# Ethnomedicinal survey of plants and animals used by Daur ethnic group, Inner Mongolia, China

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**Research**

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## Abstract

Background: The traditional medical practices of the Daur region are an important element in Chinese ethnomedicinal knowledge. However, relatively little recording of traditional Daur medicine (TDM) has been carried out. As it is gradually being replaced by traditional Chinese medicine (TCM) and modern medicine, further research is urgently needed.

Methods: We collected ethnobotany and ethnozoology data about their local name, parts used and diseases to be treated, dosage, and route for administration through semi-structured interviews with 114 informants (18 sessions), focus group discussions (6 sessions), and extensive literature reviews. Medicinal samples and specimens were collected during field investigations from June 2015 to October 2018. The diseases and ailments reported as being treated were classified according to the International Classification of Diseases 11 th (ICD-11). The expression correlation of medicine classification, medicine, and disease was assessed using Cytoscape 3.6.1 software. Quantitative indices such as informant consensus factor (ICF) and use value (UV) were used to evaluate the importance of ethnomedicinal data.

Results: We documented 30 plant species (from 19 families) and 21 animal species (from 11 families). In the past, the majority of plant species were collected from natural habitats, but now they are mainly cultivated. The most widely utilized plants were herbs (21 species), followed by shrubs (4), trees (3), and fungus (2). The most utilized groups of animals were mammals (14 species), followed by birds (5), amphibians (1), and reptiles (1). Medicines were mostly administered orally (43) but were also applied externally (11) or delivered via both routes (9). Informants indicated that medicines were prepared via decoction (21), grinding (11), boiling (10), extraction (8), and burning (7). Medicines were taken as a drink (37), eaten (16), or made into pills and powders (7), but could also be administered as an ointment/wash (6), wrap/dressing (5), in the nose, eyes, and mouth (4), or as a fumigate (2). The TDMs investigated in this study treated 76 human diseases or ailments classified under 13 disease categories, based on the ICD-11. The highest ICF (1.00) was reported for neoplasms and visual system diseases and childbirth or the puerperium, followed by injury, poisoning, or other diseases resulting from external causes (0.92), and symptoms, signs or clinical findings, not elsewhere classified (0.82). The most used medicinal species were Cervus elaphus , Cervus nippon , Capreolus , Gallus , Canis lupus familiaris , Betula platyphylla , and Artemisia integrifolia .

Conclusions: A substantial body of ethnobotanical and ethnozoological knowledge could lead to the development of new medicines. Therefore, research into Daur ethnic medicines is urgently required The current research can make an important contribution to the body of knowledge about the national medicine of the Daur people. This is particularly important because the younger generation is not interested in learning and preserving their traditional medical practices. The information documented in the present study will provide a useful basis for future investigations into the ethnopharmacological and traditional knowledge of the Daur region.


## Background

Over time, many ethnic groups have identified the plants and animals in their homelands that can be used for therapeutic purposes. Consolidation of the experience of different ethnic groups in the use of plants, animals to treat diseases has created a foundation for ethnic medicine [1–3]. Nowadays, ethnobotany, which includes the study of phytotherapy, is a discipline that can transform popular knowledge into scientific knowledge [4].

The Daur nationality is one of China's ethnic minorities, and it is one of the "three minors" (Olunchun, Ewenki, and Daur), centrally distributed among Olunchun Autonomous County, Ewenki Autonomous County, and Moridawadaer Autonomous County, respectively, in the Inner Mongolia Autonomous Region. The 2010 Census found that the Daur population of Inner Mongolia was 76255, accounting for 0.31% of the resident population in Inner Mongolia [5]. Since the 1970s, research into ethnic minority medicine in China has received increasing attention, especially in the field of medical literature collation, drug resource investigation, development, and utilisation. However, outside influences have exacerbated the loss of the Daur group's medical knowledge and this has affected the transmission of traditional wisdom to the younger generation. Over thousands of years, in the struggle against disease, the Daur people developed medical knowledge with local ethnic characteristics, and folk medicines that have real curative effects are still used in the Daur region. Records of the use of traditional Daur medicine (TDM) go back more than 300 years to the Qing Dynasty [6]. Zhang et al. [7] investigated the traditional medical practices of the Daur ethnic group in Inner Mongolia, especially the traditional authentic medicinal materials and important ethnic medicine resources by consulting the literature records, visiting practitioners, investigating traditional knowledge, collecting medicinal fungi and plant specimens, and organising the original records of the herbarium. This investigation and arrangement of the herbarium material according to the geographical distribution of the population provided an objective and scientific basis for the development and utilisation of the Daur traditional medicine resource. In another study, Liu [8] et al. researched and investigated 31 ethnic medicines and their uses by the Daur people living in the Hulunbuir League of Inner Mongolia, which reflected the characteristics of Daur ethnic medicine.

Shamanism is a dominant religious belief in the traditional culture of the Daur ethnic group. They think that these medicines for treating diseases are gifts from God, which can help the people to overcome diseases and drive out demons. It has provided the Daur people with a worldview basis and was also responsible for helping the Daur people fight diseases. They already have the most basic understanding of the severity, urgency, duration, frequency of illness, and specific symptom performance. Based on this basic knowledge, they distinguish and refer to different types of diseases. At the same time, it also gives a unique interpretation of the causes of different diseases. [9]. However, with the development of society, the exchange and integration of cultures, and the lack of a Daur script, the traditional plant knowledge they have accumulated is disappearing at an unprecedented rate, and related cultures are also changing. In addition, the expansion of modern education and medical treatment has further aggravated the loss of knowledge, resulting in the younger generation being unaware of the value, use, and preparation methods of traditional Daur medicine [8]. The Daur traditional plant knowledge and related cultural diversity constitute an intellectual heritage created by the interaction between the Daur people and plants and tested by hundreds of years of historical practice. Daur traditional knowledge not only has cultural value but it also has much to offer in the field of medicine. Therefore, it is necessary to survey the utilisation of Daur medicinal plants before further knowledge is lost.

Continuous changes in the lifestyle, environment, and outmigration of the Daur people mean that both the traditional knowledge and the number of healers is in decline. In addition, the traditional ethnic medicine of Daur has been influenced by mainstream ethnic medicine, such as traditional Chinese medicine (TCM) and traditional Mongolian medicine (TMM). The phenomenon of integration is gradually occurring, and unique ethnic characteristics are gradually being lost. Therefore, it is important to accelerate research into the Daur nation's traditional knowledge, consolidate the results, and document the inheritance to help with the development of medicines in the future. In this study, we interviewed the few remaining healers in Daur and documented as much ethnic medicinal knowledge as possible with the aim of increasing awareness of the availability and value of ethnic medicines in this region and worldwide. The application of inherited knowledge is a growing field of interest. Research of this type and the comprehensive documentation of traditional medical knowledge is important to increase the chance of discovering new drugs as well as to enhance knowledge about the sustainable use of natural resource. At the same time, it provides a scientific basis for the development and utilisation of the resource offered by Daur national traditional medicine.

