CHAPTER II

HISTORICAL

1. Chemical constituents of genus sapindus.

Distribution of chemical constituents in the genus sapindus.

Table 1 The chemical constituents of *Sapindus mukorossi*

Chemical compound	Extract	Activity	References
[1]	MeOH	molluscicidal	Huang *et al.*, 2003
[2]	MeOH	Antifungal	Zikova and Krivenchuk, 1965
[3]	MeOH	molluscicidal	Huang *et al.*, 2003
[4]	MeOH	molluscicidal	Huang *et al.*, 2003
[5]	MeOH	molluscicidal	Huang *et al.*, 2003
[6]	MeOH	molluscicidal	Huang *et al.*, 2003
[7]	MeOH	molluscicidal	Huang *et al.*, 2003
[8]	MeOH	molluscicidal	Huang *et al.*, 2003
[9]	MeOH	molluscicidal	Huang *et al.*, 2003
[10]	MeOH	Cytotoxic	Tamura, Mizutani and Yamamoto, 1990

Table 2 The chemical constituents of *Sapindus emarginatus*.

Chemical compound	Extract	Activity	References
[1]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[2]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[6]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[7]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[8]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[9]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[11]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001
[12]	MeOH	-	Kanchanapoom, Kasai and Yamasaki, 2001

Table 3 The chemical constituents of *Sapindus trifoliatus*

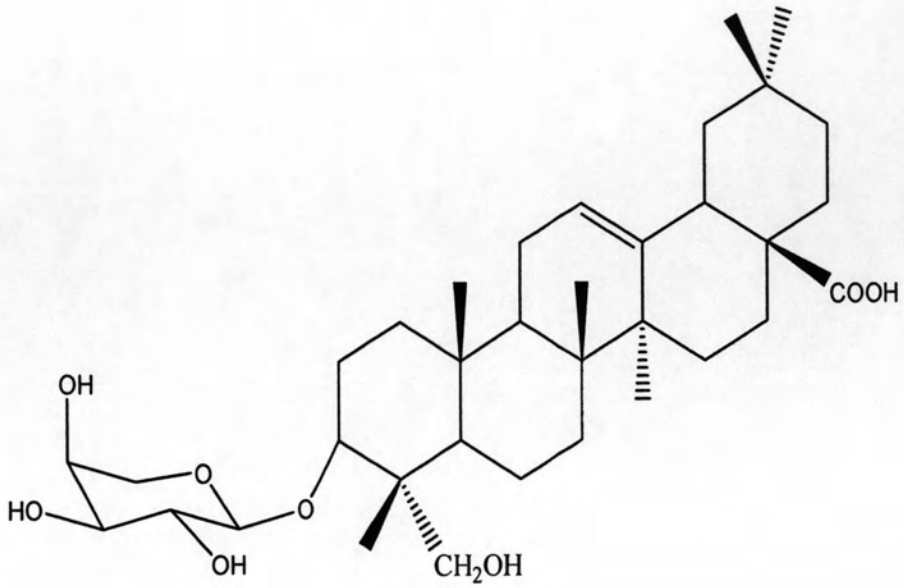
Chemical compound	Extract	Activity	References
[2]	MeOH	Cytotoxic	Tamura, Mizutani and Yamamoto, 1990
[8]	MeOH	Cytotoxic	Tamura, Mizutani and Yamamoto, 1990

Table 4 The chemical constituents of *Sapindus saponaria*

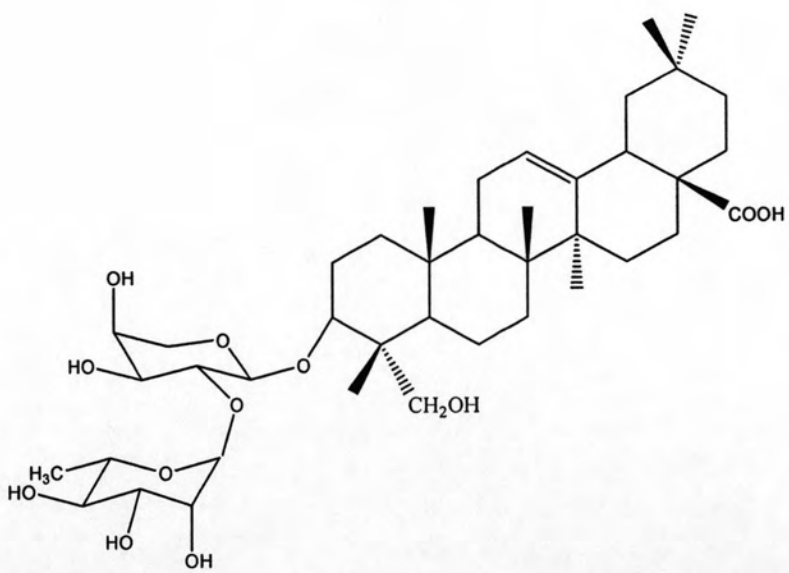
[8]	MeOH	-	Lemos *et al.*, 1994
[10]	MeOH	-	Lemos *et al.*, 1994
[18]	MeOH	-	Lemos *et al.*, 1994

Table 5 The chemical constituents of *Sapindus delavayi*

Chemical compound	Extract	Activity	References
[2]	MeOH	-	Nakayama *et al.*, 1986
[8]	MeOH	-	Nakayama *et al.*, 1986
[10]	MeOH	-	Nakayama *et al.*, 1986
[17]	MeOH	-	Nakayama *et al.*, 1986
[20]	MeOH	-	Nakayama *et al.*, 1986
[21]	MeOH	-	Nakayama *et al.*, 1986
[22]	MeOH	-	Wong *et al.*,1991
[23]	MeOH	-	Wong *et al.*,1991
[24]	MeOH	-	Wong *et al.*,1991
[25]	MeOH	-	Wong *et al.*,1991
[26]	MeOH	-	Wong *et al.*,1991

