Tropical Journal of Pharmaceutical Research June 2012; 11 (3): 485-498

Available online at http://www.tjpr.org
http://dx.doi.org/10.4314/tjpr.v11i3.19

Review Article

Chemical Constituents and Biological Properties of the Marine Soft Coral *Nephthea*: A Review (Part 1)

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Abstract

The genus Nephthea is a member of the family Acyonaceae, subfamily Nephtheidae, and is distributed throughout the world mainly in the Indo-Pacific region. The genus Nephthea has been studied for its phytochemical constituents and these studies have resulted in the discovery of over a hundred compounds comprising amides, sesquiterpenes, diterpenes and steroids. Corresponding biological activities such as anti-inflammatory and cytotoxic activities have also been observed for some of the isolated constituents. Among the isolated constituents, steroids are the most abundant followed by diterpenes and sesqui biological activities reported for twelve species of the genus Nephthea, namely, N. albida, N. armata, N. bayeri, N. brassica, N. capnelliformis, N. crassica, N. elongata, N. erecta, N. hainansis, N. pacifica, N. chabrolii and N. sinulata. The purpose of the review is to draw greater attention to the potentials of soft corals as a source of new drugs and secondary metabolites.

Keywords: Marine corals, *Acyonaceae, Nephtheidae, Nephthea, Sesquiterpenes, Diterpenes, Steroids*

Received: 16 May 2011 *Revised accepted: 11 April 2012*

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INTRODUCTION

Soft corals are an essential component of the coral reef ecosystem, and are an important source of secondary metabolites exhibiting diverse biological properties [1-6]. The family Nephtheidae is a rich source of secondary metabolites [7]. Investigations have shown that members of the *Nephthea* genus produce secondary metabolites such as sesquiterpenes, diterpenes and steroids (see Table 1a and b); their extracts and isolated constituents also possess certain biological activities, including cytotoxic and anti-inflammatory activities [7-12].

CHEMICAL CONSTITUENTS AND BIOLOGICAL PROPERTIES

Nephthea albida

Phytochemical investigations of *N. albida* have afforded five new compounds (Fig 1) including a long chain unsaturated dihydroxyamide, N-[1-(hydroxymethyl)-2-hydroxy-(E,E)-3,7-dodecadienyl]-tricosanamide **(1)**, a nortriterpenoid 29, 30-dinoroleanane-13,15,16,26-tetraol **(2)**, two steroids, 24-methylene-27-methyl-26-ethylcholesterol **(3)** and 24-methylene-26,27-dimethyl cholesterol (albidasterol) **(4)**, and a sesquiterpene nephalbidol **(5)** [13-17].

Yan *et al* prepared a formulation based on 24-methylene-cholest-3β,5α,6β,19-tetrol, isolated from *N. albida*, which is reported to exhibit neuroprotective property [18].

Nephthea armata

Phytochemical examinations of the dichloromethane extract of the soft coral *N. armata*, afforded eight compound (Fig 2), including six new sesquiterpenoids, armatins A−E (**6**−**10**), and lemnal-1(10)-ene-2,12-dione (**11**), and two new 19-oxygenated ergosterols, armatinols A and B (**12**-**13**) [19].

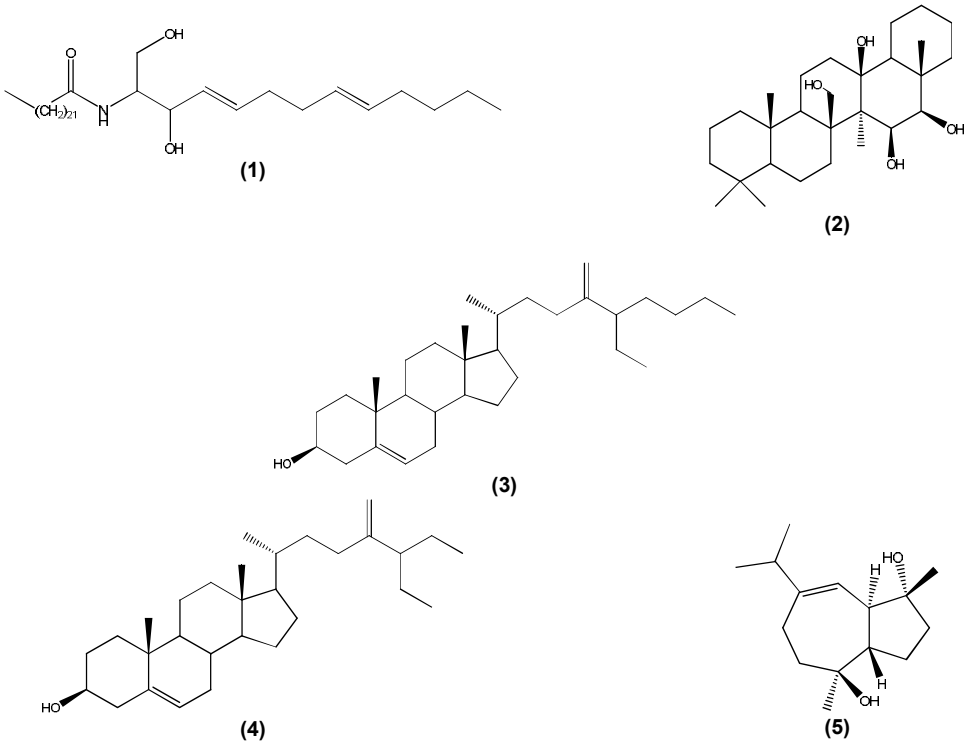
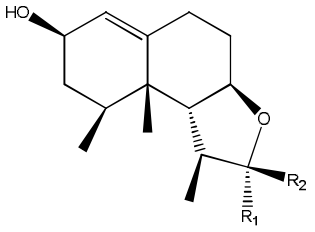
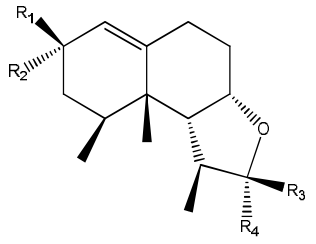


