

Yunatov's Records of Wild Edible Plant Used by the Mongols in Mongolia During 1940-1951: Ethnobotanical Arrangements and Discussions

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Research

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Abstract

Background: Researchers have rarely studied traditional botanical knowledge in Mongolia over the past 60 years, and existing studies had been based on the theory and methodology of ethnobotany. However, Russian scientists who studied plants in Mongolia in the 1940s and 1950s collected valuable historical records of indigenous knowledge and information on Mongolian herdsman utilizing local wild plants. One of the most comprehensive works is titled: "*Forage plants on grazing land and mowing grassland in the People's Republic of Mongolia*" (FPM) by A. A. Yunatov (1909-1967). Yunatov's work focused on forage plants in Mongolia from 1940 to 1951, which was published in 1954 as his early research. Later, the original FPM was translated into Chinese and Cyrillic Mongolian in 1958 and 1968, respectively.

Materials: In addition to morphological characteristics, distribution, habitat, phenology, palatability and nutrition of forage plants, Yunatov recorded the local names, the folk understanding and evaluation of the forage value, as well as other relevant cultural meanings and the use of local wild plants in FPM through interviews. The book contains the most precious records created in the 1940s and 1950s on folk knowledge of wild plants used by the Mongols in Mongolia. It is composed of 8 chapters, and 351 pages in total. The fifth chapter of FPM is titled "A systematic expounds of forage plants", and has 272 pages, accounting for 77.49% of the total. The order and content of the book appeared to be oriented along profiles of specific plant. And author collected specific information of plants such as the local name, morphology, distribution, habitats, ecological characteristics, phenology, and he also discussed the palatability to livestock, particular forage use, other usages, and chemical composition.

Methods: Through careful reading and understanding of all three versions of the book, the information of plants shown in the records regarding listed local edible use in FPM was sorted. The process is equivalent to ethnobotanical fieldwork. Edible plants listed in FPM were categorized based on purposes of use, and ethnobotanical inventories were made following the research methods of classical ethnobotany.

Results: FPM listed records of 35 species that belong to 15 families and 25 genera of wild edible plants. Most species belong to Liliaceae and Allium. Wild grain and grain substitutes come from starch-rich parts such as seeds, bulbs, roots and rhizomes of 12 species, accounting for 34.28% of all species. Wild vegetables come from the parts of a young plant, tender leaves, young fruits, lower part of stems, and bulbs of 9 species, accounting for 25.71% of all species. There are only three species of wild fruits, accounting for 8.57% of all edible plant species. Tea substitutes come from the parts such as leaves, roots, follicle, and aboveground parts of 8 species of wild plants, accounting for 22.85% of all species. Wild seasonings come from the parts such as seeds, rhizomes, tender leaves of 7 species, accounting for 20.00% of all species.

Conclusions: Six species of wild edible plants listed in FPM have been proven to be collected and consumed by Mongolian in the 12th century, which demonstrates significant cultural and heritage value. Seven species of plants mentioned in this book were closely correlated to processing of traditional dairy products, meat and milk food by the locals. Similarities and differences are noticeable in the utilization of wild edible plants between the Mongols in Mongolia and the Mongols in China. Yunatov was not an

ethnobotanist, but he faithfully recorded data obtained from interviews and surveys about the Mongols in Mongolia collection and consumption of local wild plants during 1940-1951. His research mission meant to focus on forage grass, the feed plant that livestock would consume.

Nevertheless, he also recorded the wild plants for human consumption. Although his records on the edible parts and intake methods of some plants are incomplete, it provided ethnobotanical materials aged more than 70 years, representing a living history of ethnobotany from the perspective of the history of science. Even by today's standards, it will be challenging to obtain first-hand information of the richness and to the extent of Yunatov's research.

Background

Mongolians are a Central Asian ethnographic group comprising a closely related tribal population inhabiting the Mongolian Plateau and sharing a common language and nomadic tradition. Nowadays, the Mongolian population numbers approximately 10 million and is distributed among Mongolia, Inner Mongolia Autonomous Region and other provinces and regions of China such as Xinjiang, Qinghai, Gansu of China, and Kalmykia and the Buryat Republic of Russia.

Ethnobotanical studies on uncultivated edible plants in the Mongolian Plateau were based on the theory and methodology of ethnobotany. Moreover, it had been carried out on the edible plants of given areas [1–4], wild edible fruits[5–8], wild vegetables[9, 10], tea substitute plants [11, 12], and ethnobotany of specific plant taxa related to food in some aspects [13–16] since the 1980s. There are few reports related to traditional botanical knowledge of the Mongols in Mongolia based on the theory and methodology of ethnobotany over the past 60 years. However, in the data of Russian scientists studying Mongolian plants in the 1940s and 1950s, records concerning indigenous knowledge of Mongol herdsmen using uncultivated plants have been found. Among them, the most comprehensive work is "*Forage Plants on Grazing Land and Mowing Grassland in the People's Republic of Mongolia*" (abbreviated FPM) by A. A. Yunatov. It was published in Russian as *Кормовые Растения Пастбищ и Сенокосов Монгольской Народной Республики*[17].

Along with the records from FPM, literature research from the perspective of ethnobotany and history of science in Inner Mongolia has been carried out since the 1990s. And it had covered studies of wild edible plants in the *Secret History of the Mongols* [18] and the ethnobotanical value of the book in terms of the range management [19]. A recently published article on textual research on the Mongol names of Gramineous forage in the book "*Advice to the People on How to Manage Animal Husbandry*", belongs to an arrangement of ethnobotanical information in the classical literature [20]. Jamsrangiin Sambuu (1895–1972) compiled the book, and the grazing experience of herdsmen in Mongolia was summarized in the form of advisement [21].

