

CHAPTER II

HISTORICAL

1. Chemical Constituents of the Genus *Goniothalamus*

The chemical constituents of plant in the genus *Goniothalamus* can be classified into seven groups namely, styrene derivatives, acetogenins, flavonoid, aza-anthraquinone, sterols, alkaloids and miscellaneous compounds as shown in Table 1.

Table 1 Distribution of chemical constituents in the genus *Goniothalamus*.

Plant & chemical compounds	Category	Plant part	References
<i>Goniothalamus amuyon</i>			
(-)-Anolobine [1]	Aporphine alkaloid	Wood	Lu, Wu, and Leou, 1985
(-)-Anonaine [2]	Aporphine alkaloid	Wood	Lu, <i>et al.</i> , 1985
Liriodenine [3]	Oxoaporphine alkaloid	Wood	Lu, <i>et al.</i> , 1985
Palmatine [4]	Protoberberine alkaloid	Stem bark	Lu, <i>et al.</i> , 1985
Goniodiol-7-monoacetate [5]	Styrene derivative	Leaves, Stem bark	Wu <i>et al.</i> , 1991
Goniodiol-8-monoacetate [6]	Styrene derivative	Leaves	Wu <i>et al.</i> , 1992
Goniotriol [7]	Styrene derivative	Leaves	Wu <i>et al.</i> , 1992
(-)-Tetrahydropalmatine [8]	Tetrahydroprotoberberine alkaloid	Stem bark	Lu, <i>et al.</i> , 1985
<i>G. andersonii</i>			
(+)-Goniothalamine [9]	Styrene derivative	Stem, Leaves, Root, Fruit	Jewers <i>et al.</i> , 1972

Table 1 (Continued)

Plant & chemical compounds	Category	Plant part	References
<i>G. dolichocarpus</i>			
(+)-Annonacin [10]	Acetogenin	Stem bark	Goh <i>et al.</i> , 1995
(+)-Goniothalamine [9]	Styrene derivative	Stem bark	Goh <i>et al.</i> , 1995
(+)-Goniothalamine epoxide [11]	Styrene derivative	Stem bark	Goh <i>et al.</i> , 1995
(-)-Iso-5-deoxygonio pypyrone [12]	Styrene derivative	Stem bark	Goh <i>et al.</i> , 1995
(+)-Goniodiol [13]	Styrene derivative	Stem bark	Goh <i>et al.</i> , 1995
<i>G. donnaiensis</i>			
Donnaienin A [14 or 15]	Acetogenin	Root	Jiang and Yu, 1997
34-Epi-donnaienin A [14 or 15]	Acetogenin	Root	Jiang and Yu, 1997
Donnaienin B [16 or 17]	Acetogenin	Root	Jiang and Yu, 1997
34-Epi-donnaienin B [16 or 17]	Acetogenin	Root	Jiang and Yu, 1997
Murisolin [18]	Acetogenin	Root	Jiang and Yu, 1997
Isoannonacin [19]	Acetogenin	Root	Jiang and Yu, 1997
Annonacin [10]	Acetogenin	Root	Jiang and Yu, 1997
Goniothalamine [20]	Acetogenin	Root	Jiang and Yu, 1997

Table 1 (Continued)

Plant & chemical compounds	Category	Plant part	References
<i>G. giganteus</i>			
Gigantetronenin [21]	Acetogenin	Stem bark	Fang, Anderson, Smith, McLaughlin and Wood, 1992
Gigantrionenin [22]	Acetogenin	Stem bark	Fang, Anderson, Smith, McLaughlin and Wood, 1992
Anomontacin [23]	Acetogenin	Stem bark	Fang, Anderson, Smith, McLaughlin and Wood, 1992
Gigannenin [24]	Acetogenin	Stem bark	Fang, Anderson, Smith, Wood and McLaughlin, 1992

Table 1 (Continued)