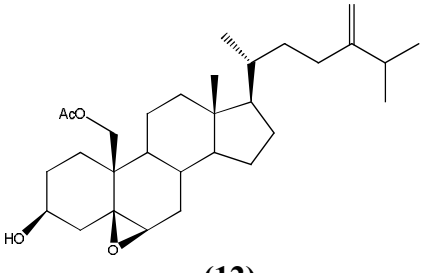
Fig 1: Compounds 1 - 5



(6) R_1 = OH, R_2 = H
(7) R_1 = R_2 = O
(8) R_1 = OMe, R_2 = H



(9) R_1 = H, R_2 = OH, R_3 = OMe, R_4 = H
(10) R_1 = R_2 = O, R_3 = OMe, R_4 = H
(11) R_1 = R_2 = O, R_3 = R_4 = O



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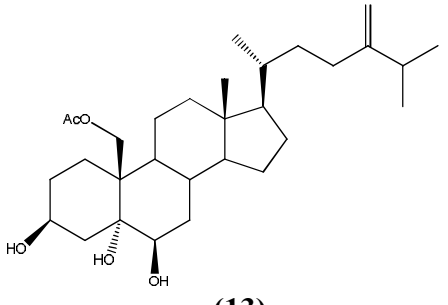


(13)

Fig 2: Compounds 6 - 13

Nephthea bayeri

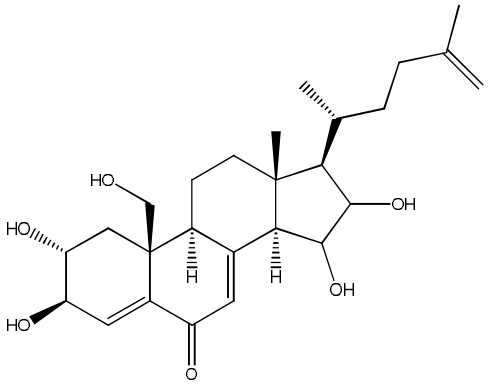
Li *et al* reported two steroidal compounds (Fig 3), 2α,3β,15,16,19-Pentahydroxy-26,27-dinorergosta-4,7,24-trien-6-one **(14)**, and 24-methyl-cholesta-5,24(28)-diene-3β,7β,19-triol **(15)**, along with the previously known compounds, 24-methylcholesta-5,24(28)-diene-3β,19-diol, 24-methylcholesta-5,24(28)-diol-3β-ol and 1-octadecyl-2,3-dihydroxypropyl ether, from the Chinese soft coral *N. bayeri* collected from the South China Sea [20-21]. Furthermore, five new polyoxygenated steroids, nanjiol A-E **(16-20)** were also reported from the soft coral *N. bayeri* [22,23].

Nephthea brassica

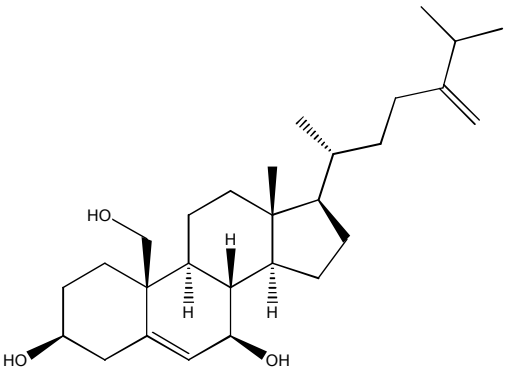
Blackman *et al* reported five known diterpenes (Fig 4) 13-cembra-1,3,7,11-tetraen-13-ol, 13-cembra-1,3,7,11-tetraen-13-one, 15-acetoxycembra-3,7,11-triene, 10,15-diacetoxy-7,8-epoxycembra-3,11-diene, and 10-acetoxy-7,8-epoxycembra-3,11-diene from the soft coral *N. brassica* [24], while Liu and Li reported the isolation of *N. brassica* a new polyhydroxylated steroid ergost-24(28)-ene-3β,6β,9,19-tetrol **(21)** from the Chinese soft coral, along with the known compounds compounds N-2-(1,3,5-trihydroxyoctadecyl)-nonadecamide and N-2-(1,3-dihydroxyoctadecan-4-en)-hexadecamide [10,25].

Duh *et al* reported two new diterpenes, brassicolide **(22)** and brassicolene **(23)**, and a sesquiterpene, (-)-4α-O-acetyl-selin-11-en **(24)** along with the known compounds brassicolide acetate, cembrene A, (-)-β-elemene, 2-hydroxynephthenol, epoxycembrene A, nephthenol and (-)-selin-11-en-4α-ol from the formosan soft coral *N. brassica* [26-27].

