T.K. Lim

Edible Medicinal and Non-Medicinal Plants

Volume 12, Modified Stems, Roots, Bulbs

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Contents

Introduction

This book continues as volume twelve of a multi-compendium on *Edible Medicinal and Non-Medicinal Plants.* It covers such plants with edible modified storage subterranean stems (corms, rhizomes, stem tubers) and unmodifed subterranean stem stolons, above-ground swollen stems and hypocotyls, storage roots (tap root, lateral roots, root tubers) and bulbs that are eaten as conventional or functional food as vegetables and spices, as herbal teas, and may provide a source of food additive or neutraceuticals. A list of such edible plant species from families Acanthaceae to Zygophyllaceae are presented in a tabular form and 32 such edible species from the families Alismataceae, Amaryllidaceae, Apiaceae, Araceae, Araliaceae, Asparagaceae, Asteraceae, Basellaceae, Brassicaceae and Campanulaceae had been covered in detail in preceding volume nine. Nineteen edible species from the families Amaranthaceae, Cannaceae, Cibotiaceae, Convolvulaceae, Cyperaceae, Dioscoreaceae, Euphorbiaceae and Fabaceae had been covered in detail in volume ten and eighteen edible species in the families Iridaceae, Lamiaceae, Marantaceae, Nelumbonaceae, Nyctaginaceae, Nymphaeaceae, Orchidaceae, Oxalidaceae, Piperaceae, Poaceae, Rubiaceae and Simaroubaceae in volume eleven. This present volume twelve covers in detail 21 edible species from the families Solanaceae (1), Tropaeolaceae (1), Typhaceae (2) and Zingiberaceae (17). Other species from these families with edible modified stems, roots and bulbs are listed in Table 1. Many plants with such edible plant parts that are better known for their edible fruits or flowers have been covered in earlier volumes and for those better known for other non-reproductive plant parts will be covered in latter volumes.

As in the preceding eleven volumes, topics covered include: taxonomy (botanical name and synonyms); common English and vernacular names; origin and distribution; agro-ecological requirements; edible plant part and uses; plant botany; nutritive and medicinal/ pharmacological properties with up-to-date research findings, traditional medicinal uses; other non-edible uses; and selected/cited references for further reading.

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Table 1 Plants with edible modified stems, roots and bulbs in the families: Solanaceae, Tropaeolaceae, Typhaceae and Zingiberaceae