Plant & chemical compounds	Category	Plant part	References
<i>G. giganteus</i>			
4-Deoxygigantecin [25]	Acetogenin	Stem bark	Fang, Anderson, Smith, Wood and McLaughlin, 1992
Goniocin [26]	Acetogenin	Stem bark	Gu <i>et al.</i> , 1994
Gigantecin [27]	Acetogenin	Stem bark	Alkofahi, <i>et al.</i> , 1990
Gigantetrocin [28]	Acetogenin	Stem bark	Fang, Rupprecht <i>et al.</i> , 1991
Gigantriocin [29]	Acetogenin	Stem bark	Fang, Rupprecht <i>et al.</i> , 1991
Goniothalamycin [20]	Acetogenin	Stem bark	Alkofahi <i>et al.</i> , 1988
(+)-Annonacin [10]	Acetogenin	Stem bark	Alkofahi <i>et al.</i> , 1988
(+)-Goniothalamine [9]	Styrene derivative	Stem bark	Fang, Anderson, Smith, Wood and McLaughlin, 1992
Goniofufurone [30]	Styrene derivative	Stem bark	Fang <i>et al.</i> , 1990

Table 1 (Continued)

Plant & chemical compounds	Category	Plant part	References
<i>G. giganteus</i>			
Goniopyrone [31]	Styrene derivative	Stem bark	Fang <i>et al.</i> , 1990
8-Acetylgoniotriol [32]	Styrene derivative	Stem bark	Fang <i>et al.</i> , 1990
(+)-Goniodiol [13]	Styrene derivative	Stem bark	Fang, Anderson, Chang, McLaughlin and Fanwick, 1991
9-Deoxygoniopyrone [33]	Styrene derivative	Stem bark	Fang, Anderson, Chang, McLaughlin and Fanwick, 1991
7-Epi-goniofufurone [34]	Styrene derivative	Stem bark	Fang, Anderson, Chang, McLaughlin and Fanwick, 1991
Gonioheptolides A [35]	Styrene derivative	Stem bark	Fang <i>et al.</i> , 1993
Gonioheptolides B [36]	Styrene derivative	Stem bark	Fang <i>et al.</i> , 1993
Goniotriol [7]	Styrene derivative	Stem bark	Alkofahi <i>et al.</i> , 1989

Table 1 (Continued)

Plant & chemical compounds	Category	Plant part	References
<i>G. giganteus</i>			
(+)-Altholactone (Goniothalenol) [37]	Styrene derivative	Stem bark	El-Zayat <i>et al.</i> , 1985
Goniobutenolide A [38]	Styrene derivative	Stem bark	Fang, Anderson, Chang, Fanwick and McLaughlin, 1991
Goniobutenolide B [39]	Styrene derivative	Stem bark	Fang, Anderson, Chang, Fanwick and McLaughlin, 1991
Goniofupyrone [40]	Styrene derivative	Stem bark	Fang, Anderson, Chang, Fanwick and McLaughlin, 1991
<i>G. grifithii</i>			
Pinocembrin [41]	Flavonoid	Stem bark	Talapatra <i>et al.</i> , 1985
<i>G. macrophyllus</i>			
(+)-Goniothalamine [9]	Styrene derivative	Stem, Leaves, Root	Sam <i>et al.</i> , 1987

Table 1 (Continued)

Plant & chemical compounds	Category	Plant part	References
<i>G. macrophyllus</i> Goniothalamine epoxide [11]	Styrene derivative	Stem, Leaves, Root	Sam <i>et al.</i> , 1987
<i>G. malayamus</i> (+)-Goniothalamine [9]	Styrene derivative	Stem, Root	Jewers <i>et al.</i> , 1972
(+)-Isoaltholactone [42]	Styrene derivative	Stem bark	Colegate <i>et al.</i> , 1990
<i>G. montanus</i> (+)-Isoaltholactone [42]	Styrene derivative	Stem bark, Leaves	Colegate <i>et al.</i> , 1990
<i>G. sesquipedalis</i> Goniopedaline [43]	Aristolactam alkaloid	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
Aristolactam AII [44]	Aristolactam alkaloid	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
<i>N,O</i> -Diacetylaristolactam AII [45]	Aristolactam alkaloid	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
Taliscanine [46]	Aristolactam alkaloid	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
Aurantiamide acetate [47]	Miscellaneous compound	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
β -Sitosterol [48]	Sterol	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
β -Sitosterol- β -D-glucoside [49]	Sterol	Leaves, Twigs	Talapatra <i>et al.</i> , 1988
5-Acetoxyisogoniothalamine oxide [50]	Styrene derivative	Stem bark	Hasan <i>et al.</i> , 1994