Alexander Afanasievich Yunatov (Александр Афанасьевич Юнатов, 1909–1967) was a famous botanist in the former Soviet Union, and he was known for being a geobotanist, phylogeographer, plant researcher of Central Asia, and later complemented as an organizer of science (Fig,1[22]). He was born in

Yekaterinoslav on December 25, 1909, and died in Leningrad on October 24, 1967. He entered the Department of Biology, Leningrad National University in 1935, and later transferred to Moscow State University in 1936 where he graduated from the Department of Botany with excellence in 1940. Subsequently, he received his associate doctor's degree in Life Science in 1948 and his doctor's degree in Life Science in 1954. After that, he was promoted to Professor in 1961. Yunatov proved himself to be a distinguished researcher and was awarded the Polaris Medal of the People's Republic of Mongolia in 1945 and the Komarov prize in 1951 [23, 24]. From 1940 to 1951, he studied forage plants in Mongolia for more than 11 years. As one of his research results, he wrote and published FPM in 1954 [17].

Huang ZH, Ma YQ and Wang JW translated FPM into Chinese in 1958. The Chinese edition was published by China's Science Press [25] (Fig. 3). Prof. G. Erdenjav brought FPM into Cyrillic Mongolian in 1968 (Fig. 4) [26].

Materials

FPM also recorded local names, folk understanding and evaluation of the forage value, as well as other relevant cultural meanings and uses of local uncultivated plants. It had been valuable information apart from conventional expounds, such as morphological characteristics, distribution, habitat, phenology, palatability and nutrition of forage plants. From the introduction of the book, the author's view on folk plant knowledge is entirely consistent with the theory of ethnobotany. The interviewing method adopted by the author in his fieldwork was precisely the same as the critical informant interview method of classical ethnobotany (Fig. 5–6). In the analysis and evaluation of folk nomenclature and classification, Russian adjective *этноботанической* was used in a sense similar word of ethnobotany in English. Therefore, it could be inferred that the author possessed the knowledge and concept of ethnobotany while composing the book. According to the current data, this is the book that has the most abundant records of folk knowledge of wild plants used by the Mongolian herdsman in Mongolia during the 1940s-1950 s. Therefore, it is necessary to arrange, inventory, analyze and evaluate the ethnobotanical information recorded in the book.

FPM was composed of 8 chapters, and 351 pages in total. The first chapter was the preface, written by E. M. Lavrenko (1900–1987), a famous botanist in the former Soviet Union. The second chapter is an introduction, and the third chapter is about the "utilization of forage plants under the condition of Mongolian nomadism". It described the ethnobotanical viewpoint of the author and the interviewing methods he used. The fourth chapter consists of "a brief introduction of various grazing land and mowing grassland in connection with national natural characteristics". It mainly introduced the central vegetation zone and its related vegetation types of grazing land and mowing grassland, and natural regionalization of the people's Republic of Mongolia. The sixth to eighth chapters were the conclusion, references and a list of forage plant names in Latin, Russian and Mongolian.

The fifth chapter of FPM was called "A systematic expounds of forage plants", and it was the crucial chapter of the book. The fifth chapter has 272 pages, accounting for 77.49% of the entire book. It

elaborated on plant families, genera, and species in order of Pteridophyta (2 families, two genera, three species), Gymnospermae (2 families, two genera, five species), and Angiospermae (62 families, 187 genera, 546 species). In the Angiosperm, Monocotyledoneae had been listed in the front of Dicotyledoneae. In Dicotyledoneae, the Salicaceae was arranged at first. Such ordering proved that the families of Angiosperm in FPM were arranged according to Engler and Prantl's early system of classification. The order and content of elaboration were specified to a specific plant, including profiles of local Mongol names, morphology, distribution, habitats, ecological characteristics, phenology, palatability to livestock, particular forage use, usage for local people themselves, and chemical composition. Among them, local Mongolian names which collected by Yunatov was the original materials for the study of Mongols' plant folk nomenclature and classification. The local knowledge of plant palatability to livestock contains what species or group of plants are suitable for which animal to feed. It contributes the raw material for studying the traditional knowledge of grazing plants of Mongolian herdsman. The present paper analyzed the information about the direct use of edible plants by herdsman in Mongolia. The local names of plants and the knowledge of grazing use (indirect method) will be studied and written about separately.

Methods

Data arrangement

The records of plants with local edible use in FPM were sorted out through careful reading and understanding among three versions of the book. This step is equivalent to ethnobotanical fieldwork, and fortunately, it had been completed by Yunatov as early as 70 years ago.

Revision of scientific names

Some of the scientific names used by the author in FPM were synonyms complied to current taxonomy. According to the International Code of Botanical Nomenclature (ICBN), some plants' popular names were found and adopted.

Categorization and Ethnobotanical inventories

The categorization of Edible plants in FPM was based on purposes of use. Ethnobotanical catalogues were made following the methods of classical ethnobotany [27-30]. Scientific names alphabetically list entries in all tables.

Results

Taxonomic features of wild edible plants

A total of 35 species of wild edible plants were recorded in FPM, which belong to 15 families and 25 genera. On the level of family, ten species of Liliaceae were reported as very prominent. Also, six species

of Rosaceae, three species of Chenopodiaceae, two species of Poaceae, Polygonaceae, Ranunculaceae, and Brassicaceae were reported, and each of the other eight families contained only one species. On the level of genus, it has recorded eight species of *Allium* with prominence. Moreover, it has reported two species of *Lilium*, *Potentilla* and *Paeonia*, and it showed each of the other 21 genera with only one species.

