Diseases

Clavibacter michiganensis subsp. sepedonicus (Spieckermann et Kothoff) Davis et al. - Ring Rot of Potato.

Object map

Systematic position.

Kingdom Procaryotae, section Irregular Nonsporing Gram-positive Rods, family Pseudomonadaceae, genus Clavibacter.

Synonyms.

Corynebacterium sepedonicum (Spieckermann et Kothoff) Skaptason et Burkholder.

Biological group.

Hemibiotroph.

Morphology and biology.

Cells of Cl. michiganensis subsp. sepedonicus are short (straight or bent), often rounded rods, single or V- and Y-shaped, settling in pairs or chains, usually 0.3-0.8 x 1.0-1.4 mkm in size. Not having flagella. Aerob. Gram-positive. On nutrient mediums, colonies grow very slowly, being round, smooth, poorly raised, opaque, brilliant. Their color is white, cream to yellow. Not diluting gelatin or diluting gelatin very poorly. Curdling milk (some strains peptonize). Reducing litmus milk. Oxydase and urease reactions are negative. Hydrolyzing starch poorly. Not reducing nitrates. Not producing NH_3 and indole. Forming H_2S in insignificant amounts. Not hydrolyzing casein. Utilizing acetate. Hydrolyzing esculin. Producing acid on sorbitol, but not producing it on inulin and ribose. Optimum temperature for growth is 20-23°C, maximum 30-31°C, minimum 3-4°C. The Ring Rot of Potato appears on tubers and adult plants. Vascular ring is usually attacked in tubers. At first stage of the disease development, the ring has a bright cream color, then turns yellow and brown. The bacteriosis attacks the vascular system of the plant, infecting it slowly; therefore, the first symptoms are frequently shown during flowering, especially in damp cold years. The disease may have latent form. The infected plants wilt, with their leaves becoming yellow, covered with spots, braided, and drying up. Diseased plants often lag behind in growth, become dwarfish, with short internodes and close arrangement of leaves. The main sources of the infection are diseased tubers and the vegetation residues.

Distribution.

The Ring Rot of Potato occurs in the USA, Canada, Venezuela, Germany, Finland, France, Austria, Denmark, England, Poland, Belgium, Czechoslovakia, Cambodia, Vietnam, Nepal, and other countries of the world. It is widely distributed in all territories of the former Soviet Union where this culture is growing; i.e., in the Russian Federation, and also in Belarus, Latvia, Armenia, Kazakhstan, Kirghizia, and Ukraine.

Ecology.

Optimum development of bacteriosis on plants is favored with warm damp weather during the first half of their vegetation. Bacteriosis causes the greatest severity in areas with adequate high temperatures; the optimum temperature for pathogen is 21-27°C in droughty years. During adverse weather conditions, the bacterial infection is capable of passing from seed tubers through stolons to young tubers where it may remain in latent form until the following vegetation period. Optimum temperature for distribution of this disease is 21-26°C.

Economic significance.

Severity of the Black Leg of Potato consists in lesion of landing tubers and plants during vegetation, and also in rotting of tubers during storage of yield. The severity of this bacteriosis is especially high in storehouses during long storage periods, if the tubers have infected with internal infection of the pathogen. Yield losses depend on a cultivated variety. In some farms of the Moscow Region, the amount of diseased plants reaches 15-30% under favorable conditions for the bacteriosis, and the amount of infected tubers reaches 8-12% during storage time. In different climatic areas of Belarus, the amount of diseased bushes varies, depending on the resistance of varieties. Within the limits of 0.4-3.8%, the amount of infected tubers having symptoms reaches 4%, and the amount of tubers with latent infection of bacteriosis exceeds 20%. However, on some fields of this country, about 30% of diseased plants are observed during epiphitotics. Control measures include optimum agriculture, maintenance of crop rotation, selection of resistant varieties, careful destruction of the vegetation residues, seed treatment by pesticides before landing, and pesticide treatment of plants during the vegetation period.

Reference citations:

Bel.skaya S.I., Dorozhkin N.A. & Generalova I.V. 1976. Results of research of potato bacterioses. In: Kulesh S.V., ed. Abstracts of reports of scientific-practical conference. Ways of application of progressive methods of plant protection to agricultural production. Diseases of agricultural crops and forests. Riga: MSKH Latviiskoi SSR, p. 79-82 (in Russian).

Bushkova L.N., Avezdzhanova G.P. 1968. The distribution of diseases of agricultural crops in the USSR in 1967. In: Polyakov I.Ya., Chumakov A.E., eds. Pests and diseases distribution on agricultural crops in RSFSR in 1967 and the forecast of their appearance in 1968. Moscow: Rosselkhozizdat, p. 57-58 (in Russian).

Chumaevskaya M.A. & Gorodilova L.M. 1974. Bacterial diseases of agricultural plants in the Tselinograd Region. In: Kandaurov V.I., ed. Selection and Planting. Scientific technical bulletin. Shortandy: VNIIZH, p. 86-92 (in Russian).

Davidchik L.Ya. 1987. About distribution and semiology of bacterial diseases in Latvia. In: Samersov V.F., ed. Protection of agricultural plants in conditions of application of intensive technologies. Abstracts of reports of research-and-production conference. Minsk: Belaruskoe Republikanskoe pravlenie NTO sel.skogo khozyaistva. Part 2. p. 124-125 (in Russian).

Davidchik D.Ya., Khodos S.F. 1990. Bacterial diseases of potato and their pathogens in Latvia. In: Gvozdjak R.I., ed. Materials of conference. Phytoncides. Bacterial diseases of plants. Part II. Kiev & Lvov: KGT-2, p. 71 (in Russian).

Derzhepil.skii L.M. 1980. Bacterioses of potato in Chernovtsy Region. In: Gorlenko M.V., ed. Condition and prospects of development of scientific researches on prevention of resistance in pests and pathogens of diseases to pesticides and development of effectual measures of struggle against bacterial diseases of plants (Abstracts of reports of IV meeting). Moscow: VASKHNIL, p. 56-57 (in Russian).

Ismailov N.D. 1990. Bacterial diseases of potato on seed landings and measures of their control in conditions of the Northeast zone of Kirghiz SSR. PhD Thesis. Moscow: TSKHA. 16 p. (in Russian).

Izrail.skii V.P. 1960. The ring decay of potato. In: Izrail.skii V.P., ed. Bacterioses of plants. Moscow: Gosudarstvennoe izdatelstvo selskokhozyaistvennoi literatury, p. 297-302 (in Russian).

Kazenas L.D. 1954. Diseases of potato in the Alma-Ati Region and its control. Works of republican station of plant protection. Alma-Ata: Kazakhskii VASKHNIL, p. 282-289 (in Russian).

Murzakova K.F. 1966. The immunological features of Corynebacterium sepedonocum (Spiecrermann et Kotthoff) Skaptason et Burkholder and of ring decay of potato caused. PhD Thesis. Moscow, 15 p. (in Russian).

Oganesyan A.A., Gyusyan M.M. & Vartanyan N.A. 1976. Pathogens of bacterioses in Armenia. In: Kanchavelli L.A. et al., eds. III All-Union conference on bacterial diseases of plants. Tbilisi: Metsniereba, p. 177-178 (in Russian).

Pavlyushin V.A. 2001. Methods of studying of bacterioses of potato. Methodical recommendations. St. Petersburg: VIZR, 27 p. (in Russian).

Pavlyushin V.A. & Makarov A.A., eds. 1999. Bacterial diseases of tomato and potato and measures of their control. Methodical recommendations. St. Petersburg: VIZR, 36 p. (in Russian).

Pereverzev D.S., ed. 1989. Methodical recommendations on identification of the bacteria attacking potato. Leningrad: VIR, 50 p. (in Russian).

Pereverzev D.S., ed. 1990. Methodical recommendations on diagnostics of a black leg and a ring rot of a potato. Leningrad: VIR, 23 p. (in Russian).

Polozhenets V.M. 1990. Studying opportunity of transfer of the infection agent of ring decay of potato through generative bodies. In: Gvozdyak R.I., ed. Phytoncides. Materials of conference. Bacterial diseases of plants. Part II. Kiev & Lvov: KGT-2, p. 68-69 (in Russian).