# Methods

### Selection of study area

The Daur population in the Hulunbuir area accounts for more than 90% of the population of this ethnic group in Inner Mongolia. They are mainly distributed in Ewenki county, Arun county, Zhalantun county, and Molidawar Daur autonomous county [9], which are in the Greater Khingan Mountains (GKM), and astern part of the GKM. Most of the area has a temperate continental monsoon climate, while a small portion lies in the cold temperate zone. Seasonally, the area experiences cold, long winters and cool, short summers. In addition, the region receives an abundance of sun and little precipitation, which occurs mainly between July and August. The area comprises many geographical types, such as the GKM, Hulunbuir Grassland, Inner Mongolia Plateau, and the grasslands at the base of the mountains. The Daur ethnic group, concentrated in the area of Hulunbuir, a district in the northeastern part of Inner Mongolia, is located between longitude 118°48'02" to 125°13'32" east and latitude 47°05'40" to 49°49'18" north (Fig. 1). The topography of the area where the Daur live is characterised by a temperate climate plus a cold temperate zone within an altitudinal range of 198.0–1706.6 m above sea level, and consists of a plateau, prairie, basin, mountain, and plain. The annual average rainfall and temperatures range from 350.0 mm to 500.0 mm and from -2.4 ℃ to 2.2 ℃, respectively. This area supports a range of minorities that include not only the Daur, but also Mongolian, Olunchun, and Ewenki ethnic groups. Therefore, the area has not only a varied topography and highly diversified medicinal flora and fauna, but also multiple ethnic groups and a rich cultural diversity [10–11].

### Social characteristics of study area

The ethnomedicinal survey comprised interviews with 114 informants and included questions about the uses of the medicines and preparation methods. Among the informants, there were 12 traditional healers who could help identify the drugs used to treat different diseases. These healers also participated in 18 group discussions with researchers to amend incorrect information and standardise recording of the ethnobotanical and ethnozoological data. The study informants were divided into groups according to age: <30, 31–40, 41–50, 51–60, and >60 years old. Most informants were in the 51–60 (50.9%) and 41–50 (20.2%) age groups. They were, therefore, representative of the main users of ethnic medicine and inheritors of related knowledge. There were few young people under 30 (6.1%) and or older people over 60 (7.9%) years of age (Table 1).

### Data collection

#### *Reconnaissance survey*

The fourth national survey of Chinese medical material resources was conducted from June 2015 to October 2018 in Hulunbuir to gain a better understanding of the species, distribution, and reserves of medicinal plants [12]. During this investigation, we carried out a series of traditional knowledge surveys of ethnic medicine, which included the Daur group. A survey team consisting of botanists, taxonomists, and indigenous people conducted the resource surveys, mainly in summer and autumn, in areas where the medicinal species were extensively found. The plant specimens were collected along transects on numerous field trips. The researchers also recorded information on the habitats in which the plants were found, and took photographs for future reference [13,14]. Collecting and categorising ethnomedicinal through a census is highly beneficial in assessing and appreciating the rich inheritance of traditional medical knowledge and the diversity of ethnic culture. Additional information on the abundance and distribution of medicinal plants in the study area was also collected. Due to the limited preparation and preservation facilities for specimens of animal origin, ethnozoological information was obtained only from interviews with informants, and animal medicinal material samples were not collected.

#### *Ethnomedicine data source and collection*

Daur ethnomedicinal data were collected from two sources: (1) the primary source comprising interviews, focus group discussions, and field observations in the study area, and (2) the secondary source comprising relevant publications and reviews related to the present study [15]. Semi-structured interviews were conducted with 114 informants. Local therapists, who are the experts and advisors on traditional indigenous knowledge and its application were key informants. The healers provided basic information on treatment methods, while laypersons described the effects of the treatments on their diseases. The interviews were conducted using a prepared list of questions; however, enough time was allowed for discussion related to any of the issues raised. We then visited experts from Daur society and key informant healers who had been using TDM for at least three years. This group comprised 12 people in total. Our interviewees were chosen through comments and suggestions from religious leaders, elders, administrators, and students, and personal observations by

researchers in community groups. The selection of key informants was also based on the quality of the explanations given by specific informants in the interviews.

The data collection team paid particular attention to the choice of language in the informant interviews, whether it was Chinese or Mongolian, or the Daur language used by local people. Prior to the visits, we obtained oral consent from the interviewees that the information provided could be made public. Key informants, namely, those expected to have extensive knowledge of TDM, were selected at the village level with the help of the village committee. Two focus group discussions were conducted in the Daur Autonomous Township, during which healers, ethnic medicine gatherers, and local village committees helped facilitate an understanding of the current medical situation of the Daur ethnic minority. Throughout all the investigations, specific information regarding the traditional Daur medicinal materials was recorded. This information included the local name, parts used, disease treated, dosage, and route for administration. The diseases were assigned to different categories according to the International Classification of Diseases 11$^{th}$ (ICD-11), and all the summarised survey information and supplementary information are presented in Tables 2 and 3.

### *Botanical and zoological identification*

We collected voucher specimens of the plants for identification by the expert taxonomist with the help of the Flora of Inner Mongolia and Flora of China [16, 17]. Family and scientific names were confirmed with the Angiosperm Phylogeny Website (http://www.mobot.org/MOBOT/research/APweb) and the Plant List database (http://www.theplantlist.org) (Fig.2). Voucher specimens of plants were prepared and deposited at the Baotou Medical College, Inner Mongolia University. Family and scientific names of medicinal animals were determined according to the Fauna of Inner Mongolia and Medicinal Fauna of China [18, 19].

## Data analysis

### *Expression correlation network*

The topological relationships between TDM and attending disease classifications were analysed using Cytoscape 3.6.1 software (https://cytoscape.org/) to obtain the key factors and to visualize the network [20, 21]. The size of each node in the disease-classification-disease-medicine network was based on the prevalence of the uses.

### *Informant consensus factor*

The informant consensus factor (ICF), was the analysis of the general use of plants and animals using the following formula:

[Please see the supplementary files section to view the equation.]

where $N_{ur}$ refers to the number of use reports for a particular disease category, and $N_t$ refers to the number of taxa used for a particular use category by all informants. ICF values are near 0 if medicinal resources are chosen randomly or if there is no exchange of information about their use among informants and close to 1.0 when there is a well-defined selection criterion in the community or if information is exchanged between informants [22, 23]. A high ICF value means that there is a strong agreement among information providers as to which medicinal plants are used in traditional treatment methods to treat a particular health problem.