Food categories

According to the original records, the author created five categories of food use based on the mode of use by the folk for classification of wild plant edibles. The groups included wild grain and grain substitutes, wild vegetables, wild fruits, tea substitutes, and seasonings sourced from wild (Table 1). Among them, *Allium lineare* L. was reported to be used as both vegetable and seasoning, *Paeonia lactiflora* Pall. Furthermore, *Paeonia anomala* L. used as both grain substitutes and tea substitutes, and *Polygonum viviparum* L. were recorded as for the use of both grain substitutes and seasoning.

Table 1 Wild edible plants and number of species arranged in food categories

Food Categories	Wild Grain and Grain Substitutes	Wild Vegetables	Wild Fruits	Tea Substitutes	Wild Seasonings
Species Number	12	9	3	8	7

Original records, ethnobotanical inventory and discussion

Wild Grain and Grain Substitutes

The original records of wild grain and grain substitutes in FPM were translated as follows:

- (a) *Agriophyllum squarrosum* (L.) Moq. [*Agriophyllum arenarium* M. B.](Note: The scientific name in square brackets is the name adopted in the original text, and the accepted name is taken in this paper.): Since ancient times, the locals have collected a large number of seeds in a good year and made them into rice or flour for consumption.
- (b) *Corispermum mongolicum* Iljin.: The locals collected its seeds, mashed them into powder and fried them to process for food.
- (c) *Kalidium gracile* Fenzl: Seeds were collected, ground into a powder then fried for meals.
- (d) *Leymus racemosus* (Lam.) Tzvel. [*Elymus giganteus* Vahl]: It has seeds that are similar to *Psammochloa villosa*. Mongolians has a long tradition of collecting them since ancient times. And it is used as food in the form of grain and dried flour.

(e) *Lilium martagon* L.: Used in the form of fresh or dried bulbs for food by the locals.

(f) *Lilium pumilum* DC. [*Lilium tenuifolium* Fisch.]: Bulbs have been widely used as food. The newly harvested (usually in autumn) bulbs were often boiled in milk or consumed with buttermilk. Bulbs could also be purchased for storage in rind (the floating film of butter) or oil. The locals considered this kind of oil or milk skin as a good food.

(g) *Paeonia lactiflora* Pall. [*Paeonia albiflora* Pall.]: The local people cooked the fat and tuberous root as food, or made into food similar to oat flour.

(h) *Paeonia anomala* L.: People used it in the same way as the previous species (note: the previous species in FPM was *Paeonia lactiflora*).

(i) *Polygonum viviparum* L.: Wild mice collect a large number of starchy rhizomes for winter and the rations are hidden in special underground storage. Hence, the rhizomes of *Polygonum viviparum* were usually obtained from the underground warehouses of wild mice. Such practice had been performed since ancient times, the collected rhizomes of *Polygonum viviparum* would be cooked and applied as seasoning for cooking meat or flour.

(j) *Potentilla anserina* L.: The local people use starchy roots for food.

(k) *Psammochloa villosa* (Trin.) Bor: The locals usually harvest its Caryopsis and use it for food in the form of flour and rice.

(l) *Rheum nanum* Siev. ex Pall.: The roots were dried and ground into flour for making pancakes by herdsmen.

Wild grain and grain substitutes are sourced from the starch-rich parts, such as seeds, bulbs, roots and rhizomes, comprising 12 species of wild plants which account for 34.28% of all edible plant species. The current paper listed the plant species, containing seeds used as grain as wild grain and the plant species whose underground parts of bulbs, roots and rhizomes were used as grain substitutes (Table 2).

A large portion of wild grain and grain substitute plants might correlate to the underdevelopment of grain production in Mongolia at the time. The nomadic Mongolian herdsmen could not guarantee food supply at a particular time since the nomadic Mongolians had not developed agriculture and food production in the past. However, they select and collected wild grain and grain substitutes from viable plants to meet the demand for starch in their dietary structure.

Among wild grain and plants with grain substitute, intake method of bulbs of *Lilium pumilum* was carefully combined with traditional local dairy products. The collection method for *Polygonum viviparum* (common name: alpine bistort) rhizomes involved a process of plundering the food of mice. Local Mongols referred to a gathering of rhizomes stored by mice as "opening the alpine bistort palace (mine)" [31]. It demonstrated the special ecological relationship among people, plants, and animals.

Table 2. Ethnobotanical inventory of wild grain and grain substitutes in FPM

Scientific name	Local name (in Mongolian Cyrillic)	Parts used	Purposes	Usage
<i>Agriophyllum squarrosum</i> (L.) Moq.	цурхил, сульхир, сюръкуль	seeds	grain	rice, flour
<i>Corispermum mongolicum</i> Iljin.	хорон хамхаг, харалтай хамхаг	seeds	grain	parched flour
<i>Kalidium gracile</i> Fenzl	шар будургана, шар мод	seeds	grain	parched flour
<i>Leymus racemosus</i> (Lam.) Tzvel.	суль, хара сульсуль, цаган суль	seeds	grain	rice, parched flour
<i>Lilium martagon</i> L.	шара тумыс	bulbs	grain substitutes	
<i>Lilium pumilum</i> DC.	цаган тумыс, сарана	bulbs	grain substitutes	boiled in milk; fresh bulbs are eaten raw; stored in cream or oil
<i>Paeonia anomala</i> L.	яган цэнэ, цэнэ	roots	grain substitutes	boil the roots or made into like oat flour
<i>Paeonia lactiflora</i> Pall.	цаган цэнэ, цэнэ, мандарвь цэцэг	roots	grain substitutes	boil the roots or made into like oat flour
<i>Polygonum viviparum</i> L.	мэхэр	rhizomes	grain substitutes	flour
<i>Potentilla anserina</i> L.	шчигэнэ	roots	grain substitutes	–
<i>Psammochloa villosa</i> (Trin.) Bor	суль, хара суль	seeds	grain	flour, rice
<i>Rheum nanum</i> Siev. ex Pall.	баджуна	roots	Grain substitutes	flour

