI.
Registry No.:4609
OC/Chisinau/Alex Ciocarlan
Proba: AC-68 (10 mg)

7.364
7.266

5.975

4.829
4.809
4.791
4.759
4.694
4.656
4.653
4.410
4.379
4.311
4.281

3.190
3.171
2.883
2.388
2.174
2.161
2.150
2.127
2.116
1.993
1.979
1.962
1.949
1.929
1.914
1.791
1.788
1.754
1.735
1.658
1.633
1.574
1.548
1.384
1.351
1.291
1.255
1.204
1.148
1.102
1.051
1.027
0.871

0.000
-0.006

Parameter Set: OH1-BBI.
Registry No.:4610
OC/Chisinau/Alex Ciocarlan
Proba: AC-69 (17 mg)

Current Data Parameters
DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
USER ProbaAC69
NAME h
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters

Date_ 13.37
Time 13.37
INSTRUM AvanceDRX400
PROBHD 5 mm Multinu
PULPROG zg0
TD 51280
SOLVENT CDC13
NS 16
DS 2
SW 16.0203 ppm
FIDRES 0.125005 Hz
AQ 3.9998901 sec
RG 128
DW 78.000 usec
DE 6.00 usec
TE 300.0 K
D1 0.03000000 sec

===== CHANNEL f1 =====

NUC1 1H
P0 3.00 usec
PL1 0.00 dB
SFO1 400.1328009 MHz

F2 - Processing Parameters

SI 65536
SF 400.1300150 MHz
WDW EM
SSB 0
LB 0.00 Hz
GB 0
PC 1.00
OFFSET 14.973 ppm
PH_mod pk

Parameter Set: OC13-CPD-BBI.
Registry No.:4610
OC/Chisinau/Alex Ciocarlan
Proba: AC-69 (17 mg)

Current Data Parameters
DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
USER ProbaAC69
NAME c
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_
Time 13.56
INSTRUM AvanceDRX400
PROBHD 5 mm Multinu
PULPROG zgpg
TD 65536
SOLVENT CDCl3
NS 1010
DS 2
SW 316.4919 ppm
FIDRES 0.485949 Hz
AQ 1.0289652 sec
RG 2048
DW 15.700 usec
DE 6.00 usec
TE 300.0 K
D1 0.03000000 sec
d11 0.03000000 sec
d12 0.00002000 sec

===== CHANNEL f1 =====
NUC1 13C
P0 4.60 usec
PL1 -6.00 dB
SFO1 100.6254358 MHz

===== CHANNEL f2 =====
CPDPRG2 waltz16
NUC2 1H
PCPD2 120.00 usec
PL2 0.00 dB
PL12 24.00 dB
PL13 24.00 dB
SFO2 400.1316005 MHz

F2 - Processing Parameters
SI 65536
SF 100.6127732 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
OFFSET 284.121 ppm
PH_mod pk

Parameter Set: 0H1-BBI.
 Registry No.: 6829
 OC/Chisinau/Alex Ciocarlan
 Proba: AC-70
 solvent: CDCl3

Current Data Parameters
 DU \Bruker-1D\Oana\Chisinau\ACiocarlan
 USER AC-70
 NAME h
 EXPNO 1
 PROCNO 1

F2 - Acquisition Parameters
 Date_ 19.53
 INSTRUM AvanceDRX400
 PROBHD 5 mm Multinu
 PULPROG zg0
 TD 51280
 SOLVENT CDCl3
 NS 16
 DS 2
 SW 16.0203 ppm
 FIDRES 0.125005 Hz
 AQ 3.9998901 sec
 RG 256
 DW 78.000 usec
 DE 6.00 usec
 TE 300.0 K
 D1 0.03000000 sec

===== CHANNEL f1 =====
 NUC1 1H
 P0 3.00 usec
 PL1 0.00 dB
 SFO1 400.1328009 MHz

F2 - Processing Parameters
 SI 65536
 SF 400.1300163 MHz
 WDW EM
 SSB 0
 LB 0.00 Hz
 GB 0
 PC 1.00
 OFFSET 14.970 ppm
 PH_mod pk

200.726

153.442

128.846

77.336
77.018
76.701
75.14864.763
62.203

56.064

45.289
42.36833.607
32.232
31.19321.801
17.905
17.710

-0.001

Parameter Set: 0C13-CPD-BBI.
 Registry No.: 6829
 OC/Chisinau/Alex Ciocarlan
 Proba: AC-70
 solvent: CDC13