### *Use value for individual species*

The use value (UVs), a quantitative measure of the relative importance [24, 25], was calculated for all species in the study area using the following formula:

[Please see the supplementary files section to view the equation.]

where $\sum$ Ui is the total number of use reports cited by each informant for a given species and N represents the total number of informants.

UVs approach zero (0) when there are few reports related to use. Higher UVs indicate that there are many useful reports for a plant or animal species, thus implying the importance of the species.

# Results And Discussion

## Ethnomedicine in Daur

### *Diversity of Daur medicinal plants*

In total, 30 medicinal plants were identified, from 19 families (Table 1). Among them, the Compositae was the dominant plant family used (4 species), followed by the Ranunculaceae and Rosaceae (3 species each), and the Gramineae, Betulaceae, and Cucurbitaceae (2 species each). There were 13 other

commonly used families including Tricholomataceae, Auriculariales, Typhaceae, Salicaceae, Moraceae, Polygonaceae, Euphorbiaceae, Araliaceae, Umbelliferae, Ericaceae, Labiatae, Solanaceae, and Caprifoliaceae (one species each).

While it has been observed that, many medicinal plants are cultivated, in our study, most plant medicines were collected from the natural environment. Herbs (21 species, 70.0%) were the most commonly used plant type, followed by shrubs (4 species, 13.3%), trees (3 species, 10.0%), and fungi (2 species, 6.7%) (Fig. 3a).

Depending on the particular medicinal plant, different parts are used in the treatment of various diseases. According to the interviews with informants, the most commonly used parts are the seeds (8); followed by the roots and fruits (6, each); whole plant (5); branches (3); bark, rhizomes, flowers, and fruiting bodies (2, each), and root nodules and leaves (1, each) (Fig. 3b). TDM differs from TCM in which the most used plant parts are the roots. These differences may be influenced by factors involving the ease of collection and application.

### *Diversity of Daur medicinal animals*

In the present study, 20 animal species from 11 families were documented from the study site (Table 2). The most widely used family was Cervidae (4 species), followed by Phasianidae, Canidae, and Bovidae (3 species each). Other families that were commonly used were Ranidae, Trionychidae, Picidae, Corvidae, Erinaceidae, Mustelidae, and Suidae (one species, each).

Mammals were the dominant animal group, accounting for 14 species (66.6%), followed by birds (5, 23.8%), and amphibians and reptiles (1, 4.8%) (Fig. 3c). Animal-based drugs mainly came from organs (12), such as the kidney, liver, gallbladder, heart, gizzard, uterus, and viscera, and involved numerous applications. Animal-based drugs were also prepared from tissues (11), including meat, hamstrings, grease, hair, and blood; from bones and the whole body (3 each); secretions and antlers (2 each); and carapaces (1) (Fig. 3d).

## Traditional applications of Daur ethnomedicine

### *Diversity of route, preparation, dosage, and usage of ethnomedicines*

We collected information on the Daur ethnomedicine administration route, preparation, dosage, and usage. According to the interviews with the informants, the most popular route was oral (39, 66.1%), followed by external administration only (11, 18.6%), and both oral and external administration (9, 15.2%) (Fig. 4).

According to the present study, plant and animal medicines were prepared via decoction (21), grinding (11), boiling (10), extraction (8), and burning (7) (Table 4). Among them, decoction, the usual preparation technique in Chinese medicine, was the method used most often (36.9%). Other preparation methods reflected the unique characteristics of TDM. In particular, various medicinal and food ingredients are boiled together and eaten as a meal, which is typical of the Daur practice of combining medicinal and edible materials in their treatments.

Most medicines are consumed as a drink (37), which involves decoction, extraction (i.e., solutions and oils). Some are taken by other methods, for example, they may be eaten (16), made into pills and powder (7), used as an ointment/wash (6), applied as a wrap/dressing (5), placed in the nose, eyes, or mouth (4), or used as a fumigant (2) (Table 5). Dosages were estimated for most medicines and were dependent on the age of the patient, severity of the illness, diagnosis, and the experience of the healers.

The ethnic groups adjacent to the Daur group include the Olunchun and Ewenki nationalities Bi [26] et al. compared the ethnic medicine approach of the “three minor nationalities” in Inner Mongolia. It appears that *Artemisia argyi* is used as a medicine by all three nationalities. While the Daur people use it to treat urticaria and rheumatic pain, the Ewenki used it for chronic hepatitis, and the Olunchun use it to treat uterine bleeding and postpartum haemorrhage. The different therapeutic uses of the same medicinal materials in different ethnic groups reflect differences in national characteristics, indicating that they are closely related to the history, culture, and life of each nationality. Table 6 compares TDM with TCM and TMM. The known efficacy of the Chinese and Mongolian medicines can help predict the effectiveness of the TDMs and identify those that have the potential for the development of new drugs in the future.

### *Diseases treated by diverse medicinal resources*

Tables 2 and 3 present TDM used to treat 76 human diseases or ailments classified under 13 disease categories, based on the ICD-11. A disease-classification-disease-medicine network of TDM was constructed and visualised with Cytoscape software using the disease classifications and medicinal species targeted (Fig. 5). The availability of the network model structure may improve our understanding of the relationship between plant medicines, animal medicines, diseases, and disease classification.

According to statistical information, the classification of ‘symptoms, signs or clinical findings, not elsewhere classified’ was primary, and included seven diseases and ailments, namely, constipation, cough, diarrhoea, dyspepsia, loss of appetite, abnormal sputum, and extravasation of blood. As shown in the constructed network, there were obvious and expressed correlations with 29 medicinal species, such as the plant medicines of *R. simsii*, *P. frutescens*, *A. integrifolia* and the animal medicines of *S. scrofa domestica*, *C. nippon*, and *C. capreolus*. Other classifications included ‘certain infectious or parasitic diseases’ (18 species), ‘injury, poisoning or certain other consequences of external causes’ (11 species), and other disease classifications. The classification of diseases and ailments clearly indicates a link between TDM and modern medicine; however, traditional medicine still has its inherent characteristics.

Thousands of years ago, the Daur people learned to use natural materials (animals, plants, and minerals) from their surroundings in the struggle against various diseases. Experience has been passed from generation to generation, gradually forming a body of medical knowledge with local ethnic characteristics, and folk medicines that really have curative effects are still circulating in Daur. These include “Kumule” the Chinese name of which translates as “Liu Ye Hao”, which is derived from *A. integrifolia*. It has the effect of heat-clearing and detoxifying and is used to treat hyperlipidaemia, excessive drinking, and stomach bleeding [27]. Among the diseases, common day-to-day ailments (cough, constipation, diarrhea, and trauma) and endemic diseases (rheumatism and rheumatoid arthritis) were treated with numerous TDM therapies at Hulunbuir.

