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BIOACTIVE GLYCOSIDES FROM CHINESE MEDICINES

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Glycosides are the bioactive components of many famous Chinese medicines. Here reported are some bioactive glycosides we discovered from Chinese medicines in recent years. (1) Phenolic glycosides from Chinese medicines: Gastrodia elata, Aconitum austroyunanense *and* Helicia erratica, *three bioactive phenolic glycosides were discovered and two of them have been developed into new drugs. (2) Terpenoidal glycosides: a) Monoterpenoid: the sweroside from* Swertia moleensis *has been developed into an anti-hepatitis drug; b) Diterpenoid:* Phlomis betonicoides *contains sweet glycosides; c) Triterpenoid: many biologically active triterpenoid glycosides were isolated from* Panax *plants and* Siraitia grosvenorii. *(3) Steroidal glycosides: a)* C_{21}*-steroid:* Cynanchum otophyllum *and* C. atratrum contain *anti-epilepsy and anti-tumor glycosides; b)* C_{27}*-steroid Hemostatic saponins were found in* Paris polyphylla.

Key words: *Gastrodia elata* – *Aconitum austroyunanense* – *Helicia erratice* – *Cynanchum otophyllum* – *Cynanchum atratum* – Sweroside from *Swertia moleensis* – *Phlomis betonicoides* – Hemostatic saponins from *Paris polyphylla* – Triterpenoid glycosides from *Panax* – *Siraitia grosvenorii*

The general administration of Chinese medicine is to make a decoction of a mixture of several medicines in boiling water and give it orally. Glycosides are the main components of many such decoctions because of their comparatively high solubility in water. Our recent studies on some well known Chinese medicines revealed that glycosides were the principles responsible for their bioactivities.

1. PHENOLIC GLYCOSIDES

Tianma (*Gastrodia elata* Bl.) is a widely known Chinese medicine which has sedative effect and is used to reduce blood pressure. Chemical investigation of its fresh tubers resulted in the isolation of nine phenolic components (Zhou et al., 1982), two of which were glycosides gastrodin (1) and parishin (2). The content of gastrodin in this plant was the highest among the nine. Pharmacological studies of gastrodin proved its sedative and hypnotic effects and now it has been synthesized (Zhou et al., 1980) as a sedative and headache-curing drug in clinical treatment.

Helicid (3), an analogue of gastrodin, was isolated in high yield from a folk medicine Doufuguo *(Helicia erratica).* Helicid has similar activities gastrodin and has also been used in clinical treatment (Chen et al., 1981).

Aconitum austroyunnanense is the main composition of an important traditional patent medicine in China. Detailed studies were carried on its diterpenoid alkaloids contents. However, our recent studies of its water soluble fraction led to the isolation of two phenolic glycosides, salidroside (4) and 3-(4'-β-D-glucopyranosyloxy)phenyl-trans-propenamide(5) (Jiang et al., unpublished). Salidroside which widely exists in *Rhodiola* was isolated for the first time from *Aconitum.* It has action in the central nervous system, (5) and has been synthesized. Preliminary pharmacological study showed that it has sedative effect. (Fig. 1).

2. TERPENOID GLYCOSIDES

a) *Monoterpenoid* – In western China, Gentanaceae plants are used in folk medicine to cure hepatitis. Both the gentiopicroside (6) isolated from *Gentiana rigescena* and sweroside (7) from *Swertia mileensis* have antihepatitis activity (He & Nie, 1980). Sweroside reduced the SGPT level in the model of mice liver damage caused by carbon tetrachloride and/or galactosamine. Sweroside also reduced the SGPT level of hepatitis patients. After 45 days treatment with sweroside, the effective cure rate for acute patients was 84% and that for chronic patients 70% (Zhou, 1989). Sweroside has now been used in clinic to treat hepatitis and is considered more suitable for acute hepatitis patients.