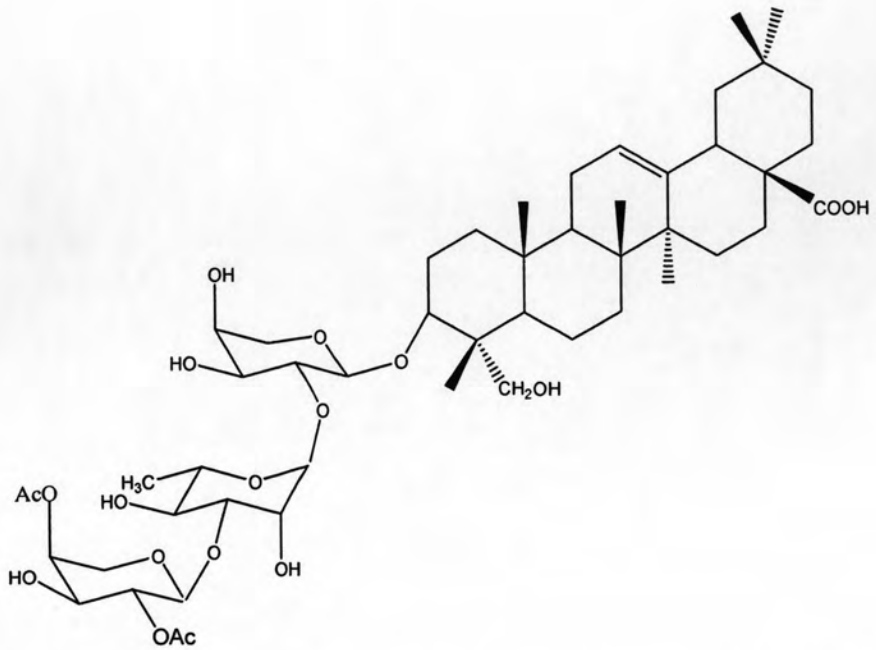


δ-Hederin **[1]**

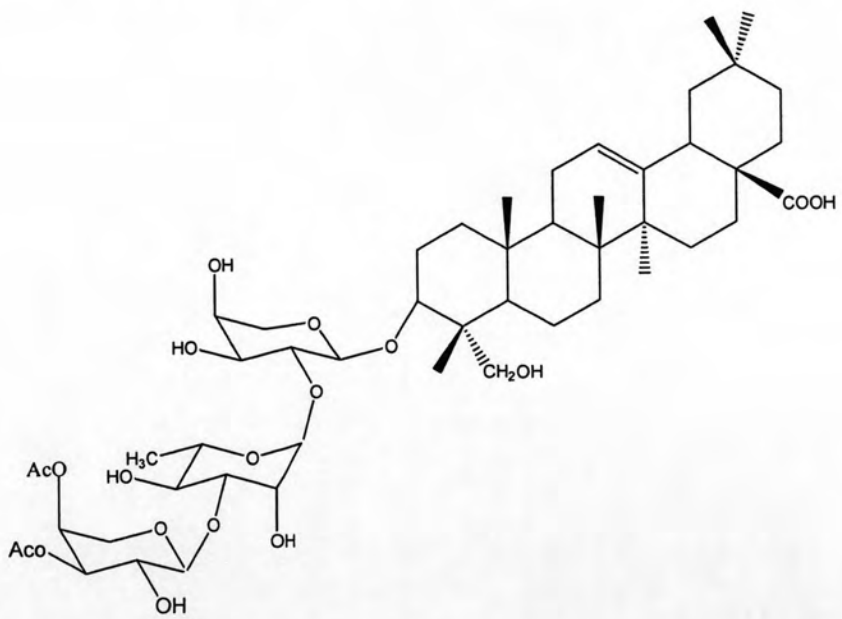


α-Hederin **[2]**

Figure 8 Structures of compounds previously isolated from genus Sapindus.

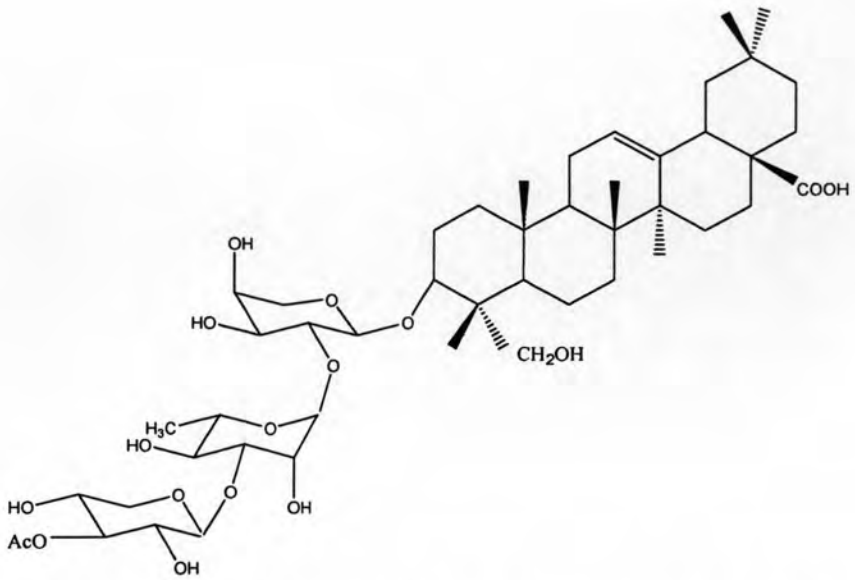


Hederagenin 3-*O*-(2,4-*O*-di-acetyl-α-L-arabinopyranosyl-(1→3)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[3]**

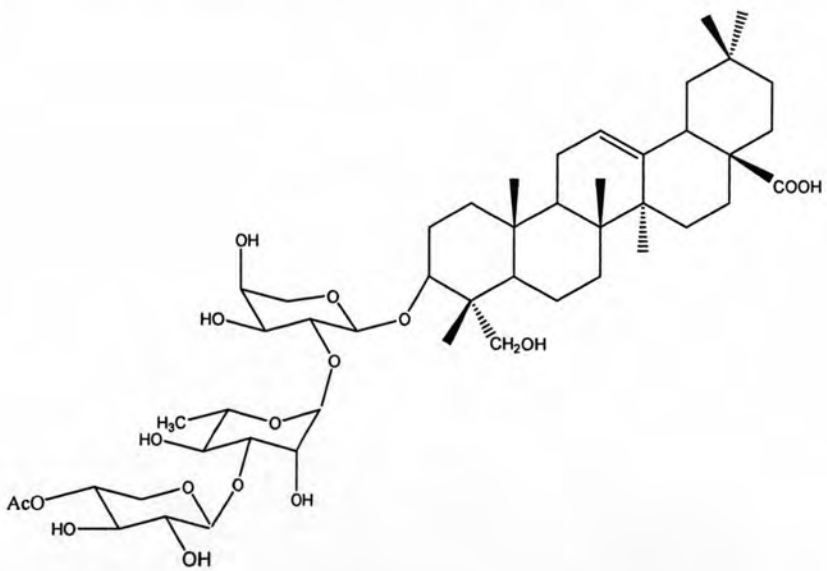


Hederagenin 3-*O*-(3,4-*O*-di-acetyl-α-L-arabinopyranosyl)-(1→3)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[4]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)



