



Selected Non-Timber Forest Products with Medicinal Applications from Jilin Province in China

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Abstract.—This paper provides a brief account of the distribution, production, and use of some non-timber forest products such as medicinal plants, medicinal and nutraceutical mushrooms, pharmaceutical insects, and “wild” vegetables in Jilin Province, China. All materials featured in this paper are used in Traditional Chinese Medicine (TCM) inside and outside of China. Given the similarities in environmental conditions between Saskatchewan and Jilin, the information provided herein may be used in assessing the potential of Saskatchewan wild plants for similar developments in the Canadian prairies.

Saskatchewan and the Province of Jilin, China, signed a twinning agreement on collaboration in agriculture research in 1984, which was extended in 1995 to include traditional medicine component. Saskatchewan Agriculture and Food and the University of Saskatchewan are attempting to evaluate production and harvesting potential of Saskatchewan native plants, as well as other herbs, for developments into economically viable crops in the province. The establishment of the Herb Research Program in 1994 was an important step in this process. Collaboration with experts from countries with a long tradition in herbal medicine, such as China, is considered invaluable in advancing herb research and industry development in Saskatchewan, particularly in the area of Traditional Chinese Medicine (TCM), which is being increasingly accepted in North America. In China, many of natural medicinal and nutraceutical materials could be classified as non-timber forest products, since they are

either collected from forested areas or cultivated under conditions that closely simulate forest environment.

Jilin Province is located in the central part of Northeast China, has a territory of 187,400 square kilometers, and a population of 25 million (Department of Agriculture, Jilin Province 1997). Jilin is a major agricultural province and one of grain baskets of China. It is surrounded by mountains in the east, plains in the center, and grasslands in the west. It has a continental monsoon climate, four distinct seasons, and abundant rainfall. Jilin is one of the six major forest regions in China. It has 7.9 million hectares of forest plantations and is the third largest in the country (Jilin Province Leading Group of Foreign Capital Utilization Office, Foreign Investment Administration & Service Center 1997). It has the country's highest production of ginseng. Of 2,700 species of wild plants, 900 species are medicinal herbs and 80 species are medicinal and nutraceutical mushrooms. Most of them grow in the forested areas. For example, *Ganoderma lucidum* (Ling Zhi), *Gastrodia elata* (Tian Ma), *Astragali radix* (Huang Qi), and evening primrose are well known throughout the world, while *Hedgehog hydnum* (Hou Tou) is very popular in China.

It is well established that tradition of using herbal medicine goes back thousands of years in China. China is one of the largest medicinal herb material markets in the world, and forest area in Jilin Province is one of the most important production bases for medicinal herb material in China. For that reason, a unique

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college in the field of Traditional Chinese Medicinal herb materials, College of Chinese Medicinal Materials and National Institute of Local Products, have been established in the city of Changchun, Jilin Province.

Jilin has its own medicinal herb material distribution and selling system. The medicinal herb materials are mainly sold through the Chinese Medicinal Material Companies that are supplied by a network of smaller branches in several cities, counties, and towns throughout the Province. In some instances, the buyers of pharmaceutical factories buy medicinal materials directly from farmers and collectors. Many materials are also exported. Due to an increased demand for natural over synthetic pharmaceuticals in developed countries in recent years, the U.S.A., Germany, Japan, and Korea in particular have become large and lucrative international markets for medicinal herb materials from Jilin. The medicinal herb materials characterized as non-timber forest products (NTRPs) in China are listed in table 1. The following are the main NTRP products cultivated or collected in Jilin Province and sold worldwide.

Table 1.—List of selected medicinal herb materials originating from China¹

Herb	Powder	Extract	Price (FOB China) \$US/kg	Package
Siberian ginseng			13.5	25 kg/tub
Grape seed			165	5 kg/iron tin
Pine bark			190	5 kg/iron tin
Puerariae			33 - 40	25 kg/tub
Horsetail			14	25 kg/tub
Ginseng			80	25 kg/tub
Schisandra chinensis			18	25 kg/tub
Astragalus			17	25 kg/tub
Hawthorn			14	25 kg/tub
Polygonum multiflorum			24	25 kg/tub

¹ The prices provided by China Tiancheng Drugs & Bio-engineering Co., April, 1999.