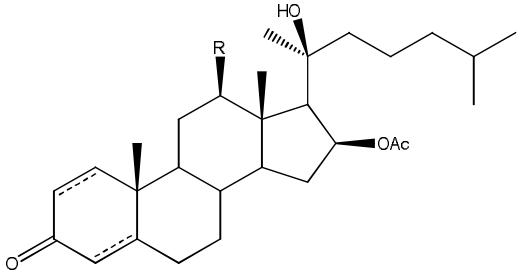
Examinations of soft coral *N. brassica* led to the isolations of two known steroids 24-methylene-3β,5α,6β,19-tetrahydroxy-5α-(cholestane) and 24-methylene-5α-cholesten-3β,7β,19-triol. Both compounds were found to exhibit anti-inflammatory activities [28-29].



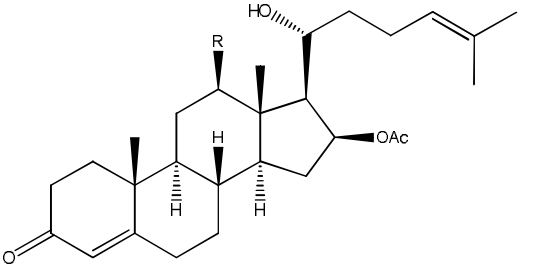
(14)



(15)

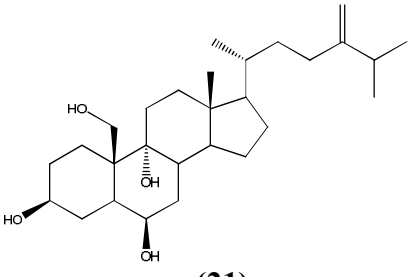


(16) R = OAc, $\Delta^{1\text{-}2,\ 4\text{-}5}$
(17) R = OAc, $\Delta^{4\text{-}5}$
(18) R = H, $\Delta^{4\text{-}5}$



(19) R = OAc
(20) R = H

Fig 3: Compounds 14 - 20



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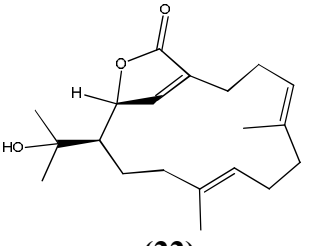

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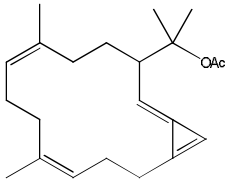
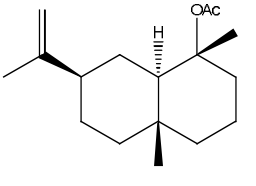


(23)



(24)

Fig 4: Compounds 21 - 24

Nephthea capnelliformis

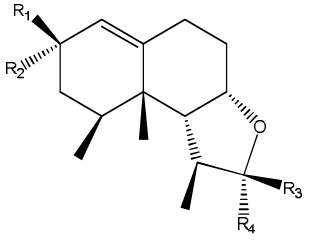
Li and Tan isolated from the soft coral *N. capnelliformis* two compounds 24-methylenecholestane-3β,5α,6β,19-tetrol and 24-methylene-5-cholesten-3,19-diol [30].

Nephthea crassica

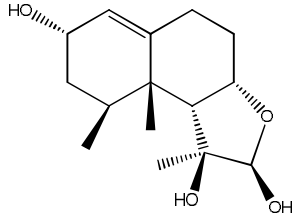
An isolate of the soft coral *N. crassica* led to the identification of two steroids, 24-methylene-5-cholesten-3β,7β,19-triol and 24-methylenecholestane-3β,5α,6β-19-tetrol [31].

Nephthea elongata

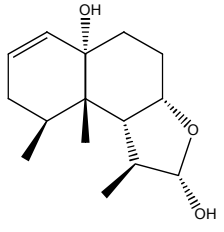
Wang and Duh isolated seven new sesquiterpenoids (Fig 5a and b), elongatols A-G **(25-31)** from the dichloromethane extract of the formosan soft coral *N. elongata*. compounds **25** and **31** showed cytotoxic activity against P-388 cell line with ED_{50} of 3.8 and 3.6 µg/ml, respectively [32]. compounds indicated cytotoxic activity against selected cancer cells. Furthermore, seven new diterpenoids, pacificins K-Q **(32-38)**, were isolated from the dichloromethane extract of *N. elongata*. Compounds **32** and **33** showed cytotoxic activity against P-388 cell line with ED_{50} of 3.2 and 2.6 µg/ml, respectively [33].



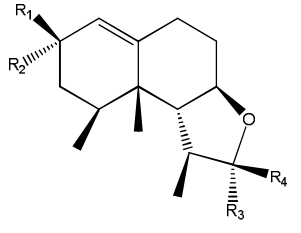
(25) R_1 = H, R_2 = OH, R_3 = H, R_4 = OH
(26) R_1 = H, R_2 = OH, R_3 = R_4 = O
(27) R_1 = OH, R_2 = R_3 = H, R_4 = OH



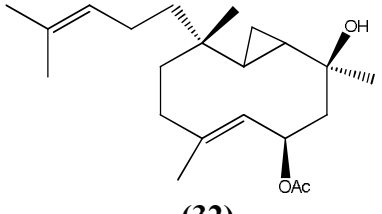
(28)



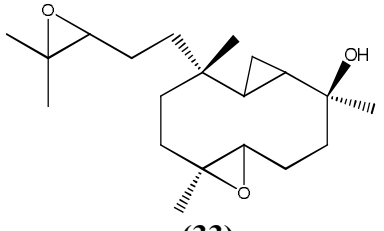
(29)



(30) R_1 = OH, R_2 = H, R_3 = OH, R_4 = H
(31) R_1 = R_2 = O, R_3 = OH, R_4 = H



(32)



(33)