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Solanaceae	*Hyoscyamus vulgaris* Neck	NF	In France, starch of root recommended as famine food for extending bread flour, after removal of bitter element	Parmentier (1781) (Cited by Freedman (2009))
Solanaceae	*Jaltomata procumbens* (Cav.) J.L.Gentry	Creeping False Holly, Jaltomate	Roots eaten raw or boiled	Altschul (1973), Facciola (1990)
Solanaceae	*Solanum ajanhuiri* Juz. & Bukasov	Ajanhuri	Root tuber edible	Codex (2014)
Solanaceae	*Solanum berthaultii* Hawkes	Wild Potato	Tubers used like the cultivated potato	Gupta and Kanodia (1968)
Solanaceae	*Solanum candolleanum* Berthault	Gentil Achochil Chocke	Tubers used like the cultivated potato	Gupta and Kanodia (1968)
Solanaceae	*Solanum curtilobum* Juz. & Bukasov	Ckaisallabitter Potatoes	Root tuber edible	Arbizu and Tapia (1994)
Solanaceae	*Solanum demissum* Lindl.	Papa Cimarrona, Papa Del Monte	Tubers cooked and eaten	Facciola (1990)
Solanaceae	*Solanum fendleri* A.Gray	Fendler Potato, Wild Potato	In southwestern United States, root tuber eaten raw or boiled with clay, by Native American Keresan Pueblo groups	Yanovsky (1936), White (1944), Hedrick (1972), Gibbons and Tucker (1979), and Facciola (1990)
Solanaceae	*Solanum jamesii* Torr.	Colorado Wild Potato	In southwestern United States, tuber eaten raw or boiled with clay, by Native American Keresan Pueblo group and also eaten by Navajo Indians. Tubers also baked or ground into flour	Saunders (1920), Yanovsky (1936), White (1944), Harrington (1974), and Facciola (1990)
Solanaceae	*Solanum paucijugum* Bitter	Sacha Pappa	Root tuber edible	Facciola (1990)
Solanaceae	*Solanum tuberosum boreale* Gray	Wild Potato	Root tubers are quite edible when cooked and eaten by Navajo and other Indians	Saunders (1920)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Solanaceae	*Solanum tuberosum* L.	Potato, Irish Potato	Russet or baking potato best for roasting, frying or baking; all-purpose potatoes used for soups, stews and mashing, red and newer cultivars best for boiling, creaming and in cold salads	Facciola (1990), Phillips and Rix (1993), Wagih and Wiersema (1996), Hu (2005), van Wyk (2006), and Santich et al. (2008)
Solanaceae	*Solanum tuberosum* L. subsp. *andigenum* (Juz. & Bukasov) Hawkes	Andigena	Root tuber edible	Codex (2014)
Solanaceae	*Solanum verrucosum* Schltdl.	Papa Morda	Root tuber edible	Facciola (1990)
Solanaceae	*Solanum juzepczukii* Bukasov	Bitter Potatoes	Root tuber edible	Arbizu and Tapia (1994)
Tropaeolaceae	*Tropaeolum tuberosum* Ruiz & Pavon	Mashua,Tuberous Nasutium, Anu, Anyu	An ancient food crop from the Andes Tubers eaten boiled, eaten as vegetable or added to stews	Popenoe et al. (1989), Facciola (1990), Johns (1981), Groen et al. (1996), Flores et al. (2003), and Codex (2014)
Typhaceae	*Typha angustata* Bory & Chaub. = *Typha domingensis* Pers.	Narrow-Leaved Cumbungi, Bulrush; Googol Bon, Hati Ghah (Assamese)	Rhizome, young shoots and inflorescence are eaten	Patiri and Borah (2007)
Typhaceae	*Typha angustifolia* L.	Narrow-Leaf Cattail	Rootstock boiled eaten like potatoes	Facciola (1990)
Typhaceae	*Typha australis* K. Schum. & Thonn.	Bullrush, Cat's Tail	French Guinea: rhizomes eaten in times of famine.	Irvine (1952)
Typhaceae	*Typha capensis* (Rohrb.) N.E.Br	Cattail	Rhizome eaten	Fox et al. (1982), Kunkel (1984), and Facciola (1990)
Typhaceae	*Typha domingensis* Pers	Narrow-Leaved Cumbungi, Bulrush	Rhizomes used to extract flour	Tanaka (1976), Low (1989), Facciola (1990), and Harden (1993)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Typhaceae	*Typha latifolia* L.	Common Cat-Tail	In China, the root is peeled, sun-dried, ground into flour and made into cakes which are then steamed. It may make a useful mixture with ordinary flours, and be substituted for corn-starch in puddings	Read (1946), Saunders (1920), Schofield (2003), and Codex (2014)
Typhaceae	*Typha laxamannii* Lepech.	Scented Flag	Rhizome source of meal made into cakes	Hedrick (1972) and Facciola (1990)
Typhaceae	*Typha muelleri* Rohrb. = *Typha orientalis* C.Presl	Bullrush, Reed Mace, Yinbun	In Australia, roots eaten raw by the Brisbane tribe. Roots also roasted in a hollow in the ground and eaten hot	Irvine (1957)
Typhaceae	*Typha orientalis* C.Presl	Broad-Leaved Cumbungi, Bulrush	Roots edible	Low (1989) and Harden (1993)
Zingiberaceae	*Achasma loroglossum* (Gagnep) K. Larsen	Karphul, Gandh Tora (Assamese)	Aromatic rhizomes eaten fresh or with betelnut or as masticatory. Small bits are added in curries for flavour	Patiri and Borah (2007)
Zingiberaceae	*Alpinia calcarata (Haw.)* Roscoe	Indian Ginger, Snap Ginger	Rhizome used as galangal substitute	Seidemann (2005)