MEDICINAL PLANTS

Ginseng (*Panax ginseng* and *Panax quinquefolium*)

Ginseng is the root, or root with rhizome, of two *Panax* species (*Araliaceae*) cultivated in Jilin Province: Oriental ginseng and North American ginseng. Oriental ginseng (Ren Shen) (*Panax ginseng* C. A. Meyer) is a native plant that has also been cultivated in China for more than 1,660 years (Huang *et al.* 1995a). The main active compounds in Oriental ginseng include ginsenosides Ro, Ra, Rb₁, Rb₂, Rc, Rd, Re, Rf, Rg₁, Rg₂, Rg₃, panaxynol, panaxdol, β-elemene, γ-elemene, and panaxans (Cui *et al.* 1996, Li and Huang 1994). The pharmacological properties of Oriental ginseng include: (1) acting on the central nervous system including excitation and inhibition processes; (2) exerting significant cardiotoxic and hypertensive effects on acute circulatory failure after heavy blood loss; (3) decreasing the level of blood sugar; (4) promoting phagocytosis and enhancing lymphocyte blastogenesis rate; (5) antiaging and improving memory (Kim 1996). Oriental ginseng is used to treat cardiovascular diseases, gastritis, hepatitis, diabetes, and neurasthenia and is particularly used during the recovery from major surgery. More recently, it has been used for treating gastric carcinoma, cervical cancer, uterine cancer, and leukemia.

Oriental ginseng is a perennial herbaceous plant. It likes a shady and cool environment, and sandy loam with rich organic matter. The optimal temperatures for the growing period range from 20 to 25°C and the optimal soil moisture content ranges from 40 to 60 percent. The yield of Oriental ginseng varies greatly, generally from 1 to 5 kg/m² (Yang 1993), depending on the cultivation situations. Oriental ginseng is usually processed as white ginseng (*Radix ginseng cruda*) (dried under the sun or in the oven), red ginseng (*Radix ginseng rubra*) (steamed and dried), sugar ginseng, ginseng powder, ginseng honey slice, ginseng extract powder, ginsenosides, ginseng cake, ginseng candy, ginseng soft drink, ginseng tea, ginseng liquor, and ginseng cigarettes (Jiangsu Medical College 1985). Jilin ginseng is very famous for its good quality and is sold inside



and outside of China. It is mainly exported to Southeast Asia, Japan, Europe, and North America. The price of Oriental ginseng ranges from \$US 50 to 60/kg and Oriental ginseng extract powder is sold for \$US 80/kg.

North American ginseng (Xi Yang Shen) (*Panax quinquefolium* L.) originated from North America and was introduced to Jilin Province from Canada in 1976 (Huang *et al.* 1995a). The germination of American ginseng seed is very difficult and slow (Huang *et al.* 1995a, 1995b). Under natural conditions, it takes 18 to 22 months for seeds to germinate upon harvest (Huang *et al.* 1996a, 1997b; Jo *et al.* 1998). Studies of the dormancy mechanism (Huang *et al.* 1995b, 1996a, 1997b, 1998) resulted in the identification of a germination-accelerating technology (Huang *et al.* 1995a, 1995b) that enabled seed to germinate within 7 to 8 months. The main active compounds in North American ginseng are ginsenosides Ro, Ra₀, Rb₁, Rc, Rd, Re, Rf, Rg₁, and Rg₂. However, the content of total ginsenosides is higher in North American ginseng than in Oriental ginseng, which is particularly true for Rb₁. The ginsenosides Rb₁ and Re constitute 50 percent of the total ginsenosides in North American ginseng (Li and Huang 1994). In China, North American ginseng is used for treating hypertension, coronary heart diseases, loss of blood, and pneumonia. North American ginseng is a perennial herbaceous plant that grows best in a shady and cool environment and in sandy loam with rich organic matter. The optimal temperatures for growing range from 18 to 24°C and optimal soil moisture ranges from 40 to 55 percent. The average yield of North American ginseng is 1 kg/m² (Yang 1993). It is processed as white ginseng (*Radix ginseng cruda*) (dried under the sun or in the oven), but not as red ginseng and sugar ginseng. Sometimes, it is processed as ginseng tea in China. It is mainly exported to Southeast Asia at a price of \$US 85 to 145/kg.

