

REVIEW

The Chemistry on Diterpenoids in 1980

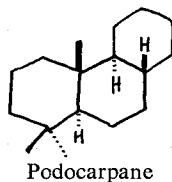
Eiichi FUJITA*, Kaoru FUJI, Yoshimitu NAGAO, Manabu NODE,
and Masahito OCHIAI

Received April 18, 1983

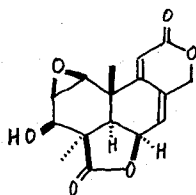
I. INTRODUCTION

This is one of a series of our annual reviews on diterpenoid chemistry. The style is changed from that in the previous reviews. The following abbreviations are used. [CN]: common name; [NS]: natural source; [REF]: reference number; [NC]: notes and comments.

II. PODOCARPANE DERIVATIVES

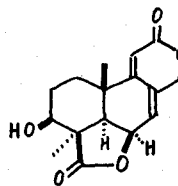


1) Isolation and Structure Determination



1

[CN] wentilactone A
[NS] *Aspergillus wentii*
[REF] 1
[NC] X-ray analysis

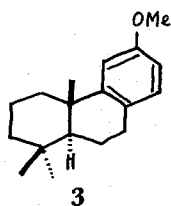


2

[CN] wentilactone B
[NS] *Aspergillus wentii*
[REF] 1

* 藤田榮一, 富士 薫, 長尾善光, 野出 学, 落合正仁: Cancer Drug Research Laboratory, Institute for Chemical Research, Kyoto University, Uji, Kyoto 611.

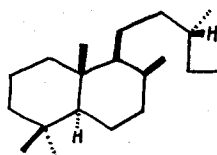
2) Synthesis and Reaction



[REF] 2

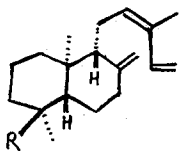
[NC] biogenetic-type cyclization

III. LABDANE DERIVATIVES



Labdane

1) Isolation and Structure Determination



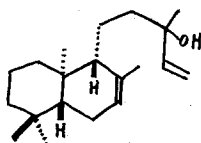
4 R=Me

5 R=CHO

6 R=CO₂H

[NS] *Helianthus* species

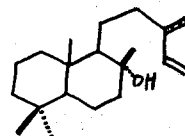
[REF] 3



7

[NS] *Helichrysum* species

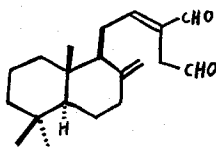
[REF] 4



8

[NS] *Smallanthus fruticosus*

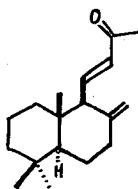
[REF] 5



9

[NS] *Alpinia speciosa*

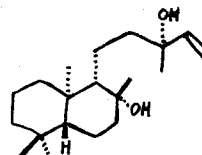
[REF] 6



10

[NS] *Alpinia speciosa*

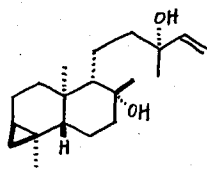
[REF] 6



11

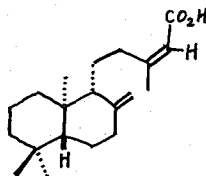
[NS] *Gnaphalium undulatum*

[REF] 7



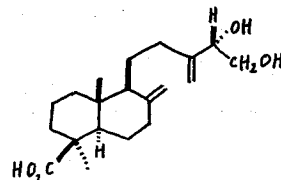
12

[NS] *Gnaphalium undulatum*
[REF] 7



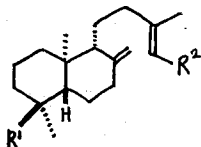
13

[NS] *Morithamnus crassus*
[REF] 8



14

[NS] *Juniperus communis*
[REF] 9



15 $R^1=CO_2H$, $R^2=CH_2OH$

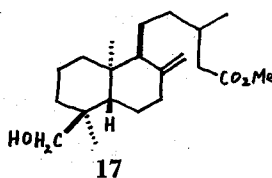
[CN] visidic acid A

16 $R^1=CO_2H$, $R^2=CH_2OAc$

[CN] visidic acid B

[NS] *Chrysothamnus viscidiflorus*

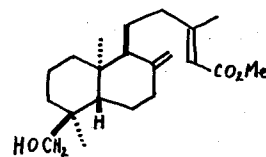
[REF] 10



17

[NS] rosin of
"Brazil capal"

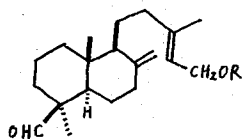
[REF] 11



18

[NS] rosin of
"Brazil capal"

[REF] 11

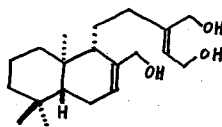


19 $R=H$

20 $R=D\text{-xylose}$

[NS] *Thujopsis dolabrata*

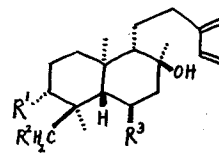
[REF] 12



21

[NS] *Achyrocline alata*

[REF] 13



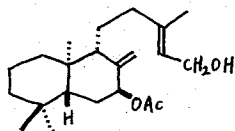
22 $R^1=H$, $R^2=OH$, $R^3=OAc$

23 $R^1=H$, $R^2=OAc$, $R^3=OH$

24 $R^1=OH$, $R^2=H$, $R^3=OAc$

[NS] *Sideritis foetens*

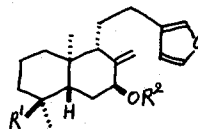
[REF] 14



25

[NS] *Austroeupeatorium*
chaparensis

[REF] 15



26 $R^1=Me$, $R^2=Ac$

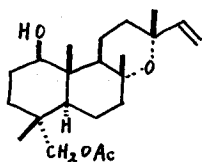
27 $R^1=CHO$, $R^2=Ac$

[NS] *Austroeupeatorium chaparensis*

[REF] 15

28 $R^1=CH_2OAc$, $R^2=Ac$

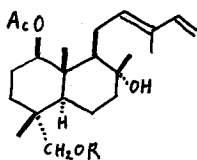
29 $R^1=CH_2OH$, $R^2=Ac$



30

[NS] *Aristequetia buddleaeifolia*

[REF] 16



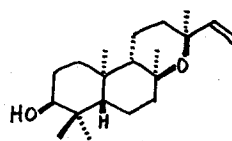
31 R=CO(CH₂)₁₈Me

32 R=COCH=CHC₆H₄OH(*p*)

33 R=COCH=CHC₆H₄OAc(*p*)

[NS] *Aristequetia buddleaeifolia*

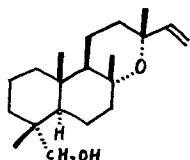
[REF] 16



34

[NS] *Subtribus espletinae*

[REF] 17

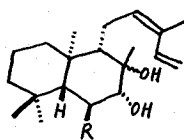


35

[CN] jhanol

[NS] *Stevia rebaudiana*

[REF] 18



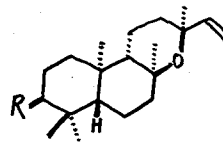
36 R=OH

[CN] austroinulin

37 R=OAc

[NS] *Stevia rebaudiana*

[REF] 18

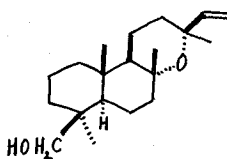


34 R=OH

38 R=H

[NS] *Libanothamnus spectabilis*

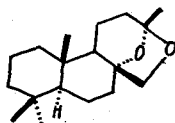
[REF] 19



39

[NS] *Baccharis tola*

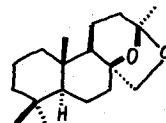
[REF] 20



40

[NS] *Pinus monticola*

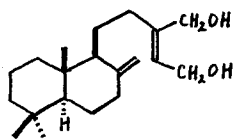
[REF] 21



41

[NS] *Pinus monticola*

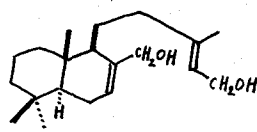
[REF] 21



42

[NS] *Ceroplastes ceriferus*

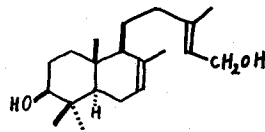
[REF] 22



43

[NS] *Ceroplastes ceriferus*

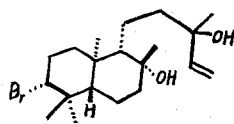
[REF] 22



44

[NS] *Ceroplastes ceriferus*

[REF] 22

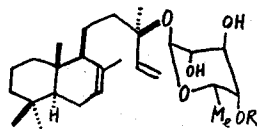


45

[CN] isoconcinndiol

[NS] *Laurencia snyderae*
var. *guadalupensis*

[REF] 23

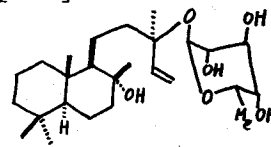


46 R=H

47 R=Ac

[NS] *Aster spathulifolius*

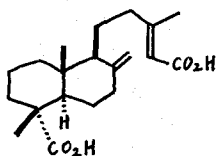
[REF] 24



48

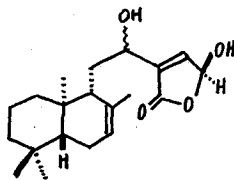
[NS] *Aster spathulifolius*

[REF] 24



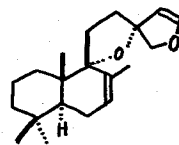
49

[CN] dehydropinifolic acid
[NS] *Pinus silvestris*
[REF] 25



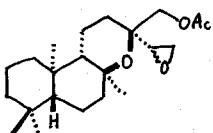
50

[NS] *Acritopappus* species
[REF] 26



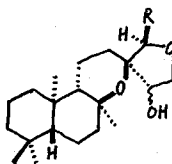
51

[NS] *Solidago* species
[REF] 27



52

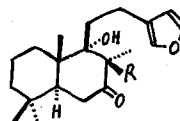
[NS] *Schkuhria* species
[REF] 28



53 R=OH

54 R=OAc

[NS] *Schkuhria* species
[REF] 28



55 R=H

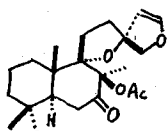
[CN] hispanolone

56 R=OAc

[CN] galeopsin

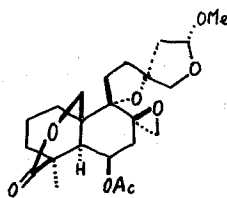
[NS] *Galeopsis angustifolia*

[REF] 29



57

[CN] pregaleopsin
[NS] *Galeopsis angustifolia*
[REF] 29



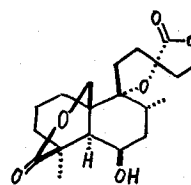
58

[CN] methoxynepetaefolin

[NS] *Leonotis nepetaefolia*

[REF] 30

[NC] X-ray analysis



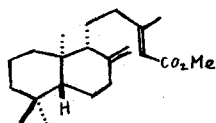
59

[CN] nepetaefolinol

[NS] *Leonotis nepetaefolia*

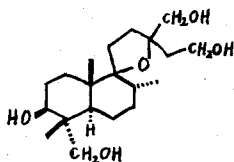
[REF] 30

2) Synthesis and Reaction



60

[CN] methyl copalate
[REF] 31
[NC] synthesis of
debromoisoplysin-20
and its C-13 epimer
from 60

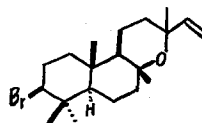


61

[CN] lagochilin

[REF] 32

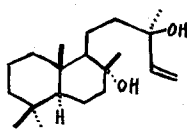
[NC] acetylation of 61
NMR studies



62

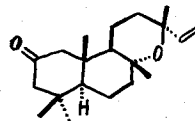
[REF] 33

[NC] brominative
cyclization of geranyl-
linalool



63

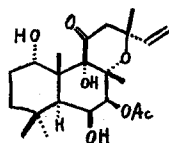
- [CN] sclareol
[REF] 34~37
[NC] oxidation of **63** by a chromium mixture



64

- [CN] 2-oxomanoyl oxide
[REF] 38
[NC] chemical conversion

3) Miscellaneous Section



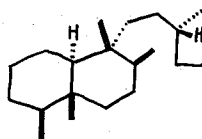
65

- [CN] forskolin
[NS] *Coleus* and *Plectranthus* species
[REF] 39
[NC] TLC and GLC assay methods for the presence of **65**

Additional references

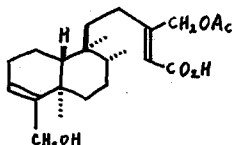
- [REF] 40
[NC] Inheritance of labdanoid producing ability in *Nicotiana Tabacum*.
[REF] 41
[NC] A review article on the chemistry of the *Compositae* diterpenoids.

