THE PLANT DISEASE REPORTER

Issued By

THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
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A CHECK LIST OF ALASKAN FUNGI

Supplement 219 February 15, 1953

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Plant Industry Station Beltsville, Maryland

A CHECK LIST OF ALASKAN FUNGI

Edith K. Cash

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With the exception of a few fairly extensive lists, particularly those published by J. P. Anderson (1915-1952), and the paper by Saccardo, Peck, and Trelease on the fungi collected on the Harriman Expedition, records of fungi collected in Alaska are widely scattered through the literature. In view of the increasing interest in the flora of the Territory, and especially of the fungi causing plant diseases which are important from an economic standpoint, it has seemed advisable to compile the available references to the fungi reported from Alaska in a single list, including also records from herbarium specimens.

Host plants and localities are cited where known. Where the reference is to "Alaska", with no more definite place of collection, no locality is given in this list. The numbers following these data in each instance refer to corresponding numbers of the Literature Cited, indicating where the published record was found. Where data were obtained from unpublished records, the name of the collector is cited instead of a number to a literature citation. Such records were taken from herbarium specimens, for the most part in the Mycological Collections of the Bureau of Plant Industry and the National Herbarium Fungus Collections, both at the Plant Industry Station, Beltsville, and identified by past and present members of the Division of Mycology. Most of the rusts have been determined by George B. Cummins.

The arrangement follows that of Martin's Outline of the Fungi, 1950. It has obviously been impossible to verify determinations, particularly where names were taken from the literature, but some evident errors have been corrected and an attempt has been made to revise the nomenclature to conform with modern usage. Pre-starting-point authorities have been omitted from the names of fungi.

The writer is indebted to S. F. Blake for a revision of the host names, to G. B. Cummins for checking the section on rusts and for supplying additional records from the Arthur Herbarium, and to various collectors who have cooperated with this project by supplying material for study, particularly D. V. Baxter, D. M. Coe, C. L. Lefebvre, and G. A. Llano.

MYXOMYCETES

ARCYRIA CINEREA (Bull.) Pers., 47; Stikine River, 59.

ARCYRIA DENUDATA (L.) Sheldon, Stikine River, 59.

CERATIOMYXA FRUTICULOSA (O. F. Muell.) Macbr., Stikine River, 59.

DIDERMA NIVEUM (Rost.) Macbr., Disenchantment Bay, Yakutat Bay, Orca, 59.

DIDYMIUM DUBIUM Rost., 51.

FULIGO SEPTICA (L.) G. F. Weber on Fragaria (Sitka hybrid), Palmer, D. M. Coe.

STEMONITIS SMITHII Macbr., Stikine River, 59.

TRICHIA SCABRA Rost., 47; Stikine River, 59.

TUBIFERA FERRUGINOSA (Batsch) Gmel., Stikine River, 59.

PHYCOMYCETES

ALBUGO CANDIDA (Chev.) Kuntze on Cruciferae, Kodiak, 31.

Cystopus candidus (Chev.) Lév.: See ALBUGO CANDIDA.

EMPUSA MUSCAE (Fr.) Cohn, 72.

LAGENIDIUM ENTOPHYTUM (Pringsh.) Zopf on Spirogyra porticalis, Popof Isl., 59.

PERONOSPORA ALTA Fckl. on Plantago sp., Cordova, 22.

PERONOSPORA FICARIAE Tul. on Ranunculus sp., Glacier Bay, 59.

PERONOSPORA OBOVATA Bon. on Spergula arvensis, Sitka, 4, 21.

PERONOSPORA PARASITICA Fr. on Arabis hirsuta, near Juneau, 4; Yakutat, 59; Capsella bursa-pastoris, Matanuska, Fairbanks, D. M. Coe.

PERONOSPORA POTENTILLAE DBy. on Potentilla sp., Wrangell, 22.

PHLYCTORHIZA VARIABILIS Karling, isolated from dead human skin in soil, St. Lawrence Isl., 39.

PHYSODERMA MENYANTHIS DBy. on Menyanthes trifoliata, Kukak Bay, 59.

PHYTOPHTHORA INFESTANS (Mont.) DBy. on Solanum tuberosum, Wrangell, 22.

PLASMODIOPHORA BRASSICAE Wor. on Brassica campestris, Sitka, 4; B. oleracea, Sitka, 1, 2, 4, 31; Raphanus sativus, Sitka, 4.

PLASMOPARA EPILOBII (Rab.) Schroet. on Epilobium latifolium, Sitka, 4; Haines, 21; Cordova, Valdez, 22.

PLASMOPARA NIVEA (Ung.) Schroet. on Ligusticum hultenii (L. scothicum), Valdez, 22; L. sp., Skagway, 21; Umbelliferae, Seward, 22.

PYTHIUM GRACILE Schenk on Spirogyra porticalis, Popof Isl., 59.

RHIZOPHIDIUM SPHAEROCARPUM (Zopf) Alf. Fisch. subsp. CRYOPHILUM Laszló Bérazi on Ancyclonema nordenskioldii, Columbia Glacier, 41.

SOMMERSTORFFIA SPINOSA Arnaudow in wet soil, Talkeetna Mts. and grown on rotifers in culture, 40.

TAPHRINALES

Exoascus cerasi (Fckl.) Sadeb: See TAPHRINA CERASI.

Exoascus deformans (Berk.) Fckl.: See TAPHRINA DEFORMANS.

TAPHRINA AMENTORUM (Sadeb.) Rostr. on Alnus oregona (A. rubra), Lake Pironsi Glacier, 50.

TAPHRINA CERASI (Fckl.) Sadeb. on Prunus avium, Sitka, 2, 4, 21.

TAPHRINA DEFORMANS (Berk.) Tul. on Amygdalus persica, Sitka, 2, 4.

TAPHRINA JAPONICA Kusano on Alnus oregona (A. rubra), Sitka, 50, 21 (as T. tosquinetii).

EUROTIALES

EUROTIUM HERBARIORUM (Wigg.) Lk. on Geum sp., Yes Bay, 59; Coptis trifoliata (Helleborus trifoliatus). Unalaska, 28.

DOTHIDEALES

AMERODOTHIS sp. on Kalmia polifolia (K. microphylla), Ketchikan , 21.

APIOSPORA PARALLELA (Karst.) Sacc. on Arctagrostis latifolia, Kotzebue, C. L. Lefebvre.

CRYPTOMYCES PTERIDIS (Fr.) Rehm on Pteridium aquilinum lanuginosum (P. l. pubescens), Sitka, 4.

CYMADOTHEA TRIFOLII (Fr.) Wolf on Trifolium repens, Skagway, 21; Sitka, W. H. Evans.

Dothidea betulina var. betulae nanae Fr.: See EURYACHORA BETULINA.

? DOTHIDEA DENIGRANS Schw. on Kalmia polifolia (K. microphylla), 21. Doubtful species; referred by Saccardo to Phyllachora but does not belong in the latter genus according to Theissen and Sydow.

DOTHIDELLA ADUSTA (Fckl.) Lind, 44.

DOTHIDELLA ALNI Pk. on Alnus sp., Lake Hardy, C. E. Prince; Anaktuvuk Pass, G. A. Llano.

Dothidella betulina (Fr.) Sacc.: See EURYACHORA BETULINA.

DOTHIDELLA BETULINA YAKUTATIANA Sacc. & Scalia on leaves of unknown plant, Yakutat Bay, 59. See Theissen & Sydow, Ann. Myc. 13: 366. 1915.

DOTHIDELLA SPHAERELLOIDES Dearn. on Saxifraga hirculus, 26.

EURYACHORA BETULINA (Fr.) Schroet., 26; Kotzebue Sound, 37, 42, 58; On Alnus sp., Anaktuvuk Pass, G. A. Llano; Betula glandulosa, Port Clarence, 59.

LIMACINIA? ALASKENSIS Sacc. & Scalia on Alnus sp., Glacier Bay, 59.

PHRAGMODOTHELLA RIBESIA (Fr.) Petr. on Ribes hudsonianum, Sitka, 4; Ribes rubrum (R. vulgare), Sitka, 4; Skagway, Haines, 21; Matanuska, C. L. Lefebvre.

Phyllachora filicina Sacc. & Scalia: See TRABUTIELLA FILICINA.

PHYLLACHORA GRAMINIS (Fr.) Fckl. on Calamagrostis canadensis scabra (C. langsdorfii), Sitka 4.

PHYLLACHORA HERACLEI (Fr.) Fckl. on Heracleum lanatum, Sitka, 4; Haines, 21; Unga Isl., 59.

Phyllachora pteridis (Fr.) Fckl.: See CRYPTOMYCES PTERIDIS.

Phyllachora trifolii (Fr.) Fckl.: See CYMADOTHEA TRIFOLII.

PHYLLACHORA WITTROCKII (Eriks.) Sacc. on Linnaea borealis longifolia, Sitka, 4.

Plowrightia ribesia (Fr.) Sacc.: See PHRAGMODOTHELLA RIBESIA.

TRABUTIELLA FILICINA (Sacc. & Scalia) Th. & Syd. on Polystichum (Aspidium) lonchitis, Unalaska, 59.

Tripospora elegans Cda.: See TRIPOSPORIUM ELEGANS.

MICROTHYRIALES

DIMEROSPORIUM TSUGAE Dearn. on Tsuga heterophylla, Sitka, 21; Prince of Wales Isl., 23; T. sp., Cordova, 22.

MICROTHYRIUM HARRIMANI Sacc. on Tsuga heterophylla, Orca, 59.

MELIOLALES

Asterina cupressina Cke.: See ASTERINELLA CUPRESSINA.

ASTERINELLA CUPRESSINA (Rehm) Th. on Chamaecyparis nookatensis, Sitka, 4.

ERYSIPHALES

Erysiphe cichoracearum DC.: See E. COMMUNIS.

ERYSIPHE COMMUNIS Fr. on Achillea borealis, Sitka, 3; Juneau, 21; Artemisia arctica, Kodiak Isl., W. H. Horne; Artemisia tilesii elatior (A. elatior), Skagway, 21; Artemisia sp., Sitka, 4; Chrysanthemum hortorum, Sitka, 4; Mertensia sp., Circle, Palmer, D. M. Coe; Mt. McKinley Nat. Park, Palmer, C. L. Lefebvre; Solidago sp., Haines, 4, 21.

ERYSIPHE GRAMINIS Merat on Agropyron latiglume, Copper Center, C. L. Lefebvre; A. sericeum, Palmer, C. L. L.; Agrostis exarata, 3, 68; Sitka, 4; Beckmannia sp., Fairbanks, C. L. L.; Elymus junceus, Matanuska, C. L. L.; Hordeum brachyantherum, Valdez, C. L. L.; Poa pratensis, 68; Skagway, Mendenhall, 21; Homer, Circle, D. M. Coe and C. L. L.; Matanuska, Talkeetna Mts., Fairbanks, Mt. McKinley Nat. Park, Kotzebue, C. L. L.; Puccinellia borealis, Circle, C. L. L.; undet. Gramineae, Sitka, 2, 3.

ERYSIPHE POLYGONI Mérat on Aquilegia formosa, Skagway, 4, 21; Haines, 4; Tenakee, 21; Geum macrophyllum, Haines, 4, 21; Skagway, 4; Ketchikan, 21; Lathyrus japonica (L. maritimus), Haines, 4, 21; Skagway, 4; L. palustris, Haines, 21; Lupinus nootkatensis, Mendenhall, 21; Ranunculus sp., Sitka, 3; Vicia gigantea (V. sitchensis), Ketchikan, 21.

Microsphaera alni Wint.: See M. PENICILLATA.

Microsphaera alni Wint. var. vaccinii (Schw.) Salm.: See M. PENICILLATA VACCINII.

MICROSPHAERA PENICILLATA (Fr.) Lév. on Alnus fruticosa sinuata (A. sitchensis), Sitka, 3, 4, 21; Skagway, 4, 21; Juneau, 21.

MICROSPHAERA PENICILLATA (Fr.) Lev. var. VACCINII (Schw.) W. B. Cke. on Menziesia

ferruginea, Vaccinium alaskense, and V. parvifolium, Ketchikan, 21.

PODOSPHAERA CLANDESTINA (Fr.) Lév. on Vaccinium uliginosum, Mendenhall, 21.

PODOSPHAERA LEUCOTRICHA (Ell. & Ev.) Salm. on Malus (hybrid), Sitka, 21.

Podosphaera oxyacanthae (DC.) D By.: See P. CLANDESTINA.

Sphaerotheca humuli (DC.) Burr.: See S. MACULARIS.

Sphaerotheca humuli fuliginea (Schlecht.) Salm.: See S. MACULARIS var. FULIGINEA.

SPHAEROTHECA MACULARIS (Fr.) W. B. Cke. on Epilobium glandulosum (E. affine), 3, 4; Ketchikan, 21; E. hornemanni, Juneau, 21; Fragaria chiloensis and F. platypetala, Sitka, 3; F. hybrids, Sitka, 4; Ribes aureum, Sitka, 3; R. bracteosum, Sitka, 2, 3, 4; Chatham, 21; R. bracteosum x nigrum, Juneau, 21; R. rubrum, Sitka, 2, 3; Rubus parviflorus, Tenakee, 21; R. spectabilis, Sitka, 2, 3, 4, 21; R. sp. (cult. raspberry) Fairbanks, J. C. Chamberland; Palmer, Matanuska, D. M. Coe; Sanguisorba officinalis (S. microcephala), Ketchikan, 21; Saxifraga punctata nelsoniana (S. aestivalis), Juneau, 21; Shepherdia (Lepargyrea) canadensis, Skagway, 21; Shepherdia sp., Mt. McKinley Nat. Park, C. L. Lefebvre.

SPHAEROTHECA MACULARIS var. FULIGINEA (Fr.) W. B. Cke. on Arnica latifolia, Skagway, 4; Astragalus sp., Valdez, D. V. Baxter; Erigeron peregrinus, Juneau, 21; Matricaria matricarioides (Chamomilla suaveolens), Klukwan, 21; Prenanthes alata (Nabalus hastatus), Skagway, 21; P. (Nabalus) sp., Petersburg, 22; Scorzonella borealis, Ketchikan, 21; Taraxacum officinale, Skagway, 21; Tellima grandiflora, Juneau, 21; Tiarella trifoliata, Sitka, 21.

SPHAEROTHECA MORS-UVAE (Schw.) Berk. & Curt. on Ribes grossularia, Sitka, 4, 21; R. g. var. uva-crispa (R. uva-crispa), Sitka, 3; R. lacustre (R. echinatum), Sitka, 1, 2, 3, 4; Skagway, Tenakee, Haines, 21; R. rubrum (R. vulgare), Sitka, 4; Skagway, 21.

SPHAEROTHECA PANNOSA (Fr.) Lév. on Rosa acicularis, Haines, 21; R. sp., Sitka, 2, 3, 4; Juneau, Ketchikan, 21.

SPHAEROTHECA sp. on Matricaria matricarioides (Chamomilla suaveolens), Sitka, 4.

UNCINULA SALICIS (Mérat) Wint. on Populus trichocarpa, Skagway, 3, 21; Sitka, 4; Haines, 21; Salix alaxensis, Haines, 21; S. barclayi, Haines, 21; S. myrtillifolia, Fairbanks, D. M. Coe; S. sitchensis, Sitka, 4; S. sp., Sitka, 4; Skagway, 21; Fairbanks, J. W. Kimmey and M. E. Fowler.

HYPOCREALES

Claviceps microcephala (Wallr.) Tul.: See CLAVICEPS PURPUREA.

CLAVICEPS PURPUREA (Fr.) Tul. on Agrostis exarata, 68; Arctagrostis latifolia, Berg, C. L. Lefebvre; Kenai, G. W. Gasser; Bromus sp., Matanuska, D. M. Coe; Calamagrostis canadensis var. scabra (C. langsdorfii), 68; Sitka, 4; Haines, 21; C. nutkaensis (C. aleutica), 68; Sitka, 4; Ketchikan 21; Colpodium fulvum (Arctophila fulva), 68; Dactylis glomerata, 68; Sitka, 4; Elymus mollis, 68; Sitka, 4; Chatham, Haines, 21; Homer, D. M. Coe; Admiralty Isl., D. V. Baxter; Kenai, G. W. Gasser; Unalakleet, Valdez, Homer, C. L. L.; Festuca rubra, Unalakleet, C. L. L.; Glyceria pauciflora, 68; Hordeum brachyantherum (H. boreale, H. nodosum), 68; Sitka, 4, 68; Kenai, C. L. L.; Phleum pratense, 68; Sitka, 4.

CORDYCEPS MILITARIS (Fr.) Lk. on insect pupae, Orca, 59.

HYALODOTHIS CARICIS Pat. & Har. on Carex buxbaumii, Sitka, 27; C. enanderi, Attu, 27; C. limosa, Knight Isl. (Prince William Sound), 27; C. lyngbyei, Kiska, 27; C. pauciflora,

Sitka, 27.

HYPOCREA CITRINA Fr. on Fomes pinicola, Prince of Wales Isl., 23.

NECTRIA CINNABARINA Fr., New Metlakatla, 59; on Alnus fruticosa sinuata (A. sitchensis), Sitka, 4; A. sp., 21; Amelanchier sp., Sitka, 4; Epilobium angustifolium (Chamaenerion spicatum), Sitka, 4; Malus (Pyrus) baccata, Sitka, 4; M. (Pyrus) diversifolia, Sitka, 4; M. sylvestris, Sitka, 1, 4; M. sp., Matanuska, C. L. Lefebvre; Prunus cerasus, Sitka, 4; P. domestica, Sitka, 4; P. padus, Sitka, 4; P. sp., Sitka, 1; Ribes bracteosum, Sitka, 4, 19; Ribes hudsonianum, Sitka, J. P. Anderson; Ribes nigrum, Sitka, 4; Ribes rubrum (R. vulgare), Sitka, 4; Matanuska, C. L. L.; Ribes sanguineum, Sitka, 4; Ribes sp., Sitka, 1, 4; Rosa nutkana, and R. rugosa, Sitka, 4; Rubus parviflorus, R. spectabilis, and R. strigosus, Sitka, 4; Salix purpurea, S. viminalis, and S. sp., Sitka, 4; Sambucus callicarpa, Sitka, J. P. Anderson; Sambucus pubens, Sitka, 4; Sorbus sitchensis, Sitka, 4; Sorbus sp., Fairbanks, C. L. L.; Tilia americana, 21; Viburnum sp., Sitka, 4.

NECTRIA CORYLI Fckl. on Salix sp., Kodiak, 13

NECTRIA EPISPHAERIA Fr. on Sphaeriaceae on Alnus sp., Sitka, 59.

NECTRIA SANGUINEA Fr., New Metlakatla, 59.

PODOSTROMA ALUTACEUM (Fr.) Atk., Wrangell, J. C. Scudder et al.

SPHAERIALES

AMPHISPHAERIA APPLANATA (Fr.) Ces. & De N., Yakutat Bay, 59.

ANTENNARIA RECTANGULARIS Sacc. on Cassiope (Harrimanella) sp., Nelly Juan, 21; Phyllodoce glanduliflora, Sitka, 2. Antennaria Lk. ex Fr. = Antennularia Reichenb. = Gibbera sec. Petrak.

ANTHOSTOMA MICROSPORUM Karst. on Alnus sp., Skagway, D. V. Baxter.

? APIOPORTHE BAVARICA (Petr.) Wehm. on Alnus sp., Valdez, D. V. Baxter.

CERIOSPORA RIBIS P. Henn. & Ploettn. on Ribes bracteosum, Sitka, 4, 21; Juneau, 21.

CLATHROSPORA PENTAMERA (Karst.) Berl. 42; on Carex aquatilis (C. stans), Camden Bay, 44; Dupontia fischeri, Walden Isl., 59; Puccinellia tenella, Camden Bay, 44.

COLEROA POTENTILLAE (Fr.) Wint. on Potentilla sp., Nimilchik, D. M. Coe.

CRYPTODIAPORTHE CALOSPHAEROIDES (Ell. & Ev.) Wehm. on Sambucus pubens, Sitka, 4.

CRYPTODIAPORTHE SALICINA (Curr.) Wehm. on Salix sp., Sitka, 4.

CUCURBITARIA CONGLOBATA (Fr.) Ces. on Alnus fruticosa sinuata (A. sitchensis), Sitka, 4; A. sp., Sitka, Skagway, 21.

DALDINIA OCCIDENTALIS Child on Betula papyrifera occidentalis, Skilak Lake (Kenai Peninsula), J. W. Kimmey and M. E. Fowler; Betula sp., Wasilla, D. M. Coe.

DIAPORTHE ANISOMERA Sacc. & Scalia on ? Corylus sp., Yakutat Bay, 59. Probably an Apioporthe sec. Wehmeyer, Genus Diaporthe p. 275. 1933.

Diaporthe calosphaeroides Ell. & Ev.: See CRYPTODIAPORTHE CALOSPHAEROIDES.

Diaporthe concrescens (Schw.) Cke.: See DIAPORTHE ERES.

DIAPORTHE ERES Nits. on Ribes sp., Sitka, 4, 59.

Diaporthe marginalis Pk.: See MELANCONIS ALNI var. MARGINALIS.

Diaporthe pungens Nits.: See D. ERES

Diaporthe salicella Fr.: See CRYPTODIAPORTHE SALICINA.

DIAPORTHE SOCIABILIS var. SAMBUCI (Ell. & Ev.) Wehm. on Sambucus sp., Kodiak, 13; Seward, Juneau, D. V. Baxter

DIAPORTHE STRUMELLA (Fr.) Fckl. f. OLIGOCARPA on Ribes laxiflorum, Sitka, 59.

DIATRYPE BULLATA Fr. on Populus trichocarpa, Skagway, 21; Salix sp., Kodiak Isl., W. T. Horne.

DIATRYPE DISCIFORMIS Fr. on Alnus sp., Skagway, 21.

DIATRYPE STIGMA Fr. on Alnus sp., Skagway, 21; Betula resinifera (B. alaskana), Fairbanks, 18.

DIATRYPELLA DISCOIDEA Cke. & Pk. on Betula resinifera (B. alaskana), Fairbanks, 18.

Didymella epilobii (Fckl.) Sacc.: See DIDYMOSPHAERIA FENESTRANS.

DIDYMELLA EUPYRENA Sacc. on Urtica lyallii, Sitka, 4.

DIDYMOSPHAERIA ARENARIA MACROSPORA Sacc. & Scalia on Deschampsia (Aira) caespitosa, Shumagin Isls., 59.

DIDYMOSPHAERIA FENESTRANS (Duby) Wint. on Epilobium (Chamaenerion) angustifolium, Sitka, 21; Kodiak Isl., W. T. Horne.

DIDYMOSPHAERIA JOHANSENII Dearn. on Mertensia maritima, Spy Isl., 26.

DIDYMOSPHAERIA NANA Rostr. on Alnus sp., Port Well, 59.

DIDYMOSPHAERIA OREGONENSIS Goodding on Alnus sp., Ketchikan, D. V. Baxter.

DIDYMOSPHAERIA sp. on Elaeagnus angustifolia, 4.

EUTYPELLA ANGULOSA (Nits.) Sacc., Koyukuk, D. V. Baxter.

EUTYPELLA CERVICULATA (Fr.) Sacc. on Alnus fruticosa sinuata, Nenana 18.

EUTYPELLA SORBI (G. Kunze & Schm.) Sacc. on Sorbus sp., Hope, D. V. Baxter.

EUTYPELLA STELLULATA (Fr.) Sacc. on Alnus sp., Nenana, 18.

GIBBERA VACCINII Fr. on Vaccinium vitis-idaea, Ketchikan, Sitka, 21.

GIBBERIDEA RIBIS Tracy & Earle on Ribes grossularia, Sitka, 21.

GNOMONIA DEPRESSULA Karst. on Rubus strigosus x parvifolius, and Rubus sp. Sitka, 21.

Gnomonia fenestrans (Duby) Sacc.: See DIDYMOSPHAERIA FENESTRANS.

GNOMONIA sp. on Salix richardsoni, Camden Bay, 26.

GNOMONIELLA TUBIFORMIS (Fr.) Sacc. on Alnus fruticosa sinuata (A. sitchensis), Berg, C. L. Lefebvre; Alnus sp., Port Wells, 59; Haines, J. P. Anderson.

GUIGNARDIA ALASKANA M. Reed, 72 (as "Guinardella"); on Prasiola borealis, Unalaska,

Kodiak Isl., 56; Baranof Isl., 59.

HERPOTRICHIA NIGRA Hartig, Tunnel, 13; on Tsuga mertensiana, Chugach Nat. Forest, 12.

HYPOXYLON BLAKEI Berk. & Curt. on Salix alaxensis, Anaktuvuk Pass, G. A. Llano.

HYPOXYLON FRAGIFORME (Fr.) Petr. on Alnus fruticosa sinuata, Anchorage, J. W. Kimmey and M. E. Fowler.

HYPOXYLON FUSCUM Fr., Koyukuk, Tunnel, 13; on Alnus sp., Mt. McKinley Nat. Park, D. V. Baxter.

HYPOXYLON MAJUSCULUM Cke. on Alnus fruticosa sinuata (A. sitchensis), Yakutat Bay, 59.

HYPOXYLON MULTIFORME Fr. on Alnus sp., Seward and Betula kenaica, Great Lake, D. V. Baxter.

HYPOXYLON OHIENSE Ell. & Ev. on Picea sp., Sitka, 59.

LAESTADIA SAXIFRAGAE Sacc. & Scalia on Saxifraga parviflora, Unalaska, 59.

LEPTOSPHAERIA ACUTA (Moug.) Karst. on Urtica lyallii, Sitka, 4.

LEPTOSPHAERIA AGNITA ssp. LABENS Sacc. & Scalia on herbaceous stems, Unalaska, 59.

LEPTOSPHAERIA CONIOTHYRIUM (Fckl.) Sacc. on Ribes nigrum, Sitka, 4.

LEPTOSPHAERIA CULMIFRAGA (Fr.) Ces. & De N. on Calamagrostis nutkaensis (C. aleutica), Sitka, 4; near Circle, C. L. Lefebvre.

LEPTOSPHAERIA DOLIOLUM (Fr.) Ces. & De N., Aleutian Isls., G. A. Llano; Heracleum sp., Kodiak, 59.

LEPTOSPHAERIA FOENICULACEA ssp. LUPINA Sacc. & Scalia on Lupinus sp., Disenchantment Bay, 59.

LEPTOSPHAERIA (? FOLLICULATA Ell. & Ev.) on Carex sitchensis, Sitka, 4.

LEPTOSPHAERIA JUNCICOLA Rehm on Scirpus caespitosus callosus. Shumagin Isl., 59.

LEPTOSPHAERIA LEERSIANA Sacc. on Agrostis sp., Yes Bay, 59.

Leptosphaeria marginata Niessl: See SPHAERULINA MARGINATA.

LEPTOSPHAERIA MODESTA (Desm.) Auers. on Castilleja pallida, Port Clarence, 44.

LEPTOSPHAERIA OPHIOPOGONIS GRAMINUM Sacc. on Festuca rubra, Yes Bay, 59.

LEPTOSPHAERIA SILENES ACAULIS De N., Unalaska, 43; on Silene-acaulis, Unalaska, 59; Stellaria humifusa, Preobraschenie Isl., 44.

LEPTOSPHAERIA sp. on Vicia faba, Sitka, 4.

LINOSPORA TETRASPORA G. E. Thompson on Populus trichocarpa, Haines, Skagway, 21 (as L. populina?); Populus sp., Matanuska, D. M. Coe.

MASSARINA DRYADIS Rostr. on Dryas integrifolia (D. octapetala integrifolia), Point Barrow, 59.

MELANCONIS ALNI Tul. var. MARGINALIS (Pk.) Wehm. on Alnus fruticosa sinuata (A.

sitchensis), Sitka, 4.

MELANCONIS STILBOSTOMA (Fr.) Tul. on Betula resinifera (B. alaskana), Fairbanks, 18.

MELANCONIS THELEBOLA (Fr.) Sacc. on Alnus sp., Ketchikan, D. V. Baxter.

MELANOMMA PULVIS-PYRIUS (Fr.) Fckl. on Alnus sp., Sitka, 21; Salix sp., Cordova, D. V. Baxter.

MELANOMMA SAMBUCI Earle on Sambucus sp., Juneau, 21.

MELOGRAMMA sp. on Menziesia ferruginea, Sitka, 4.

METASPHAERIA ANNAE Oud. on Ranunculus sulfureus, Camden Bay, 44.

METASPHAERIA CINEREA (Fckl.) Sacc. on Salix sp., Sitka, J. P. Anderson.

Metasphaeria empetri (Fr.) Sacc.: See SPHAEROPEZIA EMPETRI.

Mycosphaerella eriophila (Niessl) Lind: See M. TASSIANA.

MYCOSPHAERELLA FRAGARIAE (Tul.) Lindau on Fragaria chiloensis, Sitka, 2, 4; F. sp., College, C. L. Lefebvre; F. (Sitka hybrid), Fairbanks, D. M. Coe.

MYCOSPHAERELLA FRUTICUM (Starb.) on Rubus sp., Sitka, 21.

MYCOSPHAERELLA GAULTHERIAE (Cke. & Ell.) House on Gaultheria shallon, Sitka, 4.

MYCOSPHAERELLA IGNOBILIS (Auers.) Maire & Werner on Agrostis geminata, Nagai, 59.

MYCOSPHAERELLA IMMERSA Dearn. on Cassiope tetragona, Camden Bay, 26.

MYCOSPHAERELLA LONGISSIMA (Fckl.) Lind on Bromus secalinus, Sitka, 21.

MYCOSPHAERELLA MINOR (Karst.) Johans. var. RETICULARIA Dearn. on Salix reticulata, Camden Bay, 26.

MYCOSPHAERELLA OOTHECA (Sacc.) Dearn. on Dryas octopetala, Nagai, 59.

Mycosphaerella pachyasca (Rostr.) Vest.: See MYCOSPHAERELLA TASSIANA.

MYCOSPHAERELLA PINODES Berk. & Blox. on Pisum sativum, Sitka, 2, 4.

MYCOSPHAERELLA POPULI Schroet, on Populus balsamifera, Sitka, 4; P. trichocarpa, Haines, Mendenhall, 21.

MYCOSPHAERELLA PUNCTIFORMIS (Fr.) Starb. on Cassiope (Andromeda) lycopodioides, Unalaska, 28.

MYCOSPHAERELLA PUSILLA (Auers.) Johans. on Colpodium fulvum, Preobraschenie Isl., 44.

MYCOSPHAERELLA RANUNCULI (Karst.) Lind, 45; on Anemone parviflora and Ranunculus nivalis, Camden Bay, 44.