Fig 5a: Compounds 25 - 33

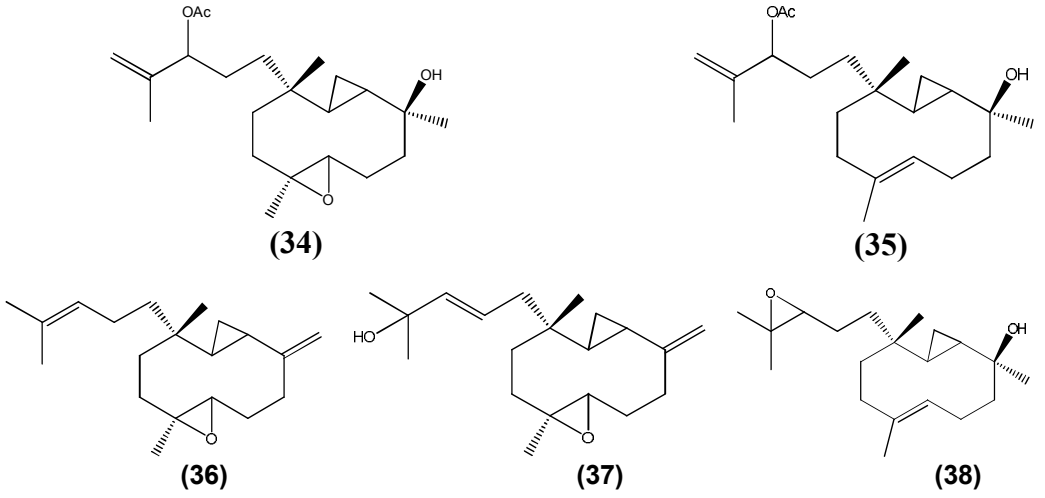


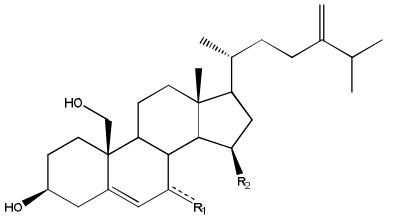
Fig 5b: Compounds 34 - 38

Nephthea erecta

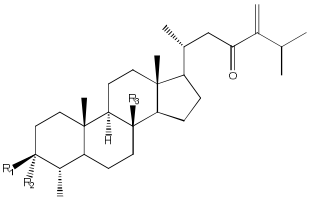
Duh *et al* reported two known steroids (Fig 6a and b) 24-methylcholesta-5,24(28)-diene-3β,15β,19-triol (**39**) and 24-methylcholesta-5,24(28)-diene-3β,19-diol-7-one (**40**), and four known steroids 24-methylcholesta-5,24(28)-diene-3β,19-diol, 24-methylcholesta-5,24(28)-diene-3β,19-diol-7β-monoaetate, 24-methylcholesta-5,24(28)-diene-3β,7β,19-triol, and 24-methylcholesta-24(28)-ene-3β,5α,6β,19-tetraol the soft coral *N. erecta*. Some of the compounds showed significant cytotoxic activity toward the growth of A549, HT-29, KB, P-388 cells. Bio-guided isolation of the dichloromethane extracts of *N. erecta* led to the isolation of four cytotoxic steroids, 24-methylcholesta-5,24(28)-diene-3β,19-diol, 24-methylcholesta-5,24(28)-diene-3β,19-diol-7β-monoacetate, 24-methylcholesta-5,24(28)-diene-3β,7β,19-triol, and 24-methylcholesta-24(28)-ene-3β,5α,6β,19-tetraol [34-35].

Cheng *et al* isolated eight new steroids, erectasteroids (A-H) **(41-48)** from the acetone soluble fraction of soft coral *N. erecta*. Compound **(48)** showed cytotoxic activity against P-388 and HT-29 with ED_{50} 3.8 and 4.7 µg/mL, respectively [12]. Three new oxygenated ergostanoids, 3β,23-Ergosta-5,24(28)-diene-3,23-diol **(49)**, 3β,23-ergosta-5,24(28)-diene-3,23-diol **(50)** and 3β,22-ergosta-5,24(28)-diene-3,17,22-triol **(51)**, five new sesquiterpenes, 4α,8-5,6,7,8-tetrahydro-4α,8-dimethylnaphthalen-2(4αH)-one **(52)**, (+)-trans-calamenen-13-al **(53)** [9], 4,5,6,10-8-oxo-eudesm-6-en-5α,11-diol **(54)**, 6,10-4,5-dioxo-11-methoxy-eudesm-6-ene **(55)** and 4,5,10-7-oxo-tri-nor-eudesm-5-en-4β-ol **(56)** [36], together with the known compounds (-)-aristolone and a (3β,22S)-ergosta-5,24(28)-diene-3,17-diol, from the ethyl acetate extract of *N. erecta*. Compounds **(51)**, **(54)**, **(55)** and **(56)** showed cytotoxic activity against P-388 with ED_{50} values 3.70, 2.60, 2.46, and 2.42 µg/mL, respectively. Compound **(49)** showed significant anti-inflammatory activity by reducing the levels of the iNOS 45.8±9.9 and COX-2 proteins 68.1±2.3 µg/mL [9, 36].
Some of them exhibited cytotoxic and anti-inflammatory activities

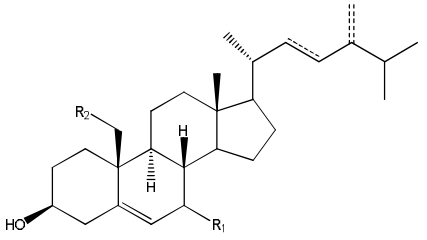
Examination of the acetone and methanol extracts of *N. erecta* also yielded five new sesquiterpenoids 5β,8β-epidioxy-11-hydroxy-6-eudesmene **(57)**, 5β,8β-epidioxy-11-hydroperoxy-6-eudesmene **(58)**, 3,4-epoxy-11-hydroxy-1-pseudoguaiene **(59)**, 8β-hydroxyprespatane **(60)** and 8β-hydroperoxyprespatane **(61)** [37].