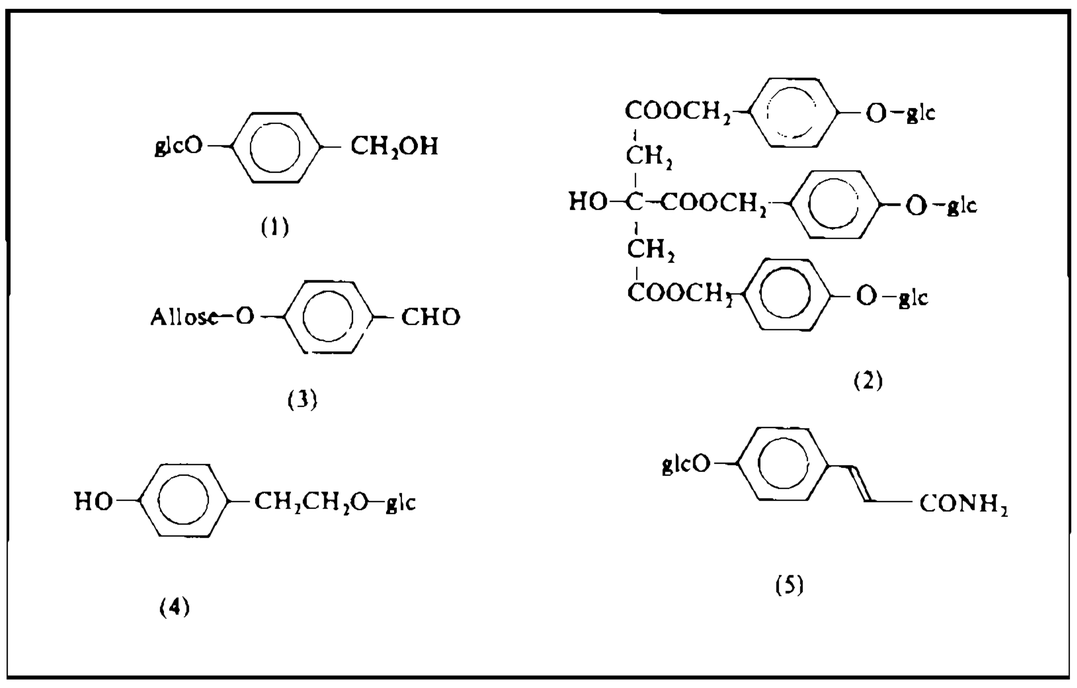


Fig. 1: Phenolic glycosides.

Lately, a novel iridoid, oleayunnanoside (8), was isolated from *Olea yunnanensis* (He et al., unpublished) (Fig. 2).

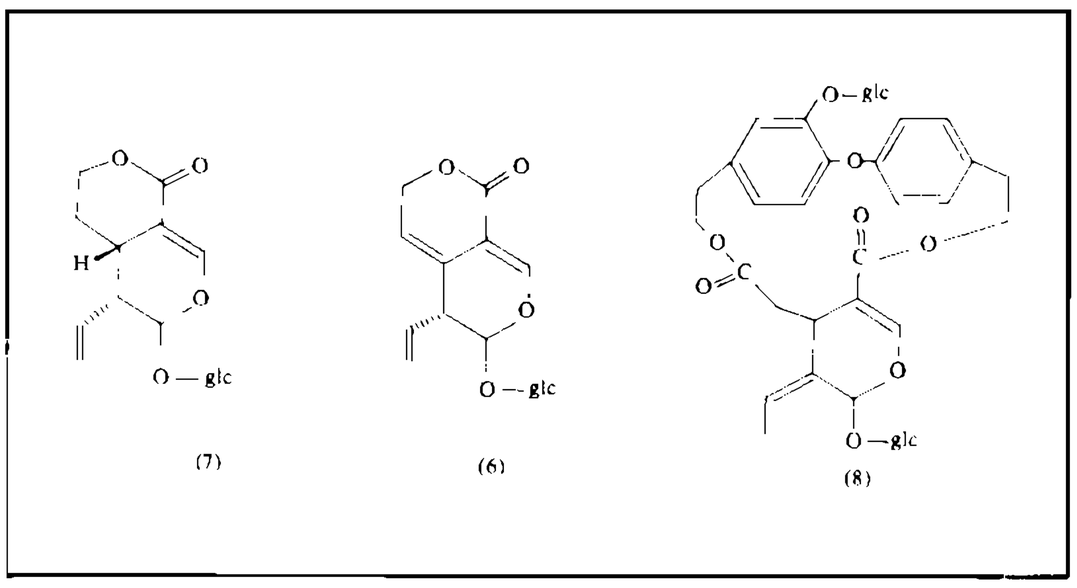


Fig. 2: Monoterpenoid glycosides.

b) *Diterpenoid – Phlomis betonicoides* is the plant distributed in west Yunnan of China, growing in meadows of high mountains. Its roots are used to cure alimentary canal diseases. Chemical studies of its roots resulted in the isolation of three diterpenoid glycosides, phlomisoside I (9), phlomisoside II (10) and baiyunoside (11) which content was comparatively higher in this plant. Baiyunoside is about 500-fold sweeter than sucrose and its sweetness lasts more then an hour (Fig. 3).