MYCOSPHAERELLA RECUTITA (Fr.) Johans. 42; on Arctagrostis latifolia, Icy Reef, 44; Bromus inermis, near Fairbanks, C. L. Lefebvre; Carex sp., Yes Bay, 59.

MYCOSPHAERELLA RUMICIS (Desm.) Cke. on Rumex occidentalis, Sitka, 4.

MYCOSPHAERELLA STELLARINEARUM (Rab.) Johans. on Stellaria (Alsine) longipes, Russell

Fiord, 59.

MYCOSPHAERELLA STROMATOIDES Dearn. on Rumex obtusifolius, Haines, 21; R. sp., Seward, 22.

MYCOSPHAERELLA TASSIANA (De N.) Johans. 42, 43, 44; on Agropyron spicatum, Mile 15, south of Circle, C. L. Lefebvre; Androsace chamaejasme, 44; Artemisia sp., St. Lawrence Bay, 59; Astragalus alpinus, Collinson Point, 26; Avena sativa, Fairbanks, C. L. L.; Draba alpina, Point Barrow, 59; Hierochloë pauciflora, Camden Bay, 44; Puccinellia tenella, 44; Stellaria longipes, Sandspit, 44.

Mycosphaerella wichuriana (Schroet.) Johans.: See M. RECUTITA.

The following species of Sphaerella for which combinations in Mycosphaerella or other genera have not been found are listed here for convenience:

Sphaerella adusta Fckl.: See SPHAERELLA EFFUSA.

SPHAERELLA ALNI-VIRIDIS De N. on Alnus sp., Port Wells, 59.

SPHAERELLA CALIFORNICA Cke. & Harkn. on Agrostis sp., Yes Bay, 59.

SPHAERELLA CARYOPHYLLI Pass. on Dianthus caryophyllus, Sitka, 4.

SPHAERELLA EFFUSA Sacc. & Syd. on Epilobium angustifolium (Chamaenerion spicatum), Sitka, 4; E. boreale, Unalaska, 59; E. hornemannii (E. bongardi), Yakutat, 59; E. sp., Yakutat, Orca, 59.

SPHAERELLA GRAMINUM Sacc. & Scalia on Poa stenantha, Shumagin Isls., 59.

SPHAERELLA GROSSULARIAE var. SALICELLA Sacc. & Scalia on Salix sp., Kodiak, 59.

SPHAERELLA HARTHENSIS Auers. on Betula glandulosa, Port Clarence, 59.

SPHAERELLA LEPTOSPORA Sacc. & Scalia on Carex mertensii, Yes Bay, 59.

OPHIOBOLUS ROSTRUPII Ferd. & Winge on Prunella sp., Unalaska, 34.

OTTHIA DIMINUTA Karst. on Salix sp., Skagway, D. V. Baxter.

PHOMATOSPORA sp. on Epilobium angustifolium (Chamaenerion spicatum), Sitka, 4.

PHYSALOSPORA BOREALIS Sacc. on Anemone sp., Kukak Bay, 59.

PHYSALOSPORA CREPINIANA Sacc. & Scalia on Empetrum nigrum, 59.

PHYSALOSPORA EMPETRI Rostr. on Empetrum nigrum, 44.

PLEOSPORA CHRYSOSPORA Niessl, 42, 43; on Artemisia arctica comata (A. comata), Camden Bay, 44; Bupleurum americanum, Port Clarence, 44; Lloydia serotina (Anthericum serotinum), Camden Bay, 44; Oxytropis nigrescens, 26; O. sp., Kukak Bay, 59; Parrya nudicaulis (P. macrocarpa), Camden Bay, 26.

PLEOSPORA COMATA Auers. & Niessl, 42, 43; on Anemone drummondii, Sadlerochit River, 44; Arenaria macrocarpa and A. verna, Port Clarence, St. Paul Isl., 59; Oxyria digyna, Camden Bay, 44; Ranunculus sulfureus, Camden Bay, 44.

Pleospora culmorum (Cke.) Sacc.: See PYRENOPHORA TRICHOSTOMA.

PLEOSPORA HERBARUM (Fr.) Rab. on Astragalus frigidus, Preobraschenie Isl., 44; Crepis (Youngia) pygmaea, Camden Bay, 44; Oxytropis arctica (O. uralensis arctica), Nagai, 59;

Papaver nudicaule, Konganevik, 26; Potentilla pulchella, Collinson Point, 26; Primula borealis, Camden Bay, 44; Ranunculus nivalis, Point Barrow, 59.

PLEOSPORA INFECTORIA Fckl. on Poa glauca (P. caesia), Nagai, 59. This species is a synonym of P. scrophulariae (Desm.) Hoehn. sec. Lind and E. Mueller.

PLEOSPORA KARSTENII Berl. & Vogl. on Hierochloë pauciflora, Camden Bay, 44.

PLEOSPORA MACROSPORA Schroet. on Colpodium fulvum, Preobraschenie Isl., Camden Bay, 44.

PLEOSPORA MAGNUSIANA Berl. on Poa arctica, Preobraschenie Isl., Camden Bay, 44.

PLEOSPORA MEDIA Niessl, 42; on Draba vernalis (? verna), Unalaska, 59. Species is a synonym of P. scrophulariae sec. Lind.

Pleospora pentamera Karst.: See CLATHROSPORA PENTAMERA.

PLEOSPORA PHAEOCOMOIDES (Sacc.) Wint. on Androsace chamaejasme, 44.

PLEOSPORA SCROPHULARIAE (Desm.) Hoehn. on Lloydia serotina (Anthericum serotinum), Camden Bay, 44.

PLEOSPORA VAGANS Niessl on Oxytropis viscida var. subsucculenta (O. leucantha), Port Clarence, 44.

PLEOSPORA VULGARIS Niessl on Labiatae cult., Seward, 22; Lychnis apetala, Icy Reef, 26; Salix alaxensis, Anaktuvuk Pass, G. A. Llano. Species = P. scrophulariae sec. Lind.

PSEUDOVALSA RIBESIA Sacc. & Scalia on Ribes laxiflorum, Sitka, 59. Doubtful species sec. Wehmeyer Revision Melanconis, 1941.

PYRENOPHORA CERASTII (Oud.) Lind on Lychnis apetala (Melandrium apetalum), Icy Reef, 44; Oxyria digyna, Camden Bay, 44; Pedicularis lanata, 44; Salix rotundifolia, Camden Bay, 44.

Pyrenophora chrysospora (Niessl) Sacc.: See PLEOSPORA CHRYSOSPORA.

Pyrenophora comata (Niessl) Sacc.: See PLEOSPORA COMATA.

PYRENOPHORA PAUCITRICHA (Fckl.) Berl. & Vogl. on Papaver nudicaule, Kogluktuakuk River, 26.

Pyrenophora phaeocomoides (Berk. & Br.) Sacc.: See PLEOSPORA PHAEOCOMOIDES.

PYRENOPHORA POLYPHRAGMOIDES Sacc. & Scalia on Polemonium humile, Popof Isl., 59.

PYRENOPHORA TRICHOSTOMA (Fr.) Fckl. on Hierochloë alpina, Kotzebue, Puccinellia borealis, Nome, and Poa pratensis, Twelve Mile Summit, all coll. C. L. Lefebvre.

ROSELLINIA AQUILA (Fr.) De N. on Picea sitchensis, Sitka, J. P. Anderson.

ROSELLINIA LIGNIARIA (Grev.) Nits. on Sambucus pubens (S. racemosa), Kodiak Isl., W. T. Horne.

Sphaerella eriophila Niessl: See MYCOSPHAERELLA TASSIANA.

Sphaerella pachyasca Rostr.: See MYCOSPHAERELLA TASSIANA.

Sphaerella rumicis Desm.: See VENTURIA RUMICIS

Other Sphaerella spp.: See MYCOSPHAERELLA.

Sphaeria hederae Fr.: See TROCHILA CRATERIUM.

Sphaeria punctiformis Pers.: See MYCOSPHAERELLA PUNCTIFORMIS.

SPHAERULINA MARGINATA (Niessl) Kirschst. on Pyrola secunda, Yakutat Bay, 59.

SPHAERULINA TRIFOLII Rostr. on Trifolium sp., Ketchikan, Wrangell, 22.

SPORORMIA AMBIGUA Niessl, Kodiak, 59.

Stigmatea ranunculi Fr.: See MYCOSPHAERELLA RANUNCULI.

TEICHOSPORA sp. on Salix sp., Sadlerochit River, 26.

VALSA ALNI Pk. on Alnus sp., Fairbanks, 18.

VALSA BOREELLA Karst. on Salix alaxensis, Anaktuvuk Pass, G. A. Llano.

VALSA FALLAX Nits. on Cornus canadensis, Skagway, 21.

VALSA LEUCOSTOMA Fr. on Malus (Siberian crabapple), Matanuska, C. L. Lefebvre; Prunus padus, Sitka, 4.

VALSA SALICINA Fr. on Salix niphoclada, Icy Reef, 44.

VALSA SORDIDA Nits., Koyukuk, 14; on Populus balsamifera, Nenana, 18; Salix sp., 12, 13, 18.

VENTURIA CIRCINANS (Fr.) Sacc. on Geranium erianthum, Virgin Bay, 59.

VENTURIA CLINTONII Pk. on Cornus canadensis, Sitka, 4.

VENTURIA INAEQUALIS (Cke.) Aderh. on Malus sylvestris (Pyrus malus), Sitka, 1, 2, 4, 21; Haines, 21; Malus (Pyrus) baccata, Sitka, 21.

VENTURIA KALMIAE Pk. on Kalmia polifolia (K. microphylla), Sitka, 4, 21.

VENTURIA KUNZEI Sacc. on Rubus pedatus, Sitka, 4; R. sp., Prince William Sound, Yakutat Bay, 59.

VENTURIA KUNZEI Sacc. var. RAMICOLA Sacc. & Scalia on Rubus stellatus, Unalaska, 59.

Venturia pomi (Fr.) Wint.: See V. INAEQUALIS

VENTURIA RUMICIS (Desm.) Wint. on Rumex occidentalis, Sitka, 4; Juneau, 59.

XYLARIA HYPOXYLON (Fr.) Grev., Prince of Wales Isl., 23.

LABOULBENIALES

LABOULBENIA NEBRIAE Peyritsch on Nebria gregaria, Aleutian Isls., 59.

HYSTERIALES

Hysterium gracile Ehr.: See LOPHODERMIUM GRACILE.

Hysterium orbiculare Ehr.: See LOPHODERMIUM ORBICULARE.

HYSTERIUM PULICARE Fr. on Malus sylvestris, Haines, D. M. Coe.

LOPHIUM DOLABRIFORME Wallr. on Salix alaxensis, G. A. Llano.

LOPHODERMIUM ARUNDINACEUM (Fr.) Chev. on Calamagrostis canadensis, Summit of Livengood Road, Chatanika, C. L. Lefebvre; Elymus mollis, Sitka, 4.

LOPHODERMIUM FILIFORME Darker on Picea glauca, Fairbanks, Mt. McKinley Nat. Park, J. W. Kimmey and M. E. Fowler; Picea mariana, Fairbanks, J. W. K. and M. E. F.

LOPHODERMIUM GRACILE (Ehr.) Sacc. on Cassiope (Andromeda) lycopodioides, Unalaska, 28.

LOPHODERMIUM MACULARE (Fr.) De N. on Pyrola sp., Valdez, 13; Salix sp., Glacier Bay, 59.

LOPHODERMIUM ORBICULARE (Ehr.) Sacc. on Cassiope (Andromeda) lycopodioides, Unalaska, 28.

LOPHODERMIUM OXYCOCCI (Fr.) Karst. on Vaccinium oxycoccus, Kodiak, 59; V. vitis-idaea, Ketchikan, 21.

LOPHODERMIUM PICEAE (Fckl.) Hoehn. on Picea sitchensis, Prince of Wales Isl., 23; Ptarmigan Lake, D. V. Baxter.

LOPHODERMIUM PINASTRI (Fr.) Chev. on Pinus contorta var. latifolia, Prince of Wales Isl., 23; Pinus sp., Sitka, 21.

LOPHODERMIUM SPHAERIOIDES (Fr.) Duby on Ledum sp., Sitka, 21.

LOPHODERMIUM VERSICOLOR (Fr.) Schroet., 44.

LOPHODERMIUM sp. on Picea sitchensis, Sitka, 4 (as L. pinastri; probably L. piceae).

LOPHODERMIUM sp. on Tsuga heterophylla, Prince of Wales Isl., 23.

PHACIDIALES

DIDYMASCELLA THUJINA (Durand) Maire on Thuja plicata, Prince of Wales Isl., 23.

DIDYMASCELLA TSUGAE (Farl.) Maire on Tsuga sp., Cordova, 22.

Keithia tsugae Farl.: See DIDYMASCELLA TSUGAE.

Naevia diminuens (Karst.) Rehm.: See HYSTEROPEZIZELLA DIMINUENS.

Phacidium diminuens Karst.: See HYSTEROPEZIZELLA DIMINUENS.

PHACIDIUM GAULTHERIAE Dearn. on Gaultheria sp., W. H. Evans.

PROPOLIS ANGULOSA Karst. on Salix (?richardsonii), Sadlerochit River, Camden Bay, 26.

RHYTISMA ANDROMEDAE Fr. on Andromeda polifolia, Sitka, 4, 21; Ketchikan, 21.

Rhytisma arbuti Phill. on Menziesia: See MELASMIA MENZIESIAE.

RHYTISMA (?RHODODENDRI) Fr. on Rhododendron kamtschaticum, Unalaska, 59.

RHYTISMA SALICINUM Fr. on Salix arctica, Juneau, 21; S. barclayi, Skagway, 21; Unalaska, I. N. Gabrielson; S. pulchra, Richardson Highway (Mile 31), C. L. Lefebvre; S. richardsonii, Kotzebue, C. L. L.; S. scouleriana, Kasilof, D. M. Coe; S. sitchensis, Haines, 21; S. sp., Sitka, 4; Tunnel, Valdez, 13; Cordova, 22; Kodiak, 59; Mt. McKinley Nat. Park, Matanuska, D. M. Coe; Anaktuvuk Pass, G. A. Llano.

RHYTISMA VACCINII Schroet. on Vaccinium parvifolium, Sitka, 4.

RHYTISMA sp. on Menziesia ferruginea, Sitka, 4.

RHYTISMA sp. on Salix rotundifolia, Konganevik, 26.

SCHIZOXYLON INSIGNE (De N.) Rehm on Salix alaxensis, West of Tuluga Lake, G. A. Llano.

SPHAEROPEZIA EMPETRI (Fr.) Rehm, 44; on Empetrum nigrum, Port Clarence, 59; Aleutian Isls., 10.

HELOTIALES

? ASCOCALYX ABIETIS Naumov, Kodiak Isl., 13.

ATROPELLIS TRELEASEI (Sacc.) Zeller & Goodding on Coniferae, Sitka, 59, 62, 71; Prince of Wales Isl., 23.

BELONIDIUM PRUINOSUM (Jerd.) Rehm on Cucurbitaria conglobata on Alnus sp., 21.

CENANGIUM ARCTICUM (Ehr.) Fr. on Cassiope (Andromeda) tetragona, St. Lawrence Isl., 28.

Cenangium cerasi Fr.: See DERMEA CERASI.

CHLOROCIBORIA AERUGINASCENS (Nyl.) Kanouse, Prince of Wales Isl., 23.

CHLOROCIBORIA AERUGINOSA (Fr.) Seaver on Populus sp., Lower Russian Lake, D. V. Baxter.

CIBORIA sp. on Tsuga sp., Yakutat Bay, 59

CUDONIA CIRCINANS Fr., Orca, 59.

DASYSCYPHA BICOLOR (Fr.) Fckl. on Coniferae, Muir Glacier, Yakutat Bay, 59, 62.

DASYSCYPHA CARNEOLA (Sacc.) Sacc. on Calamagrostis canadensis, Juneau, C. L. Lefebvre.

DASYSCYPHA OCCIDENTALIS Hahn & Ayers on Larix laricina, Fairbanks, D. V. Baxter.

DASYSCYPHA RELICINA (Fr.) Boud., Yakutat Bay, 59.

DERMEA CERASI Fr. on Prunus avium, Sitka, 21; P. cerasus, Sitka, 4.

DIPLOCARPON ROSAE Wolf on Rosa rugosa (hybrid), Juneau, 21; R. sp., Juneau, 21; Cordova, 22; Central, D. M. Coe.

FABRAEA CINCTA Sacc. & Scalia on Rubus sp., Yakutat Bay, Orca, 59.

FABRAEA MACULATA Atk. on Amelanchier alnifolia, Haines, 21; Malus fusca (Pyrus diversifolia), Sitka, 4; Sorbus sitchensis, Sitka, 4.

FABRAEA RANUNCULI (Fr.) Karst. on Ranunculus occidentalis, Sitka, 4.

FABRAEA SANGUISORBAE Jaap on Sanguisorba sp., Tunnel, 13.

GODRONIA CASSANDRAE Pk. on Vaccinium sp., Juneau, 21.

GODRONIA DAVIDSONII Cash, 62; on Ribes bracteosum x nigrum, Juneau, 21.

Godronia treleasei (Sacc.) Seaver: See ATROPELLIS TRELEASEI.

GODRONIA URCEOLUS (Fr.) Sacc., 62; on Ribes bracteosum, Sitka, 4 (as Tympanis sp.), 21; Ribes sp., Sitka, 59.

Helotium alaskae Sacc.: See HELOTIUM CITRINUM.

HELOTIUM CITRINUM Fr., Yakutat Bay, 59.

HELOTIUM FUMIGATUM Sacc. & Speg. on herbaceous stems, Yakutat Bay, 59. Doubtful species sec. Seaver (62).

HELOTIUM LENTICULARE Fr., Juneau, 59.

HETEROSPHAERIA PATELLA Grev. on Heracleum sp., Yakutat Bay, 59.

HYSTEROPEZIZELLA DIMINUENS (Karst.) Nannf. 43; on Carex canescens, Yes Bay, 59.

HYSTEROPEZIZELLA IGNOBILIS (Karst.) Lind on Carex aquatilis (C. stans), Camden Bay, 44.

HYSTEROPEZIZELLA RIGIDAE Nannf. on Carex bigelowii (C. rigida), Camden Bay, 44.

LACHNELLULA CHRYSOPHTHALMA (Fr.) Rehm on Picea sitchensis, Mt. McKinley Nat. Park, D. V. Baxter.

MOLLISIA LIGNI (Desm.) Karst. on Sambucus sp., 21.

MOLLISIA POLYTRICHI Rehm on Ceratodon purpurens f. xanthopus, Newhalen, R. Thomas.

MOLLISIA SUBLIVIDULA (Nyl.) Karst. on Salix alaxensis, Anaktuvuk Pass, G. A. Llano.

ORBILIA OCCULTA (Rehm) Sacc. on Salix sp., Skagway, D. V. Baxter.

PATINELLA ALOYSII-SABAUDIAE Sacc. on Veratrum sp., Yakutat Bay, 59.

PHIALEA CARNEOLA Sacc., Yakutat Bay, 59.

PIROTTAEA YAKUTATIANA Sacc., Yakutat Bay, 59, 62.

Pseudohelotium jerdoni Sacc.: See BELONIDIUM PRUINOSUM.

PSEUDOPEZIZA BISTORTAE (Lib.) Fckl. on Polygonum viviparum, Unalaska, 59. Doubtful species sec. Seaver (62).

PSEUDOPEZIZA CERASTIORUM ARENARIAE Sacc. on Arenaria lateriflora, Yakutat Bay, 59. Doubtful fungus sec. Seaver (62).

PSEUDOPEZIZA RIBIS Kleb. on Ribes bracteosum, Sitka, 4, 21; R. bracteosum x nigrum, Juneau, 21; R. laxiflorum, Sitka, 21; R. nigrum, 4; R. rubrum (R. vulgare), Juneau, Haines, Ketchikan, 21; R. triste, Skagway, 21.

PSEUDOPEZIZA TRIFOLII (Biv.-Bern.) Fckl. on Trifolium pratense, Sitka, 4; T. sp., Wrangell, 21.

PYRENOPEZIZA STICTOIDEA Sacc. on Hierochloë alpina, Kotzebue, C. L. Lefebvre; H. odorata, Copper Center, C. L. L.

SCLERODERRIS FULIGINOSA (Fr.) Karst. on Salix richardsonii, Sadlerochit River, 26; Salix sp., Collinson Point, 26.

Scleroderris treleasei Sacc.: See ATROPELLIS TRELEASEI.

SCLEROTINIA (? OXYCOCCI Wor.) (sclerotia) on Vaccinium alaskense, Sitka, 21; V. parvifolium, Ketchikan, 21.

SCLEROTINIA VAHLIANA Rostr. on Eriophorum (? scheucheri), Wainwright, G. A. Llano.

TRICHOPEZIZA EAROLEUCA (Berk. & Br.) Sacc. on Lupinus sp., Disenchantment Bay, 59. Doubtful species sec. Seaver (62).

TRICHOPEZIZA HAMATA Sacc., Yakutat Bay, 59.

Trichopeziza relicina (Fr.) Fckl.: See DASYSCYPHA RELICINA.

TROCHILA CRATERIUM Fr. on Cassiope (Andromeda) tetragona, St. Lawrence Isl., 28.

Tryblidium arcticum Ehr.: See CENANGIUM ARCTICUM.

TYMPANIS ALNEA Fr. on Alnus sp., Childs Glacier, D. V. Baxter.

Tympanis sp. on Ribes bracteosum: See GODRONIA URCEOLUS.

VIBRISSEA TRUNCORUM Fr., Kodiak, Yakutat Bay, 59, 62.

PEZIZALES

HUMARIA SCUTELLATA (Fr.) Fckl., Juneau, 59; Nome, 26; Sand Bay, G. A. Llano.

Lachnea scutellata (Fr.) Gill.: See HUMARIA SCUTELLATA.

MORCHELLA CONICA Fr., Kodiak Isl., W. T. Horne.

OTIDEA MICROPUS (Fr.) Sacc. var. FLAVIDA, Teller, 26.

Peziza micropus Fr. var. flavida Phill.: See OTIDEA MICROPUS FLAVIDA.

Scutellinia scutellata (Fr.) Kuntze: See HUMARIA SCUTELLATA.

TREMELLALES

DACRYOMYCES DELIQUESCENS (Mérat) Duby, Juneau, Sitka, Yakutat, 59.

EXIDIA GLANDULOSA Fr. on Salix alaxensis, Anaktuvuk Pass, G. A. Llano.

GUEPINIA LUTEA Bres., 59.

? TREMELLA AURANTIA Fr., Kodiak Isl., W. T. Horne.

? TREMELLA PHYLLACHOROIDEA Sacc. on Menziesia ferruginea, Sitka, 59.

UREDINALES

Aecidium alaskanum Trel.: See PUCCINIA PRAEGRACILIS.

Aecidium asterum Schw.: See PUCCINIA EXTENSICOLA.

Aecidium astragali-alpini Eriks.: See UROMYCES LAPPONICUS.

AECIDIUM CIRCINANS Eriks. f. ACONITI-DELPHINII on Aconitum sp., St. Paul Isl., 59. Identity doubtful; possibly Puccinia rubigo-vera (DC.) Wint.

Aecidium claytonianum (Schw.) Clint.: See PUCCINIA MARIAE-WILSONI.

AECIDIUM EPILOBII DC. on Epilobium sp., Glacier Bay, 59. Possibly Puccinia vagans (DC.) Arth.

Aecidium fraseri Trel.: See PUCCINIA SWERTIAE.

Aecidium graebnerianum P. Henn.: See PUCCINIA PRAEGRACILIS.

Aecidium grossulariae Schum.: See PUCCINIA CARICIS.

Aecidium parnassiae (Schlecht.) Graves: See PUCCINIA ULIGINOSA.

Aecidium petasitidis Syd.: See PUCCINIA POARUM.

AECIDIUM RANUNCULACEARUM DC. on Anemone richardsonii and Ranunculus sp., Unalaska, 59. Possibly Puccinia gigantispora Bub.

Aecidium swertiae Opiz: See PUCCINIA SWERTIAE.

Aecidium violascens Trel.: See UROMYCES GERANII.

Allodus gigantispora (Bub.) Arth.: See PUCCINIA GIGANTISPORA.

Allodus swertiae (Wint.) Orton: See PUCCINIA SWERTIAE.

Bullaria coelopleuri (Arth.) Arth. & Mains: See PUCCINIA COELOPLEURI.

Bullaria hieracii (Schum.) Arth.: See PUCCINIA HIERACII.

CAEOMA (AECIDIUM) EPILOBII Schlecht. on Epilobium sp., Unalaska, 28. Possibly Puccinia vagans (DC.) Arth.

Caeoma pyrolae Schlecht.: See PUCCINIASTRUM PYROLAE.

Caeoma saxifragarum (DC.) Schlecht.: See MELAMPSORA ARCTICA.

Calyptospora columnaris Kuehn: See PUCCINIASTRUM GOEPPERTIANUM.

CHRYSOMYXA ARCTOSTAPHYLI Diet. on Arctostaphylos uva-ursi, 9, 53.

CHRYSOMYXA CASSANDRAE (Pk. & Clint.) Tranz. on Chamaedaphne calyculata, Fairbanks, Franklin, 7; Matanuska, 6, 7; Tanana, D. V. Baxter; C. sp., Koyukuk, 18; P. mariana, Talkeetna, 7.

CHRYSOMYXA EMPETRI (Pers.) Schroet., Moose Pass, Upper Russian Lake, Kodiak, 14; on Empetrum nigrum, 60; Kodiak Isl., 13; Pribilof Isls., 10, Liberty Falls, Sheep Mt., 7; Picea sitchensis, 60.

CHRYSOMYXA LEDICOLA (Pk.) Lagh., Koyukuk, 12, 14; on Ledum decumbens (L. palustre), 9, 53; Tanana, 18; Skagway, 21; Virgin Bay, Kodiak, 59; Nash Harbor on Nunivak Isl., Cleary Summit (Steese Highway 21), 7; Mt. McKinley Nat. Park, C. L. Lefebvre.; L. groenlandicum, 8, 9, 22, 53; Sitka, 3; Tanana, 18; Juneau, 7, 21; Fairbanks, J. W. Kimmey & M. E. Fowler; Kodiak Isl., W. T. Horne; Mt. McKinley Nat. Park, Anchorage, Steese Highway (Mile 90), C. L. L.; Circle, Chickaloon, Cooper's Landing, Ketchikan, Richardson Highway (mile 92, 146), Willow, Wiseman, Sheep Mt., 7; Picea glauca (P. canadensis), 9, 18, 53, 60; Circle, Fairbanks, Richardson Highway (mile 86, 146, 249), Wiseman, 7; P. mariana, Healy, 7; Fairbanks, J. W. K. and M. E. F.; P. sitchensis, 9, 53; Koyukuk, Kodiak Isl., 13; Juneau, Ketchikan, 7, 21; Sitka, 21; Anchorage, J. W. K. & M. E. F.; Kasilof, D. M. Coe.

CHRYSOMYXA PYROLAE (DC.) Rostr., 13, 44, 45; Koyukuk, 12, 14; on Moneses uniflora (M. grandiflora), 9; Yes Bay, 59; Sitka, 3; Glacier Bay, Hope, Hyder, Slana-Tok Highway (12), Tenakee, 7; M. uniflora reticulata (M. reticulata), 9, 53; Tenakee, 21; Picea sitchensis, Kodiak Isl., 13; Eagle River near Juneau, 7; Pyrola asarifolia (P. uliginosa, P. rotundifolia uliginosa), 9, 53; Kodiak Isl., W. T. Horne; P. asarifolia incarnata, near Juneau, Hyder, Seward, Unalaska, 7; P. bracteana, 9; P. chlorantha, Matanuska, 6, 7; P. minor, Valdez, 6, 7; P. secunda, 9; Haines, 7, 21; Skagway, 7, 21; Deschio (Lynn Canal), 36; Matanuska, 7; P. sp., Kodiak Isl., 13; Koyukuk, 13, 18; Glacier Bay, Disenchantment Bay, 59.

COLEOSPORIUM SOLIDAGINIS (Schw.) Thuem. on Erigeron peregrinus, 9, 53; Juneau, 7, 21; Solidago multiradiata, Livengood, 7; Solidago sp., 9; Kodiak Isl., 13; Haines, 7, 21.

CRONARTIUM COLEOSPORIOIDES (Diet. & Holw.) Arth. on Pinus contorta, 9, 12, 53; New Metlakatla, 59; Skagway, Haines, 7, 21; Juneau, 7; P. contorta latifolia, Prince of Wales Isl., 23.

CRONARTIUM COMPTONIAE Arth. on Myrica gale, 9, 53; Ketchikan, 7, 21.

Cronartium harknessii (J. P. Moore) Meinecke: See C. COLEOSPORIOIDES.

Dicaeoma areolatum (Diet. & Holw.) Kuntze: See PUCCINIA AREOLATA.

Dicaeoma asterum (Schw.) Arth. & Kern: See PUCCINIA EXTENSICOLA.

Dicaeoma bistortae (DC.) Kuntze: See PUCCINIA BISTORTAE.

Dicaeoma clematidis (DC.) Arth.: See PUCCINIA RUBIGO-VERA.

Dicaeoma epilobii-tetragoni (DC.) Arth.: See PUCCINIA VAGANS.

Dicaeoma epiphyllum (L.) Kuntze: See PUCCINIA POARUM.

Dicaeoma gentianae (Strauss) Kuntze: See PUCCINIA GENTIANAE.

Dicaeoma grossulariae (Schum.) Kern: See PUCCINIA CARICIS.

Dicaeoma hieraciatum (Schw.) Arth. & Kern: See PUCCINIA EXTENSICOLA.

Dicaeoma insperatum (Jacks.) Arth.: See PUCCINIA INSPERATA.

Dicaeoma ortonii (Jacks.) Arth.: See PUCCINIA ORTONII.

Dicaeoma parnassiae (Schlecht.) Arth. & Kern: See PUCCINIA ULIGINOSA.

Dicaeoma pimpinellae (Strauss) Kuntze: See PUCCINIA PIMPINELLAE.

Dicaeoma polygoni-vivipari (H. Dietr.) Arth.: See PUCCINIA BISTORTAE.

Dicaeoma pygmaeum (Eriks.) Arth. & Fromme: See PUCCINIA PYGMAEA.

Dicaeoma rhamni (Pers.) Kuntze: See PUCCINIA CORONATA.

Dicaeoma sommerfeltii (Johans.) Arth.: See PUCCINIA SEPTENTRIONALIS.

Dicaeoma trientalis (Tranz.) Arth. & Kern: See PUCCINIA KARELICA.

Dicaeoma veratri (DC.) Kuntze: See PUCCINIA VERATRI.

Dicaeoma violae (Schum.) Kuntze: See PUCCINIA VIOLAE.