Zingiberaceae	*Alpinia caerula* (R.Br.) Benth.	Australian Blue Ginger;Native Ginger	Young Rhizome eaten raw or cooked	Cribb and Cribb (1987), Facciola (1990), and Seidemann (2005)
Zingiberaceae	*Alpinia conchigera* Griff.	Lesser Alpinia, Mussel Galanagl; Lengkuas Ranting (Malay); Riềng Rừng (Vietnamese)	Rhizome used as food flavouring and flavouring of alcoholic drinks	Perry (1980), Wong et al. (2005), Seidemann (2005), and Faridah et al. (2010)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Zingiberaceae	*Alpinia galanga* (Linn.) Willd.	Galangal, Greater Galangal; Languas, Lenguas (Indonesia, Malaysia), Phrikgnek (Assamese); Riềng Nếp (Vietnamese)	Rhizomes used as spice fresh or cooked in everday cooking, in curries and meat dishes. Essential oil extract from rhizome used to flavour liquers, ice cream, pasrt, etc.	Watt (1908), Ochse and van den Brink (1980), Scheffer and Jansen (1999), Seidemann (2005), van Wyk (2006), and Kar and Borthakur (2008)
			Rhizome eaten in Karbi, Assam India. In Indonesia, young rhizomes are sliced and used in side dishes as sayur or sambal and the juice is used in the preparation of *dengdeng*	
Zingiberaceae	*Alpinia latilabris* Ridl.	Ry (Vietnamese)	Rhizome used as food flavouring. In Vietnam, bitter rhizome used as spice	Wong et al. (2005) and Tanaka and Nguyen (2007)
Zingiberaceae	*Alpinia malaccensis* (Burm.f.) Roscoe	Malacca Galangal; Riềng Malacca (Vietnamese)	Rhizome used as spice	Burkill (1966), Kashio and Johnson (2001), Seidemann (2005), and Sirat et al. (2011)
Zingiberaceae	*Alpinia nigra* (Gaertn) Burt.	Tora (Assamese); Tareng (Mishing), Tharai (Bodo)	Young shoots and rhizomes are eaten either raw or cooked	Patiri and Borah (2007)
Zingiberaceae	*Alpinia officinarum* Hance	Lesser Galangal, Smaller Galangal, Chinese Ginger; Riềng Thuoc (Vietnamese)	Rhizome used as spice for flavouring	Ly et al. (2003) and Seidemann (2005)
Zingiberaceae	*Alpinia zerumbet* (Pers.) B.L. Burtt & R.M. Sm.	Bright Ginger, Pink Porcelain Lily, Light Ginger; Riềng Đẹp, Riềng ấm (Vietnamese)	Rhizome edible, used as spice for flavouring	Seidemann (2005)
Zingiberaceae	*Boesenbergia pandurata* (Roxb.) = *Boesenbergia rotunda* (L.) Mansfield	See below	As for *Boesenbergia rotunda*	Facciola (1990)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Zingiberaceae	*Boesenbergia rotunda* (L.) Mansfield	Chinese Keys, Temu Kunchi (Indonesia, Malaysia), Krachai (Thai)	Widely used as a spice in cooking traditional Malay, Indonesian, Laotian and Thai cuisine – mixed vegetable dishes, fish curries, soups and pickles. Aromatic rhizome used in *ulam* (raw vegetable salad) in Malaysia and in salads in Thailand	Ibrahim and Nugroho (1999), Saidin (2000), and van Wyk (2006)
Zingiberaceae	*Curcuma aeruginosa* Roxb.	Pink and Blue Ginger, Dark Blue Temu	Rhizome used as spice	Burkill (1966)
Zingiberaceae	*Curcuma amada* Roxb.	Tharmit Tharve Am Haladhi, Am-Ada (Assamese)	Rhizome eaten in Karbi, Assam. Rhizome is used to prepare salad or chutney or eaten raw. It is also used as medicinal for its zedoary content	Patiri and Borah (2007) and Kar and Borthakur (2008)
Zingiberaceae	*Curcuma angustifolia* Roxb.	Indian Arrowroot	Rhizome has edible starch	Ibrahim and Jansen (1996a)
Zingiberaceae	*Curcuma aromatica* Salisb.	Wild Turmeric, Yellow Zedoary	Rhizome used as spice, source of starch	Ibrahim and Jansen (1996a) and Hu (2005)
Zingiberaceae	*Curcuma australasica* Hook.f.	Native Ginger	Tuberous roots roasted and eaten by aborigines	Cribb and Cribb (1987
Zingiberaceae	*Curcuma caulina* J. Graham = *Hitchenia caulina* (J. Graham) Baker.	Chavar	In India (Deccan), tuberous root eaten	Watt (1908)
Zingiberaceae	*Curcuma domestica* Valeton = *Curcuma longa* L.	Turmeric	Rhizome used as spice	Phillips and Rix (1993) and Hu (2005)
Zingiberaceae	*Curcuma longa* L	Turmeric, Kunyit, Temu Kunyit (Malaysia), Khamin (Thai)	Rhizome used as culinary spice in Asian dishes, curries. Ground turmeric used in food industry as colouring agent in processed sauces, curry pastes and sauces, turmeric oil and oleoresins similarly used. Roots eaten in Meghalaya	Burkill (1966), Morton (1976), Ochse and van den Brink (1980); Facciola (1990), Dahal and Idris (1999), Saidin (2000), Hu (2005), Sawian et al. (2007), and Walter and Lebot (2007)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Zingiberaceae	*Curcuma mangga* Valeton & Zijp	Mango Ginger; Temu Pauh, Temu Mangga (Malaysia); Khamin Khao (Thai)	Rhizome used as spice	Burkill (1966), Morton (1976), Ochse and van den Brink (1980), and Facciola (1990), Saidin (2000), and van den Burgh (1994)
Zingiberaceae	*Curcuma phaeocaulis* Valeton	E Zhu (Chinese)	Rhizome used as spice	Lu et al. (2013)
Zingiberaceae	*Curcuma pierreana* Gagnep.	NF	Rhizome highly aromatic, source of starch	Ibrahim and Jansen (1996a)