IV. CLERODANE DERIVATIVES



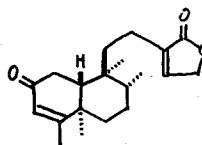
Clerodane

1) Isolation and Structure Determination



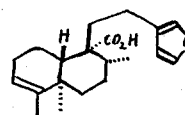
66

- [NS] *Acritopappus* species
[REF] 26



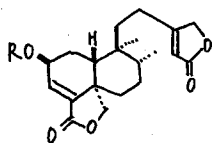
67

- [NS] *Acritopappus* species
[REF] 26



68

- [NS] *Solidago* species
[REF] 27



69 R=H

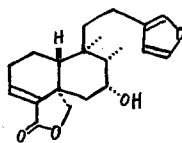
[CN] articulin

70 R=AC

[CN] articulinacetate

[NS] *Baccharis articulata*

[REF] 42

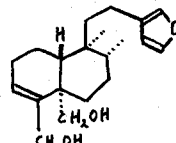


71

[CN] 1-deoxybacrispin

[NS] *Baccharis crispa*

[REF] 43

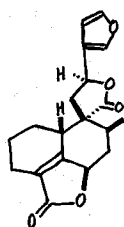


72

[CN] hautriwaic acid

[NS] *Baccharis crispa*

[REF] 43

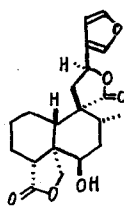


73

[CN] teuchamaedryn A

[NS] *Teucrium chamaedrys*

[REF] 44

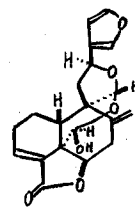


74

[CN] teuchamaedryn B

[NS] *Teucrium chamaedrys*

[REF] 44



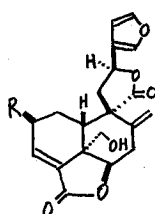
75

[CN] Plaunol A

[NS] *Croton sublyratus*

[REF] 45

[NC] X-ray analysis



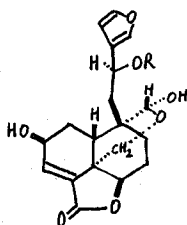
76 R=H

77 R=OH

[CN] plaunol C

[NS] *Croton sublyratus*

[REF] 45



78 R=H

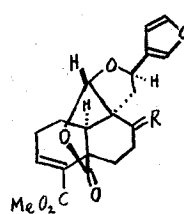
[CN] plaunol D

79 R=Ac

[CN] plaunol E

[NS] *Croton sublyratus*

[REF] 45



80 R= β -Me, α -H

[CN] dihydrocroverin

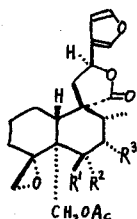
[NC] anti-peptic ulcer activity

81 R=CH₂

[CN] croverin

[NS] *Croton verreauxii*

[REF] 46



82 R¹, R²=O, R³=OAc

[CN] capitatin

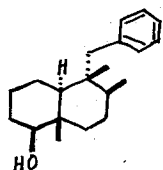
83 R¹=OAc, R²=H, R³=OH

[CN] teucapitatin

[NS] *Teucrium capitatum*

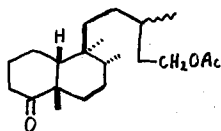
[REF] 47

2) Synthesis and Reaction



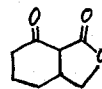
84

[REF] 48
[NC] synthesis



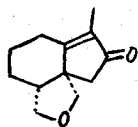
85

[REF] 49
[NC] photoisomerization



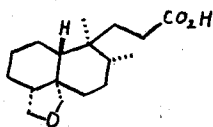
86

[REF] 50
[NC] synthesis



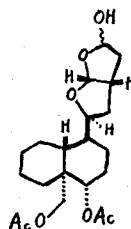
87

[REF] 51
[NC] synthesis



88

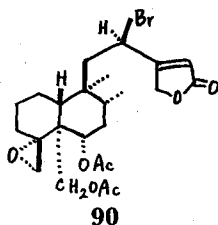
[REF] 52
[NC] synthesis



89

[REF] 53
[NC] synthesis

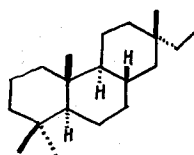
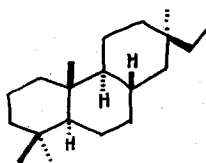
3) Miscellaneous Section



90

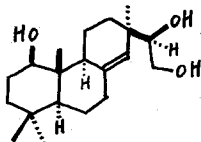
[CN] 12(R)-bromoajugarin-I
[REF] 54
[NC] bromination X-ray analysis

V. PIMARANE AND ISOPIMARANE DERIVATIVES



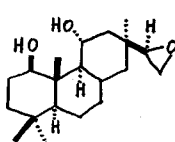
Pimarane and Isopimarane

1) Isolation and Structure Determination



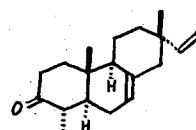
91

[CN] leucophleol
[NS] *Acacia leucophloea*
[REF] 55



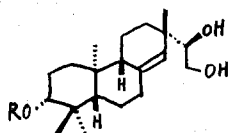
92

[CN] leucophleoxol
[NS] *Acacia leucophloea*
[REF] 55



93

[NS] *Acremonium luzulae*
[REF] 56



94 R=H

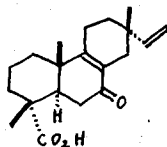
[CN] darutigenol

95 R=β-D-glucose

[CN] darutoside

[NS] *Sigesbeckia orientalis*

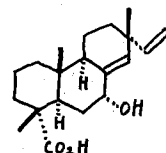
[REF] 57



96

[NS] *Juniperus communis*

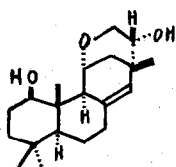
[REF] 9



97

[NS] *Juniperus communis*

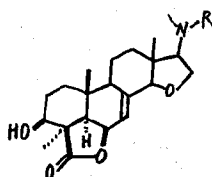
[REF] 9



98

[NS] *Acacia leucophloea*

[REF] 58



99 R=Me

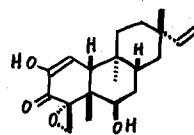
[CN] icaceine

100 R=H

[CN] de-N-methylicaceine

[NS] *Icacina guesfeldtii*

[REF] 59

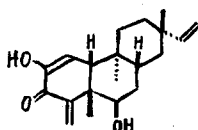


101

[CN] oxidopanamensin

[NS] *Rondeletia panamensis*

[REF] 60



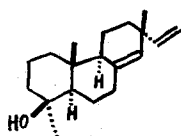
102

[CN] panamensin

[NS] *Rondeletia panamensis*

[REF] 60

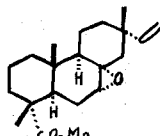
2) Synthesis and Reaction



103

[REF] 61

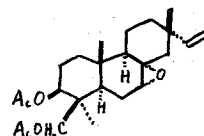
[NC] synthesis of **103**
and its C-4 epimer



104

[REF] 62

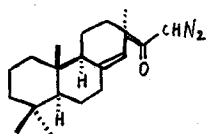
[NC] rearrangement of
104 with $\text{BF}_3\text{-Et}_2\text{O}$



105

[REF] 63

[NC] acid catalyzed ring
cleavage of **105**

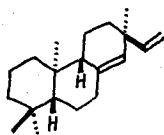


106

[REF] 64

[NC] acid catalyzed cyclization of **106**

3) Miscellaneous Section



107

[CN] *ent*-sandaracopimaradiene

[REF] 65

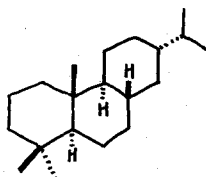
[NC] biosynthesis

Additional references

[REF] 66-68

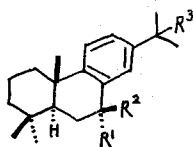
[NC] ¹³C NMR studies

VI. ABIETANE DERIVATIVES



Abietane

1) Isolation and Structure Determination



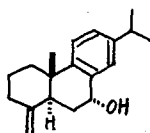
108 R¹=R²=H, R³=OH

109 R¹=OH, R²=R³=H

110 R¹, R²=O, R³=H

[NS] *Pinus monticola*

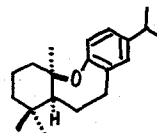
[REF] 21



111

[NS] *Pinus monticola*

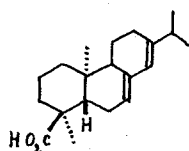
[REF] 21



112

[NS] *Pinus monticola*

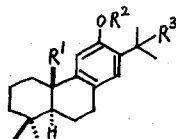
[REF] 21



113

[NS] *solidago* species

[REF] 27



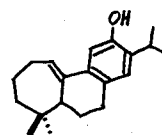
114 $R^1=Me, R^2=H, R^3=OH$

115 $R^1=CO_2H, R^2=Me, R^3=H$

116 $R^1=CHO, R^2=R^3=H$

[NS] *Chamaecyparis pisifera*

[REF] 69



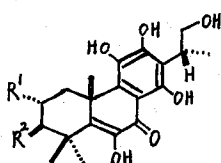
117

[CN] pisiferin

[NS] *Chamaecyparis*

pisifera

[REF] 69



118 $R^1=R^2=H$

[CN] coleon C

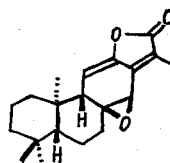
119 $R^1=H, R^2=OAc$

[CN] coleon H

120 $R^1=OCHO, R^2=H$

[NS] *Solenostemon monostachys*

[REF] 70



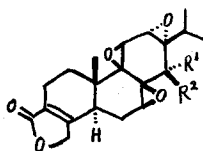
121

[CN] jolkinolide A

[NS] *Euphorbia huachangana*

[REF] 71

2) Synthesis and Reaction



122 $R^1=H, R^2=OH$

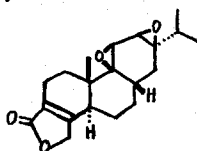
[CN] triptolide

123 $R^1, R^2=O$

[CN] triptonide

[REF] 72, 73

[NS] synthesis

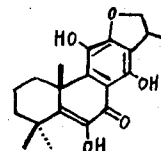


124

[CN] stemolide

[REF] 74

[NC] synthesis

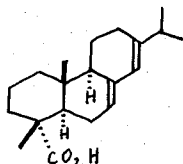


125

[CN] lycoxanthol

[REF] 75

[NC] synthetic studies of **125**



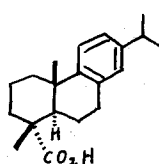
126

[CN] abietic acid

[REF] 76

[NC] Formation of coeon

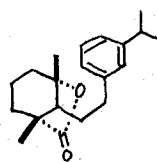
A skeleton from **126**



127

[REF] 77

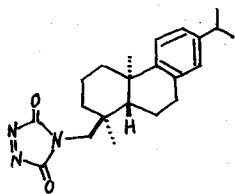
[NC] synthesis of carotene
derivative from **127**



128

[REF] 78

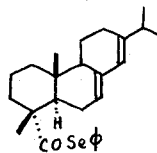
[NC] synthesis and struc-
ture determination



129

[REF] 79

[NC] asymmetric Diels-Alder reaction of **129**



130

[REF] 80

[NC] reduction of **130** with Bu_3SnH

3) Miscellaneous Section

126

Additional reference

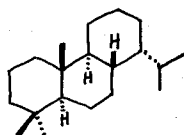
[REF] 81

[REF] 82

[NC] allergic constituents of some plants

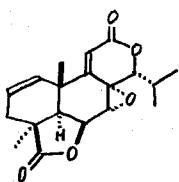
[NC] studies of hypocholesterolemic activity of abietamide derivatives

VII. TOTARANE DERIVATIVES



Totarane

1) Isolation and Structure Determination

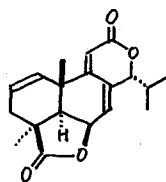


131

[CN] milanjilactone A

[NS] *Podocarpus milanjanus*

[REF] 83



132

[CN] milanjilactone B

[NS] *podocarpus milanjanus*

[REF] 83

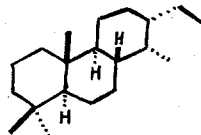
2) Miscellaneous Section

Additional reference

[REF] 84

[NC] ^{13}C NMR studies

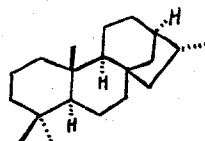
VIII. CASSANE DERIVATIVES



Cassane

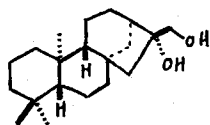
No report

IX. KAURANE DERIVATIVES



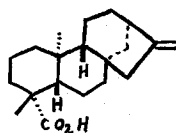
Kaurane

1) Isolation and Structure Determination



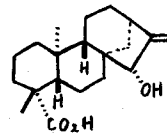
133

[NS] *Morithamnus crassus*
[REF] 8



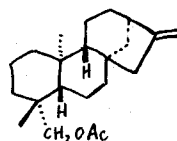
134

[NS] *Helianthus niveus* and
others
[REF] 3, 4, 7, 19, 85, 86, 87



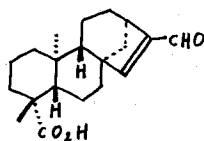
135

[NS] *Helianthus niveus*
and others
[REF] 7, 85; cf. 86



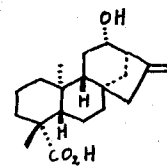
136

[NS] *Espeletiopsis* species
[REF] 88



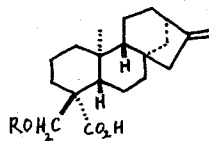
137

[NS] *Espeletiopsis* species
[REF] 88



138

[NS] *Smallanthus wedalis*
[REF] 87

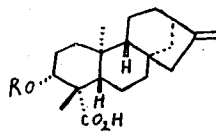


139 R=angeloyl

140 R=senecionyl

141 R=isovaleryl

[NS] *Smallanthus wedalis*
[REF] 87

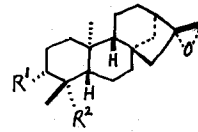


142 R=angeloyl

143 R=senecionyl

144 R=isovaleryl

[NS] *Smallanthus wedalis*
[REF] 87

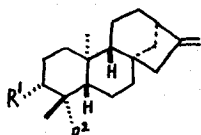


145 R¹=H, R²=CH₂O-angeloyl

146 R¹=O-angeloyl,
R²=Me

147 R¹=O-angeloyl,
R²=CHO

[NS] *Smallanthus wedalis*
[REF] 87



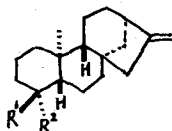
148 $R^1 = \text{OAc}$, $R^2 = \text{CO}_2\text{H}$