Polozhenets V.M., Kuchko A.A. 1990. The estimation of genotypes of potato resistance to ring decay. . In: Gvozdjak R.I., ed. Phytoncides. Bacterial diseases of plants. Materials of conference. Part II. Kiev & Lvov: KGT-2, p. 69-70. (in Russian).

Sereda G.M. 1993. Black leg of potato and development of measures of its control in conditions of Byelorussia. PhD Thesis. Priluki of Minsk Region: BelNI IEP APK. 20 p. (in Russian).

Shneider Yu.I. 1972. Bacterioses of potato, caused by soft bacteria of Pectobacterium, Pseudomonas and Bacillus. DSc Thesis. Moscow: TSKHA, 71 p. (in Russian).

Shpaar D., Kleinkhempel G., Myuller G. & Naumann K. 1980. Bacterioses of cultural plants. Handbook. Moscow: Kolos, 143 p. (in Russian).

Yanovich V.I. 1966. Distribution of ring decay of potato in Belarus both morphological and physiological properties of pathogen Corynebacterium sepedonicum. In: Beltyukova K.I., ed. Abstracts of reports of All-Union symposium on bacterial diseases of plants. Kiev: Naukova Dumka, p. 61 (in Russian).

Yanovich V.I. 1971. Features of biology of pathogen of ring decay of potato and measure of its control in conditions of Belarus. PhD Thesis. Minsk, 16 p. (in Russian).

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Erwinia carotovora subsp. atroseptica (van Hall) Dye - Black Leg (Soft Rot) of Potato.

Diseases

Erwinia carotovora subsp. atroseptica (van Hall) Dye - Black Leg (Soft Rot) of Potato.

Object map

Systematic position.

Kingdom Procaryotae, section Gram-negative aerobic rods and cocci, family Enterobacteriaceae, genus Erwinia.

Synonyms.

Bacillus atrosepticus van Hall, Erwinia atroseptica (van Hall) Jennison, B. atrosepticum (van Hall) Lehmann & Neumann, Erwinia phytophthora (Appel) Holland, Pectobacterium atrosepticum (van Hall) Patel & Kulkarni,Pect. carotovorum var. atrosepticum Hellmers & Dowson, B. carotovorum var. atrosepticum (Jones) Hellmers & Dowson, Pectobacterium phytophthorum (Appel) Waldee, E. carotovora var. atroseptica (Hellmers & Dowson) Dye.

Biological group.

Hemibiotroph.

Morphology and biology.

The Black Leg of Potato attacks tubers and plants during vegetation. It is also shown as rotting of tubers during yield storing. The radical part of plant stems (more often in seedlings) rots and gets various colors (from yellow-brown to black). Such stems lag behind in growth. Their leaves turn yellow and become chlorotic. The top leaves are fine, rigid, rolling around central rib. Diseased stems grow upward at the sharp angle, easily separating from the parent tuber. The Bacteriosis is shown on infected tubers as rotting (soft rot) of core at stolon mainly (less often in places of the infection introduction) that causes, as a rule, destruction of the bush. This diseased pulp is dark-brown to black, smelling sharply and unpleasantly. Healthy tubers may be infected by mechanical contact with the diseased ones (during vegetation and harvesting). The diseased vegetation residues and tubers are sources of the bacterial infection. Cells E.carotovora subs. atroseptica are straight bacilli, usually 0.5-1 x 1.3 mkm, moving by means of peritrichous flagella. Gram-negative. On potato agar, colonies are bluish, convex-flat, rounded, with rough borders. On Logan.s media, they are light-blue, in big bowl-shaped cavities. Diluting gelatin. Not hydrolyzing starch. Excreting H_2S and NH_3. Not forming indole. Reducing litmus milk; some strains peptonizing milk. Oxidaze test is negative. Reducing nitrates. Catalase test is positive. Having no urease. Excreting acid on mediums with carbohydrates. Having pectolitic enzymes. Optimum temperature for growth of bacteria is 24-28°C, maximum 37°C.

Distribution.

The Black Leg (Soft Rot) of Potato meets in all countries of the world. It is widely distributed in all territory of the former Soviet Union where this culture is growing.

Ecology.

Development of the Black Leg of Potato depends on combination of some abiotic factors (temperature, relative humidity of air, amount of precipitations, etc.). These factors determine also the length of incubatory period during the bacteriosis development. The bacteriosis causes the greatest severity in areas with rather high temperature (optimum temperature for the pathogen is 21-27°C) and under long damp weather conditions (especially at sufficient

precipitations and high air humidity, more than 50%). Under adverse weather conditions, the bacterial infection is able to pass from seed tubers through stolons to young tubers and to be kept there in the latent form till the following vegetation period. Optimum temperature for this disease spread is 21-26°C. The bacteriosis severity is especially high in storehouses, where the storing tubers infected with the internal infection of pathogen are kept for a long time.

Economic significance.

The pathogen of bacteriosis attacks a lot of both cultural and wild-growing species of plants of various families. Severity of the Back Leg of Potato consists in lesion of landing tubers and vegetating plants, and also in rotting of tubers during yield storing. Yield losses depend also on a cultivated variety. In the North-Western zone of Russia (Leningrad Region), the amount of infected plants varies depending on presence of surface or internal infection (from 6.5-7.5 to 30-65%). The lesion of stems and tubers by the pathogen grows at subsequent reproductions of potato. Thus, in epiphytotic 1979 the amount of diseased young plantings and tubers (the variety Stolovyi 19) reached 7.5% in superelite, 22.5% in elite, and 35.7% in the first-reproduction plants. In Primorskii Territory and in the south of the Kamchatka Region, the disease attacked 3-10% and 15-20% of bushes, and during epiphytotics - 80% and 40%, accordingly. There were 16-20% of infected plants in Belarus in epiphytotic years; storage losses caused by the Black Leg and Soft Rot varied from 10 to 30% (or 25-80%, counting the latent form). The amount of diseased plants sometimes reached to 30% in Lithuania. In Latvia, the Black Leg attacked 20-23% of plants in elite plantings; more than 5% of tubers were diseased at storage (to 40%, counting the latent form). In Georgia, the amount of infected plants was 1.5-5% during vegetation, about 2-5% of tubers during storage. In Kirgizia, in some years, the Black Leg attacked about 5-8% of plants (depending on susceptibility of varieties). Control measures include a complex of various agronomical actions, which should be directed to cultivation of healthy plants. These are maintenance of crop rotation, selection of resistant varieties, correct application of mineral fertilizers, pesticide treatment of plants during vegetation, careful destruction of the vegetation residues. Control of carriers of bacteria and of weeds as reservations of bacterial infection is important. It is necessary to use highly sensitive serological methods for early diagnostics of seed infection by the pathogen.

Reference citations:

Bel.skaya S.I., Dorozhkin N.A. & Generalova I.V. 1976. Results of research of potato bacterioses. In: Kulesh S.V., ed. Abstracts of reports of scientific-practical conference. Ways of introduction of progressive methods of plant protection to agricultural production. Diseases of agricultural crops and forests. Riga: MSKH Latviiskoi SSR, p. 79-82 (in Russian).

Binilauskaite I.K. 1959. The black leg in conditions of Lithuanian SSR. Reports of scientific conference on plant protection. In: Vinitskas Z., ed. Vilnius: AN Litovskoi SSR, p. 235-238 (in Russian).

Bushkova L.N. & Lazarev A.M. 1982. Distribution of black leg of potato on seed-growing plantings in Leningrad Region. In: Prieditis A., ed. Works of Latvian SKHA. Control against pests and diseases of potato, fruits and vegetable field cultures. Yelgava: Latviiskaya SKHA. Vol. 200. p. 38-40 (in Russian).

Chumaevskaya M.A. & Gorodilova L.M. 1974. Bacterial diseases of agricultural plants in the Tselinograd Region. In: Kandaurov V.I. ed. Selection and Planting. Scientific technical bulletin. Shortandy: VNIIZH, p. 86-92 (in Russian).