Gastrodia (*Gastrodia elata*)

Gastrodia (Tian Ma) is the tuber of *Gastrodia elata* Bl. (*Orchidaceae*) grown in symbiosis with fungi *Armillaria mellea* (Vahl ex. Fr.) Quel. It has been cultivated in Jilin Province for many years. The cultivation efficiency of this medicinal plant has improved considerably since

1976 (Yang 1993). The main compounds in Gastrodia tuber are gastrodin, vanillyl alcohol, vanillin, and some alkaloids (Li and Huang 1994). The pharmacological activities of this plant include: (1) sedative, hypnotic, and antispasmodic effects; (2) increase in blood flow and decrease in peripheral resistance of blood vessels. It is used for infantile convulsion, tetanus, epilepsy, dizziness as well as migraine and arthralgia (neuralgic pain in joints). More recently, it has also been used for treating neurasthenia and hypertension. Gastrodia is a perennial herbaceous saprophyte. It grows well in cool environmental half-shady, half-sunny locations with high humidity, and humus loam rich in organic matter. The optimal soil temperatures range from 18 to 23°C and optimal soil moisture ranges from 30 to 40 percent. Wild Gastrodia can usually be found in a jungle-like environment at elevations from 1,000 to 2,500 m. The yield of Gastrodia tuber varies greatly depending on the cultivation conditions, generally from 0.3 to 1.8 kg/m² (Yang 1993). Prior to marketing, Gastrodia tubers are washed, peeled, boiled together with millet, and dried (Li 1991). The crude Gastrodia tubers are mainly exported to Southeast Asia and Japan at a price of \$US 10/kg.

Radix Astragali (*Astragalus membranaceus*)

Radix astragali (Huang Qi) is the root of *Astragalus membranaceus* (Fisch.) Bunge var. *Mongholicus* (Bunge) Hsiao or *Astragalus membranaceus* (Fisch.) Bunge (*Leguminosae*). It is cultivated in Jilin Province. The main compounds in Radix astragali are astragaloside I, V, and VII, choline, betaine, kumatakenin, and polysaccharide (Jiangsu Medical College 1985). Its pharmacological activities include: (1) increasing the amount of leukocytes and polymorphocytes in peripheral blood and promoting lymphocyte-blastogenesis; (2) healing skin ulcers; (3) acting as a cardiogenic; (4) dilating coronary artery and capillaries. It is used for treating loose stools, fatigue and bleeding, hysteroptosis or gastroptosis, common cold in debilitated patients, ruptured abscess, skin erosion, wound healing, and skin infection. More recently, it has been used for peptic ulcer and atrophic gastritis, edema, diabetes, partial body paralysis, asthma and for treating hepatoma, cervical cancer and lung cancer as well (Ou 1992).

Radix astragali is a perennial herbaceous plant. It grows in the wild on sunny and dry hillsides or under thin forest. The plant is generally adaptable to growing conditions and is relatively easy to cultivate. It grows well in sandy, well-drained, somewhat alkaline soil (Foster and Chongxi 1992). The yield of Radix astragali depends on growing conditions, and the range of yields is quite wide according to the cultivation situations, generally ranging from 0.2 to 0.8 kg/m² (Yang 1993). The processing of Radix astragali includes washing, drying, and slicing. It is mainly exported to Southeast Asia, Korea, and Japan in crude form at an average price of \$US 6-7/kg. It is also sold as a powdered extract for \$US 17/kg.