Earlea alaskana Arth.: See PHRAGMIDIUM ALASKANUM.

Gymnoconia interstitialis (Schlecht.) Lagh.: See G. PECKIANA.

GYMNOCONIA PECKIANA (Howe) Trott., 44; On Rubus arcticus, Stebbins, St. Michael, Takotna, 7; R. stellatus, 53.

GYMNOSPORANGIUM AURANTIACUM Chev. on Sorbus scopulina, Takotna, 7; S. sitchensis, 7, 9.

GYMNOSPORANGIUM JUNIPERINUM (L.) Mart. on Sorbus sitchensis, 9, 53; Haines, 7, 21.

GYMNOSPORANGIUM NELSONI Arth. on Malus fusca (M. rivularis, Pyrus diversifolia), 9, 53; Ketchikan, 7, 21; Cordova, Wrangell, 22.

GYMNOSPORANGIUM NOOTKATENSE (Trel.) Arth. on Chamaecyparis nootkatensis, 9, 53; Sitka, 7, 21; Baranof Isl., 59; Craig, 7; Malus fusca (M. rivularis), 9, 53; Sitka, 2, 3, 7, 21; M. betulaefolia (Pyrus b.), 9, 53; Sorbus occidentalis, 9, 53; S. sitchensis, 9, 53; Sitka, 3, 7, 21.

Gymnosporangium sorbi (Arth.) Kern: See GYMNOSPORANGIUM NOOTKATENSE.

Gymnotelium nootkatense (Trel.) Syd.: See GYMNOSPORANGIUM NOOTKATENSE.

HYALOPSORA ASPIDIOTUS (Pk.) Magn., Tunnel, 13; on Dryopteris disjuncta (D. linneana, Phegopteris dryopteris), 9, 53; Sitka, 3; Tenakee, Haines, 21; Cordova, 22; Juneau, 7, 59.

Hyalopsora laeviuscula (Diet.& Holw.) Arth.: See MILESIA LAEVIUSCULA.

HYALOPSORA POLYPODII (Pers.) Magn. on Cystopteris (Filix) fragilis, 9, 53; Sitka, 7.

Hyalopsora polypodii-dryopteris (Moug. & Nestl.) Magn.: See H. ASPIDIOTUS.

MELAMPSORA ALBERTENSIS Arth. on Populus balsamifera (P. candicans, P. tacamahacca), Fairbanks, 6, 7; P. tremuloides, Fairbanks, 7, 18; Wiseman, 6, 7.

Melampsora alpina Juel: See M. ARCTICA.

MELAMPSORA ARCTICA Rostr., Tunnel, 13; on Salix arbusculoides, between Paxson and Sourdough, J. H. Christ; S. arbusculoides var. glabra, Nenana, J. H. C.; S. arctica, Point Hope, 6, 7; S. chamissonis, 7, 9, 53; S. fuscescens, 7, 9, 53; St. Lawrence Isl., 59; S. glauca var. aliceae, Circle, D. M. Coe; S. glauca var. glabrescens, Deering, 6, 7; S. ovalifolia, 9; S. polaris, 7, 9, 53; Port Clarence, 59; S. pulchra, Cape Lisburne, Nome, 6, 7; S. sitchensis, 9, 53; S. stolonifera, 9, 53; Disenchantment, 59; S. sp., Kodiak Isl., 13; Haines, 7, 21; Cordova, Valdez, 22; Nome, 7; Saxifraga bracteata, 9, 53; St. Lawrence Isl., 59; Savoonga, 7.

MELAMPSORA BIGELOWII Thuem., Koyukuk, 12, 14; on Larix laricina, Richardson Highway (Mile 287), 6, 7; Salix alaxensis, 53; Muir Glacier, 59; S. arbusculoides, 53; Franklin, Gakona, 7; S. arctica, 3, 53; Juneau, 7, 21; S. barclayi, 3, 53; Mendenhall, 21; Hope, Juneau, 7; S. glauca and var., Unalakleet, Deering, 7; S. ovalifolia var. camdensis, 53; Camden Bay, 7, 26; S. phlebophylla, Wiseman, 7; S. pulchra, 53; Collinson Point, 26; Popof Isl., 59; near Paxson, J. H. Christ; Barrow, Kivelina, Unalakleet, 7; S. reticulata, 3, 53; Juneau, 7, 21; Kukak Bay, 59; Wiseman, Tin City, 7; S. rotundifolia, Cape Lisburne, Point Lay, Talkeetna Mts., 7; S. sitchensis, 53; Skagway, 3; Juneau, 7; S. stolonifera, 53; S. sp., Koyukuk, 13, 18; Circle, Healy, Juneau, Kivelina, Matanuska, Wiseman, 7; Mt. McKinley Nat. Park, J. W. Kimmey and M. E. Fowler.

Melampsora confluens Jacks.: See M. RIBESII-PURPUREAE.

Melampsora farinosa (Pers.) Schroet.: See M. ARCTICA and M. BIGELOWII.

MELAMPSORA LINI (Pers.) Lév. on Linum lewisii (L. perenne lewisii), Richardson Highway (Mile 240), 6, 7; Gakona, 7.

MELAMPSORA RIBESII-PURPUREAE Kleb. on Ribes triste, Hope, 7; Salix alaxensis, Fairbanks, J. W. Kimmey and M. E. Fowler; S. arbusculoides, Mt. McKinley Nat. Park, C. L. Lefebvre; S. glauca var. acutifolia, Kotzebue, C. L. L.; S. reticulata, Mt. McKinley Nat. Park, C. L. L.; S. scouleriana, 53; Fairbanks, C. L. L.; S. seemanii, Kodiak Isl., W. T. Horne; S. sp., Seward, 22; College, C. L. L.

MELAMPSORELLA CERASTII (Pers.) Schroet. on Cerastium arvense, 9, 53; Cooper's Landing (Kenai Peninsula), 7; C. beeringianum, Skagway, 7, 21; Hope, 7; Picea glauca (P. canadensis), 6, 13; Tanana, 18; P. mariana, Franklin, 7; P. sitchensis, 9, 53; Haines, 7, 21; Glacier Point, 7; Stellaria (Alsine) longipes, 7, 9, 53.

Melampsorella elatina (Alb.& Schw.) Arth.: See M. CERASTII.

Melampsoridium betulae (Schum.) Arth.: See M. BETULINUM.

MELAMPSORIDIUM BETULINUM (Pers.) Kleb., Moose Pass, 13; on Betula glandulifera, Unalakleet, 6; Healy, Livengood, 7; B. glandulosa, 13; Healy, 6; Fairbanks, J. W. Kimmey and M. E. Fowler; B. kenaica 9, 53; Haines, 21; Talkeetna, 7; B. papyrifera occidentalis, Juneau, 7; B. resinifera, Fairbanks, Franklin, Sheep Mt., 7; Betula sp., Moose Pass, Kodiak Isl., 13; Klukwan, 21; Hope, D. V. Baxter; Haines, Takotna, Unalakleet, 7.

Melampsoropsis arctostaphyli (Diet.) Arth.: See CHRYSOMYXA ARCTOSTAPHYLI.

Melampsoropsis ledicola (Pk.) Arth.: See CHRYSOMYXA LEDICOLA.

Melampsoropsis pyrolae (DC.) Arth.: See CHRYSOMYXA PYROLAE.

Micropuccinia: See PUCCINIA.

MILESIA LAEVIUSCULA (Diet. & Holw.) Faull on Polypodium vulgare occidentale (P. glycyrrhiza), 9, 53; Sitka, Gull Isl. (Lynn Canal), near Juneau, 7.

MILESIA LAEVIUSCULA (Diet. & Holw.) Faull forma GLYCYRRHIZA on Polypodium vulgare occidentale (P. glycyrrhiza), Sitka, Juneau, 33.

Nigredo caryophyllina (Schrank) Arth.: See UROMYCES CARYOPHYLLINUS.

Nigredo geranii (DC.) Arth.: See UROMYCES GERANII.

NYSSOPSORA ECHINATA (Lév.) Arth. on Oenanthe sarmentorum, Goddard Hot Springs (Baranof Isl.), 7. Reported on Conioselinum benthami (Coelopleurum gmelini), 9, 53, 90, but in error sec. Anderson (7).

Peridermium cerebrum Pk. on Pinus contorta: See CRONARTIUM COLEOSPORIOIDES.

PERIDERMIUM COLORADENSE (Diet.) Arth. & Kern, Koyukuk, 11; on Picea glauca 14; Kenai River Road (Mile 56), J. W. Kimmey and M. E. Fowler; P. mariana, Koyukuk, 18; P. sitchensis, 3; Mt. McKinley Nat. Park, C. L. Lefebvre; between Central and Hot Springs, D. M. Coe.

PHRAGMIDIUM ALASKANUM (Arth.)Syd. on Rubus stellatus, 9, 53, 70; Yakutat Bay, 7, 59; Disenchantment Bay, Unalaska, 59 (as P. rubi?).

PHRAGMIDIUM AMERICANUM (Pk.) Diet. on Rosa sp., Koyukuk, Healy, D. V. Baxter.

PHRAGMIDIUM ANDERSONI Shear on Potentilla fruticosa, Circle, 6, 7; Healy, D. V. Baxter;

Franklin, 7.

Phragmidium disciflorum (Tode) James on Rosa rugosa: See P. SUBCORTICINUM.

PHRAGMIDIUM FUSIFORME Schroet. on Rosa acicularis, 9, 53, 70; Haines, 7, 21; Sitka, Kodiak, 59 (as P. subcorticium on R. cinnamomea); Cooper's Landing (Kenai Peninsula), Copper Center, near Fairbanks, Healy, Hope, Knik, Mt. McKinley Nat. Park, Takotna, 7; R. nutkana, 9, 53; Sitka, 3, 7, 21; Haines, 7; R. rugosa hybrids, Sitka, 7.

PHRAGMIDIUM MONTIVAGUM Arth. on Rosa woodsii, Circle Hot Springs, 7; Rosa sp., Kodiak, D. V. Baxter.

PHRAGMIDIUM OCCIDENTALE Arth. on Rubus parviflorus, 9, 53; Sitka, 1 (as P. rubi), 2, 3, 7; Tenakee, Haines, 7, 21; Juneau, 7.

PHRAGMIDIUM POTENTILLAE (Pers.) Karst. on Potentilla pennsylvanica and var. strigosa, Fairbanks, Franklin, Tanacross, 7; P. sp., South of Circle (Mile 15), C. L. Lefebvre.

Phragmidium rosae-acicularis Liro on Rosa acicularis and R. nutkana: See PHRAGMIDIUM FUSIFORME.

Phragmidium rosae-acicularis Liro on Rosa hemisphaerica and R. rugosa: See PHRAGMIDIUM SUBCORTICINUM.

PHRAGMIDIUM ROSAE-CALIFORNICAE Diet. on Rosa acicularis, Talkeetna, 7; R. nutkana, 9; Endicott River (Lynn Canal), 7; R. sp., Fairbanks, D. M. Coe.

Phragmidium rubi (Pers.) Wint. on Rubus parviflorus: See P. OCCIDENTALE.

? Phragmidium rubi (Pers.) Wint. on Rubus stellatus: See P. ALASKANUM.

PHRAGMIDIUM RUBI-IDAEI (DC.) Karst. on Rubus arcticus, Northway, 7; R. stellatus, Atka Isl., 7; R. strigosus (R. subarcticus), Curry, 6, 7; Talkeetna, 7; R. sp. (cult. raspberry), Juneau, C. L. Lefebvre.

? Phragmidium rubi-idaei (DC.) Karst. on Rubus chamaemorus: See PUCCINIASTRUM ARCTICUM.

PHRAGMIDIUM SUBCORTICINUM (Schrank) Wint. on Rosa hemisphaerica, 9, 53; Sitka, 3; R. rugosa, 9, 53; Sitka, 3; Juneau, 7, 21; R. sp., Kodiak, L. J. Cole; Matanuska, D. M. Coe.

Phragmidium subcorticium on Rosa cinnamomea: See P. FUSIFORME on R. acicularis.

? PHRAGMIDIUM TUBERCULATUM J. Muell. on Rosa sp., Fort Yukon, D. V. Baxter.

Polythelis pulsatillae (Rostr.) Arth.: See TRANZSCHELIA SUFFUSCA.

Puccinia acuminata Pk.: See P. PORPHYROGENITA.

PUCCINIA ADOXAE Hedw. f. on Adoxa moschatellina, Hope, Palmer, 7.

PUCCINIA ANGELICAE (Schum.) Fckl. on Angelica genuflexa, near Juneau, 7.

PUCCINIA ARENARIAE (Schum.) Wint. on Arenaria (Moehringia) lateriflora, 9, 53; Circle, Matanuska, Takotna, 7; A. (Merckia) physodes, Circle, 6, 7; Stellaria (Alsine) longipes 9, 53; Goldie, 7.

PUCCINIA AREOLATA Diet. & Holw. on Caltha biflora, 9, 53; Ketchikan, 7, 21; Craig, 7; C. leptosepala, Talkeetna Mts., 6, 7; C. palustris asarifolia, Matanuska, 6, 7.

PUCCINIA ARNICALIS Pk. on Arnica louiseana frigida, Globe, 7; Healy, Wiseman, 6, 7.

PUCCINIA ARTEMISIAE-NORVEGICAE Tranz. & Woron. on Artemisia arctica, Wiseman, 6, 7.

PUCCINIA ASTERIS Duby on Aster foliaceus, Kodiak, 59.

PUCCINIA BISTORTAE (Str.) DC., 45; on Angelica lucida, Unalaska, 7; Conioselinum benthami (Coelopleurum gmelini), 9, 53; Polygonum bistorta, Wiseman, 6, 7; P. plumosum (P. bistorta plumosum), Franklin, Takotna, Wiseman, 7; Mt. McKinley Nat. Park, C. L. York; P. viviparum (Bistorta vivipara), 9, 53; Eagle River, Juneau, Nome, Unalaska, 7.

PUCCINIA BULLATA (Pers.) Schroet. on Conioselinum benthami (Coelopleurum gmelini), St. Paul Isl., Popof Isl., 59.

PUCCINIA BUPLEURI Rudolphi on Bupleurum americanum, Franklin, 7.

PUCCINIA CARICIS (Schum.) Schroet. on Carex gmelini, Kodiak Isl., W. T. Horne; C. lyngbyei (C. cryptocarpa), Kodiak Isl., W. T. Horne; C. macrochaeta, 53; Sitka, 3, 7; Juneau, 7, 21; C. mertensii, 53; Sitka, 3, 7; Haines, 7, 21; Juneau, 7; C. pluriflora, 7; C. raymondii (C. atratiformis), Cordova, 22; C. sitchensis, 53; Sitka, 3, 7; C. stygia, 53; Sitka, 3; C. tolmiei, New Metlakatla, Sitka, 59; Ribes alpinum, 9, 53; Sitka, 2, 3, 7; R. bracteosum, 9, 53; Sitka, 1, 2, 3, 7, 21; Juneau, Tenakee, 7, 21; Hyder, 7; R. glandulosum, Sitka, 1; R. gordianum, 9, 53; R. hudsonianum, 9, 53; Fairbanks, 7; R. lacustre (R. echinatum), 9; Sitka, 1, 2, 3, 7, 9, 21; Gull Isl. (Lynn Canal), 7; R. laxiflorum, 9, 53; Sitka, 2, 3, 8; Juneau, 7, 21; Hyder, 7; R. (Grossularia) oxyacanthoides, 53; Sitka, 2, 3; R. petiolare, 9; R. rubrum (R. vulgare), 9, 53; Sitka, 7, 21; Wrangell, W. H. Evans; R. sanguineum, 9, 53; Sitka, 2, 3, 7; R. triste, 7, 9, 53; Sitka, 2, 3; Skagway, 21; R. sp., Juneau, 21, 59; Wrangell, Sitka, Yakutat, 59; Urtica lyallii, 9; Juneau, 7.

Puccinia caricis grossulariata Arth.: See PUCCINIA CARICIS.

PUCCINIA CARICIS-SHEPHERDIAE J. J. Davis on Carex sp., Juneau, D. V. Baxter.

Puccinia caricis urticata (Kern) Arth.: See PUCCINIA CARICIS

PUCCINIA CICUTAE Lasch on Cicuta douglasii, Haines, 7, 21.

PUCCINIA CIRCAEAE Pers. on Circaea alpina, 3, 9, 53; Echo Cove (Lynn Canal), Juneau, Ketchikan, Sitka, Talkeetna, 7; C. pacifica (?), 9, 53; C. sp., Juneau, 59.

Puccinia clematidis (DC.) Lagh.: See PUCCINIA RUBIGO-VERA.

PUCCINIA COCKERELLIANA Bethel on Festuca rubra lanuginosa, Kenai, C. L. Lefebvre.

PUCCINIA COELOPLEURI Arth. on Angelica lucida, 7; Conioselinum benthami (Coelopleurum gmelini), 9, 53, 70; Haines, 7, 21; Eagle River near Juneau, Echo Cove (Lynn Canal), Hope, Juneau, Seward, 7.

PUCCINIA CONGLOMERATA (Strauss) Schm. & G. Kunze on Petasites frigidus, Talkeetna Mts., Barrow, Wainwright, 6, 7; Mt. McKinley Nat. Park, D. V. Baxter.

PUCCINIA CORONATA Cda. on Bromus arcticus and B. inermis, Anchorage, C. L. Lefebvre; B. ciliatus, Dunbar, C. L. L.; Calamagrostis canadensis, Wiseman, 6, 7; College, C. L. L.; Shepherdia (Lepargyrea) canadensis, 9, 53; Klukwan, 21; Fairbanks, Franklin, Healy, Ketchikan, 7; Mt. McKinley Nat. Park, C. L. L.

PUCCINIA CRUCIFERARUM Rudolphi on Cardamine bellidifolia, Talkeetna Mts., 6, 7.

PUCCINIA DRABAE Rudolphi on Draba aurea, 9, 53; Draba sp., Skagway, 7, 21.

Puccinia epilobii-tetragoni (DC.) Wint.: See PUCCINIA VAGANS.

PUCCINIA EXTENSICOLA Plowr. on Aster foliaceus, 9, 53; Kodiak, 59; on Erigeron peregrinus, Unalaska, 7; Scorzonella borealis, 53.

Puccinia extensicola asteris (Thuem.) Arth.: See P. EXTENSICOLA.

Puccinia extensicola hieraciata (Schw.) Arth.: See P. EXTENSICOLA.

PUCCINIA FERGUSSONI Berk. & Br. on Viola blanda, Kodiak, 59; V. epipsila repens, Hope, 7; V. langsdorfii, Juneau, 6, 7; V. palustris, 9, 53.

PUCCINIA FESTUCAE (DC.) Plowr. on Festuca altaica, Homer, C. L. Lefebvre.

PUCCINIA GEMELLA Diet. & Holw. on Caltha leptosepala, 7, 9, 53.

PUCCINIA GENTIANAE (Strauss) Pk. on Gentiana algida (G. frigida, G. romanzovii), 9, 53; Nome, 7, 8.

Puccinia geranii-silvatici Karst.: See P. LEVEILLEI.

PUCCINIA GIGANTEA Karst. on Epilobium angustifolium, Circle, 6, 7; Epilobium sp., Copper Center, D. V. Baxter.

PUCCINIA GIGANTISPORA Bub. on Anemone multifida (A. globosa), Chitina, 6, 7; Gakona, 7; A. naricissiflora, 53.

PUCCINIA GRAMINIS Pers. on Agrostis sp., Cordova, D. V. Baxter.

Puccinia grossulariae (Schum.) Lagh.: See PUCCINIA CARICIS.

PUCCINIA GRUMOSA Syd. & Holw. on Zygadenus elegans, Ehlutna Lake, C. L. York; Cooper's Landing (Kenai Peninsula), Franklin, 7.

PUCCINIA GYMNANDRAE Tranz. on Lagotis glauca, Nunivak Isl., 6, 7.

PUCCINIA HEUCHERAE (Schw.) Diet., 6; Tunnel, 13; on Heuchera glabra, 9, 53; Juneau, 7, 21, 59; Skagway, Haines, 7, 21; Kodiak Isl., 13; Cordova 7, 22; Russell Fiord, 59; Ivanof Bay, Seward, 7; H. sp., 21; Mitella pentandra, 6; Douglas, Hyder, Talkeetna Mts., 7; Saxifraga lyallii, North of Tlehini (Lynn Canal), 36; Talkeetna Mts., 7; S. punctata nelsoniana (Micranthes nelsoniana), 9, 53; Juneau, 59; S. sp., 59; Tellima grandiflora, 9, 53; Disenchantment Bay, 59; Ivanof Bay, 7; Tiarella trifoliata, 9, 53; Sitka, Tenakee, 7, 21; Cordova, 22; T. unifoliata, 6; Juneau, 7; Tolmiea menziesii, 6; Craig, 7.

PUCCINIA HIERACII (Schum.) Mart. on Hieracium albiflorum, Hyder, 6, 7; Taraxacum lyratum, 9, 53; Skagway, 21; T. mutilum, Fairbanks, Wiseman, 6; T. officinale (T. vulgare, Leontodon taraxacum), 9, 53; Skagway, 21; Seward, Cordova, 22; T. spp., Anchorage, Haines, Skagway, Talkeetna, Valdez, Wiseman, 7.

PUCCINIA HOLBOELLII (Horn.) Rostr. on Arabis divaricarpa, Potter, D. M. Coe; A. holboellii, 9, 53; Chickaloon, Cooper's Landing (Kenai Peninsula), Fairbanks, Gakona, Matanuska, Tanacross, 7; A. holboellii var. retrofracta, Gakoma, J. P. Anderson; A. lyallii occidentalis, 9, 53; Kodiak Isl., W. T. Horne; A. lyrata kamchatica (A. ambigua), 9, 53; Eagle Creek, Hope, Juneau, Seward, 7; north of Nushagak, J. B. Mertie, Jr.; A. sp., Kenai Peninsula, L. J. Palmer; Bodenborg Butte (Matanuska Valley), J. C. Chamberlin.

PUCCINIA INSPERATA Jacks. on Prenanthes alata (Nabalus hastatus), 9, 53; Ketchikan, Sitka, 7, 21.

PUCCINIA KARELICA Tranz. on Trientalis europaea arctica (T. arctica), 9, 53; Juneau, 7, 21.

PUCCINIA LAURENTIANA Trel. on Saxifraga (Ocrearia) nudicaulis, 9, 53; St. Lawrence Isl.,

7, 59.

PUCCINIA LEVEILLEI Mont. on Geranium erianthum, 9, 38, 53; Cooper's Landing (Kenai Peninsula), Juneau, Talkeetna Mts., Unalaska, 7; Popof Isl., 59; G. sp., Kenai, C.L. Lefebvre.

PUCCINIA LIGUSTICI Ell. & Ev. on Conioselinum benthami (Conioselinum gmelini kamtschaticum), Gull Isl. (Lynn Canal), St. Paul Isl., 6, 7; Amchitka Isl., 7.

PUCCINIA LINKII Klotzsch on Viburnum edule (V. pauciflorum), Skagway, Matanuska, 6, 7; Seward, 7.

PUCCINIA MAJANTHEMI Diet. on Maianthemum dilatatum (M. bifolium), Aleutian Isls., G. A. Llano.

PUCCINIA MARIAE-WILSONI G. W. Clint. on Claytonia arctica, St. Paul Isl., 59.

PUCCINIA MERTENSIAE Pk. on Mertensia paniculata, Mt. McKinley Nat. Park, D. V. Baxter; Clearwater Creek at Slana-Tok Highway, 7 (as P. mertensiana).

PUCCINIA MESOMAJALIS Berk. & Curt. on Clintonia uniflora, Ketchikan, Hyder, 6; C. sp., Ketchikan, D. V. Baxter.

PUCCINIA MILLEFOLII Fckl. on Achillea borealis, 9, 53; Haines, 7, 21; Circle, D. M. Coe; Achillea multiflora, Circle, D. M. Coe; Artemisia laciniata, Globe, 7; Artemisia tilesii (A. elatior), Healy, 6, 7; Franklin, 7; Seward, D. V. Baxter.

PUCCINIA NEPHROPHYLLIDII Mains on Nephrophyllidium crista-galli, Ketchikan, 49. See note by Anderson (7) on possible identity with P. areolata Diet. & Holw.

PUCCINIA OBSCURA Schroet. on Luzula multiflora, Eagle River near Juneau, 7.

PUCCINIA ORTONI Jacks. on Dodecatheon frigidum, 6, 9, 53; Haines, 7, 21; Lignite, 7; D. jeffreyi (?), 6, 9, 53; Port Benny, 22; D. macrocarpum, Juneau, 7; D. pauciflorum, 6; D. viviparum, Annette Isl., Juneau, Ketchikan, 7.

PUCCINIA OUDEMANSII Tranz. on Parrya nudicaulis, Cape Lisburne, 6, 7.

PUCCINIA OXYRIAE Fckl.,Tunnel, 13; on Oxyria digyna, near Juneau, 6, 7, 13; Cordova, D. V. Baxter.

PUCCINIA PARCA Arth. on Polygonum sp., Healy, D. V. Baxter.

PUCCINIA PARKERI Diet. & Holw. on Ribes lacustre (R. echinatum), 9; Chatham, 7, 21.

PUCCINIA PAZSCHKEI Diet. on Saxifraga tricuspidata, Lawing, D. V. Baxter.

PUCCINIA PIMPINELLAE (Strauss) H. Mart. on Osmorrhiza chilensis (O. intermedia), 7, 9, 53; Klukwan, 21; O. longistylis, Cordova, D. V. Baxter.

PUCCINIA POAE-SUDETICAE (West.) Jorst., Tunnel, 13; on Phleum alpinum, Homer, C. L. Lefebvre; Poa glauca, Happy Valley, Kenai Peninsula, S. C. Litzenberger; Mt. McKinley Nat. Park, Glenn Highway (Mile 82), C. L. L.; Poa pratensis, 9; Sitka, 3; Klukwan, 21; Homer, Dunbar, C. L. L.; Juneau, 7; Poa stenantha, Valdez, C. L. L.; Trisetum spicatum, Mt. McKinley Nat. Park, Valdez, Kotzebue, C. L. L.

PUCCINIA POAE-SUDETICAE (West.) Jorst. var. AIRAE (Lagh.) Diet. on Deschampsia caespitosa, Unalakleet, C. L. Lefebvre.

PUCCINIA POARUM Niessl on Petasites corymbosus, 9, 53; P. frigidus, 9, 53; Pribilof Isls., 6; Kotzebue, 6, 7; Sitka, 8 (as Aecidium sp.); St. Paul Isl., 7; Richardson Highway 152, 233, Stebbins, Lignite, 7; P. hyperboreus, Eagle River near Juneau, 7; P. sagittatus,

Northway, 7; P. sp., Kodiak Isl., W. T. Horne.

Puccinia poarum Niessl on Poa pratensis: See PUCCINIA POAE-SUDETICAE.

PUCCINIA POLEMONII Diet. & Holw. on Polemonium acutiflorum, Gambell, 7; St. Lawrence Isl., 6; P. humile, Hope, D. V. Baxter.

PUCCINIA POLYGONI-ALPINI Cruch. & Mayor on Polygonum alaskanum (Aconogonum phytolaccaefolium), Golovin, Unalakleet, 6, 7.

PUCCINIA PORPHYROGENITA Curt. on Cornus canadensis, 9, 53; Sitka, 3, 59; Juneau, 6, 7; Tenakee, Haines, 7, 21; Cordova, 22; Yes Bay, Douglas Isl., 59; Ketchikan, Echo Cove (Lynn Canal), Eagle Isl., 7; C. suecica, Juneau, 7.

PUCCINIA PRAEGRACILIS Diet. on Habenaria dilatata (Limnorchis leptoceratatis), 9, 53; Kodiak, Popof Isl., Yakutat Bay, 59; Juneau, 6, 7; H. hyperborea, 7, 9, 53; Kodiak, 59; H. saccata, Unalaska, 7; H. viridis bracteata (Coeloglossum viride bracteatum), 7, 9, 53; Kodiak, Bering Isl., 59; H. sp., 70; Kodiak Isl., W. T. Horne; Orchis aristata, 7, 9, 53; Kodiak, Unalaska, 59; O. sp., 70.

PUCCINIA PRENANTHIS (Pers.) Fckl. on Prenanthes alata, Sitka, Kodiak, 59. Possibly P. insperata Jacks.

Puccinia procera Diet. & Holw. on Elymus dahuricus: See P. RUBIGO-VERA on Elymus virescens.

PUCCINIA PULSATILLAE Kalchb. on Anemone narcissiflora, Richardson Highway 207, 7; A. parviflora, Wiseman, 7; A. patens wolfgangiana (Pulsatilla ludoviciana), Healy, 6, 7.

PUCCINIA PYGMAEA Eriks. on Arctagrostis arundinacea, 9; Nome 8; A. latifolia, Nome, Glenn Highway, C. L. Lefebvre; A. l. var. arundinacea, Alaska Highway, 7; Calamagrostis aleutica, 9, 53; Sitka, 3; C. nutkaensis, Sitka, 7; Hordeum brachyantherum (H. nodosum boreale), Cordova, 22.

PUCCINIA RANUNCULI Blytt, 45; on Ranunculus eschscholtzii, 9; Sitka, 7, 21.

PUCCINIA RETECTA Syd. on Anemone narcissiflora (A. zephyra), 6, 9, 53; Cleary Summit (Steese Highway 20), Healy, Juneau, Takotna, Unalaska, 7.

Puccinia rhamni (Pers.) Wettst.: See P. CORONATA.

PUCCINIA RIBIS DC., Tunnel, 13; on Ribes rubrum, Homer, W. H. Evans; Wasilla, D. M. Coe.

PUCCINIA RUBEFACIENS Johans. on Galium boreale, 9, 53; Circle, Fairbanks, Healy, Wiseman, 7.

PUCCINIA RUBIGO-VERA (DC.) Wint. on Aconitum delphinifolium, 9, 53; St. Paul Isl., 7; Aconitum maximum, Aleutian Isls., 6; Igitkin Isl., St. Paul Isl., 7; Actaea arguta, 9, 53; Klukwan, 7, 21; Coopers's Landing (Kenai Peninsula), 7; Actaea eburnea (A. alba), 9, 53; Klukwan, 21; Aquilegia formosa, 9; Juneau, 7, 21; Cooper's Landing (Kenai Peninsula), Gull Isl. (Lynn Canal), 7; Elymus mollis, 7, 9, 53; E. villosus (E. holwellii), 9, 53; Revillagigedo Isl., 59; E. virescens, 7, 9, 53; Puccinellia sp., Juneau, D. V. Baxter; Ranunculus cymbalaria, 9, 53; Matanuska, 7; R. occidentalis, 9, 53; Unalaska, 7; Thalictrum hultenii (T. kemense), Aleutian Isls., 6; Unalaska, 7; Trisetum spicatum, Talkeetna, 7.