Davidchik D.Ya., Khodos S.F. 1990. Bacterial diseases of potato and their pathogens in Latvia. In: Gvozdjak R.I., ed. Materials of conference. Phytoncides. Bacterial diseases of plants. Part II. Kiev & Lvov: KGT-2, p. 71 (in Russian).

Derzhepil.skii L.M. 1980. Bacterioses of potato in Chernovtsy Region. In: Gorlenko M.V., ed. Condition and prospects of development of scientific researches on prevention of resistance in pests and pathogens of diseases to pesticides and development of effectual measures of struggle against bacterial diseases of plants (Abstracts of reports of IV meeting). Moscow: VASKHNIL, p. 56-57 (in Russian).

Garin N.A. & Kvasha V.I. 1973. The influence of duration of potato tuber greensprouting on yield and on lesion of plants by black leg. In: Kuz.min G.T., ed. Works of Far East NIISK. V. 13, part 2. Khabarovsk: Khabarovskoe knizhnoe izdatel.stvo, p. 274-275 (in Russian).

Generalova I.V. 1975. The distribution and severity of black leg and spot decay of potato in Belarus. In: Ambrosov A.L., ed. Materials of Republican conference on plant protection. Minsk: Belarus Respublikanskoe pravlenie NTO sel.skogo khozyaistva, p. 30-31 (in Russian).

Giorgobiani N.S., Elishvili P.K., Keshelava R.F. & Alishvili T.D. 2005. Members of the genus Erwinia - the pathogens of rots of potato and white-head cabbage in Georgia. In: Podgorskii V.S., ed. Phytopathogenic bacteria. Phytoncidology. Allelopathy. Collection of articles of participants of International Scientific Conference. Kiev: Gosudarstvennyi Agroekologicheskii Universitet, p. 40-43 (in Russian).

Ismailov N.D. 1990. Bacterial diseases of potato on seed landings and measures of their control in conditions of the Northeast zone of Kirghiz SSR. PhD Thesis. Moscow: TSKHA. 16 p. (in Russian).

Kazenas L.D. 1954. Diseases of potato in the Alma-Ati Region and its control. Works of republican station of plant protection. Alma-Ata: Kazakhskii VASKHNIL, p. 282-289 (in Russian).

Lazarev A.M. 1985. Biological features of the pathogen of black leg of potato in the North-Western zone of RSFSR and methods of its diagnostics. PhD Thesis. Leningrad: VIZR, 18 p (in Russian).

Lazarev A.M. 1990. The black leg of potato in the South of the Kamchatka Region. In: Gvozdjak R.I., ed. Phytoncides. Bacterial diseases of plants. Materials of conference. Part II. Kiev & Lvov: KGT-2, p. 63-64 (in Russian).

Oganesyan A.A., Gyusyan M.M. & Vartanyan N.A. 1976. Pathogens of bacterioses in Armenia. In: Kanchavelli L.A. et al., eds. III All-Union conference on bacterial diseases of plants. Tbilisi: Metsniereba, p. 177-178 (in Russian).

Sereda G.M. 1993. Black leg of potato and development of measures of its control in conditions of Byelorussia. PhD Thesis. Priluki of Minsk Region: BelNI IEP APK. 20 p. (in Russian).

Shneider Yu.I. 1972. Bacterioses of potato, caused by soft bacteria of Pectobacterium, Pseudomonas and Bacillus. DSc Thesis. Moscow: TSKHA, 71 p. (in Russian).

Shpaar D., Kleinkhempel G., Myuller G. & Naumann K. 1980. Bacterioses of cultural plants. Handbook. Moscow: Kolos, 143 p. (in Russian).

Sidlyarevich V.I., Kolyadko N.N., Popov F.A., Prishchepa L.I., Zhukova P.S., Mikulskaya N.I., Bunyaki V.P., Zherdetskaya

T.A., Zabara J.M., Evstegneeva N.V., Komarova M.S., Korunets I.V., Lameko V.M., Novikova O.T. & Osipov V.G. 1998. Vegetable cultures. In: Samersov V.F., ed. The integrated systems of protection of agricultural crops from pests, diseases and weeds. Baranovichi: Baranovichevskaya ukrupnennaya tipografiya, p. 61-62 (in Russian).
Skrynnik L.I. 1975. The features of appearance and development of black leg of potato in Kamchatka. In: Yarushin A.M., ed. Proceedings (Vols. 2-3). Khabarovsk: Khabarovskoe knizhnoe izdatel.stvo, p.182-186 (in Russian).
Zagurskaya L.E. & Sereda G.M. 1989. The distribution of bacterial diseases of potato depending on seed quality. In: Samersov V.F., ed. Plant protection. Collection of proceedings of Belarus NIIZR. Vol. 14. Minsk: Urozhai, p. 39-41 (in Russian).

Alternaria solani Sor. - Early Blight of Potato

Diseases

Alternaria solani Sor. - Early Blight of Potato

Object map

Systematic position.
Section Deuteromycota, order Hyphales, family Dematiaceae, genus Alternaria.

Synonym.
Macrosporium solani Ell. et Mart.

Biological group.
Facultative parasite.

Morphology and biology.
Leaves, stems, and tubers are affected by this pathogen. Initial infection is most frequent on older leaves. Spots are dark brown, having concentric rings. The spots develop mainly in the center of leaves. During the period of potato vegetation the disease progresses and infected leaves turn yellow and dry or fall. On stems the spots are gaunt, having no clear contours. During potato harvest the fungus spores can be transferred to tubers from infected leaves and tops, but the tuber infection is usually evident only several months later after potato storage. Dry, dark and pressed into tubers, the lesions appear on the tuber surface. The underlying flesh is dry, leathery, and usually brown. Lesions can enlarge during storage, and tubers can become shriveled. Mycelium, conidia, and chlamidospores winter in soil or in dead leaves and infected tops. If spring weather is moist and warm, the fungus begins to produce spores actively and infects potato. A. solani produces large (15-19 x 150-300 microns) pear-shaped conidia with both transverse and longitudinal cross walls. The multi-cellular conidia vary in color from pale to light tan. Conidiophores occur singly or in small groups; they are pale to olive-brown. Spores are carried primarily by wind, infecting potato leaves under conditions of warm weather and high relative humidity (95%).

Distribution.
The disease is spread everywhere throughout the zones of potato cultivation. Every year this disease is found in Volga-Vyatka, Central and Central Black Soil areas, and in the Far East. Early Blight has a very high severity in Baikal zone, in the Far East and in North East region of the European part of Russia; a moderate development of the disease is observed in Central Russia.

Ecology.
In addition to the potato, A. solani can infect tomato. Warm weather, with short rains or abundant dews, is favorable for the development of the disease. Optimum temperature for the conidia germination is 24-30 degrees C, minimum is 7 degrees C; optimum humidity is 90-100%. Late cultivars are usually more resistant than early ones. Early Blight is often more prevalent on older tissues and on the leaves damaged by insects. The disease is more severe when the potato plants are under stress, having been injured or having poor nutrition.

Economic significance.

The disease decreases the germination of sowing material and tuber yield, causes premature dying of tops, and diminishes the quality of tubers during storage. During years of epidemics 75% of tops of early varieties are infected with A. solani, and the tuber yield decreases by more than 40%. Tuber storage length and germinating power also decreases. To protect the potato from the disease, the following measures are recommended: removal of infected tubers during storage; crop rotation with the use of cereals as precursors; spatial isolation of potato and tomato sowings; the use of resistant cultivars. Before appearance of the first disease symptoms the potato plants should be sprayed by fungicides. The first treatment is a preventive (prophylactic) one, when the conditions are favorable for disease development, but before the tops begin to close in plant rows. The next treatments must be applied in 10-14 days. It is necessary to remove or plow crop residues.

Reference citations:

Kvasnyuk N.Y., Kozlovskii B.E. 1985. Early Blight of Potato. Zashchita rastenii, 11: 27-28. (In Russian)

Levkina L.M. 2003. Genus Alternaria Nees. News in systematics and nomenclature of fungi. Moscow: National Academy of Mycology. 276-303 p. (In Russian)

Volovik A.S., Kladova A.I. 1969. Fungal diseases of potato. Distribution of pests and diseases of agricultural plants in Russia in 1968 and forecast of their appearance in 1969. Moscow: Rosselkhozizdat. 126-129 p. (In Russian)

Volovik A.S., Litun B.P. 1975. Damage of potato diseases. Zashchita rastenii, 7: 4-5. (In Russian)

Yagneshko D.I. 2000. Early Blight of Potato. Achova Raslin, 3: 21-22. (In Russian)

Phytophthora infestans (Mont.) de Bary - Potato Late Blight.