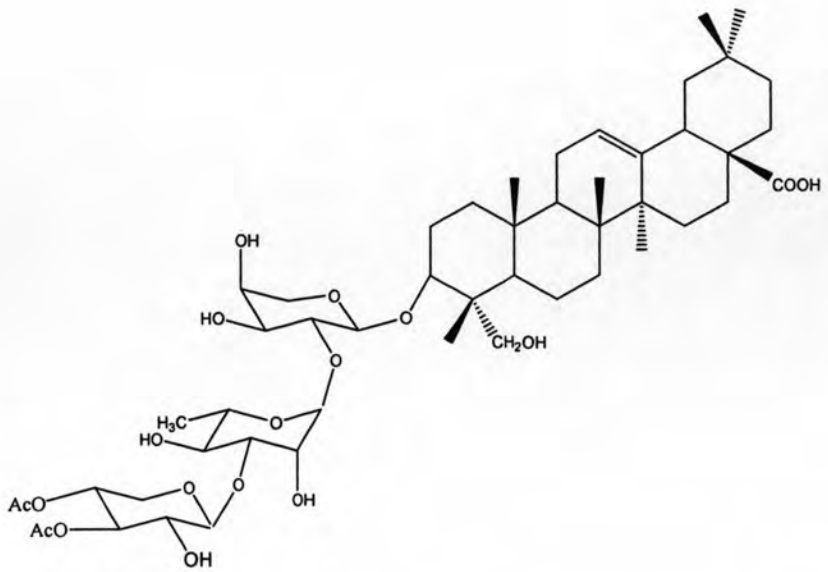
Hederagenin 3-*O*-(3-*O*-acetyl-β-D-xylopyranosyl)-(1→3)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[5]**



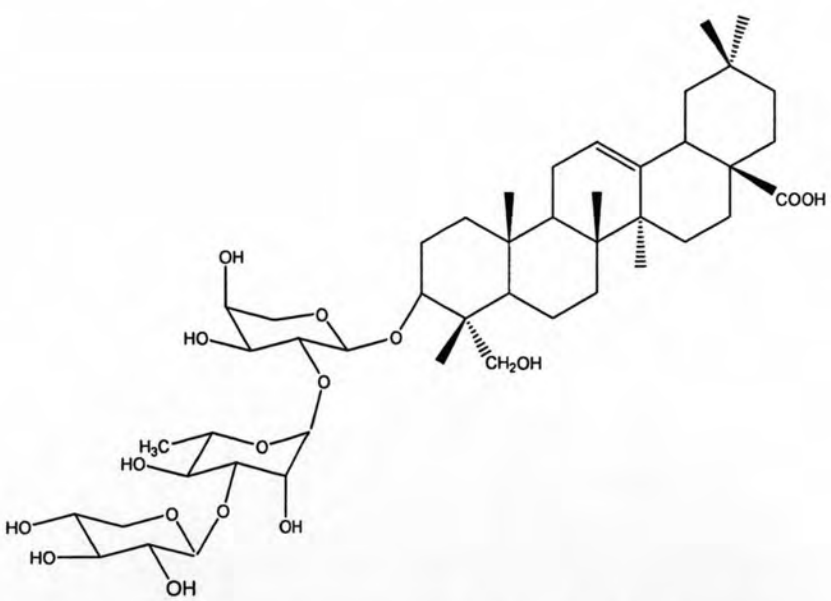
Hederagenin 3-*O*-(4-*O*-acetyl-β-D-xylopyranosyl)-(1→3)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside

(Mukurozi-saponin E_1) **[6]**

Figure 8 Structures of compounds previously isolated from genus Sapindus. (Cont.)

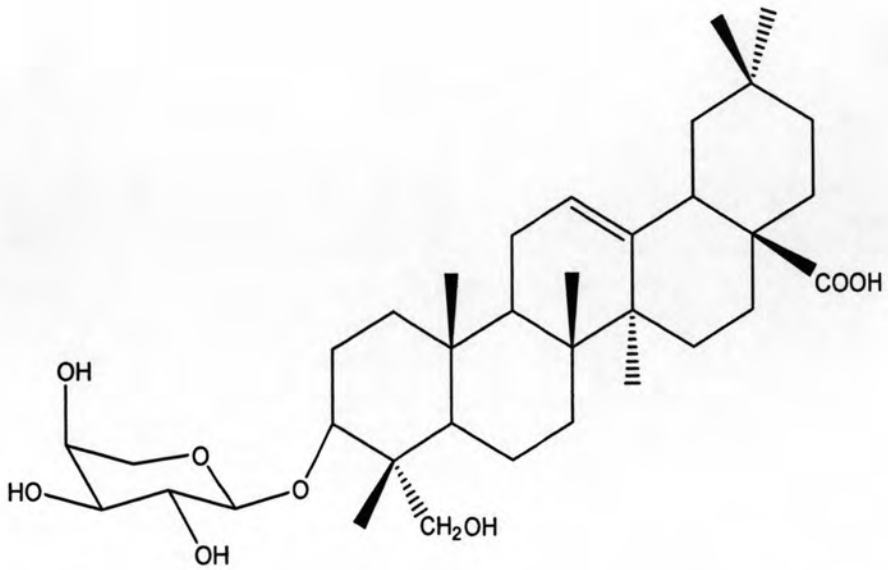


Hederagenin 3-*O*-(3,4-*O*-*di*-acetyl-*β*-D-xylopyranosyl)-(1→3)-*α*-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[7]**

