

# 東北医科薬科大学

## 審査学位論文（博士）要旨

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**Studies on phytochemical constituents and biological activity of Mongolian  
traditional medicinal plants; *Oxytropis*, *Brachanthemum*, *Calligonum*, and  
*Apocynum* species**

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For many thousands of years, plants have been considered to be one of the major sources of food and medicines that are usually used as primary health care for humans. In this contemporary era, many researchers are paying their attention on the investigations of the medicinal plants for they might reach to success in the field of drug discoveries and developments in the future. Moreover, up to date, chemical constituents and bioactivities of numerous plant species which grow not only in Mongolia but also worldwide have not been investigated yet.

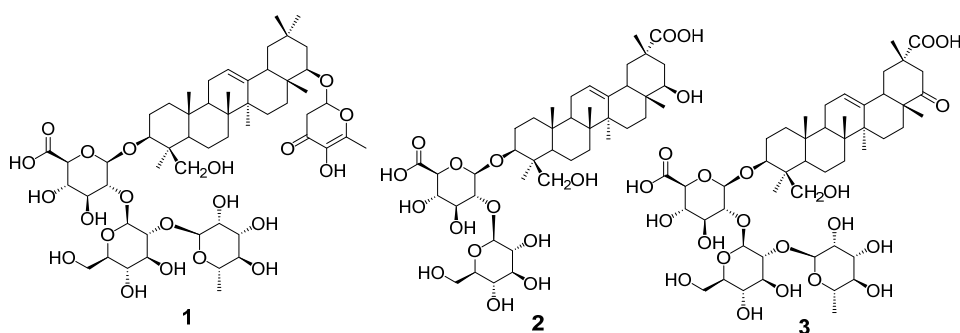
In addition, zoonotic diseases, including trypanosomosis, have been posing one of the big issues happening in livestock husbandry of Mongolia. Due to the consequences of the zoonotic diseases, financial losses have been widely observed in the animal industry which is vital sector of the Mongolian economy. Hence, studying highly effective compounds from Mongolian native plants is a really essential way to combat zoonotic diseases, especially trypanosomosis.

In this study, we focused on studying chemical constituents and biological activities of four plant species, named *Oxytropis lanata*, *Brachanthemum gobicum*, *Calligonum mongolicum*, and *Apocynum pictum*. Typically, this diploma thesis was written with five chapters that will be briefly explained below.

**Chapter one** generally covers medicinal plants growing in Mongolia and

Worldwide and their brief history. Therefore, the conditions of animal husbandry and zoonotic diseases in Mongolia and the overview of some biological activities were written in this chapter.

**Chapter two** describes phytochemical and biological investigations on the aerial parts of *Oxytropis lanata*, which belongs to the family Fabaceae. As a result of the phytochemical analysis, three new oleanane-type saponins (**1**, **2**, and **3**) and 33 known compounds, namely saponins, flavonoids, oxazole alkaloids, and glycosides were obtained from aerial parts of this plant. In terms of compounds **28**, **29**, **33**, and **34**, they were previously isolated from the roots of *O. lanata* while other compounds were reported for the first time to the aerial parts. For trypanocidal screening, 5,7,4'-trihydroxyisoflavone (**25**) exhibited inhibitory activity against *T. congolense* ( $IC_{50} = 10.5 \mu M$ ), the causative agent of African trypanosomiasis in animals; this activity was little weak to compare with 2-(2',3'-dihydroxyphenyl)-5-(2''-hydroxyphenyl)oxazole ( $IC_{50} = 1.0 \mu M$ ) isolated from roots of this plant. Furthermore, anti-hyaluronidase experiments of some compounds were carried out based on the traditional usage of *O. lanata* as used for treatment of inflammatory diseases. Saponins, 3-O-[ $\alpha$ -L-rhamnopyranosyl(1 → 2)- $\beta$ -D-glucopyranosyl(1 → 2)- $\beta$ -D-glucuronopyranosyl]-3 $\beta$ ,24-dihydroxyolean-12-en-22-oxo-29-oic acid (**3**) and dehydroazukisaponin V (**9**) showed a potent inhibitory activity<sup>1</sup>.