Diseases

Phytophthora infestans (Mont.) de Bary - Potato Late Blight.

Object map

Systematic position.

Class Oomycetes, order Peronosporales, family Phytophthoraceae, genus Phytophthora.

Biological group.

Obligate pathogen.

Symptoms of disease and biology of pathogen.

P. infestans affects the leaves, stems and potato tubers. Symptoms appear at first as water-soaked spots, usually at the edges of the lower leaves. In moist weather the spots enlarge rapidly and form brown, blighted areas with indefinite borders. High humidity favors the appearance of white aerial mycelium on the undersides of the leaves. On stems the symptoms of disease develop as dark brown spots, and the stems break off. On potato tubers the Late Blight develops as purplish or brownish blotches consisting of water-soaked, dark, somewhat reddish brown tissue that extends into the flesh of the tuber. In their life cycle the fungi have two stages, asexual and sexual. In asexual stage the mycelium produces branched sporangiophores with lemon-shaped sporangia at their tips. Sporangia germinate in water on leaf surface and produce motile zoospores that are biflagellate. They move in water, then lose flagellums, form cell wall (encyst) and develop germ tubes penetrating into plant tissue, where multinuclear nonseptate mycelium develop. The type of sporangia germination is governed by environmental conditions, especially by temperature. The sporangia release zoospores at low temperatures (4. . 12.C), but they germinate by producing a germ tube at higher temperatures (20. . 27.C). The spores are washed from top, then they penetrate into soil and infect tubers. In sexual stage P. infestans have two mating types designated as A1 and A2. It can undergo sexual reproduction if only mycelia of both mating types are present in a population. Mycelia of both mating types differentiate anteridia and oogonia. When the anteridia and oogonia of different mating types fuse, the oospores are formed. They are covered with hard thick wall and can survive long in the soil in the absence of a host plant. After winter the oospores germinate by a germ tube that produces a sporangium.

Distribution.

The Late Blight disease of potato is found in all areas where potatoes are grown. However, the damage of the disease depends on climatic and soil conditions. The South of the former USSR (Uzbekistan, Turkmenistan, Tajikistan, Georgia, and Azerbaijan) is a zone of low development of the disease (about 20% of affected tops). Central and Black Earth areas of Russia and the North Caucasus are the zones of moderate development of the disease (20-50% affected tops). The North West of Russia, the Ural, Siberia and especially the Far East is characterized by high damage (more than 50% of affected tops) of the disease.

Ecology.

The development of the Late Blight epidemics depends greatly on the prevailing humidity and temperature during the different stages of the life cycle of the fungus. Late blight may cause total destruction of all plants in a field within a week or two, when the whether is cool and wet. The fungus grows and sporulates most abundantly at relative humidity near 100% and temperature between 15 and 25.C.

Economic significance.

Potato Late Blight is one of the most devastating diseases in human history. Besides potato the Late Blight is also very destructive to tomatoes. Late Blight of potato can be controlled by combination of sanitary measures, resistant varieties, and well-timed chemical sprays. Fungicides used for the Late Blight control include Mancozeb.

Related references:

Chumakov A.E., Zakharova T.I. 1990. Damage of agricultural plant diseases. Moscow: Agropromizdat, 126 p. (in Russian).

Dudka I.A., Burdyukova L.I. 1996. Flora Fungorum Ukrainicae. Oomycetes. Phytophthoraceae, Albuginaceae. Kiev: Naukova Dumka, 204 p. (in Russian).

Popkova K.V. 1972. Potato Late Blight. Moscow: Kolos, 175 p. (in Russian).

Zakharenko V.A. 2003. Tendencies to the alteration of complexes of species, varieties of intrapopulation structures and dynamics of harmful organisms. Moscow, 31 p. (in Russian).

Potato leafroll luteovirus - Potato Leaf Roll Virus (PLRV)

Potato leafroll luteovirus - Potato Leaf Roll Virus (PLRV)

Object map

Systematic position.

Kingdom Vira, genus Polerovirus. Strains: Tobacco yellow top virus, Tomato yellow top strain. ICTV decimal code: 39.0.1.0.012.

Synonyms.

Potato leaf-roll virus (Appel, 1911), Potato phloem necrosis virus (Quanjer, 1913), Potato virus 1 (Jonson), Solanum virus 14 (Smith), Corium solani (Holmes).

Biological group.

Obligate parasite.

Morphology and biology.

The symptoms of the disease development depend on potato cultivar, time of infection and climatic factors. Leaves of the infected plants become coarse, brittle, and rolled along midrib. The symptoms are registered on leaves of both upper and lower layers. Tubers collected from the infected plants are usually smaller; they germinate, producing thin filiform sprouts; quite often they have inner necrosis. On the whole, the symptoms of the infection depend in many respects on the cultivar characteristics of potato, on ecological conditions, and on the pathogenicity of virus strain. PLRV infects most of solanaceous crops, being transmitted by various aphid species; but the more efficient vector is Myzodes persicae; in its body the PLRV multiplies and retains itself until the aphid dies. Virions have spherical shape, 24 nm in diameter. The PLRV is not transmitted by mechanical inoculation or by seeds and pollen, but is transmitted by grafting.

Distribution.

PLRV is widely distributed in the areas of potato growing, especially in the climatic zones with traditionally high infestation by the aphid vectors, and in agrocenoses, where screening of seed potato for virus infection is not performed. This virus is registered in Primorskii Territory, Kazakhstan; republics of Central Asia, Volga region, Transcaucasia; the Northern Caucasus, Moldova, Baltic States, in the Central region of Russia, in Nizhnii Novgorod, Ivanovo, and Velikii Novgorod Regions.

Ecology.

Ecological factors considerably affect the extent of PLRV harmfulness, as the virus distribution completely depends on the number of aphid vectors.

Economic significance.

Potato leaf roll is distributed in all main zones of potato growing. According to the data of Vlasov & Larina (1982), the yield decrease ranges between 38% and 74%.

Reference citations:

Ambrosov A.L., Davidchik L.Ya. 1975. The harmfulness of L-virus of potato in Belorussia. In: Yurkevich I.D., ed. Botany. Issue 17. Minsk: Nauka i Tekhnika, p.176-180. (in Russian).
Bubentsov S.T. 1967. Leaf roll. In: Potato diseases. Alma-Ata: Kainar, p.19-24. (in Russian).
Cherepanova R.V. & Sinitsin V.V. 1980. To the question of the diagnostics of potato leaf roll virus. Selektsia i semenovodstvo kartofelya 36: 92-97. (in Russian).
Goncharov V.S. & Morozova N.P. 1978. Potato leaf roll in Central Chernozem zone. In Kuznin N.A., ed. Technology of growing grain, industrial and forage crops. Scientific Transactions of Agricultural Research Institute of Central Chernozem zone. V.15(1). Kamennaya Step': Agricultural Research Institute of Central Chernozem zone, p.120-127. (in Russian).
Ivshin E.I. & Krasavin V.F. 1988. Distribution and harmfulness of potato leaf roll in the conditions of the South-East. In: Bobrov L.G., ed. Scientific provision of potato production in Kazakhstan. Alma-Ata: VASKhNIL, Eastern branch, p.18-27. (in Russian).
Maryukhina Z.D. & Baidin V.A. 1986. Potato leaf roll in the conditions of the Southeast of Kazakhstan. Vestnik selskokhozyaistvennoi nauki Kazakhstana 1: 44-46. (in Russian).
Randalu I. & Kass Kh. 1976. About potato leaf roll in Estonian SSR. In: The ways of introduction of progressive methods of plant protection in agricultural production. (Proc. scientific-practical conf.). Riga: MSKh Latv.SSR, p.97-98. (in

Russian).
Ryzhkov V.L. & Protsenko A.E. 1968. Atlas of viral plant diseases. Moscow: Nauka. 136 pp. (in Russian).
Vlasov Yu.I. & Larina E.I. 1982. Agricultural virology. Moscow: Kolos. 237 pp. (in Russian).
Zhukova I.M. 1983. About potato leaf roll in Byelorussia. In: Migene M.Ya., ed. Ways of the further improvement of plant protection in Baltic republics and Byelorussia. Part 2. Riga: Upr.NTI MSKh Latv.SSR, p.111-113. (in Russian).
Zhukova I.M. 1989. About distribution of potato leaf roll virus. In: Samersov V.F., ed. Zashchita rastenii. V.14. Minsk: Uradzhai, p.35-38. (in Russian).
Zykin A.G. 1976. Distribution of viral and mycoplasma diseases and their pathogens. In: Viral diseases of potato. Leningrad: Kolos, p.38. (in Russian).