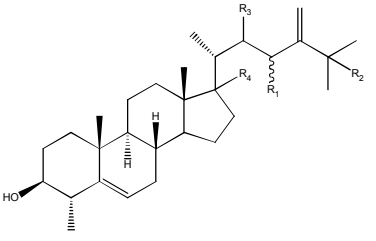
(39) R_1 = H, R_2 = OH
(40) R_1 = O, R_2 = H



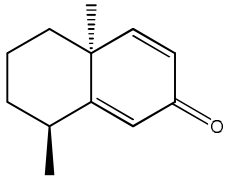
(41) R_1 = OH, R_2 = R_3 = H
(42) R_1 = R_2 = O, R_3 = OH



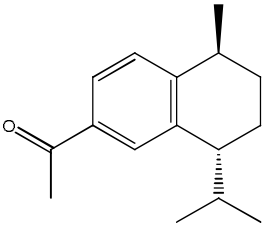
(43) R_1 = OAc, R_2 = OH
(44) R_1 = OAc, R_2 = OH, $\Delta^{22\text{-}23}$
(45) R_1 = OAc, R_2 = OH, $\Delta^{22\text{-}23,\ 24\text{-}28}$
(46) R_1 = R_2 = OH, $\Delta^{22\text{-}23,\ 24\text{-}28}$
(47) R_1 = R_2 = OH, $\Delta^{24\text{-}28}$
(48) R_1 = R_2 = OH, $\Delta^{24\text{-}28}$



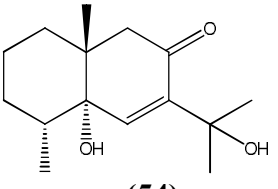
(49) R_1 = (S)-OH, R_2 = R_3 = R_4 = H
(50) R_1 = (R)-OH, R_2 = R_3 = R_4 = H
(51) R_1 = H, R_2 = H, R_3 = R_4 = OH



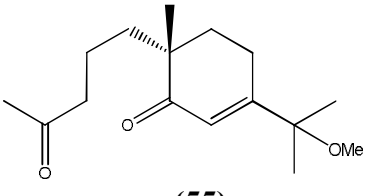
(52)



(53)

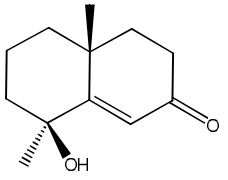


(54)

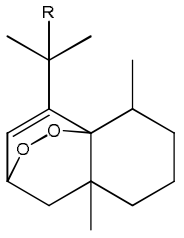


(55)

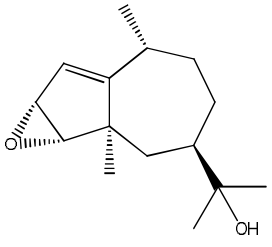
Fig 6a: Compounds 39 - 55



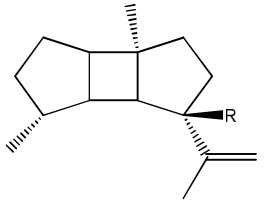
(56)



(57) R = OH
(58) R = OOH

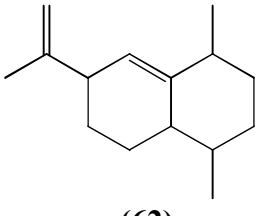


(59)

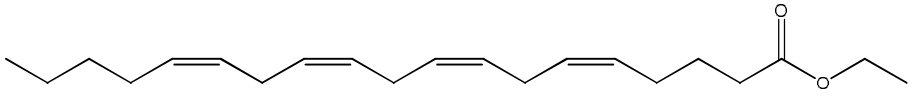


(60) R = OH
(61) R = OOH

Fig 6b: Compounds 56-61



(62)



(63)

Fig 7: Compounds 62 and 63

Nephthea hainansis

Two new compounds, (Fig 7) a pseudosesquiterpene, 7α, 10α-dimethyl-3β-isopropene-1,2-ene-octahydronaphthalene **(62)** and a poly unsaturated fatty acid, 5,8,11,14-Nonadecatetraenoic acid, ethyl ester **(63)** were isolated from the soft coral *N. hainansis* [38].

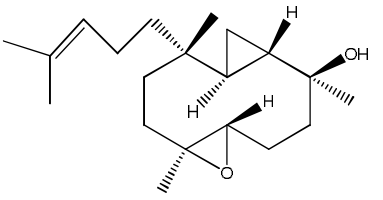
Nephthea pacifica

El-Gamal *et al* isolated ten new prenylbicyclogermacrane diterpenoids (Fig 8), pacificins A-J **(64-73)** from the dichloromethane extract of soft coral *N. pacifica*. Compounds **(66)** and **(71)** showed cytotoxic activity against P-388 with ED_{50} values of 1.44 and 2.01 µg/mL, respectively [39].

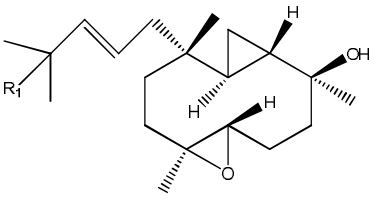
Some of the compounds exhibited potent cytotoxic activity.

