Geoff Hall
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2009

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major manuscripts. It was published posthumously in Russian in 1962."

Without the English translation of *Five Continents*, Nabhan's and Pringle's well-researched books would have been orders of magnitude more difficult to write, and much less interesting to read. Since *Five Continents* can be freely downloaded from the publisher, the International Plant Genetic Resources Institute, no readers of either Nabhan or Pringle should deprive themselves of Vavilov's own account of his expeditions.

A Soviet agronomist travels the world to help end famine and ironically dies of starvation in Stalin's prison

> "It seemed that we had finally passed this very difficult trail so that we could mount the horses and continue on. But suddenly from the cliff above the trail, two gigantic eagles flew out from a nest, circling on enormous wings. My horse shied and bolted, galloping along the trail and the ovring. The rein was unexpectedly torn out of my hand and I had to hang on to the mane. Above my head were cliffs but below me, 1000 metres down in the deep ravine, rumbled the beautiful, blue Pyandzh, the upper reaches of one of the great rivers of Inner Asia. That is the experience, which afterwards this traveller remembers best. Such moments steel one for the rest of one's life: they prepare a scientist for all difficulties, all adversities, and everything unexpected. In this respect, my first great expedition was especially useful." (1916, *Five Continents*)

The man who wrote these lines was Nikolay Vavilov (1887–1943), Russian geneticist, plant breeder, plant geographer, and first President of the Lenin All-Union Academy of Agricultural Sciences who, for almost two decades, had at his disposal countless experimental stations with a total staff of 25,000 scattered throughout the Soviet Union.

Vavilov wanted to increase farm productivity to eliminate recurring Russian famines. Early on, he defended the Mendelian theory that genes are passed on unchanged from one generation to the next. He became the main opponent of Stalin's favored scientist, Trofim Lysenko, by speaking out against the neo-Lamarckian agronomist's belief in the inheritance of acquired characteristics.

Little known by non-Russians until the release of *The Murder of Nikolai Vavilov* by Peter Pringle (2008) and *Where Our Food Comes From: Retracing Nikolay Vavilov s Quest to End Famine* by Gary Paul Nabhan (2009), Vavilov was arrested by the NKVD secret police in 1940 while collecting samples in the Ukraine, and disappeared.

In a supreme irony, the architect of Russia's increased food producing capacity died an ignominious death in a Stalinist prison from

starvation after being sentenced to death at a secret trial for espionage, sabotage, and wrecking.

Released documents showed that before his show trial, Stalin's police, seeking a confession, had subjected Vavilov to 1,700 hours of brutal interrogation over 400 sessions, some lasting 13 hours, carried out by an officer known for his extreme methods. Before his arrest, during the long rise in influence of Lysenko, beginning in the 1920s, Vavilov, unlike Galileo, had refused to repudiate his beliefs, saying, "We shall go into the pyre, we shall burn, but we shall not retreat from our convictions."

Who was Vavilov and why does time cement his stature as almost a 20th century Darwin?

In a 2005 article in the *Journal of Bioscience*, Moscow geneticist Ilya Zacharov described Vavilov as "a person of inexhaustible energy and unbelievable efficiency. During his relatively short life, he accomplished a surprising amount: in his expeditions he travelled all over the world, he formulated very important postulates in genetics, he wrote more than ten books, and carried out the gigantic task of organizing a system of agricultural institutions in the USSR."

Vavilov spoke many tongues fluently and learned the essentials of numerous local languages spoken by farmers he encountered in his world-wide travels.

Nabhan interviewed various farm experts in the countries he visited. One in Ethiopia said that Vavilov had "an uncanny ability . . . to pinpoint areas of high diversity." An elderly agronomist in Kazakhstan, who as a boy had guided Vavilov into forests of wild apples, remembered that "he figured out everything . . . from little more than a day in the field." Indeed Vavilov moved at breakneck speed, often commenting, "time is short, and there is so much to do. One must hurry."

Despite knowing something about Lysenko, ethno-botany, and biodiversity hotspots due to professional floristic work in Quebec, Guerrero, and temperate wetlands, I never learned Vavilov's name well enough to retain it until reading Nabhan's persuasive book. I asked friends professionally linked to agronomy outside the U.S., in Canada, France, and Cuba, about Vavilov. Only Anel Matos Vinals, a field botanist in the Cuban Sierra del Cristal, was familiar with

notions that ecologists don't accept, but that most readers are not equipped to challenge.

There are good reasons to defend native agriculture without claiming miraculous virtues. We depend on agriculture for survival, but this was not always the case. As Harlan wrote in 1975, "Crops are artifacts made and molded by man as much as a flint arrowhead, a stone ax-head, or a clay pot . . . The threat of famine has become a characteristic of agricultural systems; we have no evidence that this was a part of preagricultural systems.