Mongolians have a long history of eating bulbs of *Lilium pumilum*, and it can be traced back to the end of the 12th century [18] when Genghis Khan was a child. The Mongolian residents of Arhorchin Banner, Xilingol League, Ordos plateau and Ejina Banner of China are still using the seeds of *Agriophyllum squarrosum* as a source of wild grain [1-4]. *Agriophyllum squarrosum* was probably the most common wild plant as grain for Mongols. Mongolians in the Ordos plateau also used seeds of *Psammochloa villosa* as wild grain [3]. Genus *Corispermum* and *Kalidium* are important wild grain plants used by Mongolians. FPM has shown that Mongols in the Mongolia had been using the seeds of *Corispermum mongolicum* as grain, whereas, another species of *Corispermum dilutum* (Kitag.) C. P. Tsien & C. G. Ma, *Corispermum declinatum* Stephan ex Iljin gained popularity in Inner Mongolia [1,3]. Mongols in the Mongolia used the seeds of *Kalidium gracile* as grain, but the Mongols in Inner Mongolia preferred another species of *Kalidium foliatum* (Pall.) Moq. [2]. The Mongols in Mongolia and Ejina Banner of Inner Mongolia shared the same practice in the use of flesh roots of *Rheum nanum* as grain substitutes [2]. The bulbs of *Lilium martagon* and *Lilium pumilum* had been used as grain substitutes in Mongolia, but Inner Mongolians select the bulbs of *Lilium pumilum* and *Lilium concolor* Salisb. var. *pulchellum* (Fischer) Regel as fruit or snacks and consumed it raw [1,4]. However, the young plant of *Lilium pumilum* and *Potentilla anserina* were consumed as vegetable by the Mongols in Daqinggou of Inner Mongolia, China[10].

Wild vegetables

The original records of wild vegetables in FPM were translated as follows:

(a) *Allium altaicum* Pall.: The locals collected the juicy and sweet bulbs (weighing up to 100g) for food. The green leaves cannot be used for food because of extensive fiber content. According to the description (1881-1883) of G. N. Potanin, *Allium altaicum* was produced in Khangai district and exported to Urgoo (Ypry). Before the Chinese revolution, commercial companies exported thousands of pounds of bulbs from Uliastay to China.

(b) *Allium leucocephalum* Turcz.: Local people use it as food.

(c) *Allium lineare* L.: Local people use it as food.

(d) *Allium ramosum* L. [*Allium odorum* L.]: Local people use it as food.

(e) *Allium senescens* L.: It is considered a very resourceful plant by the locals. For example, the bulbs, the lower part of the stems and the tender leaves could all be used for food. Harvested fresh plant could be purchased and stored for later use in winter. It is required to be processed through fermentation, drying or crushing before storage. Sometimes it could be mixed with goat cheese (aaruul) and baked into pancakes.

(f) *Allium victorialis* L.: The tender leaves can be consumed in fresh or salted state. It is sold in large quantities in the local markets of Ulaanbaatar and Altanbulag.

(g) *Cynanchum thesioides* (Freyn) K. Schum.[*Antitoxicum sibiricum* (L.) Pobed.]: The locals used its young fruit for making pickles.

(h) *Pugionium dolabratum* Maxim.[*Pugionium cristatum* Kom.]: The herdsmen salted the young plants of *Pugionium dolabratum* and consumed.

(i) *Ulmus pumila* L.: The local people cooked the immature fruit in salted water.

Wild vegetables were sourced from uncultivated plants such as part of a young plant, tender leaves, young fruits, the lower part of stems, and bulbs, comprising nine species of wild plants which account for 25.71% of all edible plant species (Table 3). The nomadic Mongols had not developed vegetable planting technique in the past. Thus, they select and used uncultivated vegetables from the wild.

Among the wild vegetables, six species were reported as *Allium*. Edible parts of *Allium senescens* consisted of bulbs, the lower part of the stems and the tender leaves. Its storage method was fully integrated with the characteristics of living tradition among nomadic people. Yunatov provided the trade history of *Allium altaicum* in the 1880s according to the description (1881-1883) of G. N. Potanin [32],.

Table 3. Ethnobotanical inventory of wild vegetables in FPM

Scientific name	Local name (in Mongolian Cyrillic)	Parts used
<i>Allium altaicum</i> Pall.	соншн, джумагыл, согоно, сарымсак	bulbs
<i>Allium leucocephalum</i> Turcz.	гогод	not described in FPM; could be tender leaves
<i>Allium lineare</i> L.	гогод	not described in FPM; could be tender leaves
<i>Allium ramosum</i> L.	гогод	not described in FPM; could be tenderleaves
<i>Allium senescens</i> L.	мангир	bulbs, the lower part of stems, tender leaves
<i>Allium victorialis</i> L.	халяг	tender leaves
<i>Cynanchum thesioides</i> (Freyn) K. Schum.	тэмэний хох	young fruits
<i>Pugionium dolabratum</i> Maxim.	дээрлэг лован	young plant
<i>Ulmus pumila</i> L.	хайляс	young fruits

