Macmillan Reference USA
1633 Broadway
New York, NY 10019

Gale Group
27500 Drake Rd.
Farmington Hills, MI 48331-3535

Printed in Canada
1 2 3 4 5 6 7 8 9 10

Library of Congress Cataloging-in-Publication Data
Plant sciences / Richard Robinson, editor in chief.
p. cm.
Includes bibliographical references (p.).
ISBN 0-02-865434–X (hardcover : set) — ISBN 0-02–865430-7 (vol. 1) —
ISBN 0-02-865431-5 (vol. 2) — ISBN 0-02-865432-3 (vol. 3) —
ISBN 0-02-865433-1 (vol. 4)
1. Botany—Juvenile literature. 2. Plants—Juvenile literature. [1. Botany—Encyclopedias.] I. Robinson, Richard, 1956-
QK49.P52 2000
580—dc21
00—046064

allele(s) one form of a gene

Autopolyploids may have a different type of genetic buffering. Most autopolyploids are highly heterozygous, with two, three, or more **alleles** represented at any one genetic locus. This may provide the organism with different avenues of response to the demands of different sets of environmental conditions. SEE ALSO CHROMOSOMES; COTTON; SPECIATION; WHEAT.

Andrew H. Paterson

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Potato

The potato (*Solanum tubersosum*) is one of the world's most productive, nutritious, and tasty vegetables, and it is the fourth most important food worldwide regarding production (following rice, wheat, and corn). It is the most economically valuable and well-known member of the plant family Solanaceae, which contains such foods as tomatoes and peppers, and flowers such as the petunia. The edible tubers of potato are actually swollen underground stems, in contrast to the similarly appearing sweet potatoes, which have swollen roots, and are a member of the separate family Convovulaceae (morning glory family).

Early peoples in the high Andes Mountains of Bolivia and Peru, where many wild potato species grow, likely selected the potato as a food about ten thousand years ago. This is a time when many crops were believed to have been selected in Andean South America, and dried potato remains date from about seven thousand years ago from caves in Central Peru. Wild potato species have a geographic range from the southwestern United States to south-central Chile. There is much controversy regarding the number of wild potato species, from perhaps only one hundred to over two hundred.

The potato was not introduced into Europe until the late sixteenth century, where it was only slowly accepted as a food, and even then only by the poor. The potato is infected by many diseases and requires a lot of care. The fungal disease potato late blight was the cause of the devastating Irish potato famine that began in 1846. The famine killed more than one million people and stimulated the huge immigration of Irish people to continental Europe and the United States. SEE ALSO ECONOMIC IMPORTANCE OF PLANTS; POTATO BLIGHT; SOLANACEAE.

David M. Spooner

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Potato Blight

Potato blight (or potato late blight) is caused by a mildewlike fungus called *Phytophthora infestans* that can infect the potato foliage and its tubers. Although *P. infestans* is best known as a **pathogen** of the potato, this fungus also attacks the tomato and a number of other plants belonging to the family Solanaceae.

pathogen disease-causing organism

History

This disease first came to the attention of the world in the 1840s, when it suddenly appeared in Europe and caused the disastrous Irish potato famine. From Europe, the fungus spread all over the world. At first it was thought that the blight was simply due to rainy, cool weather, which caused the potato foliage to turn black and die. In 1863, a German scientist, Anton deBary, proved that *P. infestans* was the cause of the disease, and through his pioneering work, deBary established the base for a new science: plant pathology.

sporulate(s) to produce or release spores

In 1884 in France, a fungicide spray containing copper sulphate and lime, called Bordeaux mixture, was discovered to be an effective means of controlling potato blight when applied to the foliage. This was the first time a plant disease was controlled by protective spraying. During the past fifty years hundreds of chemical fungicides have been developed for the control of potato blight. In the early twenty-first century, the potato crop receives more chemicals annually than any other food plant that we grow. The annual losses due to potato late blight, including both the direct losses in yield and the expense of chemical control, amount to billions of dollars a year.

A potato diseased with potato late blight.

The Disease

P. infestans passes the winter in infected seed tubers kept in potato storages or in the soil of the potato field to be planted. As the new potato crop becomes established during a cool, wet season, the fungus emerges, **sporulates**, and attacks both the foliage and the tubers. If this favorable weather continues, the potato plants can be completely destroyed.

Unfortunately, almost all commercial potato varieties are susceptible to blight and must be protected by spraying with chemical fungicides. Although the potato has emerged as one of the four major food crops in the world during the last few centuries (rice, wheat, and corn being the others), the need for expensive protective spraying has tended to confine its major impact to the more prosperous, industrialized countries of the world. It is urgent that we initiate and support a long-term program to enable the potato to continue and expand its contribution to the nutrition of a growing world population.

An obvious solution for this disease problem, which has caused so much expense and uncertainty in world potato production, is to incorporate a durable late blight resistance in commercially acceptable potato varieties. A high level of this blight resistance has been found in a number of wild potato species in Mexico, which is now recognized as the place of origin of *P. infestans.* These resistant wild potatoes have evolved there, surviving for thousands of years, in a climate favorable for an annual battle with the blight fungus.

Research programs in many countries are now trying to develop commercially acceptable potato varieties with this durable resistance. These resistant potato varieties will not only save the farmer the cost of applying the expensive fungicides, but will provide them with greater security in the production of a good crop of potatoes. Perhaps even more important, for the first time the potato would be available as a basic food crop to many millions of subsistence farmers in developing countries. Today these farmers cannot grow the potato because they do not have the resources needed for the purchase of expensive chemicals used for the control of potato blight.

Today there is an increasing global concern over the quality of the environment. A substantial reduction in the use of agricultural chemicals is considered to be an important step if we are to make progress in improving the environment. The worldwide use of blight-resistant potato varieties would be an important contribution to this program. SEE ALSO BREEDING; ECONOMIC IMPORTANCE OF PLANTS; GENETIC ENGINEERING; INTERACTIONS, PLANT-FUNGAL; PATHOGENS; POTATO.

John S. Niederhauser

Propagation

Plant propagation simply means "making more plants." Reproducing plants from seeds is called sexual propagation. If plant parts other than seeds are used to reproduce a plant, the method is known as asexual propagation. Many ornamental trees, flowering shrubs, foliage plants, and turf grasses are propagated by asexual means. Asexual propagation of plants is generally accomplished by one of three methods: cuttings, grafting, and tissue culture or micropropagation.

Asexual Propagation

Asexual propagation is easy to accomplish, inexpensive, and often requires no special equipment. Asexual techniques are used because larger plants can be produced in a shorter period of time. If a plant does not form **viable** seeds, or if the seeds are difficult to germinate, asexual methods may

viable able to live or to function

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September 25, 2001

Plant Sciences

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Set: 0-02-865434-X
Vol. 1: 0-02-865430-7 (Articles A through CL)
Vol. 2: 0-02-865431-5 (Articles CO through G)
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