Table 1 (Continued)

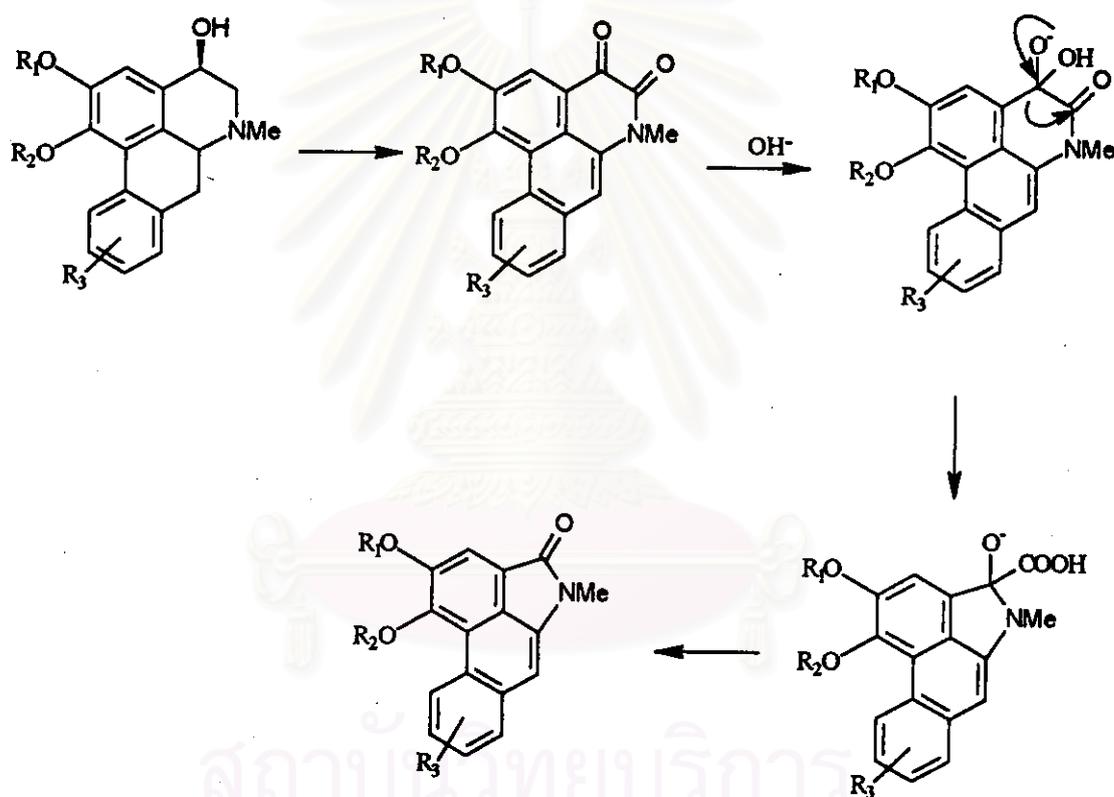
Plant & chemical compounds	Category	Plant part	References
<i>G. scortechnii</i> Scorazanone [51]	Aza-anthraquinone	Root	Din, Colegate and Razak, 1990
<i>G. tapis</i> (+)-Isoaltholactone [42]	Styrene derivative	Root	Colegate <i>et al.</i> , 1990
<i>G. uvaroides</i> 5-Acetylgoniothalamine [52]	Acetogenin	Root	Ahmad <i>et al.</i> , 1991
(+)-Goniothalamine [9]	Styrene derivative	Root	Ahmad <i>et al.</i> , 1991
<i>G. velutinum</i> Velutinam [53]	Aristolactam alkaloid	Stem bark	Omar <i>et al.</i> , 1992
Aristolactam BII [54]	Aristolactam alkaloid	Stem bark	Omar <i>et al.</i> , 1992

2. Introduction to aristolactams and 4,5-dioxoaporphines

Aristolactams are also known as phenanthrene lactams because their structure contains phenanthrene and lactam groups. Most of them are found in the family Aristolochiaceae. They are also found in the families Annonaceae, Menispermaceae and Piperaceae.