Mongols have a long history of using *Allium ramosum*, *Allium senescens* and *Allium victorialis* in diets, and the record of dietary application can be traced back to the 12th century [18]. It is reported that nine species of *Allium* were used as vegetables, non-staple food and seasonings by the Inner Mongolians [15]. Among them, *Allium ramosum* had been very special in terms of use [14]. The Mongols in Arhorchin Banner also used *Allium ramosum*, *Allium senescens*, *Allium victorialis*, *Cynanchum thesioides*, *Ulmus pumila* as wild vegetables [1]. In addition to using *Cynanchum thesioides* and *Ulmus pumila* as vegetables, Mongols in Arhorchin Banner also included young fruits of the above species as fruits in their dietary structure [5]. Tender leaves, as well as inflorescences of *Allium ramosum* and *Allium senescens*, and young fruits of *Cynanchum thesioides* were consumed as vegetables by the Mongols in Daqinggou of Inner Mongolia, China [10]. The Mongols in Alashan Left Banner of Alashan League used young fruits of *Cynanchum thesioides* as edible fruits [6]. Mongols in Xilingol League also used *Allium ramosum*, *Allium senescens*, *Cynanchum thesioides* as wild vegetables [4]. The Mongols in the Ordos plateau also used *Cynanchum thesioides*, *Pugionium dolabratum*, *Ulmus pumila* as wild vegetables. In addition to *Pugionium dolabratum*, *Pugionium cornutum* (L.) Gaertn was also eaten as vegetable [3]. Instead of using *Pugionium dolabratum*, the Mongols in Ejina Banner of Alashan League used another species of *Pugionium cornutum* (L.) Gaertn. as vegetables [2].

Wild fruits

The original records of wild vegetables in FPM were translated as follows:

- (a) *Fragaria orientalis* Losinsk.: The fruit is bright red and edible.
- (b) *Malus baccata* (L.) Borkh.[*Malus pallasiana* Juz.]: Small spherical fruits (up to 1 cm in diameter) serve as food for local people.
- (c) *Nitraria sibirica* Pall.: Local people use its fruit for food.

There are only three species of wild fruits recorded, accounting for 8.57% of all edible plant species (Table 4).

Table 4. Ethnobotanical inventory of wild fruits listed in FPM

Scientific name	Local name (in Mongolian Cyrillic)	Parts used
<i>Fragaria orientalis</i> Losinsk.	гудзэлъцзгэнэ	Fruits
<i>Malus baccata</i> (L.) Borkh.	Урил, улир	Fruits
<i>Nitraria sibirica</i> Pall.	Топцог, сундул, хармаг	Fruits

It is reported that *Malus baccata* have been consumed as a fruit by Mongols for a long time. *Malus baccata* was used as wild fruit in Arhorchin Banner and Xilingol League [1,4,5]. Also, there are records of using *Nitraria sibirica* as wild fruit in the Ordos plateau, in the Ejina Banner and in the Alshan Left Banner of Alashan League. Apart from that, *Nitraria sibirica*, *Nitraria tangutorum* Bobr were also used; furthermore, *Nitraria roborowskii* Kom. were also consumed as wild fruits [2,3,6].

Tea substitutes

The original records of tea substitutes in FPM were translated as follows:

- (a) *Bergenia crassifolia* (L.) Fritsch: Used as tea substitutes.
- (b) *Clematis hexapetala* Pall.: The locals widely use it as tea substitutes.
- (c) *Geranium pseudosibiricum* J. Mayer: Local people widely use it as tea substitutes.
- (d) *Paeonia anomala* L.: People use it in the same way as the previous species (note: the earlier species in FPM was *Paeonia lactiflora*).
- (e) *Potentilla fruticosa* L.: Local people used it as tea substitutes since ancient times.
- (f) *Rosa acicularis* Lindl.: Used as tea substitutes.
- (g) *Sanguisorba officinalis* L.: Leaves and roots are used as tea substitutes.

Tea substitutes are sourced from leaves, roots, and the aboveground parts of possibly eight species of wild plants, accounting for 22.85% of all edible plant species (Table 5). Drinking milk tea had become one of the characteristics of the Mongolian diet and culture. Mongols have been drinking brick tea (a type of compressed tea) for a long time. The habit of drinking tea can be seen as the direct driving force of choosing and using tea substitutes from local wild plants by Mongol people. The tea substitutes sourced from the wild can relieve the shortage of tea when the brick tea may be unavailable for purchase in a period.

Table 5. Ethnobotanical inventory of tea substitutes in FPM

Scientific name	Local name (in Mongolian Cyrillic)	Parts used
<i>Bergenia crassifolia</i> (L.) Fritsch.	бадан	not described in FPM; could be aboveground parts
<i>Clematis hexapetala</i> Pall.	Зогдыр	not described in FPM; could be aboveground parts
<i>Geranium pseudosibiricum</i> J. Mayer	мягмасанжа, дугур хорло	not described in FPM; could be aboveground parts
<i>Paeonia anomala</i> L.	цаган цэнэ, цэнэ, мандарвь цэцэг	roots, follicle
<i>Paeonia lactiflora</i> Pall.	цаган цэнэ, цэнэ, мандарвь цэцэг	roots, follicle
<i>Potentilla fruticosa</i> L.	шуур борольцэган шуур, бурягул, далан халис	not described in FPM; could be aboveground parts
<i>Rosa acicularis</i> Lindl.	нохойн хушу, улан халахаг	not described in FPM; could be leaves
<i>Sanguisorba officinalis</i> L.	сюдэ убс,суд	leaves and roots

Plant roots such as *Sanguisorba officinalis* were reported as a vital food source whose dietary use could be traced back to the end of the 12th century [18]. *Clematis hexapetala* (stems & leaves), *Paeonia lactiflora* (Follicle without seed) and *Sanguisorba officinalis* (roots & stems) were reported as traditional tea substitutes of the Mongols in Inner Mongolia [11]. The Mongols in Arhorchin Banner have been using *Clematis hexapetala* stems and leaves, *Paeonia lactiflora* follicle, and *Sanguisorba officinalis* roots, stems for viable tea substitutes. However, *Potentilla fruticosa* and *Rosa acicularis* were reported with lesser use, and an alternative species of *Potentilla chinensis* Ser. (aboveground parts) and *Rosa davurica* Pall. (leaves, flowers, fruits) might have been used as tea substitutes [1,12]. Also, *Sanguisorba officinalis* L. roots stems were reported as preferred tea substitutes by Mongols in Xilingol League. However, they tended not to use *Potentilla fruticosa*, but, instead, an alternative species of *Potentilla anserina* L. (leaves) [4].