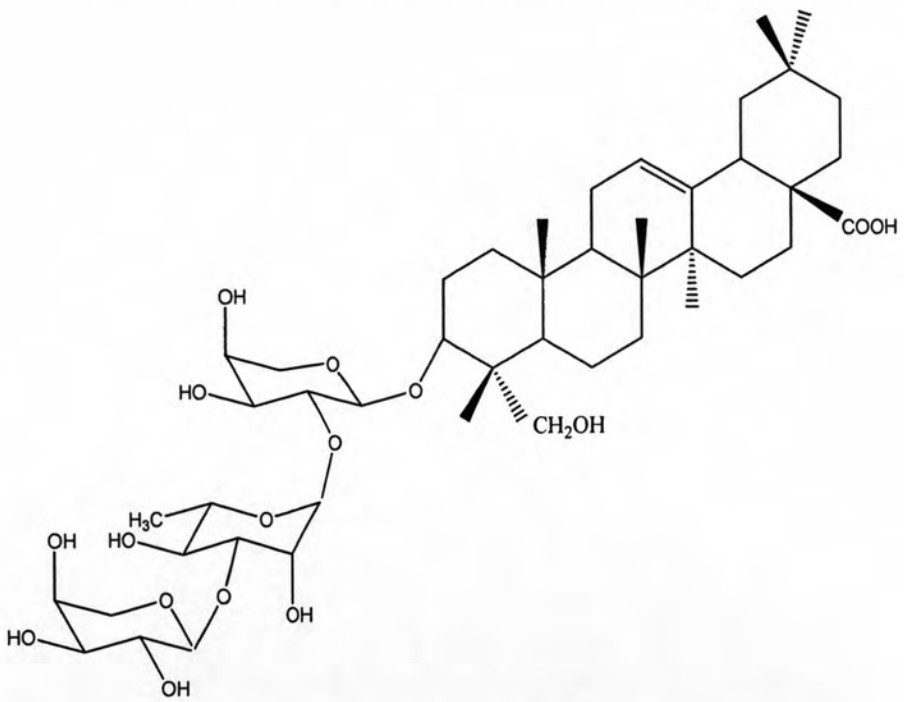


Hederagenin 3-*O*-*β*-D-xylopyranosyl-(1→3)-*α*-L-rhamnopyranosyl-(1→2)-*α*-L-arabinopyranoside (Sapindoside B) **[8]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

