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Chemical constituents of *Viscum album* var. *meridianum*

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ABSTRACT

Twenty known compounds were isolated from *Viscum album* L. var. *meridianum* Danser. As major compounds, flavanones, flavanone glycosides and triterpenenes could be chemotaxonomic markers for the genus *Viscum* according to our study and literatures.

1. Subject and source

Viscum album L. var. *meridianum* Danser, belonging to the Loranthaceae family, is a semi-parasitic shrubby plant and distributed in Southwest China (Kiu et al., 2003b). As a plant variety of well-known mistletoe (*V. album* L.), which was frequently used as an alternative cancer treatment in Europe (Seifert and Jesse, 2008) and it has been employed as a folk herb. The plant material was collected in March 2007 in Tengchong County of Yunnan Province of Southwest China and was identified by Prof. Yongping Yang, Kunming Institute of Botany, where a voucher specimen has been deposited under LY 20070314.

2. Previous work

According to previous investigations of other *Viscum* species, flavonoids, triterpenoids and sterols are the most common chemical compounds for the genus *Viscum* (Leu et al., 2004, 2006; Wang et al., 1990, 1992, 1995; Yao et al., 2006). However, there is no report on the chemical constituents of *V. album* var. *meridianum*.

3. Present study

In our previous studies on the chemical constituents of *Viscum* species, we have once reported the isolation of two phenolic glycosides and nine flavonones from *Viscum articulatum* Burm.f. (Li et al., 2008). In the present study, the air-dried aerial parts of *V. album* var. *meridianum* (4.0 kg) were powdered and extracted with 70% aqueous acetone (3×12 L) for 24 h at room temperature and concentrated in vacuo to give a crude extract (135 g), which was suspended in H_2O and partitioned

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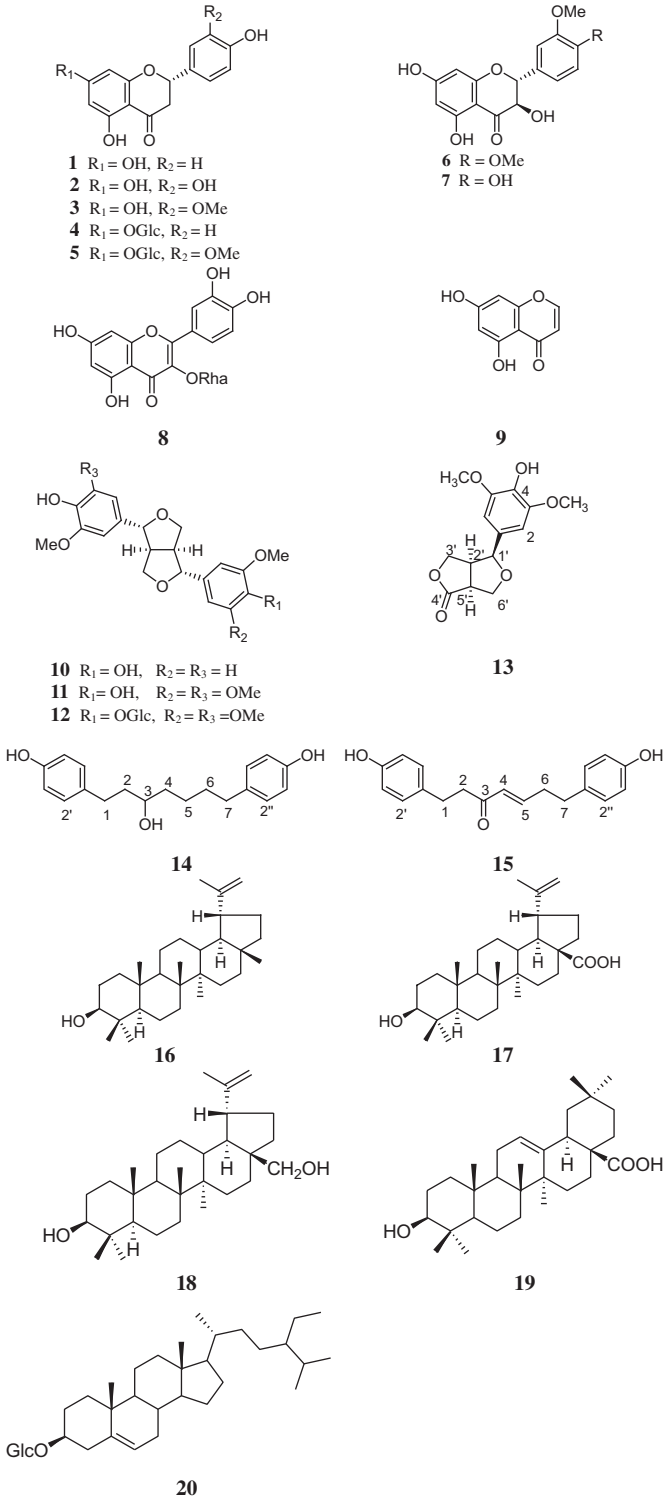