Potato virus Y potyvirus - Potato Virus Y (PVY)

Diseases

Potato virus Y potyvirus - Potato Virus Y (PVY)

Object map

Systematic position.

Kingdom Vira, Group Potyvirus, family Potyviridae. ICTV decimal code 57.0.1.0.058. Strains: Y^N (tobacco veinal necrosis strain), Y^O (common strain), Y^C (stipple streak strain).

Synonyms.

Kartoffel-Y-virus; datura 437 virus; potato acropetal necrosis virus; potato severe mosaic virus; potato virus 20; potato virus Y; tobacco veinal necrosis virus; Solanum virus 2.

Biological group.

Obligate parasite

Morphology and biology.

Symptoms on potato plants depend on PVY strain and cultivar, including mild to severe leaf mottling, or streak or leaf-drop streak with vein necrosis (stipple-streak). Virions filamentous, not enveloped, usually flexuous, with clear modal length, 730 nm, 10 nm wide (Delgado-Sanchez and Grogan, 1966). Temperature for the virus inactivation is 52-62.C, limiting dilution . 1:100, loss of infectivity in sap is 48-72 hours. Transmitted by a vector; an insect; Myzus persicae Sulz. is the most efficient vector, others are Aphis nasturtii Kalt., A. fabae Scop., Aulacorthum solani Kalt.

Distribution.

Probably, the PVY is distributed worldwide, where potato is grown. In the former USSR, it is distributed everywhere. The disease severity is registered in Byelorussia, Latvia, Lithuania, Moldova, Ukraine, in Northern Caucasus, Central and North-West regions, and in the Far East.

Ecology.

Ecological factors influence mainly on the dynamics of aphids numbers. PVY transmission occurs by infected potato tubers; as a result, it can be maintained in potato crop independently of natural foci of the virus.

Economic significance.

Broad specialization of PVY allows infecttion of many Solanaceae crops (potato, pepper, tomato, aubergine, etc.) and yield losses can reach 60-80%. PVY is especially harmful in central and southern regions of Russia. The main control methods are virus free seed potato production and growing crops when vectors are absent or their numbers are low.

Reference citations:

Ambrosov, A.L. 1975. Viral diseases of potato and crop protection. Minsk: Uradzhai, p. 41-49 (in Russian).
Blotskaya, Zh.V. 2000. Viral, viroid and phytoplasma.s diseases of potato. Minsk: Tekhnologia, p. 11-12 (in Russian).
Bokx, de J.A. & Huttinga, H. 1981. Potato virus Y//CMI. AAB Descriptions of Plant Viruses. N 242.
Chesnokov, P.G. 1961. Degeneracy diseases of potato. Leningrad-Moscow: Publishing house of agricultural literature, magazines and posters, p. 240-250 (in Russian).
Loebenstein, G., Berger, P.H., Brunt, A.A., Lawson, R.H., eds. 2000. Virus and virus-like diseases of potato and production of seed potatoes. Dordrecht, Boston, London: Kluwer Academic Publishers, p. 22-25.
Reifmann, V.G. 1966. Viral diseases of potato and their occurrence in the Far East region. In: Viral diseases of potato. Moscow: Nauka, p.95-97 (in Russian).
Shelabina, T.A. 1989. Resistance of potato cultivars to viruses and features of plant protection in the North-west region of Russia. PhD thesis. Leningrad: VIZR, 19 p. (in Russian).
Sozonov, A.N. 2005. Potato virus Y in the North-west region of Russia: distribution, strain structure and preventive measures of this disease. PhD thesis. Saint Petersburg: VIZR, 19 p. (in Russian).
Vlasov, U.I., Larina, E.I. 1982. Agricultural virology. Moscow: Kolos, p. 89-151 (in Russian).
Zikin, A.G. 1970. Aphids - carriers of potato viruses. Leningrad: Kolos, 71 p. (in Russian).
Zikin, A.G. 1976. Viral diseases of potato. Leningrad: Kolos, p. 33-37 (in Russian).

Ralstonia solanacearum (Smith) Jabuuchi et al. - Brown bacteriosis (Bacterial Wilt) of Potato.

Diseases

Ralstonia solanacearum (Smith) Jabuuchi et al. - Brown bacteriosis (Bacterial Wilt) of Potato.

Object map

Systematic position.
Kingdom Procaryotae, section Gram-negative aerobic rods and cocci, family Pseudomonadaceae, genus Pseudomonas.

Synonyms.
Pseudomonas solanacearum Smith.

Biological group.
Hemibiotroph.

Morphology and biology.
The pathogen causes vascular disease of potato. First attributes of the disease are observed during flowering and formation of tubers. Plants unexpectedly wither, leaves shrink and droop, and the lower radical part of stem softens and rots. Typical attribute of this bacteriosis is stem splitting. The drops of bacterial exudate of brown color bleed from their cross-section. Later the bacteria penetrate into the stolons and young tubers, staining their vascular ring in brown color. The exudate excretes from tuber eyes and from places of stem attachment. The pathogen has 5 races, of which the 3rd one (low-temperature) is the most dangerous in the Russian Federation as it attacks potato. Cells of R. solanacearum are straight bacilli, usually 0.4-0.6 x 1.2-1.5 mkm in size, moving by means of polar flagella. Gram-negative. On potato agar colonies are gray, round, brilliant, smooth, transparent (later they become dark due to excretion of the melanin). Oxidase and catalase reaction is positive. Giving alkali on litmus milk. Not hydrolyzing starch. Diluting poorly or not diluting gelatin. Reducing nitrates. Hydrolyzing twins. Producing acid on media with carbohydrates

in 3-5 days. Not forming indole, excreting H_2S and NH_3 irregularly. Optimum temperature for the 3rd biotype is 37°C, maximum 41°C, minimum 10°C, critical temperature 52°C. Sources of bacterial infection are the infected ground, vegetation residues, weeds of the genus Solanum, and tubers with the latent infection.

Distribution.

This bacterial disease is found in the USA, Southern Africa, Sweden, Denmark, India, Japan, Philippines, New Zealand, Australia, and other countries. The bacteriosis meets in many regions of the Russian Federation; i.e., in the Leningrad, Moscow, Ekaterinburg, Voronezh, Kaliningrad Regions, in the Krasnodar Territory, Western and Eastern Siberia, Primorskii Territory, and also in Belarus, Latvia, and Ukraine.

Ecology.

Active development of the bacteriosis is marked during vegetation seasons with the temperature 20-25C and with significant amount of precipitations.

Economic significance.

The bacteriosis can cause significant economic damage. In some varieties, about 43% of plants are diseased and their yield decreases during vegetation by 40% in 3 years after accumulation of the infection; the storage losses can reach 50% and more. Up to 18% plants of the variety Slava are diseased in the Krasnodar Territory; the varieties Izora, Temp, Nevskii are strongly attacked in the Kaliningrad Region. The amount of infected plants of the varieties Izora and Nevskii is more than 8-10% in the Ekaterinburg Region. The amount of diseased bushes is 0.5-19.5% depending on a variety resistance in Belarus. The analysis of phytosanitary risk of this disease in territory of the Russian Federation shows that this bacteriosis is able to acclimatize in practically all zones of potato growing. The zone of the greatest danger is the Far East having monsoon climate, where yield losses may be maximal. The pathogen damage more than 200 species of cultural and weed plants. Control measures include maintenance of crop rotation, pesticide disinfection of tubers, cultivation of comparatively resistant varieties, landing high quality seed material, careful gathering and destruction of the vegetation residues, struggle against weeds. Precise serological tests are important for the pathogen diagnostics.