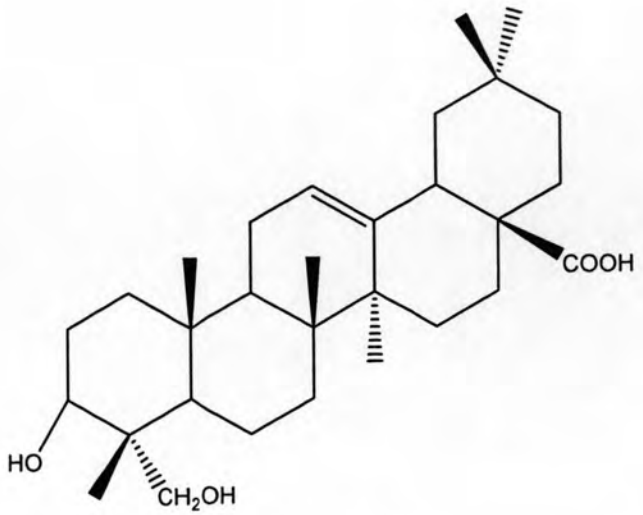


Hederagenin 3-*O*-α-L-arabinopyranoside **[9]**

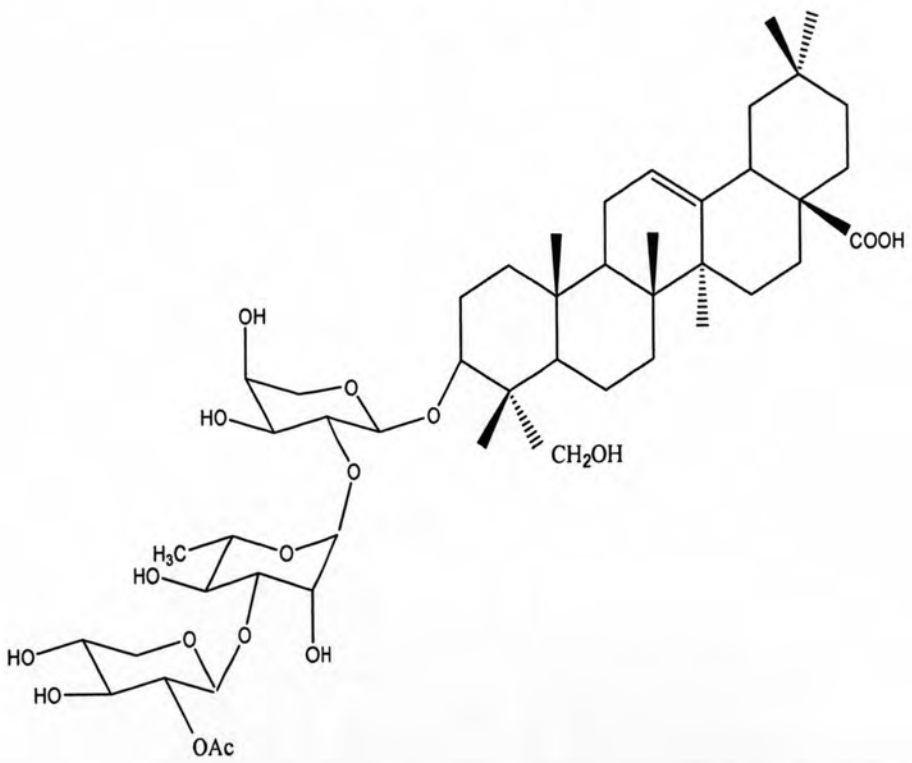


Clemontoside-C **[10]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

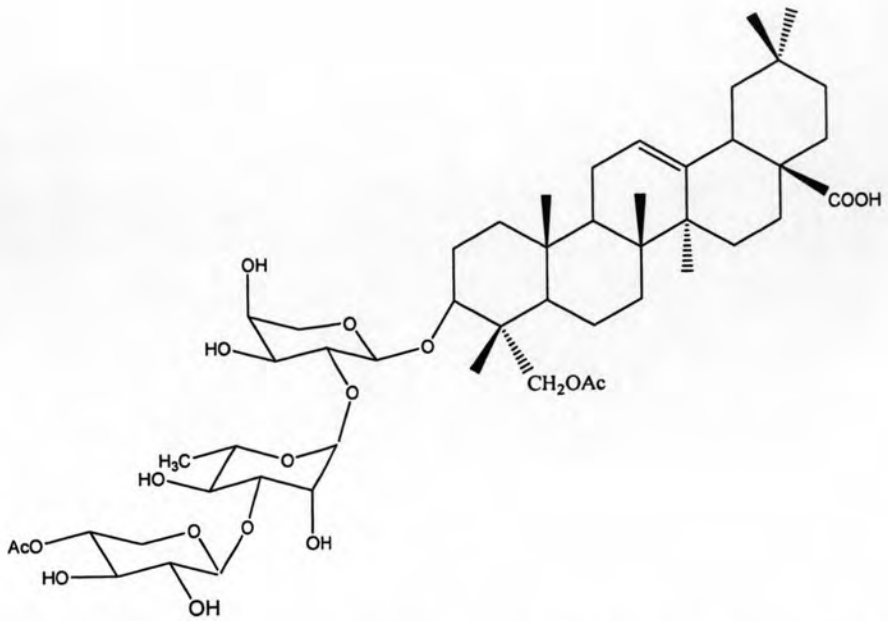


Hederagenin **[11]**

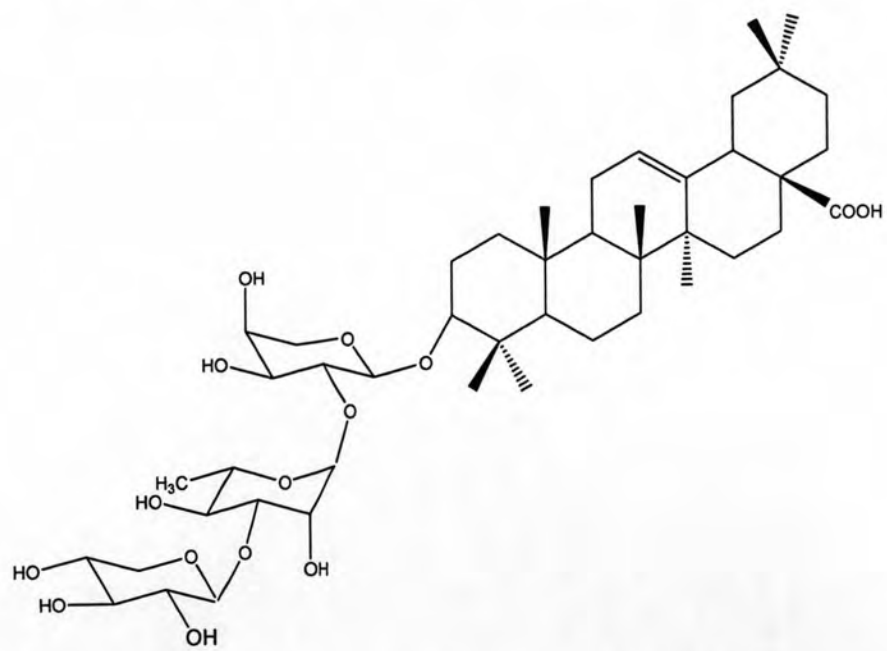


Hederagenin 3-*O*-(2-*O*-acetyl-β-D-xylopyranosyl)-(1→3)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[12]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

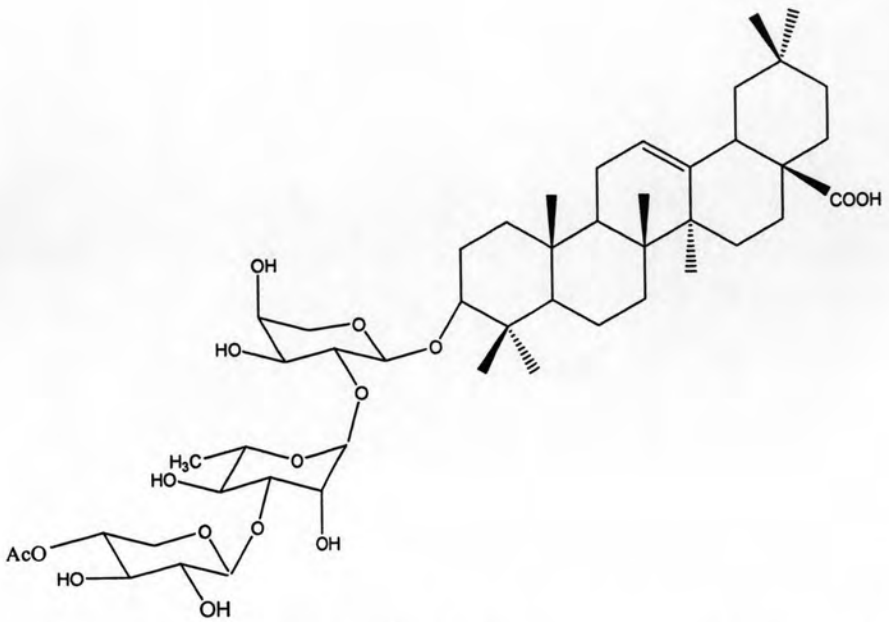


23-*O*-acetyl-Hederagenin 3-*O*-(4-*O*-acetyl-*β*-D-xylopyranosyl)-(1→3)-*α*-L-rhamnopyranosyl-(1→2)-*α*-L-arabinopyranoside **[13]**

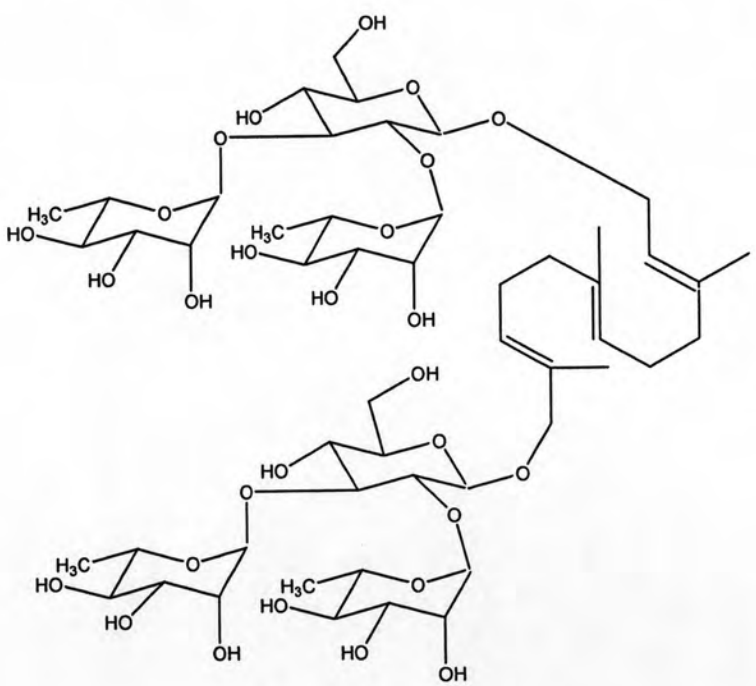


Oleanolic acid 3-*O*-*β*-D-xylopyranosyl-(1→3)-*α*-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside (Prosapogenin CP_3) **[14]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