149 $R^1 = \text{OH}$, $R^2 = \text{CH}_2\text{OH}$

150 $R^1 = \text{OH}$, $R^2 = \text{CO}_2\text{H}$

[NS] *Stachys lanata*

[REF] 89



151 $R^1 = R^2 = \text{Me}$

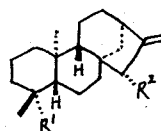
152 $R^1 = \text{Me}$, $R^2 = \text{H}$

153 $R^1 = \text{H}$, $R^2 = \text{Me}$

[NS] *Libanothamnus*

granatesianus

[REF] 19



154 $R^1 = \text{CO}_2\text{H}$, $R^2 = \text{OAc}$

155 $R^1 = \text{CO}_2\text{H}$, $R^2 = \text{O}$

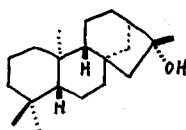
isovaleryl

156 $R^1 = \text{CH}_2\text{OH}$, $R^2 = \text{H}$

[NS] *Libanothamnus*

granatesianus

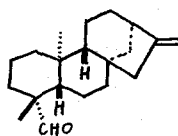
[REF] 19



157

[NS] *Helichrysum* species

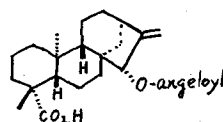
[REF] 4



158

[NS] *Gnaphalium undulatum*

[REF] 7

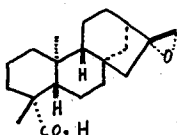


159

[NS] *Smallanthus fruticosus*

and others

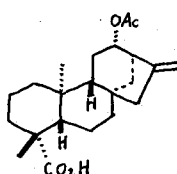
[REF] 3, 5, 27



160

[NS] *Smallanthus fruticosus*

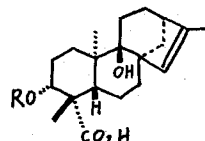
[REF] 5



161

[NS] *Helianthus* species

[REF] 3

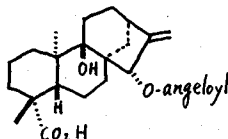


162 $R = \text{isovaleryl}$

163 $R = \text{isobutyl}$

[NS] *Polymnia canadensis*

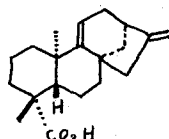
[REF] 90



164

[NS] *Steiractinia mollis*

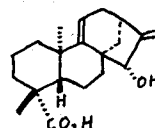
[REF] 91



165

[NS] *Steiractinia mollis* and others

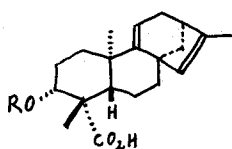
[REF] 3, 7, 19, 91, 92



166

[NS] *Smallanthus fruticosus*

[REF] 5



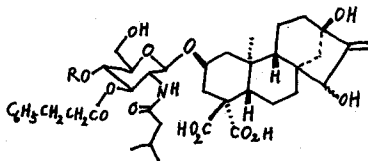
167 $R = \text{isovaleryl}$

168 $R = \text{isobutyl}$

169 $R = \text{tigil}$

[NS] *Polymnia canadensis*

[REF] 90



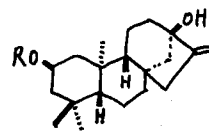
170 $R = \text{H}$

[CN] wedeloid

171 $R = \text{L-rhamnopyranosyl}$

[NS] *Wedelia asperima*

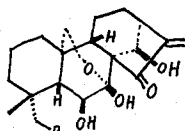
[REF] 93



172 $R = \beta\text{-D-glucosyl}$

[NS] *Lindsaea chienii*

[REF] 94



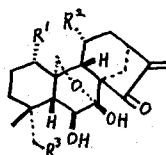
173 R=H

174 R=OAc

[CN] longikaurin A (173)
and B (174)

[NS] *Rabdosia longituba*

[REF] 95



175 R¹=OH, R²=R³=H

176 R¹=OAc, R²=R³=H

177 R¹=OH, R²=H,
R³=OAc

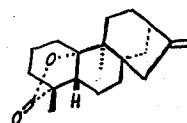
178 R¹=R³=OAc, R²=H

179 R¹=R²=OH, R³=H

[CN] effusanin A-E

[NS] *Rabdosia effusa*

[REF] 96

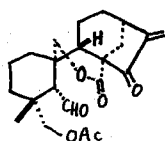


190

[CN] tetrachyrin

[NS] *Tetrachyrin*
orizabaensis

[REF] 97

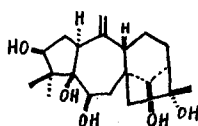


191

[CN] effusin

[NS] *Rabdosia effusus*

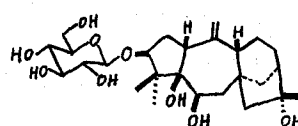
[REF] 98



192

[CN] grayanotoxin II

[REF] 99

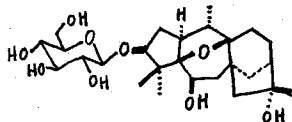


193

[CN] grayanoside C

[NS] *Leucothoe grayana*

[REF] 100

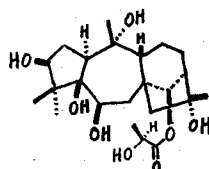


194

[CN] grayanoside D

[NS] *Leucothoe grayana*

[REF] 101

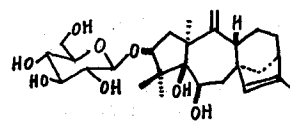


195

[CN] asebotoxin-X

[NS] *Pieris japonica*

[REF] 102, 103

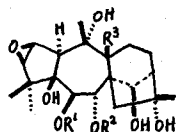


196

[CN] pieroside A

[NS] *Pieris japonica*

[REF] 102



197 R¹=R²=R³=H

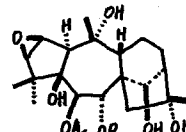
198 R¹=Ac, R²=H, R³=OH

199 R¹=Ac, R²=COC₂H₅, R³=OH

[CN] pieristorin H, J, K

[NS] *Pieris japonica*

[REF] 103



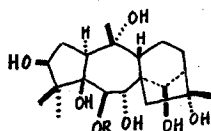
200 R=H

201 R=Ac

[CN] kalmixtoxin IV, V

[NS] *kalmia latifolia*

[REF] 104



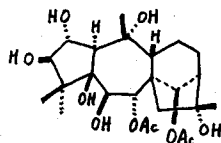
202 R=H

203 R=Ac

[CN] kalmitoxin I, III

[NS] *Kalmia latifolia*

[REF] 104

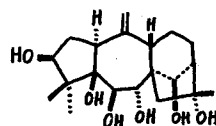


204

[CN] kalmitoxin VI

[NS] *Kalmia latifolia*

[REF] 104



205

[CN] kalmitoxin II

[NS] *Kalmia latifolia*

[REF] 104

Additional references

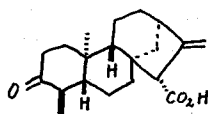
[REF] 105

[NC] studies of constituents of *Sideritis flavovirens*

[REF] 106

[NC] studies of constituents of *Eupatorium tinofolium*

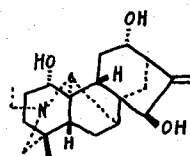
2) Synthesis and Reaction



206

[REF] 107

[NC] synthesis of optically active **206**

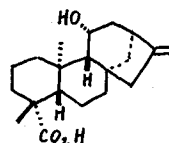


207

[CN] napelline

[REF] 108

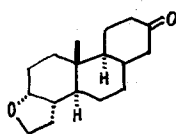
[NC] total synthesis



208

[REF] 109

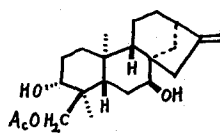
[NC] conversion of **165** to **208** and 12-hydroxy derivatives



209

[REF] 110

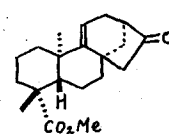
[NC] intermediate to epoxynorcastestanone



210

[REF] 111

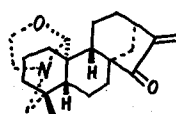
[NC] oxidation with $\text{SeO}_2\text{-H}_2\text{O}_2$



211

[REF] 112

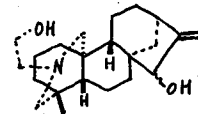
[NC] $10\alpha \rightarrow 9\alpha$ -methyl migration



212

[REF] 113

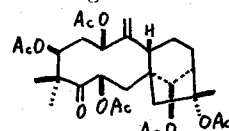
[NC] alumina catalyzed addition of amine to **212**



213

[REF] 114

[NC] oxidative cyclization

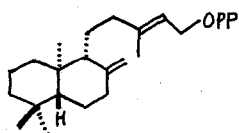


214

[REF] 115

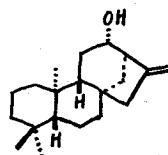
[NC] conversion of grayanotoxin II tetraacetate to **214**

3) Miscellaneous Section



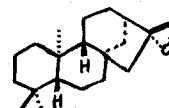
215

[CN] copalyl pyrophosphate
[REF] 116, 117
[NC] enzymatic cyclization
of **215** to *ent*-kaurene



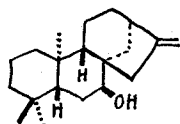
216

[REF] 118
[NC] microbial transfor-
mation of **216**



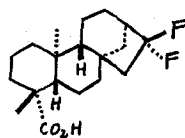
217

[REF] 119
[NC] inhibition of gib-
berellic acid bi-
osynthesis by **217**



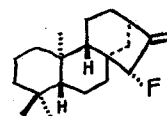
218

[REF] 120
[NC] microbial transformation
of diterpenoids



219

[REF] 121
[NC] microbial
transformation



220

[REF] 122
[NC] Biological activity
of some fluorodi-
terpenoids

Additional references

[REF] 123, 124

[NC] ¹³C NMR studies

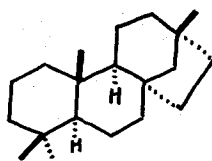
[REF] 125

[NC] analytical studies of
stevioside of *stevia*
rebaudiana

[REF] 126

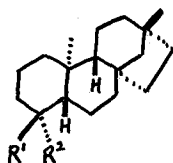
[NC] A review article on
diterpenoid alkaloids

X. BEYERANE DERIVATIVES



Beyerane

1) Isolation and Structure Determination



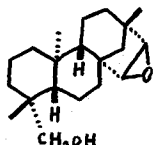
221 $R^1=Me, R^2=CH_2OH$

[CN] erythroxytol-A

222 $R^1=CH_2OH, R^2=Me$

[NS] *Baccharis tola*

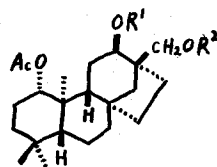
[REF] 20



223

[NS] *Baccharis tola*

[REF] 20



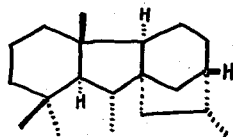
224 $R^1=H, R^2=Ac$

225 $R^1=Ac, R^2=H$

[NS] *Sideritis serrata*

[REF] 127

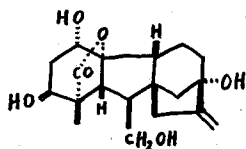
XI. GIBBERELLANE DERIVATIVES



Gibberellane

1) Isolation and Structure Determination

Additional references



226

[CN] gibberellin A_{57}

[NS] *Gibberilla fujikuroi*

[REF] 128

[REF] 129

[NC] identification of gibberellins in Spinach shoots

[REF] 130

[NC] identification of gibberellins in wheat grain

[REF] 131

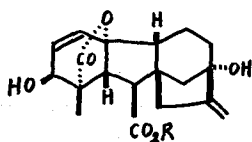
[NC] gibberellins in mature apple seeds

[NS] *pharbitis purpurea*

[REF] 132

[NC] glucosyl esters of GA_5 and A_{44}

2) Synthesis and Reaction

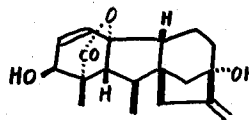


227 R=H

- [CN] gibberellin A₃
- [REF] 133, 134
- [NC] total synthesis
- [REF] 135
- [NC] introduction of fluorine at C-4
- [REF] 136
- [NC] rearrangement
- [REF] 137
- [NC] Pd (OAc)₂-catalyzed reactions
- [REF] 138
- [NC] partial synthesis of 16, 17-dihydro-Δ¹⁵-G A₃

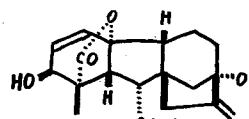
228 R=CH₃

- [REF] 139
- [NC] photochemistry, crystal structure
- [REF] 140
- [NC] introduction of chlorine and bromine at C-7
- [REF] 141
- [NC] 3-O-acetyl derivative, reaction with PBr₃



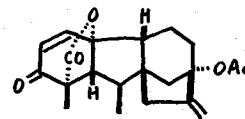
229

- [REF] 142
- [NC] chemical conversion from GA₃



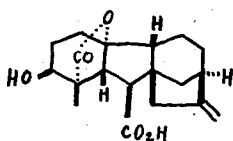
230

- [CN] 6-*epi*-gibberellin A₃
- [REF] 143
- [NC] chemical conversion from GA₄



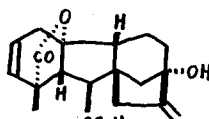
231

- [REF] 144
- [NC] reduction with NaBH₄ or NaBD₄



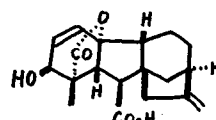
232

- [CN] gibberellin A₄
- [REF] 145
- [NC] total synthesis
- [REF] 146
- [NC] physiological studies
- [REF] 147
- [NC] deuterium labeling



