All-Russian Institute of Plant Industry: history, structure, and current research based on theories developed by Nikolaj Vavilov


102x102

Leningrad, 1942

In 1894 the Applied Botany Bureau was organized in ex capital of Russia - St. Petersburg

In 1917 it was reorganized to Department of Applied Botany and Plant Breeding

1920 –N. Vavilov was invited to be its director.

From 1922 to 1924 it was being a part of Institute of Experimental Agronomy.

In 1924 on a base of this Department “All-Union Institute of Applied Botany and New Crops” was founded.
In 1930 this Institute conferred the name “All- Union Institute of Plant Industry” (VIR)

Nikolaj Vavilov

(1887-1943)

«… Mobilization of the globe plant sources, intensive application of wide world plant riches on practical breeding is the first grade goal…»

The mean goals of Institute are:
collecting, preservation, evaluation and use of plant genetic diversity

Experimental laboratories in Petrograd Region – Pushkin.

Green-houses in Pushkin

Under the leadership of N. Vavilov the experimental plots in 100 sites of the USSR – so called "geographic plots" were organized. For the first time in a world biological and agricultural science began to study the variability in crop traits depending on different climatic conditions.

N. Vavilov made wider a methodological basis of researches introducing the new methods developed by Russian and foreign scientists.

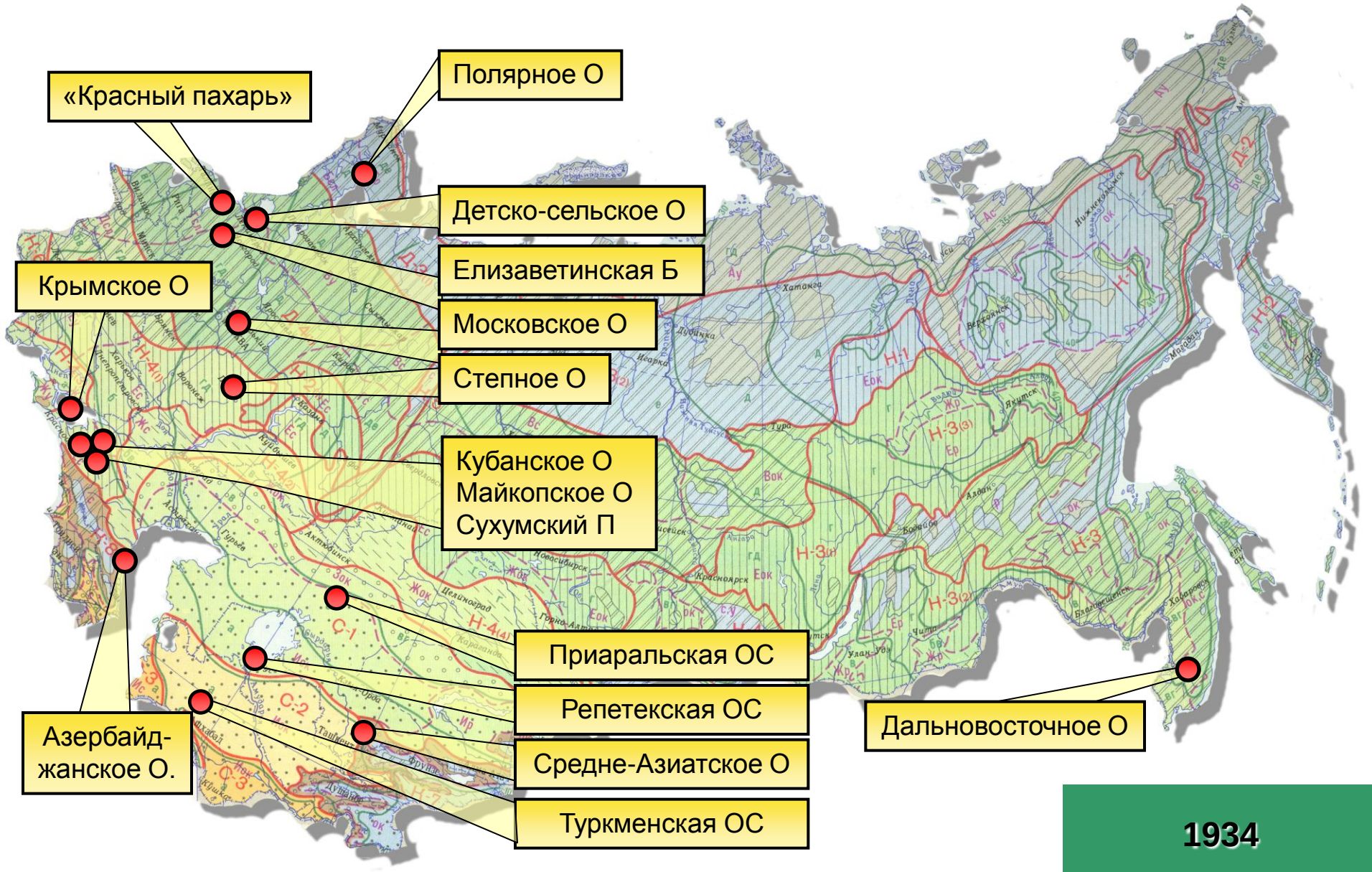
He invited to the Institute able and prominent scientists from other cities of the country and organized several departments: genetics, physiology, cytology, anatomy, biochemistry...