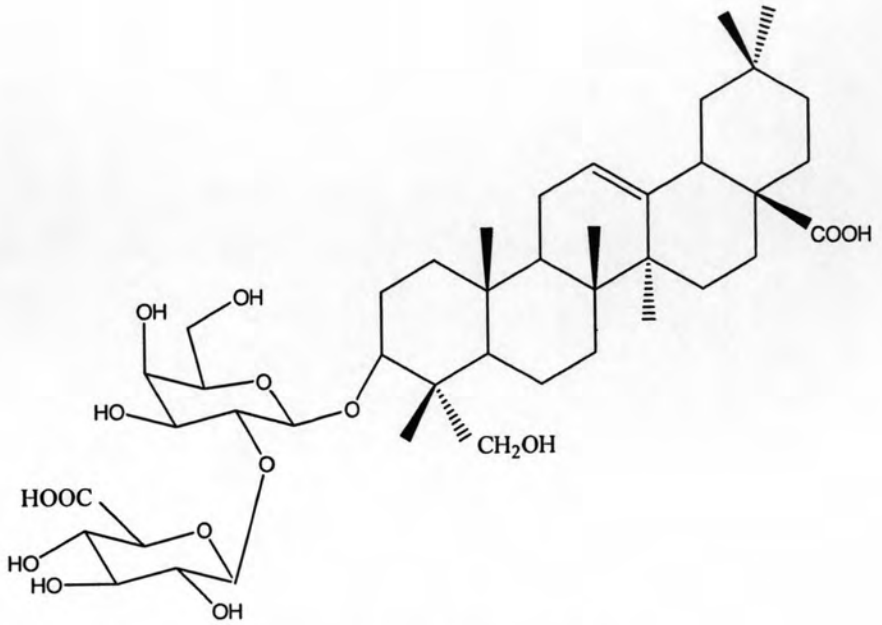


Oleanolic acid 3-*O*-(4-*O*-acetyl-*β*-D-xylopyranosyl)-(1→3)-*α*-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[15]**

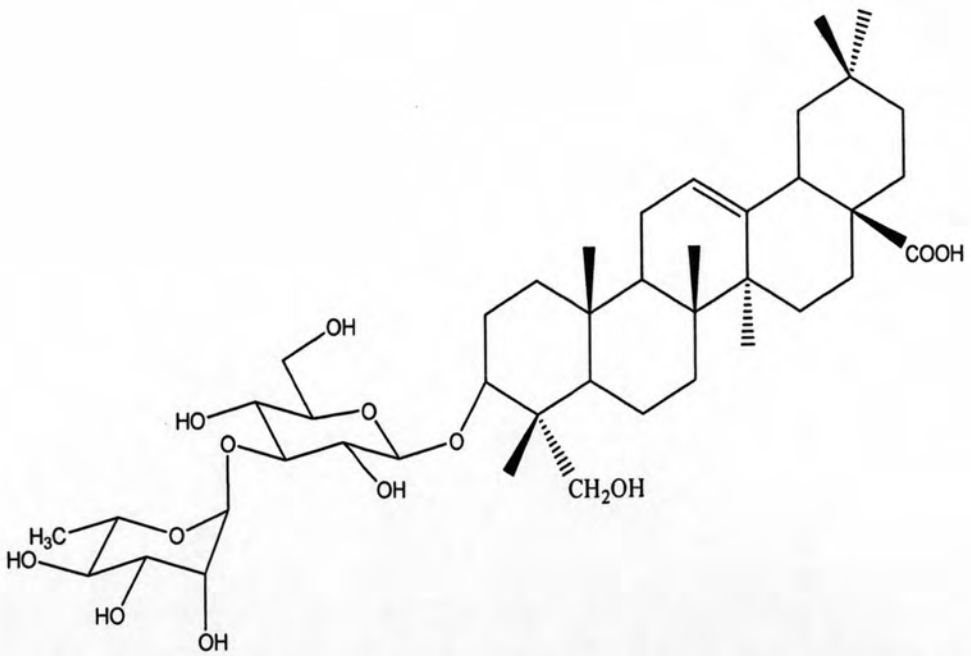


Mukurozioside IIb **[16]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

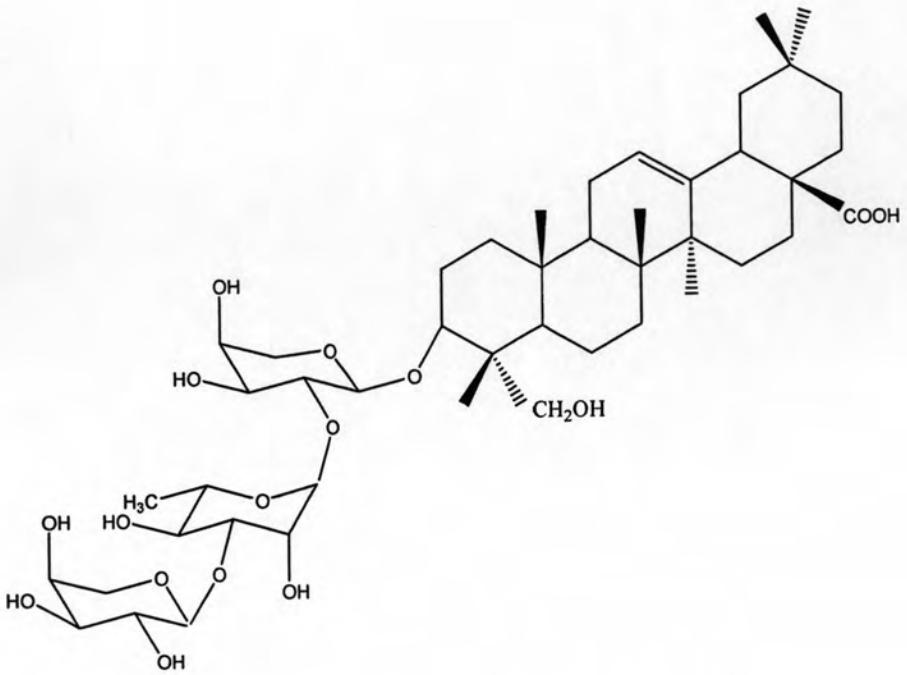


Emarginatoside C **[17]**

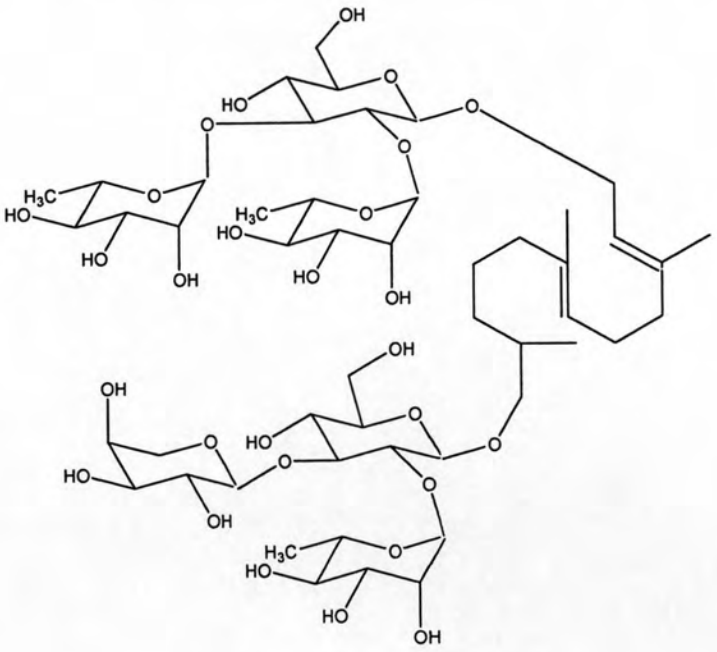


Hederagenin 3-*O*-α-L-rhamnopyranosyl-(1→3)-β-D-glucopyranoside**[18]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