Nabhan himself quotes a colleague as saying, "Crop biodiversity is the biodiversity that people made." In a 1998 article by a close student of Vavilov, J.G. Hawkes mentioned, "If we consider the world flora, even a quick survey will show us that there are many areas of plant diversity which have little to do with cultivated plant origins."

Nabhan also puts an inordinate amount of blame on conservationists for the loss of crop varieties due to conflicts between native rights and park creation in the tropics, although park creation is at the extreme bottom of the list of the causes of world crop genetic erosion. Vavilov's own writings do not confuse agriculture with nature. In *Five Continents*, he marvelled at nature regularly and I would be surprised if the "prominent scholars and field scientists" mentioned by Nabhan as presenting Vavilov to the West in the 1950s are any different. This passage about Ethiopia in 1927 is typical of Vavilov's sensibilities: "Fields had disappeared. The area had become more sparsely populated and increasingly more beautiful. Ahead a panorama of a picturesque valley opened up. In hollows and along deep ravines there were groves of wild palms (*Phoenix abyssinica* Drude), a relative of the date palm."

Nearly thirty years before it was published in English in 1997, Maryland botanist E.E. Leppik (1969) mentioned in *Economic Botany* Vavilov's "principal work, entitled *Five Continents*. This was a scientific survey of his travels and explorations. It was to be published in two comprehensive volumes. For this purpose, he prepared extensive manuscripts with numerous original photographs . . . After Vavilov's death, his valuable materials and manuscripts were destroyed. Fortunately his typist, A.S. Mishina, appreciating and comprehending the value of these papers, managed to salvage portions of the

pestilence, floods, and other catastrophes," including neglect and warfare.

Here is where the creation and replenishment of modern local, national and global seed banks confront the issue of agricultural biodiversity as intellectual property, much discussed by Vandana Shiva, an Indian physicist who has authored a dozen books on the ramifications of what she calls "biopiracy," or the theft of germplasm from the Third World and its copyright by multinationals.

Was Vavilov a biopirate? A one-dimensional pirate Vavilov possessing "uncanny abilities to pinpoint areas of high diversity" on the payroll of an earth-poisoning corporation would be the opposite of the real Vavilov of the 1930s, devoted to the collective goal of feeding the world through subtle detection and meticulously sampling of crop varieties or ancestors in the field. What person in any country visited by Vavilov would wish that he had not left behind descriptions of agriculture and crops and sometimes living strains in Russia that could be returned to the source locality?

In *The Living Field* (1995), Jack Harlan wrote, "The world of N.I. Vavilov is vanishing and the sources of genetic variability he knew are drying up. The patterns of variation [that Vavilov described on his expeditions] may no longer be discernible in a few decades and living traces of the long coevolution of cultivated plants may well disappear forever."

In his foreward to Nabhan's book, K.B. Wilson of the Christensen Fund acknowledges an ambiguity underlying the work that can only be explained by the stark differences in attitude three generations ago: "Vavilov is a hero for environmental and social justice activists troubled by the unintended consequences of that same post-WWII crop breeding revolution that Vavilov's discoveries helped to usher in. These consequences included the spread of industrial farming and the 'green revolution' that contributed to the destruction of diversity in crops and their wild relatives."

There are some negatives to Nabhan's book. He causes recurrent irritation when he equates wild diversity with cultural diversity, implying that primitive peoples enhance biodiversity by their presence in an ecosystem and impoverish biodiversity by their absence,

his name and work, having participated in a project inspired by Vavilov's writings, the study of wild mountain relatives of Cuban cultivated plants.

To improve the standard of nutrition for his people, Vavilov wanted to select and introduce resistant crop varieties adapted to Russia's varying conditions. To use the planet as his garden of Eden was dazzling and ambitious, wrote agronomist Jack Harlan in *Crops and Man* (1975), "It was his plan to collect and assemble all of the useful germplasm of all crops that had potential in the Soviet Union, to study and classify the material, and to utilize it in a national plant breeding effort."

Vavilov launched a worldwide plant exploration program and organized — and often led on horseback — 115 expeditions to 64 countries (including Afghanistan, Iran, Taiwan, Korea, Spain, Algeria, Palestine, Eritrea, Argentina, Bolivia, Peru, Brazil, Mexico, and in the U.S., California, Florida and Arizona) to collect seeds of crop varieties and their wild ancestors. To begin, Vavilov concentrated on "areas in which agriculture has been practiced for a very long time and in which indigenous civilizations arose" (Harlan).