Puccinia rubigo-vera agropyri (Eriks.) Arth.: See PUCCINIA RUBIGO-VERA

Puccinia saxifragae Schlecht.: See PUCCINIA HEUCHERAE.

PUCCINIA SEPTENTRIONALIS Juel on Polygonum (Bistorta), viviparum, 9, 53; Nome, 8; Juneau, 7; Thalictrum alpinum, 7, 9, 53; Kodiak, 8.

PUCCINIA SIEVERSIAE Arth. on Geum turbinatum, Palmer, D. V. Baxter.

PUCCINIA SWERTIAE Wint., Kodiak 59 (as Aecidium fraserae on Frasera sp. -- probably Swertia perennis); Swertia perennis, 9, 59; Isabella Pass, 7; Kodiak Isl., W. T. Horne.

PUCCINIA SYMPHORICARPI Harkn. on Symphoricarpos albus (S. racemosus), 9, 53; Klukwan, 21; S. rivularis, Klukwan, 7.

Puccinia taraxaci Plowr.: See PUCCINIA HIERACII.

PUCCINIA THLASPEOS Schub. on Arabis lyrata kamchatica (A. ambigua), Disenchantment Bay, 59. Probably P. holboellii (Horn.) Rostr.

Puccinia tiarellae Berk. & Curt.: See PUCCINIA HEUCHERAE.

PUCCINIA ULIGINOSA Juel on Parnassia palustris, 9, 53, 70; Kodiak, 7, 59.

PUCCINIA VAGANS (DC.) Arth. on Epilobium anagallidifolium, Juneau, 21; Talkeetna Mts., 6, 7; E. glandulosum, Sitka, 53; Juneau, 7; E. hornemannii (E. bongardi), 53; E. (Chamaenerion) latifolium, 53; E. sp., Kodiak Isl., W. T. Horne.

Puccinia vagans var. epilobii tetragoni DC.: See P. VAGANS.

PUCCINIA VALERIANAE Carest. on Valeriana capitata, St. Paul Isl. 59.

PUCCINIA VERATRI (DC.) Duby on Epilobium adenocaulon, Sitka, 8; E. anagallidifolium, 9, 53; Talkeetna Mts., 7; E. latifolium, Talkeetna Mts., 7; E. sp., Ketchikan, 7; Veratrum eschscholtzii, Spruce Isl., D. V. Baxter.

PUCCINIA VESICULOSA Schlecht. on Anemone narcissiflora var. villosissima, Unalaska, 28.

PUCCINIA VIOLAE (Schum.) DC. on Viola adunca, Haines, 7; V. epipsila repens, Hyder, Juneau, Sitka, 7; V. glabella, Echo Cove (Lynn Canal), Ketchikan, 7; V. langsdorfii, 9, 53; Juneau, Eagle River near Juneau, 7; Skagway, 7, 21; V. palustris, 9, 53; Sitka, 21; V. renifolia brainardii, Chickaloon, 7; V. sp., Talkeetna, 7; Kodiak Isl., W. T. Horne.

PUCCINIA VIRGAUREAE (DC.) Lib. on Solidago sp., Kodiak, D. V. Baxter.

PUCCINIA VOLKARTIANA E. Fisch. on Androsace chamaejasme, 9, 70; A. chamaejasme lehmanniana, Rapids Lodge (Richardson Highway 233), 7.

PUCCINIASTRUM ALASKANUM Mains on Gentiana glauca, Mt. McKinley Nat. Park, 7, 14, 49; Nome, Russian River, 14.

PUCCINIASTRUM ARCTICUM (Lagh.) Tranz. 70; Tunnel, 13; on Rubus alaskensis, Curry, Talkeetna, 7; R. arcticus (R. acaulis), 9, 53; Nash Harbor on Nunivak Isl., Nome, Talkeetna Mts., Little Susitna River, Chickaloon, Hope, 7; R. chamaemorus, 7, 9, 53; Kodiak, 59 (as Phragmidium rubi-idaei); R. stellatus, 9, 53; Mendenhall, Juneau, 21; Kodiak Isl., W. T. Horne; Seward, Moose Pass, Hunter, Little Susitna River, Unalaska, Juneau, Chichagof Isl., 7.

Pucciniastrum epilobii Otth: See P. PUSTULATUM.

PUCCINIASTRUM GOEPPERTIANUM (Kuehn) Kleb. on Vaccinium ovalifolium, 9; Skagway, 7, 21; V. parvifolium, Hollis Anchorage (Prince of Wales Isl.), J. A. Klein; V. uliginosum, 21; Skagway, 7; V. vitis-idaea, 9; Skagway, 7, 21; V. sp., 23.

PUCCINIASTRUM MYRTILLI (Schum.) Arth., Tunnel, 13; on Vaccinium alaskense, 9; Sitka,

Haines, Ketchikan, 7, 21; Endicott River, near Juneau, 7; V. caespitosum, 9; Sitka, 3, 7, 21; Ketchikan 7, 21; Juneau, 7; V. myrtillus, Tenakee, 21; V. ovalifolium, 9; Sitka, 3, 7, 21; Juneau, 7; V. uliginosum, Talkeetna, Unalaska, 7; V. sp., Koyukuk, 18; Sitka, 59.

PUCCINIASTRUM PUSTULATUM (Pers.) Diet., 14; on Abies lasiocarpa, 9, 53; Skagway, 7, 21; Clarkia elegans, 9, 53; Juneau, 7, 21; Epilobium adenocaulon, 9, 53; E. alpinum, 9, 53; E. angustifolium (Chamaenerion exaltatum, E. spicatum), 9, 53; Haines, 7, 21; Kodiak Isl., 13; Seward, 22; Fairbanks, Matanuska, Takotna, Wiseman, 7; E. glandulosum (E. affine), 9, 53; Sitka, 3, 7; Ketchikan, 7, 21; Juneau, Tenakee, 7; E. (Chamaenerion) latifolium, 9; E. palustre, 9, 53; E. sp., Cordova, 22; Valdez, D. V. Baxter; Kodiak Isl., W. T. Horne; Skagway, J. P. Anderson; Fuchsia speciosa, Juneau, 7; Godetia amoena (G. grandiflora, Clarkia superba), 9, 53; Juneau, 7, 21; Tenakee, 7.

PUCCINIASTRUM PYROLAE (Pers.) Schroet., Tunnel, 13; on Pyrola asarifolia, 9; P. asarifolia incarnata, 7; P. minor, Hyder, 6, 7; Skagway, 7; P. rotundifolia (?), Unalaska, 28; P. secunda, Valdez, D. V. Baxter; Talkeetna, 7.

PUCCINIASTRUM SPARSUM (Wint.) E. Fisch. on Arctostaphylos (Mairania) alpina, 9, 53; Wiseman, 7; A. rubra (A. alpina rubra, Arctous erythrocarpa), 6; Circle, Fairbanks, Franklin, Richardson Highway 86, 7.

Pucciniastrum vacciniorum Lagh.: See P. MYRTILLI.

Pucciniola carnea (Nees) Arth.: See UROMYCES LAPPONICUS.

Pucciniola hedysari-obscuri (DC.) Arth.: See UROMYCES HEDYSARI-OBSCURI.

Pucciniola miurae (Syd.) Arth.: See UROMYCES MIURAE.

Thecopsora vacciniorum (Lk.) Karst.: See PUCCINIASTRUM MYRTILLI.

TRANZSCHELIA SUFFUSCA (Holw.) Arth., Healy, 6; on Anemone patens multifida, Globe, Healy, Matanuska, Lignite, 7; A. patens wolfgangiana (Pulsatilla ludoviciana), 9, 53.

TRANZSCHELIA THALICTRI (Chev.) Diet. on Thalictrum sp., Moose Pass, D. V. Baxter.

URAECIUM HOLWAYI Arth. on Tsuga heterophylla, 9, 53; Sitka, 7, 21.

UREDINOPSIS STRUTHIOPTERIDIS Stoerm. on Athyrium cyclosorum, Ketchikan, 6; A. filix-femina, Juneau, Ketchikan, 7.

Uredo alpina (Juel) Arth.: See MELAMPSORA ARCTICA.

Uredo bigelowii (Thuem.) Arth.: See MELAMPSORA BIGELOWII.

Uredo holwayi Arth.: See URAECIUM HOLWAYI.

Uredo ledicola Pk.: See CHRYSOMYXA LEDICOLA.

UREDO MCKINLEYENSIS Cummins on Salix reticulata gigantifolia, 24.

Uredo nootkatensis Trel.: See GYMNOSPORANGIUM NOOTKATENSE.

UROMYCES CARYOPHYLLINUS (Schrank) Wint. on Dianthus caryophyllus, 53; Sitka, 3, 63; Juneau, 7.

Uromyces erythronii (DC.) Pass on Fritillaria kamtschatcensis: See UROMYCES MIURAE.

UROMYCES FABAE (Pers.) D By. on Lathyrus japonicus (L. maritimus), Knik, S. C. Litzenberger; Haines, Matanuska, Unalakleet, 6, 7; L. sp., Valdez, D. V. Baxter.

UROMYCES GERANII (DC.) Fr. on Geranium erianthum, 9, 53; Haines, 21; Kodiak, Kukak Bay, 59; Juneau, 7, 21; Cooper's Landing (Kenai Peninsula), Echo Cove (Lynn Canal) Palmer, Unalaska, Ivanof Bay, 7.

UROMYCES HEDYSARI-OBSCURI (DC.) Car. & Piccone on Hedysarum alpinum americanum, 9, 53; Endicott River, Healy, Matanuska, Wiseman, 7; H. boreale, Mt. McKinley Nat. Park, C. L. Lefebvre; H. mackenzii, Wiseman, 6, 7; Gakona, 7; H. sp., Nome, Healy, 6; Matanuska Glacier, Glenn Allen Highway (Mile 101), C. L. L.

UROMYCES LAPPONICUS Lagh. on Astragalus sp., 9, 53; O. nigrescens, Healy, Twelve Mile Summit (Steese Highway 87), Unalakleet, 7.

UROMYCES MIURAE Syd. on Fritillaria kamtschatcensis, 9, 53, 70; Kodiak, Kukak Bay, 59 (as U. erythronii); Hope, Hyder, Juneau, 7.

UROMYCES PHACAE-FRIGIDAE (Wahl.) Hariot on Astragalus umbellatus, Eagle Summit on Steese Highway, Wiseman, 6, 7; A. (Phaca) sp., Unga Isl., 6.

UROMYCES POLYGONI (Pers.) Fckl. on Polygonum aviculare, 9, 53; Seward, Palmer, 6; Haines, 21; P. buxiforme, Haines, Palmer, Seward, 7.

XENODOCHUS CARBONARIUS Schlecht., 70; on Sanguisorba officinalis (S. microcephala), Sitka, 7, 21 (as X. minor); Kodiak Isl., W. H. Horne.

XENODOCHUS MINOR Arth. on Sanguisorba sitchensis (S. latifolia), Sitka, 3, 7, 70; Talkeetna Mts., 6, 7.

Xenodochus minor Arth. on Sanguisorba microcephala: See X. CARBONARIUS.

USTILAGINALES

CINTRACTIA ASPERA Liro on Carex chordorrhiza, 61.

CINTRACTIA CARICIS (Pers.) Magn. on Carex aquatilis, Circle, Nome, D. V. Baxter; Copper Center, C. L. Lefebvre; C. gmelini, 53; C. laevirostris, Nenana, D. V. Baxter; C. pachystachya (C. festiva), 53; C. rostrata, Fairbanks, D. V. Baxter; C. stygia (C. limosa stygia), 53.

CINTRACTIA CARICIS (Pers.) Magn. var. ACUTARUM Savile on the following species of Carex, 61; C. aquatilis, C. livida?, C. lyngbyei cryptocarpa, C. ramenskii.

CINTRACTIA CARICIS (Pers.) Magn. var. CARICIS Savile on Carex livida, 61.

CINTRACTIA CARICIS (Pers.) Magn. var. INTERMEDIA Savile on Carex gmelini and C. lyngbyei cryptocarpa, 61.

CINTRACTIA CARPOPHILA (Schum.) Liro on the following species of Carex, 61; C. brunnescens, C. canescens, C. disperma, C. gynocrates, C. loliacea, C. pauciflora, C. petricosa, C. rossii, C. tenuiflora x ? gynocrates.

CINTRACTIA CARPOPHILA (Schum.) Liro var. ELYNAE (Syd.) Savile on Carex lachenelii, 61.

CINTRACTIA CARPOPHILA (Schum.) Liro var. KENAICA Savile on Carex pyrenaica micropoda, Kenai Peninsula, 61.

CINTRACTIA CARPOPHILA (Schum.) Liro var. VERRUCOSA Savile on Carex macloviana pachystachya, Kenai Peninsula, 61.

CINTRACTIA FISCHERI (Karst.) Liro on Carex rostrata, 61.

CINTRACTIA LIMOSA Syd. var. GIGANTISSIMA (Lehtola) Savile on the following species of Carex, 61; C. limosa, C. lyngbyei cryptocarpa, C. paupercula, C. pluriflora.

CINTRACTIA LIMOSA Syd. var. LIMOSA Savile on the following species of Carex, 61: C. buxbaumii, C. lasiocarpa americana, C. paupercula.

CINTRACTIA LIMOSA Syd. var. MINOR Savile on Carex scirpoidea, 61.

CINTRACTIA SUBINCLUSA (Koerner) Magn. on Carex physocarpa, 61.

SPHACELOTHECA INFLORESCENTIAE (Trel.) Jaap. 43; on Polygonum viviparum (Bistorta vivipara), 53; Kodiak, Yakutat, 59; Unalaska, 35, 59.

Sphacelotheca ustilaginea (DC.) Ito: See S. INFLORESCENTIAE.

TILLETIA CARIES (DC.) Tul., 46; on Triticum (Changat wheat), Palmer, R. Thompson.

TILLETIA CEREBRINA Ell. & Ev. on Deschampsia caespitosa, Kodiak Isl., C. C. Georgeson.

TILLETIA FOETIDA (Wallr.) Liro on Triticum, 46; T. (Siberian wheat), Matanuska, C. L. Lefebvre.

TUBURCINIA TRIENTALIS Berk. & Br. on Trientalis europaea arctica (T. arctica), 53; T. sp., Kodiak, Unalaska, 59.

UROCYSTIS AGROPYRI (Preuss) Schroet. on Agropyron trachycaulum, Homer, C. L. Lefebvre; Poa sp., Mt. McKinley Nat. Park, C. L. L.

UROCYSTIS ALASKANA Zundel on Boykinia richardsoni, Nome.

UROCYSTIS ANEMONES (Pers.) Wint. on Anemone narcissiflora, Juneau, 21.

UROCYSTIS CARCINODES (Berk. & Curt.) Alek. Fisch. on Actaea arguta, Moose Pass, D. V. Baxter.

UROCYSTIS SOROSPORIOIDES Koern. on Anemone narcissiflora, 53; Juneau, J. P. Anderson.

UROCYSTIS VIOLAE (Sow.) Alek. Fisch. on Viola glabella, 53; Juneau, 21.

USTILAGO AVENAE (Pers.) Jens. on Avena sativa, 46; Sitka, 4; Fairbanks, D. V. Baxter.

USTILAGO BISTORTARUM (DC.) Koern. on Polygonum viviparum (Bistorta vivipara), 9; Skagway, 21; Port Wells, 59.

Ustilago bistortarum inflorescentiae Trel.: See SPHACELOTHECA INFLORESCENTIAE.

USTILAGO BULLATA Berk. on Hordeum jubatum, 53; Circle, D. M. Coe; Rampart, D. V. Baxter.

USTILAGO CALAMAGROSTIDIS (Fckl.) Clint. on Calamagrostis canadensis, Unalakleet, C. L. Lefebvre.

USTILAGO HORDEI (Pers.) Lagh. on Hordeum vulgare, 46; Palmer, A. Thompson; Matanuska, C. L. Lefebvre.

Ustilago inflorescentiae Maire: See SPHACELOTHECA INFLORESCENTIAE.

USTILAGO KOLLERI Wille on Avena sativa, 46; Palmer, D. M. Coe, P. Johnson; Fairbanks, Matanuska, C. L. Lefebvre.

Ustilago lorentziana Thuem.: See USTILAGO BULLATA.

USTILAGO STRIIFORMIS (West.) Niessl on Arctagrostis latifolia, Unalakleet, C. L. Lefebvre;

USTILAGO STRIIFORMIS (West.) Niessl on Arctagrostis latifolia, Unalakleet, C. L. Lefebvre; Calamagrostis canadensis, Homer, C. L. L.

USTILAGO TRITICI (Pers.) Rostr. on Triticum aestivum, Palmer, D. M. Coe; Matanuska, C. L. Lefebvre.

USTILAGO VINOSA (Berk.) Tul., 35, 43, 44; on Oxyria digyna, 53; Point Barrow, 59.

USTILAGO VIOLACEA (Pers.) Fckl. on Cerastium maximum, 53.

EXOBASIDIALES

EXOBASIDIUM COMOSUM Ell. & Ev. (ined.) on Vaccinium ovalifolium, Yes Bay, M. W. Gorman. Possibly E. vaccinii (Fckl.) Wor.

EXOBASIDIUM DENDROIDES Ell. & Ev. (ined.) on Cassiope tetragona, Yes Bay, M. W. Gorman. Possibly E. vaccinii (Fckl.) Wor.

Exobasidium discoideum Ell.: See E. VACCINII.

EXOBASIDIUM VACCINII (Fckl.) Wor. on Andromeda polifolia, Sitka, J. P. Anderson; Cassiope mertensiana, Sitka, 4; Kalmia polifolia (K. microphylla), Skagway, Sitka, J. P. Anderson; Ledum decumbens (L. palustre), Kodiak Isl., W. T. Horne; L. groenlandicum, Sitka, J. P. Anderson; Menziesia ferruginea, Sitka, 4; M. sp., Yes Bay, M. W. Gorman; Sitka, 20; Vaccinium caespitosum, Sitka, J. P. A.; V. ovalifolium, Orca, 59; Kodiak Isl., W. T. Horne; V. oxycoccus, Seldovia, 59; V. uliginosum, Sitka, Skagway, Juneau, J. P. A.; V. uliginosum mucronatum, Kodiak Isl., W. T. H.; V. vitis-idaea, W. T. H.; Wainwright, J. P. Stow.

AGARICALES

AGARICUS CAMPESTRIS Fr., Kodiak, 59.

AGARICUS MUTABILIS, 25. Possibly Pholiota mutabilis (Fr.) Quél. Dall (25, p. 123, 594) refers to the occurrence of several edible fungi (unnamed): "They were of two or three species, all poisonous in our climate; but in this extreme northern region they proved to be innocuous and eatable, though quite tasteless."

AGARICUS SILVATICUS Fr., Punik Isl., W. Geist.

ALEURODISCUS SUBCRUENTATUS (Berk. & Curt.) Burt, Kodiak, G. Silverwood.

ALEURODISCUS WEIRII Burt on Tsuga sp., Tunnel, 13.

AMANITA MUSCARIA (Fr.) S. F. Gray, Lake Iliamna, 12; Skagway, E. E. Morse.

AMANITOPSIS VAGINATA (Fr.) Quél. var. LIVIDA Pk., St. Lawrence Isl., W. Geist.

BOLETUS SCABER Fr., Skagway, G. Dortero.

CANTHARELLUS BRYOPHILUS Pk. nec Fr., Muir Glacier, 59.

CANTHARELLUS FLOCCOSUS Schw. f. FLOCCOSUS, Prince of Wales Isl , 23.

CANTHARELLUS MULTIPLEX Underw., Prince of Wales Isl., 23.

CLAVARIA SUECICA Fr., Yukon River, L. J. Palmer.

CLITOCYBE CYATHIFORMIS (Fr.) Kummer, St. Paul Isl., 48, 59.

CLITOCYBE DIATRETA (Fr.) Kummer, St. Paul Isl., 48, 59.

CLITOCYBE INFUNDIBULIFORMIS (Fr.) Quél., Wrangell, J. C. Scudder et al.

CLITOCYBE LACCATA (Fr.) Kummer, St. Paul Isl., 48, 59; Skagway, E. E. Morse: Wrangell, J. C. Scudder et al.

COLLYBIA CONFLUENS (Fr.) Kummer, Skagway, E. E. Morse.

COLLYBIA DRYOPHILA (Fr.) Kummer, Wrangell, Juneau, Sitka, Kodiak, 59; near Nome, C. W. Thornton.

COLLYBIA TUBEROSA (Fr.) Kummer on old agarics, Skagway, Mrs. G. Dortero.

COLLYBIA VELUTIPES (Fr.) Kummer var. SPONGIOSA Pk., Yakutat, 59.

COPRINUS PLICATILIS Fr., Hot Springs, Baranof Isl., 59.

CORTICIUM EVOLVENS Fr. on Betula sp., Tenana, 18.

Corticium incarnatum Fr.: See PENIOPHORA INCARNATA.

Corticium laeve Pers.: See C. EVOLVENS.

CORTICIUM RADIOSUM Fr., Ketchikan, 19.

CORTICIUM VAGUM Berk. & Curt. on Picea glauca, Eagle, 18.

CORTINARIUS sp., St. Paul Isl., 48, 59.

CYTIDIA FLOCCULENTA (Fr.) Hoehn. & Litsch. on Alnus fruticosa sinuata and Salix sp., Nenana, 18.

CYTIDIA SALICINA (Fr.) Burt on Salix alaxensis, Anaktuvuk Pass, G. A. Llano; Salix sp., Hope, D. V. Baxter.

DAEDALEA CONFRAGOSA Fr., Koyukuk, 12, 13, 14; Skagway, E. E. Morse; on Salix sp., Stillwater Crossing, 18.

DAEDALEA UNICOLOR Fr. on Betula resinifera (B. alaskana), Koyukuk, 18.

DICTYOLUS MUSCIGENUS (Fr.) Quél., 45.

DICTYOLUS RETIRUGUS (Fr.) Quél., 54.

ECCILIA CONCHINA (Fr.), Juneau, 59.

ECHINODONTIUM TINCTORIUM (Ell. & Ev.) Ell. & Ev., Russian River, 13; on Tsuga heterophylla, Moose Pass, 13; T. mertensiana, 12, 13; T. sp., Admiralty Isl., 29.

ENTOLOMA CLYPEATUM (Fr.) Kummer, Glacier Bay, 59.

FAVOLUS ALVEOLARIUS (Fr.) Quél. on Salix sp , Koyukuk, 12, 13, 14, 18.

Favolus canadensis Klotzsch: See F. ALVEOLARIUS.

FLAMMULA FULVELLA Pk., 48, 59.

FOMES ANNOSUS (Fr.) Cke., 11-XII, 12; Tongass Nat. Forest, 11-XXIII; on Picea sitchensis, 17; Tsuga heterophylla, Sitka, 11-XII, 17; Prince of Wales Isl., 23.

FOMES APPLANATUS (S. F. Gray) Gill., Koyukuk, 12, 13, 14; on Picea sitchensis, 30; Populus balsamifera (P. tacamahaca), Stillwater Crossing, 18; Valdez, 13; Ketchikan,

W. C. Weir.; Populus trichocarpa, Anchorage, J. W. Kimmey and M. E. Fowler; Thuja plicata, and Tsuga heterophylla, Prince of Wales Isl., 23; Tsuga sp., Kuiu Isl., 32.

FOMES FOMENTARIUS (Fr.) Kickx on Betula resinifera (B. alaskana), Tanana, 18; B. papyrifera occidentalis, Fairbanks, Kenai Peninsula, J. W. Kimmey and M. E. Fowler; B. sp., Koyukuk, 13; White Pass, 59.

FOMES IGNIARIUS (Fr.) Kickx, Koyukuk, 12; Tunnel, Russian River, Valdez, 13; Rampart, C. W. Gilmore; Unalakleet, L. J. Palmer; on Populus tremuloides, Moose Pass, 13; Kenai River Road (Mile 56), J. W. Kimmey and M. E. Fowler.

FOMES IGNIARIUS (Fr.) Kickx var. NIGRICANS (Fr.) Overh., Koyukuk, 12, 14; on Alnus fruticosa sinuata (A. sitchensis), Prince of Wales Isl., 23; Valdez, 11-XXIII; Betula resinifera (B. alaskana), Fairbanks, 18; Koyukuk, 13; Nogheling Trail, M. W. Gorman; B. kenaica, Moose Pass, 11-XI, 11-XVI, 11-XXIII; B. sp., St. Michael, Lake Iliamna, 59; Salix alaxensis, Koyukuk, 13, 18; S. sp., Valdez, 11-XXIII.

Fomes nigricans (Fr.) Gill.: See F. IGNIARIUS var. NIGRICANS.

FOMES NIGROLIMITATUS (Rom.) Egeland, 11-V; on Picea glauca (P. canadensis), Sitka, Cordova, W. C. Weir; P. sitchensis, Hollis (Prince of Wales Isl.), 30; Moose Pass, 13; P. sp., 17; Tsuga heterophylla, 11-XXIII; Wrangell, Tyee, 11-VIII, 11-XVI, 13, 17.

FOMES OFFICINALIS (Fr.) Neuman on Picea sitchensis, Hollis (Prince of Wales Isl.), 30.

FOMES PINI (Fr.) Karst., Russian River, 13; Koyukuk, 14; on Picea glauca, Koyukuk, 12, 13, 18; P. mariana, 12; P. sitchensis, 14; Moose Pass, Kodiak Isl., 13; Prince of Wales Isl., 23, 30; Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey.

FOMES PINI (Fr.) Karst var. ABIETIS (Karst.) Overh. on Picea spp., 12.

FOMES PINICOLA (Fr.) Cke., Tunnel, Russian River, Kodiak, 13; Orca, Sitka, 59; Koyukuk, Moose Pass, 13, 14; on Picea glauca, Koyukuk, Nenana, Fairbanks, 18; P. sitchensis, Chugach Nat. Forest, Tongass, 17; Prince of Wales Isl., 23, 30; Bear Lake Sale area (Chugach Nat. Forest) J. W. Kimmey; P. sp., Wrangell, J. C. Scudder et al; Tsuga heterophylla, 14; Prince of Wales Isl., 23; T. mertensiana, Chugach Nat. Forest, 12.

Fomes putearius Weir: See F. NIGROLIMITATUS.

Fomes robustus Karst.: See F. ROBUSTUS var. TSUGINUS.

FOMES ROBUSTUS Karst. var. TSUGINUS (Murr.) Overh., on Tsuga heterophylla, 11-XXIII, 11-V; Prince of Wales Isl., 23; T. mertensiana, Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey.

FOMES ROSEUS (Fr.) Cke. on Picea glauca, Circle, 18.

Fomes tinctorius Ell. & Ev.: See ECHINODOTHIUM TINCTORIUM.

GALERA SPHAGNORUM (Fr.) Karst., Kodiak, 59.

Ganoderma applanatum (S. F. Gray) Pat.: See FOMES APPLANATUS.

GANODERMA OREGONENSE Murr. on Tsuga heterophylla, Prince of Wales Isl., 23; Ketchikan, D. V. Baxter.

GLOEOCYSTIDIUM KARSTENII Bourd. & Galz. on Populus balsamifera, Nenana, 18.

Gymnopilus dryophilus (Fr.) Murr.: See COLLYBIA DRYOPHILA.

Gymnopilus fulvellus (Pk.) Murr.: See FLAMMULA FULVELLA.

HERICIUM LACINIATUM Banker on Populus trichocarpa, Anchorage, J. W. Kimmey and M. E. Fowler.

HYDNUM ABIETIS Weir (nom. nud.) on Tsuga heterophylla, Hollis (Prince of Wales Isl.), 30. Probably Hericium laciniatum Banker.

HYDNUM CORALLOIDES S. F. Gray, Prince of Wales Isl., 23.

Hydnum flagellum Banker: See HERICIUM LACINIATUM.

HYDNUM IMBRICATUM Fr., Prince of Wales Isl., 23.

HYDNUM SUAVEOLENS (Fr.) Quél., Prince of Wales Isl., 23.

HYGROPHORUS CANTHARELLUS Fr., Camden Bay, 26.

HYGROPHORUS CERACEUS Fr., Wrangell, J. C. Scudder et al.

HYGROPHORUS CONICUS Fr., St. Paul Isl., A. G. Whitney.

HYGROPHORUS LAETUS Fr., Wrangell, J. C. Scudder et al.

HYGROPHORUS LIMACINUS Fr., 59.

HYMENOCHAETE AGGLUTINANS Ell. on Salix sp., Tunnel, Valdez, 13.

HYMENOCHAETE TABACINA (Fr.) Lév., Tunnel, Russian River, Valdez, 13; Sitka, 19, 59; Prince of Wales Isl., 23; on Alnus fruticosa sinuata, Koyukuk, 18; Salix sp., Lower Russian Lake, D. V. Baxter.

HYPHOLMA VELUTINUM (Fr.) Kummer, St. Lawrence Isl., W. Geist.

LACTARIUS INSULSUS Fr., G. Dortero.

LACTARIUS RESINUS Fr., Skagway, E. E. Morse.

LENTINUS KAUFFMANII A. H. Sm. on Picea sitchensis, Hollis (Prince of Wales Isl.), 30.

LENZITES BETULINA Fr. on Betula resinifera (B. alaskana), Fairbanks, 18; B. papyrifera occidentalis, J. W. Kimmey and M. E. Fowler; B. sp., Skagway, E. E. Morse.

LENZITES SAEPIARIA Fr., Tunnel, Russian River, 13; Skagway, E. E. Morse; Wrangell, J. C. Scudder et al.; on Picea glauca, Koyukuk, Eagle, Nenana, 18; Moose Pass, 11-XXII; P. sitchensis, Prince of Wales Isl., 23; Anchorage, J. W. Kimmey and M. E. Fowler.

MARASMIUS ANDROSACEUS Fr., Virgin Bay, 59.

MARASMIUS COHAERENS (Fr.) Quél., Skagway, E. E. Morse.

MARASMIUS FILIPES Pk. on Tsuga sp., Orca, 59.

MARASMIUS PAPILLATUS Pk., Wrangell, J. C. Scudder et al.

MARASMIUS PERFORANS Fr. on Tsuga sp., Orca, 59.

MERULIUS CORIUM Fr. on Betula resinifera (B. alaskana), Tanana, 18.

MERULIUS FUGAX Fr. on Picea glauca, Tanana, 18.

MERULIUS NIVEUS Fr., Tunnel, Russian River, Valdez, 13; on Alnus sp., 13.

MYCENA ATROCYANEA (Fr.) Gill., Yakutat, Orca, Virgin Bay, 59.

MYCENA DEBILIS (Fr.) Quél., Sitka, 59.