Reference citations:

Avezdzhanova G.P. 1985. Bacterial diseases of potato at storage. In: Gvozdyak R.I., ed. Bacterial diseases of plants (Abstracts of reports). Part 2. Kiev: Naukova dumka, p. 59-60 (in Russian).

Bermicheva N.S., Pletneva V.A. & Meshechkina Z.F. 1985. The lesion of potato by brown bacterial rot in Ural. In: Gvozdyak R.I., ed. Bacterial diseases of plants (Abstracts of reports). Part 2. Kiev: Naukova dumka, p. 61 (in Russian).

Bilai V.I., Gvozdyak R.I., Kraev V.G., Ellanskaya I.A., Zirka T.I. & Muras V.A. 1988. Microorganisms are the pathogens of diseases of plants. Kiev: Naukova dumka, 552 p. (in Russian).

Davidchik D.Ya., Khodos S.F. 1990. Bacterial diseases of potato and their pathogens in Latvia. In: Gvozdjak R.I., ed. Materials of conference. Phytoncides. Bacterial diseases of plants. Part II. Kiev & Lvov: KGT-2, p. 71 (in Russian).

Kuzmichev A.A., ed. 1994. Diagnostics of bacterial brown rot of potato and measures of its control. Methodical instructions. Moscow: Rossel.khozakademia, 40 p. (in Russian).

Matveeva E.V. 1994. Brown rot of a potato. In: Zakharenko V.A. & Matveeva E.V., eds. Proceedings of All-Russian Conference. Bacterial diseases of potato and vegetable cultures and methods of their control. Moscow: RASKHN, p. 17-23 (in Russian).

Pavlyushin V.A., ed. 1999. Methodical recommendations on research of bacterioses of tomato and potato and measures of their control. St. Petersburg: VIZR, 36 p. (in Russian).

Shklyar S.N. 1984. Bacterial withering of potato. Zashchita rastenii 5: 39 (in Russian).

Shneider E. Yu. & Sudarikova S.V. 2005. Quarantine bacterioses for Russia. In: Podgorskii V.S., ed. Collection of papers of participants of the International Scientific Conference. Phytopathogenic bacteria. Fytoncidology. Allelopathy. Kiev: Gosudarstvennyi Agroekologicheskii Universitet, p. 83-88 (in Russian).

Shneider Yu.I, Terent.eva, L.L. & Meshechkina Z.F. 1980. Brown bacterial rot of potato. In: Gorlenko M.V. et al., eds. Condition and prospects of development of scientific researches on prevention of resistance of pests and pathogens of diseases to pesticides and development of effectual measures of struggle against bacterial diseases of plants (abstracts of reports at IV meeting). Moscow: VASKHNIL, p. 71-72 (in Russian).

Sudarikova S.V. 2005. Brown rot of a potato - quarantine disease for the Russian Federation. In: Podgorskii V.S., ed. Collection of papers of participants of the International Scientific Conference. Phytopathogenic bacteria. Fytoncidology. Allelopathy. Kiev: Gosudarstvennyi Agroekologicheskii Universitet, p. 26-31 (in Russian).

Vasil.eva S.V. 1998. Brown bacterial rot. Zashchita rastenii 11: 34-35 (in Russian).

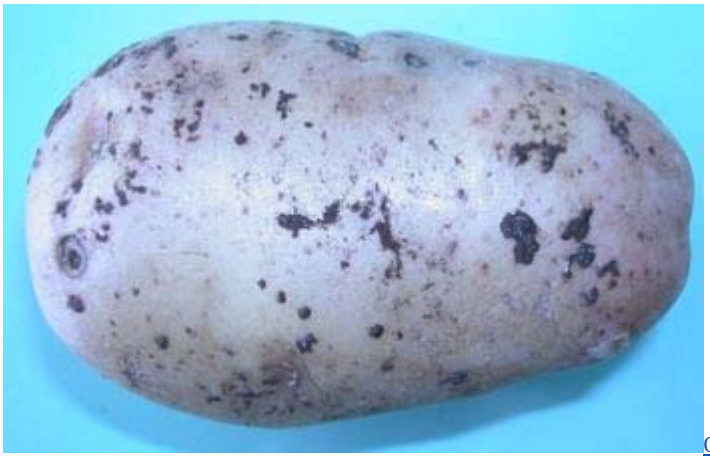
Vasyutin A.S., Levchenko V.I. & Sovershenova V.A. 2002. Atlas of pests, pathogens of plants and weeds having quarantine significance for the Russian Federation. In: Vasyutin A.S., ed. Moscow: Spetspechat, 136 p. (in Russian).

Zagurskaya L.E. & Sereda G.M. 1989. Distribution of bacterial diseases of potato depending on quality of seeds. In: Samersov V.F., ed. Proceedings of Belarus NIIZR. V. 14. Minsk: Urozhai, p. 39-41 (in Russian).

Thanatephorus cucumeris (Frank) Donk. (anamorpha Rhizoctonia solani Kuehn.) - Stem Canker and Black Scurf on potatoes

Diseases

Thanatephorus cucumeris (Frank) Donk. (anamorpha Rhizoctonia solani Kuehn.) - Stem Canker and Black Scurf on potatoes


Object map

Systematic position.
Class Basidiomycetes, family Ceratobasidiacea, species T. cucumeris Donk.; anamorpha R. solani (Mitosporic fungi).

Biological group.
Hemibiotrophic pathogen.

Biology and morphology.
Infects tubers, stems, stolons, and roots of adult potato plants. The fungus forms dark brown to black encrustations (sclerotia) on the surface of affected tubers; the sclerotia vary in size and look somewhat like bits of black soil. Dark brown lesions known as stem canker develop on sprouts and roots. A whitish-gray covering over the base of the potato stem caused by teleomorph is visible later in the growing season under favorable weather conditions. R. solani survives in soil on decomposing plant residues and (as sclerotia) on infected tubers. At high humidity and low temperature the mycelium arising from germinated sclerotia can attack young sprouts, causing canker blotches. Mycelium is dark brown; sclerotia are brownish-black, having irregular form. Sexual stage of the fungus is observed in the middle of summer on radical part of stems.

Distribution.
Stem Canker and Black Scurf are widely distributed in potato growing regions, being more significant in North-West, Central Volga-Vyatka, Ural regions of Russian Federation, West and East Siberia, Far East, Baltic countries, Belarus, woodlands of Ukraine, north and central regions of Kazakhstan.

Ecology.
Caused agent develops under high air humidity and temperature 9 to 27oC (optimum from 15 to 21oC). Cold weather since the period of potato planting till sprouting and strong soil overwetting strengthen disease harmfulness.

Economic significance.
Disease harms at all forms of the diseases appearances, affecting young sprouts during storage of tubers and vegetation period, attacking stems below or above the soil surface, and covering tubers with sclerotia. The highest harmfulness is observed, if a number of cancers develops on young sprouts at the beginning of tuber germination; therefore the first sprouts often die before reaching the soil surface, or their emergence is delayed, and there is a reduction in the number of stems produced, and as a result, the yield losses are observed. During the storage period the molds can develop on infected tubers. Protection measures include crop rotation, application of optimal doses of organic and chemical fertilizers, optimal time and depth for tubers planting, suitable and well-timed care and harvest, use of healthy seed potatoes, use of fungicides for treating seed potatoes.

Related references.