Zingiberaceae	*Curcuma pseudomontana* R. Grah.	Hill Turmeric	In India (Deccan), rhizomes eaten	Watt (1908)
Zingiberaceae	*Curcuma purpurascens* Blume	Temu Tis, Koneng Pinggang, Kunir Tinggang (Indonesia)	Rhizome edible	Ochse and van den Brink (1980)
Zingiberaceae	*Curcuma zanthorrhiza* Roxb.	Temu Lawak (Malaysia)	Rhizome used as spice or eaten raw	Burkill (1966), Ochse and van den Brink (1980), Facciola (1990), Jansen (1996), and Saidin (2000)
Zingiberaceae	*Curcuma zedoaria* (Christm.) Roscoe	Zedoary, Temu Kuning (Malaysia)	Rhizome used as spice, young rhizome added to salads	Burkill (1966) Morton (1976), Ochse and van den Brink (1980), Facciola (1990), Ibrahim and Jansen (1996b), and Saidin (2000)
Zingiberaceae	*Hedychium coronarium* J.König	White Ginger Lily	Tubers eaten in India (Deccan)	Watt (1908) and Lim (2014)
Zingiberaceae	*Hornstedtia scottiana* (F.Muell.) K.Schum.	Jiddo, Scotts Ginger	Tuberous root eaten edible	Wikipedia (2014)
Zingiberaceae	*Kaempferia galanga* L.	Cekur, Kencur	Rhizome eaten as spice to flavour food	Burkill (1966), Ochse and van den Brink (1980), and Facciola (1990)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Zingiberaceae	*Kaempferia pandurata* Roxb. = *Boesenbergia rotunda* (L.) Mansf.	Kencur, Temu Putri, Kunir Putih, Ardong, Kunci Pepet	Rhizome eaten as spice to flavour food in Java	Ochse and van den Brink (1980)
Zingiberaceae	*Kaempferia rotunda* L.	Round-Rooted Galangal Kencur, Temu Putri, Kunir Putih, Ardong, Kunci Pepet	Rhizome eaten as spice to flavour food in Java	Burkill (1966), Ochse and van den Brink (1980), and Facciola (1990)
Zingiberaceae	*Languas galanga* (L.) Stuntz	Greater Galangal, False Galangal Langkuas, Lenguas	Rhizome used as a spice	Burkill (1966), Morton (1976), and Phillips and Rix (1993)
Zingiberaceae	*Languas javanica* (Blume) Burkill = *Alpinia javanica* Blume	Puar Putih, Tepus Putih, Kantan Hutan	Rhizome used as food, scentless and bitter	Burkill (1966)
Zingiberaceae	*Zingiber amaricans* Blume = *Zingiber zerumbet* subsp. *zerumbet*	Lampuyang Pahit (Malay)	Young rhizome tip eaten raw with rice edible	Ochse and van den Brink (1980) and Facciola (1990)
Zingiberaceae	*Zingiber aromaticum* Valeton = *Zingiber zerumbet* subsp. *zerumbet*	Lampuyang Pahit	Rhizome edible fragrant, bitter and pungent	Ochse and van den Brink (1980)
Zingiberaceae	*Zingiber cassumunar* Roxb. = *Zingiber montanum* (J.König) Link ex A.Dietr.	Cassumunar Ginger; Bengal Gingermoran Ada (Assamese); Bonglai (Malaysia)	In Assam, India and Malaysia, rhizomes used as condiments; rhizome juice with honey is used for cough problems	Saidin (2000), Seidmann (2005), and Barua et al. (2007)
Zingiberaceae	*Zingiber chrysostachys* Ridley	Lempui (Malaysia)	Pungent rhizomes used as spice, substitute for *Z. zerumbet*	Jansen (1999) and Seidmann (2005)
Zingiberaceae	*Zingiber montanum* (J.König) Link ex A. Dietr.	Cassumunar Ginger, Bengal Root, Banglai (Indonesia), Bunglai, Bolai (Malaysia)	Rhizomes used for food flavouring	Wolf et al. (1999)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Zingiberaceae	*Zingiber officinale* Roscoe	Ginger, Halia (Malaysia),	Underground rhizome widely used as culinary spice, fresh, whole, slices, diced, crushed or powdered, preserved or pickled. Used to flavour beverages, drinks ale, etc.; used in bakery product and processed food, desserts and cakes, jams, marmalades and confectionaries	Burkill (1966), Ochse and van den Brink (1980), Cribb and Cribb (1987), Facciola (1990), Sutarno et al. (1999), Saidin (2000), Walter and Lebot (2007), van Wyk (2006), Phillips and Rix (1993)
Zingiberaceae	*Zingiber ottensii* Valeton	Bunglai Hantu, Panglai Hideung (Indoneisa), Lampoyang Hitam, Kunyit Hitam, Berseh Hitam	Pungent rhizome used as flavouring in traditional Malay cuisine	Jansen (1999), Saidin (2000)
Zingiberaceae	*Zingiber spectabile* Griff.	Black Gingerwort,Tepus Tanah, Tepus Halia(Malaysia)	Rhizome used as flavouring in traditional Malay cuisine	Burkill (1966), Wolf et al. (1999), Saidin (2000), and Seidemann (2005)
Zingiberaceae	*Zingiber zerumbet* (L.) Roscoe ex Sm.	Wild Ginger, Zerumbert Ginger, Shampoo Ginger; Lampoyang (Malaysia), Phrilang Dung (Assamese)	Rhizome used as flavouring in traditional Malay cuisine; Rhizome eaten in Karbi, Assam	Ochse and van den Brink (1980), Cribb and Cribb (1987), Facciola (1990), Wolf et al. (1999), Saidin (2000), Seidemann (2005), and Kar and Borthakur (2008)
Zingiberaceae	*Zingiber zerumbet* (L.) Smith var. *zerumbet*	Lempuyang Gajah, Lempuyan Kapur, Lampunyang Badak (Indonesia)	Rhizome used as flavouring in traditional Malay cuisine	Wolf et al. (1999)
Zingiberaceae	*Zingiber zerumbet* (L.) Smith var. *amaricans* Blume	Lampuyan Pahit, Lempuyang Pait, Lempuyan Emprit (Indonesia), Hui Dam (Thai)	As above	Wolf et al. (1999)