The Ewenki and Daur people both live in Hulunbuir, Inner Mongolia. Traditional medicines of the two groups focus on different diseases. Ewenki medicine is mainly used for respiratory system diseases, digestive system diseases, skin and subcutaneous tissue diseases, while the Daur’s drugs are used for certain infectious diseases and parasitic infestations, digestive diseases, injuries, poisoning, trauma, and musculoskeletal and connective tissue diseases.

### *Quantitative assessment of ethnobotanical data*

#### *Informant consensus factor*

ICF is used to identify plants of particular intercultural relevance. With the ICF, we evaluated how homogenous the information was. Thirteen disease categories were identified. The ICF was calculated for each disease category, and the range was from 0.29 to 1.00 (Table 7). The highest ICF (1.00) was reported for the neoplasms, visual system diseases, childbirth or puerperium; all of which involved one species and one use. The next group included injury, poisoning or certain other medical problems arising from external causes (0.92) with two species and 13 use reports. The third group comprised symptoms, signs or clinical findings, not elsewhere classified (0.82) with 18 species and 95 use reports. The highest ICF for the neoplasms, visual system diseases, childbirth, puerperium, injury, poisoning or certain other medical problems arising from external causes can be probably related to the low number of cases. Trauma and poisoning are mainly treated by taking agaric and *Artemisia integrifolia* medicines.

#### *Use value*

The most used medicines were *C. elaphus* and *C. nippon* with UVs of 2.70 followed by *C. capreolus*, *G. gallus*, *C. lupus familiaris*, and *B. platyphylla* with UVs of 1.82, 1.81, 1.33, and 1.07, respectively. Many parts of these species are used as medicine and they are readily available or are typical species of the area. Specifically, *A. integrifolia*, with an UV of 1.00, is a well-known local species that is used for both food and medicine. In the published literature, *A. integrifolia* has reportedly been used to treat various diseases including hypertension, hyperlipidaemia, diabetes, and hepatitis, besides its use in TDM [28]. Species that are used to treat three diseases and more (39%) were dominant, followed by species used to treat single diseases (37%), and plants or animals used to treat two diseases (24%). With respect to animal parts, the Daur tribe uses bile (for example, from bear, pig, and sheep) the most. The next most commonly used animal-derived medicines are made from bone, followed by those made from meat, and those that use the whole body of the animal. The most widely used families for animal-based drugs are Corvidae (crows) (four species), followed by Anatidae (ducks), Canidae (canines), and Bovidae (bovines) (three species each). Animal-based medicines are mainly composed of kidney, liver, gallbladder, heart, sac, uterus, and other organs, and are widely administered. With respect to the animals used, mammals dominate, accounting for 14 species (66.6%), followed by birds (five species, 23.8%) and amphibians (one species, 4.8%).

## Conclusions

The Hulunbuir area has rich biodiversity and traditional culture in which numerous important ethnomedicines have been preserved. In Daur, the traditional plant and animal medicines that are used for ethnomedical purposes are obtained close to the place of residence of users. During the three years of our ethnobotany and ethnozoology investigation, we identified 30 species of medicinal plants, belonging to 19 families, and 21 species of medicinal animals, belonging to 11 families. Analyses of the collected data revealed that herbs were the dominant plant medicine, and seeds and roots were the parts most often used in ethnomedicine. Mammals dominated the list of medicinal animals, and several kinds of organs and tissues were used in Daur medicine. Most medicines were administered orally. The dominant preparation technique was decoction, and medicines were most frequently consumed as a drink. A comparative analysis of the TDM, TCM, and TMM reflects the uniqueness and national characteristics of the medicines of the Daur nationality.

Apart from a handful of experienced and knowledgeable traditional therapists, the route and dosage of plant-based medicine is usually based on haphazard application. Even a qualified therapist is not perfectly consistent. The implication of this is that improper use of medicinal plants may have severe short-term and long-term effects on the health of patients and may sometimes even endanger life.

In drug research and development, some plants in TDM with higher medicinal value are candidate plants for further phytochemical analysis. Comprehensive documentation of TDM is critical to promote the discovery of new sources of drugs and the sustainable use of natural resources. One of the main characteristics of traditional medicinal knowledge is its dynamism. As revealed by the analysis of the data collected from both field investigations and interviews, there are many types of medicinal fungi, animals, and plants in the Daur region, most of which are folk medicines and have significant effects, but data on phytochemistry, pharmacology, and quality control is lacking. The use of plant and animal medicine based on traditional knowledge is gradually declining in the study region with the increased use of modern medication in recent generations. It is therefore essential to build awareness among community members of the importance of protecting traditional knowledge and medicinal plants before they disappear and to take urgent measures to protect threatened plant species. Systematic research into medicinal animals and plants can provide an objective and scientific basis for folk applications of the ethnomedicines of the Daur group. This will enable people to continue to use traditional practices, which have been proven to be safe and effective.

# Declarations

### Abbreviations

TDM: traditional Daur medicine; TCM: traditional Chinese medicine; TMM: traditional Mongolian medicine; UV: use value; ICD-11: International Classification of Diseases 11th; A: Certain infectious or parasitic diseases; B: Neoplasms; C: Diseases of the nervous system; D: Diseases of the visual system; E: Diseases of the circulatory system; F: Diseases of the respiratory system; G: Diseases of the digestive system; H: Diseases of the skin; I: Diseases of the musculoskeletal system or connective tissue; J: Diseases of the genitourinary system; K: Pregnancy; childbirth or the puerperium; L: Symptoms, signs or clinical findings, not elsewhere classified; M: Injury, poisoning or certain other consequences of external causes; Or: Oral; Ex: External.

### Ethics approval and consent to participate

Ethics approval and consent participate Permission to conduct the ethnobotanical study was obtained from the district administration and village office in the study area. The purpose of the study was explained to all participants, and they agreed to provide information.

### Consent for publication

Our manuscript does not contain any individual's person data.

### Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.


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### Authors' contributions

XL responsible for the revision of the entire manuscript. LTY: supervised the project and designed the study.YQB: participated in research survey, data evaluation and wrote the manuscript as the major contributor of the study. LZ: analyzed data and provided technical support. YHS: designed the research survey and collected data. MHL: contributed to the structure, discussion contents of the study, and helped with species identification. All authors read and approved the final manuscript.