Herba Asari (*Asarum heterotropoides*)

Herba asari (Xi Xin) is the whole plant of *Asarum heterotropoides* Fr. Schmidt var. *mandshuricum* (Maxim) Kitag (*Aristolochiaceae*). It is cultivated mainly in Jilin Province. The main compounds in Herba asari include dl-demethyl coclaurine, safrole, methy leugenol, β -pinene, eucarvene, asarylketone, cineole, ι -asarinin (Li and Huang 1994). Its pharmacological actions include: (1) sedative, analgesis, antipyretic effects; (2) induces anesthetic effect on the sciatic neuroplexus of frogs and human lingual mucosa when used as an alcoholic infusion; (3) acts as a cardiotoxic and vasodilator and can also relax smooth muscles, accelerate lipid metabolism, and raise blood sugar level (effect of dl-demethyl coclaurine); (4) antimycotic (effect of safrole). It is used for treating common cold, headache, toothache, arthralgia, and cough. It can be used to wake a person from unconsciousness and to induce sneezing.

Herba asari is a perennial herbaceous plant. In the wild, it grows in rich loam soil or under thin forest canopy, and it likes lots of moisture. Typically, the yield of dry root is 0.8 to 1.2 kg/m² (Yang 1993). It is minimally processed, cleaned without washing, dried in the shade (Xu *et al.* 1997), and sold largely in China at a price of \$US 10/kg. Powdered extract is sold for \$US 17/kg.

Some of the other medicinal plants produced in Jilin Province include evening primrose (*Oenothera odorata* Jaeq.) (Yue Jian Cao), used for cardiovascular diseases; red-spotted stonecrop (*Rhodiola sachalinensis* A. Bor) (Gao

Shan Hong Jing Tian), used for eliminating tiredness; bulaocal (*Boschniakia rossica* Fedtsch. et Flerov) (Cao Cong Rong), used for improving male sexual ability; and fructus schisandrea (*Schisandra chinensis* (Turcz.) (Wu Wei Zi), used for insomnia and neurasthenia.

All plants mentioned above are used as medicinal materials in Traditional Chinese Medicine inside and outside of China.

MEDICINAL AND NUTRACEUTICAL MUSHROOMS

Ganoderma (*Ganoderma lucidum*)

Ganoderma (Ling Zhi) is the sporophore of *Ganoderma lucidum* (Leyss. ex Fr.) Karst. (*Polyporaceae*). Its medicinal uses have been recorded since the 11th century B.C. At the present time, it is cultivated in the manmade biofactory in Sulan County, Jilin Province. Its main constituents are organic germanium; polysaccharides BN₃C₁, BN₃C₂, BN₃C₃, and BN₃C₄; ganoderic acids A, B, C₁, C₂, D₁, D₂, E₁, E₂, F, G, H, I, J, T, U, W, X, Y, and Z; lucidenic acids A, B, C, D₁, D₂, E₁, E₂, and F; ganolucidic acids A, B, and C; acid protease, lysozyme, trehalose, and ergosterol (Li *et al.* 1996). Its pharmacological properties include: (1) acting as a sedative and analgesic; (2) increasing the tolerance of cold and anoxia in experimental mice; (3) exerting mild and prolonged hypotensive effect in rabbits; (4) protecting the liver in mice and decreasing the level of serum glutamic-pyruvic transaminase (SGPT); (5) decreasing blood sugar level; (6) acting as an antitussive and expectorant. The ganoderma is used for insomnia, amnesia, dullness, cough, and difficulty in breathing. Recently, it has also been used for hyperlipemia, hypertension, coronary heart diseases, arrhythmia, leukocytopenia, hepatitis, antiaging, and for some forms of cancers such as lung, esophagus, gastric, and nasopharyngeal carcinoma.