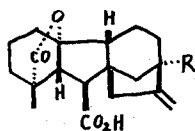
233

- [CN] gibberellin A₅
- [REF] 148
- [NC] 1-deuterated derivative
- [REF] 149
- [NC] partial synthesis, 3-deuterated derivatives



234

- [CN] gibberellin A₇
- [REF] 150
- [NC] partial synthesis



235 R=H

[CN] gibberellin A₉

[REF] 147

[NC] deuterium labeling

[REF] 149

[NC] partial synthesis, 3-deuterated derivative

236 R=OH

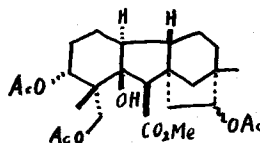
[CN] gibberellin A₂₀

[REF] 147

[NC] deuterium labeling

[REF] 149

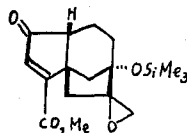
[NC] partial synthesis 3-deuterated derivative



237

[REF] 151

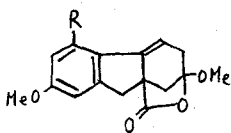
[NC] synthesis



238

[REF] 152

[NC] synthesis

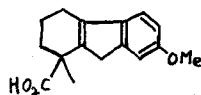


239 R=H

240 R=OMe

[REF] 153

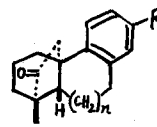
[NC] synthesis



241

[REF] 154

[NC] synthesis

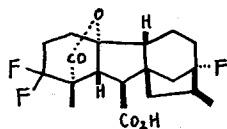


242 n=1 or 2, R=H

243 n=1 or 2, R=OMe

[REF] 155

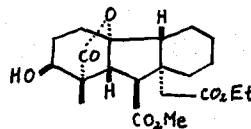
[NC] synthesis



244

[REF] 156

[NC] chemical conversion from benzyl gibberellate

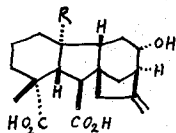


245

[REF] 157

[NC] photoproduct from gibberellin C, X-ray analysis

3) Miscellaneous Section

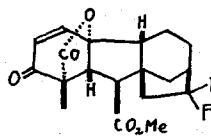


250 R=Me

251 R=CO₂H

[REF] 118

[NC] microbial transformations



252

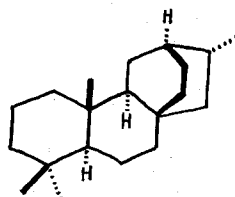
[REF] 121

[NC] microbial transformations

Additional references

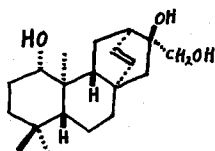
- | | | |
|--|--------------------------------------|---------------------------------|
| [REF] 158 | [REF] 160 | [REF] 162 |
| [NC] application of gibberellic acid in treatment of lung cancer | [NC] HPLC separation of gibberellins | [NC] a review on plant hormone |
| [REF] 159 | [REF] 161 | [REF] 163 |
| [NC] phytohormone activity of gibberellin A ₃ | [NC] mass spectrometric studies | [NC] metabolism of gibberellins |

XII. ATISANE DERIVATIVES



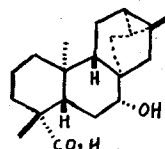
Atisane

1) Isolation and Structure Determination



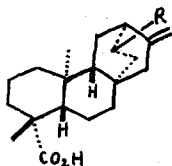
253

- [CN] sideritol
[REF] 164
[NC] X-ray analysis of *p*-bromobenzoate



254

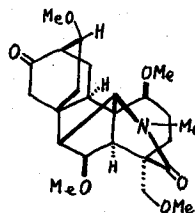
- [CN] ciliaric acid
[NS] *Helianthus niveus*
[REF] 85



255 R=O-ang

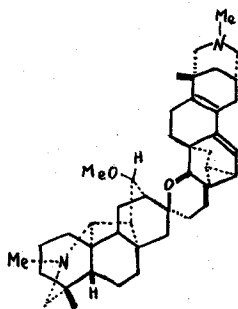
256 R=O-isoval

- [NS] *Helianthus* species
[REF] 3



257

- [REF] 165
[NS] X-ray analysis, intermediate for total synthesis



258

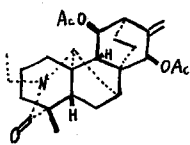
[CN] staphisine

[NS] *Delphinium staphisagria*

[REF] 166

[NC] X-ray analysis

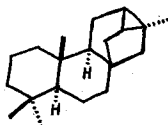
2) Synthesis and Reaction



259

[REF] 167

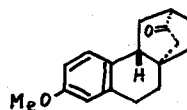
[NC] total synthesis



260

[REF] 168

[NC] chemical conversion



261

[REF] 169

[NC] synthesis

3) Miscellaneous Section

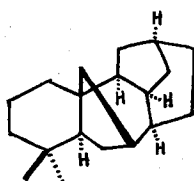
[REF] 41

[NC] a review

[REF] 126

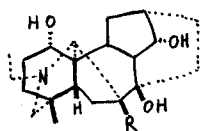
[NC] a review

XIII. ACONANE DERIVATIVES



Aconane

1) Isolation and Structure Determination



262 R=H

[CN] cardiopetaline

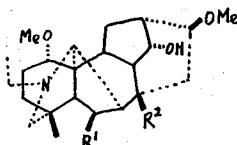
263 R=OH

[CN] cardiopetalidine

[NS] *Delphinium cardiopetalum*

[REF] 170

[NC] X-ray analysis of **262**



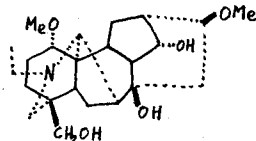
264 R¹=OAc, R²=OMe

265 R¹=R²=OH

[NS] *Delphinium bicolor*

[REF] 171

[NC] X-ray analysis



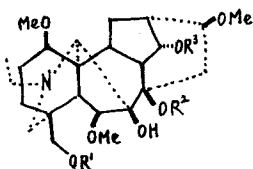
266

[CN] cammaconine

[NS] *Aconitum variegatum*

[REF] 172

[NC] structure revision



267 R¹=R²=Me, R³=Ac

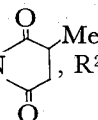
[CN] ambiguiine

268 R¹=Me, R²=H, R³=Ac

[CN] 14-acetylbrowniine

269 R¹=COC₆H₄-o-NHAc, R²=H, R³=Ac

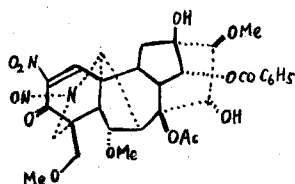
[CN] ajadine

270 R¹=COC₆H₄-o-N , R²=H, R³=Bz

[CN] ajacusine

[NS] *Consolida ambigua*

[REF] 173



271

[REF] 174

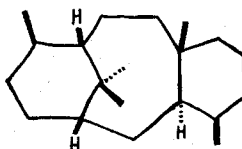
[NC] oxidation product of
aconitine

Additional reference

[REF] 126

[NC] a review

XIV. TAXANE DERIVATIVES



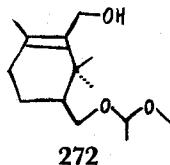
Taxane

1) Isolation and Structure Determination

[REF] 175

[NC] a review

2) Synthesis and Reaction

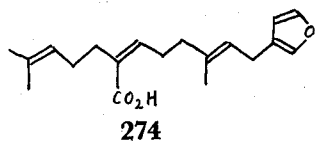
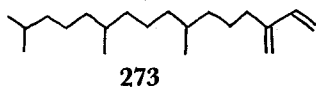


[REF] 176

[NC] synthesis of a key intermediate

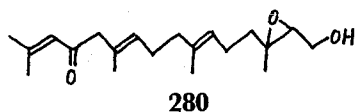
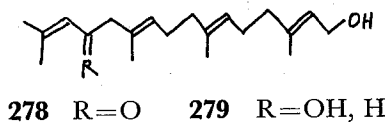
XV. THE OTHERS

1) Isolation and Structure Determination



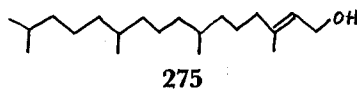
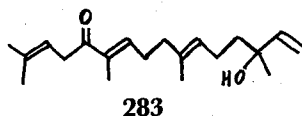
[CN] neophytadiene (273)
centipedic acid (274)

[NS] *Plagiocheilus prostratus*
[REF] 177



[CN] eleganolone (278), elegandiol (279)
epoxy eleganolone (280)

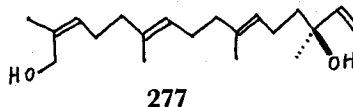
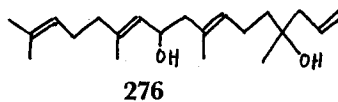
[NS] *Cystoseira elegans* and *Bifurcaria bifurcata*
[REF] 180 and 181



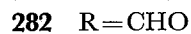
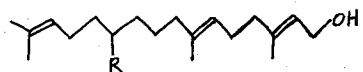
[CN] phytol

[NS] *Thymelea hirsuta*

[REF] 178



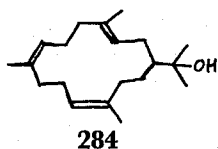
[NS] *Nicotiana sylvestris*
[REF] 179



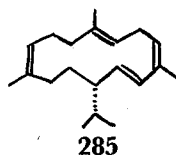
[NS] *Croton kerrii*
[REF] 182

[REF] 180

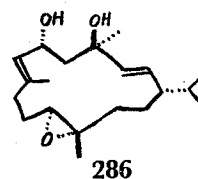
[NC] acyclic diterpenes from
mediterranean cystoseiraceae



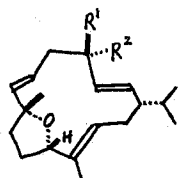
[NS] *Helichrysum* species
[REF] 4



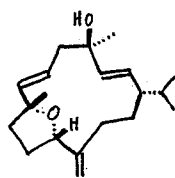
[CN] cembrene
[NS] *Nicotiana tabacum*
[REF] 183



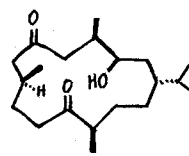
[NS] Greek tobacco
[REF] 184



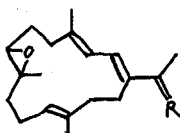
[NS] Greek tobacco
[REF] 184



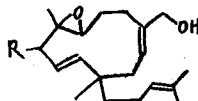
[NS] Greek tobacco
[REF] 184



[CN] plexauroлоне
[NS] *Plexaura*-related species
[REF] 185
[NC] X-ray analysis



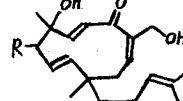
[NS] *Sarcophyton crassocaule*
[REF] 186



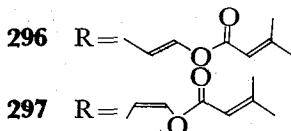
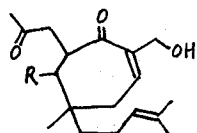
294 $R=H$

[CN] vibsamine A (**293**)
vibasamine B (**295**)
vibasamine F (**294**)

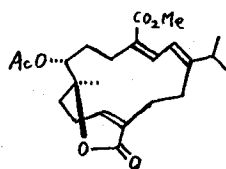
[NS] *Viburnum odoratissimum*
[REF] 187



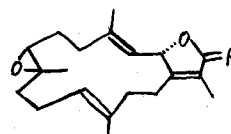
[CN] vibsamine A (**293**)
vibasamine B (**295**)
vibasamine F (**294**)



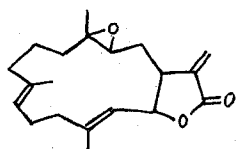
[CN] vibsamine C (**296**)
vibasamine D (**297**)
[NS] *Viburnum odoratissimum*
[REF] 187



[CN] emblide
[NS] *Sarcophyton glaucum*
[REF] 188
[NC] X-ray analysis



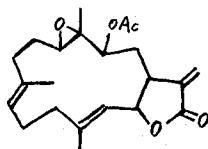
[CN] deoxosarcophine (**299**)
sarcophine (**300**)
[NS] *Sarcophyton* species
[REF] 189



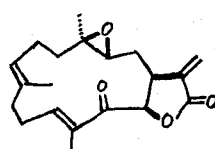
301

[NS] *Lobophytum pauciflorum*

[REF] 190



302



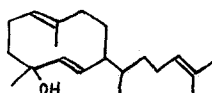
303

[CN] peunicin

[NS] *Eunicea succinea*

[REF] 191

[NC] X-ray analysis

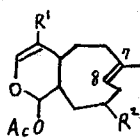


304

[CN] obscuronatin (**304**), xeniculin (**305**)

[NS] *Xenia macrospiculata* and *X. obscuronate*

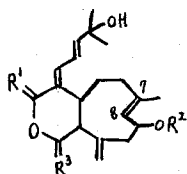
[REF] 192



305 $R^1 = \text{OAc}$, $R^2 = \text{OAc}$

306 $R^1 = \text{OAc}$, $R^2 = \text{H}$

307 $R^1 = \text{OAc}$, $R^2 = \text{H}$,
7, 8-epoxide



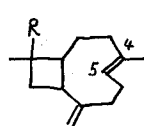
308 $R^1 = \text{O}$, $R^2 = \text{H}$, $R^3 = \text{H}_2$