Although aristolactams are non-basic, they are classified as aporphinoids since their respective skeleton [55] bears a distinct similarity to that of the aporphines (Mix, Guinaudean and Shamma, 1982: 657).

The aporphines are the largest group (over 100) of isoquinoline alkaloids and 4,5-dioxoaporphines are represented by the general structure [56] (Cordell, 1981). One of the most important physical characteristics of aristolactams and 4,5-dioxoaporphines is their ability to fluoresce under UV light due to their highly conjugated structure. The biogenetic relationships between aristolactams and aporphines have been proposed as illustrated in Scheme 1 (Castedo, Suau and Mourino, 1976).



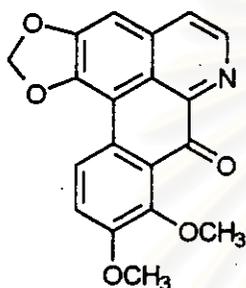
Scheme 1 Biogenesis of aristolactams



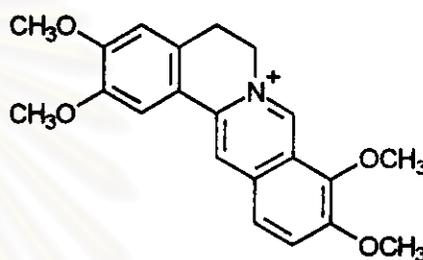
(-)-Anolobine [1]



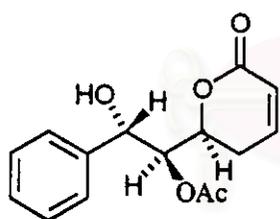
(-)-Anonaine [2]



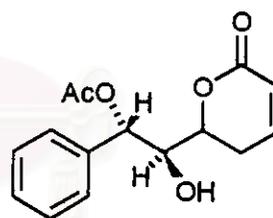
Liriodenine [3]



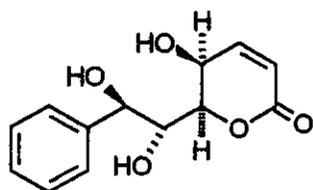
Palmatine [4]



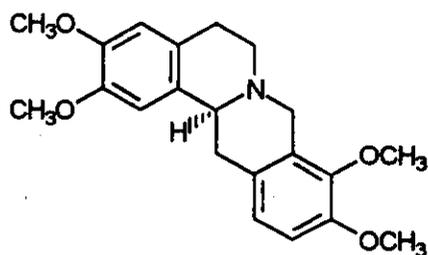
Goniidiol-7-monoacetate [5]



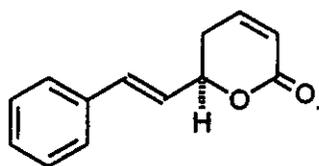
Goniidiol-8-monoacetate [6]



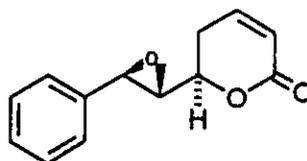
Goniotriol [7]



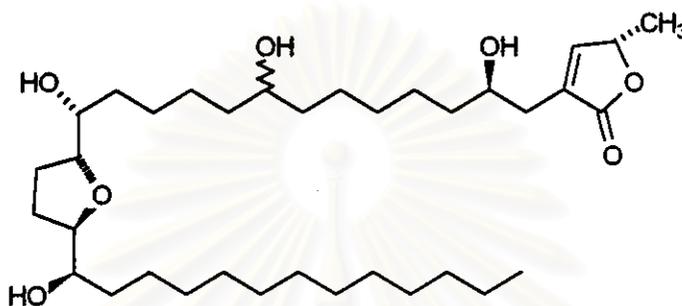
(-)-Tetrahydropalmatine [8]



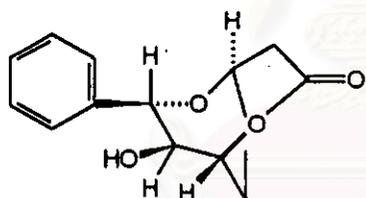
(+)-Goniothalamine [9]