Ganoderma is a saprophytic fungus that thrives in an environment with high temperatures (24 to 30°C) and high relative humidity (85 to 90 percent). Wild ganoderma can be found beside tree stumps under the broadleaf tree forest. Cultivated ganoderma can produce 1 to 1.5 kg of dry product per 100 kg of media (Li 1996). Ganoderma can be processed into powder, extract, polysaccharides, health foods



and beverages, candy, liquor, makeup, shampoo, and so on (Huang 1992, Ou 1992). The crude ganoderma is mainly exported to Southeast Asia and Korea at a price of \$US 4.5/kg.

Hedgehog Hydnum (*Hericium erinaceus*)

Hedgehog hydnum (Hou Tou) is the sporophore of *Hericium erinaceus* (Bull. ex Fr.) Pers. (*Hydnaceae*). This mushroom has been cultivated in the manmade biofactory in Duenhua County of Jilin Province since the 1960's (Jiang 1992). Hedgehog hydnum contains mainly polysaccharide and polypeptides (Li *et al.* 1996). The pharmacological activities of hedgehog include: (1) inhibiting synthesis of DNA and RNA in cancer cells; (2) inhibiting sarcoma₁₈₀ and Ehrlich-Ascites tumor *in vitro*. It is used for peptic ulcer, chronic gastritis, and more recently for the cancers of the esophagus, stomach, and intestines. Wild hedgehog hydnum can be found on walnut and oak trees. The optimal growing conditions for hedgehog hydnum are temperatures from 22 to 28 °C and relative humidity from 85 to 95 percent (Li *et al.* 1996). A single fresh hedgehog hydnum weighs from 60 to 100 g. It can be processed into candy, beverage, extract, liquor, and so on (Li *et al.* 1996). The crude hedgehog hydnum is mainly exported to Southeast Asia and Korea at a price of \$US 15-17/kg.

Indian Bread (*Poria cocos*)

Indian bread (Fu Ling) is the dry sclerotium of the fungus *Poria cocos* (Schw.) Wolf (*Polyporaceae*). It has been cultivated in Jilin Province for many years. Its main compounds include several organic acids, pachymic acid, tumulosic acid, eburicoic acid, pinicolic acid, 3 β -hydroxylahosta-7,9 (11), 24-trien-21-oic acid, and polysaccharides pachyman and pachymeran (Li and Huang 1994). The pharmacological activities of Indian bread include: (1) enhancing macrophage phagocytosis in mice (pachyman) and lymphocyte-blastogenesis rate *in vitro*; (2) preventing gastric ulcer formation under stress in rats; (3) acting as diuretic and liver-protective. Indian bread is used for edema, dysuria, leucorrhagia, cough, jaundice, palpitation, insomnia, and chronic schizophrenia. Recently, it has also been used for treating many types of malignant tumors.

The fungus can be found on roots in pine forests at elevations of 700 to 1,000 m. It grows well in sandy loam at high temperatures (22 to 28 °C) and dry environment. The yields of fresh Indian bread range from 5 to 30 kg per cut pine root (Li *et al.* 1996). Indian bread can be processed into cake, pie, makeup, liquor mixed with ginseng, liquor mixed with *Radix astragali*, polysaccharides (Li 1985, Wei 1996). The crude Indian bread is mainly exported to Southeast Asia and Korea at a price of \$US 4.5-6/kg.

Agaric (*Polyporus umbellatus*)

Agaric (Zhu Ling) is the dry sclerotium of *Polyporus umbellatus* (Pers.) Fries (*Polyporaceae*). Although it has a long history of use as a medicine in China—more than 2,500 years—it has not been cultivated yet. In Jilin Province, it is collected in forests at elevations 1,200 ~ 2,200 m. Agaric's main compounds are ergosterol, α -hydroxy-tetracosanoic acid, biotin, and polysaccharides (Li and Huang 1994). The pharmacological activities include: (1) inhibiting sarcoma₁₈₀ and hepatic carcinoma in mice (polysaccharide); (2) enhancing macrophage phagocytosis and lymphocyte-blastogenesis rate; (3) acting as a diuretic. It is used for edema, dysuria, leukorrhea, jaundice, stranguria, urinary stone, and chronic hepatitis. Injections of agaric polysaccharides are used together with chemotherapy and radiotherapy for cancers of the lung, liver, and acute leukemia.