One by one branches of the institute had been organized in different regions of the USSR

Experimental stations of the institute

1922-1923

Experimental stations of the institute



1934

Scientific researches were based on the following disciplines:

- **theoretical background of breeding and genetics;**
- **plant origin and phylogeny;**
- **cytology, anatomy, physiology, biochemistry, technological qualities of cultivated plants and wild relatives;**
- **geography and introduction of cultivated plants.**

Great attention was devoted to the development of agro-geographic plant evaluation. Researchers found and determined new species, studied their household value. Some new plant species had been domesticated.

1921-1934: expeditions to about 180 areas around the world, N. Vavilov himself observed 52 different countries.

He studied the diversity and was looking for new species and new ecotypes of the species.

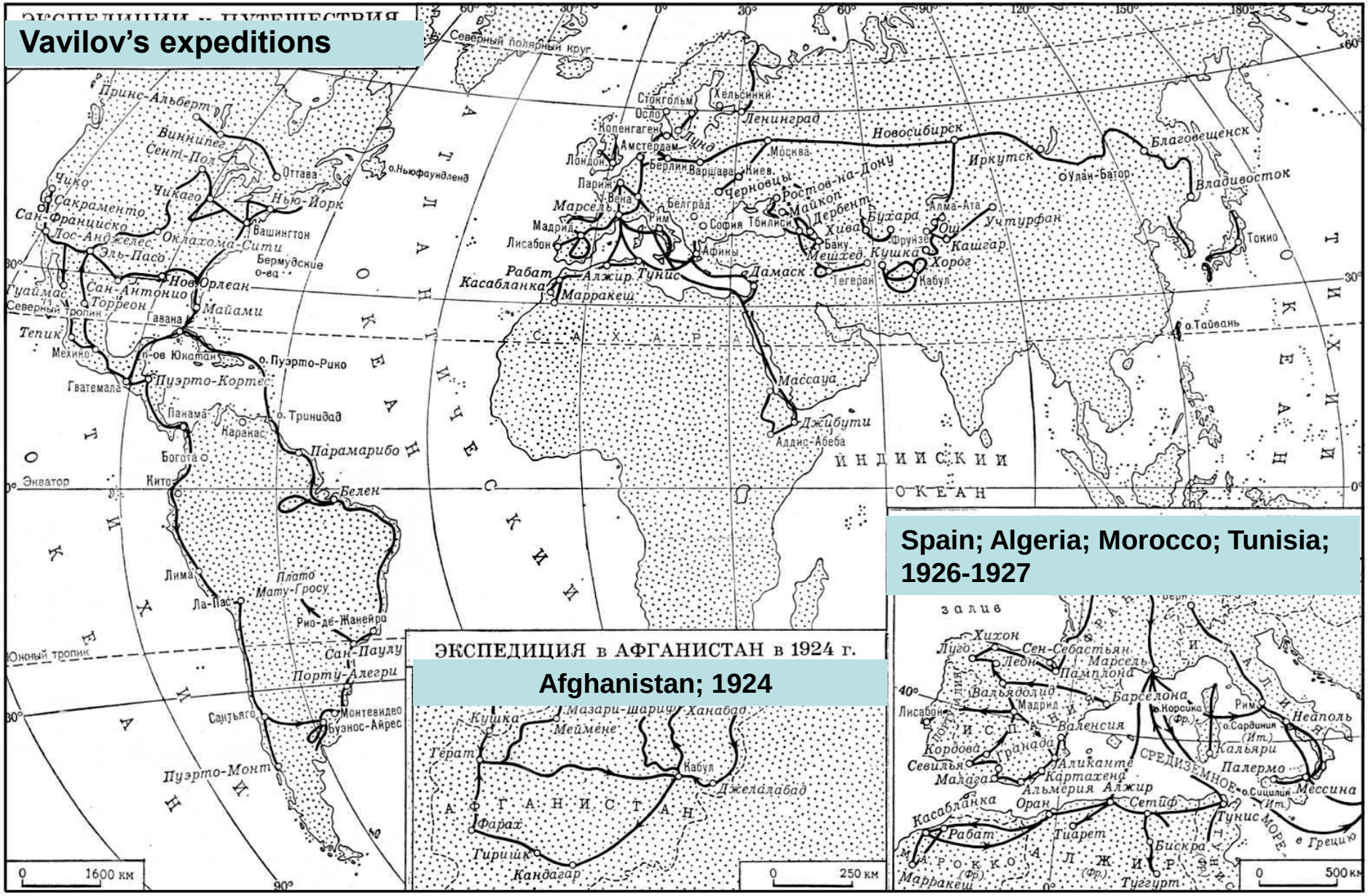
Vavilov's "know how" throughout the world using his original phyto-geographic method of research, which was as an "user guide", to determine the cite where to go (for example, Andian region – potato).