MYCENA EPIPTERYGIA (Fr.) S. F. Gray, Wrangell, J. C. Scudder et al.

MYCENA STANNEA (Fr.) Quél., Baranof Isl., Orca, Yakutat, 59.

MYCOACIA MACRODON (Fr.) L. W. Miller & Boyle on Populus balsamifera, Koyukuk, 18.

NAUCORIA BADIPES (Fr.) Quél., Juneau, 59.

NAUCORIA CAMERINA (Fr.) Quél., Orca, 59.

NAUCORIA VERNALIS (Pk.) Sacc., Orca, 59.

NOLANEA JUNCEA (Fr.) Quél., Sitka, 59.

NOLANEA? sp., St. Paul Isl., 48 (as "Nalaviea"), 59.

ODONTIA CRISTULATA Fr. on Alnus fruticosa sinuata, Koyukuk, 18.

OMPHALIA CAMPANELLA (Fr.) Kummer, Sitka, 59.

OMPHALIA GRACILLIMA (Fr.) Kummer, Port Clarence, 59.

OMPHALIA MONTANA Pk., St. Paul Isl., 59.

OMPHALIA PSEUDO-ANDROSACEA (Fr.) Gill., Juneau, Sitka, 59.

OMPHALIA PYXIDATA (Fr.) Kummer var. HEPATICA (Fr.) Sacc. Pk. Trel., Yakutat Bay, 59.

OMPHALIA SEMIVESTIPES Pk., Orca, 59.

Omphalia sphagnophila Pk.: See O. UMBELLIFERA.

OMPHALIA UMBELLIFERA (Fr.) Kummer, 45, 54; Cape Fox, Juneau, Sitka, Orca, Virgin Bay, Port Wells, Port Clarence, Yakutat, Hall Isl., St. Lawrence Is., 59.

Oxydontia macrodon (Fr.) L. W. Miller: See MYCOACIA MACRODON.

PANAEOLUS SOLIDIPES (Pk.) Sacc., Skagway, E. E. Morse.

PAXILLUS INVOLUTUS Fr., Skagway, E. E. Morse.

PAXILLUS PANUOIDES Fr. on Picea sitchensis, Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey.

PELLICULARIA FILAMENTOSA (Pat.) Rogers on Solanum tuberosum, Palmer, D. M. Coe.

PENIOPHORA AFFINIS Burt on Alnus fruticosa sinuata, Tanana, 18.

PENIOPHORA AURANTIACA Bres., Tunnel, Russian River, Kodiak, Valdez, 13; Koyukuk, 12, 14; on Alnus fruticosa sinuata, Koyukuk, 18; A. sp., 13; Betula sp., Skagway, E. E. Morse.

PENIOPHORA BOREALIS (Pk.) Burt, Yakutat Bay, 19, 59.

PENIOPHORA CRASSA Burt on Chamaecyparis nootkatensis, Ketchikan; Picea glauca, Mt. McKinley Nat. Park; P. sitchensis, Seward; Tsuga heterophylla, Wrangell; T. sp., Ketchikan; all coll. D. V. Baxter.

Peniophora disciformis borealis Pk.: See P. BOREALIS.

PENIOPHORA GIGANTEA (Fr.) Mass. on Picea glauca, Tanana, 18.

PENIOPHORA INCARNATA (Fr.) Karst., Farragut Bay, 19, 59.

PENIOPHORA SETIGERA (Fr.) Bres. on Alnus fruticosa sinuata, Nenana, 18.

PENIOPHORA SHEARII Burt on Alnus fruticosa sinuata, Anchorage, J. W. Kimmey and M. E. Fowler.

PENIOPHORA TABACINA Burt on Picea glauca, Tanana, 18.

PHOLIOTA ADIPOSA (Fr.) Kummer, Valdez, 13; Koyukuk, 12, 14; on Salix sp., Koyukuk, 13, 18.

PHOLIOTA MARGINATA (Fr.) Quél., Muir Glacier, 59.

PHOLIOTA PRAECOX (Fr.) Quél. var. SYLVESTRIS Pk., Yakutat Bay, 59.

PHOLIOTA SQUARROSOIDES (Pk.) Sacc. on Betula papyrifera occidentalis, Fairbanks, J. W. Kimmey and M. E. Fowler.

PHOLIOTA UNICOLOR (Fr.) Gill., Yakutat Bay, 59.

PLEUROTUS CANDIDISSIMUS (Berk. & Curt.) Sacc., Valdez, 13.

PLEUROTUS OSTREATUS (Fr.) Kummer on Populus tremuloides, Skilak Lake (Kenai Peninsula), J. W. Kimmey and M. E. Fowler.

PLEUROTUS PETALOIDES (Fr.) Quél., Wrangell, J. C. Scudder et al.

PLUTEUS CERVINUS (Fr.) Kummer, Skagway, E. E. Morse.

POLYPORUS ABIETINUS Fr., Russian River, 13; Point Gustavus, 59; on Picea glauca, Healy, 11-XV, 11-XVIII, 17; Nenana, Purgatory, 18; P. sitchensis, Kodiak, 13; Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey; Matanuska, D. M. Coe; Tsuga heterophylla, Prince of Wales Isl., 23.

POLYPORUS ADUSTUS Fr., 11-XIX; Valdez, 13; Skagway, E. E. Morse; on Populus balsamifera, Koyukuk, 18.

POLYPORUS ALBELLUS Pk., Valdez, 13; on Alnus fruticosa sinuata, Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey; Betula resinifera (B. alaskana), Hot Springs, 18; B. papyrifera occidentalis, Anchorage, J. W. Kimmey and M. E. Fowler.

POLYPORUS ALBOLUTESCENS Rom., 11-XIV.

POLYPORUS ALBOLUTEUS Ell. & Ev., Russian River, Kodiak Isl., 13; on Picea glauca (P. canadensis), 11-IX; Lower Russian Lake, 11-XV, 17; P. sitchensis, Chugach Nat. Forest, Moose Pass, 13; Juneau, 11-IX, 11-XV, 11-XVI, 17; Hope, D. V. Baxter.

POLYPORUS ANCEPS Pk. on Picea glauca, 17; Hot Springs, 18.

Polyporus benzoinus Fr.: See P. RESINOSUS.

POLYPORUS BETULINUS Fr. on Betula resinifera (B. alaskana), Fairbanks, 18; B. papyrifera occidentalis, Skilak Lake (Kenai Peninsula), J. W. Kimmey and M. E. Fowler; B. sp., Matanuska, D. M. Coe.

POLYPORUS BIFORMIS Klotzsch, 11-XIX; Tunnel, 13.

POLYPORUS BOREALIS Fr. on Picea sitchensis, Hollis (Prince of Wales Isl.), 30.

POLYPORUS CAESIUS Fr., Valdez, 13; on Populus balsamifera, 11-XX; Koyukuk, 18.

POLYPORUS CINNABARINUS Fr., 11-XVII.

POLYPORUS CRISPUS Fr., Skagway, Mrs. G. Dortero.

POLYPORUS CUNEATUS (Murr.) Overh. on Thuja plicata, Prince of Wales Isl., 23.

POLYPORUS DICHROUS Fr., 11-XIV.

POLYPORUS ELEGANS Fr., Valdez, 13; Skagway, E. E. Morse; on Salix alaxensis, Anaktuvuk Pass, G. A. Llano; Sambucus pubens (S. racemosa), Prince of Wales Isl., 23.

POLYPORUS FIBRILLOSUS Karst. on Picea sitchensis, Prince of Wales Isl., 23.

POLYPORUS FRAGILIS Fr., Russian River, 13.

POLYPORUS HIRSUTUS Fr., Inlet Bay, E. E. Morse; on Betula papyrifera occidentalis, Fairbanks, J. W. Kimmey and M. E. Fowler.

POLYPORUS MELANOPUS Fr., Orca, 59.

POLYPORUS PARGAMENUS Fr., Valdez, 13; on Betula resinifera (B. alaskana), 18; B. papyrifera occidentalis, Fairbanks, J. W. Kimmey and M. E. Fowler; B. sp., Matanuska, D. M. Coe; Picea glauca, Skilak Lake (Kenai Peninsula), J. W. K. and M. E. F.

POLYPORUS PERENNIS Fr., Prince of Wales Isl., 23; Skagway, E. E. Morse et al.

POLYPORUS PICIPES Fr. on Picea sitchensis, Hollis (Prince of Wales Isl.), 30; on Tsuga heterophylla, Prince of Wales Isl., 23.

POLYPORUS PUBESCENS Fr., 11-XX; Kukak Bay, 59.

POLYPORUS RADIATUS Fr., Kukak Bay, 59; Moose Pass, 13; on Alnus fruticosa sinuata, Koyukuk, 13, 18; A. sp., Kodiak Isl., 13; Betula kenaica, Koyukuk, 18; Moose Pass, 11-XI, 11-XIV, 11-XVI.

Polyporus resinascens Rom.: See PORIA RESINASCENS.

POLYPORUS RESINOSUS Fr. on Betula resinifera (B. alaskana), Tanana, 18; Tsuga mertensiana, Anchorage, J. W. Kimmey and M. E. Fowler.

POLYPORUS SCHWEINITZII Fr., 12, 14, 16, 30; Russian River, 13; on Picea sitchensis, Prince of Wales Isl., 23, 30; Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey and M. E. Fowler.

POLYPORUS STEREOIDES Fr. on Alnus sp., Kodiak Isl., 13; Betula resinifera (B. alaskana), Koyukuk, 11-X, 18.

Polyporus suaveolens Fr.: See TRAMETES SUAVEOLENS.

POLYPORUS SULPHUREUS Fr., 14, 16; on Picea sitchensis, Kodiak Isl., 12, 13; Prince of Wales Isl., 23, 30; Populus deltoides, Skagway, E. E. Morse; Tsuga heterophylla, Prince of Wales Isl., 23.

POLYPORUS TULIPIFERUS (Schw.) Overh., 11-XX.

POLYPORUS VERSICOLOR Fr., near Tunnel, 13; on Betula papyrifera occidentalis, Shilak Lake (Kenai Peninsula), and Populus trichocarpa, Anchorage, both coll. J. W. Kimmey

and M. E. Fowler.

POLYPORUS ZONATUS Fr., Skagway, E. E. Morse et al.; on Populus tremuloides, Kenai River Road (Mile 56), J. W. Kimmey and M. E. Fowler.

Polystictus spp.: See POLYPORUS.

PORIA ALBOBRUNNEA (Rom.) Baxter on Tsuga heterophylla, Wrangell, 11-X.

PORIA ANEIRINA (Sommerf.) Cke. on Populus balsamifera, Russian River, 11-XV; Nenana, 18; Moose Pass, 11-XII.

PORIA AUREA Pk., 11-XIX.

PORIA BOMBYCINA (Fr.) Cke., 11-XVIII.

Poria callosa (Fr.) Cke.: See TRAMETES SERIALIS.

PORIA CINERASCENS Bres. on Picea glauca, Fairbanks, 18.

PORIA CORTICOLA (Fr.) Cke., Valdez, 13.

PORIA CRASSA (Karst.) Sacc., Farragut Bay, 59 ("sterile and doubtful"); on Tsuga mertensiana, Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey.

PORIA CRUSTULINA Bres., Koyukuk, 13; Mt. McKinley Nat. Park, Moose Pass, 11-VIII; on Picea glauca, 11-IX, 11-XIV, 13; Tanana, 11-VIII, 11-XV, 17, 18; Fairbanks, J. W. Kimmey and M. E. Fowler.

PORIA FERREA Bourd. & Galz., Koyukuk, 12, 14; Tunnel, Valdez, 13; on Alnus fruticosa sinuata, Skagway, 11-XVI, 11-XXIV; Koyukuk, 18; A. incana (A. tenuifolia), Skagway, 11-V; A. sp., Kodiak Isl., 13.

PORIA FERRUGINEO-FUSCA Karst., Russian River, 13; on Tsuga heterophylla, Skagway, 11-V, 11-XVI.

PORIA FERRUGINOSA (Fr.) Karst., 11-V; on Alnus fruticosa sinuata, Betula resinifera (B. alaskana), and Salix alaxensis, all Nenana, 18.

PORIA LENIS Karst. on Chamaecyparis nootakensis, Baranof Isl., 11-VII; Picea glauca, Mt. McKinley Nat. Park, 11-VII.

PORIA MOLLUSCA Cke., 11-X.

PORIA MYCELIOSA Pk., 11-X.

PORIA NIGRESCENS Bres., 11-IX.

PORIA PUNCTATA (Fr.) Karst. 11-XXIII; on Alnus fruticosa sinuata, Nenana, 18.

PORIA PURPUREA (Fr.) Cke. var. ROSEO-LILACINA Bres. on Picea glauca, Stillwater Crossing, 18.

PORIA RESINASCENS (Rom.) Lundell & Nannf., 11-XIV.

PORIA RETICULATA (Fr.) Cke. on Salix sp., 11-IX.

PORIA SITCHENSIS Baxter on Picea sitchensis, Sitka, 11-IX, 11-XV; Tenakee, 11-IX; Tongass and Chugach Nat. Forests, 17; Tsuga heterophylla, Wrangell, Sitka, 11-IX.

PORIA SUBACIDA (Pk.) Sacc. 11-VI; on Picea sitchensis, Hollis (Prince of Wales Isl.), 30;

Picea sp., 17; Tsuga heterophylla, 17.

Poria subfuscoflavida (Fr.) Rom.: See P. CINERASCENS Bres.

PORIA TAXIFOLIA (Pers.) Bres., 11-IX.

Poria tsugina (Murr.) Sacc. & Trott.: See FOMES ROBUSTUS var. TSUGINUS.

PORIA VAPORARIA (Fr.) Cke., 11-XII.

PORIA VERSIPORA (Pers.) Rom., 11-XI.

PORIA VIRIDANS (Berk. & Br.) Cke., 11-X.

PORIA VULGARIS (Fr.) Cke., 11-XIV.

PORIA WEIRII Murr. on Thuja plicata, 11-V; Prince of Wales Isl., 23; on wood products, Old Kasaan (Prince of Wales Isl.), 11-XXIV.

PORIA XANTHA (Fr.) Cke., 11-VII; Wiseman, 15; on Picea glauca, Fairbanks, 18; P. sp. (lumber), 12.

PORIA XANTHA (Fr.) Cke. f. CRASSA (Karst.) Sacc. on Picea glauca, Mt. McKinley Nat. Park, 11-VII, 11-XV; Skagway, 17; Fairbanks, 18; Koyukuk, 13; P. sp., Mt. McKinley Nat. Park, 17; Pinus contorta, Tongass Nat. Forest, 11-VII.

Psalliota silvatica (Secr.) Quél.: See AGARICUS SILVATICUS.

PSATHYRELLA ATOMARIA Fr., Sitka, 59. Possibly P. atomata (Fr.) Quél.

PSATHYRELLA DISSEMINATA (Fr.) Quél., Yakutat Bay, 59.

PSILOCYBE POLYTRICHI (Fr.) Gill., St. Paul Isl., 59.

RADULUM QUERCINUM Fr., Tunnel, Valdez, 13.

RUSSULA DELICA Fr., Skagway, E. E. Morse.

RUSSULA NIGRODISCA Pk., 54, 48, 59.

RUSSULA SANGUINEA Fr., Skagway, E. E. Morse.

SEBACINA CALCEA (Fr.) Bres. on Picea glauca, Nenana, 18.

SOLENIA ANOMALA (Fr.) Fckl. on Salix alaxensis, Anaktuvuk Pass, G. A. Llano.

STECCHERINUM OCHRACEUM (Fr.) S. F. Gray on Populus balsamifera, Valdez, 13; Nenana, 18; Salix sp., Tanana, Koyukuk, 18.

STEREUM ABIETINUM Fr., 17; on Picea glauca, Stillwater Crossing, 18; Lower Russian Lake, D. V. Baxter; Tsuga heterophylla, Lower Russian Lake, D. V. B.

STEREUM GAUSAPATUM Fr. on Alnus fruticosa sinuata, Anchorage, J. W. Kimmey and M. E. Fowler.

STEREUM HIRSUTUM (Fr.) S. F. Gray on Alnus sp., Tunnel, 13; Betula papyrifera occidentalis, Fairbanks, J. W. Kimmey and M. E. Fowler.

STEREUM PURPUREUM Fr., Russian River, Kodiak Isl., Valdez, 13; on Alnus fruticosa sinuata, Anchorage, J. W. Kimmey and M. E. Fowler; A. sp., Valdez, D. V. Baxter; Betula papyrifera occidentalis, Fairbanks, J. W. K. and M. E. F.; Populus balsamifera,

Stillwater Crossing, 18.

STEREUM RUGISPORUM (Ell. & Ev.) Burt on Coniferae, Prince of Wales Isl., 23.

STEREUM RUGOSUM Fr. on Alnus sp., Seward, D. V. Baxter.

STEREUM SANGUINOLENTUM Fr., Russian River, 13; on Picea glauca, Koyukuk, 17; P. sitchensis, Bear Lake sale area (Chugach Nat. Forest), J. W. Kimmey; P. sp., Juneau, D. V. Baxter.

STEREUM SULCATUM Burt on Picea glauca, Tanana, 18; Mt. McKinley Nat. Park, D. V. Baxter.

Stereum tabacinum Fr.: See HYMENOCHAETE TABACINA.

STROPHARIA MAGNIVELARIS Pk., Yakutat, 59.

STROPHARIA SEMIGLOBATA (Fr.) Quél., Wrangell, J. C. Scudder et al.

Thelephora laciniata Fr.: See T. TERRESTRIS.

THELEPHORA TERRESTRIS Fr., 59; Skagway, 19, 45; Valdez, 13.

TRAMETES ALASKANA Baxter on Picea glauca, Koyukuk, Moose Pass, 11-XIII; P. sitchensis, Cordova, Sitka, Seward, Ketchikan, Hope, Valdez, 11-XIII; Juneau, 11-XV; Kodiak Isl., Tongass Nat. Forest, 17; Tsuga heterophylla, Ketchikan, Wrangell, Cordova, Sitka, 11-XIII; Seward, 11-XV, 17; Juneau, 17; T. mertensiana, Admiralty Isl., 11-XIII.

TRAMETES HETEROMORPHA (Fr.) Bres., Valdez, 11-VII; Picea glauca, Tanana, 18; Mt. McKinley Nat. Park, Nenana, Sitka, Moose Pass, Lake Iliamna, 11-XIII; P. sitchensis, 11-IX; Juneau, 11-XV; Tongass Nat. Forest, 17; Seward, Hope, Sitka, Lawing, Kodiak Isl., Moose Pass, 11-XIII; Salix sp., Birch Lake, 11-XIII; Tsuga heterophylla, 11-XV; Wrangell, Sitka, Ketchikan, 11-XIII; T. mertensiana, 12; Hope, 11-XIII; 11-XV; Cordova, Ptarmigan Lake, 11-XIII; T. sp., Skagway, Seward, Lawing, 11-XIII.

TRAMETES HISPIDA Bagl., 11-XIV.

TRAMETES ISABELLINA Fr., 11-VIII.

TRAMETES MOLLIS (Sommerf.) Fr., 11-XXI.

TRAMETES ODORATA Fr., 11-XIV; Russian River, 13; on Picea glauca, Moose Pass, 13; Tanana, 18.

TRAMETES SERIALIS Fr., Koyukuk, Moose Pass, Juneau, 12; Wiseman, 15; N. of Cape Kruzenstern, 11-XIII; on Picea glauca, Tanana, Hot Springs, Ruby, Fairbanks, 11-XIII, 18; Koyukuk, 11-XIII, 13; Nenana, Moose Pass, Skagway, Beaver, Unalakleet, 11-XIII; P. sitchensis, 17, 30; Kodiak Isl., 11-XI, 17; Skagway, Moose Pass, Tunnel, Seward, 11-XIII; Prince of Wales Isl., 23, 30; Tsuga heterophylla, 11-XIII, 11-XV, 17; T. mertensiana, Fairbanks, 11-XIII; on totem poles, 11-XXIV.

TRAMETES SUAVEOLENS Fr., Koyukuk, 12, 14; on Salix alaxensis, Koyukuk, 13, 18.

TRAMETES TROGII Berk., 11-XI.

TRAMETES VARIIFORMIS Pk., 11-VII; Koyukuk, Russian River, Moose Pass, 13; on Picea glauca, Koyukuk, 13, 18; Mt. McKinley Nat. Park, Sheep Creek, Sitka, Fairbanks, Noatak River, 11-XIII; Picea sitchensis, Moose Pass, Seward, near Tanana, Hope, 11-XIII; Picea sp., Tanana, Stillwater Crossing 11-XIII; Mt. McKinley Nat. Park, 11-XV, 18; Wiseman, 15; on Pinus contorta, Skagway, 11-XIII; Populus trichocarpa, Anchorage, J. W. Kimmey and M. E. Fowler; Tsuga heterophylla, Wrangell, 11-XIII.

TRICHOLOMA IONIDES (Fr.) Kummer, south of Point Barrow, W. Geist.

TRICHOLOMA MELALEUCUM (Fr.) Kummer, Orca, 59.

TRICHOLOMA NUDUM (Fr.) Kummer, Skagway, E. E. Morse.

TROGIA CRISPA Fr. on Betula papyrifera occidentalis, J. W. Kimmey and M. E. Fowler.

TUBARIA BREVIPES Pk., 55; Port Clarence, 59.

LYCOPERDALES

CALVATIA CRETACEA (Berk.) Lloyd, 45; Gooper Gulch, Nome, C. W. Thornton; Cape Lisburne, H. L. Mason; Wainwright, Umiat, Anaktuvuk Pass, G. A. Llano.

CALVATIA CYATHIFORMIS (Bosc) Morg., Skagway, E. E. Morse.

CALVATIA SACCATA var. ELATA (Mass.) Hollós, Virgin Bay, 59.

CRUCIBULUM LEVIS (DC.) Kambly, Prince of Wales Isl., 23.

Lycoperdon furfuraceum de T.: See L. POLYMORPHUM.

LYCOPERDON FUSCUM Bon., Kodiak Isl., W. T. Horne.

Lycoperdon gemmatum Fr.: See L. PERLATUM.

LYCOPERDON PERLATUM Pers., Anchorage, G. A. Llano; Skagway, E. E. Morse.

LYCOPERDON POLYMORPHUM Vitt., Wainwright, G. A. Llano.

LYCOPERDON PYRIFORME Pers., Cape Fox, 59; Skagway, E. E. Morse; Kodiak Isl., W. T. Horne.

Lycoperdon saccatum Vahl: See CALVATIA SACCATA var. ELATA.

NIDULARIALES

NIDULA CANDIDA (Pk.) White, Farragut Bay, Sitka, Orca, Yakutat, 59; Ketchikan, Y. Mexia; Wrangell, E. K. Cash.

NIDULA MICROCARPA Pk., Kodiak Isl., G. A. Silverwood.

PHYLLOSTICTALES

ASCOCHYTA AQUILEGIAE (Rab.) Hoehn. on Aquilegia sp., Wrangell, Cordova, 22.

ASCOCHYTA CHEIRANTHI Bres. on Cheiranthus cheiri, Sitka, J. P. Anderson.

ASCOCHYTA COLORATA Pk. on Fragaria sp., Sitka, 4.

ASCOCHYTA COMPOSITARUM J. J. Davis var. PARVA J. J. Davis on Compositae, Wrangell, 22.

ASCOCHYTA GRAMINICOLA Sacc. on Hordeum brachyantherum (H. nodosum), Funter; Poa pratensis, Homer, C. L. Lefebvre.

ASCOCHYTA HYDRANGEAE Arn. on Hydrangea sp. cult., Cordova, 22.

ASCOCHYTA IMPERFECTA Pk. on Medicago falcata, Fairbanks, C. L. Lefebvre; Matanuska, H. J. Hodgson; M. sativa, Fairbanks, C. L. L.; M. sativa x falcata, Matanuska, C. L. L.

ASCOCHYTA LYCOPERSICI Brun. on Solanum tuberosum, Wrangell, 22.

ASCOCHYTA PISI Lib. on Pisum sativum, Sitka, 1, 2, 4; near Wasilla, D. M. Coe.

ASCOCHYTA SAMBUCI Sacc. on Sambucus nigra aurea, Sitka, 4.

ASCOCHYTA SODALIS Grove on Carex sp., Homer, C. L. Lefebvre.

ASCOCHYTA SORGHI Sacc. on Agropyron latiglume, Richardson Highway (Mile 245) and A. spicatum, south of Circle (Mile 15), C. L. Lefebvre.

ASCOCHYTA TARAXACI Grove on Taraxacum, Ketchikan, Seward, 22.

ASCOCHYTA VIOLICOLA McAlp. on Viola sp. cult., Wrangell, 22.

ASCOCHYTA sp. on Arenaria (Ammodenia) peploides major, Sitka, 4.

ASTEROMA RIBICOLA Ell. & Ev. on Ribes sp., Fairbanks, C. L. Lefebvre.

CLYPEOPYCNIS AERUGINASCENS Petr. on Ribes bracteosum, Sitka, 21.

CONIOTHYRIUM FULIGINEUM (Karst.) Sacc. on Salix ovalifolium, Martin Point, 44.

CONIOTHYRIUM FUSCIDULUM Sacc. on Sambucus callicarpa, Sitka, J. P. Anderson.

CONIOTHYRIUM OLIVACEUM Bon. on Rubus strigosus, Sitka, 4; Sambucus pubens, 4.

CONIOTHYRIUM sp. on Prunus (hybrids), Sitka, 4.

Cytospora chrysosperma Pers. ex Fr.: See VALSA SORDIDA.

Cytospora corni West.: See VALSA FALLAX.

Cytospora leucostoma Sacc.: See VALSA LEUCOSTOMA.

Cytospora salicis (Cda.) Rab.: See VALSA SALICINA.

CYTOSPORA sp. on Alnus fruticosa sinuata (A. sitchensis), Sitka, 4.

CYTOSPORA sp. on Prunus domestica, Sitka, 4.

CYTOSPORINA LUDIBUNDA Sacc. on Prunus cerasus, Sitka, 4.

DARLUCA FILUM (Biv.-Bern.) Cast. on rust on Arctagrostis latifolia, Mt. McKinley Nat. Park, C. L. Lefebvre.

DIPLODIA DEFLECTENS Karst. on Lonicera tatarica, Sitka, 4.

DIPLODINA LYNGEI Lind on Potentilla biflora, Port Clarence, 44.

DIPLODINA ROSTRUPII Vest. on Phyllodoce glanduliflora, Skagway, 21.

DISCOSIA ACUTA Dearn. on Ranunculus nivalis, Collinson Point, 26.

DOTHIORELLA INVERSA (Fr.) Hoehn. on Alnus fruticosa sinuata, Juneau, D. V. Baxter.

DOTHIORELLA LATITANS (Fr.) Sacc. on Vaccinium vitis-idaea, Sitka, 4, 21; Ketchikan, 21.

DOTHIORELLA PYRENOPHORA (Karst.) Sacc. on Sorbus sp., Fairbanks, C. L. Lefebvre.

DOTHIORELLA PYRENOPHORA (Karst.) Sacc. var. SALICIS Karst. on Salix sp., Sitka, J. P.

Anderson.

HENDERSONIA CRASTOPHILA Sacc. on Calamagrostis canadensis var. scabra, Seward, 65, 68.

HENDERSONIA CULMICOLA var. MINOR Sacc. on Calamagrostis canadensis, Seward, Wasilla, C. L. Lefebvre.

LEPTOSTROMA HERBARUM (Fr.) Lk. on Heuchera glabra, Juneau, 21; Polemonium caeruleum villosum, Longanevik, 26.

LEPTOTHYRIUM ALNEUM (Lév.) Sacc. on Alnus fruticosa sinuata (A. sitchensis), 4.

LEPTOTHYRIUM CLYPEOSPHAERIOIDES Sacc. on Rubus chamaemorus, Unalaska, 59.

LEPTOTHYRIUM CONSPICUUM Dearn. & House on Vaccinium ovalifolium and V. parvifolium, Juneau, 21.

LEPTOTHYRIUM JUNCINUM Cke. & Harkn. on Juncus drummondii, Talkeetna Mts., J. P. Anderson.

LEPTOTHYRIUM PULCHRUM Dearn. on Salix pulchra, Collinson Point, 29.

LEPTOTHYRIUM VULGARE (Fr.) Sacc. on Rubus stellatus, Yakutat Bay, 59.

LEPTOTHYRIUM VULGARE f. PARRYAE Sacc. on Parrya nudicaulis (P. macrocarpa), Shumagin Isl., 59.

Mastomyces proboscidea (Fr.) Sacc.: See SCLERODERRIS FULIGINOSA.

MELASMIA MENZIESIAE Dearn. & Barth. on Menziesia ferruginea, Juneau, Ketchikan, 21; Wrangell, 22; Bartlett Glacier, D. V. Baxter; M. sp., Wrangell, Cordova, Ketchikan, 22; Prince of Wales Isl., 23; Tunnel, 13.

PHLEOSPORA ACERIS (Lib.) Sacc. on Acer douglasii, Klukwan, Skagway, Tenakee, 21.

Phoma acuta Fckl.: See LEPTOSPHAERIA ACUTA.

PHOMA COMMUNIS Rob. on Tilia americana, Sitka, 21.

PHOMA COMPLANATA Desm., 42; on Heracleum sp., St. Paul Isl., 59.

PHOMA GRAMINIS West. on Poa arctica, Preobaschenie Isl., 44.

PHOMA MAJANTHEMI Pk. on Maianthemum dilatatum (Unifolium eschscholtzianum), Sitka, 4.

PHOMA OLERACEA Sacc. on Cardamine bellidifolia, St. Paul Is., 59.

PHOMA SALICINA West. on Salix sp., Sitka, J. P. Anderson.

PHOMA sp. on Festuca elatior and F. rubra, 68.

PHOMA sp. on Salix sp., Sitka, 4.

PHOMOPSIS (?PADINA Sacc.) on Prunus cerasus, Sitka, 4.

PHOMOPSIS sp. on Malus (Pyrus) baccata, Sitka, 4.

PHYLLOSTICTA ALCIDES Sacc. on Populus sp., Seward, 22.

PHYLLOSTICTA ALNEA Oud. on Alnus sp., Valdez, 22.

PHYLLOSTICTA BALDENSIS Mass. on Paeonia sp., Wrangell, 22.

PHYLLOSTICTA CARICICOLA Sacc. & Scalia on Carex sp., 52; Orca, 59.

PHYLLOSTICTA DIGITALIS Bell on Digitalis purpurea, 52; Sitka, 4.

PHYLLOSTICTA EXCAVATA Sacc. on Heuchera glabra, Juneau, 21.

PHYLLOSTICTA GALLORUM Thuem. on Caragana arborescens, Sitka, 4.