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## Tables

**Table. 1** Socio-demographic characteristics of the informants

| Basic information | Number of informants | Percentage (%) |
|---|---|---|
| Sex | | |
| Male | 68 | 59.6 |
| Female | 46 | 40.4 |
| Age | | |
| ≤30 | 7 | 6.1 |
| 31-40 | 17 | 14.9 |
| 41-50 | 23 | 20.2 |
| 51-60 | 58 | 50.9 |
| 60 | 9 | 7.9 |

**Table. 2** List of plant species for medicinal purposes in Daur, Inner Mongolia, China

The 13 diseases according to ICD-11 are classified as follows:(A)Certain infectious or parasitic diseases, (B)Neoplasms, (C)Diseases of the nervous system, (D)Diseases of the visual system, (E)Diseases of the circulatory system, (F)Diseases of the respiratory system, (G)Diseases of the digestive system, (H)Diseases of the skin, (I)Diseases of the musculoskeletal system or connective tissue, (J)Diseases of the genitourinary system, (K)Pregnancy, childbirth or the puerperium, (L)Symptoms, signs or clinical findings, not elsewhere classified, (M)Injury, poisoning or certain other consequences of external causes.

Or: Oral, Ex: External

| Family | Scientific name | Local name | Parts used | Disease treated | Classification of diseases (ICD-11) | Taxonomic | Route, dose and usage | UV | Voucher Specime |
|---|---|---|---|---|---|---|---|---|---|
| Tricholomataceae | *T. mongolicum* S. Imai | Qi gan mog | Fruiting body | Measles | A | Fungus | Or:50g cut and used in decoction | 0.04 | 201707 |
| Auriculariales | *A. auricula* (L. ex Hook.) Underw | Bakerte | Fruiting body | Cervical cancer, hypertension, constipation, vaginal cancer, trauma | B, E, L, M | Fungus | Or: 5-30g used in food or burned to carbon powder | 0.94 | 201706 |
| Typhaceae | *Typha orientalis* Presl. | Laesu | Whole grass | Rheumatoid arthritis, rheumatism | I | Herb | Ex: fumigated with fresh grass for 1 hour | 0.06 | 201707 |
| Poaceae | *Setaria italica* (L.) Beauv. var. *italica*. | Narem baei tos | Fruit | Several kinds of ringworm and scabies | A | Herb | Ex: anointed the affected area with oil | 0.36 | 201708 |
| | *Avena sativa* L. | Kua lin po | Seed | Loss of appetite, constipation | L | Herb | Or: 30-60g used in decoction | 0.99 | 201706 |
| Salicaceae | *Populus davidiana* Dode | Holordaan koltus | Bark | Dental disease | G | Tree | Ex: decocted for gargling | 0.10 | 201707 |
| Betulaceae | *C.heterophylla* Fisch | Ququu | Seed | Diarrhea, loss of appetite, cough | L | Tree | Or: 30-60g used in decoction or grinded to powder | 0.77 | 201708 |
| | *Betula platyphylla* Suk. | Qaalbaan koltus | Bark | Bacillary dysentery, diarrhea, gastric ulcer | A, G, L | Tree | Or: 5g burned to carbon powder and taken with water | 1.07 | 201707 |
| | | Qaalbaan tos | Branch | Open wound of lower limb | M | | Ex: burned defined amount branch into oil and wiped at the affected area | | |
| Cannabaceae | *Cannabis sativa* L. | - | Seed | Smallpox | A | Herb | Ex: grinded seeds mixed with Raphanus sativus leaves and applied the exuding latex to the affected area | 0.23 | 201707 |
| Polygonaceae | *Fagopyrum esculentum* Moench | Haul | Seed | Cholera, dyspepsia | A, L | Herb | Or: boiled seed mixed with hot cow's milk | 0.99 | 201706 |
| Ranunculaceae | *P. chinensis* (Bunge) Regel | - | Root,flower | Rheumatism | I | Herb | Or: used in decoction or extracted in wine<br><br>Ex: grinded fresh herbs for applying to affected area | 0.09 | 201704 |
| | *A. kusnezoffii* Reichb. | - | Root | Rheumatism | I | Herb | Or: 3- 6g used in decoction or made for pills and powder (If used in soup should be prepared 1-2 hours in | 0.03 | 201707 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | advance, in order to reduce toxicity.)<br><br>Ex: extracted in wine or vinegar for applying to affected area | | |
| | *C. dahurica* L. | Cha Yang osu | Rhizome | Mumps | A | Herb | Or: used in decoction<br><br>Ex: 15g dried rhizome decocted or grinded fresh herbs applied to affected area | 0.08 | 201707 |
| Rosaceae | *R. davurica* Pall. | Jaami gada | Root nodule | Rheumatoid arthritis | I | Shrub | Or: 7 root nodules used in decoction<br><br>Ex: used in decoction to wash the affected area | 0.14 | 201708 |
| | *Potentilla flagellaris* Willd. ex Schlecht. | Suadelil eus | Whole grass | Gaseous abdominal distention, urethritis | G,J | Herb | Or: drank it like tea or used in decoction | 0.15 | 201706 |
| | *S.sorbifolia* (L.) A. Br. | Caakunku | Branch | Costal chondritis, trauma | I, M | Shrub | Or:9- 15g used in decoction<br><br>Ex: used in decoction to wash the affected area | 0.82 | 201707 |
| Euphorbiaceae | *E.fischeriana* Steud. | Temee mek | Root | Tuberculosis, tuberculosis of bones, several kinds of scabies | A | Herb | Or: 50g dried root decocted mixed with 100g jujube and eat 2 jujube twice a day | 0.38 | 201706 |
| Araliaceae | *Panax ginseng* C. A. Mey. | Aorgiden | Root | All kinds of disease | - | Herb | - | 0.61 | 201707 |
| Umbelliferae | *C. Virosa* L. | Juma qin | Rhizome | Venomous snakes or insects bite, extravasation of blood, osteomyelitis, gout, rheumatism | I, L, M | Herb | Ex: decocted or grinded rhizome appling to the affected area, mixed with egg white or *Cicuta virosa* to use together | 0.04 | 201707 |
| Ericaceae | *R. Simsii* Planch. | Nadeg yilga | Flower or fruit | Tracheitis, pneumonia, irregular periods, amenorrhe, uterine bleeding, rheumatism, trauma | A, F, J, I, M | Shrub | Or: 5g flowers used in decoction or extracted in wine, 2- 3g fruits grinded to powder | 0.62 | 201707 |
| Labiatae | *Perilla frutescens* (L.) Britt. | Balei tos | Seed | Abnormal sputum, cough, constipation | L | Herb | Or: drank 5- 10 ml or boiled seeds mixed | 0.93 | 201709 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | bal | Seed and Fruit | Hepatitis, cough, constipation | G, L | | with *G. gallus* domesticus Or: 6- 10g used in decoction or made for pills and powder□15g eat as raw | | |
| | *S.baicalensis* Georgi | - | Root | Abdominal pain, diarrhea, dysentery, cough | A, G, L | Herb | Or: drank it like tea | 0.39 | 201708 |
| Solanaceae | *Nicotiana tabacum* L. | danga larq | Leaves | Carbuncle, furuncle, dermatitis, eczema, trauma | A, H, M | Herb | Or: 6- 9g used in decoction<br>Ex: grinded and wrapped around the affected area | 0.61 | 201707 |
| Caprifoliaceae | *S.williamsii* Hance | Caawui mood | Branch | Trauma, costal chondritis | M, I | Shrub | Or: 25g used in decoction<br>Ex: 25g used in decoction to wash the affected area | 0.27 | 201707 |
| Cucurbitaceae | *Cucurbita moschata* (Duch. ex Lam.) Duch. ex Poiret | Wogi Hur | Seed | Ascariasis, disease due to nematode | A | Herb | Or: 15g eat as raw | 0.67 | 201707 |
| | *C. sativus* L. | Kengki Hur | Seed | Fracture | M | Herb | Or: 15g eat as raw | 0.39 | 201707 |
| Asteraceae | *X. sibiricum* Patrin ex Widder | Zhang guozi | Fruit | Rheumatism | I | Herb | Or: used in decoction | 0.52 | 201707 |
| | *Artemisia argyi* Levl. et Vant. | Qigaan suaig | Whole grass | Urticaria, rheumatism | H, I | Herb | Or: used in decoction<br>Ex: used in decoction to fumigate affected area | 0.84 | 201706 |
| | *F. sibiricum* (L.) Kitam. | Taoli suaig | Whole grass | Pneumonia | F | Herb | Or: 3g whole grass decocted mixed with 30g flowers and leaves of *R. dauricum*, and taken for twice a day | 0.27 | 201707 |
| | *A. integrifolia* L. | Kumile | Whole grass | Dysentery, diarrhea, laryngeal carcinoma | A, B, L | Herb | Or: defined amount bud boiled mixed with Phaseolus vulgaris or drank as tea | 1.00 | 201706 |