Routes of the main Vavilov's expeditions 1916–1940

maize, common been,lima been, grain amaranth, winter pumpkin, upland cotton, bourbon cotton., sweet potato, pepper, papaya, cashew, black cherry, tomato, cacao.

Routes of the main Vavilov's expeditions 1930-1932

primitive cultivated potato species, maize, common been, Egiptian cotton, cocoa, tobacco, common potato, strawberry, manioc, peanut.


Vavilov's expeditions
Spain; Algeria; Morocco; Tunisia; 1926-1927
ЭКСПЕДИЦИЯ в АФГАНИСТАН в 1924 г.
Afghanistan; 1924
Северный полярный круг
Экватор
Северный тропик
Южный тропик
Принс-Альберт
Виннипег
Сент-Пол
Оттава
Чикаго
Нью-Йорк
Сакраменто
Сан-Франциско
Лос-Анджелес
Оклахома-Сити
Эль-Пасо
Вашингтон
Бермудские о-ва
Гуаймас
Сан-Антонио
Торреон
Новый Орлеан
Майами
Гавана
Тепик
Мехико
п-ов Юкатан
о. Пуэрто-Рико
Гватемала
Пуэрто-Кортес
Панама
о. Тринидад
Каракас
Богота
Кито
Парамарибо
Белен
Лима
Ла-Пас
Плато Мату-Гросу
Рио-де-Жанейро
Сан-Паулу
Порту-Алегри
Сантьяго
Монтевидео
Буэнос-Айрес
Пуэрто-Монт
о. Ньюфаундленд
Стокгольм
Осло
Копенгаген
Хельсинки
Ленинград
Амстердам
Лондон
Берлин
Варшава
Киев
Москва
Новосибирск
Иркутск
Улан-Батор
Благовещенск
Владивосток
Токио
о. Тайвань
Париж
Вена
Марсель
Мадрид
Лиссабон
Белград
Рим
София
Афины
Тбилиси
Черновцы
Ростов-на-Дону
Майкоп
Дербент
Баку
Бухара
Хива
Мешхед
Тегеран
Алма-Ата
Ош
Фрунзе
Кушка
Учтурфан
Кашгар
Хорог
Кабул
Дамаск
Рабат
Касабланка
Алжир
Тунис
Марракеш
Массауа
Джибути
Аддис-Абеба
САХАРА
АТЛАНТИЧЕСКИЙ ОКЕАН
ТИХИЙ ОКЕАН
ИНДИЙСКИЙ ОКЕАН
0 1600 км
Кушка
Мазари-Шариф
Ханабад
Меймене
Герат
Кабул
Джелалабад
Фарах
Гиришк
Кандагар
АФГАНИСТАН
0 250 км
залив
Хихон
Луго
Сен-Себастьян
Леон
Памплона
Вальядолид
Барселона
Мадрид
Валенсия
Кордова
Гранада
Севилья
Аликанте
Малага
Картахена
Альмерия
Алжир
Оран
Сетиф
Касабланка
Рабат
Тиарет
Бискра
Марракеш
Туггурт
Корсика (Фр.)
Сардиния (Ит.)
Сицилия (Ит.)
Рим
Неаполь
Кальяри
Палермо
Мессина
Тунис
СРЕДИЗЕМНОЕ МОРЕ
в Грецию
МАРОККО (Фр.)
АЛЖИР (Фр.)
ТУНИС
0 500 км

The list of Vavilov's expeditions:

1916 - Expedition to Iran (Hamadan and Khorasan) and Pamir (Shungan, Rushan and Khorog).

1921 - Acquaintance trip to Canada (Ontario) and USA (New York, Pennsylvania, Maryland, Virginia, North and South Carolina, Kentucky, Indiana, Illinois, Iowa, Wisconsin, Minnesota, North and South Dakota, Wyoming, Colorado, Arizona, California, Oregon, Maine).

1924 - Expedition to Afghanistan (Herat, Afghan Turkestan, Gaimag, Bamian, Hindu Kush, Badakhshan, Kafiristan, Jalalabad, Kabul, Herat, Kandahar, Baquia, Helmand, Farakh, Sehistan).

1925 - Expedition to Khoresm (Khiva, Novyi Urgench, Gurlen, Tashauz).1926-1927 - Expedition to Mediterranean countries (France, Syria, Palestine, Transjordan, Algeria, Morocco, Tunisia, Greece, Sicily, Sardinia, Cyprus and Crete, Italy, Spain, Portugal and Egypt, Abyssinia (Djibouti, Addis Ababa, banks of Nile, Tsana Lake), Eritrea (Massaua) and Yemen (Hodeida, Jidda, Hedjas).

1927 - to Mountainous regions in Wuertemberg (Bavaria, Germany).