Nephthea sinulata

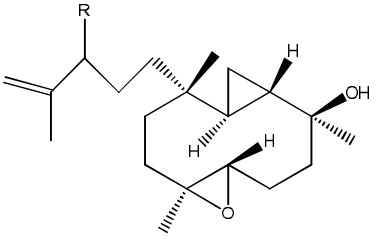
Liu *et al* reported a steroid (Fig 9) 24(28)-methylene-cholest-5-ene-3β,7β,19-triol-7β-monoacetate **(74)** from the soft coral *N. sinulata* [40].

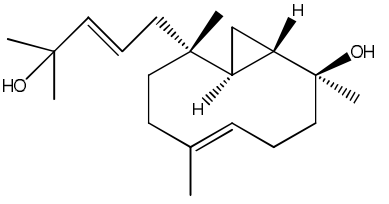


(64)



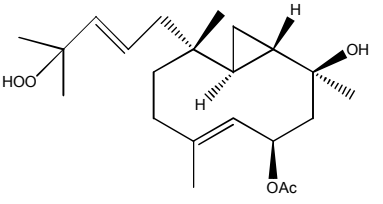
(65) R = OH
(66) R = OOH

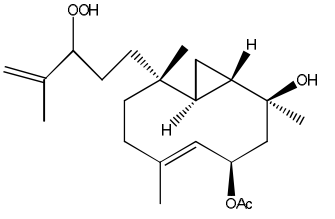




(67) R = OH
(68) R = OOH

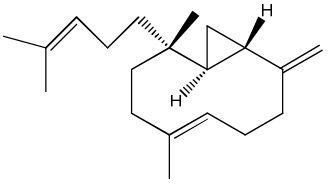
(69)

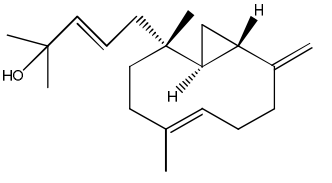




(70)

(71)

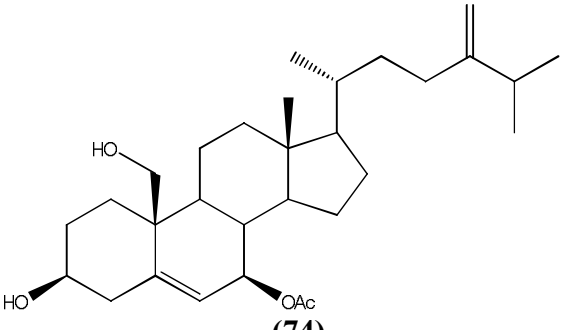




(72)

(73)

Fig 8: Compounds 64 - 73



(74)

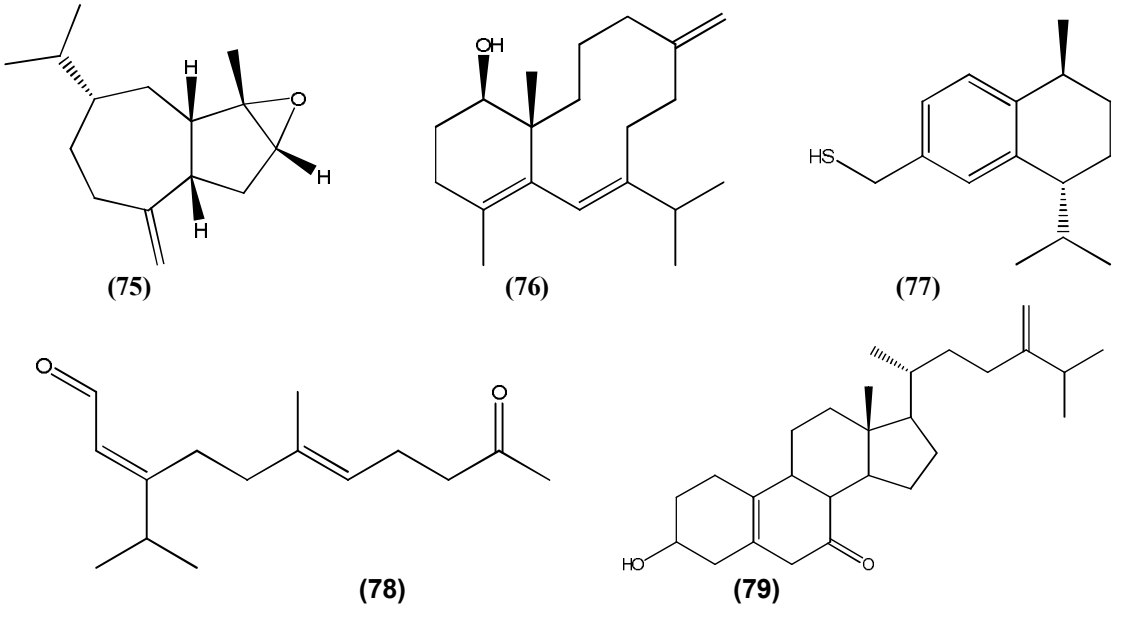
Fig 9: Compound 74

Combined studies on the genus *Nephthea*

Investigations of the soft coral species of the *Nephthea* genus of the Indian Ocean afforded two new compounds - a new sesquiterpenoid 3,4-epoxyguaia-10(12)-ene (Fig 10) **(75)** and a new diterpenoid, 1-Benzocyclodecenol-decahydro-4,12α-dimethyl-9-methylene-6-(1-methylethyl) **(76)**. The known compounds, 9(15)-africanene, 9-aristolene, the ubiquitous batyl alcohol, 4α-methylcholest-24(28)-en-3β-yl acetate, 4α,23,24-trimethylcholest-22-ene-3β-yl acetate, 3β,7β, 19-trihydroxyergosta-5,24(28)-diene, 24-methylenecholestane-3β,5α,6β-triol, 24-methylcholesta-7,25-diene-3β-ol, 24-ethylidenecholest-5-en-3β-ol and 24-ethylcholest-5-en-3β-ol, were also reported [41].