309 $R^1 = \text{H}_2$, $R^2 = \text{H}$, $R^3 = \text{O}$

310 $R^1 = \text{H}_2$, $R^2 = \text{Ac}$, $R^3 = \text{O}$

311 $R^1 = \text{O}$, $R^2 = \text{H}$, $R^3 = \text{H}_2$, 7, 8-epoxide

312 $R^1 = \text{H}_2$, $R^2 = \text{H}$, $R^3 = \text{OH}$, H



313 $R = \text{CH}_2$, OH

314 $R = \text{CH}_2$, OH , 4,5-epoxide

315 $R = \text{CH}_2$, OH

316 $R = \text{CH}_2$, OH , 4,5-epoxide

317 $R = \text{CH}_2$, OH

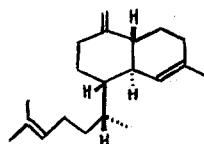
318 $R = \text{CH}_2$, OAc , OH

319 $R = \text{CH}_2$, OAc , OH , 4,5-epoxide

[CN] xeniolide-A (**308**) xeniolide-B (**309**), xenialactol (**312**), xeniaphyllenol (**313**), isoxeniaphyllenol (**315**)

[NS] *Xenia macrospiculata* and *X. obscuronate*

[REF] 192

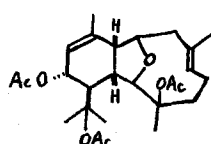


320

[NS] *Cubitermes umbratus*

[REF] 193

[NC] X-ray analysis

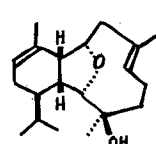


321

[CN] ophirin

[NS] *Muricella* species

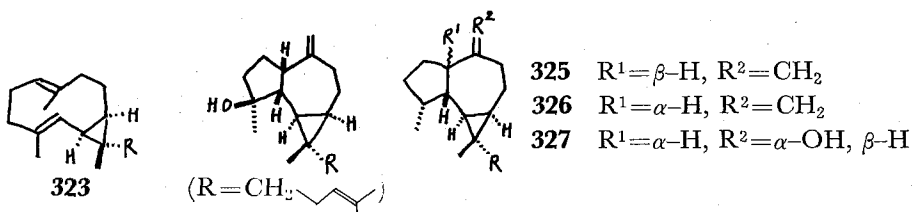
[REF] 194



322

[NS] pacific soft coral

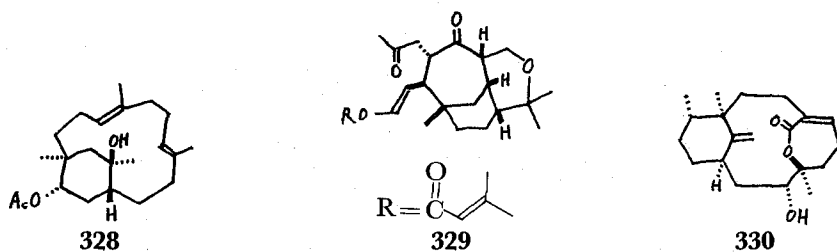
[REF] 195



[CN] cneorubin Y (323), cneorubin X (324)
cneorubin W₁ (325), cneorubin W₂ (326)
cneorubin U (327)

[NS] *Cneorum tricoccon* and *Neochamaelea pulverulenta*

[REF] 196



[CN] secotrinervitane

[NS] *Nasutitermes princeps*

[REF] 197

[NC] X-ray analysis

[CN] vibsamin E

[NS] *Viburnum odoratissimum*

[REF] 187 and 198

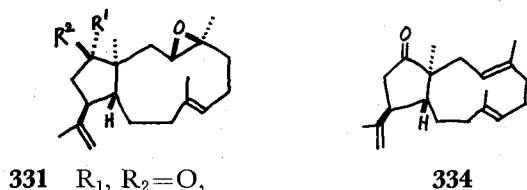
[NC] X-ray analysis

[CN] cleomeolide

[NS] *Cleome viscosa*

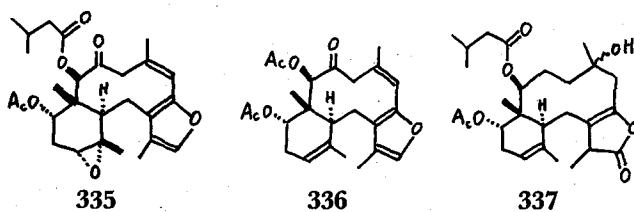
[REF] 199

[NC] X-ray analysis



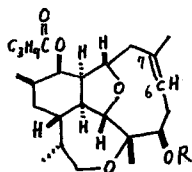
[NS] *Dictyota dichotoma*

[REF] 200



[NS] *Scytalium
tentaculatum*

[REF] 201



338 R=Ac, 6, 7-trans

[CN] asbestinin-1

339 R=H, 6, 7-trans

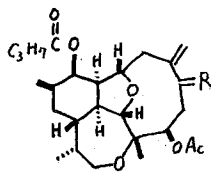
[CN] asbestinin-3

340 R=Ac, 6, 7-cis

[CN] asbestinin-2

[REF] 202

[NC] X-ray analysis (**338**)

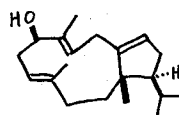


341 R=O

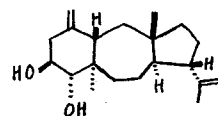
[CN] asbestinin-4

342 R= α -OH, β -H

[CN] asbestinin-5



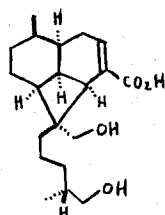
343



344

[NS] *Clavularia inflata*

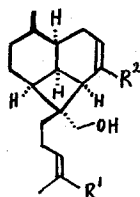
[REF] 203



345

[NS] *Eremophila* species

[REF] 204



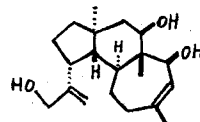
346 R¹=R²=CH₂OH

347 R¹=CO₂H, R²=Me

348 R¹=CO₂H, R²=CH₂OH

[NS] *Eremophila decipiens*

[REF] 205



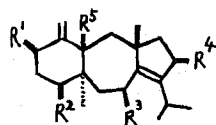
349

[CN] onychiol B

[NS] *Onchium japonicum*

[REF] 206

[NC] X-ray analysis



350 R¹=H, R²=R⁵=OH,

R³=R⁴=OAc

351 R¹=R³=R²=H,

R²=R⁵=OH

352 R¹=R⁵=OH,

R²=R³=R⁴=H

353 R¹=R³=R⁴=R⁵=H,

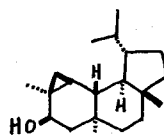
R²=OH

[CN] amijidietylol (**350**), amijiol

(**351**), isoamijiol (**352**)

[NS] *Dictyota linearis*

[REF] 207 and 208



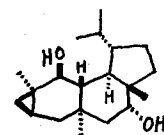
354

[CN] neoverrucosan-5 β -ol

[NS] *Mylia verrucosa*

[REF] 209

[NC] X-ray analysis



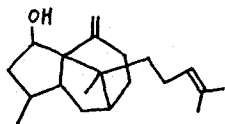
355

[CN] dihydroxy-verrucosane

[NS] *Mylia verrucosa*

[REF] 210

[NC] X-ray analysis

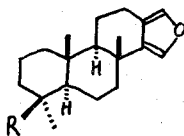


356

[CN] stoechospermol

[NS] *Stoechospermum marginatum*

[REF] 211



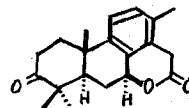
357 R=CO₂H

358 R=CHO

359 R=Me

[NS] *Spongia officinalis*

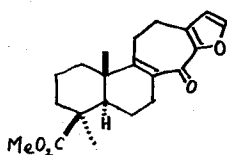
[REF] 212



360

[NS] *Vellozia compacta*

[REF] 213



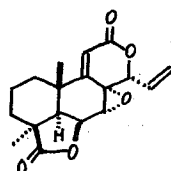
361

[CN] hispanonic acid methyl ester

[NS] *Balloya hispanica*

[REF] 214

[NC] X-ray analysis



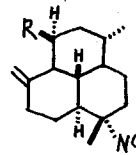
362

[CN] Salignone-D

[NS] *Podocarpus saligna*

[REF] 215

[NC] X-ray analysis



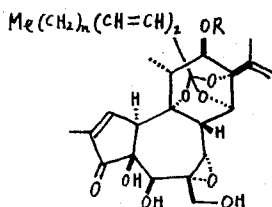
363 R=CH=CMe₂

364 R=CH₂-C(=CH₂)Me

365 R=CH₃-C(=CH₂)NC

[NS] *Adosia* species

[REF] 216



R=CO(CH=CH)₃(CH₂)₂CH₂OY

n=2

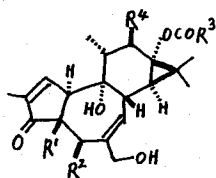
366 Y=H, 367 Y=CO(CH₂)₁₂Me

368 Y=COCH=CH(CH₂)₁₁Me

369 Y=COC₁₃H₂₇

370 Y=COC₁₄H₂₇

[NS] *Stillingia sylvatica* [REF] 217



371 R¹=R²=H, R³=CH₂CH Me₂

R⁴=OCOC(Me)=CHMe

[NS] *Synadenium grantii*

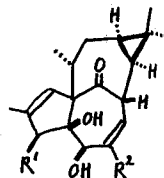
[REF] 218

372 R¹=R²=OH, R⁴=H

R³=(CH₂)₁₄Me

[NS] *Stillingia sylvatica*

[REF] 217



373 R¹=angelate, R²=Me

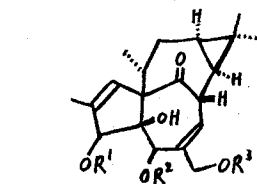
374 R¹=hexanoate, R²=Me

375 R¹=angelate, R²=CH₂OH

[NS] *Euphorbia paralias*

[REF] 219

[NC] Irritant and cytotoxic constituents



376 $R^1 = \text{COC}_2\text{H}_5$, $R^2 = \text{H}$, $R^3 = \text{COCH}(\text{Me})\text{C}_2\text{H}_5$

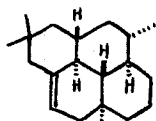
377 $R^1 = R^2 = \text{H}$, $R^3 = \text{COCHMe}_2$

378 $R^1 = \text{COC}_2\text{H}_5$, $R^2 = \text{H}$, $R^3 = \text{COCHMe}_2$

399 $R^1 = R^3 = \text{COCHMe}_2$, $R^2 = \text{H}$

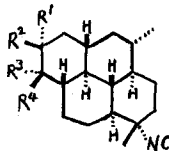
[NS] *Euphorbia cotinifolia*

[REF] 220



380

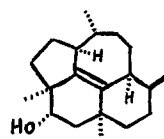
[NS] *Adocia* species



381 $R^1 = \text{NC}$, $R^2 = R^3 = \text{Me}$, $R^4 = \text{H}$

382 $R^1 = R^4 = \text{Me}$, $R^2 = \text{H}$, $R^3 = \text{NC}$ [NS] *Nasutitermes*

[REF] 216

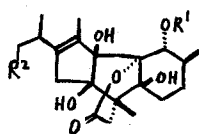


383

rippertii and *N. ephratae*

[REF] 221

[NC] X-ray analysis

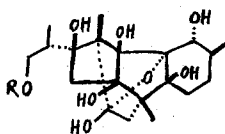


384 $R^1 = \text{Ac}$, $R^2 = \text{H}$

385 $R^1 = R^2 = \text{H}$

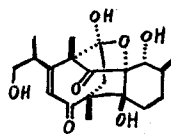
386 $R^1 = \text{H}$, $R^2 = \text{OH}$

387 $R^1 = \text{H}$, $R^2 = \text{O-}\beta\text{-p-gluc-pyr}$

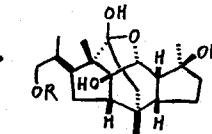


388 $R = \text{H}$

389 $R = \beta\text{-D-gluc-pyr}$



390



391 $R = \text{H}$

392 $R = \beta\text{-D-gluc-pyr}$

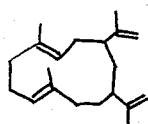
[CN] cinnacassiol-A (**386**), -B (**388**), -C (**390**), -D (**391**)

[NS] *Cinnanomum cassia*

[REF] 222, 223, 224, 225

[NC] X-ray analysis

2) Synthesis and Reaction



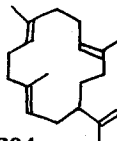
393

[CN] ($\pm$)-cubitene

[REF] 226

[NC] intramolecular coupling of allylic dibromide

total synthesis



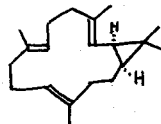
394

[CN] neocembrene

[REF] 227

[NC] synthesis of d- and l-neocembrenes and their geometrical isomers

pheromone activity

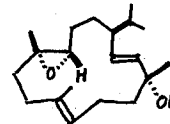


395

[CN] (–)-casbene

[REF] 228

[NC] total synthesis from 1R, 3S(+)-cis-chrystan-themic acid

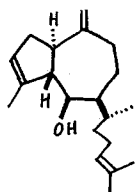


396

[CN] isocembrol (thunbergol)

[REF] 229

[NC] epoxidation



397

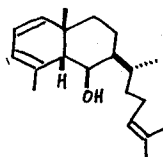
[CN] (+)-pachydietyl A (**397**)

(-)-dictyolene (**398**)