Wild seasonings

The original records of wild seasonings in FPM were translated as follows:

(a) *Allium lineare* L.: Seasoning in soups and meats when fresh and dry.

- (b) *Allium mongolicum* Regel: Gobi herders especially like to use fresh or dried (crushed) *Allium mongolicum* as meat seasoning. In this regard, herders prefer *Allium mongolicum* to *Allium polyrhizum*.
- (c) *Allium polyrhizum* Turcz. ex Regel: Sometimes, people use it for seasoning food.
- (d) *Nepeta annua* Pall.[*Schizonepeta annua* (Pall.) Schischk.]: Seeds are used as flavoring for meat.
- (e) *Polygonum viviparum* L.: Cooked as a seasoning for meat.
- (f) *Saposhnikovia divaricata* (Turcz.) Schischk: The local people use the seeds as seasoning of meat.
- (g) *Sisymbrium heteromallum* C. A. Mey.: In the Gobi Altai region, its seeds are used as pungent condiments in food.

Seasonings from wild source consist of the parts of plants from seeds, rhizomes, tender leaves (possibly), comprising seven species of wild plants, accounting for 20.00% of all edible plant species (Table 6).

Table 6 Ethnobotanical inventory of wild seasonings in FPM

Scientific name	Local name	Parts used
<i>Allium lineare</i> L.	гогод	not described in FPM; could be tender leaves
<i>Allium mongolicum</i> Regel	хумуль	not described in FPM; could be tender leaves
<i>Allium polyrhizum</i> Turcz. ex Regel	тан (таан)	not described in FPM; could be tender leaves
<i>Nepeta annua</i> Pall.	бивилинг, вандуй	seeds
<i>Polygonum viviparum</i> L.	мэхэр	rhizomes
<i>Saposhnikovia divaricata</i> (Turcz.) Schischk.	гонид	seeds
<i>Sisymbrium heteromallum</i> C.A.Mey.	борбот	seeds

The tender leaves of *Allium polyrhizum* were consumed as vegetables or inflorescens as seasonings by Mongols in Arhorchin Banner [1]. However, in Xilingol League, Mongols used tender leaves of *Allium mongolicum* and *Allium polyrhizum* as vegetables and seasonings [4]. In contrast, Mongols from Ordos plateau tended to use the leaves of *Allium mongolicum* as vegetables and seasonings, and inflorescens of *Allium polyrhizum* for seasonings [3]. Ejina Banner were reported to use tender leaves and inflorescens of *Allium mongolicum* as vegetables, and inflorescens of *Allium polyrhizum* as seasonings[2].

Conclusions

It has been seen as early as in the 12th century when *Lilium pumilum*, *Allium ramosum*, *Allium senescens*, *Allium victorialis*, *Malus baccata*, *Sanguisorba officinalis* have been collected and used for food by Mongols. It demonstrates that the knowledge of the application of these plants by Mongolians has a long history, from the Genghis Khan era to the present day, thereby representing significant cultural and historical value.

Meat and milk are the main elements in the traditional diet structure of Mongol herdsmen. The consumption of *Lilium pumilum*, *Allium senescens*, *Allium lineare*, *Nepeta annua*, *Polygonum viviparum*, *Saposhnikovia divaricata* is tightly integrated with the meat and dairy intake of the locals.

There are many differences in the selection and utilization of wild plants among the same ethnic groups in different regions. In the categories of wild grain and grain substitutes, *Agriophyllum squarrosum*, *Psammochloa villosa*, *Rheum nanum* and *Lilium pumilum* shown a significant level of similarities among Mongols in the two countries. Mongols used *Corispermum*, *Kalidium* and *Lilium* genera in both countries, but there had been differences in terms of the exact species. In the categories of wild vegetables, Mongols in both countries used *Allium ramosum*, *Allium senescens*, *Allium victorialis*, *Cynanchum thesioides*, *Pugionium dolabratum* and *Ulmus pumila* for vegetables. Still, sometimes there was a slight difference in intake methods. *Corispermum*, *Kalidium* and *Lilium* were evident in the dietary structure of the Mongols in both countries; however, there were differences in the selected species. In the categories of wild fruit, *Malus baccata* were reported in typical consumption of wild fruit in the two countries. *Nitraria tangutorum* and *Nitraria roborowskii* had seen as wild fruits in Inner Mongolia. *Clematis hexapetala*, *Paeonia lactiflora* and *Sanguisorba officinalis* were popular tea substitutes in both Inner Mongolia and the Mongolia. While, Mongols in both countries had regular consumption of *Potentilla* and *Rosa* with differences in the selected species. Despite that, in the categories of wild seasoning, Mongols in both countries used *Allium mongolicum* and *Allium polyrrhizum* as seasonings ingredients.

Although Yunatov was not an ethnobotanist himself, he faithfully recorded the data obtained from interviews and surveys about the Mongols in Mongolia regarding collection and consumption of local wild plants during 1940–1951. His devotion to the research mission resulted in valuable first-hand knowledge on forage grass, natural feed of livestock, and wild plants for human consumption. Despite there being incomplete information on the edible parts and eating methods of some plants, it should be borne in mind that the content was written more than 70 years ago. As a result, FPM is an invaluable source of historical ethnobotanical information. Even with present-day facilities, it will be challenging to carry out interviews and investigation to such an extent and obtain such rich and varied first-hand information.

Abbreviations

FPM: Forage plants on grazing land and mowing grassland in the People's Republic of Mongolia.