1929 - Expedition to China (Xinjiang - Kashgar, Uch-Turfan, Aksu, Kucha, Urumchi, Kulja, Yarkand, Hotan) together with M.G. Popov, then alone to Chine (Taiwan), Japan (Honshu, Kyushu and Hokkaido) and Korea.
1930 - Expedition to USA (Florida, Louisiana, Arizona, Texas, California), Mexico, Guatemala and Honduras.

1932-1933 - Trip to Canada (Ontario, Manitoba, Saskatchewan, Alberta, British Columbia), USA (Washington, Colorado, Montana, Kansas, Idaho, Louisiana, Arkansas, Arizona, California, Nebraska, Nevada, New Mexico, North and South Dakotas, Oklahoma, Oregon, Texas, Utah); Expedition to Cuba, Mexico (Yucatan), Ecuador (Cordilleras), Peru (Lake Titicaca, Puno Mt., Cordilleras), Bolivia (Cordilleras), Chile (Panama River). Brazil (Rio de Janeiro, Amazon), Argentina, Uruguay, Trinidad and Porto Rico.

1921-1940 - Systematic explorations of the European part of Russia and the whole regions of the Caucasus and the Middle Asia.

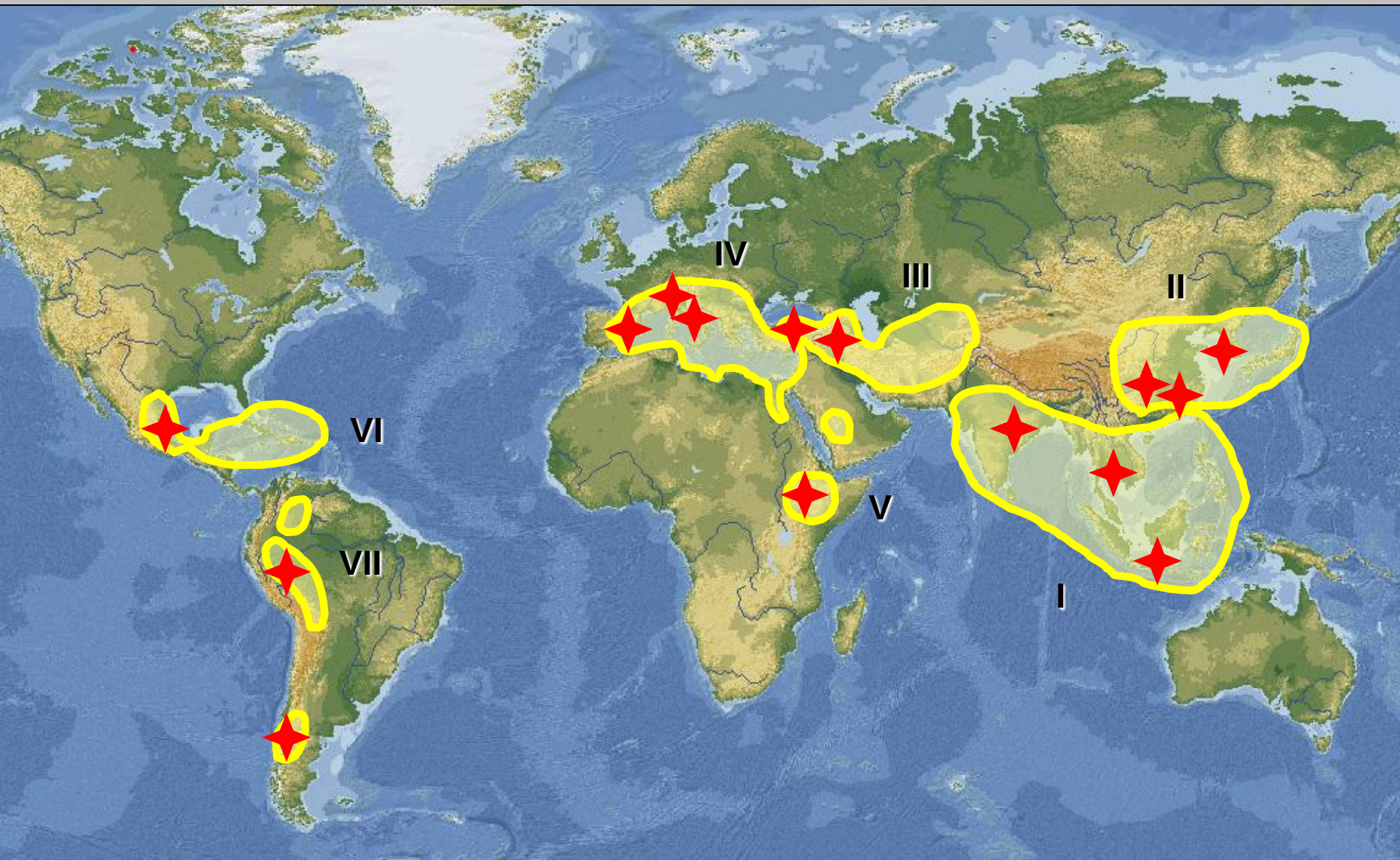
As a result of his expeditions Vavilov sampled accessions of 50 000 varieties of wild plants and 31 000 wheat specimens for the collection of the institute in Russia and postulated that a cultivated plant's centre of origin would be found in the region in which wild relatives of the plant showed maximum adaptiveness.