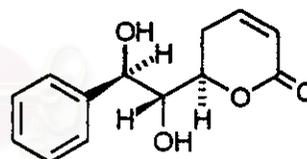
(+)-Goniothalamine epoxide [11]



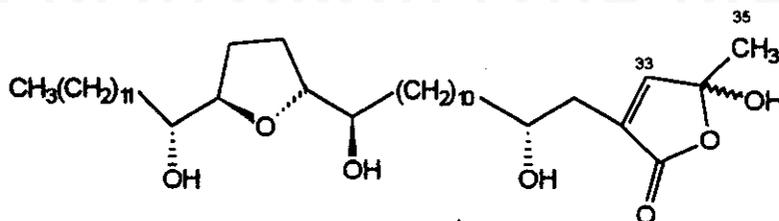
(+)-Annonacin [10]

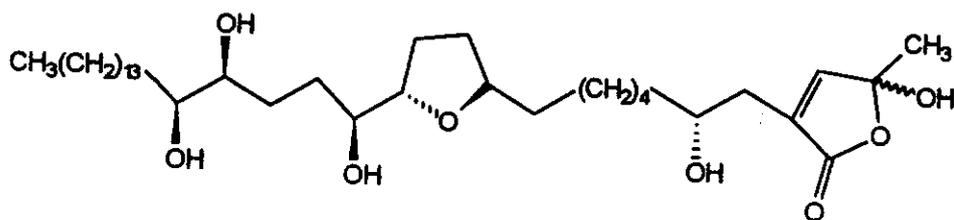


(-)-Iso-5-deoxygoniopyrone [12]



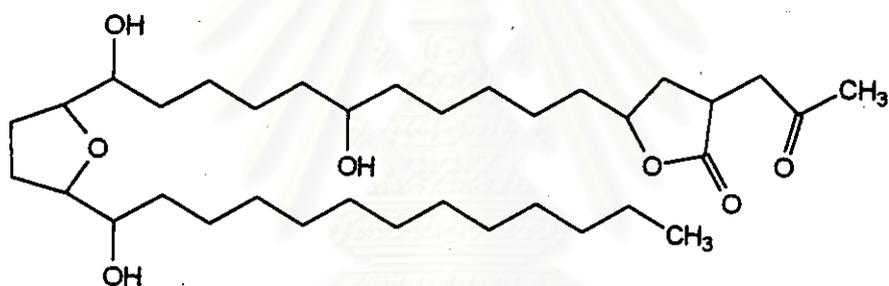
(+)-Goniodiol [13]

Donnaienin A and
34-Epi-donnaienin A [14 and 15]

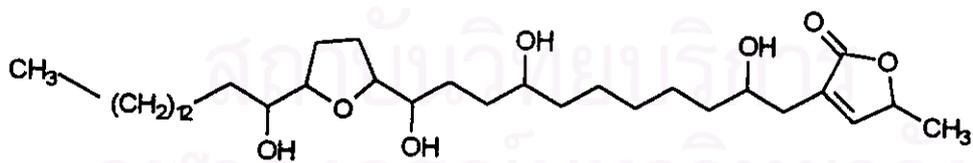


Donnaienin B and
34-Epi-donnaienin B [16 and 17]

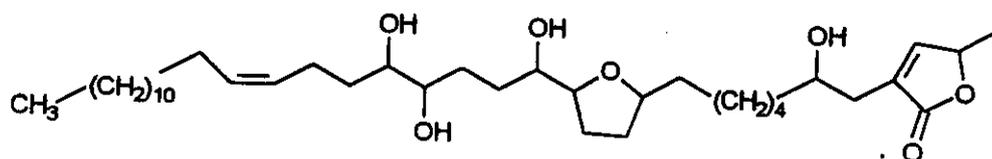
murisolin [18]



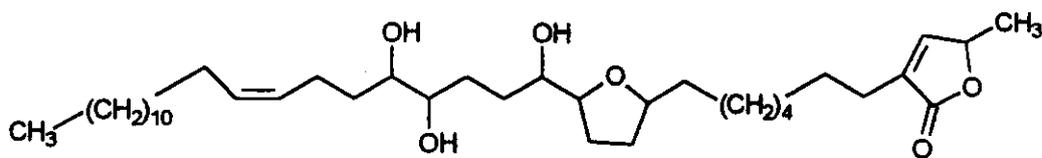
Isoannonacin [19]