Fig. 1. Compounds **1**–**20** from *V. album* var. *meridianum*.

with EtOAc. The EtOAc extract was evaporated and the residue (120 g) was subjected to open column chromatography over MCI-gel CHP-20P eluting with 95% ethanol. The eluent from 95% ethanol (100 g) was concentrated in vacuo and subjected to column chromatography over silica gel (200−300 mesh) eluting with petroleum ether and acetone (1:0, 4:1, 2:1, 1:1, 1:2 and 0:1) to afford fractions A−C. Fraction A was subjected to Sephadex LH-20 ($CHCl_3$/MeOH 1:1) and column chromatography

over silica gel (petroleum ether/acetone) to yield lupeol (**16**, 3 mg) (Gao et al., 2005), betulinic acid (**17**, 8 mg) (Gao et al., 2005), belulin (**18**, 1 mg) (Fu et al., 2005), oleanolic acid (**19**, 10 g). Fraction B was chromatographed on Sephadex LH-20 ($CHCl_3$/MeOH 1:1) and silica gel ($CHCl_3$/MeOH) columns to yield3′,4′-*O*-dimethyltaxifolin (**6**, 5 mg) (Jew et al., 2000), 3,5,7,4′-tetrahydroxy-3′-methoxyflavanone (**7**, 2 mg) (Pavanasasivam et al., 1975), homoeriodictyol (**3**, 15 mg) (Leu et al., 2004), homoeriodictyol 7-*O*-β-D-glucopyranoside (**5**, 8 mg) (Wang et al., 1995), quercetin-3-*O*-α-L-rhamnoside (**8**, 10 mg) (Lu et al., 2008), 5,7-dihydroxychromone (**9**, 3 mg) (Yang, 1998), (+) -pinoresinol (**10**, 3 mg) (Yan et al., 2008), (−) -syringaresinol (**11**, 10 mg) (Cuca Suarez et al., 2009), (+) -syringaresinal-4′-*O*-β-D-glucopyranoside (**12**, 2 mg) (Yan et al., 2008), curuilignan D (**13**, 1 mg) (Quang et al., 2002), centrolobol (**14**, 4 mg) (Sunnerheim and Bratt, 2004), acerogenin G (**15**, 2 mg) (Da et al., 1999), daucosterol (**20**, 20 mg). Fraction C was also subjected to sephadex LH-20 ($CHCl_3$/MeOH 1:1) and column chromatography over silica gel ($CHCl_3$/MeOH) to yield naringenin (**1**, 5 mg) (Leu et al., 2006), eriodictyol (**2**, 6 mg) (Zhu et al., 2006), 5,4′-dihydroxyflavanone 7-*O*-β-D-glucopyranoside (**4**, 10 mg) (Leu et al., 2004). The pure compounds were identified by means of spectral analysis and comparison of their NMR data with the corresponding published data.

4. Chemotaxonomic significance

This is the first report of the chemical composition of *V. album* var. *meridianum*, including the isolation of three flavanones (**1**–**3**), two flavanone glycosides (**4**, **5**), two flavanonols (**6**, **7**), one flavonol glycoside (**8**), one chromone (**9**), four lignans (**10**–**13**), two diarylheptanoids (**14**, **15**), four triterpenoids (**16**–**19**) and one sterol (**20**) (Fig. 1).

Compounds **1**–**5**, **9** have been isolated previously from other *Viscum* species i.e. from *Viscum coloratum* (Leu et al., 2006), *Viscum nudum* (Zhu et al., 2006) and *V. articulatum* (Li et al., 2008). Flavanones and their glycosides (**1**–**5**), all substituted at C-5, 7, 3′, 4′, are widespread metabolites in the genus *Viscum* (Chou et al., 1999; Lin et al., 2002; Yang et al., 2005b). Triterpenoids (**16**–**19**) have also been reported from this genus (Leu et al., 2004, 2006; Yang et al., 2005a; Yang et al., 2005b; Zhu et al., 2006).Thus, the isolation of flavanones, their glycosides and triterpenoids indicates that these compounds could be chemotaxonomic markers for the genus.

Viscaceae was former subfamily in Loranthaceae (Kiu and Ling, 1988) in which quercetin and its glycosides are major flavonoids (Chen and Feng, 1993; Chen et al., 1997; Gong et al., 2004; Ohashi et al., 2003). Our study confirmed Viscaceae is not closely related taxonomically with Loranthaceae, which was in agreement with other research (Han et al., 2004; Kiu et al., 2003a, 2003b). On the other hand, compounds **6**–**8**, **10**–**15** are characterized for the first time from the genus *Viscum*.

Up to now, there are no report on chemical composition of other genus of Viscaceae, *Korthalsella* and *Arceuthobium*. Flavanones, their glycosides and triterpenoids might also be useful chemotaxonomic markers for the family.

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