(continued)

Table 1 (continued)

Family	Scientific Name	Common /Vernacular Names	Edible Part Use	Reference
Zingiberaceae	*Zingiber zerumbet* (L.) Smith var. *aromaticum (*Valeton) Theilade	Lampuayng Wangi, Lempuyang Wangi (Indonesia), Lampoyang, Lempoyang, Tepus (Malaysia)	As above	Wolf et al. (1999)
Zygophyllaceae	*Tribulus solanderi* F. Muell.	Nf	Roots eaten roasted	Cribb and Cribb (1987)

NF not found

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Solanum tuberosum

Scientific Name

***Solanum tuberosum* L.**

Synonyms

Solanum andigenum Juz. & Bukasov, *Solanum andigenum* subsp. *aya-papa* Bukasov & Lechn., *Solanum andigenum* subsp. *bolivianum* Lechn., *Solanum andigenum* subsp. *ecuatorianum* Lechn., *Solanum aquinas* Bukasov, *Solanum chiloense* Berthault, *Solanum chilotanum* Hawkes, *Solanum cultum* Berthault, *Solanum diemii* Brücher, *Solanum fonckii* Phil., *Solanum kesselbrenneri* Juz. & Bukasov, *Solanum leptostigma* Juz. & Buk., *Solanum molinae* Juz., *Solanum oceanicum* Brücher, *Solanum ochoanum* Lechn., *Solanum sanmartiniense* Brucher, *Solanum subandigena* Hawkes, *Solanum tascalense* Brucher, *Solanum tuberosum* var. *guaytecarum* Hawkes, *Solanum tuberosum* var. *tuberosum, Solanum tuberosum* subsp. *tuberosum, Solanum zykinii* Lechn.

Family

Solanaceae

Common/English Names

Common Potato, Irish Potato, European Potato, Potato, Spud, White Potato

Vernacular Names

Afrikaans: Aartappel
Albanian: Patate
Arabic: Batates
Austria: Aardapfel, Ärdäppel, Bramburi, Erdapfel (German)
Bulgarian: Kartof
Burmese: Ah Lou, Ar Loo
Chinese: Ma Ling Shu, Tǔdòu, Yángyù
Croatian: Krumpir
Czech: Brambor
Danish: Kartoffel, Kartofler
Dutch: Aardappel, Aardappelen
Estonian: Kartul
Ethiopia: Dinittch
Finnish: Peruna, Potaati
French: Pomme De Terre, Patata
Gabon: Émongo-a-mutangani (Baduma), Amongo-mbé-ntanga (Bakèlè), Mongu-Bibamba (Balumbu), Mbala-bibamba (Bapunu), Mbala-yi-mutangeni (Bavarama, Bavungu, Eshira), Lifita-la-gibamba (Bavili),

T.K. Lim, *Edible Medicinal and Non-Medicinal Plants: Volume 12, Modified Stems, Roots, Bulbs*,
DOI 10.1007/978-3-319-26065-5_2

Mbongo-y'utangani (Benga), Imongo-i-ntangani (Béséki), Amonghe-ntangha (Fang), Futa-wu-otangani (Mindumu), égwéta-a gébamba (Mitsogo), Mongo-y'atanga (Mpongwè, Galoa, Nkomi, Orungu), Mongo-a-gebamba (Ngowé)

German: Herdapfel, Inkatrüffel, Kartoffel, Kartoffeln, Kautüffel, Ketüffel, Krumbirn, Krumbiir, Tartuffli

Greek: Patáta

Hungarian: Burgonya

Icelandic: Kartafla

India: Aalu (Bengali), Bataka, Batata (Gujerati), Alu, Salooalu (Hindi), Urulaikkilangnku (Tamil)

Indonesia: Kentang

Italian: Pomi Di Terra, Patata, Tartufolo

Japanese: Jagaimo

Korean: Gamsa

Khmer: Damlong Barang

Laotian: Man Falangx

Latvian: Kartupelis

Malaysia: Ubi Kentang

Morocco: Batâtâ, Btâtâ (Moroco), Pomme De Terre (French)

Nepali: Alu, Aloo

Papua New Guinea: Poteto

Peru: Papa Común

Philippines: Papas, Patatas (Cebu Bisaya, Bikol, Tagalog)