**Table. 3** List of animal species for medicinal purposes in Daur, Inner Mongolia, China

| Family | Scientific name | Local name | Parts used | Disease treated | Classification of diseases （ICD-11） | Taxonomic | Route, dose and usage | UV |
|---|---|---|---|---|---|---|---|---|
| Ranidae | *Rana chensinensis* David | Meleg | Whole body | Rheumatic heart disease | E | Amphibian | Or: cut 5 whole animals and boiled with 50g pork for once a day | 0.42 |
| Trionychidae | *Trionyx sinensis* Wiegmann | Kaberin miaal | Tissue (meat) | Urgency of urination | J | Reptile | Or: boiled meat or taken soup | 0.19 |
| | | - | Carapace | Urgency of urination | J | | Or: burned to carbon and taken with water | |
| Phasianidae | *Gallus domesticus* | - | Tissue (meat) | Rheumatism | I | Bird | Or: boiled meat with pork together | 0.84 |
| | *Coturnix japonica* Temminck et Schlegel | Bedeni xirbes | Tissue (hamstring) | Injury of fascia or tendon | M | Bird | Or: grinded hamstring and applied at the site of wound | 0.10 |
| | *G. gallus* | Kakera chulqi | Organ (gallbladder) | Cough, abnormal sputum | L | Bird | Or: extracted bile and mixed with sugar to drinking | 1.81 |
| | | - | Organ (viscera) | Trauma | M | | Ex: applied the viscera organ to affect area with hot compress | |
| | | Kakera toturig | Organ (gizzard) | Traumatic hemorrhag, dyspepsia | M, L | | Or: grinded to powder<br><br>Ex: applied the gizzard to affect area with hot compress | |
| | | kakraa tos | Tissue (grease) | Rheumatic heart disease， coronary heart disease | L, E | | Or: 15ml taken for twice a day | |
| *Picidae* | *Dendrocopos major* Linnaeus | Tontroookil | Whole body | Cramp or spasm | C | Bird | Or: burned to carbon and taken with water | 0.17 |
| Corvidae | *Corvus macrorhynchos* Vagler | Gawu miag | Tissue (meat) | Diseases of stomach, hepatic cirrhosis | G | Bird | Or: boiled meat or taken soup | 0.84 |
| Erinaceidae | *Erinaceus amurensis* Schrenk | Jierie | Whole body | Urgency of urination | J | Mammal | Or: lightly burnt whole body to eat meat and drink water soaked with skin | 0.13 |
| Canidae | *C. lupus* Linnaeus | Guska tos | Tissue (grease) | Tuberculosis | A | Mammal | Or: 10ml take for 3 times a day | 0.01 |
| | | Guske ios | Bone | Rheumatism, rheumatoid arthritis | I | | Or: bone extracted in vinegar, and 10ml taken for twice a day | |
| | | - | Tissue (hair) | Allergic contact dermatitis | H | | Ex: anointed at the affected area | |
| | *C. lupus familiaris* Linnaeus | Nowuei tos | Tissue (grease) | Tuberculosis | A | Mammal | Or: 10ml taken for twice a day | 1.33 |
| | | Nowuei ios | Bone | Rheumatism, rheumatoid arthritis | I | | Or: boiled water to drink | |
| | *Vulpes vulpes* Linnaeus | Hunuwuei jurwu | Organ (heart) | Palpitation, rheumatic heart disease | E | Mammal | Or: mixed with Cinnabaris, Ambrum and *Angelica sinensis* to eat together | 0.18 |
| Mustelidae | Meles meles Linnaeus | Hewur tos | Tissue (grease) | Tuberculosis, burn | A, M | Mammal | Or: 10ml taken for three times a day<br><br>Ex: wrapped around the affected area | 0.51 |
| Suidae | *Sus scrofa domestica* Brisson | gag chulqi | Organ (gallbladder) | Constipation, cough， asthma, carbuncle, dermatophytosis of | A, H, F, L, M | Mammal | Ex: dressed at the affected area until the bile dry | 0.87 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | scalp, furunculosis, eczema, trauma | | | | |
| Cervidae | *C. elaphus* Linnaeus | Bawoi jurwu qow | Tissue (blood) | Palpitation | E | Mammal | Or: a little quantity for once a day | 2.70 |
| | | Pentu | Antlers | Cough, frostbite | L, M | | Or: cut into pieces, and used in decoction or extracted in wine.<br>1-3g grinded to powder, and made for pills and powder<br>Ex: applied the blood of antler to affected area | |
| | | - | Organ (uterus) | Irregular menstruation, infertility, uterine bleeding | J | | Or: 15-25g made for pills and powder, or boiled the fresh uterus | |
| | *C. nippon* Temminck | Bawoi jurwu qow | Tissue (blood) | Palpitation | E | Mammal | Or: a little quantity for once a day | 2.70 |
| | | Pentu | Antlers | Cough, frostbite | L, M | | Or: cut into pieces, and used in decoction or extracted in wine. 1-3g grinded to powder, and made for pills and powder<br>Ex: applied the blood of antler to affected area | |
| | | - | Organ (uterus) | Irregular menstruation, infertility, uterine bleeding | J | | Or: 15-25g made for pills and powder, or boiled the fresh uterus | |
| | *Moschus moschiferus* Linnaeus | - | Secretion | Epilepsy, contraception, stroke, carbuncle, pyogenic abscess of the skin, trauma | A, C, E, K, L | Mammal | Or: 0.06-0.1g made for pills and powder<br>Ex: inhaled drugs from the nose in moderation | 0.10 |
| | *Moschus sifanicus* Przewalski | - | Secretion | Epilepsy, contraception, stroke, carbuncle, pyogenic abscess of the skin, trauma | A, C, E, K, L | Mammal | Or: 0.06-0.1g made for pills and powder<br>Ex: inhaled drugs from the nose in moderation | 0.10 |
| | *C. capreolus* Linnaeus | Juri bast | Organ (kidney) | Cough | L | Mammal | Or: Eaten with salt | 1.82 |
| | | Juri beleg | Organ (liver) | Night blindness, astigmatism, glaucoma | D | | Or: Eaten with salt | |
| | | Juri ios | Bone | Rheumatism | I | | Or: bone extract in vinegar, and 10ml taken for twice a day | |
| *Bovidae* | *Ovis aries* Linnaeus | honi chulqi | Organ (gallbladder) | Constipation, cough, asthma, carbuncle, dermatophytosis of scalp, furunculosis, eczema, trauma | A, F, H, L, M | Mammal | Ex: dressed at the affected area until the bile dry | 0.62 |
| | *Capra hircus* Linnaeus | Honi chulqi | Organ (gallbladder) | Constipation, cough, asthma, carbuncle, dermatophytosis of scalp, furunculosis, eczema, trauma | A, F, H, L, M | Mammal | Ex: dressed at the affected area until the bile dry | 0.64 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Bostaurus domesticus* Gmelin | Wuker chulq | Organ (gallbladder) | Tracheitis, icterus, infantile convulsions, constipation, haemorrhoids, carbuncle | A, C, G, F, L | Mammal | Or: 0.3-0.9g made for pills or powder<br><br>Ex: anointed at the affected area or dropped in eyes | 0.30 |