Isolation of the acetone extract of the soft coral *N. erecta* led to the isolation of a new calamenene-type sesquiterpene erectathiol **(77)** together with a known sesquiterpenoid, (+)-trans-calamenene. Work on soft coral *N. chabrolii* led to the isolation of two new compound a sec-germacrane sesquiterpene 2,6-3-isopropyl-6-methyl-10-oxoundeca-2,6-dienal **(78)** and a 19-norergosterol chabrosterol **(79)**. The isolated compounds **(77)** and **(79)** showed potent anti-inflammatory activity by 10 μM) significantly reducing the levels of the iNOS protein (58.0 ± 6.5% and 12.4 ± 2.9%) and COX-2 protein (108.7 ± 4.5% and 45.2 ± 5.4%). Compound **(77)** also showed moderate antimicrobial activity [7]. (1 and 3) showed potent anti-inflammatory and antimicrobial activities

Zeng *et al* reported two sterols 24-methylene-cholestan-3β,5α,6β,19-tetrol (nephalsterol A) from the soft coral *N. albida*, and 24-methylene-cholest-5-ene-3β,7β,19-triol (nephalsterol B) from the soft coral *N. tiexiexae* [42-43]. Nephalsterol-A and B were also isolated again from the soft coral of the genus *Nephthea* [44]. Four known steroids, 24-methylenecholesterol, 5β,8β-epidioxy-11-hydroxy-6-eudesmene, 5β,8β-epidioxy-11-hydroperoxy-6-eudesmene and 24-methyl-cholesta-5,24(28)-diene-3β,19-diol-7β-monoacetate were isolated from the species of the genus *Nephthea* [45].



(75) **(76)** **(77)** **(78)** **(79)**

Fig 10: Compounds 75 – 79

Table 1(a): New chemical constituents from the genus *Nephthea*

Isolated compound	No.	Class	Species	Reference
N-[1-(hydroxymethyl)-2-hydroxy-(E,E)-3,7-dodecadienyl]-tricosanamide	**1**	Amide	*N. albida*	[14]
29, 30-Dinoroleanane-13,15,16,26-tetraol	**2**	Triterpene	*N. albida*	[15]
24-Methylene-27-methyl-26-ethylcholesterol	**3**	Steroid	*N. albida*	[13]
Albidasterol	**4**	Steroid	*N. albida*	[16]
Nephalbidol	**5**	Sesquiterpene	*N. albida*	[17]
Armatin A	**6**	Sesquiterpene	*N. armata*	[19]
Armatin B	**7**	Sesquiterpene	*N. armata*	[19]
Armatin C	**8**	Sesquiterpene	*N. armata*	[19]
Armatin D	**9**	Sesquiterpene	*N. armata*	[19]
Armatin E	**10**	Sesquiterpene	*N. armata*	[19]
Lemnal-1(10)-ene-2,12-dione	**11**	Sesquiterpene	*N. armata*	[19]
Armatinol A	**12**	Steroid	*N. armata*	[19]
Armatinol B	**13**	Steroid	*N. armata*	[19]
2α,3β,15,16,19-Pentahydroxy-26,27-dinorergosta-4,7,24-trien-6-one	**14**	Steroid	*N. bayeri*	[21]
24-Methyl-cholesta-5,24(28)-diene-3β,7β,19-triol	**15**	Steroid	*N. bayeri*	[20]
Nanjiol A	**16**	Steroid	*N. bayeri*	[22]
Nanjiol B	**17**	Steroid	*N. bayeri*	[22]
Nanjiol C	**18**	Steroid	*N. bayeri*	[22]
Nanjiol D	**19**	Steroid	*N. bayeri*	[23]
Nanjiol E	**20**	Steroid	*N. bayeri*	[23]
Ergost-24(28)-ene-3β,6β,9,19-tetrol	**21**	Steroid	*N. brassica*	[25]
brassicolide	**22**	Diterpene	*N. brassica*	[26]
brassicolene	**23**	Diterpene	*N. brassica*	[27]
(-)-4α-O-acetyl-selin-11-en	**24**	Sesquiterpene	*N. brassica*	[26]
Elongatol A	**25**	Sesquiterpene	*N. elongata*	[32]
Elongatol B	**26**	Sesquiterpene	*N. elongata*	[32]
Elongatol C	**27**	Sesquiterpene	*N. elongata*	[32]
Elongatol D	**28**	Sesquiterpene	*N. elongata*	[32]
Elongatol E	**29**	Sesquiterpene	*N. elongata*	[32]
Elongatol F	**30**	Sesquiterpene	*N. elongata*	[32]
Elongatol G	**31**	Sesquiterpene	*N. elongata*	[32]
Pacificin K	**32**	Diterpene	*N. elongata*	[33]
Pacificin L	**33**	Diterpene	*N. elongata*	[33]
Pacificin M	**34**	Diterpene	*N. elongata*	[33]
Pacificin N	**35**	Diterpene	*N. elongata*	[33]
Pacificin O	**36**	Diterpene	*N. elongata*	[33]
Pacificin P	**37**	Diterpene	*N. elongata*	[33]
Pacificin Q	**38**	Diterpene	*N. elongata*	[33]
24-Methylcholesta-5,24(28)-diene-3β,15β,19-triol	**39**	Steroid	*N. erecta*	[35]
24-Methylcholesta-5,24(28)-diene-3β,19-diol-7-one	**40**	Steroid	*N. erecta*	[35]
Erectasteroid A	**41**	Steroid	*N. erecta*	[12]
Erectasteroid B	**42**	Steroid	*N. erecta*	[12]
Erectasteroid C	**43**	Steroid	*N. erecta*	[12]
Erectasteroid D	**44**	Steroid	*N. erecta*	[12]
Erectasteroid E	**45**	Steroid	*N. erecta*	[12]

