

## Recent results on structural chemistry of new natural products from Chinese herbal medicine

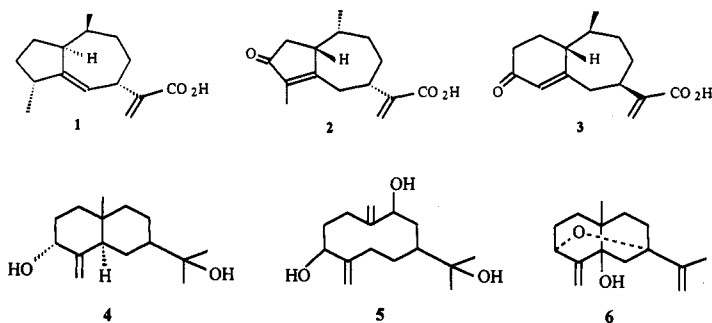
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**Abstract:** This review deals with 43 new structures of natural products studied in our laboratory in recent years. They were isolated from Chinese herbal medicine including 8 species of plant kingdom and 2 species of fungus. The structure and stereochemistry of new compounds were established mainly by spectral analysis and chemical evidence as well as x-ray diffraction. Preliminary pharmacological tests exhibited quite a few isolates have significant biological activities.

In the course of our investigation of new biologically active principles from natural source, we have carried out systematic extraction studies of a series of Chinese herbal medicine. Each extract is then bioassayed separately to monitor the isolation and characterization of the active compounds. As one approach to this bioassay, we have used mostly antitumor, antiviral, antifungal, antiinflammatory and immunosuppressive activity tests based on its use in medical practice. Many constituents have been isolated and identified among which over 100 compounds have been shown to have new structure and have some biological activities. Some of the recent studies are briefly presented here.

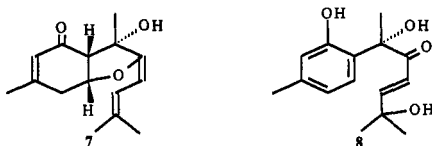
The genus *Artemisia* has been attracting a great deal of interest due to the presence of many bioactive components such as qinghaosu (*artemisinin*) etc. *Artemisia rupestris* L. is a folk medicine used in the Kazak nationality of Xinjiang region as anticancer, antianaphylaxis and antidote agents. Three sesquiterpenes (1 to 3) were isolated from this species. Isorupestonic acid (3) has an unusual skeleton determined by x-ray diffraction (ref. 1 and 2).



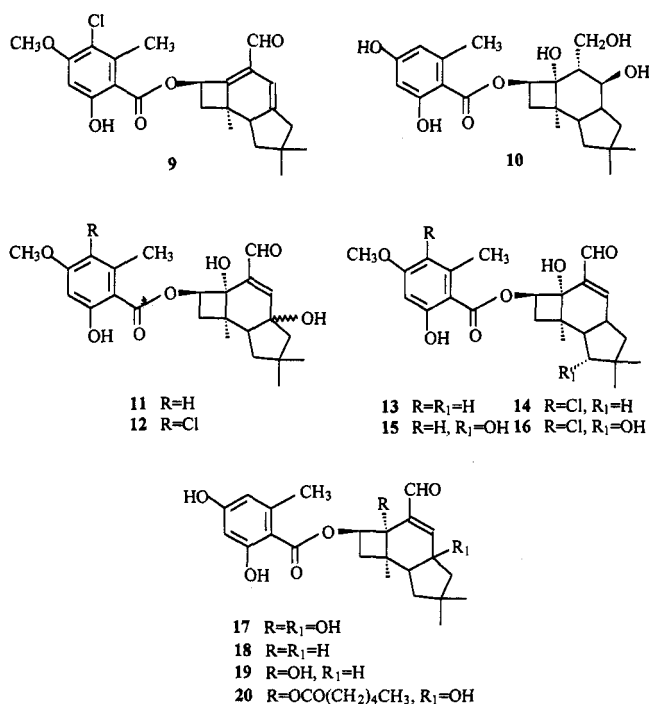
The other three sesquiterpenes (4 to 6) were isolated from *Chrysanthemum indicum* L., a traditional Chinese medicine used as antipyretic and detoxicant drug. Chrysanthemol (4) exhibited significant antiinflammatory activity (ref. 3 and 4).

*Ligusticum sinense* Olive is one of the traditional Chinese medicine used for expelling wind and removing dampness, dispersing cold and relieving pain. Two novel sesquiterpenoids with a bisabolane skeleton named ligustilone (7) and ligustiphenol (8) have been isolated along with six known compounds (ref. 5 and 6).

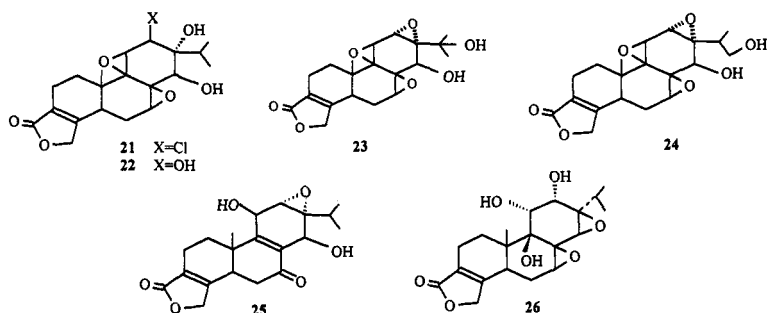
Ligustiphenol showed strong immunosuppressive activity with an  $IC_{50}$   $2.4 \times 10^{-8}$  M.