**Table. 4** Methods of preparation of plant and animal parts used in Daur ethnomedicine

| No. | Type of preparation | Number of medicines | Percentage (%) |
|---|---|---|---|
| 1 | Decoction | 21 | 36.9 |
| 2 | Grinding | 11 | 19.3 |
| 3 | Boiling | 10 | 17.5 |
| 4 | Extraction | 8 | 14.1 |
| 5 | Burning | 7 | 12.2 |

**Table. 5** Methods of usage of plant and animal parts used in Daur ethnomedicine

| No. | Type of usage | Number of medicines | Percentage (%) |
|---|---|---|---|
| 1 | Drink/take | 37 | 48.1 |
| 2 | Eaten | 16 | 20.7 |
| 3 | Made for pills and powder | 7 | 9.1 |
| 4 | Anointment/wash | 6 | 7.8 |
| 5 | Wrap/dressing | 5 | 6.5 |
| 6 | Used at nose, eyes and mouth touth | 4 | 5.2 |
| 7 | Fumigate | 2 | 2.6 |

**Table 6** Comparison of the efficacy of different ethnic characteristics

| Scientific name | Daur | Traditional Chinese medicine | Mongolian medicine |
|---|---|---|---|
| Artemisia integrifolia Linn. | Hypertension, stomach bleeding | Detoxification[29] | Scabies |
| Allium macrostemon Bunge. | Pneumonia | Insecticide[30] | Irregular menstruation, Trauma bleeding |
| Pycnonotus sinensis | Detoxification | Cooling blood[31] | Fractures and tendons |
| Sorbaria sorbifolia (L.) A. Br | Bruises, chondritis | Activating blood removing stasis[32] | Cold |
| Perilla frutescens (L.) Britt. | Hepatitis | Constipation[33] | Excessive phlegm |

**Table 7** Informant consensus factor for ailment categories

| Disease categories | Number of use reports (Nur) | Number of taxa (Nt) | Informant consensus factor (ICF) |
|---|---|---|---|
| Certain infectious or parasitic diseases | 69 | 23 | 0.68 |
| Neoplasms | 1 | 1 | 1.00 |
| Diseases of the nervous system | 5 | 3 | 0.50 |
| Diseases of the visual system | 1 | 1 | 1.00 |
| Diseases of the circulatory system | 23 | 8 | 0.68 |
| Diseases of the respiratory system | 9 | 5 | 0.50 |
| Diseases of the digestive system | 46 | 6 | 0.89 |
| Diseases of the skin | 23 | 6 | 0.77 |
| Diseases of the musculoskeletal system or connective tissue | 32 | 13 | 0.29 |
| Diseases of the genitourinary system | 24 | 6 | 0.78 |
| Pregnancy, childbirth or the puerperium | 1 | 1 | 1.00 |
| Symptoms, signs or clinical findings, not elsewhere classified | 95 | 18 | 0.82 |
| Injury, poisoning or certain other consequences of external causes | 13 | 2 | 0.92 |

## Figures

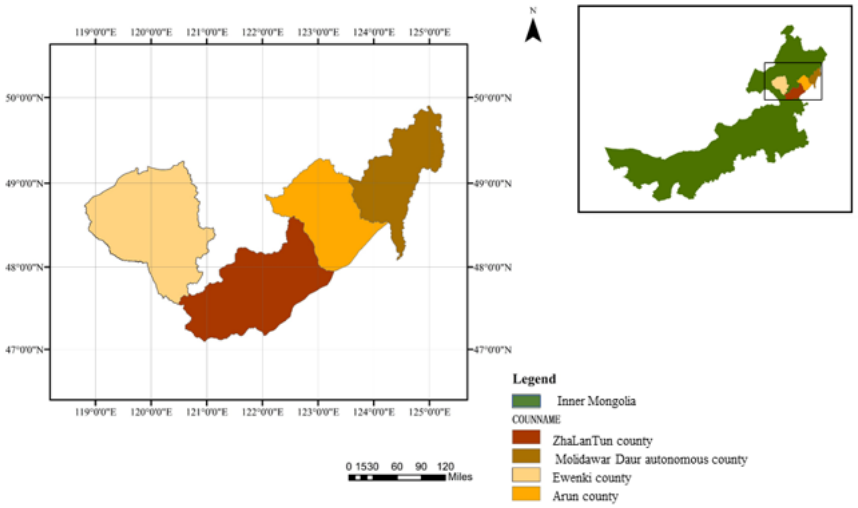


**Figure 1**

Map of Daur main distribution in Hulunbuir, Inner Mongolia, China. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

**Figure 2**

Parts of plants used in Daur medicine at study area a. Panax ginseng C. A. Mey., b. Scutellaria baicalensis Georgi, c. Sorbaria sorbifolia (L.) A. Br., d. Euphorbia fischeriana Steud., e. Rosa davurica Pall., f. Cicuta virosa L., g. Cucumis sativus L., h. Rhododendron dauricum L., i. Auricularia auricula (L. ex Hook.) Underw, j. Corylus heterophylla Fisch., k. Cimicifuga dahurica (Turcz.) Maxim., l. Xanthium sibiricum Patrin ex Widder, m. Sambucus williamsii Hance, n. Pulsatilla chinensis (Bunge) Regel, o. Filifolium sibiricum (L.) Kitam., p. Aconitum kusnezoffii Reichb.