Polish: Ziemniaki

Portuguese: Batata, Batata-Da-Terra-Semelha, Batateira

Romanian: Cartof

Russian: Kartofel, Kartoška

Serbian: Krompir

Slovakian: Zemiak, Bramboru

Slovenian: Krompir

Spanish: Papa, Patata

Swedish: Jordpäron, Kartoffel, Potatis, Potät, Tartuffe

Switzerland: Ardoffel, Mailinterra, Tartuffel, Tiffel, Truffel (French, Romansh Switzerland), Erdbirne, Erpele, Frundbirne, Gummel (German, Schwyz Canton), Grundbirn, Happere, Hardopfel, Harpfel (German, Upper Valais)

Welsh: Cloron, Tatws

Thai: Man-Farang, Man-Alu

Turkish: Patates

Ukrainian: Kartóplja

Vietnamese: Cây Khoai Tây, Khoai Tay

Origin/Distribution

The potato originated in the Andean regions of Peru and Bolivia. The potato was introduced into Spain from South America in the latter half of the sixteenth century. From Spain, the potato was introduced to adjacent countries and within 100 years was being grown fairly extensively in many regions of Europe. Distribution beyond Europe soon occurred with the introduction into India in the seventeenth century and China and Japan in the eighteenth century.

Agroecology

Potato is a cool climate crop. It prefers day temperatures of 20–25°C and night temperatures below 20 °C. Such temperature conditions are conducive to growth and tuberisation. Night temperatures above 22 °C retard tuberisation. In the tropics it is usually grown in the highlands above 800 m where the temperatures are cooler. In PNG they are grown in altitude between 1500 m and 2200 m. High light intensities are required for optimum dry matter production. It is susceptible to frost and freezing. Potato requires a well distributed rainfall of 500–750 mm in a growing period of 3–4.5 months.

Potato grows on a wide range of soils but not waterlogged soils. It grows best in loose, friable soil and well-drained mineral or organic soils with medium loam or light or medium silty textures. Deep soils with good aeration and permeability give good growth and high tuber yields. Potato tolerates a wide range of pH from 4.8–7.

Edible Plant Parts and Uses

Potato is a very versatile food crop that can be used in multivariate ways. It is eaten cooked and occasionally raw. Potato can be boiled, steamed,

microwaved, baked, fried, grilled, mashed and added to soups, stews, curries, pies, vegetable salads, dumplings, pancakes ('rosti') and goes well with all sorts of meat and seafood. One common dish is mashed potato where boiled, peeled potato is mashed with butter, margarine, milk or yoghurt. Potato is also consumed as fresh fries, pomes fries, wedges, potato bread (such as boxty) and hash browns. Potato is also thinly sliced and made into chips and crisps by baking or deep-frying for snack appetiser or as a side dish. Potatoes have been used to prepare a product known as chuño, which has played an important role in the diet of the population of the highland and lowland Andes of South America. Potato can be processed into many dehydrated, frozen or canned tubers. Potatoes can also be processed into alcohol and alcoholic beverages including vodka and schnapps.

Potato tuber storage protein, patatin, was found to have potential as food ingredients, in cheese making (Spellbrink et al. 2015). When patatin was added to milk during cheese making, the lipase preferentially released short-chain fatty acids that contributed to cheese flavour in a dose-dependent manner. Fortuitously, the lipase activity was found mainly in the curd.

Potato flour/potato starch is an important processed product from potato and has highly versatile uses in manufacturing convenience foods—ready to cook instant curries, dhals and snacks. Potato flour/starch can be used to prepare potato mash, snack foods, extruded foods, sweets and other bakery products (cakes, bread, pancakes, etc.), weaning foods and baby foods. Its protein content is superior to that of cassava and yam flour, slightly inferior to that of refined maize meal and wheat flour and similar to that of rice. Potato flour has higher levels of fibre than refined wheat flour, maize meal and rice but lower levels of fibre than cassava and yam flour. Its carbohydrate and energy contents are comparable to those of similar foods. The high starch content in potato flour can improve the functional properties of several food products. It has a higher heat point than cornstarch, so it may be superior for certain foods that require high temperatures. Another health benefit is that potato flour or potato starch is gluten-free and is used as a substitute for wheat to make gluten-free food products for people with gluten intolerance. It can be also blended with wheat flour to make instant noodles, the Indian 'paratha' bread and the Indian sweet preparation 'gulab jamun' (potato flour, wheat flour and milk). It is commonly used as thickeners in soups, sauces and gravies. Potato starch is much used for determining the diastatic value of malt extract (Grieve 1971). A volatile oil—chemically termed amylic alcohol, in Germany known as *Fuselöl*—is distilled by fermentation from potato spirit. Boiled with weak sulphuric acid, potato starch is changed into glucose or grape sugar, which by fermentation yields alcohol, this spirit being often sold under the name of British Brandy.

Potato starch/flour is widely used for making commercial extruded and blended potato chips/crisp snack food, viz. Pringles and Lay's Stax brands.