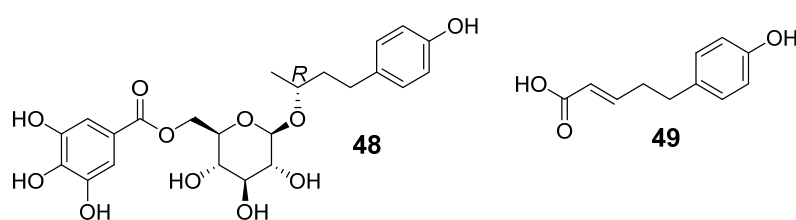


Chemical structures of previously unreported oleanane-type saponins isolated from the aerial parts of *O. lanata*

In **chapter three**, absolute configurations of compounds isolated from *Brachanthemum gobicum*, which included in the family Asteraceae, were discussed. Drs B. Odonbayar and Ph.D T. Murata performed almost all of the experiments in this research work of *B. gobicum*. Consequently, 11 new and 40 known compounds were isolated from aerial parts of this plant. However, there were some compounds with the racemic mixture before purifying pure enantiomers by using chiral phase HPLC. After purification of them, absolute configurations of **37**, **38**, **39**, **41**, **44**, and **45** were elucidated by spectral data obtained from specific rotation and ECD spectra. For compounds **40**, **42**, **43**, **46**, and **47**, absolute configurations were not determined due to the inadequate yield of enantiomers. In the trypanocidal screening, compounds **37**, **38**, **39**, **40**, **44**, and **45** showed inhibitory activities. Among them, compounds **38** ( $IC_{50} = 2.8 \mu M$ ) and **44** ( $IC_{50} = 2.4 \mu M$ ) inhibited more efficiently than others<sup>2</sup>.

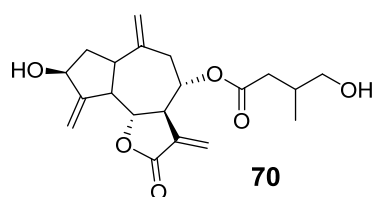
**Chapter four** presents phytochemical and biological investigations on the aerial parts of *Calligonum mongolicum*, which is one of the largest genera in the family Polygonaceae. As the result of the phytochemical studies, two new compounds, named *R*-4-(4-hydroxyphenyl)-2-butanol 2-*O*-(6-*O*-galloyl)- $\beta$ -D-glucopyranoside (**48**) and 5-(4-hydroxyphenyl) 2-pentenoic acid (**49**), and 20 known (**50-69**) compounds, including flavonols, flavanonols, flavanols, alkaloids, a monoterpene, a phenol, and

glycosides, were isolated for the first time from this plant. Compound **48** was not reported previously to literature, while compounds **49** and **50** were newly obtained from a natural source. With regard to an examination of the trypanocidal activities, all of the isolated compounds did not show significant activity. In the anti-phenoloxidase screening, however, catechin (**54**) was roughly ten times higher phenoloxidase inhibitory activity ( $IC_{50}$  9.1  $\mu$ M) compared with epicatechin (**55**) ( $IC_{50}$  148.3  $\mu$ M). Generally, compounds **54** and **55** have a similar molecular structure except for their stereochemistry, and this result was supported by a reproducibility test using pure guaranteed authentic samples<sup>3</sup>.



Chemical structures of new compounds isolated from the aerial parts of *C. mongolicum*

**Chapter five** illustrates phytochemical investigations of *Apocynum pictum*, which belongs to the family Apocynaceae. By doing phytochemical investigations on the aerial parts of *A. pictum*, one new (**70**) and 20 known compounds (**71-90**), including flavonoids, sesquiterpenoids, glycosides, and amino acids, were isolated. Therefore, these compounds were obtained from this species for the first time. It is interesting that no previous research works on the genus *Apocynum* reported that quaiane-type sesquiterpenes are one of the chemical constituents in this genus<sup>4</sup>.



Chemical structures of new compound isolated from the aerial parts of *A. pictum*

**Reference:**

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