Current Data Parameters
 DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
 USER AC-70
 NAME coada
 EXPNO 5
 PROCNO 1

F2 - Acquisition Parameters

Date_ Time 22.31
 INSTRUM AvanceDRX400
 PROBHD 5 mm Multinu
 PULPROG zgpg
 TD 65536
 SOLVENT CDC13
 NS 4096
 DS 2
 SW 316.4919 ppm
 FIDRES 0.485949 Hz
 AQ 1.0289652 sec
 RG 3251
 DW 15.700 usec
 DE 6.00 usec
 TE 300.0 K
 D1 0.03000000 sec
 d11 0.03000000 sec
 d12 0.00002000 sec

===== CHANNEL f1 =====

NUC1 13C
 P0 4.60 usec
 PL1 -6.00 dB
 SFO1 100.6254358 MHz

===== CHANNEL f2 =====

CPDPRG2 waltz16
 NUC2 1H
 PCPD2 120.00 usec
 PL2 0.00 dB
 PL12 24.00 dB
 PL13 24.00 dB
 SFO2 400.1316005 MHz

F2 - Processing Parameters

SI 65536
 SF 100.6127700 MHz
 WDW EM
 SSB 0
 LB 1.00 Hz
 GB 0
 PC 1.40
 OFFSET 284.152 ppm
 PH_mod pk

7.260

6.498

Parameter Set: 0H1-BBI.
 Registry No.:4612
 OC/Chisinau/Alex Ciocarlan
 Proba: AC-71 (8 mg)

4.543
 4.518
 4.379
 4.353

3.079
 2.955

2.162
 2.151
 2.131
 2.119
 2.098
 2.088
 1.773
 1.747
 1.680
 1.646
 1.612
 1.578
 1.542
 1.462
 1.428
 1.337
 1.297
 1.288
 1.248
 1.183
 1.168
 1.081
 0.888
 0.874
 0.856

Current Data Parameters
 DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
 USER ProbaAC71
 NAME h
 EXPNO 1
 PROCNO 1

F2 - Acquisition Parameters
 Date
 Time 14.48
 INSTRUM AvanceDRX400
 PROBHD 5 mm Multinu
 PULPROG zg0
 TD 51280
 SOLVENT CDCl3
 NS 16
 DS 2
 SW 16.0203 ppm
 FIDRES 0.125005 Hz
 AQ 3.9998901 sec
 RG 128
 DW 78.000 usec
 DE 6.00 usec
 TE 300.0 K
 D1 0.03000000 sec
 NUC1 1H
 P0 3.00 usec
 PL1 0.00 dB
 SFO1 400.1328009 MHz

F2 - Processing Parameters
 SI 65536
 SF 400.1300174 MHz
 WDW EM
 SSB 0
 LB 0.00 Hz
 GB 0
 PC 1.00
 OFFSET 14.967 ppm
 PH1_mod pk

1.000

2.128

0.952

1.066

1.208

6.156

7.391

6.836

4.038

ppm

Current Data Parameters
DU \\Bruker-1\D\Oana\Chisinau\ACiocarlan
USER ProbaAC71
NAME coada
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters

Date_
Time 12.19
INSTRUM AvanceDRX400
PROBHD 5 mm Multinu
PULPROG zgpg
TD 65536
SOLVENT CDC13
NS 2048
DS 2
SW 316.4919 ppm
FIDRES 0.485949 Hz
AQ 1.0289652 sec
RG 2048
DW 15.700 usec
DE 6.00 usec
TE 300.0 K
D1 0.03000000 sec
d11 0.03000000 sec
d12 0.00002000 sec

===== CHANNEL f1 =====

NUC1 13C
P0 4.60 usec
PL1 -6.00 dB
SFO1 100.6254358 MHz

===== CHANNEL f2 =====

CPDPRG2 waltz16
NUC2 1H
PCPD2 120.00 usec
PL2 0.00 dB
PL12 24.00 dB
PL13 24.00 dB
SFO2 400.1316005 MHz

F2 - Processing Parameters

SI 65536
SF 100.6127737 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
OFFSET 284.116 ppm
PH_mod pk

Parameter Set: OC13-CPD-BBI.
Registry No.:4622
OC/Chisinau/Alex Ciocarlan
Proba: AC-71 (8 mg)
(reluata)