Erectasteroid F	**46**	Steroid	*N. erecta*	[12]
Erectasteroid G	**47**	Steroid	*N. erecta*	[12]

Table 1(b): New chemical constituents from the genus *Nephthea* (***contd***)

Isolated compound	No.	Class	*Species*	Reference
Erectasteroid H	**48**	Steroid	*N. erecta*	[12]
3β,23-Ergosta-5,24(28)-diene-3,23-diol	**49**	Steroid	*N. erecta*	[9]
3β,23-Ergosta-5,24(28)-diene-3,23-diol	**50**	Steroid	*N. erecta*	[9]
3β,22-Ergosta-5,24(28)-diene-3,17,22-triol	**51**	Steroid	*N. erecta*	[9]
4α,8-5,6,7,8-Tetrahydro-4α,8-dimethylnaphthalen-2(4αH)-one	**52**	Sesquiterpene	*N. erecta*	[9]
(+)-Trans-calamenen-13-al	**53**	Sesquiterpene	*N. erecta*	[9]
4,5,6,10-8-Oxo-eudesm-6-en-5α,11-diol	**54**	Sesquiterpene	*N. erecta*	[36]
6,10-4,5-Dioxo-11-methoxy-eudesm-6-ene	**55**	Sesquiterpene	*N. erecta*	[36]
4,5,10-7-Oxo-tri-nor-eudesm-5-en-4β-ol	**56**	Sesquiterpene	*N. erecta*	[36]
5β,8β-Epidioxy-11-hydroxy-6-eudesmene	**57**	Sesquiterpene	*N. erecta*	[37]
5β,8β-Epidioxy-11-hydroperoxy-6-eudesmene	**58**	Sesquiterpene	*N. erecta*	[37]
3,4-Epoxy-11-hydroxy-1-pseudoguaiene	**59**	Sesquiterpene	*N. erecta*	[37]
8β-Hydroxyprespatane	**60**	Sesquiterpene	*N. erecta*	[37]
8β-Hydroperoxyprespatane	**61**	Sesquiterpene	*N. erecta*	[37]
7α,10α-Dimethyl-3β-isopropene-1,2-ene-octahydronaphthalene	**62**	Sesquiterpene	*N. hainansis*	[38]
5,8,11,14-Nonadecatetraenoic acid, ethyl ester	**63**	Sesquiterpene	*N. hainansis*	[38]
Pacificin A	**64**	Diterpene	*N. pacifica*	[39]
Pacificin B	**65**	Diterpene	*N. pacifica*	[39]
Pacificin C	**66**	Diterpene	*N. pacifica*	[39]
Pacificin D	**67**	Diterpene	*N. pacifica*	[39]
Pacificin E	**68**	Diterpene	*N. pacifica*	[39]
Pacificin F	**69**	Diterpene	*N. pacifica*	[39]
Pacificin G	**70**	Diterpene	*N. pacifica*	[39]
Pacificin H	**71**	Diterpene	*N. pacifica*	[39]
Pacificin I	**72**	Diterpene	*N. pacifica*	[39]
Pacificin J	**73**	Diterpene	*N. pacifica*	[39]
24(28)-Methylene-cholest-5-ene-3β,7β,19-triol-7β-monoacetate	**74**	Steroid	*N. sinulata*	[40]
3,4-epoxyguaia-10(12)-ene	**75**	Sesquiterpene		[41]
1-Benzocyclodecenol-decahydro-4,12α-dimethyl-9-methylene-6-(1-methylethyl)	**76**	Diterpene		[41]
erectathiol	**77**	Sesquiterpene	*N. erecta*	[7]
2,6-3-isopropyl-6-methyl-10-oxoundeca-2,6-dienal	**78**	Sesquiterpene	*N. chabrolii*	[7]
chabrosterol	**79**	Steroid	*N. chabrolii*	[7]

CONCLUSION

The genus *Nephthea* is a rich source of new secondary metabolites, some of which could be artefacts or breakdown products of the mother compounds during isolation processes since it has been an important target of many chemical and pharmacological investigations. Only a limited number of studies have been conducted on certain species including *N. albida, N. armata, N. bayeri, N. brassica, N. capnelliformis, N. crassica*, *N. hainansis, N. pacifica* and *N. Sinulata*. Thus, it would be useful to conduct bioguided chemical investigations on these species for the purpose of isolating new secondary metabolites for new drug discovery and development.

ACKNOWLEDGEMENT

The authors would like to acknowledge support for this work through a research grant (no. 1001/PKIMIA/811187); and the authors (F.A.) and (Y.C.K.) are also grateful to Universiti Sains Malaysia for the USM fellowship awards.

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