Declarations

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Authors Contributions

The data collection were conducted by Y, W, S, and K. The data analysis and manuscript preparation were made by Y and K. All authors read and approved the final manuscript.

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Availability of data and materials

We have already included all data in this manuscript.

Ethics approval and consent to participate

Permissions were provided by all participants in this study. The authors have all copyrights.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Figures



Figure 1

Yunatov A. A. (1910-1967), Source:[24]

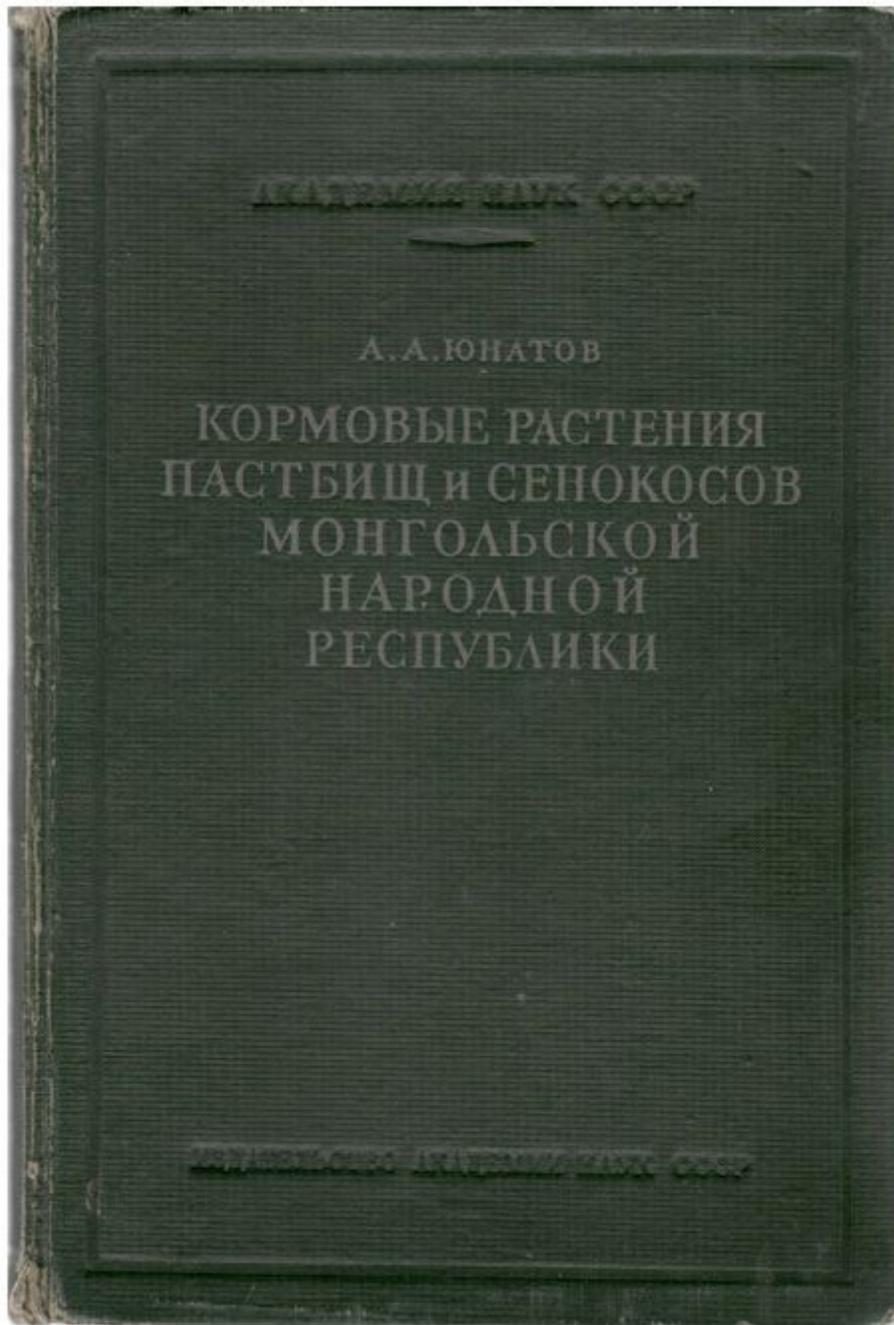


Figure 2

Original edition FPM, 1954 (scanned by Khasbagan)