These conclusions were summarized in The Origin, Variation, Immunity and Breeding of Cultivated Plants, a work that was translated into English in 1951.

- It is believed that the center of origin is also the center of diversity.Until today Vavilov centers are regions where a high diversity of wild relatives can be found, representing the natural relatives of domesticated crops. Later he expanded the theory, stating that the region of greatest diversity of a species of plant represents its centre of origin.

- The centres were located in several relatively small geographic areas on the globe, especially in the mountain areas of Asia, Africa, along the Mediterranean coast and in South, Central and North America.

Centers of origin of cultivated plants



1) Central and South American Center: **maize, common been,lima been, grain amaranth, winter pumpkin , upland cotton, bourbon cotton., sweet potato, pepper, papaya, cashew, black cherry, tomato, cacao.**

2) South American Center: **primitive cultivated potato species, maize, common been, Egiptian cotton, cocoa, tobacco, common potato(48 chromosomes), strawberry, manioc, peanut.**

3) Mediterranean**: (durum wheat, Mediterranean oats, pea, lupine, clover, serradella, flax, rape, mustard, olive, cabbage, turnip, lettuce, asparagus, celery, anyse, thmine).**

4) Middle East Center: **common wheat, oriental wheat, Persian wheat, two-row barley, rye, Mediterranean oats, common oats, lentil, alfalfa, Persian clover, fig, apple, pear, cherry.**

5) Ethiopia: **Abyssinian hard wheat, barley,grain sorghum, pearl millet, African millet, flax, sesame, castor been, coffee, indigo.**

6) Central Asiatic Center: common wheat, peas, lentil, horse been, mustard, flax, sesame, cotton, onion, garlic, spinach, carrot, pistacio, pear, grape, apple.

7) Indian Center (172 species), including: rice, cucumber, radish, yam, mango, orange, citron, sugar cane, coconut palm, sanflower, jute, kenaf, tree cotton.

8) Chinese Center (a total of 136 endemic plants): broomcorn millet., hull-less barley, soybeen, velvet been, chinese yam, radish, Chinese cabbage,onion, cucumber, Chinese apple, peach, apricot, cherry, opium poppy, shugar cane.

Homologous series in hereditary variation

In connection with research concerned Centers of the origin, N. Vavilov discovered the law of the homologous series of inherited variation, which states that closely related species tend to develop parallel hereditary variations.

The law of homologous series reflects a universal and fundamental phenomenon in nature.

N. Vavilov approached the question of the parallelism in variability of allied species and genera from a genetic standpoint and on the basis of a comparative study of very extensive worldwide data.

Great similarity in genotype (almost identical sets of genes) posses similar potential hereditary variability (similar mutations of the same genes).

On the basis of this empirical law N. Vavilov had hoped to predict the direction of the evolution of plant species and the emergence of new biological species.

Before the Second World War the collections of All-Union Institute of Plant Industry numbered

- over 36,000 accessions of **wheat**,
- over 10,000 of **maize**,
- over 23,000 of **legumes**,
- around 18,000 of **vegetables**,
- over 12,000 of **fruit** and **small fruit crops**,
- over 23,000 of **forages**.

The total of accessions reached 250,000 in the times of N.I.Vavilov. All this rich diversity was thoroughly studied at experiment stations in different geographical zones of the country.

VIR’s collection includes about 320 000 accessions of cultivated plants and their wild relatives on 2539 botanical varieties on 304 species of 155 botanical families.

The Institute’s herbarium contains more than 250 000 specimens collected in different locations of Russia.

The Departments of Plant Resources:

- Department of Wheat
- Department of Rye, Barley and Oats
- Department of Leguminous Crops
- Department of Maize and Small Grains
- Department of Forage Crops
- Department of Industrial Crops
- Department of Tuber Crops
- Department of Vegetables and Melons
- Department of Fruits, Berries, Grapes, Ornamental and Subtropical crops

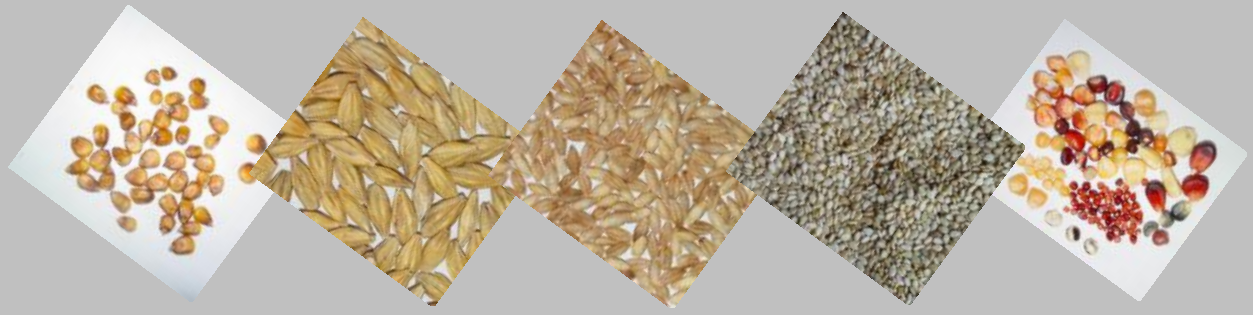
Methodological Departments and Laboratories:

- Department of Computerized Information Systems
- Department of Genetics
- Department of Foregin Relations
- Department of Plant Biochemistry and Molecular Biology
- Department of Plant Immunity
- Department of Plant Introduction, Systematics and Meteorology
- Department of Plant Resistance and Development Physiology
- Laboratory of Biotechnology
- Laboratory of Genetics and Physiology of Productivity
- Laboratory of Ecological Genetics of Quantitative Plant Characters
- Long Therm Storage of Seeds Laboratory

Following Vavilov's concept of developing initial material for breeding, researchers of the Institute study plant genetic resources for characters possessing value for this purpose.

As a result of such cooperation, more than 70% of commercial varieties of modern Russia have been bred using material from the VIR world collection. In cereals, 95% of all cultivars bred in the recent period were based on germplasm stored in the VIR collection.

Using plant materials from VIR's collection the breeders have developed over 2,500 cultivars of various agricultural crops in our country.



The Institute has facilities for germplasm storage including buds and shoots cryopreservation.

Genetics department

- The Department incorporates:
- Laboratory of plant resistance;
- Group of molecular genetics;
- Group of abiotic stress.

The Department of Genetics together with the Departments of Plant Genetic Resources studies the genetic aspects of agricultural crops characters with the aim of their efficient utilization in plant breeding.

- 1. Work for development of the methodology for identification of different genetic systems in plants.
- 2. The search of genes and polygenic complexes controlling plant ontogenesis, quality, resistance to harmful organisms and abiotic stresses; their expression study.
- It is the main direction in the department, it includes:
- - screening the VIR world collection of cultivated plants and their wild relatives;
- - identification of genes for economically valuable traits with the use of traditional and molecular methods;

- investigation of meiosis as a basis of recombination processes in plants;
-construction of high-density linkage maps;
- investigation of genetic stability of plants and plant associations;
- study of the introgression mechanisms;
- study of plant – environment and plant – harmful organism interaction.