The carbohydrate (starch and sugar) composition of tubers plays an important role in determining variety usage. Processing varieties, for example, must have relatively high starch and low reducing sugar (glucose/fructose) levels. Starch content is directly related to specific gravity (SG) or dry matter (DM) in tubers. Typically, 60–80 % of the dry matter is present as starch. Therefore, high specific gravity or high dry matter (solids) tubers contain high levels of starch. Generally, table varieties have low SG below 1.069 and low DM below 18.1 %. Some examples are Desiree, Red Pontiac, Sequoia, Sebago, Bintje, Patrones, Denali, Granola, Tess, Pontiac, Bison, Red Bison and Nadine. Varieties with high SG above 1.079 and high DM above 20.3 % are used for processing, e.g. Atlantic, Snowden, Shepody, Niska, Chipeta, Norvalley, Ivory Crisp, Dakota Pearl, Gemchip, Russet Burbank, Ranger Russet and Kennebec.

Botany

An erect or sprawling herb, 30–100 cm tall, with robust angular, branched and winged stem glabrous or sparsely pubescent with simple and

glandular hairs (Plates 1 and 2). Stolons bearing underground tubers; tubers white, brown, yellowish brown, pink, red, purple or purplish blue; globose, oblate or elliptic; 3–10 cm in diameter; fleshy; and with axillary buds (eyes) and numerous lenticels (Plates 3, 4, 5, 6, 7, 8, and 9). Leaves alternate, interruptedly odd-pinnate, with 6–8 pairs of leaflets and smaller, unequal interstitial leaflets; petiole 2.5–5 cm long, leaflet blade ovate or oblong, 2–10 cm by 1–6 cm, dark green, pinnatinerved, mostly sparingly pilose. Inflorescences appearing terminal, leaf opposed, or axillary, many-flowered, sparingly branched panicles. Pedicel articulate near middle, 1–2 cm. Calyx campanulate with 5-lanceolate lobes sparsely pubescent; Corolla white, pink, or blue purple (Plate 2), sometimes all on one plant, rotate to rotate–stellate, 2.5–3 cm in diameter, with 5 deltate lobes, 5 mm; filaments thick with five free, erect yellow anthers, 5–6 mm. Ovary glabrous. Style 8 mm with capitate stigma, berry green or yellowish green, often striped, globose, smooth, 1.5–2 cm in diameter. Seeds numerous (300), flat, suborbicular to ovate, small, yellowish brown embedded in mucilaginous pulp.

Plate 1 Potato plant habit

Nutritive/Medicinal Properties

The proximate nutrient value per 100 g edible portion of raw, skin potato was reported as: water 83.29 g, energy 58 kcal (243 kJ), protein 2.57 g, total lipid 0. 10 g, ash 1.61 g, carbohydrate 12.44 g, total dietary fibre 2.5 g, minerals (Ca 30 mg, Fe 3.24 mg, Mg 23 mg, P 38 mg, K 413 mg, Na 10 g, Zn 0.35 mg, Cu 0.423 mg, Mn 0.602 mg, Se 0.3 µg), vitamins (vitamin C 11.4 mg, thiamine 0.021 mg, riboflavin 0.038 mg, niacin 1.033 mg, pantothenic acid 0.302 mg, vitamin B6 0.239 mg), total folate 17 µg, total saturated fatty acids 0.026 g (10:0 0.001 g, 12:0 0.003 g, 14:0 0.001 g, 16:0 0.016 g, 18:0 0.004 g),

Plate 2 Leaves and flower

Plate 3 Potatoes with different skin colours

Plate 4 Desiree potatoes

total monounsaturated fatty acids 0.002 g (16:1 undifferentiated 0.001 g and 18:1 undifferentiated 0.001 g) and total polyunsaturated fatty acids 0.043 g (18:2 undifferentiated 0.032 g and 18:3 undifferentiated 0.010 g) (USDA-ARS 2014). The variety × location interaction and location effects of soluble and insoluble dietary fibre contents of six Canadian potato varieties were significant on a dry weight basis (Mullin et al. 1993). The same effects for total dietary fibre were significant after storage except for soluble fibre in the skins, insoluble fibre in the flesh and whole potatoes. On a fresh weight basis, the range of soluble fibre was 0.9–1.30 % for both

Plate 5 Bintje potatoes

Plate 6 Kipfler potatoes

fresh and stored potatoes; for insoluble fibre the range was 0.6–0.8 % and 0.6–0.7 % for fresh and stored samples, respectively.

The following sugars were found in cold-stored Kennebec potato tubers with stearic acid as internal standard: β-D-fructose; α-glucose, β-D-glucose, myo-inositol and sucrose (Varns and Shaw 1973). Potato tubers were found to contain citric and malic acids in the ratio of nearly 20:1 together with a small amount of isocitric acid (Curl and Nelson 1940).