PHYLLOSTICTA GARRETTII Syd. on Senecio triangularis, Juneau, 21.

PHYLLOSTICTA HELLEBORICOLA COPTIDIS Sacc. & Scalia on Coptis trifoliata, Unalaska, 59.

PHYLLOSTICTA HERACLEI Ell. & Dearn. on Heracleum sp., Cordova, 22.

PHYLLOSTICTA INTERMIXTA Seaver on Populus sp., Matanuska, D. M. Coe.

PHYLLOSTICTA JAPONICA Thuem. on Berberis thunbergii, Juneau, 21.

PHYLLOSTICTA MELANOPLACA Thuem. on Veratrum? sp., Ketchikan, 22.

PHYLLOSTICTA OSTEOSPORA Sacc. on Populus trichocarpa, Skagway, 21.

PHYLLOSTICTA PLANTAGINIS Sacc. on Plantago macrocarpa, Sitka, 4.

PHYLLOSTICTA RIBESCIDA Speg. on Ribes sp. (wild currant), Wrangell, 22.

PHYLLOSTICTA sp. on Maianthemum dilatatum (Unifolium eschscholtzianum), Ketchikan, 21.

PHYLLOSTICTA sp. on Solanum tuberosum, Sitka, 4.

RHABDOSPORA CAMPTOSPORA Sacc. & Scalia on Anemone narcissiflora, Yes Bay, 59.

RHABDOSPORA INAEQUALIS Sacc. on Sorbus sitchensis, Sitka, 4.

RHABDOSPORA INTERRUPTA (Berk. & Curt.) Sacc. on Viburnum opulus, Sitka, 4.

RHABDOSPORA PASTINACINA (Sacc.) Allesch. on Heracleum sp., Cordova, 22.

RHABDOSPORA RUBI Ell. on Rubus strigosus, Sitka, 4.

RHYNCHOPHOMA RADULOIDES Sacc. & Scalia on Ribes bracteosum, Juneau, 21; R. laxiflorum, Sitka, 59.

SELENOPHOMA BROMIGENA (Sacc.) Sprague & A. G. Johnson on Bromus inermis, Fairbanks and College, C. L. Lefebvre.

SELENOPHOMA DONACIS (Pass.) Sprague & A. G. Johnson var. STOMATICOLA (Baeumler) Sprague & A. G. Johnson on Agropyron trachycaulum, Homer, C. L. Lefebvre; Phleum pratense, 68; Ketchikan, 69; Gramineae undet., Mt. McKinley Nat. Park, C. L. L.

SEPTORIA ALNIFOLIA Ell. & Ev. on Alnus fruticosa sinuata (A. sitchensis), Sitka, 4.

SEPTORIA AMMODENIAE Dearn. on Ammodenia (Halianthus) peploides, Martin Point, 26.

SEPTORIA ARCTICA Berk. & Curt. on Calamagrostis nutkaensis, 67, 68.

SEPTORIA CALAMAGROSTIDIS (Lib.) Sacc. on Agrostis exarata, 67, 68.

SEPTORIA CANADENSIS Pk. on Cornus canadensis, Sitka, 4, 59; Ketchikan, 22; Yakutat Bay, Virgin Bay, 59.

SEPTORIA CHAMISSONIS Sacc. & Scalia on Eriophorum chamissonis, Point Barrow, 59.

SEPTORIA COPTIDIS Berk. & Curt. on Coptis asplenifolia, Sitka, 4.

SEPTORIA CULMIFIDA Karst. on Phleum pratense, Ketchikan, 21.

SEPTORIA DEARNESSII Ell. & Ev. on Angelica? sp., Virgin Bay, Yakutat, 59.

SEPTORIA DRUMMONDII Ell. & Ev. on Phlox drummondii, Sitka, 4.

SEPTORIA EPILOBII West. on Epilobium sp., Ketchikan, 22.

Septoria eriophorella Sacc. & Scalia: See STAGONOSPORA ERIOPHORELLA.

SEPTORIA ERIOPHORI Oud. on Eriophorum vaginatum, Camden Bay, 44.

SEPTORIA GEI Rob. & Desm. on Geum sp., Petersburg, 22.

SEPTORIA GRAMINEUM Desm. on Agrostis exarata, Sitka, 4 (probably S. calamagrostidis (Lib.) Sacc. sec. Sprague (66); Calamagrostis sp., Sitka, 4 (see note by Sprague (66): "Suggests S. arctica Berk. & Curt.").

SEPTORIA GRYLLI Sacc. on Agrostis exarata, 59; A. geminata, Yes Bay, 59. Probably S. calamagrostidis sec. Sprague (66).

SEPTORIA HYALINA Ell. & Ev. on Viola palustris, Sitka, 4.

SEPTORIA NEMATOSPORA J. J. Davis on Carex macrocephala, Kenai, C. L. Lefebvre.

SEPTORIA ORCHIDEARUM West. on Tofieldia palustris, Port Clarence, 44.

SEPTORIA PETROSELINI ssp. TRELEASIANA Sacc. & Scalia on Conioselinum benthami, Kenai, C. L. Lefebvre; C. sp. Virgin Bay, 59.

SEPTORIA POLYGONINA Thuem. on Polygonum sp., Seward, 22.

SEPTORIA RIBIS Desm. on Ribes bracteosum, Sitka, 21; R. grossularia, Sitka, 4, 21; R. laxiflorum, Skagway, 21; R. nigrum, Ketchikan, Sitka, 21; R. rubrum (R. vulgare), 21; R. sp., Sitka, 2.

SEPTORIA RUBI West. on Rubus spectabilis, Sitka, 1, 4, 21; Ketchikan, 21; R. sp., Cape Fox, 59; Wrangell, Cordova, Ketchikan, 21.

SEPTORIA SALICICOLA (Fr.) Sacc. on Salix (?barclayi), Skagway, 21.

SEPTORIA SAMBUCINA Pk. on Sambucus sp., Cordova, Wrangell, 22.

SEPTORIA URTICAE Desm. & Rob. on Urtica sp., Wrangell, 22.

SPHAEROGRAPHIUM ABDITUM Sacc. & Scalia on Heracleum, Kodiak, 59.

SPORONEMA OXYCOCCI Shear on Vaccinium oxycoccus, Sitka, 21.

SPORONEMA STROBILINUM Desm. on Picea sitchensis, Orca, 59; Tsuga mertensiana, Orca, 59.

STAGONOSPORA AQUATICA LUZULICOLA Sacc. & Scalia on Luzula arcuata, Point Barrow, 59.

STAGONOSPORA ARENARIA Sacc. on Elymus junceus, Matanuska, C. L. Lefebvre; E. mollis, 68; Seward, 64.

STAGONOSPORA BROMI A. L. Sm. & Ramsb. on Bromus pampellianus, College, C. L. Lefebvre.

STAGONOSPORA ERIOPHORELLA (Sacc. & Scalia) Lind, 43; on Eriophorum chamissonis, Point Barrow, 59.

STAGONOSPORA GRAMINUM Sacc. & Scalia on Deschampsia (Aira) atropurpurea, 68. Iliuliuk, 59.

STAGONOSPORA HELEOCHARIDIS CARICINA Sacc. & Scalia on Carex pachystachya (C. festiva), Yakutat Bay, 59.

STAGONOSPORA MELILOTI (Lasch) Petr. on Trifolium repens, Fairbanks, Kenai, C. L. Lefebvre.

STAGONOSPORA PULSATILLAE Vest. on Anemone sp., Kodiak, Kukak Bay, 59

STAGONOSPORA STRICTAE Ell. & Ev. on Carex brunnescens, Livengood Road north of Fairbanks, C. L. Lefebvre.

STICTOCHORELLA LUPINI Syd. on Lupinus sp., Wrangell, 22; Kenai, C. L. Lefebvre.

MELANCONIALES

Actinonema rosae (Lib.) Fr.: See DIPLOCARPON ROSAE

COLLETOTRICHUM GRAMINICOLA (Ces.) G. W. Wils. on Calamagrostis canadensis, Tatalina, North of Fairbanks, C. L. Lefebvre; C. purpurascens, Mt. McKinley Nat. Park, C. L. L.

COLLETOTRICHUM KENTIAE Halst. on Kentia sp. (greenhouse), Juneau, 21.

COLLETOTRICHUM LINDEMUTHIANUM (Sacc. & Magn.) Briosi & Cav. on Phaseolus vulgaris, Sitka, 2, 4.

COLLETOTRICHUM LINEOLA Cda. on Gramineae, Port Benny, 22.

CORYNEUM FOLIICOLA Fckl. on Malus sylvestris, Sitka, 4; Rosa sp., Ketchikan, 21.

CORYNEUM LONGISTIPATUM Berl. on Amelanchier sp., Sitka, 4; Malus sylvestris, Sitka, 4.

CORYNEUM SALICINUM (Cda.) Sacc. on Salix sp., Sitka, J. P. Anderson.

CORYNEUM sp. on Ribes alpinum and R. triste, Sitka, 4.

Entomosporium maculatum Lév.: See FABRAEA MACULATA.

GLOEOSPORIUM ALNI Ell. & Ev. on Alnus sp., Port Benny, 22.

HYALOCERAS KRIEGERIANUM (Bres.) Diet. on Epilobium sp., Wrangell, 22.

Marsonia potentillae (Desm.) Fisch.: See MARSSONINA POTENTILLAE.

MARSSONINA BRACTEOSUM Dearn. & Barth. on Ribes bracteosum, Juneau, 21.

MARSSONINA PANATTONIANA (Berl.) Magn. on Lactuca sativa, Palmer, D. M. Coe.

MARSSONINA POTENTILLAE (Desm.) Magn. on Fragaria (cult. hybrids), Ketchikan, 21; Cordova, 22.

MELANCONIUM APIOCARPON Lk. on Alnus fruticosa sinuata (A. sitchensis), Sitka, 4.

Melanconium betulinum Fr.: See MELANCONIS STILBOSTOMA.

MONOCHAETIA MONOCHAETA Desm. f. LIBERTIANA on Rubus (Cuthbert raspberry), 21.

MONOCHAETIA TAPHRINICOLA (Ell. & Ev.) Sacc. on Quercus sp., Sitka, 21.

MYXOSPORIUM VALSOIDEUM (Sacc.) Allesch. on Quercus sp., 21.

PESTALOTIA COMPTA Sacc. on Rosa sp., Kodiak Isl., W. T. Horne.

PESTALOTIA LIGNICOLA Cke. on Salix purpurea, Sitka, 4.

PESTALOTIA TRUNCATA Lév. on Salix purpurea, Sitka, 4.

PESTALOTIA TRUNCATA Lév. var. RUBI Karst. on Rubus strigosus, Sitka, 4.

SEPTOGLOEUM LUPINI Ell. & Ev. on Lupinus sp. cult., Wrangell, 22.

SEPTOGLOEUM OXYSPORUM Sacc. Bomm. & Rouss. on Calamagrostis canadensis, Mt. McKinley Nat. Park, Unalakleet, C. L. Lefebvre; Poa eminens, Unalakleet, C. L. L.

SEPTOGLOEUM SALICINUM (Pk.) Sacc. on Salix sitchensis, Haines, 21.

MONILIALES

ALTERNARIA BRASSICAE (Berk.) Sacc. on Brassica oleracea, Sitka, 4.

ALTERNARIA DIANTHI F. L. Stevens & J. G. Hall on Lychnis chalcedonica, Sitka, 21.

ALTERNARIA TENUIS Auct. on Callistephus sp., 21.

ASPERGILLUS sp. on Rubus strigosus, Sitka, 4.

BOSTRICHONEMA ALPESTRE Ces., 43; on Polygonum viviparum, Glacier Bay, Yakutat, 59.

BOTRYTIS CINEREA Fr., Sitka, 1; on the following host plants, all reports except where otherwise noted, being from Sitka, 4: Amelanchier alnifolia, Haines, 21; Apium graveolens, ; Asparagus (Myrsiphyllum) asparageoides; Brassica oleracea; Calendula officinalis; Callistephus hortensis; Cheiranthus cheiri; Conioselinum benthami (Coelopleurum gmelini); Coreopsis sp.; Dianthus caryophyllus, D. hedwigii; Dimorphotheca aurantiaca, Eschscholtzia californica, Euphorbia pulcherrima, Fragaria sp., Heliotropium peruvianum, Iberis umbellata, Lactuca sativa, Lathyrus odoratus, Linaria cymballaria, Lobelia erinus, Lonicera involucrata, Cape Fox, Yakutat Bay, 59; L. tatarica, Sitka, 21; Lycopersicon cerasiforme; L. esculentum; Matthiola incana annua; Mimulus luteus; Nicotiana tabacum; Papaver sp., Sitka, 4; Seward, 22; Petroselinum crispum (Apium petroselinum), Phaseolus sp., Skagway, 21; Prunus sp., Rheum officinale, Juneau, 21; Rhinanthus sp., Sitka, 21; Ribes americanum (R. floridum), Sitka, 2; Ribes aureum, Sitka, 2, 4; Ribes nigrum, Sitka, 2, 4; Ribes rubrum, Sitka, 2; Ribes sanguineum, Sitka, 2; Ribes triste; Ribes vulgare, Sitka, 4, 21; Rosa spp.; Rubus idaeus; R. parviflorus, Sitka, 4; Haines, 21; Rubus spectabilis, Sitka, Juneau, 21; Rubus strigosus (R. subarcticus); Sitka, Haines, 21; Saxifraga ?rivularis, Chatham, 21; Solanum tuberosum; Tagetes erecta; Thymus officinalis; Tropaeolum majus; Vaccinium alaskense, Haines, 21; Vicia faba; Viola tricolor; Zinnia elegans. Reported by Anderson (5) also on the following genera: Abutilon, Agave, Amorphophallus, Antirrhinum, Artemisia, Athyrium, Begonia, Bellis, Calceolaria, Campanula, Chrysanthemum, Citrus, Coleus, Cucumis, Cuphea, Cyrtomium, Dahlia, Erigeron, Fuchsia, Geranium, Gladiolus, Godetia, Grevillea, Hibiscus, Hippeastrum, Hosta (Funkia), Hydrangea, Lantana, Ligularia (Farfugium), Lunularia, Lychnis, Melissa, Nepeta, Nephrolepis, Oenothera, Oplopanax (Echinopanax), Oxalis, Pelargonium, Phlox, Pisum, Poa, Potentilla, Primula, Sambucus, Senecio (Cineraria), Tradescantia, Tulipa, Zantedeschia (Calla), and Zebrina.

Botrytis vulgaris Fr.: See BOTRYTIS CINEREA

CENTROSPORA ACERINA (Hartig) Newhall on Viola sp. cult., Wrangell, 22.

CERCOSPORA APII ANGELICAE Sacc. & Scalia on Angelica? sp., St. Paul Isl., 59.

Cercospora apii selini-gmelini Sacc. & Scalia: See C. SELINI-GMELINI.

CERCOSPORA GALII Ell. & Holw. on Galium triflorum, Klukwan, 21.

Cercospora macrospora Osterw.: See CENTROSPORA ACERINA.

CERCOSPORA SELINI-GMELINI (Sacc. & Scalia) Chupp on Conioselinum benthami (Selinum gmelini), Yakutat Bay, 59.

CERCOSPORA SYMPHORICARPI Ell. & Ev. on Symphoricarpos albus (S. racemosus), Klukwan, 21.

CERCOSPORA VARIA Pk. on Viburnum sp., Cordova, 22.

CERCOSPORA sp., on Castilleja pallida, Sitka, 4.

CERCOSPORELLA ALBOMACULANS (Ell. & Ev.) Sacc. on Brassica oleracea, Homer, C. L. Lefebvre.

CERCOSPORELLA ALNI Dearn. & Barth. on Alnus fruticosa sinuata (A. sitchensis), Ketchikan, 21.

CLADOSPORIUM CARPOPHILUM Thuem. on Prunus padus, Sitka, 4.

Cladosporium heliotropii Eriks. on Heliotropium peruvianum, Sitka, 4.

CLADOSPORIUM HERBARUM (Fr.) Lk. on Calamagrostis canadensis, Circle, Hot Springs, Tatalina, C. L. Lefebvre; Pisum sativum, Wrangell, 22; Salix sp., Sadlerochit River, 26; Triticum aestivum, Homer, C. L. L.

CLADOSPORIUM PAEONIAE Pass. on Paeonia sp. cult., Sitka, 4. Report (20) from Wrangell based on misdetermination.

CLADOSPORIUM SUBSESSILE Ell. & Barth. on Populus sp., Matanuska, D. M. Coe.

CLADOSPORIUM. Undetermined species reported by Anderson (4) from Sitka on Gaillardia sp., Prunus mahaleb, Ribes hudsonianum, and Viburnum edule (V. pauciflorum).

CONIOSPORIUM ATRATUM Karst. & Malbr., Yakutat, 59.

CYLINDROSPORIUM ALNI Dearn. on Alnus oregona, Ketchikan, 21.

CYLINDROSPORIUM SHEPHERDIAE Sacc. on Shepherdia (Lepargyrea) canadensis, Haines, 21.

DIDYMARIA DIDYMA (Ung.) Sacc. on Ranunculus macounii, Haines, 21.

EPICOCCUM NEGLECTUM Desm. on Avena sativa, Fairbanks, C. L. Lefebvre.

EPICOCCUM PURPURASCENS Lk. on Lupinus sp. cult., Wrangell, 22.

FUSARIUM GRAMINEARUM Schwabe on Triticum aestivum, 68.

FUSARIUM ILLOSPORIOIDES Sacc. on Ribes sp., Sitka, 59.

FUSARIUM OXYSPORUM Schlecht. on Solanum tuberosum, Sitka, 2, 4.

FUSICLADIUM DEPRESSUM (Berk. & Br.) Sacc. on Angelica genuflexa, Sitka, Haines, 21; A. sp., Cordova, 22.

GLOMERULARIA CORNI Pk. on Cornus canadensis, Orca, 59.

HADROTRICHUM LINEARIS Pk. on Calamagrostis canadensis var. scabra (C. langsdorfi), Sitka, 4.

HAPLOBASIDIUM PAVONINUM Hoehn. on Aquilegia sp., Sitka, 4.

HELMINTHOSPORIUM AVENAE Eidam on Avena sativa, 68; Sitka, 4.

Helminthosporium avenae-sativae (Briosi & Cav.) Lindau: See H. AVENAE.

HELMINTHOSPORIUM ERYTHROSPILUM Drechs. on Agrostis, Ketchikan, C. L. Lefebvre.

HELMINTHOSPORIUM GRAMINEUM Rab. on Hordeum vulgare, Fairbanks, Matanuska, Wasilla, etc., D. M. Coe.

HELMINTHOSPORIUM TRITICI-REPENTIS Died. on Elymus innovatus, Mt. McKinley Nat. Park, C. L. Lefebvre.

HELMINTHOSPORIUM VAGANS Drechs. on Poa pratensis, Homer, Kenai, Curry, Richardson Highway, Ketchikan, Cordova, C. L. Lefebvre.

HETEROSPORIUM HORDEI Bub. on Hordeum sp., Matanuska, C. L. Lefebvre.

? HETEROSPORIUM MONTENEGRINUM Bub. on Gladiolus sp., Juneau, 21.

HETEROSPORIUM PHLEI Greg. on Agropyron michnoi, Matanuska; A. trachycaulum, Kenai; Arctagrostis latifolia, Nome; Bromus inermis, Anchorage; B. (hybrids), Matanuska; Calamagrostis canadensis, Wasilla, Unalakleet; Elymus junceus, Matanuska; Festuca altaica, Homer; F. rubra lanuginosa, Kenai; Poa pratensis, Anchorage, Kenai, Homer; all coll. C. L. Lefebvre.

HETEROSPORIUM SPIRAEAE Syd. on Spiraea sp. cult., Wrangell, 22.

HORMISCIUM STILBOSPORUM (Cda.) Sacc. on Salix pulchra, Collinson Point, Camden Bay, 26.

Macrosporium brassicae Berk.: See ALTERNARIA BRASSICAE.

Macrosporium caudatum Cke. & Ell.: See ALTERNARIA TENUIS.

Macrosporium commune Rab.: See STEMPHYLIUM BOTRYOSUM.

MASTIGOSPORIUM RUBRICOSUM (Dearn. & Barth.) Nannf. on Calamagrostis canadensis, Wasilla, Anchorage, Mt. McKinley Nat. Park, Unalakleet, C. L. Lefebvre; C. canadensis scabra, 68.

MICROCERA BRACHYSPORA Sacc. & Scalia, New Metlakatla, 59.

MYXOTRICHELLA RESINAE (Fr.) Jaap on Picea sitchensis, Seward, D. V. Baxter.

OVULARIA BULBIGERA (Fckl.) Sacc. on Sanguisorba sitchensis, Haines, Juneau, 21; S. sp., Kodiak, Popof Isl., Unalaska, 59.

OVULARIA DESTRUCTIVA (Phill. & Plowr.) Mass. on Myrica gale, Kodiak, 59.

OVULARIA HORDEI (Cav.) Sprague on Bromus inermis, Anchorage, C. L. Lefebvre; B. spp. (hybrids), Matanuska, C. L. L.

OVULARIA OBLIQUA (Cke.) Oud. on Polygonaceae, Petersburg, 22; Rumex sp., Valdez, 22.

OVULARIA PULCHELLA (Ces.) Sacc. on Agropyron michnoi, Matanuska; A. trachycaulum, Alopecurus alpinus, and Festuca rubra, Homer; F. rubra lanuginosa, Kenai, all coll. C. L. Lefebvre.

Ovularia sommeri (Eichelbaum) Sacc.: See O. DESTRUCTIVA.

Ovularia trientalis Berk.: See TUBURCINIA TRIENTALIS.

OZONIUM AURICOMUM Pk. on Salix alaxensis, Anaktuvuk Pass, G. A. Llano.

PASSALORA BACILLIGERA var. ALNOBETULAE Jaap on Alnus fruticosa sinuata (A. sitchensis), 21.

Polythrincium trifolii Schm. & G. Kunze: See CYMADOTHEA TRIFOLII.

RAMULARIA AEQUIVOCA Ces. on Ranunculus sp., Kodiak, Unalaska, 59.

RAMULARIA ANGELICAE Hoehn. on Angelica genuflexa, Haines, 21.

RAMULARIA ARMORACIAE Fckl. on Capsella sp., Seward, 22.

RAMULARIA ARNICALIS Ell. & Ev. on Arnica chamissonis, Kodiak, 59.

RAMULARIA ARVENSIS Sacc. on Potentilla (Argentina) anserina, Skagway, 21; P. norvegica (P. monspeliensis), Haines, 21.

RAMULARIA CERCOSPORIOIDES Ell. & Ev. on Epilobium angustifolium (Chamaenerion spicatum), Sitka, 21; Kodiak, 59; E. sp., Seward, Cordova, Wrangell, 22; Wasilla, C. L. Lefebvre.

RAMULARIA HERACLEI (Oud.) Sacc. on Heracleum lanatum, Sitka, 4; Chatham, 21; H. sp., Cape Fox, 59.

? RAMULARIA IONOPHILA J. J. Davis on Viola glabella, Juneau, 21.

RAMULARIA LACTEA (Desm.) Sacc. on Viola sp. cult., Wrangell, 22.

RAMULARIA LUPINI J. J. Davis on Lupinus sp., Homer, C. L. Lefebvre.

RAMULARIA MACROSPORA Fres. on Campanula linifolia, 59.

RAMULARIA PLANTAGINIS Pk. on Plantago sp., Petersburg, 22.

RAMULARIA PRATENSIS Sacc. on Rumex occidentalis, Glacier Bay, Yakutat, Virgin Bay, Popof Isl., 59.

RAMULARIA PUNCTIFORMIS Sacc. on Potentilla anserina, Yakutat Bay, 59; P. norvegica, near Fairbanks, C. L. Lefebvre.

RAMULARIA PUNCTIFORMIS (Schlecht.) Hoehn. 1908, nec Sacc. 1904, on Epilobium sp., Circle, Palmer, D. M. Coe. Name untenable; probably identical with one or more of the spp. of Ramularia described on Epilobium.

RAMULARIA RETICULATA Ell. & Ev. on Ligusticum? sp., Port Benny, 22.

RAMULARIA ROSEA (Fckl.) Sacc. on Salix arbusculoides and S. bebbiana perrostrata, Fairbanks, C. L. Lefebvre.

RAMULARIA ROSEOLA Bub. & Vleugel on Lathyrus palustris, Haines, 21.

RAMULARIA RUBICUNDA Bres. on Maianthemum dilatatum (Unifolium eschscholtzianum), Tenakee, 21; M. sp., Wrangell, Ketchikan, Port Benny, 22.

RAMULARIA RUMICIS Kalchb. & Cke. on Rumex sp., Livengood Road (Mile 40), C. L. Lefebvre.

RAMULARIA TARAXACI Karst. on Taraxacum sp., Seward, Ketchikan, Cordova, 22.

Ramularia tulasnei Sacc.: See MYCOSPHAERELLA FRAGARIAE.

RAMULARIA ULMARIAE Cke. on Aruncus vulgaris (A. acuminatus), Sitka, 21.

RAMULARIA URTICAE Ces. on Urtica lyallii, Sitka, 21.

RAMULARIA sp. on Plantago major, Sitka, 4.

RHYNCHOSPORIUM SECALIS (Oud.) J. J. Davis on Agropyron trachycaulum, and Bromus ciliatus, Homer; B. inermis, Matanuska, Fairbanks; Poa eminens, Kenai, all coll. C. L. Lefebvre.

SCLEROTIUM DURUM Fr. on Veratrum sp., Orca, 59.

SCLEROTIUM RHIZODES Auers. on Calamagrostis canadensis, Homer, C. L. Lefebvre.

SCLEROTIUM VARIUM Fr. on Heracleum sp., Kodiak, 59.

SCLEROTIUM. Unidentified species reported on Rusa rugosa, and Sambucus pubens, Sitka, 4.

SCOLECOTRICHUM GRAMINIS Fckl. on the following hosts, coll. C. L. Lefebvre except where otherwise noted: Agropyron latiglume, Richardson Highway; A. sericeum, Fairbanks; A. trachycaulum, Matanuska, Fairbanks, Homer; Alopecurus aequalis, Fairbanks; Arctagrostis latifolia, Homer; Elymus mollis, 68; St. Paul Isl., J. M. Macoun; Horner, Kotzebue, Nome, Deering; Hordeum brachyantherum, Kenai; H. jubatum, Berg, Fairbanks, Circle; H. vulgare, Matanuska; Phleum alpinum and P. pratense, Homer; Poa pratensis, 68; undet. Gramineae, St. Paul Isl., 59; Kenai, C. L. L.

SPEIRA EFFUSA (Pk.) Sacc., Yakutat Bay, 59.

SPEIRA MINOR Sacc., Yakutat Bay, 59.

SPOROCYBE sp. on Ledum groenlandicum, Sitka, 4.

STEMPHYLIUM BOTRYOSUM Wallr. on Pisum sativum, Sitka, 4.

STIGMINA POPULI (Ell. & Ev.) Pound & Clements on Populus tremuloides, Mt. McKinley Nat. Park, C. L. Lefebvre.

STILBUM GLOMERULAESPORUM Ell. & Ev. (nom. nud.) on Picea sitchensis, Prince of Wales Isl., 23.

TRIPOSPORIUM ELEGANS Cda. on Sambucus pubens, 4 (as Tripospora).

TUBERCULARIA SAMBUCI Cda. on Sambucus pubens (S. racemosa), Kodiak Isl., W. T. Horne.

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Stagonospora aquatica luzulicola

LYCHNIS
Alternaria ?dianthi
Botrytis cinerea
Pleospora vulgaris
Pyrenophora cerastii

LYCOPERSICON
Botrytis cinerea

MAIANTHEMUM
Phoma majanthemi
Phyllosticta sp.
Puccinia majanthemi
Ramularia rubicunda

Mairania: See ARCTOSTAPHYLOS

MALUS
Coryneum foliicola
--- longistipatum
Fabraea maculata
Gymnosporangium nelsoni
--- nootkatense
Hysterium pulicare
Phomopsis sp.
Podosphaera leucotricha
Valsa leucostoma
Venturia inaequalis

MATRICARIA
Sphaerotheca macularis

MATTHIOLA
Botrytis cinerea

MEDICAGO
Ascochyta imperfecta

Melandrium: See LYCHNIS

MELISSA
Botrytis cinerea

MENZIESIA
Exobasidium vaccinii
Melasmia menziesiae
Melogramma sp.
Microsphaera penicillata
Rhytisma sp.
Tremella phyllachoroidea

MENYANTHES
Physoderma menyanthis

Merckia: See ARENARIA

MERTENSIA
Didymosphaeria johansenii
Erysiphe communis
Puccinia mertensiae

Micranthes: See SAXIFRAGA

MIMULUS
Botrytis cinerea

MITELLA
Puccinia heucherae

Moehringia: See ARENARIA

MONESES
Chrysomyxa pyrolae

MYRICA
Cronartium comptoniae
Ovularia destructiva

Myrsiphyllum: See ASPARAGUS

Nabalus: See PRENANTHES

NEBRIA
Laboulbenia nebriae

NEPETA
Botrytis cinerea

NEPHROLEPIS
Botrytis cinerea

NEPHROPHYLLIDIUM See Anderson (7)
Puccinia nephrophyllidii

NICOTIANA
Botrytis cinerea

Ocrearia: See SAXIFRAGA

OENANTHE
Nyssopsora echinata

OENOTHERA
Botrytis cinerea

OPLOPANAX
Botrytis cinerea

ORCHIS
Puccinia praegracilis

OSMORRHIZA
Puccinia pimpinellae

OXALIS
Botrytis cinerea

OXYRIA
Pleospora comata
Puccinia oxyriae
Pyrenophora cerastii
Ustilago vinosa

OXYTROPIS
Pleospora chrysospora
--- herbarum
--- vagans
Uromyces lapponicus

PAEONIA
Cladosporium sp.
Phyllosticta baldensis

PAPAVER
Botrytis cinerea
Pleospora herbarum
Pyrenophora paucitricha

PARNASSIA
Puccinia uliginosa

PARRYA
Leptothyrium vulgare parryae
Pleospora chrysospora
Puccinia oudemansii

PEDICULARIS
Pyrenophora cerastii

PELARGONIUM
Botrytis cinerea

PETASITES
Puccinia conglomerata
--- poarum

PETROSELINUM
Botrytis cinerea

Phaca: See ASTRAGALUS

PHASEOLUS
Botrytis cinerea
Colletotrichum lindemuthianum

Phegopteris: See DRYOPTERIS

PHLEUM
Claviceps purpurea
Puccinia poae-sudeticae
Scolecotrichum graminis
Selenophoma donacis stomaticola
Septoria culmifida

PHLOX
Botrytis cinerea
Septoria drummondii

PHYLLODOCE
Antennaria rectangularis
Diplodina rostrupii

PICEA
Chrysomyxa empetri
--- ledicola
--- pyrolae
Corticium vagum
Fomes annosus
--- applanatus
--- nigrolimitatus
--- officinalis
--- pini
--- pinicola
--- roseus
Hypoxylon ohiense
Lachnellula chrysophthalma
Lentinus kauffmanii
Lenzites saepiaria
Lophodermium filiforme
--- piceae
--- sp.
Melampsorella cerastii
Merulius fugax
Myxotrichella resinae
Peniophora crassa
--- gigantea
--- tabacina
Peridermium coloradense
Polyporus abietinus
--- alboluteus
--- anceps
--- borealis
--- fibrillosus
--- pargamenus
--- picipes
--- schweinitzii
--- sulphureus
Poria cinerascens
--- crustulina
--- lenis
--- purpurea roseo-lilacina
--- sitchensis

(Picea continued)
Poria subacida
--- xantha
--- xantha crassa
Rosellinia aquila
Sebacina calcea
Sporonema strobilinum
Stereum abietinum
--- sanguinolentum
--- sulcatum
Stilbum glomerulaespora
Trametes alaskana
--- heteromorpha
--- odorata
--- serialis
--- variiformis

PINUS
Cronartium coleosporioides
Lophodermium pinastri
Poria xantha crassa
Trametes variiformis

PISUM
Ascochyta pisi
Botrytis cinerea
Cladosporium herbarum
Mycosphaerella pinodes
Stemphylium botryosum

PLANTAGO
Peronospora alta
Phyllosticta plantaginis
Ramularia plantaginis
--- sp.