Agaric grows under the soil surface and prefers soil with high organic matter. Under optimal growing conditions (soil temperatures of 12 to 20 °C and soil moisture of 30 to 50 percent), it yields 2 kg of fungus per 70 cm x 70 cm x 50 cm cell. Agaric is considered as one of the best anticancer fungi. It is mainly exported in sliced and dry form (Li *et al.* 1996) to Southeast Asia and Korea at a price of \$US 4.5-7/kg.

Other medicinal and nutraceutical mushrooms produced in Jilin Province and used mainly as food and for anticancer activities include: paddy straw mushroom [*Flammulium velutipes* (Curt. ex Fr.) Sing.] (Jin Zhen Gu), champignon [*Lentinus edodes* (Berk.) Sing.] (Xiang Gu), tremella (*Tremella fuciformis* Berk.) (Yin Er) (also used for cough), and Jew's ear [*Auricularia auricula* (L. ex Hook.)] (Hei Mu Er) (used as food and recommended for people working in mining, chemical, and textile industries (Li *et al.* 1996).

PHARMACEUTICAL INSECTS

Ground Beetle (*Eupolyphaga sinensis*)

Ground beetle (Tu Bie), presently reared in Jilin, refers to the whole body of dry female adult of *Eupolyphaga sinensis* Waller (Blattodea: Corydiidae). Beetles are killed with boiling water, and female insects are selected and dried for medicinal application (Zhu 1994). The main known compounds in ground beetle are naphthalene, volatile oil, alkaloid, fatty aldehyde, aroyl aldehyde, and camphor (Jiangsu Medical College 1985). The pharmacological activities include: (1) activity against L1210, P388, and SNU-1 cancer cells *in vitro*; (2) 126 percent increase in lifespan of S_{180} mice during 60-day *in vivo* tests with boiling water fraction (Huang *et al.* 1996b, Huang *et al.* 1997a). Ground beetle is used for trauma, fracture, anemia, hepatosplenomegaly, extrauterine pregnancy, chronic hepatitis, and pulmonary tuberculosis. More recently, it has been used for some cancers like nasopharyngeal carcinoma, melanoma, and uterine and ovarian cancer. The crude ground beetle is mainly exported to Southeast Asia and Korea for \$US 7 to 8/kg.

Batryticated Silkworm (*Bombyx mori*)

Batryticated silkworm (Jiang Can), presently collected in the wild and reared in Jilin, is the larvae in the fourth and fifth stages of development of *Bombyx mori* L. (Lepidoptera: Bombycidae) parasitized by a fungus *Beaveria bassiana* (Bal.s) Vuill. Prior to use as a medicine, batryticated silkworm is dried by quick exposure to lime. Its main known compounds are chitinase, bassianins, beauvericin, corticoids, ecdysterone, and 3-hydroxykynurennine (Jiangsu Medical College 1985). Pharmacological activities of batryticated silkworm include: (1) sedative and hypnotic effect in mice (at oral dose of 2.5 g/kg similar to hypodermic injection of phenobarbital at 50 mg/kg); (2) cytotoxic activity shown against L1210, P388, and SNU-1 cancer cell lines *in vitro* (Huang *et al.* 1996b); (3) increased lifespan of S_{180} mice at 80.2 percent during 60-day test *in vivo*. Batryticated silkworm is used for convulsion, epilepsy, tetanus, apoplexy, headache, ocular pain, sore throat, prurigo, urticaria, psoriasis, asthma, rheumatoid arthritis, diabetes, gastric cancer, and laryngocarcinoma. The crude batryticated silkworm is mainly exported to Southeast Asia and Korea for \$US 7 to 8/kg.