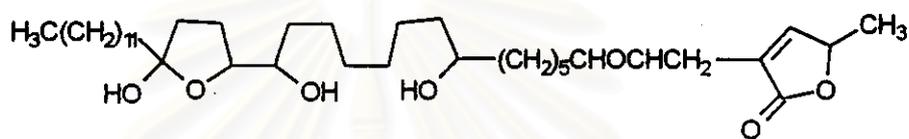
Goniotalamicin [20]



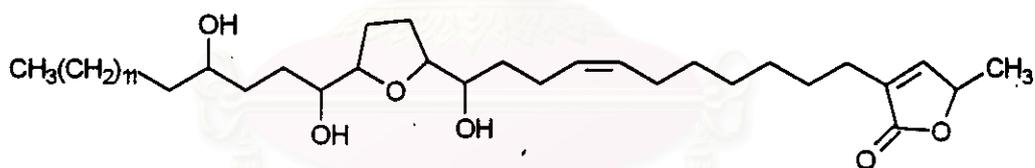
Gigantetronenin [21]



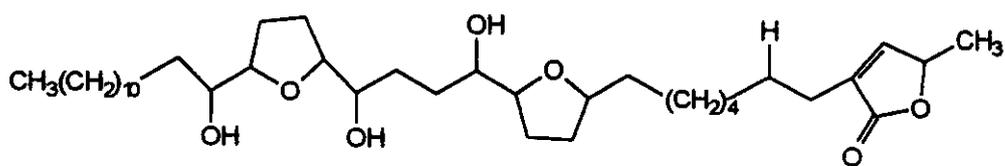
Gigantrionenin [22]



Anomontacin [23]

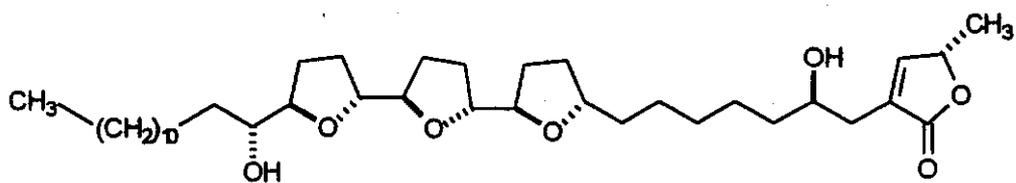


Gigannenin [24]

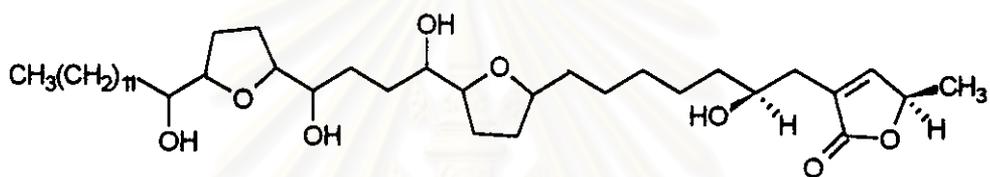


4-Deoxygigantecin [25]

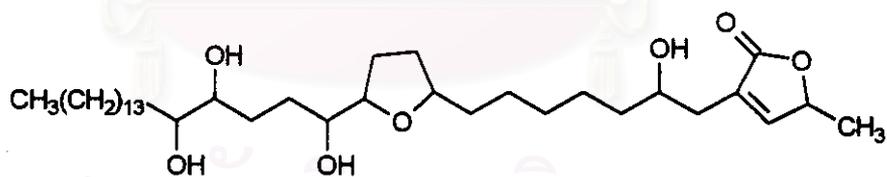
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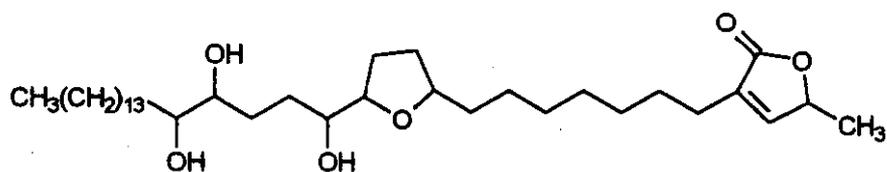
Goniocin [26]