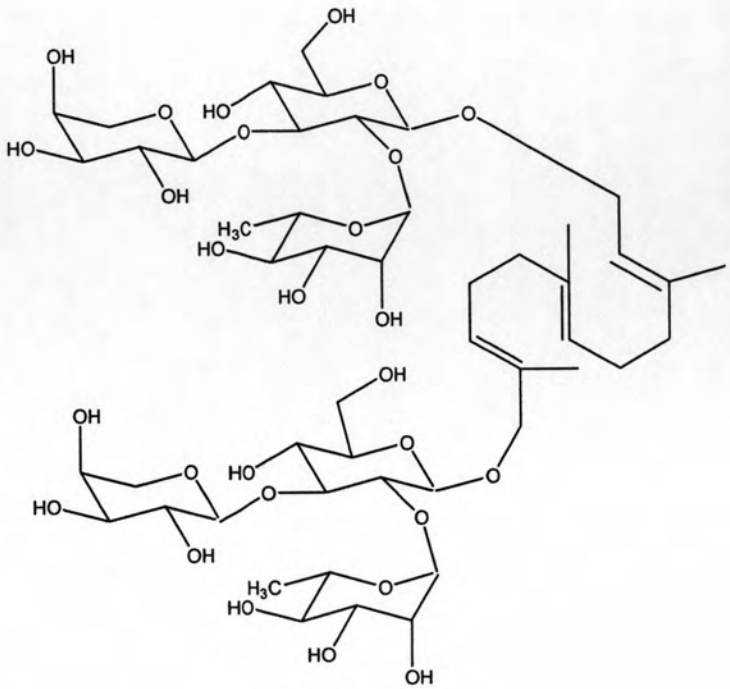


Hederagenin 3-*O*-α-L-arabinofuranosyl-(1→3)-α-L-rhamnopyranosyl-(1→2)-α-L-arabinopyranoside **[19]**