A total of 17 fatty acids were detected in quantifiable amounts in all genotypes of *Solanum phureja* and *S. tuberosum* (Dobson et al. 2004). The predominant fatty acid was linoleic followed by α-linolenic and palmitic acids. 15-Methyl hexadecanoate was present as a minor acid in both species. For both species, the contents (both as absolute levels and as percent compositions) of linoleic acid decreased and α-linolenic acid increased in tubers over the whole storage period. Niacin degradation in potato followed first-order kinetics, where the rate constant increased with an increase in the temperature of 50–120 °C (isothermal process) (Nish et al. 2009). The results obtained indicate a niacin degradation of a similar magnitude in all three modes of cooking, namely, normal open pan cooking, pressure cooking and a newly developed and patented fuel-efficient 'EcoCooker'. Potatoes had been found to contain a number of health-promoting phytonutrients such as phenolics, flavonoids,

Plate 7 Purple Congo potatoes

Plate 8 Royal blue potatoes

folates, kukoamines and carotenoids (Ezekiel et al. 2013). Pigmented potatoes contained high concentration of phenolic acids as compared to white-fleshed potatoes and richer in natural colourants and antioxidants.

Proteins

Potato had been reported to have several types of protein. Osborne and Campbell (1896) isolated a globulin from potato tubers by salt extraction which they designated 'tuberin'. Kon (1928) reported on the nutritional value of tuberin, the globulin of potato. Groot et al. (1947) separated tuberin into two fractions by electrophoresis. Slack (1948) concluded that the only true protein present in potato was a globulin. Lindner et al. (1960) fractionated potato tuber proteins into tuberin, globulin II, albumin, prolamine and glutelin. Stegmann and Loeschcke (1961), Desborough and Peloquin (1966) and Nakasone et al. (1972) separated tuber proteins into additional fractions by electrophoresis and chromatography. Kapoor et al. (1975) fractionated protein in Red Pontiac tuber into tuberin, the main proteins (71 %), and found that 40 % of tuberin was albumin. All the protein fractions except prolamine were well balanced in essential amino acids and comparable to FAO reference protein. Methionine was the limiting amino acid of the potato fractions. The chemical score, essential amino acid indices and biological value of albumin, globulin, glutelin and residual protein did not vary significantly. Since all the fractions except prolamine, which is a negligible

Plate 9 Royal blue potato flesh colour

portion of total protein, are of high nutritional quality, Red Pontiac has high-quality protein. Potato tubers had 1.67 % N/dry matter (Gorinstein et al. 1988). Of the total N content, 43 % was dialyzable N and 32.9 % true protein N. The protein, by solubility fractionation, provided 67 % albumin, 23 % globulin, 1.4 % prolamine and 9 % glutelins. Albumin had two major protein species, one of 45×10^3 and the other of $12–25 \times 10^3$ daltons. Prolamine and glutelins contained protein bands coinciding in molecular weight with those of albumin and globulin. Some minor losses in protein composition of potatoes occurred during processing. Ultrafiltration gave the best yield recovery of protein from potato juice compared to polyelectrolyte coagulation and cryoconcentration (Wojnowska et al. 1981). Depending on the method of potato juice concentration, differences were observed in: foaming and emulsifying properties, wettability, swelling and buffer capacity of preparations. The dried preparations contained a high level of proteolytic enzyme inhibitors and glycoalkaloids. Thermal inactivation of preparations before drying led to 43–48 % destruction of protease inhibitors and 81–89 % glycoalkaloids. At the same time, it was observed that thermal treatment led to distinct changes in the amino acid composition of the proteins and had an adverse effect on the properties of the dried preparations.

Racusen and Foote (1980) reported that a glycoprotein of molecular mass about 45,000 accounted for about 20 % of the total soluble protein in potato and proposed the alternative name 'patatin', based on 'patata', the original American Indian-derived Spanish word for potato. Park et al. (1983) estimated the molecular mass of patatin to be about 40,000 and showed extensive heterogeneity with forms differing in electrophoretic mobility at pH 8·6 and in mobility on SDS–PAGE. Paiva et al. (1983) demonstrated that there was a linear relationship between the amount of patatin, expressed as a percentage of total soluble protein, and the logarithm of tuber weight from 0·3 to 300 g, with patatin forming about 40 % of the total soluble protein in tubers above about 200 g. Under normal conditions, patatin was found in only trace amounts, if at all, in leaves, stems or roots of plants which were either actively forming tubers or which had been grown under long days to prevent tuberisation. However, if tubers and axillary buds were removed, patatin could accumulate in stems and petioles. Patatin was reported to account for 30–40 % of the total soluble protein in potato tubers (Andrews et al. 1988). Besides being a storage protein, it also exhibited lipid acyl hydrolase and acyltransferase activities. It was active with phospholipids, monoacylglycerols and p-nitrophenyl esters and moderately active with galactolipids but is apparently inactive with di- and triacylglycerols. Isolated patatin at room temperature was found to be a highly structured molecule at both secondary and tertiary levels (Pots et al. 1998). About 33 % of the residues adopted an α-helical and 46 % a β-stranded structure. Patatin was thermally destabilised at temperatures exceeding 28 °C. It was shown that parts of the α-helical