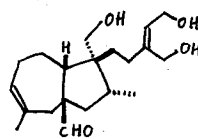
[REF] 230

[NC] total syntheses from

(-)- α -santonin



398



399

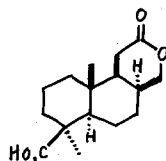
[CN] (±)-portulal

[REF] 231

[NC] total synthesis

[REF] 232

[NC] selective degradation of side chain

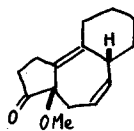


400

[CN] dihydro-8-epi-acrostalidic acid

[REF] 233

[NC] total synthesis

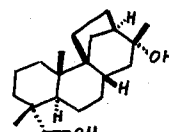


401

[REF] 234

[NC] synthetic approach to phorbol

divinylcyclopropane rearrangement

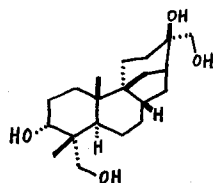


402

[CN] (±)-stemarin

[REF] 235

[NC] total synthesis

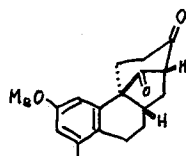


403

[CN] (±)-aphidicolin

[REF] 236

[NC] total synthesis

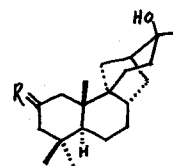


404

[REF] 237

[NC] synthetic approach to aphidicolin

thermolysis of benzocyclobutene



405 R = α -OH, β -H

406 R = O

[CN] (±)-stemodin

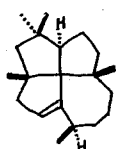
(**405**)

(±)-stemodinone

(**406**)

[REF] 238

[NC] total synthesis

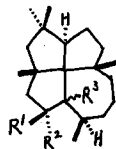


407

[CN] lauren-1-ene

[REF] 239

[NC] osmic acid oxidation
NMR spectra



408 R¹ = OH, R² = H, R³ = α -H

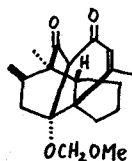
409 R¹ = H, R² = OH, R³ = α -H

410 R¹ = OH, R² = H, R³ = β -H

411 R¹ = H, R² = OH, R³ = β -H

[REF] 240

[NC] remote functionalization with I₂/Pb(OAc)₄

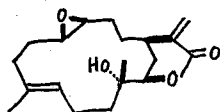


412

[REF] 241

[NC] synthetic precursors to pleuromutilin
one-step synthesis

3) Miscellaneous Section



413

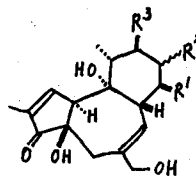
[CN] flexibilide

[REF] 242

[NC] ^{13}C -NMR study

spin-lattice

relaxation measurements



414

[REF] 243

[NC] structure-activity relations for
irritant and tumor promoting
activity

tigliane derivatives (414)

$\text{R}^1 = \text{H}$ or $\text{C}(\text{Me})=\text{CH}_2$

$\text{R}^2 = \alpha\text{-}$ or $\beta\text{-OOC}(\text{CH}_2)_{12}\text{Me}$

$\text{R}^3 = \text{H}$ or $\text{OOC}(\text{CH}_2)_6\text{Me}$

Additional references

[REF] 244

[NC] structure-activity relationships for phorbol-related diterpene esters

[REF] 41 [NC] a review article on the chemistry of the *Compositae*
(cembrene type diterpenoids)

[REF] 81 [NC] a review article on the plants and plants products that
induced contact dermatitis (tiglane, daphnane, ingenane
type diterpenoids)

[REF] 245 [NC] a review article on the drugs from marine organisms
(cembranoid)

REFERENCES

- (1) J. W. Dorner, R. J. Cole, J. P. Springer, R. H. Cox, H. Cutler, and D. T. Wicklow, *Phytochemistry*, **19**, 1157 (1980).
- (2) D. Nasipuri, A. K. Samaddar, and G. Das, *Indian J. Chem., Sect. B*, **19 B**, 727 (1980). (*Chem. Abstr.*, **94**, 139975f [1981].)
- (3) F. Bohlmann, J. Jakupovic, R. M. King and H. Robinson, *Phytochemistry*, **19**, 863 (1980).
- (4) F. Bohlmann, C. Zdero, W-R. Abraham, A. Suwita, and M. Grenz, *ibid.*, **19**, 873 (1980).
- (5) F. Bohlmann, J. Ziesche, R. M. King, and H. Robinson, *ibid.*, **19**, 973 (1980).
- (6) H. Itokawa, M. Morita, and S. Mihashi, *Chem. Pharm. Bull.*, **28**, 3452 (1980).
- (7) F. Bohlmann and J. Ziesche, *Phytochemistry*, **19**, 71 (1980).
- (8) F. Bohlmann, J. Jakupovic, H. Robinson, and R. M. King, *ibid.*, **19**, 2769 (1980).

- (9) J. de Pascual Teresa, A. F. Barrero, L. Muriel, A. San Feliciano, and M. Grande, *ibid.*, **19**, 1153 (1980).
- (10) N. Le-Van and T. Van Cuong Pham., *ibid.*, **19**, 1971 (1980).
- (11) H. Sakamaki, M. Matsumoto, Y. Nishi, and Y. Ichinoe, *Bull. Dep. Gen. Educ., Coll. Sci. Technol., Nihon Univ.*, **27**, 43 (1980). (*Chem. Abstr.*, **93**, 220944w [1980].)
- (12) S. Hasegawa and Y. Hirose, *Phytochemistry*, **19**, 2479 (1980).
- (13) F. Bohlmann, W-R. Abraham, H. Robinson, and R. M. King, *ibid.*, **19**, 2475 (1980).
- (14) M. C. García-Alvarez and B. Rodríguez, *ibid.*, **19**, 2405 (1980).
- (15) F. Bohlmann, A. Suwita, R. M. King, and H. Robinson, *ibid.*, **19**, 111 (1980).
- (16) F. Bohlmann, E. Rosenberg, R. M. King, and H. Robinson, *ibid.*, **19**, 977 (1980).
- (17) F. Bohlmann, H. Suding, J. Cuatrecasas, R. M. King, and H. Robinson, *ibid.*, **19**, 267 (1980).
- (18) M. Sholichin, K. Yamasaki, R. Miyama, S. Yahara, and O. Tanaka, *ibid.*, **19**, 326 (1980).
- (19) F. Bohlmann, C. Zdero, J. Cuatrecasas, R. M. King, and H. Robinson, *ibid.*, **19**, 1145 (1980).
- (20) A. S. Martín, J. Rovirosa, R. Becker, and M. Castillo, *ibid.*, **19**, 1985 (1980).
- (21) A. H. Conner, B. A. Nagasampagi, and J. W. Rowe, *ibid.*, **19**, 1121 (1980).
- (22) F. Miyamoto, H. Naoki, Y. Naya, and K. Nakanishi, *Tetrahedron*, **36**, 3481 (1980).
- (23) B. M. Howard and W. Fenical, *Phytochemistry*, **19**, 2774 (1980).
- (24) Y. Uchino, M. Nagasaki, S. Eguchi, A. Matsuo, M. Nakayama, and S. Hayashi, *Tetrahedron Lett.*, **21**, 3775 (1980).
- (25) T. Norin, S. Sundin, and O. Theander, *Acta Chem. Scand.*, **B34**, 301 (1980).
- (26) F. Bohlmann, C. Zdero, R. K. Gupta, R. M. King, and H. Robinson, *Phytochemistry*, **19**, 2695 (1980).
- (27) F. Bohlmann, U. Fritz, R. M. King, and H. Robinson, *ibid.*, **19**, 2655 (1980).
- (28) F. Bohlmann, J. Jakupovic, H. Robinson, and R. M. King, *ibid.*, **19**, 881 (1980).
- (29) B. Rodriguez and G. Savona, *ibid.*, **19**, 1805 (1980).
- (30) J. F. Blount and P. S. Manchand, *J. C. S. Perkin Trans I*, 264 (1980).
- (31) P. M. Imamura and E. A. Rúveda, *J. Org. Chem.*, **45**, 510 (1980).
- (32) Z. I. Mavlyankulova, U. N. Zainutdinov, S. I. Mukhamedkhanova, V. B. Léontév, and Kh. A. Aslanov, *Khim. Prir. Soedin.* 46 (1980). (*Chem. Abstr.*, **93**, 72011x [1980].)
- (33) T. Kato, K. Ishii, I. Ichinose, Y. Nakai, and T. Kumagai, *J. C. S. Chem. Comm.*, 1106 (1980).
- (34) P. F. Vlad, M. N. Koltsova, V. E. Sibirtseva, and S. D. Kustova, *Zh. Obshch. Khim.*, **50**, 195 (1980). (*Chem. Abstr.*, **92**, 198570b [1980].)
- (35) P. F. Vlad, M. N. Koltsova, V. E. Sibirtseva, and S. D. Kustova, *ibid.*, **50**, 206 (1980). (*Chem. Abstr.*, **92**, 198571c [1980].)
- (36) P. F. Vlad, M. N. Koltsova, V. E. Sibirtseva, and S. D. Kustova, *ibid.*, **50**, 213 (1980). (*Chem. Abstr.*, **92**, 198572d [1980].)
- (37) P. F. Vlad, M. N. Koltsova, V. E. Sibirtseva, and S. D. Kustova, *ibid.*, **50**, 218 (1980). (*Chem. Abstr.*, **92**, 198573e [1980].)
- (38) R. C. Cambie, S. H. Leong, B. D. Palmer, and A. F. Preston, *Austral. J. Chem.*, **33**, 155 (1980).
- (39) V. Stah, S. V. Bhat, B. S. Bajwa, H. Dornauer, and N. J. de Souza, *Planta medica*, **39**, 183 (1980).
- (40) H. Tomita, M. Sato, and N. Kawashima, *Agr. Biol. Chem.*, **44**, 2517 (1980).
- (41) F. Bohlmann, *Naturwissenschaften*, **67**, 588 (1980).
- (42) G. Stapel, H. G. Menssen, and G. Snatzke, *Planta medica*, **39**, 366 (1980).
- (43) C. E. Tonn and O. S. Giordano, *An. Asoc. Quim. Argent.*, **68**, 237 (1980). (*Chem. Abstr.*, **95**, 62443s [1981].)
- (44) G. Papanov and P. Malakov, *Z. Naturforsch., Sect. B*, **35**, 764 (1980). (*Chem. Abstr.*, **93**, 204879y [1980].)
- (45) E. Kitazawa, A. Sato, S. Takahashi, H. Kuwano, and A. Ogiso, *Chem. Pharm. Bull.*, **28**, 227 (1980).
- (46) E. Fujita, M. Node, K. Nishide, M. Sai, K. Fuji, A. T. McPhail, and J. A. Lamberton, *J. C. S.*