Blister Beetle (*Mylabris calida*)

Blister beetle (Yuan Qing) refers to the dry adult of *Mylabris calida* Pallas (Coleoptera: Meloidae). In Jilin, blister beetle is not reared but collected in the wild. It is typically consumed as fried with rice. Cantharidin, its main active compound (Jiangsu Medical College 1985), has been shown to display strong cytotoxic activity against L1210, P388, and SNU-1 cancer cells *in vitro*; corresponding ED_{50} were 0.62, 1.05, and 0.58 mg/ml, respectively (Huang 1997a). Cantharidin also inhibits S_{180} reticulothelioma and ascitic hepatocarcinoma in *in vivo* tests; it also inhibits synthesis of DNA, RNA, and protein. It is used for rabies, externally for carbuncle, scabies, leukoplakia of vulva, distortion of the face, and more recently, for gastric, liver, and esophageal cancer, lingering and chronic hepatitis, tuberculosis of bone and lymph node, and rheumatism. The crude blister beetle is exported mainly to Southeast Asia and Korea at a price of \$US 4/kg.

Fuscous Ant (*Formica fusca*)

Fuscous ant (Ma Yi) refers to the dry adult of the worker ant of *Formica fusca* L. (Hymenoptera: Formicidae). It is artificially reared and/or collected in Jilin Province, then killed in steam (not fried or boiled) and dried (Wu 1994). The main compounds of Fuscous ants are aliphatic hydrocarbons, formic acid, farnesene, isoxanthopterin, 2-amino-6-hydroxypteridine, and biopterin (Wu 1994). Its pharmacological activities include: (1) anticancer activity against L1210, P388, and SNU-1 cancer cell lines *in vitro* (Huang *et al.* 1997a); (2) antiphlogistic activity; (3) antiaging in mice test; (4) recovering the immunity of old mice. Fuscous ant is used for rheumatoid arthritis, chronic hepatitis, sex functioning obstruction, postponing senescence, and diabetes. The crude fuscous ant is mainly sold in China at a price of \$US 7/kg.

Other pharmaceutical insects collected in Jilin are tabanid (*Tabanus mandarinus* Schiner) (Mang Chong) for cervical cancer; dung beetle (*Catharsius molossus* L.) (Qiang Lang) for many kinds of cancers; cockroach (*Periplanete americana* L.) (Zhang Lang) for hepatoma, gastric carcinoma, and esophageal cancer; mole cricket (*Gryllotalpa africana* Pal. de Beauvois.) (Lou Gu) for edema.



The pharmaceutical insects mentioned above are approved for use as materials for both Traditional Chinese Medicine and health products in China.

WILD VEGETABLES

Brachen (*Pteridium aquilinum*)

Brachen (Jue Cai) refers to the tender leaves of *Pteridium aquilinum* (L.) Huhn var. (Desv.) Underw. ex Heller (Pteridaceae), a perennial herbaceous plant that grows in rich soil and sunny locations close to the forest. It is cultivated in Jilin Province. Every 100 g of fresh brachen contains 1.6 g protein, 0.4 g fat, 10 g carbohydrates, 1.3 g crude fiber, 1.68 mg carotene, and 35 mg of vitamin C. A gram of dry brachen contains 11.89 mg Ca, 2.18 µg P, 617.40 µg Fe, 16.58 µg Cu, 388.20 µg Zn, and 44.50 µg Mn (Dong 1997). It is used in dishes with beef or chicken, as a salad with green onions, and is used to treat jaundice and insomnia. It is washed for 1 minute in boiling water and for 7 - 8 hours in cold water prior to cooking, or dried after a 1 minute wash in boiling water. It is exported mainly to Japan and Korea for \$US 2.5/kg.