Bertel.ts A.O., Bubentsov S.T. 1958. Black scurf of potato in Central Kazakhstan and protection measures // Trudy NII zashity rastenii. - Uralsk - V.4. - P.52-59 (in Russian).
Bordukova M. 1970. Black scurf of potato and whitish-gray mildew on stem // Kartofel. i ovoshchi. - N4. - P.42-44 (in Russian).
Bubentsov S.T., Sechkina T.Yu. 1976. Black scurf of potato and protection measures // Puti uvelicheniya proizvodstva kartofelya v Uzbekistane. - Tashkent. - P.120-122. (in Russian).
Chumakov A.E, Zakharova T.I. 1990. Harmfulness of diseases of agricultural crops. . Moscow: Agropromizdat. . 127 pp. (in Russian).
Gross O.K. 1985. Black scurf of potato // Zashchita rastenii. - N2. - P.56 (in Russian).
Ivanyuk V.G., Aleksandrov O.T. 2000. Singularity of appearance of potato black scurf in Byelorussia // Mikologiya i fitoptologiya. - V.34(5). - P.51-59 (in Russian).
Hawksworth D.L., Kirk P.M., Sutton B.C., Pegler D.N. 1995. Dictionary of the fungi. - CAB International, - 616 p.
Kostitsin V.V., Tsvetkova N.A. 1997. Black scurf of cereals and potato // Zashchita rastenii i karantin. - N10. - P.32 (in Russian).
Leichenkova S.V. 1985. Morphological-cultural characteristics and pathogenicity of Rhizoctonia solani Kuehn. from different ecological-geographic regions // Selektsia i semenovodstvo kartofelya. - Moskow . -P.86-92 (in Russian).
Lisutina N.I. 1967. Black scurf in Kursk region // Nauchnye trudy (Agronomiya). - Kursk. - V.4. - P.193-115 (in Russian).
Peresypkin V.F.1989. Agricultural phytopathology. . Moscow: Agropromizdat. . 480 pp. (in Russian).
Popkova K. V., Shneider A.S., Volovik A.S., Shmuglya V.A. 1980. Diseases of potato. - Moscow: Kolos. - 304 pp. (in Russian).

Sechkina T.Y. 1978. Black scurf of potato and protection measures // Voprosy rasvitiya selskogo hozyastva v zone Kokchetavskogo melkosopochnika (Sbornik nauchnykh statei). . Alma-Ata: Kainar. - P.124-125 (in Russian).
Volovik A.S., Litun B.P., Fedorova M.I. 1974. Harmfulness of most spread diseases of potato in RF and economic effectiveness of protection measures // Tekhnologiya proizvodstva kartofelya (Nauchnye trudy). - Moskow. - V.XIX. - P.177-183 (in Russian).
Volovik A.S., Litun B.P. 1975. Harmfulness of potato diseases // Zashchita rastenii. - N7. - P.4-6 (in Russian).
Zaikin B.A. 2003. Struggle against potato diseases requires a complex approach // Kartofel' i ovoshchi. - N3. - P.25-27 (in Russian).
Zolotareva E.V., Mamakova T.F. 1984. Black scurf on potatoes in Khabarovsk Terrotory // Zashchita rastenii ot vreditelei, boleznei i sornyakov na Dal'nem Vostoke. - Novosibirsk -P.4-13 (in Russian).

Spongospora subterranea (Wallr.) Lagerh. - Powdery Scab of Potato

Diseases
Spongospora subterranea (Wallr.) Lagerh. - Powdery Scab of Potato

Object map

Systematic position.
Division Myxomycota, genus Spongospora.
Biological group.
Obligate parasite.
Morphology and biology.
The cause of Powdery Scab of Potato (S.subterranea) has multinuclear plasmodium to 70mkm in size. They form dense lumps of spores in affected cells. In soil the spores release zoospores to 2.5-4.6 mkm in diameter, which infect tubers and roots of potato. Sometimes they also infect stolons. The parasite can affect tomatoes and others Solanaceae. The disease appears on the tuber surface as deepened star-shaped open ulcers filled with numerous brown lumps of spores. Tumors are formed on the affected roots. Sources of the infection are spores, which can be kept in soil over five years, and affected tubers.
Distribution.
Powdery Scab of Potato is registered in Belarus and in separate regions of Northwest, Volga-Vyatka, and Central regions of Russia.
Ecology.
The disease appears in conditions of sufficient humidifying and low temperature of soil.
Economic significance.
Strongly affected tubers are completely destroyed. The disease reduces significantly food and commercial quality of potato and promotes its affection by saprogenic microorganisms. The most effective control measures against S.subterranea are 5-year crop rotation and presowing fungicide treatment of seed tubers.
Related references:
Ginfner K., Chak Z. 1958. Diseases and damage to potato tuber. Budapest: Academy of Sciences of Hungary, p.24-25 (in Russian).
Gorlenko M.V. 1968. Powdery scab of potato. Agricultural phytopathology. Moscow: Vysshaya shkola, p.260-261 (in

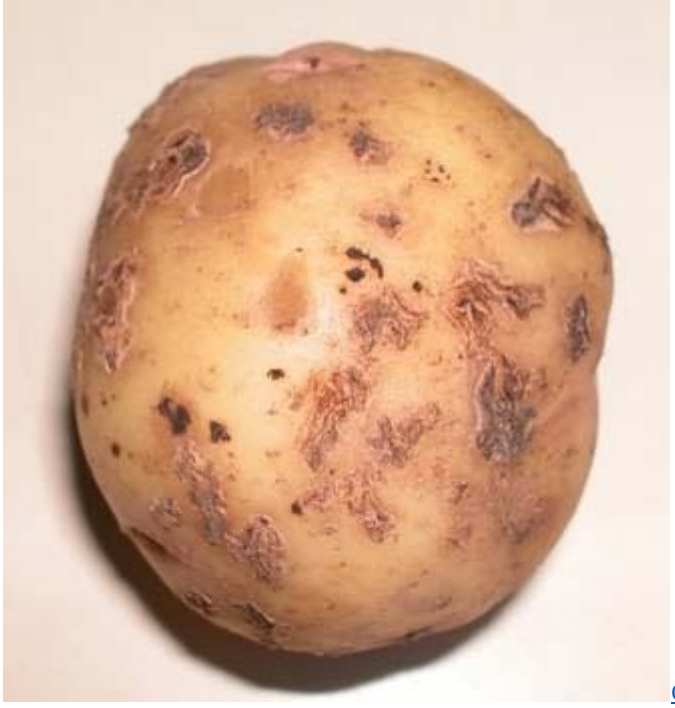
Russian).
Pidoplichko N.M. 1977. Fungal parasites of cultural plants. Guide, vol.1. Kiev: Naukova Dumka, 299 p. (in Russian).
Sizova T.P. 1976. Division Myxomycota. Fungi. Moscow: Prosveshchenie, p.7-12 (in Russian).
Volovik A.S., Borisenok A.B., Erokhina S.A., Zakharova T.I. 1971. Fungal diseases of potato. In: Polyakov I.Ya., Minkevich I.I., eds. Pests and diseases distribution on agricultural crops in RSFSR in 1970 and the forecast of their appearance in 1971. Moscow: MSKH RSFSR, VIZR: p.168-178 (in Russian).

The photo of the affected potato tuber by Spongospora subterranea belongs to J.Sekach (Ginfner K., Chak Z. 1958. Diseases and damage to potato tuber. Budapest: Academy of Sciences of Hungary, p.24-25) (in Russian).

Streptomyces scabies (Thaxter) Waksman et Henrici - Common Scab of Potato

Diseases

Streptomyces scabies (Thaxter) Waksman et Henrici - Common Scab of Potato



Object map

Systematic position.

Causal agents of Common Scab are actinomycete fungi. Actinomycetes have characteristic position between bacteria and fungi. The most widespread causal agent is Streptomyces scabies (genus Streptomyces).

Biological group.

Soil-born pathogen.

Biology and morphology.

Scab develops on tuber surface as spots with irregular margins, from several millimeters to 1 or more centimeters in diameter; the spots increase later in size and suberificate. Four kinds of Common Scab are distinguished: a flat kind (only the peel or upper layer of the periderm is affected), a convex one (the spots are bulgy or warty in appearance), a deep one (spots are sunken in tissue, with margins and brownish bottom), and a reticular kind (entire surface of tubers is coarse-reticular). Development of different kinds of Common Scab depends on depth of pathogen infection; the latter is influenced by environmental conditions and by potato varieties. Actinomycetes causing the Common Scab inhabit different organic residues and seed potato tubers in the soil. Infection of potato tubers by Scab begins when tuber formation starts. The pathogen infects the tuber directly through lenticels; infected areas on the potato respond immediately by forming a corky layer. As each new layer is invaded by the Scab pathogen the new cork forms, until a mature scab spot is produced. Mycelium of S. scabies fungus is non-septated, treelike branched. Hyphae with spirally twirled sporophores are developed on mycelium, and small-sized cylindrical oblong spores, 1.2-1.5 x 0.8-1.0 microns in size, develop on tops of sporophores.