POA
Ascochyta graminicola
Botrytis cinerea
Erysiphe graminis
Helminthosporium vagans
Heterosporium phlei
Leptostroma herbarum
Phoma graminis
Pleospora infectoria
--- magnusiana
Puccinia poae-sudeticae
Pyrenophora trichostoma
Rhynchosporium secalis
Scolecotrichum graminis
Septogloeum oxysporum
Sphaerella graminum
Urocystis agropyri

POLEMONIUM
Puccinia polemonii
Pyrenophora polyphragmoides

POLYGONACEAE
Ovularia obliqua

POLYGONUM
Bostrichonema alpestre
Pseudopeziza bistortae
Puccinia polygoni-alpini
--- bistortae
--- parca
--- septentrionalis
Septoria polygonina
Sphacelotheca inflorescentiae
Uromyces polygoni
Ustilago bistortarum

POLYPODIUM
Milesia laeviuscula
--- laeviuscula glycyrrhiza

POLYSTICHUM
Trabutiella filicina

POPULUS
Chlorociboria aeruginosa
Cladosporium subsessile
Diatrype bullata
Fomes applanatus
--- igniarius
Gloeocystidium karstenii
Linospora tetraspora
Melampsora albertensis
Mycoacia macrodon
Mycosphaerella populi
Phyllosticta alcides
--- intermixta
--- osteospora
Pleurotus ostreatus
Polyporus adustus
--- caesius
--- sulphureus
--- versicolor
--- zonatus
Poria aneira
Steccherinum ochraceum
Stereum purpureum
Stigmina populi
Trametes variiformis
Uncinula salicis
Valsa sordida

POTENTILLA
Botrytis cinerea
Coleroa potentillae
Diplodina lyngei
Peronospora potentillae
Phragmidium andersoni
--- potentillae
Pleospora herbarum
Ramularia arvensis
--- punctiformis

PRASIOLA
Guignardia alaskana

PRENANTHES
Puccinia insperata
--- prenanthis
Sphaerotheca macularis

PRIMULA
Botrytis cinerea
Pleospora herbarum

PRUNELLA
Ophiobolus rostrupii

PRUNUS
Botrytis cinerea
Cladosporium carpophilum
Coniothyrium sp.
Cytospora sp.
Cytosporina ludibunda
Dermea cerasi
Nectria cinnabarina
Phomopsis ?padina
Taphrina cerasi
--- deformans
Valsa leucostoma

PTERIDIUM
Cryptomyces pteridis

PUCCINELLIA
Clathrospora pentamera
Erysiphe graminis
Mycosphaerella tassiana
Puccinia rubigo-vera
Pyrenophora trichostoma

Pulsatilla: See ANEMONE

PYROLA
Chrysomyxa pyrolae
Lophodermium maculare
Pucciniastrum pyrolae
Sphaerulina marginata

Pyrus: See MALUS

QUERCUS
Monochaetia taphrinicola
Myxosporium valsoideum

RANUNCULUS
Aecidium ranunculacearum
Didymaria didyma
Discosia acuta
Erysiphe polygoni
Fabraea ranunculi
Metasphaeria annae
Mycosphaerella ranunculi
Peronospora ficariae
Pleospora comata
--- herbarum
Puccinia ranunculi

(Ranunculus continued)
Puccinia rubigo-vera
Ramularia aequivoca

RAPHANUS
Plasmodiophora brassicae

RHEUM
Botrytis cinerea

RHINANTHUS
Botrytis cinerea

RHODODENDRON
Rhytisma ?rhododendri

RIBES
Asteroma ribicola
Botrytis cinerea
Ceriospora ribis
Cladosporium sp.
Clypeopycnis aeruginascens
Coryneum sp.
Diaporthe eres
--- stromella oligocarpa
Fusarium illosporioides
Gibberidea ribis
Godronia davidsonii
--- urceolus
Leptosphaeria coniothyrium
Marssonina bracteosum
Melampsora ribesii-purpureae
Nectria cinnabarina
Phragmodothella ribesia
Phyllosticta ribesicida
Pseudopeziza ribis
Pseudovalsa ribesia
Puccinia caricis
--- parkerae
--- ribis
Rhynchophoma raduloides
Septoria ribis
Sphaerotheca macularis
--- mors-uvae

ROSA
Botrytis cinerea
Coryneum foliicola
Diplocarpon rosae
Nectria cinnabarina
Pestalotia compta
Phragmidium americanum
--- fusiforme
--- montivagum
--- rosae-californicae
--- subcorticinum
--- ? tuberculatum
Sclerotium sp.
Sphaerotheca pannosa

RUBUS
- Aspergillus sp.
- Botrytis cinerea
- Coniothyrium olivaceum
- Fabraea cincta
- Gnomonia depressula
- Gymnoconia peckiana
- Leptothyrium clypeosphaerioides
- --- vulgare
- Monochaetia monochaeta libertiana
- Mycosphaerella fruticum
- Nectria cinnabarina
- Pestalotia truncata rubi
- Phragmidium alaskanum
- --- occidentale
- --- rubi-idaei
- Pucciniastrum arcticum
- Rhabdospora rubi
- Septoria rubi
- Sphaerotheca macularis
- Venturia kunzei
- --- kunzei ramicola

RUMEX
- Mycosphaerella rumicis
- --- stromatoidea
- Ovularia obliqua
- Ramularia pratensis
- --- rumicis
- Venturia rumicis

SALIX
- Cladosporium herbarum
- Coniothyrium fuligineum
- Coryneum salicinum
- Cryptodiaporthe salicina
- Cytidia flocculenta
- --- salicina
- Daedalea confragosa
- Diatrype bullata
- Dothiorella pyrenophora salicis
- Exidia glandulosa
- Favolus alveolarius
- Fomes igniarius nigricans
- Gnomonia sp.
- Hormiscium stilbosporum
- Hymenochaete agglutinans
- --- tabacina
- Hypoxylon blakei
- Leptothyrium pulchrum
- Lophium dolabriforme
- Lophodermium maculare
- Melampsora arctica
- --- bigelowii
- --- ribesii-purpureae
- Melanomma pulvis-pyrius
- Metasphaeria cinerea
- Mollisia sublividula
- Mycosphaerella minor reticulata
- Nectria cinnabarina
- --- coryli

(Salix continued)
- Orbilia occulta
- Otthia diminuta
- Ozonium auricomum
- Pestalotia lignicola
- --- truncata
- Pholiota adiposa
- Phoma salicina
- --- sp.
- Pleospora vulgaris
- Polyporus elegans
- Poria ferruginosa
- --- reticulata
- Propolis angulosa
- Pyrenophora cerastii
- Ramularia rosea
- Rhytisma salicinum
- --- sp.
- Scleroderris fuliginosa
- Septogloeum salicinum
- Septoria salicicola
- Solenia ochracea
- Sphaerella grossulariae salicella
- Steccherinum ochraceum
- Teichospora sp.
- Trametes heteromorpha
- --- suaveolens
- Uncinula salicis
- Uredo mckinleyensis
- Valsa boreella
- --- salicina
- --- sordida

SAMBUCUS
- Ascochyta sambuci
- Botrytis cinerea
- Coniothyrium fuscidulum
- --- olivaceum
- Cryptodiaporthe calosphaeroides
- Diaporthe sociabilis sambuci
- Melanomma sambuci
- Mollisia ligni
- Polyporus elegans
- Rosellinia ligniaria
- Sclerotium sp.
- Septoria sambucina
- Triposporium elegans
- Tubercularia sambuci

SANGUISORBA
- Fabraea sanguisorbae
- Ovularia bulbigera
- Sphaerotheca macularis
- Xenodochus carbonarius
- --- minor

SAXIFRAGA
- Botrytis cinerea
- Dothidella sphaerelloides
- Laestadia saxifragae
- Melampsora arctica

(Saxifraga continued)
Puccinia heucherae
--- laurentiana
--- pazschkei
Sphaerotheca macularis

SCIRPUS
Leptosphaeria juncicola

SCORZONELLA
Puccinia extensicola
Sphaerotheca macularis

Selinum: See CONIOSELINUM

SENECIO
Botrytis cinerea
Phyllosticta garrettii

SHEPHERDIA
Cylindrosporium shepherdiae
Puccinia coronata
Sphaerotheca macularis

SILENE
Leptosphaeria silenes-acaulis

SOLANUM
Ascochyta lycopersici
Botrytis cinerea
Fusarium oxysporum
Pellicularia filamentosa
Phyllosticta sp.
Phytophthora infestans

SOLIDAGO
Coleosporium solidaginis
Erysiphe communis
Puccinia virgaureae

SORBUS
Dothiorella pyrenophora
Eutypella sorbi
Fabraea maculata
Gymnosporangium aurantiacum
--- juniperinum
--- nootkatense
Nectria cinnabarina
Rhabdospora inaequalis

SPERGULA
Peronospora obovata

SPHAERIACEAE
Nectria episphaeria

SPIRAEA
Heterosporium spiraeae

SPIROGYRA
Lagenidium entophytum

(Spirogyra continued)
Pythium gracile

STELLARIA
Leptosphaeria silenes acaulis
Melampsorella cerastii
Mycosphaerella stellarinearum
--- tassiana
Puccinia arenariae

SWERTIA
Puccinia swertiae

SYMPHORICARPOS
Cercospora symphoricarpi
Puccinia symphoricarpi

TAGETES
Botrytis cinerea

TARAXACUM
Ascochyta taraxaci
Puccinia hieracii
Ramularia taraxaci
Sphaerotheca macularis

TELLIMA
Puccinia heucherae
Sphaerotheca macularis

THALICTRUM
Puccinia rubigo-vera
--- septentrionalis
Tranzschelia thalictri

THUJA
Didymascella thujina
Fomes applanatus
Polyporus cuneatus
Poria weirii

THYMUS
Botrytis cinerea

TIARELLA
Puccinia heucherae
Sphaerotheca macularis

TILIA
Nectria cinnabarina
Phoma communis

TOFIELDIA
Septoria orchidearum

TOLMIEA
Puccinia heucherae

TRADESCENTIA
Botrytis cinerea

TRIENTALIS
Puccinia karelica
Tuburcinia trientalis

TRIFOLIUM
Cymadothea trifolii
Pseudopeziza trifolii
Sphaerulina trifolii
Stagonospora meliloti

TRISETUM
Puccinia poae-sudeticae
--- rubigo-vera

TRITICUM
Cladosporium herbarum
Fusarium graminearum
Tilletia caries
--- foetida
Ustilago tritici

TROPAEOLUM
Botrytis cinerea

TSUGA
Aleurodiscus weirii
Ciboria sp.
Didymascella tsugae
Dimerosporium tsugae
Echinodontium tinctorium
Fomes annosus
--- applanatus
--- nigrolimitatus
--- pini
--- pinicola
--- robustus var. tsugensis
Ganoderma oregonense
Herpotrichia nigra
Hydnum abietis
Lophodermium sp.
Marasmius ?filipes
--- perforans
Microthyrium harrimani
Peniophora crassa
Polyporus abietinus
--- picipes
--- resinosus
--- sulphureus
Poria albobrunnea
--- crassa
--- ferrugineo-fusca
--- sitchensis
--- subacida
Sporonema strobilinum
Stereum abietinum
Trametes alaskana
--- heteromorpha
--- serialis
--- variiformis
Uraecium holwayi

TULIPA
Botrytis cinerea

UMBELLIFERAE
Plasmopara nivea

Unifolium: See MAIANTHEMUM

URTICA
Didymella eupyrea
Leptosphaeria acuta
Puccinia caricis
Ramularia urticae
Septoria urticae

VACCINIUM
Botrytis cinerea
Dothiorella latitans
Exobasidium comosum
--- vaccinii
Gibbera vaccinii
Godronia cassandrae
Leptothyrium conspicuum
Lophodermium oxycocci
Microsphaera penicillata vaccinii
Podosphaera clandestina
Pucciniastrum goeppertianum
--- myrtilli
Rhytisma vaccinii
?Sclerotinia oxycocci
Sporonema oxycocci

VALERIANA
Puccinia valerianae

VERATRUM
Patinella aloysii-sabaudiae
Phyllosticta melanoplaca
Puccinia veratri
Sclerotium durum

VIBURNUM
Cercospora varia
Cladosporium sp.
Nectria cinnabarina
Puccinia linkii
Rhabdospora interrupta

VICIA
Botrytis cinerea
Erysiphe polygoni
Leptosphaeria

VIOLA
Ascochyta violicola
Botrytis cinerea
Centrospora acerina
Puccinia fergussoni
--- violae
? Ramularia ionophila
--- lactea

(Viola continued)
Septoria hyalina
Urocystis violae

Youngia: See CREPIS

ZANTEDESCHIA
Botrytis cinerea

ZEBRINA
Botrytis cinerea

ZINNIA
Botrytis cinerea

ZYGADENUS
Puccinia grumosa

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THE PLANT DISEASE REPORTER

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THE PLANT DISEASE SURVEY

Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

AGRICULTURAL RESEARCH ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES AND DEVELOPMENTS IN THE UNITED STATES IN 1952

Supplement 220 August 15, 1953

PLANT DISEASE REPORTER SUPPLEMENT

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES AND DEVELOPMENTS IN THE UNITED STATES IN 1952

Compiled by Nellie W. Nance

Plant Disease Reporter
Supplement 220 August 15, 1953

Some 1951 reports of plant diseases are included in this summary which were not published when the 1951 summary was completed. Otherwise this summary includes important diseases of 1952 compiled for the most part from reports to the Plant Disease Survey and articles in Phytopathology. Reports listed in the tables are for the most part not noted again in the text.

Noteworthy Observations. Oak wilt was not found in any additional States during the 1952 surveys, but it was found to be spreading in affected areas. The best control that could be recommended was to destroy the oak wilt-infected trees.

In 1952, for the country as a whole, late blight of potato and tomato was less widely distributed and caused less damage than during any of the preceding six years. Drought and record-breaking heat in the South and East during June and July and adequate control measures to a large extent inhibited disease development and spread.

Heavier than normal precipitation in Arizona in the early part of the year may have been a factor in the unusual development of rusts on pine and pear, as reported below.

The identity and distribution of virus diseases of the small grains received much attention. One significant discovery is the constant presence of a seed-borne virus in plants of a low-yielding strain of a barley variety. An outbreak of a soil-borne wheat mosaic developed in some of the Plains States. In Arkansas, the oat virus diseases yellow dwarf and red spot mosaic caused considerable damage, especially on winter oats. Aphids on cereal crops were probably more abundant in this State than at any time during the past 30-odd years.

Gladiolus corms received by Florida growers from southern Oregon were infected with the western aster yellows virus. There was no evidence of spread in Florida; nevertheless the introduction of western aster yellows into the eastern United States constitutes a menace to celery and zinnia in areas where only the eastern strain of the virus is known to occur.

Presence of the insect Bemisia tabaci in Florida, determined in connection with studies on the spread of Abutilon mosaic on Sida, may be a matter for concern, since this species is the vector for several other virus diseases not yet known to occur in this country.

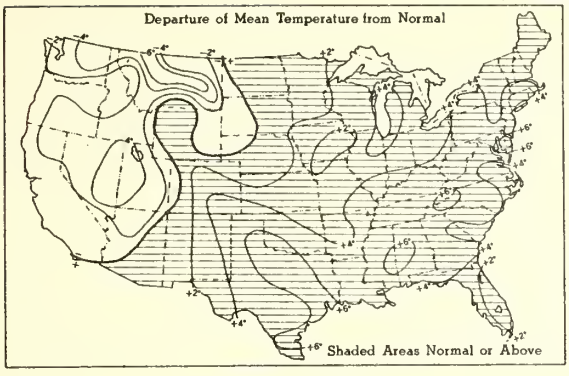
General Summary of Weather Conditions -- 1952. Severe drought over large areas of the Country during the summer and fall was the outstanding weather feature of 1952. The simultaneous occurrence of drought and record-breaking heat in the South and East during June and July greatly reduced crop yields, particularly in New England, the Carolinas, Georgia and Tennessee where losses were estimated at many millions of dollars. The fall drought was almost Nation-wide and was particularly severe from the middle of September through the first decade of November. The weather during this period was ideal for harvesting but was unfavorable for pastures and seeding and growth of winter grains. Low humidity and the absence of rain created an extreme fire hazard and widespread fires east of the Rocky Mountains burned over vast areas of grass and brush as well as large tracts of valuable timber. Smoke from these fires at times reduced visibility to less than a mile and on one or two mornings in New Orleans, Louisiana, thick smog resulting from the smoke disrupted traffic.

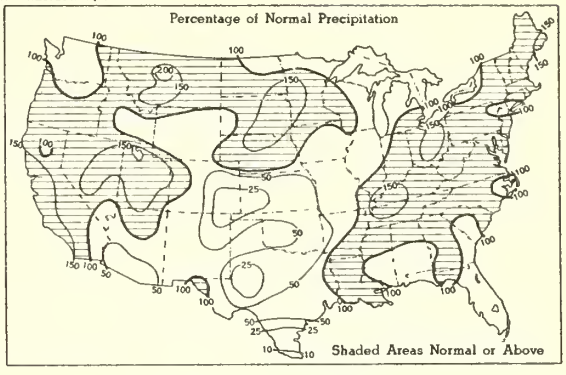
Another major weather feature of the year was an early season heat wave during late March and early April in the north-central interior that rapidly melted a heavy snowcover over a frozen surface, resulting in damaging floods in the Minnesota and upper Mississippi Rivers and the most destructive flood in history along the Missouri River.

Other important features included the heavy winter snowfall in the western mountains, which assured abundant irrigation water, and adequate rainfall and favorable temperatures in the Main Corn Belt during the summer months, which contributed materially to the production of bumper crops of corn, soybeans, and hay. In Iowa, the yields of corn and soybeans per acre were the

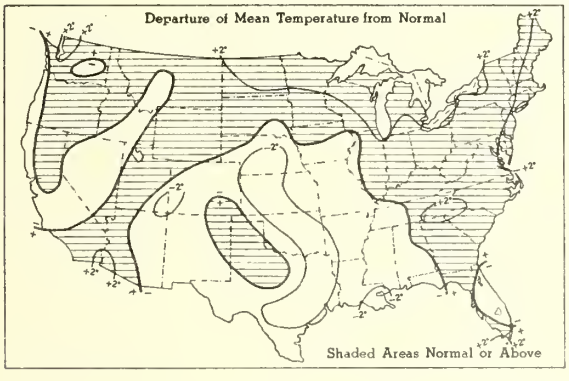
TEMPERATURE AND PRECIPITATION

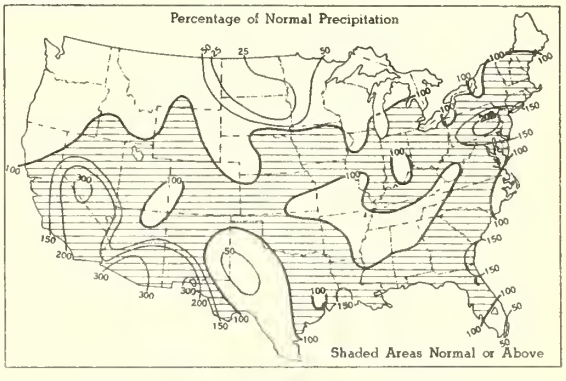
WINTER OF (DECEMBER–FEBRUARY) 1951–52



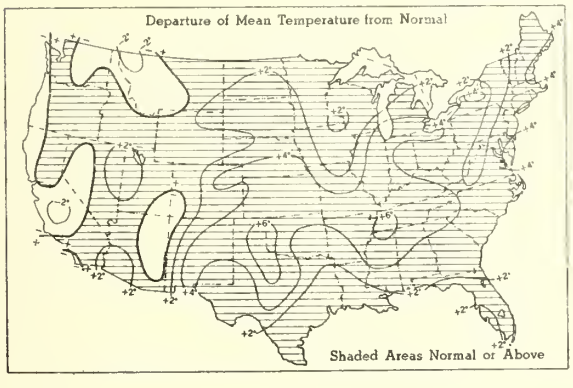


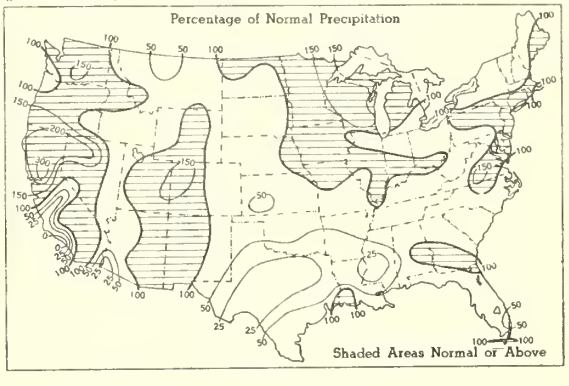
SPRING (MARCH-MAY) 1952



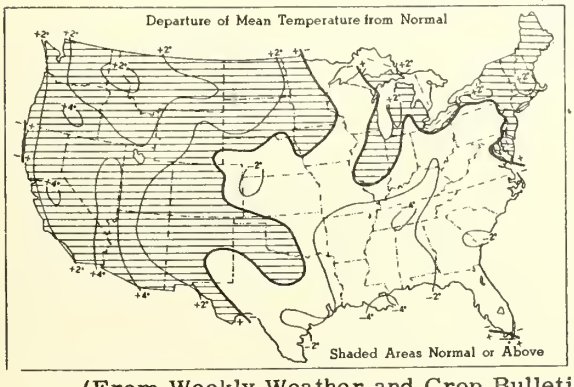


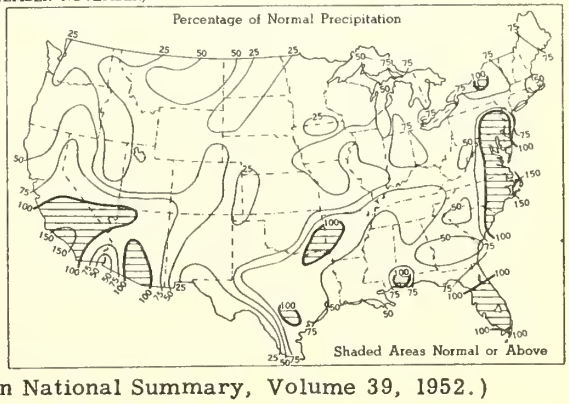
SUMMER OF 1952 (JUNE–AUGUST)





FALL OF 1952 (SEPTEMBER–NOVEMBER)





(From Weekly Weather and Crop Bulletin National Summary, Volume 39, 1952.)

greatest of record.

PRECIPITATION. The Nation-wide precipitation average for 1952 was the lowest since 1934. Central and northern Mississippi, some sections in the Pacific Northwest, and the major portion of the Great Plains received less than 75% of normal, and a few stations in western Texas and along the Canadian Border in the northern Great Plains reported less than 50%.

In the Pacific Northwest precipitation was normal or above only in June and December. Fortunately, rainfall came at timely intervals during the growing season and the yields of most crops were average or above. In the fall and early winter, however, the moisture deficiency delayed seeding, reduced the acreage of winter wheat, and resulted in insufficient stream flow for electric power.

In large areas of the lower Great Plains the year was one of prolonged drought. In Oklahoma the crop season was the driest on record, and at Hardesty an annual total of 8.10 inches of moisture was the lowest ever recorded for a calendar year in the State. In Texas the year's drought was reflected in the lowering of the major reservoirs, which declined from near one-half full in January to less than one quarter full in December. In the remainder of the Great Plains above-normal moisture in January or February, timely showers in late June and early July, and favorable temperatures during the growing season, produced good crops. In southern and eastern regions east of the Great Plains drought-breaking rains occurred in Louisiana and extreme southern Mississippi about the middle of July and in most of the remaining eastern States during August.

Above-normal precipitation for 1952 was largely limited to California, Nevada, and Arizona, most of the middle and north Atlantic States, and scattered sections in the upper Mississippi Valley and Great Lakes Region.

SNOWFALL. Heavy snows fell in the western mountains from January through March, particularly in the Sierra Nevadas where January depths at many stations were the greatest of record. In the Sierra Nevadas heavy snowfall and strong winds damaged power and communication lines, blocked roads and isolated some communities, and snowslides and avalanches in some localities demolished homes and other buildings killing several people. Rapid snowmelt caused damaging floods along the Milk River in Montana in late March and in Utah and Nevada in April and May.

East of the Rocky Mountains the year's snowfall was generally about average in the more northern districts, but generally below normal in middle sections where the ground was free of snow much of the time.

TEMPERATURE. East of the Continental Divide temperatures for the year averaged 3° to 4° above normal along the Canadian Border and north Atlantic Coast and 1° to 2° elsewhere, but west of the Divide yearly averages were near normal at all reporting stations. Nation-wide monthly averages were below normal only for March, October and November.

The winter of 1951-1952 was unusually mild over the eastern two-thirds of the Country, and freeze damage in the deep South was relatively light. In the northern Rocky Mountains and far West, however, the winter was colder than usual.

The spring was somewhat cooler than normal in the central and south-central interior, and generally above normal elsewhere.

The summer was characterized by abnormally warm weather, particularly in central and southern areas east of the Continental Divide.

In the far West the autumn was warmer than normal during September and October, but was unusually cold during November. East of the Divide temperatures averaged below normal for this season, except in the Northeast.

DESTRUCTIVE STORMS. During 1952 damage caused by high winds, tornadoes, and hail was above the average of previous years. Of these three types of storms, high winds were the most destructive, causing damage of about $75,000,000. More than one-half of this total occurred on September 1 when winds, which registered 90 m.p.h. before the anemometer was smashed, damaged buildings, installations, and 35 large planes at Carswell Air Base in Tarrant County, Texas.

Hail damage totaled nearly $50,000,000, about four-fifths of which occurred between the Rocky Mountains and the Mississippi River. Oklahoma reported the greatest damage, over $7,000,000, followed by North Dakota with over $6,000,000 and Nebraska and Kansas with over $5,000,000 each. Probably the most destructive single hailstorm of the year occurred on June 24 in Huron, South Dakota and surrounding localities where damage was estimated at $3,500,000.

Tornadoes killed 230 persons and caused over $35,000,000 damage. The greatest tornado

disaster of the year occurred on March 21 and 22 when a series of these storms swept through parts of Arkansas, Tennessee, Missouri, Kentucky, Alabama, and Mississippi, leaving over 200 persons dead and 1,200 injured, and destroying property estimated at nearly $15,000,000.

The year's only important hurricane damage occurred in South Carolina on August 30 and 31 and was estimated at slightly over two million dollars. Severe glaze in southeastern Missouri and adjacent sections of Arkansas, Kentucky, and Illinois during the first three days of January resulted in losses estimated to be in excess of $1,500,000. (Summary furnished by Weather Bureau, Department of Commerce, July 10, 1953.)

Maps on page 73 show the temperature and precipitation for the winter of 1951-52, spring, summer, and fall of 1952.

Table 1. Diseases reported in States where they had not been found or reported on a particular host until 1952[1].

Host Disease (Cause)	Where found	Remarks
CORN		
Meadow nematode (Pratylenchus zeae)	Texas	Found causing considerable damage to localized spots in a corn field. (PDR 36: 491)
OATS		
Downy mildew (Sclerospora macrospora)	Florida	Found on Southland oats collected near Greenville late in May 1952. (PDR 36: 338)
	Alabama Tennessee	Found during the late spring of 1952 in these two States. (PDR 36: 347)
WHEAT		
Take-all (Ophiobolus graminis)	Georgia	Occurrence in Georgia represents a significant southward extension in the known range of take-all. (PDR 36: 391)
	Illinois	Mature perithecia of this fungus were found on Royal wheat in late June 1952. (PDR 37: 148)
Soil-borne mosaic viruses	Oklahoma	Found for the first time in Okla. during the season of 1952. Serious losses in some fields. (PDR 37: 27)
SOYBEAN		
Target spot (Corynespora cassiicola)	Virginia	Found on soybeans at the Va. Truck Exp. Station, Norfolk, Oct. 8, 1952. Spotting prevalent on leaves of the vars. Dortchsoy 31 and Roanoke. (PDR 36: 491)
Yellow bean mosaic (Phaseolus virus 2)	Mississippi	Observed for first time in 1952. Virus diseases not a factor in soybean production in Miss. (PDR 37: 154)
APPLE		
Flyspeck (Microthyriella rubi)	California	Found on vars. Double Red Delicious and Newton Pippin. (PDR 37: 166)

[1]Thomas E. Summers and Donald H. Bowman. The cereal rusts and other diseases of small grains in Mississippi. PDR 37:142. They state that eleven diseases were found for the first time in Mississippi. For some new species of Ustilaginales from North America see Research Studies of the State College of Washington Vol. 20 (1): 3-10. 1952.