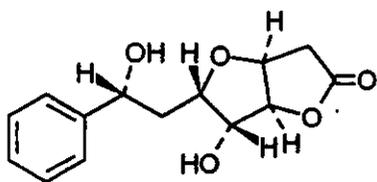
Gigantecin [27]



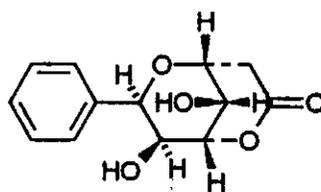
Gigantetrocin [28]



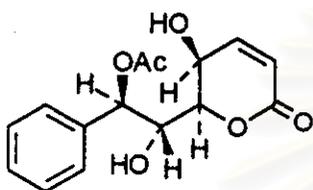
Gigantriocin [29]



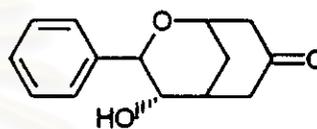
Goniofufurone [30]



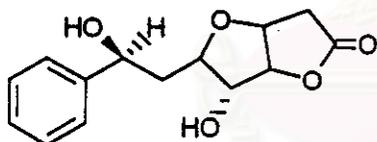
Goniopyrone [31]



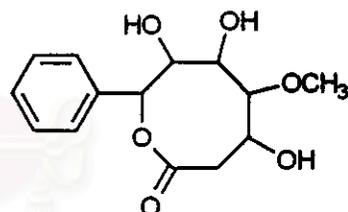
8-Acetylgoniotriol [32]



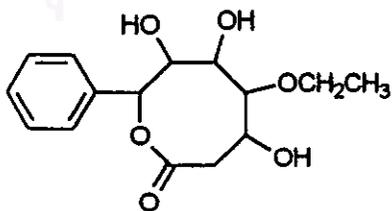
9-Deoxygoniopyrone [33]



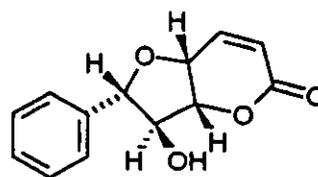
7-Epi-goiofufurone [34]



Gonioheptolide A [35]

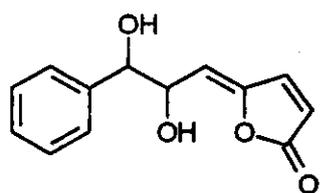


Gonioheptolide B [36]

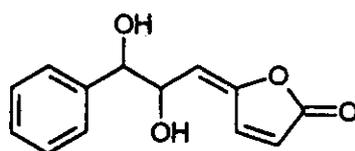


(+)-Altholactone [37]

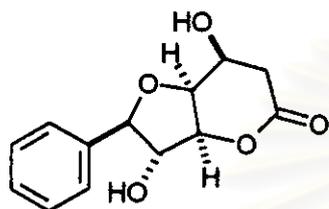
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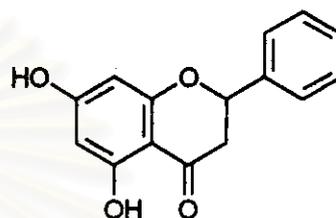
Goniobutenolide A [38]



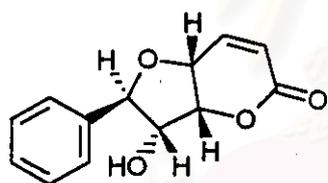
Goniobutenolide B [39]



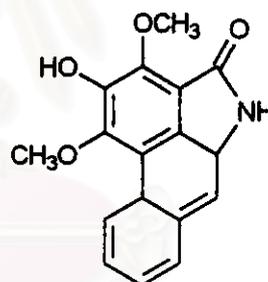
Goniofupyrone [40]



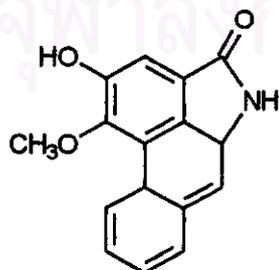
Pinocembrin [41]