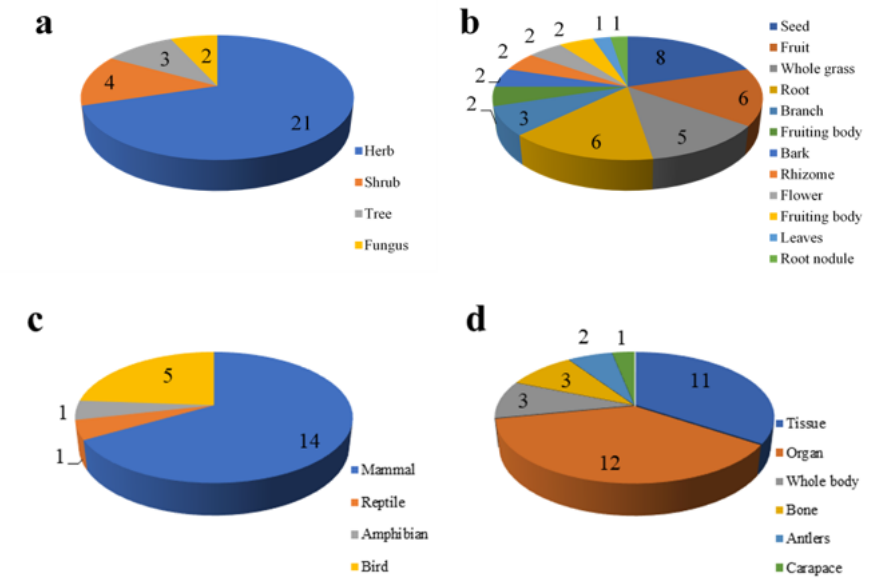


Figure 3

Graphical representation showing plant and animal species of taxonomic and various used parts (a. plant species of taxonomic; b. plants according to various used parts; c. animal species of taxonomic; d. plants according to various used parts)

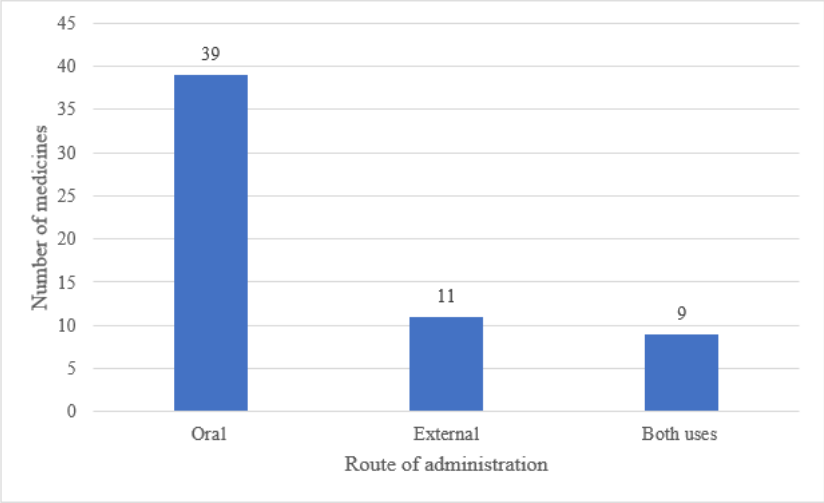


Figure 4

Rount of diversity Daur medicine

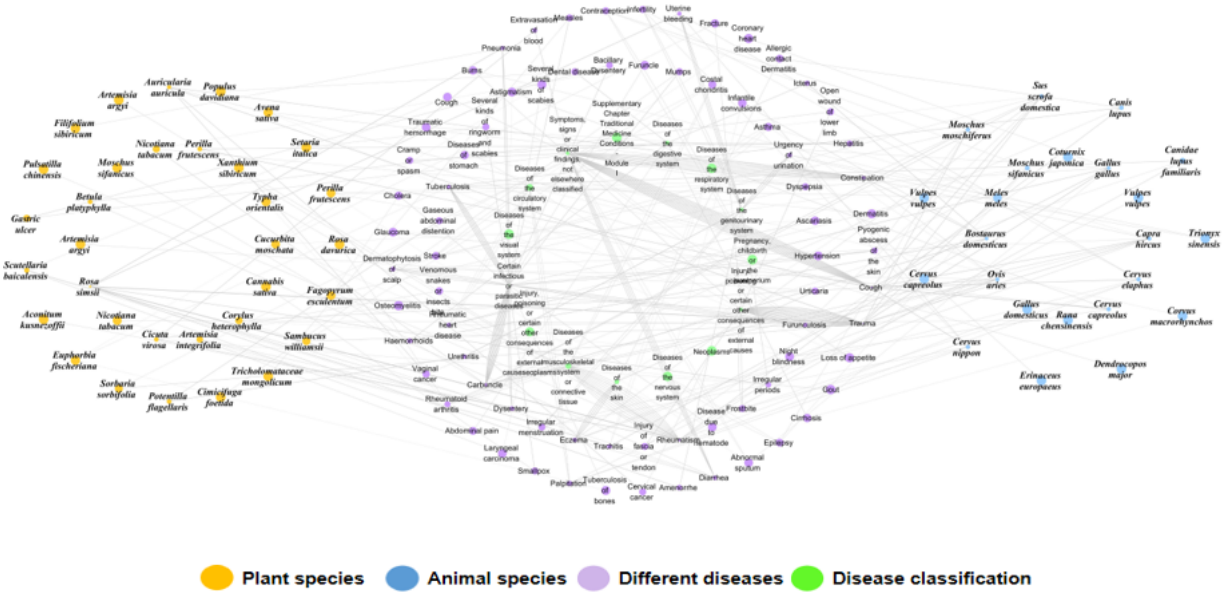


**Figure 5**

Network visualization of the relationship between disease and Daur medicines

## Supplementary Files

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