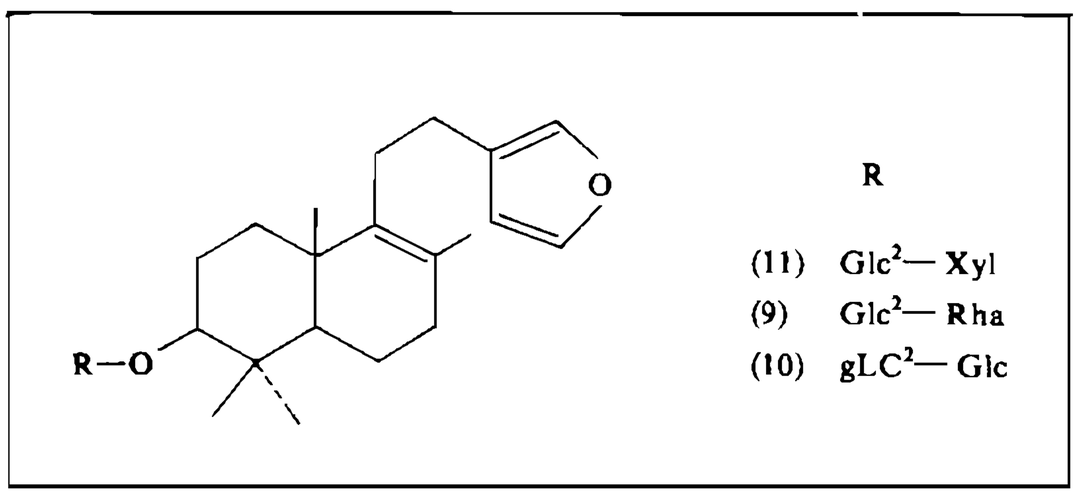
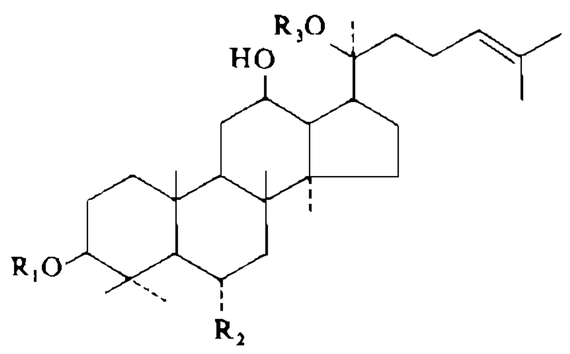


Fig. 3: Sweet diterpenoid glycosides in *Phlomis betonicoides*.

c) *Triterpenoid – Panax ginseng, P. quinquefolium* and *P. notoginseng* are three famous drugs of *Panax* plants. *P. notoginseng* is widely cultivated in Yunnan and Guangxi of China. The roots (Zhou et al., 1981; Matsuura et al., 1983), leaves and seeds (Yang et al., 1983), and flowers (Taniyusu et al., 1982) of the plant have been carefully studied. Twelve known and eight new saponins were isolated from it (Fig. 4). Two types of saponins, dammarane and oleanane, were found in *Panax*. The latter type is widely distributed in many plants while the dammarane type does not so often exist in plants. It may be interesting to note that *P. notoginseng* contains no oleanane type triterpenoid saponins but has dammarane type saponins which were proved to be the bioactive components.



		R_1	R_2	R_3
a)	notoginsenoside–Fa:	glc(2–1)glc(2–1)xyl	H	glc(6–1)glc
	notoginsenoside–Fc:	glc(2–1)glc(2–1)xyl	H	glc(6–1)xyl
	notoginsenoside–Fe:	glc	H	glc(6–1)ara(f)
b)	notoginsenoside–R4:	glc(2–1)glc	H	glc(6–1)glc(6–1)xyl
	notoginsenoside–R1:	H	O–glc(2–1)xyl	glc
	notoginsenoside–R2:	H	O–glc(2–1)xyl	H
	notoginsenoside–R3:	H	O–glc	glc(6–1)glc
	notoginsenoside–R6:	H	O–glc	glc(6–1)glc′

glc: β–D–glucopyranosyl glc′: α–D–gluocopyransyl xyl β–D–xylopyransyl
araf: β–L–arabinofuranosyl
a) from leaves b) from roots

Fig. 4: New soponins of *Panax notoginseng*.