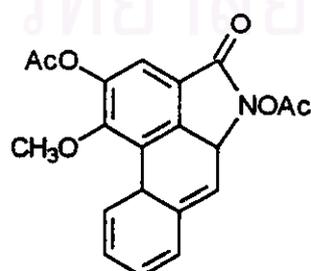
(+)-Isoaltholactone [42]

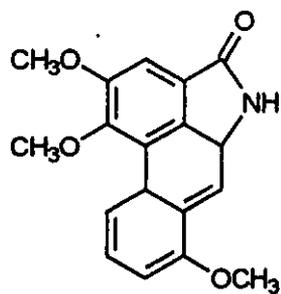


Goniopedaline [43]

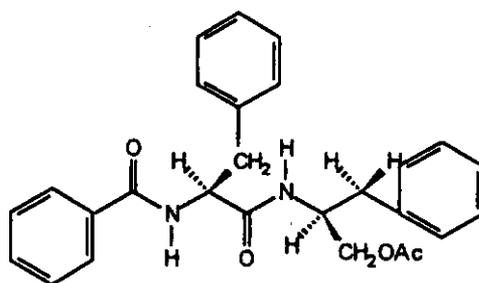


Aristolactam AII [44]

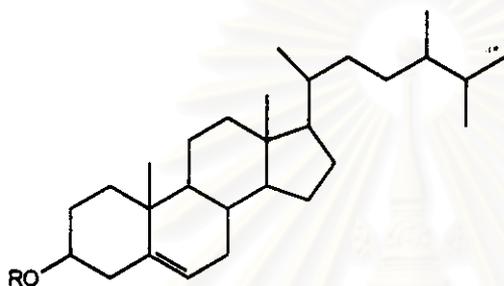
*N,O*-Diacetylaristolactam AII [45]



Taliscanine [46]

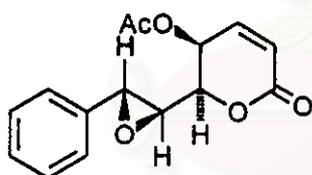


Aurantiamide acetate [47]

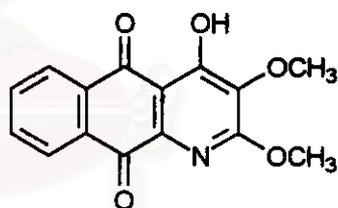


R = H [48]

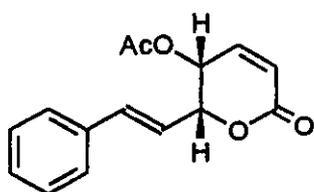
R = D-glucose [49]



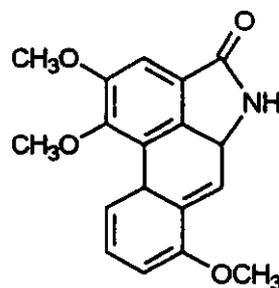
5-Acetoxyisogoniothalamin oxide [50]



Scorazanone [51]

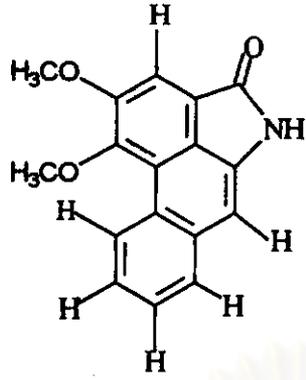


5-Acetylgoniothalamin [52]

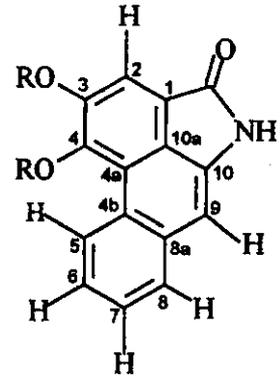


Velutinam [53]

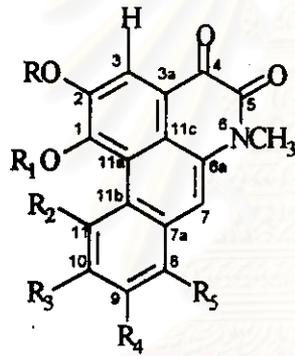
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Aristolactam BII [54]



[55]



[56]

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