



The James
Hutton
Institute



CPC
Commonwealth
Potato Collection

The Commonwealth Potato Collection



Commonwealth Potato Collection
glasshouse in full bloom

Introduction

The Commonwealth Potato Collection (CPC) is a living collection that is utilised to address the needs of the potato industry through research. The CPC is part of a global network of potato gene banks, safeguarded for the benefit of humanity by The James Hutton Institute and supported by the Scottish Government. The collection holds the distinction of being the first-ever seed deposit by a U.K. institution into the Svalbard Global Seed Vault, Norway.

With more than 1500 accessions, the collection represents about 80 wild and cultivated potato species originating from highly diverse habitats in South America, the origin of potatoes. The CPC was initially established in response to the late blight pathogen, which caused the Famine in Ireland and the West Coast of Scotland in the 1840s. The collection's roots can be traced back to the collaborative efforts of a consortium of British Empire countries that funded collections led by E.K. Balls and assisted by Jack Hawkes in 1938 and 1939.

Today, our gene bank serves as an *ex-situ* reservoir for wild relatives and primitive cultivated types of potato. Researchers world-wide request access to the collection and it is our responsibility to preserve this invaluable material and to support scientific advancements. The natural diversity preserved in the CPC holds the key to future-proof the third most important global food crop against the threats posed by climate change and to foster sustainable crop production. The species and images showcased in this booklet represent a small fraction of the diverse range found within the collection.



Professor Jack Hawkes



S. acaule

Derivation

Stemless (grows in low rosette formation).



Distribution

Peru, Bolivia & Argentina.



Research is conducted to understand the ability to self-fertilise while determining the barriers to outcrossing with typical (tetraploid) potato varieties.



Habitat

High altitudes from 3700m up to 4650m in alpine meadows, by paths, walls and arable fields.



Attributes

The most frost resistant of all wild potato species and also drought tolerant.



S. berthaultii

Derivation

Named after French taxonomist, Pierre Berthault.



Habitat

Dry valleys among cactus vegetation at 2400-2750m.



Distribution

Bolivia.



Attributes

Colorado potato beetle and aphid resistance.



Disease resistance against late blight has been identified in this species and deployed in cultivars such as Carousel developed by James Hutton Limited.



S. bulbocastanum

Derivation

Tuber like a chestnut.



Distribution

Central to Southern Mexico.



Habitat

Woods, grassland and field borders under fairly dry conditions at around 1500 – 2000m.



Attributes

Heat and drought tolerant, late blight and black leg resistance.



Genetic studies have identified novel and broad-spectrum resistances against the late blight pathogen.



S. cardiophyllum

Derivation

Heart shaped leaflet.



Distribution

Mexico.



Only limited research has been conducted for this species.



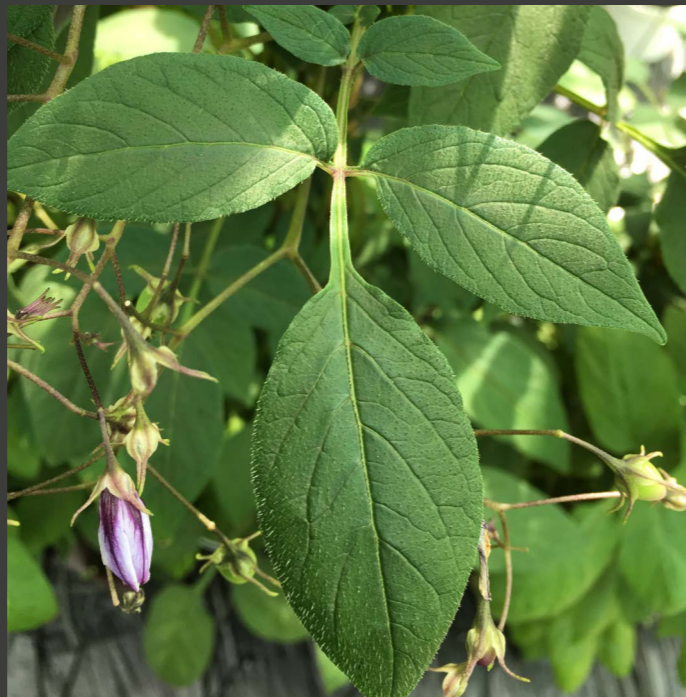
Habitat

Dry scrub vegetation especially as weeds of cultivation.



Attributes

Some accessions with reported resistance to Potato Cyst Nematode.