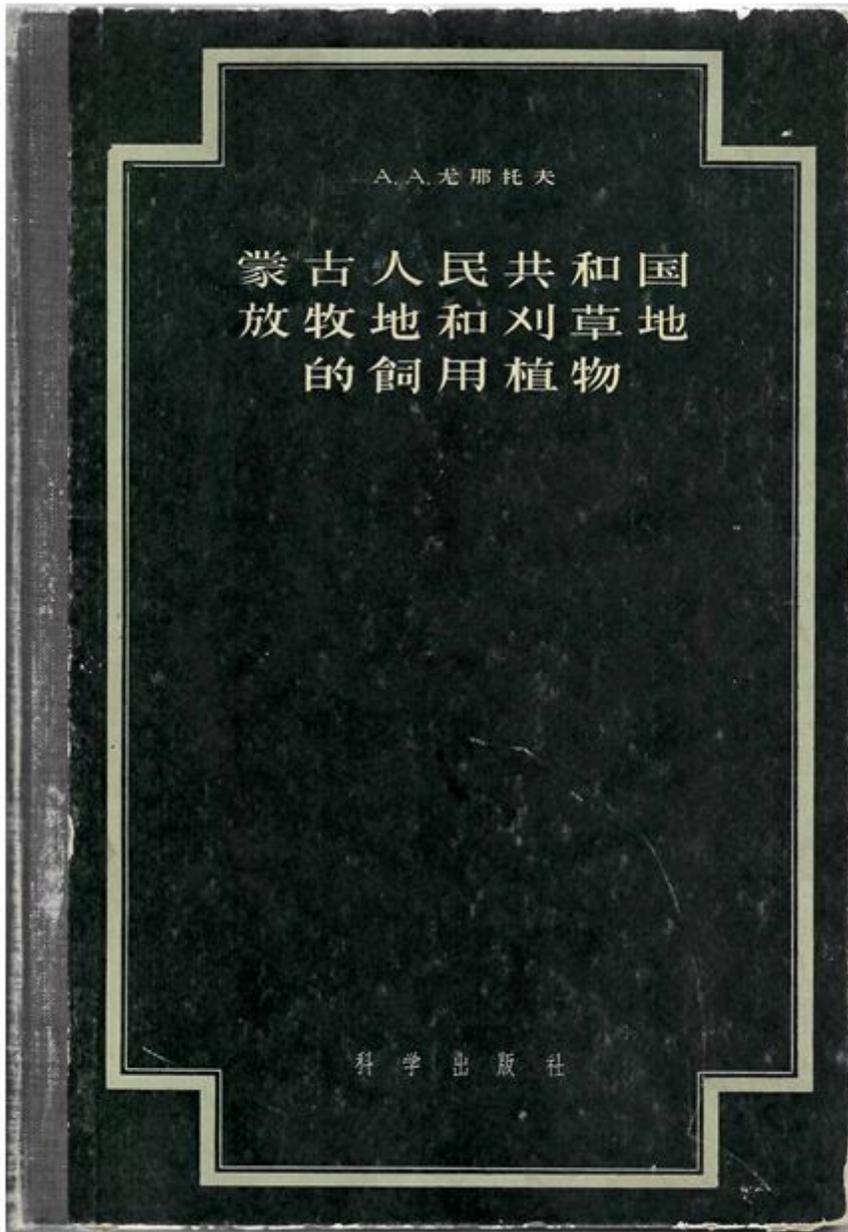


Figure 3

Chinese version of FPM, 1958 (photocopy scanned by Khasbagan)

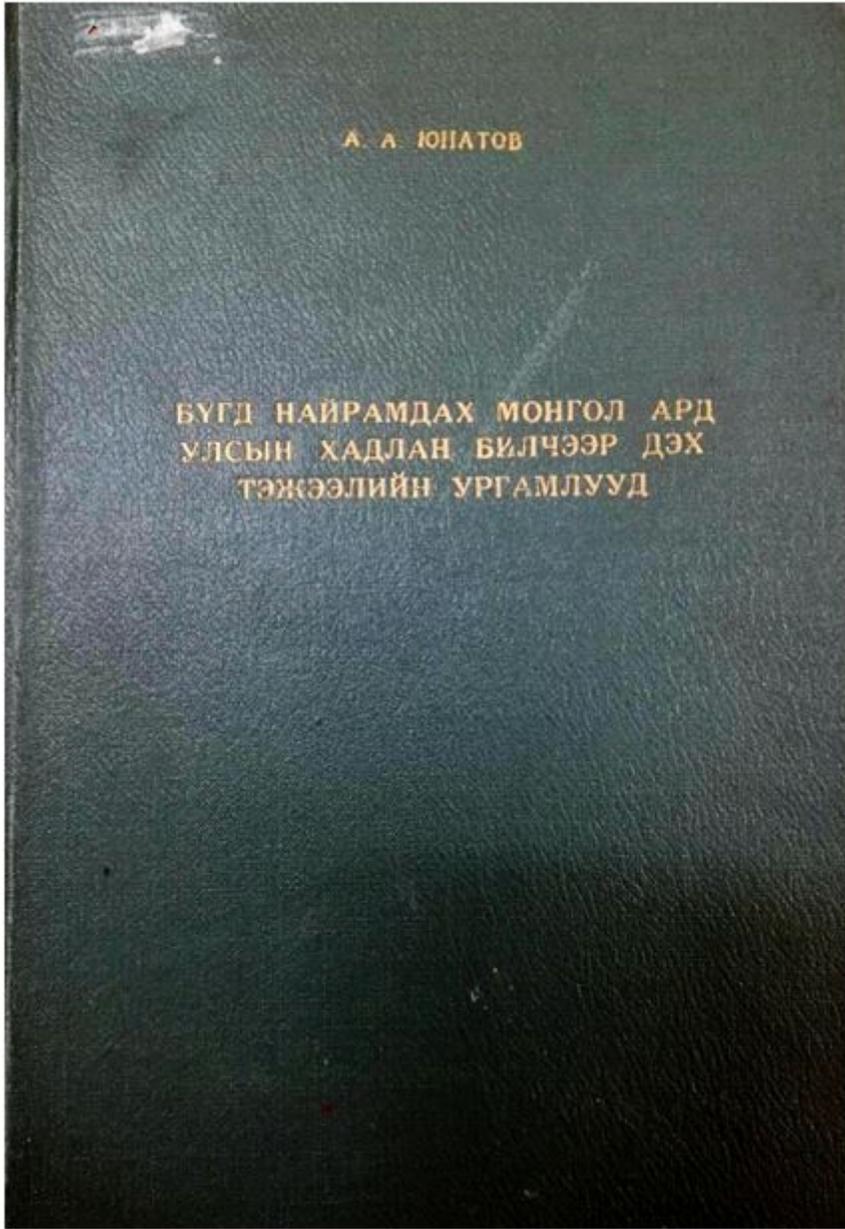


Figure 4

Cyrillic Mongolian version of FPM, 1968 (photocopy scanned by Khasbagan)



Figure 5

Yunatov was interviewing Mongolians, Source:[24]



Figure 6

Yunatov and the Mongolians in the field, Source:[24]