The Chemistry on Diterpenoids in 1980

- Chem. Comm.*, 920 (1980).
- (47) S. Marquerz, R. M. Rabanal, S. Valverde, L. Euren, A. Perales, and J. Fayos, *Tetrahedron Lett.*, **21**, 5039 (1980).
 - (48) A. S. Sarma and P. Chattopadhyay, *ibid.*, **21**, 3719 (1980).
 - (49) I. Kitagawa, T. Kamigauchi, K. Yonetani, and M. Yoshihara, *Chem. Pharm. Bull.*, **28**, 2403 (1980).
 - (50) D. J. Goldsmith, T. K. John, and F. Van Middlesworth, *Synth. Commun.*, **10**, 551 (1980).
 - (51) J. M. Luteijn, M. van Doorn, and A. de Groot, *Tetrahedron Lett.*, **21**, 4127 (1980).
 - (52) J. M. Luteijn and A. de Groot, *ibid.*, **21**, 4129 (1980).
 - (53) Y. Kojima and N. Kato, *ibid.*, **21**, 5033 (1980).
 - (54) I. Kubo, M. Kido, and Y. Fukuyama, *J. C. S. Chem. Comm.*, 897 (1980).
 - (55) R. K. Bansal, M. C. Garcia-Alvarez, K. C. Joshi, B. Rodriguez and R. Patni, *Phytochemistry*, **19**, 1979 (1980).
 - (56) N. Cagnoli, P. Ceccherelli, M. Curini, N. Spagnoli, and M. Ribaldi, *J. Chem. Research (S)*, 276 (1980).
 - (57) R. N. Barua, R. P. Sharma, G. Thyagarajan, W. Herz, and S. V. Govindan, *Phytochemistry*, **19**, 323 (1980).
 - (58) A. Perales, M. Martinez-Ripoll, J. Fayos, B. K. Bansal, K. C. Joshi, R. Patni, and B. Rodriguez, *Tetrahedron Lett.*, **21**, 2843 (1980).
 - (59) P. Onokoko and M. Vanhaelen, *Phytochemistry*, **19**, 303 (1980).
 - (60) K. Koike, G. A. Cordell, N. R. Farnsworth, A. A. Freer, C. J. Gilmore, and G. A. Sim, *Tetrahedron*, **36**, 1167 (1980).
 - (61) A. K. Banerjee and W. F. Garcia, *Synth. Commun.*, **10**, 693 (1980).
 - (62) B. Delmond, M. Taran, and J. Valade, *Tetrahedron Lett.*, **21**, 1339 (1980).
 - (63) M. Curini, P. Ceccherelli, R. Pellicciari, and E. Sisani, *Gazz. Chim. Ital.*, **110**, 621 (1980).
 - (64) P. Ceccherelli, M. Curini, M. Tingoli, and R. Pellicciari, *J. C. S. Perkin Trans. I*, 1924 (1980).
 - (65) K. A. Drengler and R. M. Coates, *J. C. S. Chem. Comm.*, 856 (1980).
 - (66) E. Wenkert, M. S. Raju, P. Ceccherelli, M. Curini, M. Tingoli, and R. Pellicciari, *J. Org. Chem.*, **45**, 741 (1980).
 - (67) A. I. Rezvukhin, I. V. Solomennikova, S. F. Bychkov, and E. N. Shmidt, *Izv. Akad. Nauk. SSSR, Ser. Khim.*, **29**, 317 (1980).
 - (68) N. Bellavita, J.-M. Bernassan, P. Ceccherelli, M. S. Raju, and E. Wenkert, *J. Am. Chem. Soc.*, **102**, 17 (1980).
 - (69) M. Yatagai and T. Takahashi, *Phytochemistry*, **19**, 1149 (1980).
 - (70) T. Miyase, P. Rüedi, and C. H. Eugster, *Helv. Chim. Acta*, **63**, 95 (1980).
 - (71) P. Hoet, I. Landa, M. Rivera, M. Van Meerssche, G. Germain, and J. P. Declercq, *Bull. Soc. Chim. Belg.*, **89**, 385 (1980).
 - (72) E. E. van Tamelen, J. P. Demers, E. G. Taylor, and K. Koller, *J. Am. Chem. Soc., soc.*, **102**, 5424 (1980).
 - (73) R. S. Buckanin, S. J. Chen, D. M. Frieze, F. T. Sher, and G. A. Berchtold, *ibid.*, **102**, 1200 (1980).
 - (74) E. E. van Tamelen and E. G. Taylor, *ibid.*, **102**, 1202 (1980).
 - (75) A. Andersen, M. Neron-Desbiens, S. Savard, and R. H. Burnell, *Synth. Commun.*, **10**, 183 (1980).
 - (76) T. Matsumoto, S. Imai, K. Ondō, N. Takeyama, and K. Fukui, *Chemistry Lett.*, 425 (1980).
 - (77) H. P. Märki and C. H. Eugster, *J. C. S. Chem. Comm.*, 527 (1980).
 - (78) W. Herz and S. Mohanraj, *J. Org. Chem.*, **45**, 5417 (1980).
 - (79) L. A. Paquett and R. F. Doehnen, Jr., *ibid.*, **45**, 5105 (1980).
 - (80) J. Pfenniger, C. Heuberger, and W. Graf, *Helv. Chim. Acta*, **63**, 2328 (1980).
 - (81) F. J. Evans and R. J. Schmidt, *Planta medica*, **38**, 289 (1980).
 - (82) Y. Fujita, K. Sempuku, K. Kitaguchi, T. Mori, Y. Yoshikuni, H. Enomoto, and R. Löser, *Chem. Pharm. Bull.*, **28**, 453 (1980).
 - (83) J. A. Hembree, C.-J. Chang, J. L. McLaughlin, and J. M. Cassady, *Experientia*, **36**, 28 (1980).

- (84) Y. Hayashi, T. Matsumoto, M. Uemura, and M. Koreeda, *Org. Magn. Reson.*, **14**, 86 (1980).
- (85) N. Ohno and T. J. Mabry, *Phytochemistry*, **19**, 609 (1980).
- (86) J. C. Oberti, A. B. Pomolio, and E. G. Gros, *ibid.*, **19**, 2051 (1980).
- (87) F. Bohlmann, K.-H. Knoll, H. Robinson, and R. M. King, *ibid.*, **19**, 107 (1980).
- (88) F. Bohlmann, H. Suding, J. Cuatrecasas, H. Robinson, and R. M. King, *ibid.*, **19**, 2399 (1980).
- (89) F. Piozzi, G. Savona, and J. R. Hanson, *ibid.*, **19**, 1237 (1980).
- (90) F. Bohlmann, C. Zdero, R. M. King, and H. Robinson, *ibid.*, **19**, 115 (1980).
- (91) F. Bohlmann, K.-H. Knoll, H. Robinson, and R. M. King, *ibid.*, **19**, 971 (1980).
- (92) F. Bohlmann, A. K. Dhar, and R. Ahmed, *ibid.*, **19**, 1850 (1980).
- (93) P. B. Oelrichs, P. J. Vally, J. K. Macleod, and I. A. S. Lewis, *J. Natural Products (Lloydia)*, **43**, 414 (1980).
- (94) F. Satake, T. Murakami, Y. Saiki, and C.-M. Chen, *Chem. Pharm. Bull.*, **28**, 1859 (1980).
- (95) T. Fujita, Y. Takeda, and T. Shingu, *J. C. S. Chem. Comm.*, 205 (1980).
- (96) T. Fujita, Y. Takeda, T. Shingu, and A. Ueno, *Chemistry Lett.*, 1635 (1980).
- (97) V. Zabel, W. H. Watson, N. Ohno, and T. J. Marbry, *Acta Cryst.*, **B36**, 3134 (1980).
- (98) I. Kubo, T. Kamikawa, T. Isobe, and T. Kubota, *J. C. S. Chem. Comm.*, 1206 (1980).
- (99) A. Furusaki, N. Hamanaka, and T. Matsumoto, *Bull. Chem. Soc. Jpn.*, **53**, 1956 (1980).
- (100) J. Sakakibara, N. Shirai, T. Kaiya, and Y. Iitaka, *Phytochemistry*, **19**, 1495 (1980).
- (101) J. Sakakibara and N. Shirai, *ibid.*, **19**, 2159 (1980).
- (102) J. Sakakibara, T. Kaiya, and N. Shirai, *Yakugaku Zasshi*, **100**, 540 (1980).
- (103) M. Katai, M. Fujiwara, T. Terai, and H. Meguri, *Chem. Pharm. Bull.*, **28**, 3124 (1980).
- (104) S. F. El-Naggar, R. W. Doskotch, T. M. Odell, and L. Girard, *J. Natural Products (Lloydia)*, **43**, 617 (1980).
- (105) E. M. Escamilla and B. Rodriguez, *An. Quim.*, **76**, 189 (1980).
- (106) B. Moreno, M. G. Delle, M. F. Delle, and G. B. Marini-Bettolo, *IL Farmaco (Edizione Scientifica)*, **35**, 457 (1980).
- (107) A. L. Cossey, L. N. Mander, and J. V. Turner, *Austral. J. Chem.*, **33**, 2061 (1980).
- (108) S. P. Sethi, K. S. Atual, R. M. Marini-Bettolo, T. Y. R. Tsai, and K. Wiesner, *Can. J. Chem.*, **58**, 1889 (1980).
- (109) N. J. Lewis and J. MacMillan, *J. C. S. Perkin Trans. I*, 1270 (1980).
- (110) S. K. Maji, S. K. Mukhopadhyaya, D. Mukkerjee, and P. C. Dutta, *ibid.*, 2511 (1980).
- (111) A. Garcia-Grenados, A. Parra Sanchez, and A. Pena Carrillo, *An. Quim., Ser. C*, **76**, 85 (1980). (*Chem. Abstr.*, **94**, 192480s [1981].)
- (112) N. J. Lewis and J. MacMillan, *J. C. S. Perkin Trans. I*, 1279, (1980).
- (113) S. W. Pelletier, A. P. Venkov, J. Finer-Moore, and N. V. Mody, *Tetrahedron Lett.*, **21**, 809 (1980).
- (114) S. W. Pelletier, A.-M. M. Ateya, N. V. Mody, H. K. Desai, and L. C. Schramm, *ibid.*, **21**, 3647 (1980).
- (115) T. Terai, H. Meguri, N. Hamanaka, T. Matsuzaki, A. Furusaki, T. Kato, and T. Matsumoto, *Chemistry Lett.*, 1111 (1980).
- (116) R. M. Coates and P. L. Cavender, *J. Am. Chem. Soc.*, **102**, 6358 (1980).
- (117) K. Honda, T. Shishibori, and T. Suga, *J. Chem. Res. (S)*, 218 (1980).
- (118) K. Wada and H. Yamashita, *Agr. Biol. Chem.*, **44**, 2249 (1980).
- (119) J. R. Hanson, C. L. Willis, and K. P. Parry, *Phytochemistry*, **19**, 2323 (1980).
- (120) B. M. Fraga, J. R. Hanson, M. G. Hernandez, and F. Y. Sarah, *ibid.*, **19**, 1087 (1980).
- (121) B. E. Cross and P. Filippone, *J. C. S. Chem. Comm.*, 1097 (1980).
- (122) R. E. Banks, J. H. Bateson, B. E. Cross, and A. Erasmuson, *J. Chem. Research (S)*, 46 (1980).
- (123) A. Patra, A. K. Mitra, S. R. Mitra, C. L. Kirtaniya, and N. Adityachaudhury, *Org. Magn. Reson.*, **14**, 58 (1980).
- (124) N. Shirai, H. Nakata, T. Kaiya, and J. Sakakibara, *Chem. Pharm. Bull.*, **28**, 365 (1980).
- (125) J. Iwamura, R. Kinoshita, and N. Hirao, *Nippon Nōgeikagaku Kaishi*, **54**, 195 (1980).
- (126) S. W. Pelletier and N. V. Mody, *J. Natural Products (Lloydia)*, **43**, 41 (1980).
- (127) E. M. Escamilla and B. Rodriguez, *Phytochemistry* **19**, 463 (1980).

- (128) N. Murofushi, M. Sugimoto, K. Itoh, and N. Takahashi, *Agr. Biol. Chem.*, **44**, 1583 (1980).
- (129) J. D. Metzger and J. A. D. Zeevaart, *Plant Physiol.*, **65**, 623 (1980).
- (130) P. Gaskin, P. S. Kirkwood, J. R. Lenton, J. MacMillan, and M. E. Radley, *Agr. Biol. Chem.*, **44**, 1589 (1980).
- (131) F. G. Dennis, Jr., G. C. Martin, P. Gaskin, and J. MacMillan, *Planta*, **147**, 376 (1980).
- (132) I. Yamaguchi, M. Kobayashi, and N. Takahashi, *Agr. Biol. Chem.*, **44**, 1975 (1980).
- (133) L. Lombardo, L. N. Mander, and J. V. Turner, *J. Am. Chem. Soc.*, **102**, 6626 (1980).
- (134) J. M. Hook, L. N. Mander and R. Urech, *ibid.*, **102**, 6628 (1980).
- (135) R. E. Banks, K. Boulton, and B. E. Cross, *J. Chem. Res. (S)*, 180 (1980).
- (136) P. S. Kikwood, J. MacMillan, and M. L. Sinnott, *J. C. S. Perkin Trans. I*, 2117 (1980).
- (137) E. P. Serebryakov, *Izv. Akad. Nauk. SSSR, Ser. Khim.*, 2596 (1980). (*Chem. Abstr.*, **95**, 25308f [1981].)
- (138) M. Lieschewski, G. Adam, and E. P. Serebryakov, *Tetrahedron Lett.*, **21**, 45 (1980).
- (139) L. Kutschabsky, G. Reck, E. Höhne, B. Voigt, and G. Adam, *Tetrahedron*, **36**, 3421 (1980).
- (140) B. E. Cross and I. C. Simpson, *Tetrahedron Lett.*, **21**, 215 (1980).
- (141) T. V. Romanchenko, A. G. Druganov, and V. A. Raldugin, *Khim. Priir. Soedin.*, 269 (1980). (*Chem. Abstr.*, **93**, 150412v [1980].)
- (142) M. Lieschewski and G. Adam, *Tetrahedron*, **36**, 1237 (1980).
- (143) M. Lieschewski and G. Adam, *Tetrahedron Lett.*, **21**, 1627 (1980).
- (144) M. H. Beale and J. MacMillan, *J. C. S. Perkin Trans. I*, 877 (1980).
- (145) A. L. Cossey, L. Lombardo, and L. N. Mander, *Tetrahedron Lett.*, **21**, 4383 (1980).
- (146) J. Bianco and C. Bulard, *Z. Pflanzenphysiol.*, **99**, 411 (1980). (*Chem. Abstr.*, **94**, 2113d, [1981].)
- (147) J. R. Hanson, *Monogr. Br. Plant Growth Regul. Group*, **5**, 5 (1980). (*Chem. Abstr.*, **95**, 25320d [1981].)
- (148) J. MacMillan, *Plant Growth Subst., Proc. Int. Conf. 10th*, 1979, 161 (1980). (*Chem. Abstr.*, **95**, 98064h [1981].)
- (149) M. H. Beale, P. Gaskin, P. S. Kirkwood, and J. MacMillan, *J. C. S. Perkin Trans. I*, 885 (1980).
- (150) M. H. Beale and J. MacMillan, *J. Chem. Res. (s)*, 289 (1980).
- (151) G. Yabuta, T. Ogawa, K. Mori, and M. Matsui, *Agr. Biol. Chem.*, **44**, 499 (1980).
- (152) G. Stork, W. C. Still, J. Singh, and S. Takei, *Tetrahedron Lett.*, **21**, 4051 (1980).
- (153) J. M. Hook and L. N. Mander, *J. Org. Chem.*, **45**, 1722 (1980).
- (154) S. Ghosh, R. Dasgupta, J. Chakravarty, and U. R. Ghatak, *J. C. S. Perkin Trans. I*, 804 (1980).
- (155) U. R. Ghatak, S. Ghosh, and B. Sanyal, *ibid.*, 2881 (1980).
- (156) B. E. Cross and I. C. Simpson, *J. Chem. Res. (s)*, 118 (1980).
- (157) L. Kutschabsky, G. Reck, G. Adam, and T. V. Sung, *Tetrahedron*, **36**, 741 (1980).
- (158) S. Miklussak, E. Schwartz, V. Dornetzhuber, L. Badalik, V. Laczko, M. Krčová, A. Laczková, S. Rajecová, and D. Zemková, *Neoplasma*, **27**, 203 (1980).
- (159) M. K. Chailakyan and V. N. Khyranin, *Naturwissenschaften*, **67**, 94 (1980).
- (160) A. G. Druganov, L. I. Demenkova, I. E. Maximov, V. A. Raldugin, and V. A. Pentegova, *Khim. Priir. Soedin.*, 228 (1980).
- (161) D. Voigt, G. Adam, and P. Franke, *Org. Mass Spectrom.*, 587 (1980).
- (162) N. Murofushi, *Shokubutsu no Kagaku Chosetsu*, **15**, 11 (1980).
- (163) M. Noma, *ibid.*, **15**, 101 (1980).
- (164) W. A. Ayer, J.-A. H. Forsythe, L. T. J. Delbaere, and C. U. Delbaere, *Can. J. Chem.*, **58**, 2406 (1980).
- (165) M. Przybylska and F. R. Ahmed, *Acta Cryst.* **B36**, 494 (1980).
- (166) S. W. Pelletier, W. H. DeCamp, J. Finer-Moore, and I. V. Mićović, *ibid.*, **B36**, 3040 (1980).
- (167) S. P. Sethi, R. Sterzycki, W.-W. Sy, R. Marini-Bettolo, T. Y. R. Tsai, and K. Wiesner, *Heterocycles*, **14**, 23 (1980).
- (168) R. M. Cory, D. M. T. Chan, Y. M. A. Naguib, M. H. Rastall, and R. M. Renneboog, *J. Org. Chem.*, **45**, 1852 (1980).
- (169) S. C. Roy, M. Sakkar, and U. R. Ghatak, *Indian J. Chem., Sec. B*, **19B**, 305 (1980).