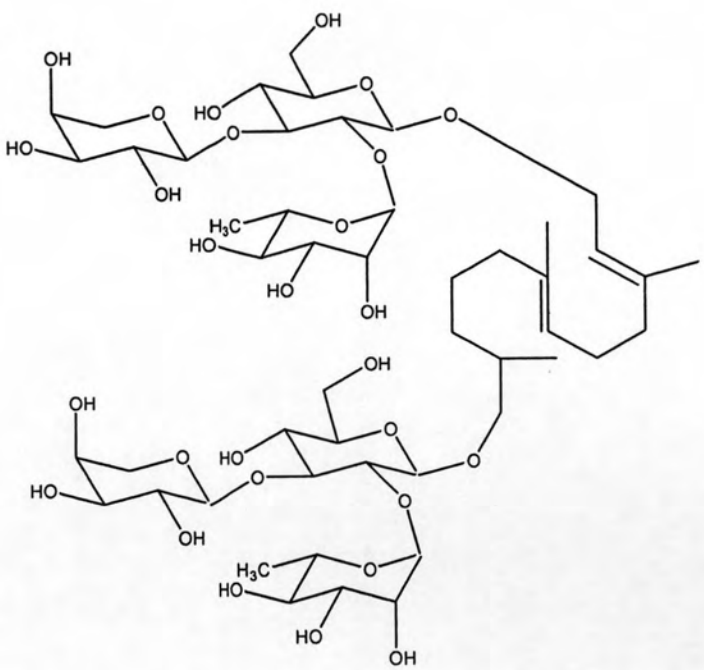


Pyishauosides IIIa **[20]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

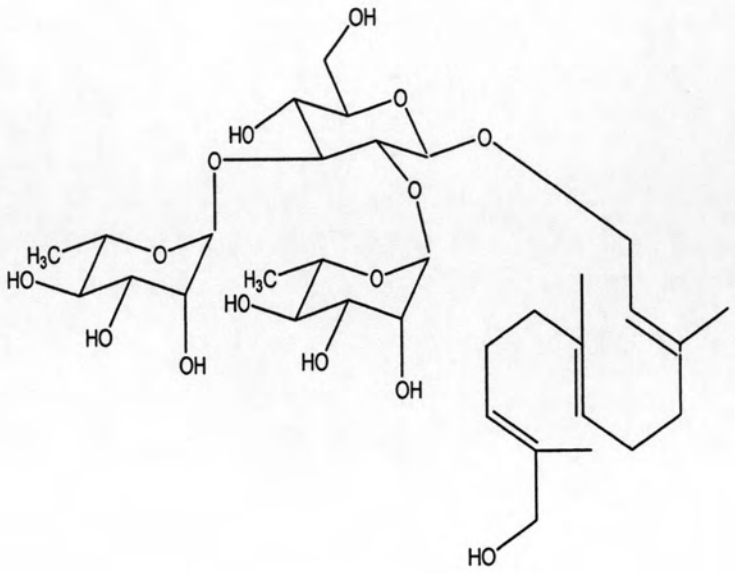


Pyishauosides IVb **[21]**

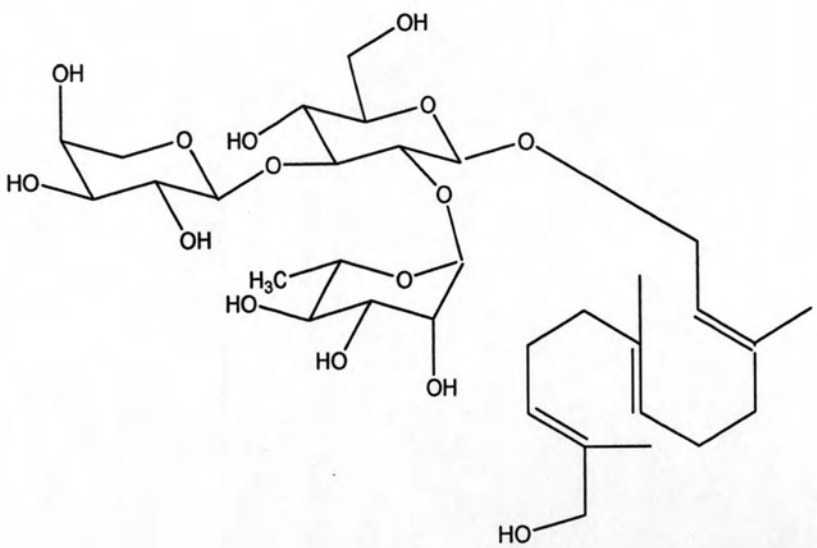


Pyishauosides IVa **[22]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

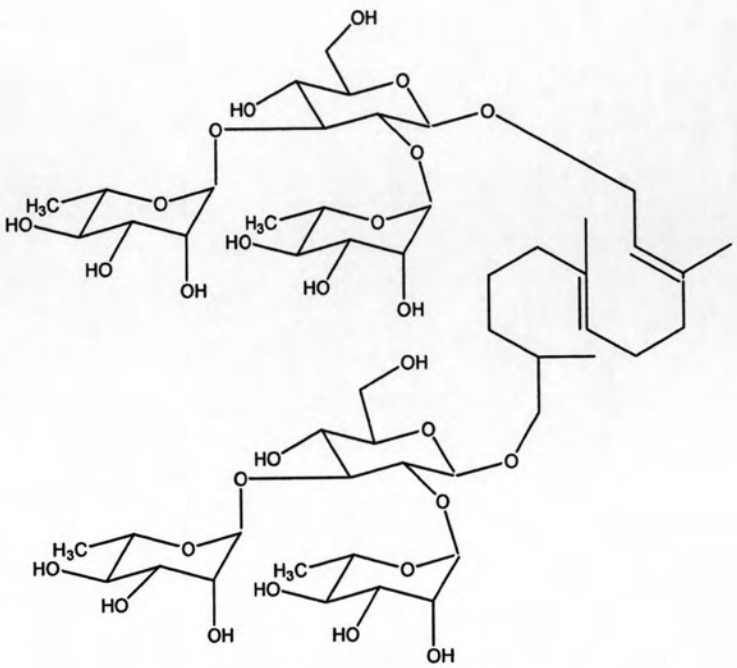


Pyishauosides Ib **[23]**

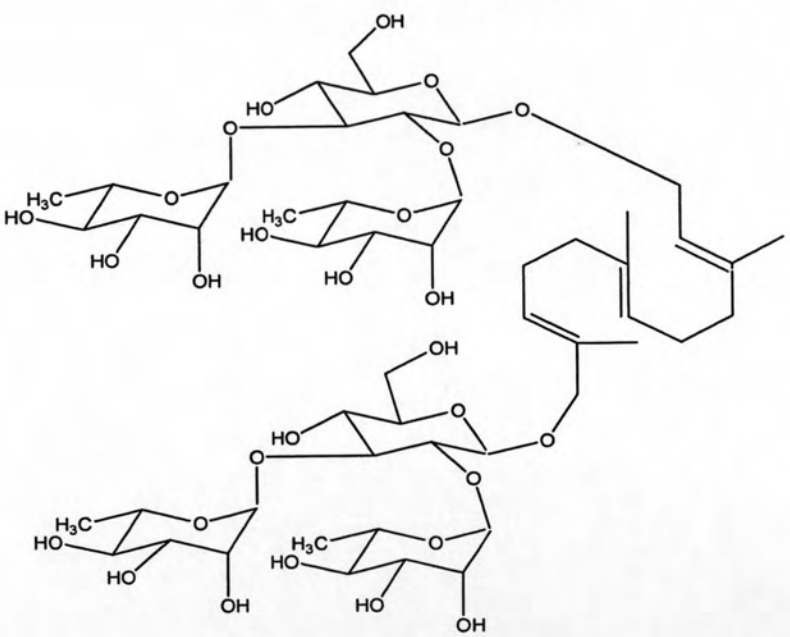


Pyishauosides IIb **[24]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)



Mukurozioside IIa **[25]**



Mukurozioside IIb **[26]**

Figure 8 Structures of compounds previously isolated from genus Sapindus (Cont.)

2. Literature Review

2.1 Literature review on molluscicidal activity of saponins.

Molluscicidal activity has so far only been observed for monodesmosidic saponins [Domon and Hostettmann, 1984], with bidesmosidic saponins requiring basic or enzymatic hydrolysis to the corresponding monodesmosidides before the induction of activity. Saponins of oleanolic acid or hederagenin are the most active, while the corresponding aglycones are inactive [Marston and Hosttetmann, 1985]. Other factors which are important for the activity are: The nature of sugar chains, the sequence of the monosaccharide, and the interglycosidic linkages.

Lauhachinda (1996) reported that neem seed extract at the concentration at 2-3 ppm caused 73 - 100 % death of the tested animals in 72 h. after application. Field test of the neem seed extract on various sizes of snails demonstrated that concentration at 6 ppm can caused 70-80 % death of all size snails at 72 h. [Lauhachinda *et al.*, 1996]

Somkasettrin (1999) reported that neem extracts at concentration 3 ppm caused 100% mortality to small size snails (20-30 mm) at 48 h. while the medium (30 - 40 mm) and large size (50- 60 mm) snails reach 100 % mortality at 72 h. [Somkasettrin *et al.*, 1996]

Derris root and tea seed cake extracted by distilled water at 12 h. maceration were tested on three sizes (5-20, 21-35 and 36-50 mm.) of golden apple snail. The LC_{50} value of derris root extract was 25.20, 45.26 and 77.00 mg/l for three sizes of snail, respectively. The hatching of eggs

showed that there was no effect on the extracts in all concentration [นันทิยา, 2543]

Somrudee (2002) studied the toxicity of indigenous plant extracts to golden apple snail. The result showed that strong activity was observed in the aqueous extracts of *Bougainvillea spectabilis*, *Calotropis gigantean* and *Croton tiglium* and many types of plant in ethanolic extract. [Somrudee, 2002]

Triterpenoid hederagenin saponins isolated from *Sapindus mukorossi* Garetn. (Sapindaceae) had molluscicidal effects against the golden apple snail, *Pomacea canaliculata*, which have become major pests of rice and other aquatic crops throughout Taiwan and other parts of Asia [Huang *et al.*, 2003]. Seven isolated hederagenin saponins including one new hederagenin saponins, caused 70 %- 100 % mortality at 10 ppm against the golden apple snails. Hederagenin saponins with three sugar moieties had higher molluscicidal activity than triterpenoid saponins with one sugar moiety.