Cinnamon Fern (*Osmunda cinnamomea*)

Cinnamon fern (Zi Qi) refers to the tender leaves of *Osmunda cinnamomea* L. var. *asiatica* Fernald., a perennial herbaceous plant that can be found in wet places under the forest. It is also cultivated in Jilin Province. Every 100 g of fresh cinnamon fern contains 1.97 mg carotene, 0.25 mg of vitamin B², and 69 mg of vitamin C. Each gram of dry plant contains 31.2 mg K, 1.9 mg Ca, 2.93 mg Mg, 7.11 mg P, 0.51 mg Na, 125 µg Fe, 81 µg Mn, 62 µg Zn and 18 µg Cu (Dong *et al.* 1997). It can be cooked with pork, snake, or fish spiced with ginger. It is used to treat cough, cold with fever, increased menstruation, rheumatism, intestinal cancer, gastric carcinoma, and hepatoma. Cinnamon fern needs to be washed, kept for 24 hours in cold water, and cooked or canned. Alternatively, it can be washed for 1 minute in boiling water and dried (Zhang 1997). It is exported mainly to Korea and Japan for \$US 2.5/kg.

Balloonflower (*Platycodon grandiflorum*)

Balloonflower (Jie Geng) refers to the root of *Platycodon grandiflorum* (Jacq.) A. DC. (*Campanulaceae*), a perennial herbaceous plant cultivated in Jilin Province. It grows well at warm temperatures (20 °C) and relatively high moisture; dry product yield is 0.2 to 0.3 kg/m². Every 100 g of fresh balloonflower roots contains 14 g starch, 0.9 g protein, 3.19 g crude fiber, 10.00 mg of vitamin C, and 0.44 mg of vitamin B₂ (Dong 1997). It is used in cooking as sweet and sour balloonflower, balloonflower with hot pepper and pork, balloonflower with cucumber and carrot, and balloonflower with tremella to treat sore throat, cough, laryngocarcinoma, and lung and tonsil cancer. Processing involves washing, peeling, soaking in salt water for 24 hours, cooking, drying, or canning (Yang 1993). It is exported mainly to Korea and Japan for \$US 5/kg.

Japanese Aralia (*Aralia elata*)

Japanese aralia (Song Mu) refers to the tender buds of *Aralia elata* (Miq.) Seem, a small arbor tree that grows well in sandy loam and is presently cultivated in Jilin Province. Every 100 g of fresh Japanese aralia contains 5.4 g protein, 0.2 g fat, 4.0 g carbohydrates, 1.6 g fiber, 20 mg Ca, 150 mg P, 1 mg Na, 590 µg K, 1.1 µg Fe, 32 µg Zn, 530IU of vitamin A, 19 mg of vitamin B₁, 0.26 mg of vitamin B₂, and 12 mg of vitamin C (Dong 1997). It is used in cooking with eggs and in sauteed Japanese aril. Japanese aralia buds are used to treat neurasthenia, rheumatoid arthritis, diabetes, nephritis, gastric carcinoma, intestinal cancer, gall bladder cancer, and lung cancer. Processing involves washing of buds for 1 minute in boiling water, followed by 1 to 2 hours in cold water, followed by cooking or canning (Dong 1997). It is exported mainly to Korea at a price of \$US 0.5/kg of fresh product.

Other "wild" vegetables cultivated and/or collected in Jilin Province are dwarf yellow daylily (*Hemerocallis middendorffii* Trautv. et Mey.) (Huang Hua Cai), field sowthistle (*Sonchus brachyotus* DC.) (Qu Mai Ca), dandelion (*Taraxacum mongolicum* Hand Mazz.) (Pu Gong Ying), and shepherdspurse (*Capsella bursa-pastoris* (L.)) (Ji Ji Cai). They are quite popular in China and are often more expensive than cultivated vegetables in Chinese markets. Some are exported to Japan and South Korea every year.

Quite a few species of non-timber forest products are collected or cultivated in Jilin Province, China. Some of them have developed into a new industry already, while others still have great opportunities for growth ahead. We believe that the lessons we've learned about the non-timber forest products in Jilin Province may serve as good background information in planning and developing a viable non-timber forest industry in Saskatchewan.

ACKNOWLEDGMENT

Funding for Dr. Huang was provided by the Agriculture Development Fund of Saskatchewan Agriculture and Food. Dr. Huang is thankful to the College of Chinese Medicinal Materials, Jilin Agricultural University, China, for allowing him a leave of absence.

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