S. humectophilum

Derivation

Loving damp places.



Distribution

Peru.



Resistance to early blight has been observed under glasshouse conditions.



Habitat

Very humid mountain forests 2875m together with Fuchsia, Escallonia.



Attributes

Floriferous plant with some accessions reported to be resistant to Late blight. Dramatic dark red colouring on underside of leaf.



S. infundibuliforme

Derivation

Funnel shaped.



Distribution

Bolivia, Argentina and Chile.



Only limited research has been conducted for this species.



Habitat

Dry cactus scrub deserts at 2500-4100m.



Attributes

Aphid resistance.



S. jamesii

Derivation

Named after army surgeon, Dr E. James.



Distribution

Mexico to southern USA.



Habitat

Desert conditions.



Attributes

Delicate plant of small stature. Heat and drought tolerant. Tubers reported to contain more protein, zinc, manganese and calcium than regular potato cultivars.



The high protein content found in *S. jamesii* is of scientific interest.



S. lignicaule

Derivation

Woody stem.



Distribution

Peru.



Only limited research has been conducted for this species.



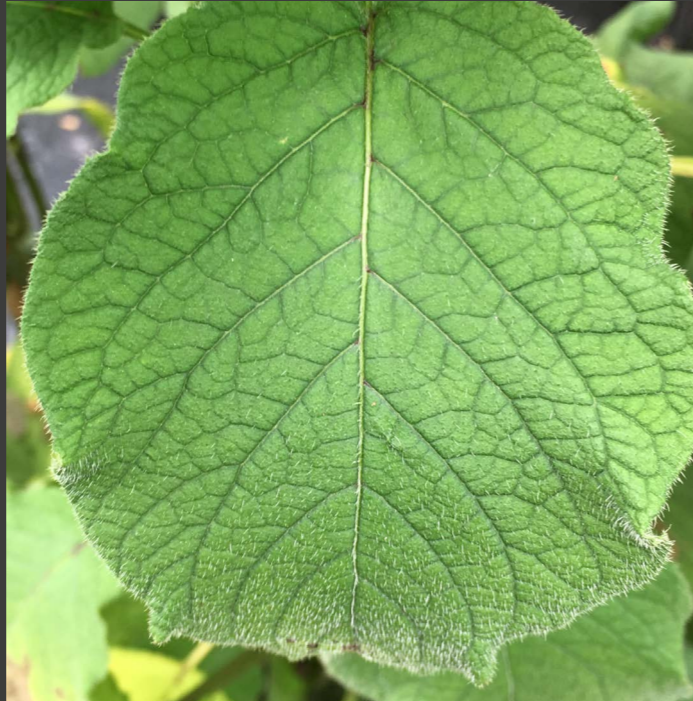
Habitat

Cuzco on dry slopes and old cultivation terraces. Endemic to the ruins of the Inca fortress of Pisac.



Attributes

Aphid resistance.



S. microdontum ssp gigantophyllum

Derivation

Small teeth, giant sized leaf.



Distribution

Bolivia & Argentina.



As a plant often found in the shade, the adaptation processes and conversion rates of light into energy are studied. Further, resistances against the late blight pathogen have been identified.



Habitat

Very humid cloud forests from 1800 – 3000m.



Attributes

Large robust plant with large simple leaves. Structure allows plant to compete for light in forest conditions. Late blight, Black leg and Root Knot Nematode resistance.



S. neorossii

Derivation

In honour of Prof. Hans Ross.



Distribution

Argentina.



Resistance to powdery mildew has been identified in this species.



Habitat

2500-3400m in Montano phytogeographical district.



Attributes

Beautiful heavy scented floriferous plant with large showy purple to violet blue corollas.



S. ocranthum

Derivation

Ochre yellow flowers (yellow flower is rare in the potato world!).



Habitat

Humid forest and scrub woodland at 1800-3500m.



Distribution

Columbia, Ecuador and Peru.



Attributes

Woody stem perennial plant that is somewhere in between a tomato and a potato. This species produces large berries like a tomato and doesn't produce any tubers or stolons.



The unique phylogenetic position of this species between tomatoes and potatoes is used in scientific research.



S. polyadenium

Derivation

With many glands.



Distribution

Central Mexico.



Differences in volatiles have been found between accessions that correspond to their ability to repel insects.



Habitat

Dry stony areas among trees and shrubs from 2000-3000m.