Inspired by renowned Swiss botanist Alphonse De Candolle's attempt in 1882 to deduce the region of origin of many cultivated plants, Vavilov predicted that by analyzing geographic patterns of variation and mapping regions where genetic diversity was concentrated, the origin of a domesticated plant could be found, especially, "if much of the variation was controlled by dominant genes and if the region also contained wild races of the crop in question" (Harlan).

As he gathered data on the back of mules, Vavilov postulated the existence of eight world centers of origin of cultivated plants, often associated with mountainous areas and their tribal peoples. After modification, these centers of origin later became "Vavilovian Centers of Diversity."

Later study showed that the phenomenon of centers of variation is real for many crops but not always related to the region of origin of a crop per se, i.e., where first domestication took place. After his exploration phase was cut short in 1933 by Stalin's order, Vavilov developed concepts not only of secondary crops derived from the weeds of fields of more ancient primary crops, but also of secondary

centers to account for the fact that centers of diversity may not be the same as centers of origin. Much later, Harlan considered data still too sketchy to do more than identify three broad independent systems of origin, each involving centers and non-centers of first domestications.

Nabhan points out that the concept of Vavilovian centers of diversity has been one of enduring usefulness to geneticists, conservation biologists, and biogeographers. Vavilov's analyses of patterns of concentration of crop varieties helped lead to the realization that there are patterns of concentration of wild species (biological hot spots) and centers of origin of ornamental plants.

The results of Vavilov's efforts to pinpoint where our food comes from included the creation in Leningrad of an international seed bank, maintained with frequent rejuvenation in field lots, of 200,000 recognizable forms of 2,500 species of food crops.

With the encirclement of Leningrad in 1941 by Hitler's Operation Northern Light, this huge collection of living seeds and roots was in danger not only of falling into the hands of informed Nazi geneticists like Heinz Brucher, but also of being used for food by the suffering local population. Before the arrival of German troops, Stalin had agreed to the secret evacuation of Russia's greatest art museum, the Hermitage, housed in the Winter Palace. But Stalin did nothing to evacuate the seed bank in Vavilov's institute, considering it to be an indulgence of "bourgeois science." 700,000 starved during the three-year siege, including many colleagues in Vavilov's institute who barricaded themselves in with the hidden collection and managed to protect it. These researchers refused to eat the specimens, viewing them as an irreplaceable means for feeding humanity after the Nazi blockade and their own deaths would be forgotten.

In 1969, following 25 years of Lysenko's domination of Soviet biology, much of the authenticity and germinability of the collection had been lost. Nevertheless, Russian writer Genady Golubev wrote in 1979 that "80% of all the Soviet Union's cultivated areas are sown with varieties" derived from Vavilov's collection, including "over a thousand valuable varieties known as 'Vavilov.'"

Other results included over 350 publications by Vavilov, some issued posthumously, including his principal work, *Five Continents*, the narrative that underlies both Nabhan and Pringle.

Nabhan, who knows his subject probably better than anyone, as his ethnobotanical experience, selected Vavilov itinerary and source materials attest, did a more than competent job of researching and presenting the Russian's story and legacy. With Pringle, he shares the great merit of giving Vavilov an audience in the West.

By his title, *Where Our Food Comes From*, Nabhan reminds us that crop varieties providing the world's food descend from wild biota that are absent from over 80 percent of the earth's land surface, including most of the developed world, and that many basic domesticated varieties were selected and preserved by peoples in remote areas.

He also reminds us that "global food security" depends on variability within crop species, a variability that has declined 75 percent over the past century. He lists the causes of this crop genetic erosion, "due to the actions of the poor or the rich, or both" and throughout the book suggests ways and a philosophy to stop this one-way trend.

In countries selected from many visited by Vavilov, Nabhan uses maps, pictures, and text to compare current crops and farmers with those Vavilov encountered between the World Wars — using, in at least one case, detailed field notes that escaped NKVD raids — and allows us a glimpse of Vavilov's previous work.

Nabhan devotes space to Vavilov's scapegoating by Stalin for the Russian famine of 1933, to the rise of Lysenko, and to the dark repression that fell upon Vavilov, his colleagues and their Research Institute as it quietly worked to develop crop strains from its unique collection of genetic material.

An admirer of a man who set the stage for the exploration and preservation of the earth's genetic resources and created before its time an international seed bank to fight famine, Nabhan demonstrates convincingly that, on the one hand, widespread chronic hunger today is not a result of low seed diversity in gene banks, but rather a lack of distribution, and on the other seed collections must be safeguarded as "buffers against famine caused by plagues,