The fruits of *Siraitia grosvenorii (Momondica grosvenorii)* is a well known sweeter in China. Careful investigation led to the discovery of another plant, *S. siamensis* of which the fruits are much larger than that of *S. grosvenorii*. Apart from mogroside IV (12) and mogroside V (13) which are the sweet components of *S. grosvenorii* (Takemoto et al., 1983), another new sweet saponin siamenoside I (14) was isolated from *S. siamensis* (Fig. 5) (Kasai et al., 1989). The sweetness of 12, 13 and 14 is 392, 425 and 563 times that of sucrose respectively. *S. siamensis* was demonstrated to have a promising future as a sweet plant and its domestication in now in progress.

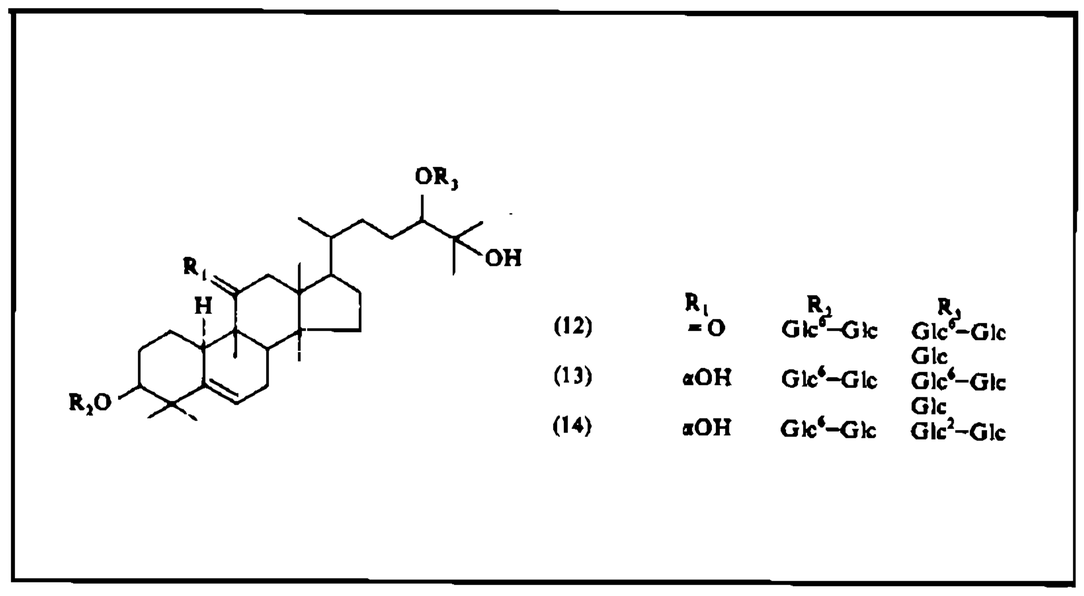


Fig. 5: Sweet triterpenoid glycosides of *Siraitia grosvenorii.*

3. STEROIDAL GLYCOSIDES

a) *C_{21}-Steroid* – Many plants of Asclepiadaceae, especially of genera *Cynanchum* and *Marsdenia*, are medicinal plants in China and they all contain C_{21}-steroidal glycosides. A new type of C_{21}-steroidal glycosides was also found in *Cynanchum atratum* (Zhang et al., 1985 a, b). Otophylloside A (15) and otophylloside B (16), isolated from C. otophyllum, were pharmacologically proved to have anticonvulsant action and have been used as antiepilepsy drug in clinic (Mu et al., 1986) (Fig. 6).