Attributes

Insect repelling by production of strong-smelling sticky substance on glandular hairs thought to mimic aphid alarm pheromones.



S. tuberosum Group Andigena

Derivation

Born in the Andes.



Habitat

High altitudes over 2000m in drier areas.



Distribution

Andes of Colombia, Ecuador, Argentina, Bolivia and Peru.



Attributes

Resistance to *Globodera rostochiensis*.



This species is used to understand long- and short-day adaptation of potatoes and the molecular components that determine flowering and tuberisation. It is also the origin of the *H1* gene identified in CPC accession 1673 that controls the potato cyst nematode species *Globodera rostochiensis* and now features in almost every new potato cultivar developed.



S. tuberosum Group Phureja

Derivation

Aymara Indian word for early maturing potatoes.



Distribution

Colombia, Ecuador, Peru & North Bolivia.



Diploid cultivars such as Mayan Gold, Inca Dawn, etc. have been developed from *S. phureja* by James Hutton Limited. In addition, self-compatible accessions have been identified that are of scientific interest and could enable novel commercial and scientific approaches for potato breeding.



Habitat

Wet mountain slopes in the Andes and lower altitudes than other cultivated species.



Attributes

Diverse tuber shape and colour. Very short dormancy period so can produce multiple crops per season. Some accessions with reported virus resistance and resistance to Root Knot Nematode.



S. tuberosum Group Stenotomum

Derivation

Narrowly cut referring to the narrow leaflets.



Habitat

High altitudes on dry slopes.



Distribution

Peru to Bolivia.



Attributes

Diverse tuber shape and colour. Resistance to Bacterial Wilt. Some accessions possess deep thick tap roots. Highly dormant tubers.



The impact of the root system on water use efficiency and nitrogen fixation is being studied to develop new varieties that require less input and are drought-resistant. As a domesticated landrace, this species features in breeding.



S. vernei

Derivation

Named after plant collector Professor Claude Verne.



Habitat

In mountain forests in partial shade at 2,200-2800m.



Distribution

Argentina.



Attributes

Resistance to potato cyst nematode and late blight.



A very important source of resistance against the Potato Cyst Nematode species *Globodera pallida*.



S. verrucosum

Derivation

Warty or verrucose.



Habitat

Found commonly in pine, oak and fir forests at high altitude.



Distribution

Mexico.



Attributes

Late Blight resistance



A high-quality genome with transcription and methylation data has been assembled. Late blight resistance has been characterised.

Closing remarks

Potatoes are the most important non-cereal food crop.

Potatoes are the third most important food crop in the world and consumed by over a billion people. The success of potato as a staple crop is based on important attributes:

- Potatoes provide 2-4 times the food quantity per hectare of land compared to cereals.
- Potatoes are seven times more efficient in water use than cereals.
- Potatoes produce more food per unit of water than any other major crop.
- Potatoes are highly nutritious and two medium-sized boiled potatoes provide the entire daily requirements of an adult for Vitamin C, Potassium, and Iron.
- Potato is the only major crop that provides all essential amino acids for life.

The Commonwealth Potato Collection holds the key for sustainable production.

To future-proof potatoes against the effects of climate change, including threats from diseases and extreme weather events such as heat, drought and flooding, scientists work closely with industry, breeders and stakeholders. The key genetic makeup required for sustainable production and to mitigate the impact of climate change is preserved in the Commonwealth Potato Collection.

State-of-the-art science unlocks the potential of the Commonwealth Potato Collection.

Modern genomics, genetics and molecular physiology, all of which are enabled through access to state-of-the-art methods, are used to understand key genes involved in the adaptation of potatoes to challenges. The CPC is at the very heart of such efforts. The impact of the collection and the research is truly global and associated data is collected through 'Germinate' to meet the criteria of FAIR (findability, accessibility, interoperability, and reusability) (<https://ics.hutton.ac.uk/germinate-cpc>).

With a very high probability, you will have 'eaten' part of the Commonwealth Potato Collection.

As a prominent example, the collection provided the foundation of European cultivars and their resistance to the Potato Cyst Nematode species *Globodera rostochiensis*. The resistance was identified and mobilised from the accession CPC 1673 (*Solanum tuberosum* group *Andigena*) and is now found in almost all new potato cultivars and was first deployed in the famous cultivar Maris Piper.



Safeguarding the collection in the Svalbard Global Seed Vault, Norway



Scan here to view online



ics.hutton.ac.uk/germinate-cpc

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