- (170) A. G. González, G. de la Fuente, M. Reina, V. Zabel, and W. H. Watson, *Tetrahedron Lett.*, **21**, 1155 (1980).
- (171) P. W. Coddington, K. A. Kerr, M. H. Benn, A. J. Jones, S. W. Pelletier, and N. V. Mody, *ibid.*, **21**, 127 (1980).
- (172) N. V. Mody, S. W. Pelletier, and N. M. Molloy, *Heterocycles*, **14**, 1751 (1980).
- (173) S. W. Pelletier, R. S. Sawhney, H. K. Desai, and N. V. Mody, *J. Natural Products (Lloydia)*, **43**, 395 (1980).
- (174) T. Amiya, Y. Kanaiwa, H. Bando, N. Nakano, T. Mori, and H. Sugimoto, *Bull. Chem. Soc. Jpn.*, **53**, 1381 (1980).
- (175) R. W. Miller, *J. Natural Products (Lloydia)*, **43**, 425 (1980).
- (176) I. Kitagawa, H. Shibuya, H. Fujioka, A. Kajiwara, S. Tsujii, Y. Yamamoto, and A. Takagi, *Chemistry Lett.*, 1001 (1980).
- (177) F. Bohlmann, H. Robinson, and R. M. King, *Phytochemistry*, **19**, 2235 (1980).
- (178) A. Garcia-Granados and A. S. de Buruaga, *Ann. Quim.*, **76C**, 94 (1980).
- (179) I. Wallin, C. Narbonne, I. Wahlberg, T. Nishida, and C. R. Enzell, *Acta Chem. Scand.* **B34**, 391 (1980).
- (180) G. Combaut, C. Francisco, L. Piovetti, E. Gonzales, J. Teste, and L. Codomier, *Bull. Soc. Chim. Belg.*, **89**, 1063 (1980).
- (181) J. F. Blard, J. F. Verbist, R. Floch, and Y. Letourneux, *Tetrahedron Lett.*, **21**, 1849 (1980).
- (182) A. Sato, A. Ogiso, and H. Kuwano, *Phytochemistry*, **19**, 2207 (1980).
- (183) Y. Takagi, T. Fujimori, H. Kaneko, and K. Kato, *Agr. Biol. Chem.*, **44**, 467 (1980).
- (184) D. Behr, I. Wahlberg, T. Nishida, C. R. Enzell, J.-E. Berg, and A.-M. Pilott, *Acta Chem. Scand.*, **B34**, 195 (1980).
- (185) S. E. Ealick, D. van der Helm, R. A. Gross Jr., A. J. Weinheimer, L. S. Ciereszko, and R. E. Middlebrook, *Acta Cryst.*, **B36**, 1901 (1980).
- (186) B. F. Bowden, J. C. Coll, and S. J. Mitchell, *Austral. J. Chem.*, **33**, 879 (1980).
- (187) K. Kawazu, *Agr. Biol. Chem.*, **44**, 1367 (1980).
- (188) J. A. Toth, B. J. Bureson, P. J. Scheuer, J. Finer-Moore, and J. Clardy, *Tetrahedron*, **36**, 1307 (1980).
- (189) J. M. Frincke, D. E. McIntyre, and D. J. Faulkner, *Tetrahedron Lett.*, **21**, 735 (1980).
- (190) Y. Yamada, S. Suzuki, K. Iguchi, H. Kikuchi, Y. Tsukitani, and H. Horiai, *Chem. Pharm. Bull.*, **28**, 2035 (1980).
- (191) C. Y. Chang, L. S. Ciereszko, M. B. Hossain, and D. van der Helm, *Acta Cryst.* **B36**, 731 (1980).
- (192) Y. Kashman and A. Groweiss, *J. Org. Chem.* **45**, 3814 (1980).
- (193) D. F. Wiemer, J. Meinwald, G. D. Prestwich, B. A. Solheim, and J. Clardy, *ibid.*, **45**, 191 (1980).
- (194) Y. Kashman, *Tetrahedron Lett.*, **21**, 879 (1980).
- (195) J. E. Hochlowski and J. Faulkner, *ibid.*, **21**, 4055 (1980).
- (196) D. Trautmann, B. Epe, U. Oelbermann, and A. Mondon, *Chem. Ber.*, **113**, 3848 (1980).
- (197) J. C. Braekman, D. Daloz, A. Dupont, J. Pasteels, B. Tursch, J. P. Delercq, G. Germain, and M. van Meerssche, *Tetrahedron Lett.*, **21**, 2761 (1980).
- (198) K. Fukuyama, Y. Katsube, and K. Kawazu, *J. C. S. Perkin Trans. II*, 1701 (1980).
- (199) B. A. Burke, W. R. Chan, V. A. Honkan, J. F. Blount, and P. S. Manchand, *Tetrahedron*, **36**, 3489 (1980).
- (200) V. Amico, G. Oriente, M. Piattelli, C. Tringali, E. Fattorusso, S. Magno, and L. Mayol, *ibid.*, **36**, 1409 (1980).
- (201) B. N. Ravi, J. F. Marwood, and R. J. Wells, *Austral. J. Chem.*, **33**, 2307 (1980).
- (202) D. B. Stierle, B. Carté, D. J. Faulkner, B. Tagle, and J. Clardy, *J. Am. Chem. Soc.*, **102**, 5088 (1980).
- (203) B. F. Bowden, J.-C. Braekman, J. C. Coll, and S. T. Mitchell, *Austral. J. Chem.*, **33**, 927 (1980).
- (204) K. D. Croft, E. L. Ghisalberti, P. R. Jefferies, D. G. Marshall, C. L. Raston and A. H. White, *ibid.*, **33**, 1529 (1980).

The Chemistry on Diterpenoids in 1980

- (205) E. L. Ghisalberti, P. R. Jefferies, and P. N. Sheppard, *Tetrahedron*, **36**, 3253 (1980).
- (206) T. H. Hseu, J. L. Wang, and C. P. Tang, *Acta Cryst.*, **B36**, 2802 (1980).
- (207) M. Ochi, M. Watanabe, M. Kido, Y. Ichikawa, I. Miura, and T. Tokoroyama, *Chemistry Lett.*, 1233 (1980).
- (208) M. Ochi, M. Watanabe, I. Miura, M. Taniguchi, and T. Tokoroyama, *ibid.*, 1229 (1980).
- (209) A. Matsuo, H. Nozaki, M. Nakayama, D. Takaoka, and S. Hayashi, *J. C. S. Chem. Comm.*, 822 (1980).
- (210) H. Nozaki, A. Matsuo, Y. Kushi, M. Nakayama, S. Hayashi, D. Takaoka, and N. Kamijo, *J. C. S. Perkin Trans. II*, 763 (1980).
- (211) S. L. Fernandes, S. Y. Kamat, and S. K. Paknikar, *Tetrahedron Lett.*, **21**, 2249 (1980).
- (212) N. Capelle, J. C. Braekman, D. Daloze, and B. Tursch, *Bull. Soc. Chim. Belges*, **89**, 399 (1980).
- (213) A. C. Pinto, *Anais da Acad. Brasileira de Ciências*, **52**, 473 (1980).
- (214) J. López de Lerma, S. García-Blanco, and J. G. Rodríguez, *Tetrahedron Lett.*, **21**, 1273 (1980).
- (215) V. Zabel, W. H. Watson, M. Silva, M. Bittner, and D. A. Langs, *Acta Cryst.* **B36**, 2660 (1980).
- (216) R. Kazlauskas, P. T. Murphy, R. J. Wells and J. F. Blount, *Tetrahedron Lett.*, **21**, 315 (1980).
- (217) W. Adolf and E. Hecker, *ibid.*, **21**, 2887 (1980).
- (218) A. D. Kinghorn, *J. Pharm. Sci.*, **69**, 1446 (1980).
- (219) M. D. Sayed, A. Ritzk, F. M. Hammouda, M. M. El-Missiry, E. M. Williamson, and F. J. Evans, *Experientia*, **36**, 1206 (1980).
- (220) M. Hirota, H. Ohigashi, Y. Oki, and K. Koshimizu, *Agr. Biol. Chem.*, **44**, 1351 (1980).
- (221) G. D. Prestwich, S. G. Spanton, J. W. Lauher, and J. Vrkoč, *J. Am. Chem. Soc.*, **102**, 6825 (1980).
- (222) A. Yagi, N. Tokubuchi, T. Nohara, G. Nonaka, I. Nishioka, and A. Koda, *Chem. Pharm. Bull.*, **28**, 1432 (1980).
- (223) T. Nohara, N. Tokubuchi, M. Kuroiwa, and I. Nishioka, *ibid.*, **28**, 2682 (1980).
- (224) T. Nohara, I. Nishioka, N. Tokubuchi, K. Miyahara, and T. Kawasaki, *ibid.*, **28**, 1969 (1980).
- (225) T. Nohara, Y. Kashiwada, T. Tomimatsu, M. Kido, N. Tokubuchi, and I. Nishioka, *Tetrahedron Lett.*, **21**, 2647 (1980).
- (226) O. P. Vig, S. S. Bari, I. R. Trehan, and R. Vig, *Indian J. Chem.*, **19B**, 446 (1980). (*Chem. Abstr.*, **94**, 65877b [1981].)
- (227) T. Kato, M. Suzuki, T. Kobayashi, and B. P. Moore, *J. Org. Chem.*, **45**, 1126 (1980).
- (228) L. Crombie, G. Kneen, G. Pattenden, and D. Whybrow, *J. C. S. Perkin Trans. I*, 1711 (1980).
- (229) V. A. Raldugin, N. I. Yaroshenko, and T. P. Ponomareva, *Khim. Prir. Soedin.*, 844 (1980). (*Chem. Abstr.*, **95**, 43402m [1980].)
- (230) A. E. Greene, *J. Am. Chem. Soc.*, **102**, 5337 (1980).
- (231) T. Tokoroyama, K. Matsuo, H. Kotsuki, and R. Kanazawa, *Tetrahedron*, **36**, 3377 (1980).
- (232) T. Tokoroyama, K. Matsuo, and R. Kanazawa, *Bull. Chem. Soc. Japan*, **53**, 3383 (1980).
- (233) I. H. Sánchez and J. C. Aranda, *Tetrahedron Lett.*, **21**, 3655 (1980).
- (234) P. A. Wender, C. L. Hillemann, and M. J. Szymonifka, *ibid.*, **21**, 2205 (1980).
- (235) R. B. Kelly, M. L. Harley, and S. J. Alward, *Can. J. Chem.*, **58**, 775 (1980).
- (236) E. J. Corey, M. A. Tius, and J. Das, *J. Am. Chem. Soc.*, **102**, 1742 (1980).
- (237) T. Kametani, T. Honda, Y. Shiratori, and K. Fukumoto, *Tetrahedron Lett.*, **21**, 1665 (1980).
- (238) E. J. Corey, M. A. Tius, and J. Das, *J. Am. Chem. Soc.*, **102**, 7612 (1980).
- (239) P. J. Eaton, J. M. Fawcett, M. K. Jogia, and R. T. Weavers, *Austral. J. Chem.*, **33**, 371 (1980).
- (240) N. K. Nathu and R. T. Weavers, *ibid.*, **33**, 1589 (1980).
- (241) E. G. Gibbons, *J. Org. Chem.*, **45**, 1540 (1980).
- (242) R. S. Norton and R. Kazlauskas, *Experientia*, **36**, 276 (1980).
- (243) B. Sorg, M. Gschwendt, H. W. Thielmann, and E. Hecker, *Z. Naturforsch.*, **35B**, 1470 (1980).
- (244) P. E. Driedger and P. M. Blumberg, *Cancer Research*, **40**, 399 (1980).
- (245) K. von Berlepsch, *Naturwissenschaften*, **67**, 338 (1980).