Resistance of cereals to harmful organisms

WHEAT

P. graminis
P. triticina
P. dispersa
P. hordei
B. graminis
U. nuda
U. hordei

RYE

TRITICALE

BARLEY

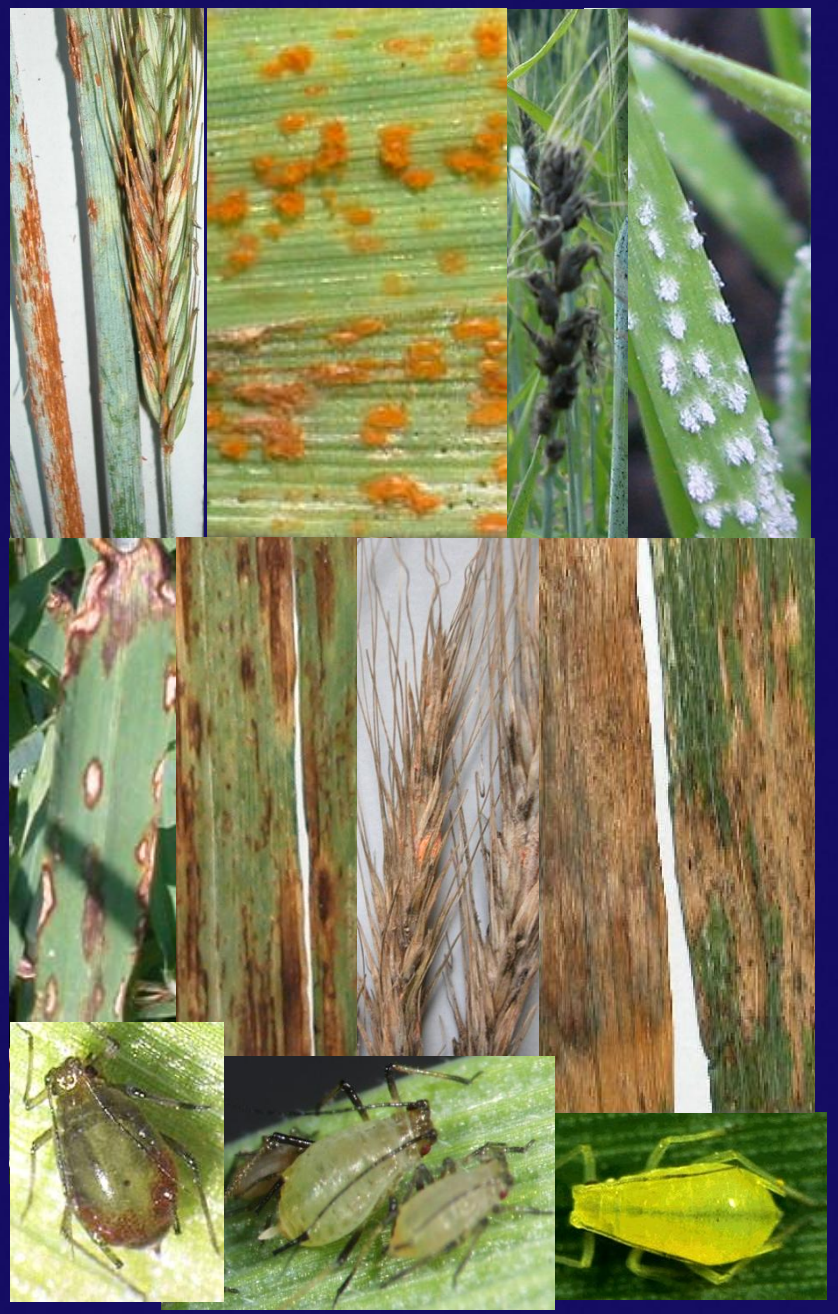
OAT

S. nodorum
D. teres
R. secalis
F. graminearum
C. sativus

SORGHUM

GOAT GRASS (AEGILOPS)

S. graminum
R. padi
S. avenae



STUDIES ON GENETIC STUBILITY OF SUNFLOWER INTERSPECIFIC HYBRIDS

With the use of interspecific hybridization the new forms of annual sunflower (the introgressive lines) have been originated in VIR from crosses of CMS sunflower lines and perennial Helianthus species.

Top branching

Basal branching

The introgressive lines have demonstrated a number of valuable agronomic characters:

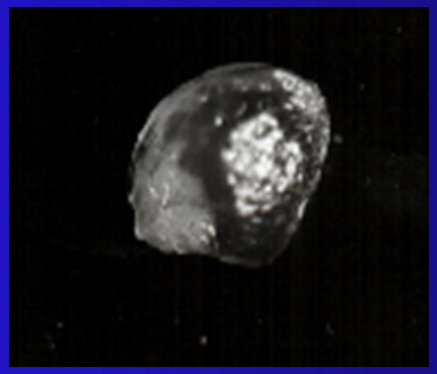
- resistance to downy mildiew;
- tolerance to *Phomopsis;*
- ability to restore fertility of CMS forms;
- early maturation;
- good combining ability;
- recessive branching.

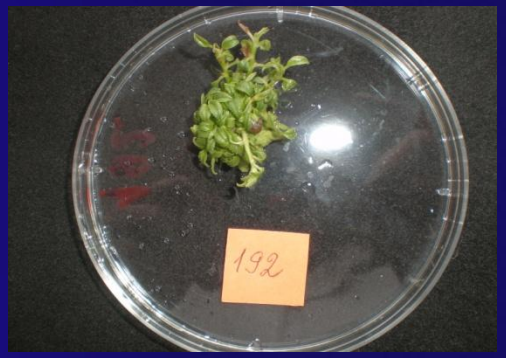
Mean goal - producing of the commercial hybrids.

Resistance of sour and sweet cherries varieties to *Blumeriella jaapii*

Cherry leaf spot caused by *Blumeriella jaapii* is one of the most serious diseases of both sweet and sour cherries in Russia and almost in all around the world. Our research includes several activities: germplasm collection, hybridization, seedling and regenerating evaluation, culture of immature embryos.

Culture of immature embryos applied for producing interspecific hybrids





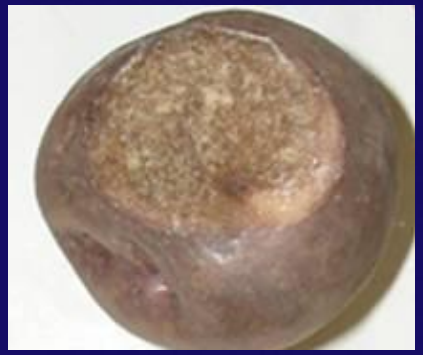
Potato resistance to *Phytophthora infestans*