Distribution.

Disease has worldwide distribution.

Ecology.

Causal agent is aerobe; optimum temperature for its development is 25 to 27.C. Low soil temperature at the time of tuber formation reduces Streptomyces development. Neutral to alkaline soil (pH 6-7.5) is favorable for Potato Scab

development. Potato growing on loamy and sandy soil with alkaline pH is often highly affected. Dry and hot weather also promotes an increase of the disease development.

Economic significance.

Severe damage worsens the quality of tubers. Scab tubers have bad taste and poor market quality because of lower starch concentration. Tubers infected with Scab are more often invaded by moulds. Strongly affected tubers have low germinating capacity and are unsuitable for planting. Protection measures include: use of disease-free seed tubers, disinfection of the seed tubers, growing of resistant varieties, testing the pH of the soil, crop rotation, and application of green manure crops for fertilization.

Reference citations:

Bus.ko I.I. 1990. Features of pathogenesis of Common Scab of Potato and development of protection measures in Byelorussia. Abstract of PhD thesis. Minsk: Samokhvalovichi. 20 p. (In Russian)

Denisenko V.A. 2000. Common Scab of Potato. Akhova Raslin, 3: 23-24. (In Russian)

Ivanyuk V.G., Busko I.I. 1990. Caused agents of Common Scab of Potato and protection measures in Byelorussia conditions. Samersov V.F., ed. Collection of repots of Byelorussian research institute of plant protection. V. 15. Minsk: Uradzhai. 58-63 p. (In Russian)

Peresypkin V.F. 1989. Agricultural phytopathology. Moscow: Agropromizdat. 480 p. (In Russian)

Popkova K.V., Shneider A.S., Volovik A.S., Shmuglya V.A. 1980. Diseases of potato. Moscow: Kolos. 304 p. (In Russian)

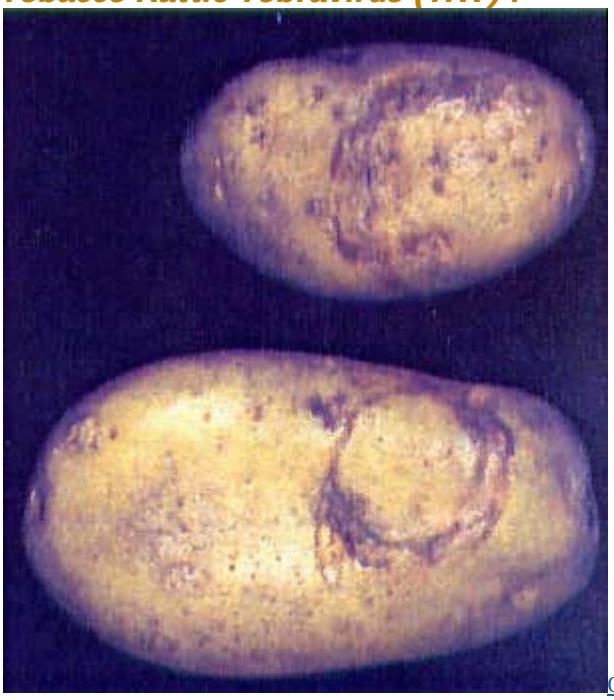
Sedova V.I. 1999. Common Scab of Potato. Zashchita rastenii i karantin, 5: 18. (In Russian)

Volovik A.S., Litun B.P. 1975. Harmfulness of potato diseases. Zashchita rastenii, 7: 4-6. (In Russian)

Tobacco Rattle Tobravirus (TRV) .

Diseases

Tobacco Rattle Tobravirus (TRV) .



Object map

Systematic position.

Kingdom Vira, group Tobravirus.

Synonyms.

Potato corky ringspot virus, potato stem mottle virus, stengelbonk virus Rosendal; tobacco virus 11, Johnson; Nicotiana virus 5, Smirh.

Biological group.

Obligatory parasite.

Morphology and biology.

First data on this virus was published in Germany in 1931 (Boning). The virus is most harmful on potato plants. Symptoms are various; leaves, stems and leafstalks have necrotic strips, yellow arcs and spots; tubers have necrotic arcs and rings. Leaves become twisted and spotted. There are two strains which cause either variegation of stems or necrosis of tubers. Virions are baculiform, either 46-114 or 180-197 nm in length. Temperature of inactivation (TIP) is

80-85°C, loss of infectious activity (LIV) at keeping in sap occurs in 40-50 days. Maximal dilution is 1:1000. The virus has natural foci of infection. Nematodes of the genera Paratrichodorus and Trichodorus transfer this disease. Natural hosts of the virus in North-Western region are Sonchus arvensis L., Cirsium arvensis Scop., Cirsium vulgare Tenore. The infection of the potato takes place within the area of natural foci of virus.

Distribution.

Within the territories of the former Soviet Union, the disease is distributed everywhere the potato is growing. The disease severity is registered in Central and North-Western regions of Russia, in Byelorussia, Tatarstan, Lithuania, Latvia, Ukraine, Primorskii Territory.

Ecology.

Distribution and severity of TRV depends on the numbers of nematode vectors and natural plant-hosts.

Economic significance.

Because of wide specialization, the TRV infects many cultural plants (potato, tomato, lettuce, tobacco, and others). Severity during the epiphytoties on potato tubers can reach 20-40%.

Reference citations:

Aleksandrova N.D. & Trofimets L.N. 1981. Investigation of isolation forms of Tobacco rattle tobravirus on potato in Moscow region. In: Vlasov Yu.I., ed. Viral strains of plants and their practical use. Elgava, 3-6 p. (in Russian).
Aleksandrova N.D. 1980. Isolation and identification of potato tuber necrosis. In: Trofimets L.N., ed. Selection and seed production of potato (Proc. NIIKKH, 36). Moscow: NIIKKh, 69-73 p. (in Russian).
Ambrosov A.L., Sokolova L.A., Davidchik L.Ya. & Ivanova B.P. 1979. Soil virus of variegation of potato stems in BSSR conditions. In.: Ambrosov A.L., ed. Proceedings of AN BSSR. Vol. 23, N 3. Minsk: AN BSSR, 269-272 (in Russian).
Antonova V.V., Larina E.I. & Leshcheva O.M. 1982. Methods of revealing Tobacco rattle virus foci and nematode vectors. In: Novozhilov K.V., ed. Biological bases of nematode control (Proc. VIZR). Leningrad: VIZR, 82 p. (in Russian).
Gus'kova L.A. & Antonova V.V. 1981. Nematodes - vectors of Tobacco rattle virus in Leningrad region. Zashchita rastenii 4: 15 (in Russian).
Larina E.I. & Teploukhova T.N. 1975. Tobacco rattle tobravirus on potato. Zashchita rastenii 3: 51 (in Russian).
Larina E.I., Osipova E.A. & Bryantseva I.V. 1980. Natural foci of Tobacco rattle tobravirus. In.: Vlasov Yu.I., ed. Virus diseases of agricultural cultures. Moscow: Kolos, 39-42 p.(in Russian).
Samsonova L.N., Tsyplenkov A.E. & Yakutkina T.A. 2001. Diagnostic virus and phytoplasma diseases on vegetable cultures and potato. Saint-Petersburg: VIZR, 50 p. (in Russian).
Tsyplenkov A.E. & Larina E.I. 1975. Natural reservoirs of potato viruses. Potato and vegetables 8: 34-35 (in Russian).
Vlasov Yu.I. & Larina E.I. 1970. Agricultural virology. Moscow: Kolos, 237 p. (in Russian).
Zamanieva F.F. 1995. Soil viruses on potato in Tatar Republic. In: Proceedings of All-Russian Plant Protection Congress. Saint-Petersburg: VIZR, 570 p. (in Russian).