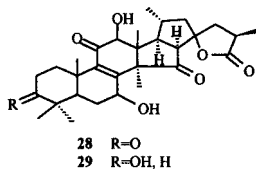
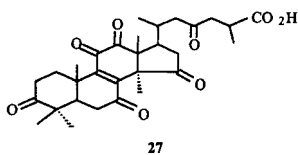
In China tablets containing artificially cultured mycelium of *Armilloria mellea* (Vahl. ex Fr.) Quel are used for the treatment of dizziness, headache neurasthenia, insomnia and infantile convulsion. From the mycelium of *A. mellea*, 12 protoilludane-type sesquiterpenoid aromatic esters (**9-20**) were isolated (ref. 7, 8, 9 and 10).



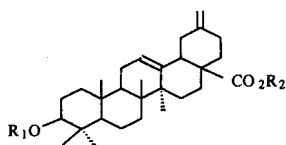
The crude extract and some isolates of *Tripterygium wilfordii* Hook showed significant male antifertile activity in animal tests. Six new diterpenoids (**21 to 26**) were obtained from the roots and leaves of this plant along with a series of diterpenes of known structures. All of the polyepoxy diterpenes showed powerful immunosuppressive activities, the ED<sub>50</sub> being about 0.1 mg/kg *in vivo* (ref. 11 and 12).



*Ganoderma lucidum* Karst is a famous tonic in Chinese traditional medicine. The extract of its spores was shown to be effective for hepatic protection and used clinically for the treatment of atrophic and muscle rigidity. Three new triterpenoids ganosporic acid (**27**), ganosporelactone A (**28**) and B (**29**) with lanostane skeleton have been isolated from the spores of *G. lucidum* together with five known compounds (ref. 13).

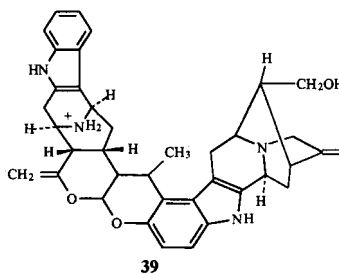
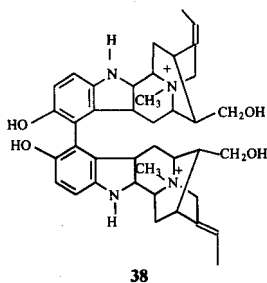


The total saponins of *Stauntonia cinensis* DC, a Chinese folk medicine, have been used for analgesic and sedative purposes, especially for the treatment of trigeminal neuralgia. Eight new 30-nor-oleanane-type triterpene saponins (**30** to **37**) were isolated from the whole plant of this species together with 6 known structures (ref. 14 and 15).

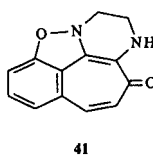
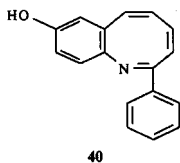


- 30  $R_1 = \text{ara}^{2,1} \text{ara}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}^{4,1} \text{rha}$   
 31  $R_1 = \text{ara}^{2,1} \text{rha}^{3,1} \text{glc}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}$   
 32  $R_1 = \text{ara}^{2,1} \text{rha}^{3,1} \text{glc}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}^{4,1} \text{rha}$   
 33  $R_1 = \text{ara}^{2,1} \text{rha}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}^{4,1} \text{rha}$   
 34  $R_1 = \text{ara}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}$   
 35  $R_1 = \text{ara}^{2,1} \text{rha}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}$   
 36  $R_1 = \text{ara}^{3,1} \text{rha}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}$   
 37  $R_1 = \text{ara}$ ,  $R_2 = \text{glc}^{6,1} \text{glc}^{4,1} \text{rha}$

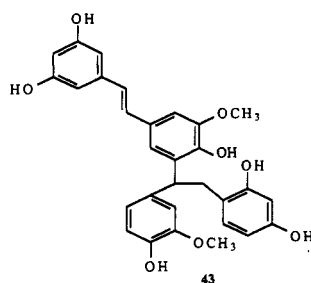
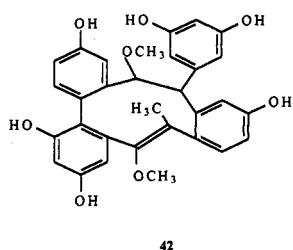
From the roots of *Rauwolfia verticillata* (Lour) Baill var. *hainanensis* Tsiang, four water soluble strongly hypotensive alkaloids were isolated, among them two were the dimeric indole alkaloids with novel structures **38** and **39** determined by x-ray diffraction (ref. 16 and 17).



The folk medicine *Hypodematium sinense* Iwatsuki is used to treat menier's syndrome in Sandong region of China and the effective rate was 95%. Two novel alkaloids (**40** and **41**) were found to have a rare skeleton (ref. 18 and 19).



*Gnetum parvifolium* has been used in the treatment of bronchitis and arthritis in folk medicine. Two new components were isolated and the structures were determined as dimeric stilbene derivatives (**42** and **43**) (ref. 20).



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