Sampling of *P. infestans* isolates from affected potato plant

Evaluation of potato in seedling test

Screening for resistance to *P. infestans* by the use of the original method

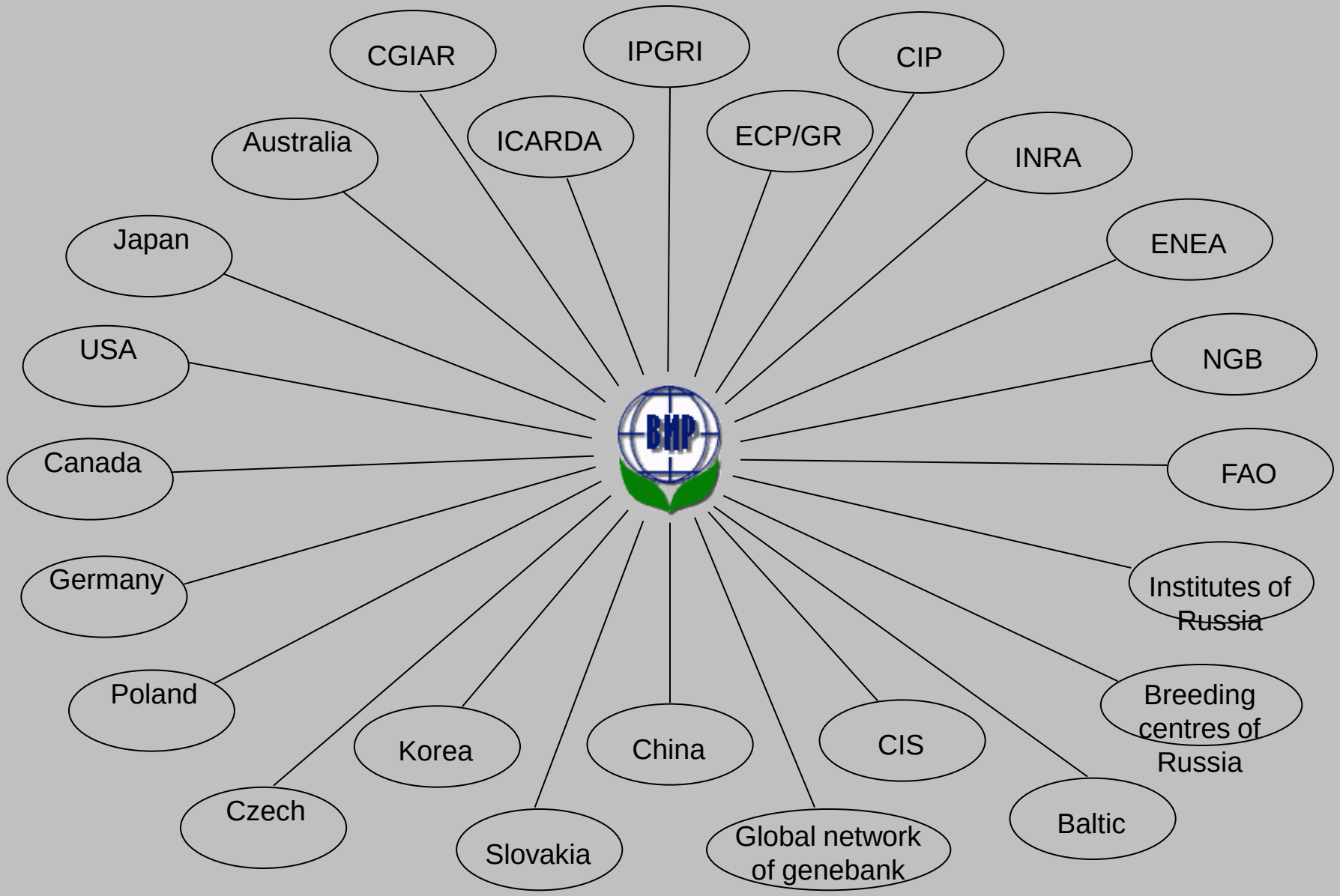
Potato cultivars with different levels of tuber resistance



Mycelium growth on tubers with different level of resistance

✓**From more than 1000 accessions we selected 240 with foliar resistance and 50 with tuber resistance to the pathogen**

International relations of the Institute



File Edit View Go Communicator Help

Back Forward Reload Home Search Netscape Print Security Shop Stop

Bookmarks Location: http://www.vir.nw.ru/ What's Related

N.I.Vavilov Research Institute of Plant Industry

- Всероссийский ИИ растениеводства им. Н.И.Вавилова (ВИР) -

http://www.vir.nw.ru

The Ins ated and developed from the Bureau of Applied Botany organise nder the Ministry of Agriculture and State Property of Russia. Bureau was transformed into the Department of Applied B ant Breeding, which was in 1922 incorporated into the netwo nstitute of Experimental Agronomy (SIEA). This 924 the NC), but 930 the AIAB & NC was reorganised into the All-Union Institute of Plant Industry (VIR). In 1992 this Institute received its current name, and since 1967 has been bearing the name of Academician N.I.Vavilov, a brilliant scientist and the talented director of the Institute from 1921 till 1940.

The N.I. Vavilov Institute of Plant Industry is the only research institution in Russia whose activities include plant genetics resources (PGR) collection, conservation and study. This Institute, its accomplishments, and role in maintaining the global ex situ collection are well known world-wide. Its global PGR collection represents plant diversity

CONTACT
STRUCTURE
HISTORICAL REVIEW
PUBLICATIONS
LIBRARYES/JOURNALS
VIR DATABASE
EUROPEAN GLYCINE DATA
RELATED LINKS
Q&A
GENRES
FAO
IPGRI
EPGRIS
RUS/ENG

Document: Done