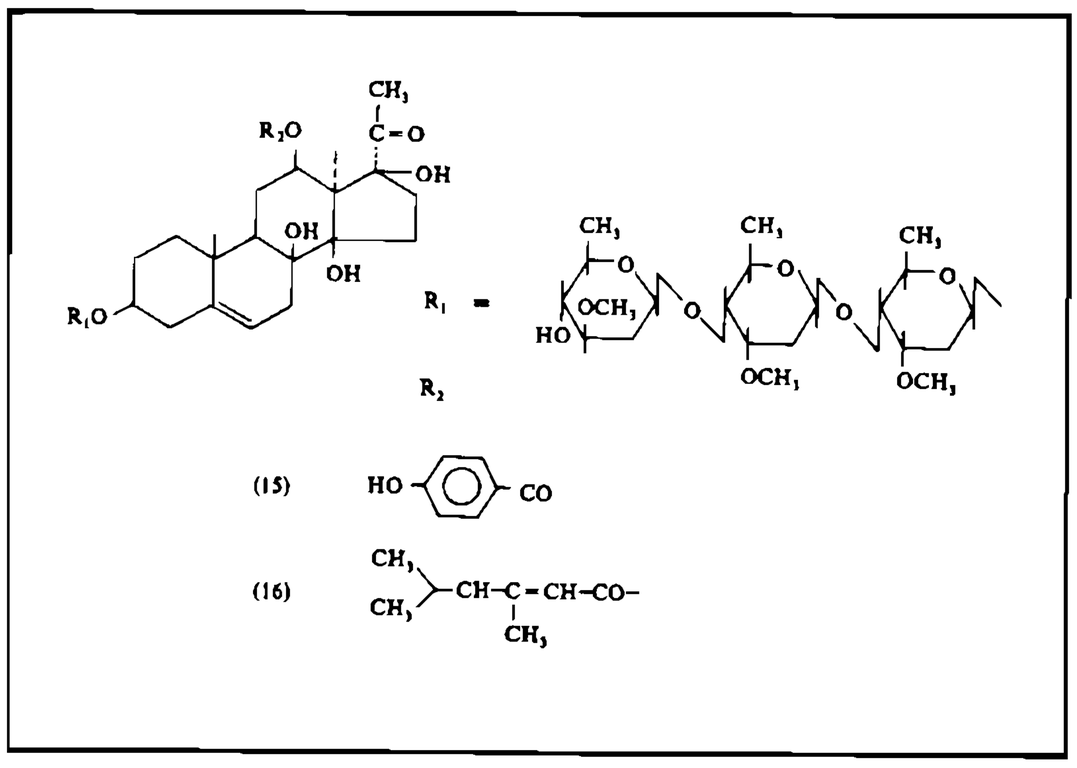


Fig. 6: C_{21}-steroidal glycosides from *Cynanchum otophyllum.*

b) *C_{27}-steroid* – *Paris polyphylla* var. *yunnanensis* has long been used as hemostatic herbal medicine and it is also a component of a famous Chinese traditional patent medicine. Two saponins (17) and (18) were isolated from this plant (Chen et al., 1983). These two saponins strongly contract uterine muscle and have now been used as a hemostatic drug in gynaecoloy (Fig. 7).

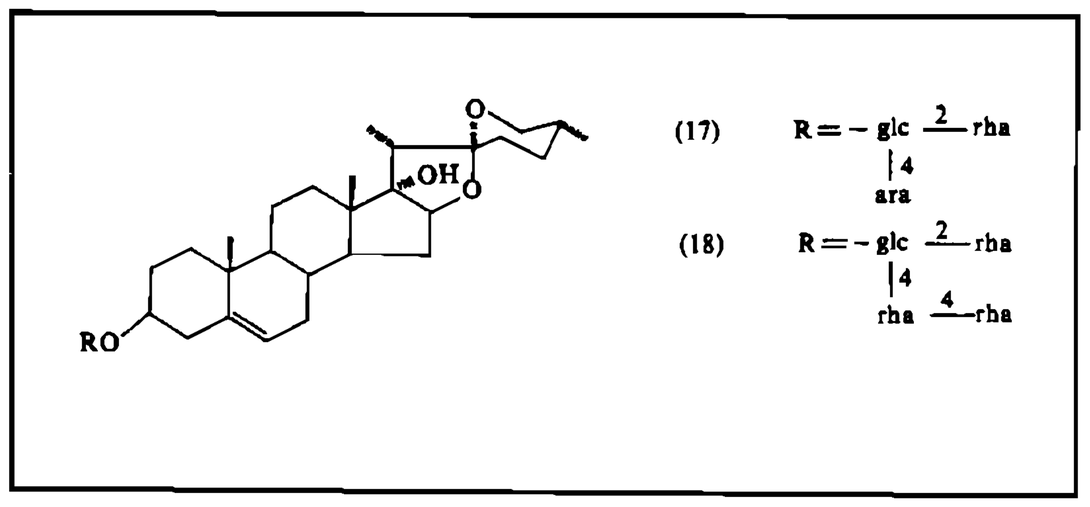


Fig. 7: C_{27}-steroidal saponins in *Paris polylhylla* var. *yunnanensis.*

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