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
GERANIUM MACULATUM		
Rhizome rot (Seaverinia geranii)	Ohio	The Botrytis conidial stage was also found on the rhizomes. Seaver recorded the disease from New York and Wisconsin. (PDR 37: 374)
GLADIOLUS		
Curvularia sp.	Oregon	Found on few corms but has not been found on gladiolus foliage or flowers. (PDR 36: 474)
Meloidogyne hapla (northern root-knot nematode)	Florida	Previously had not been reported farther south than North Carolina (PDR 36: 335)
Topple (?calcium deficiency)	North Carolina	High percentages of cut spikes of four varieties of gladiolus in Western N. C. were affected in the 1952 season. (PDR 37: 285)
HYDRANGEA OPULOIDES		
Stem nematode (Ditylenchus sp.)	Alabama	Found on greenhouse hydrangeas in 1949, 1951 and 1952, apparently the first record for this country. (PDR 37: 340)
ORNAMENTAL ARBORVITAE (THUJA ORIENTALIS var. CONSPICUA)		
Blight (Cercospora thujina)	Tennessee	Over 30,000 plants were affected in the nursery that submitted specimens. (PDR 37: 258)
SNAPDRAGON		
Downy mildew (Peronospora antirrhini)	Maryland	Caused serious damage in a commercial greenhouse. (PDR 36: 211)
VIOLA spp.		
Violet scab (Sphaceloma violae)	Kansas	(PDR 36: 331)
PEANUT		
Meloidogyne hapla (northern root-knot nematode)	Alabama	Found in three fields. In one field most of the plants were severely stunted during June 1952. (PDR 36: 335)
PLANTAGO spp.		
Plantain scab (Sphaceloma plantaginis)	Iowa Kansas Missouri	(PDR 36: 331)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
SUGARCANE "Sclerospora disease" (Sclerospora sp.)	Louisiana	First record of positive identification, other than in Australia, where it has been for 10 years, and in Peru where it was recently identified. (The Sugar Bull. 30: 390. Sept. 1952)
SPINACH White rust (Albugo occidentalis)	Louisiana	White rust was widespread and severe in a planting of several acres of spinach near Natchitoches on April 4, 1952. (PDR 36: 211)
SWEETPOTATO Internal cork (Virus)	Florida	Found in Palm Beach and Martin Counties. Combined plantings totaled about 1500 acres, disease varied from 30 to 70% in the saleable field-run roots. (PDR 36: 337)
TOMATO Meloidogyne hapla (northern root-knot nematode)	Florida	Previously had not been reported farther south than North Carolina. (PDR 36: 335)

Table 2. Diseases found or reported in this country for the first time in 1952=*; diseases found on new hosts=**.

Host Disease (Cause)	Where found	Remarks
CORN Maize leaf fleck virus (Corium zeae n. sp.)	California	The virus is not mechanically transmissible nor is it carried in the seed produced by infected plants. Transmission of the virus did not occur through the soil. Three aphid species were demonstrated vectors of the virus. (Warren N. Stoner. Phytopath. 42: 683)
RYE Dwarf bunt**		Affected rye plants found in a field

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
(Rye continued) Tilletia caries =T. brevifaciens	Utah	of the dwarf-bunt-resistant wheat var. Wasatch on a farm in Sanpete County, Utah. (PDR 36: 434)
ALFALFA Yellow mosaic (Marmor medicaginis var. flavo-varians n. var.)	Idaho	A new strain of alfalfa mosaic virus producing both necrotic local lesions and systemic necrosis and mottling on beans was isolated from naturally infected alfalfa in Idaho. (W. J. Zaumeyer. Phytopath. 43: 38)
CRABGRASS (DIGITARIA SANGUINALIS) WITCHGRASS (PANICUM CAPILLARE) Crazy dwarf**	Indiana	Found growing near affected corn plants. (Phytopath. 42: 675)
JOHNSON GRASS (HOLCUS HALEPENSIS) Downy mildew (Sclerospora sp.)**	Mississippi	Perhaps S. macrospora, associated with diseased oats (PDR 37: 143)
OAT GRASS, TUALATIN var. (ARRHENATHERUM ELATIUS var. BULBOSUM) Dwarf smut* (Tilletia brevifaciens)	Oregon	Found in five fields varying from a trace to 50% dwarfed culms. (PDR 36: 343)
STRAWBERRY Western aster yellows** (Virus)	California	Found during 1952 in scattered area of Central California, mostly on plantings of the Lassen variety. Identity of virus determined by cross-inoculations. (PDR 37: 272)
DWARFMISTLETOE (ARCEUTHOBIUM AMERICANUM) Anthracnose** (Septogloeum gillii)	Montana	In October 1948 this mistletoe suffered heavy mortality at several locations in the Lewis and Clark Nat. Forest. (PDR 36: 300)
FITTONIA VERSCHAFFELTII var. ARGYRONEURA Blight** (Rhizoctonia solani)	Ohio	Found in 1952 in greenhouses. (PDR 37: 373)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
FORSYTHIA INTERMEDIA F. F. SUSPENSA		
Cane blight** (Botryosphaeria ribis)	Maryland	Although this is believed to be the first report on forsythia it is not the first observation. Identified on nursery specimens from near Rockville, Maryland in 1945. (PDR 36: 440)
GERANIUM VISCOSSISSIMUM		
Leaf spot (Cercosporella geranii n. sp.)	Washington	Whitman County (Wm. B. Cooke and C. G. Shaw. Lloydia 15: 126)
HOLLY (ILEX CRENATA var. ROTUNDIFOLIA)		
Physalospora ilicicola**	Georgia	Collected during the early part of September 1951, from dying plants near Atlanta. (PDR 36: 355)
AMARANTHUS RETROFLEXUS CAPSELLA BURSA-PASTORIS SOLANUM SARACHOIDES		
Broomrape** (Orobanche ramosa)	California	Observed in 1952 (PDR 37: 136)
CALIFORNIA LAUREL (UMBELLULARIA CALIFORNICA)		
Bacterial leaf spot (Pseudomonas lauracearum n. sp.)	California	Diseased leaves were collected from a California laurel tree, located on the west slope of the Berkeley hills, east of the Univ. of Calif. campus. (John M. Harvey. Madroño 11: 195)
JUNIPER MISTLETOE (PHORADENDRON JUNIPERINUM)		Found in June 1952. (PDR 37: 258)
Rust** (Uredo Phoradendri)	Arizona	
MAGNOLIA GRANDIFLORA.		
Leaf scab (Sphaceloma magnoliae n. sp.)	Florida Georgia Louisiana Mississippi	The disease was severe in Ga. from 1941-1943, but has since been less harmful. (Anna E. Jenkins and J. H. Miller. Jour. Wash. Acad Sci. 42: 323)
VIOLA PATRINII		
Violet scab** (Sphaceloma violae)	Kansas	Found in garden on Kansas State College campus. Plants in only a small area affected. (PDR 36: 331)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
BEAN		
Yellow bean mosaic strain (virus)	Washington	A new local-necrotic-lesion-producing virus isolated from infected bean pods collected in eastern Wash. is described, identified, and compared with other bean viruses. Believed to be a new strain of yellow bean mosaic. (Zaumeyer and Fisher. Phytopath. 43:45)
PEPPER, BELL		
Cladosporium leaf spot (Cladosporium capsici)	Georgia	First collected in Sept. in a two-acre field in Union County. The entire field was seriously affected. Unable to find out where the seed came from. (PDR 36: 440)
BRUSSELS SPROUTS		
Brassica-root nematode* Heterodera cruciferae	California	First record of this nematode in the U. S. Evidence indicates that it has been present in Calif. for many years. Heavy populations of the nematode in most fields. (PDR 36: 438)

J. E. Machacek reported results of the 1952 cooperative seed-treatment trials in Canada and the United States for the control of wheat bunt (Tilletia spp.), oat smut (Ustilago spp.), barley smut (Ustilago spp.), wheat seedling blight (Helminthosporium sativum), and flax seed rot. (PDR 37: 59).

E. D. Hansing reported results of Kansas experiments conducted in the field nursery in 1950, 1951, and 1952, comparing new fungicides with older ones to determine their relative value as seed treatments for the control of bunt (Tilletia foetida) or stinking smut (T. caries) of wheat, loose and covered smuts (Ustilago avenae and U. kolleri) of oats, covered kernel smut (Sphacelotheca sorghi) of sorghum and Victoria blight (Helminthosporium victoriae) of oats. Experiments were conducted also in the nursery to determine the comparative effect of these fungicides on emergence of these crops. (PDR 37: 49).

According to G. W. Bruehl temporary soil sterilization did not provide a basis for estimating losses from root and crown rots of wheat and barley. (PDR 36: 234).

AVENA SATIVA. OATS: H. H. McKinney and others reported investigations on the effects of light, temperatures, mineral nutrition, soil reaction, aphid infestation, and acid burning on chlorophyll degeneration and the development of anthocyanin pigments in oats and other grasses. They found that nutrition is a major factor in chlorophyll degeneration. (PDR 36: 445).

Erysiphe graminis var. avenae, powdery mildew. John F. Schafer and others reported the reaction of oats varieties and selections to powdery mildew at Lafayette, Indiana. This disease developed in severe proportions in the greenhouse at Lafayette, in 1950-51 and 1951-52. (PDR 37: 306).

Helminthosporium spp., blight. Beginning in early December leaf blotch (H. avenae) was observed in all fields surveyed and was especially severe where oats followed oats, according to Julian H. Miller and others, reporting notes on small grain diseases in Georgia for 1951-1952. The other blight (H. victoriae) has all but disappeared since the epiphytotic of 1946-47. (PDR 36: 287).

Leptosphaeria avenaria, Septoria black stem, in epidemic proportions was noted by T. R. Stanton in many of the important oat-growing sections of Iowa, the Dakotas, Minnesota, and Wisconsin during an automobile trip from June 29 to July 16, 1952. (PDR 36: 349). In Iowa, Septoria black stem and kernel blight did not appear to be seed-transmitted. There was no evidence of seedling infection at any of the temperatures, according to experimental results reported by Simons and Murphy. The infected seed was not toxic to chickens and mice under conditions of the experiment. (PDR 36: 448).

Puccinia graminis var. avenae, stem rust. P. Rothman and K. J. Frey reported that in experiments at East Lansing, Michigan, in 1951 and 1952 an epiphytotic of stem rust of oats caused a 25 percent reduction in yield, an 8 percent reduction in test weight, and a two-day delay in heading of susceptible oat strains as compared with their resistant counterparts from the same cross. (PDR 37: 302).

Puccinia coronata var. avenae, crown rust, was again the most damaging disease of cereals, according to R. W. Earhart reporting on small grain diseases of the Southeastern Coastal Plain. (PDR 36: 420).

Sclerospora macrospora, downy mildew, was reported by Thomas E. Summers as much more important in some southern areas than had been realized. He gave the known susceptible varieties, field distribution of diseased plants, sources of infection and control, and distribution as determined by a survey in 1952. (PDR 36: 347). According to Summers and Bowman in their report on cereal rust and other diseases of small grains in Mississippi, downy mildew was the most important disease of oats in the State in 1952. (PDR 37: 142).

Smog. According to Ruth Ann Bobrov, smog in the Los Angeles, California area causes serious damage to the oat crop. Ultimate browning and death of the entire blade may result. The extent of injury is in proportion to the concentration of smog in the air. (Phytopath. 42: 558).

Virus diseases

Marmor terrestre var. typicum and M. terrestre var. oculatum, soil borne viruses, have been observed in North Carolina, South Carolina, Georgia, and Alabama. The actual loss from these diseases has never been determined but in recent years has been little. J. G. Moseman and others reported the reaction of winter oat varieties and selections to soil-borne viruses in the southeastern United States. The two varieties Letoria and Stanton, developed in the Carolinas, were not recommended in those States in 1952, but were said to be good farther north in

States where mosaic had not been observed. (PDR 37: 226).

Red leaf. According to results of experiments reported by Wilson and Murphy this disease of oats as observed in Iowa is a systemic virus disease. It is readily soil and aphid transmitted, but is not seed transmissible. Low temperature and direct sunlight favored symptom expression of the disease. Differential varietal reaction to the disease was observed. (PDR 37: 21). In Mississippi very little was observed in 1952 although it had been destructive during 1950 and 1951. (PDR 37: 142).

Virus diseases of small grains in Arkansas in 1951-52 including yellow dwarf and red spot mosaic were described and reported by R. H. Rosen. While the diseases caused considerable damage in Arkansas in 1952, especially on winter oats, it was also true that aphids were probably more abundant on these crops in this State than at any time during the past 30-odd years. (PDR 36: 315).

HORDEUM VULGARE. BARLEY: Erysiphe graminis, powdery mildew. V. F. Tapke reported that the development of resistance to powdery mildew in the adult stage of susceptible barleys is a variable character which may be greatly affected by the environmental conditions under which the plants are grown in the pre-adult stage. (Phytopath. 43: 162).

Helminthosporium sativum, spot blotch. Results of comparative studies on the pathogenicity of H. sativum to brome grass, tall fescue grass, and barley were reported by E. S. Luttrell. Susceptibility of smooth brome and rescue grass to leaf infection with H. sativum approached that of barley while tall fescue grass was highly resistant. (PDR 37: 150).

Ustilago nuda, loose smut, was the most important barley disease observed in Georgia, appearing in 10 to 15 percent of the plants in all fields inspected, according to Miller and others. (PDR 36: 287).

Stripe mosaic (virus)

R. F. Eslick determined the effect on yield of barley stripe mosaic (false stripe), a seed-borne virus disease heretofore not considered serious, over the five-year period 1947 to 1951 in the variety Glacier. The average reduction in yield was 31 percent. The presence of the disease in the seed of Montana's recommended varieties is a serious threat to the State's 18-million bushel barley crop. (PDR 37: 290).

According to H. H. McKinney, reporting new evidence on virus diseases in barley, the "running out" of certain barley varieties, as claimed by many farmers, is explained by the fact that about 90 percent of the plants grown from seed from a low yielding plot of Glacier barley were infected with seed-borne virus, although most of the infected plants showed few or no virus disease symptoms. There is some evidence that strains of the barley stripe mosaic virus exist. What appear to be mild or semi-mild strains were isolated from barley collections in South Dakota and Nebraska. Also, there seems to be an oat strain that is seed-transmitted to some extent. Brome grass mosaic virus or a strain of it was isolated from barley leaves collected in Nebraska. The brome grass mosaic virus, so far as known, is not seed-transmitted.

ORYZA SATIVA. RICE: Since white tip disease of rice has been found to be caused by a seed-borne nematode, Aphelenchoides oryzae, E. H. Todd pointed out that it was of interest to determine the longevity of the organism within the rice seed. Periodic examinations of seed from panicles of severely affected rice plants collected in 1949 have shown that the nematode is capable of surviving in seed for at least 24 months. It was also concluded that the nematode is an external parasite. (Proc. So. Agri. Workers. p. 141. 1952).

For lowland rice culture as a possible means of controlling Sclerotinia sclerotiorum and rootknot in vegetable crops in the Florida Everglades, see the Vegetable Crop section.

SECALE CEREALE. RYE: Puccinia rubigo-vera var. secalis, leaf rust, was the only damaging disease attacking rye, according to R. W. Earhart reporting on small grain diseases of the Southeastern Coastal Plain. (PDR 36: 421).

SORGHUM VULGARE. SORGHUM: Sorghum seed treatment tests in South Dakota from 1948 through 1952 were summarized by R. H. Converse and C. M. Nagel. (PDR 37: 401).

SORGHUM VULGARE var. CAFFRORUM. SHARON KAFIR: Sphacelotheca sorghi, covered kernel smut. Leukel and Webster gave experimental results of seed treatment tests in 1952. Eleven treatments eliminated covered smut at both Beltsville, Maryland and Lincoln,

Nebraska. (PDR 36: 426).

TRITICUM AESTIVUM. WHEAT: Puccinia graminis var. tritici, stem rust. C. M. Nagel reported that race 15B of stem rust was generally prevalent throughout eastern South Dakota in late June. (PDR 36: 338).

Reaction of various wheat and Agropyron hybrid selections to stem rust (Puccinia graminis var. tritici) and leaf rust (P. rubigo-vera var. tritici) and a soil-borne virus was reported by W. J. Sando. (PDR 37: 296).

Reactions at Beltsville, Maryland, of segregates from hybrids of wheat x Agropyron elongatum x wheat to eight races of P. graminis var. tritici were reported by W. J. Sando and C. V. Lowther. (PDR 37: 300).

Puccinia rubigo-vera var. tritici, leaf rust. Julian H. Miller et al. stated that leaf rust was unusually late appearing in the Georgia Piedmont area in the 1951-52 season and predicted a loss much less than usual, about 5 to 10 percent. The late appearance was explained by the previous summer's drought during which very little volunteer wheat survived. (PDR 36:287). On the other hand, leaf rust was by far the most serious disease attacking wheat during the past season in the Southeastern Coastal Plain of Georgia and Florida, according to R. W. Earhart. Susceptible varieties were seriously damaged in some locations. (PDR 36: 421). H. C. Young and others reported that after the leaf rust forecast in Oklahoma for the 1952 crop season was made leaf rust development proceeded according to prediction until about May 1, 1952. Then, for the first time since the Oklahoma forecasts have been made, rust development was almost completely retarded by a period of hot dry winds. Subsequent development caused an estimated loss of about 5 percent of the crop, instead of 7 to 10 percent originally predicted. The summer and fall of 1952 in Oklahoma were the driest on record. (PDR 37: 311). Nagel reported leaf rust rapidly killing the lower leaves of wheat during late June in eastern South Dakota. (PDR 36: 338). Johnston and Levine reported the distribution and prevalence of physiologic races of the leaf rust of wheat in the United States in 1951. The physiologic race content of 316 field collections made in 27 States was determined in Kansas and Minnesota. Although 30 races were isolated, only 5 could be considered as abundant and widely distributed. Race 5, representing 27.0 percent of all isolates, was by far the most abundant. Race 126 was second in importance. One of the features worthy of special note was the increasing abundance and distribution of race 15 and the related race 2. (PDR 36: 345). Johnston and Levine reported that although wheat leaf rust was less severe than usual in many parts of the United States in 1952, uredial collections from 28 States were received for physiologic race determinations. They listed the races isolated. (PDR 37: 438).

Tilletia caries, dwarf bunt. Holton and Jackson reported results of soil treatment of infested soil for control of this bunt, which has become an important problem in the winter wheat areas of the Pacific Northwest. Dwarf bunt can persist in the soil for more than one year, even in the absence of a wheat crop. Seed treatment has proven ineffective. (PDR 36: 423). 1952 seed-treatment tests for bunt control in winter and spring wheats in Washington were reported by Holton and Woo. (PDR 36: 424). A heavy infection of dwarf bunt in Rex wheat and lesser amounts in Elmar wheat, near Genesee, Idaho, in the summer of 1952 is evidence that more than one pathogenic race of the fungus causes dwarf bunt of winter wheat in the Pacific Northwest. These varieties posses the Martin factor for bunt resistance and, along with other varieties with this factor, have hitherto been highly resistant to dwarf bunt throughout the Pacific Northwest. (PDR 36: 434).

Siang and Holton reported that the effectiveness of hexachlorobenzene against dwarf bunt (T. caries) as well as common bunt (T. foetida) of wheat seemed to be due primarily to the inhibitory action of the vapor on spore germination. In field practice, the efficiency of control was dependent on the concentration of vapor given off by the HCB in the soil. (PDR 37: 63).

Ustilago spp. R. W. Leukel reported the results of cooperative tests with fungicides for smut control in wheat and oats in 1952. (PDR 36: 428).

Virus diseases

Soil-borne mosaic viruses. The 1952 epiphytotic of a soil-borne wheat mosaic in Kansas was reported by H. Fellows and others. The disease is not new in the State but had previously been sporadic or local in occurrence and this was the first known widespread outbreak of significance. It was observed in 36 eastern counties but probably was present in others. Losses on the whole were light, but yields from affected areas as compared with healthy areas in the same field were lower by 8 to 13 percent. (PDR 37: 287). An outbreak of a similar disease in north central Oklahoma was reported by D. F. Wadsworth and H. C. Young,

Jr. (PDR 37: 27). Mosaic with symptoms indicating the soil-borne mosaic-rosette or wheat virus 1 as the causal agent was widespread in the Piedmont and Tidewater areas of Virginia in 1952, according to Fenne and Roane. This outbreak seemed to be coupled with the introduction in 1950 of the mosaic-susceptible Atlas 50 and Atlas 66 wheats. Previously only mosaic-resistant sorts were widely grown. (PDR 36:212). H. H. McKinney reported results of tests of soils from mosaic wheat fields for the presence of soil-borne wheat mosaic viruses in the Western Prairies and the Great Plains. Soil collections were made from 1949 to 1952 in northcentral and northwestern Missouri, throughout Kansas, in western Iowa and in north-central Oklahoma. Occurrence of soil-borne mosaic virus was demonstrated in all these States. The farthest west that such viruses were collected was near the 100th meridian in Kansas. Except for those from Hodgeman and Pratt Counties, active soil samples collected in Kansas were from the eastern half, and most from the eastern fourth, of the State. The affected area in Oklahoma roughly connects with that in southern Kansas. The identity of the virus or viruses involved is not yet determined. (PDR 37: 24).

Yellow streak-mosaic virus. H. Fellows and others reported studies on the relative abundance of wheat yellow streak-mosaic virus in leaves, crowns, and roots of the wheat plant. Very low virus concentrations were found in the roots and high concentrations in tissue of both dormant leaves and leaves starting active spring growth. The findings should be helpful in the search for a vector. (PDR 36: 319). H. Fellows and John W. Schmidt reported that wide variation in reaction of Agropyron-Triticum hybrids to the wheat yellow-streak mosaic virus suggested the possibility of selecting resistant wheat-like strains. (PDR 37: 349). Sill and Fellows reported experimental investigation on the effect of temperature on symptom expression by the yellow strain of the wheat streak-mosaic virus. Results explain and confirm previous field observations that mosaic symptoms appear in the spring and become increasingly severe with rising temperatures. (PDR 37:30).

ZEA MAYS. CORN: Diplodia zeae, Fusarium moniliforme, Gibberella zeae, Nigrospora oryzae, ear rots. Benjamin Koehler reported ratings of some yellow corn inbreds for ear rot resistance. (PDR 37: 440).

Helminthosporium turcicum, northern leaf blight. Paul E. Hoppe reported that the disease has occurred in some areas of Wisconsin during recent years, but had never before been so severe nor so widely distributed as in 1952. (PDR 37: 94). C. C. Wernham outlined a method for mass production of corn resistant to H. turcicum. (PDR 37: 138). According to James G. Dickson a general spore shower of Puccinia sorghi and H. turcicum was indicated by the extensive appearance of rust and leaf blight in southern Wisconsin about July 25. General spread on commercial hybrids in the area was not evident until August 7. (PDR 36: 350).

DISEASES OF FORAGE AND COVER CROPS

Information obtained from a survey to determine the occurrence and relative importance of diseases on forage crops, including legumes and grasses, in New York was summarized by Daniel A. Roberts and others. (PDR 36: 416).

GRASSES

Ustilago bullata, head smut. Meiners and Fischer reported that further studies on host specialization in head smut of grasses have resulted in the differentiation of 4 additional races, and in the reduction of the number of differential grass species from 14 to 11. (Phytopath. 43: 200).

AGROSTIS spp. BENTGRASS: Anguina agrostis, bentgrass nematode, has become a serious pest during recent years in bentgrass grown for seed production in the Pacific Northwest according to Courtney and Howell, who reported results of extensive investigations on life history, host range, and control. The nematode was probably introduced in poorly cleaned and graded seed shipments. Damage is largely from reduction of seed yield. (PDR 36: 75).

Curvularia lunata, "fading-out". Howard and Davies reported that since 1949, the velvet bent plots at the Rhode Island Agricultural Experiment Station at times developed a yellow and green dappled color pattern from which C. lunata was consistently isolated. "Fading-out" made at least three epiphytotic appearances in 1952 in Rhode Island. The disease was also found in Massachusetts, Connecticut, New York, New Jersey and Missouri. (Phytopath. 43: 109).

BROMUS INERMIS. MOUNTAIN BROME: Ustilago bullata, head smut. Seed treatment tests

to control this fungus on mountain brome were conducted at Pullman, Washington, in 1952. Jack P. Meiners stated that of the seven fungicides tested, only Ceresan M and Panogen gave adequate control of head smut without reducing stands. (PDR 37: 152).

DACTYLIS GLOMERATA. ORCHARD GRASS: Stagonospora maculata, purple leafspot, is a major disease of the above-ground parts of orchard grass in the Northeast, according to J. H. Graham. Studies showed that the fungus overwinters as pycnidia and mycelium in leaves and stems of orchard grass. Preliminary data indicated that high resistance may be obtained by selection. (Phytopath. 42: 653).

HOLCUS HALEPENSIS. JOHNSON GRASS: Two recently discovered diseases of Johnson grass are reported apparently for the first time from Mississippi. Downy mildew (Sclerospora sp.) was found in the fall of 1952, often along the edges of fields in which oats had been affected by S. macrospora during the spring. A virus disease was widespread over the State in 1950 and 1951, but was observed more locally in 1952. The English grain aphid Macrosiphum granarium was found to be a vector, and in controlled experiments the virus mildly affected oats to which it had been transmitted by this insect. (PDR 37: 142).

LEGUMES

In seed disinfection tests carried out in Oklahoma, Texas, Alabama, Georgia, Tennessee, and North Carolina in co-operation with the representatives of the Du Pont Company, nine types of forage crops were treated with Arasan, the cost of treated seed being only about 1 percent per lb. of seed more than the price of unprotected seed of the same quality. Striking results were obtained for all crops. Average stand increases ranged from 17 to 130 (Lespedeza sericea) and 227 percent (Ladino clover). In one experiment with Lespedeza 164 percent more plants developed as a result of seed treatment. (Seed World 71: 40, 1952).

ARACHIS HYPOGAEA. PEANUT: See under Special Crops.

GLYCINE MAX. SOYBEAN: The effect of seed treatment on yield and nodulation of soybeans in Minnesota is reported by M. F. Kernkamp and others. If soybeans are planted in ground that has never produced the crop, it appears that the best practice is to use the inoculant and dispense with seed treatments. (PDR 37: 224).

Kilpatrick and Johnson reported fungi isolated from different parts of soybean plants in 1951 and 1952. The studies showed that a variety of fungi occurred on soybeans in the Mississippi Delta. Several caused serious diseases, while others were secondary and of little or no economic importance. (PDR 37: 98). In a further report on soybean diseases in Mississippi in 1951 and 1952 Johnson and Kilpatrick stated that the bacterial foliar diseases were the most prevalent of all soybean diseases each year. Evidence indicated occurrence of two races of the downy mildew fungus, Peronospora manshurica, in the area. Among other diseases reported were several diseases not listed in the host index of Mississippi plant diseases; they include leaf spot (Phyllosticta sp.), target spot (Corynespora cassiicola), leaf spot (Alternaria sp.), anthracnose (Colletotrichum spp.), purple seed stain (Cercospora kikuchii), and yellow bean mosaic (Phaseolus virus 2).

J. H. Graham summarized the results of North Carolina studies on the overwintering of three pathogens (bacterial pustule, (Xanthomonas phaseoli var. sojensis), bacterial blight (Pseudomonas glycinea), and wildfire, (Pseudomonas tabaci)), in association with seed, soil, and debris. These pathogens were found to be seed-borne. (Phytopath. 43: 189). Graham also reported the cultural and epipytotic relationships of these three bacteria. (Phytopath. 43: 193).

Cephalosporium gregatum, brown stem rot, is recognized as one of the most important diseases of the soybean in Illinois and several neighboring States, as well as in Canada in southwestern Ontario. The observations on its spread in the soil recorded by A. A. Hildebrand in Ontario have value from the standpoint of practical control of the disease. They warn specifically against the danger of spreading the disease from one location to another by transfer of infested soil. The necessity of crop rotation is also pointed out. (PDR 36: 106).

Sherwin and Kreitlow reported conspicuous discolorations designated as "gray," "brown," or "papillate" found in seed of soybeans from Illinois, Louisiana, Maryland, Mississippi, and Virginia. The discolorations were caused by the frogeye fungus Cercospora sojina. Seeds discolored by this fungus failed to germinate as well as clean seeds in greenhouse and field tests. In addition, many seedlings originating from discolored seeds bore lesions on cotyledons and developed earlier infection on leaves in the field. In the field there was a tendency toward

progressive increase in seed discoloration when plants were left standing after they matured. (Phytopath. 42: 568).

LESPEDEZA spp. BUSH CLOVER: Meloidogyne spp., root-knot nematodes. J. C. Wells and others reported that the superiority of Rowan lespedeza in tests on root-knot nematode soils at four widely separated locations in North Carolina suggested that M. incognita was the predominant species found at these locations. In view of its resistance to this species, Rowan appeared promising as a variety and as a source of resistance in a breeding program. (PDR 37: 97).

LUPINUS spp. LUPINE: Pythium ultimum, root and stem rot. J. L. Weimer described this disease on blue (L. angustifolius) and white (L. albus) lupines in Georgia. The disease did not reach epiphytotic proportions, but a considerable number of plants were killed. (PDR 36: 279).

MEDICAGO SATIVA. ALFALFA: Corynebacterium insidiosum, bacterial wilt. During the summer of 1951 Hodgson and Coe found alfalfa plants in the Matanuska Valley, Alaska affected by lucerne bacterial wilt. This appears to be the most northerly record of the disease so far. (PDR 36: 116).

Witch's broom (virus). In Washington J. D. Menzies reported alfalfa witch's broom as especially serious in areas where small fields and permanent plantings had been the custom. The disease had spread more rapidly in small thin stands than in larger, dense plantings. Its range of spread was not great and benefits from isolating new plantings were reported. Experience in the Methow Valley of Washington indicated that area-wide removal of old, diseased fields followed by reseeding and the maintenance, through good cultural practices, of dense, productive stands is an effective means of preventing spread into new plantings. (Phytopath. 42: 649).

TRIFOLIUM REPENS. WHITE CLOVER: Heterodera trifolii, clover root nematode, according to Raski and Hart, was found in white clover in a lawn in Camarillo, California in August 1951. Soil from the infested lawn was used in testing the host range of this species. So far this species is known from this one locality in California and has not been collected in any commercial plantings of clover. (PDR 37: 197).

TRIFOLIUM REPENS var. LADINO. LADINO CLOVER: A severe and widespread occurrence of a virus disease in Ladino clover in Virginia was reported by S. B. Fenne. The virus apparently spreads from other crops that carry it but are not damaged by it. (PDR 36: 491).

TRIFOLIUM PRATENSE. RED CLOVER: Pythium sp., damping-off. In an experiment reported by J. W. Gerdemann red clover proved more susceptible to pre-emergence damping-off in warm soil than in cold soil. There was an indication that Arasan partially controlled pre-emergence damping-off in the warm soil. (PDR 36: 419).

Stemphylium sarcinaeforme, leaf spot (target spot). Reaction of red clover strains to Stemphylium leaf spot was reported by J. H. Graham. The relatively resistant strains came from areas where the disease was most severe. Although no strain was highly resistant differences in reaction among plants of locally adapted varieties suggested the possibility of isolating more resistant clones. (PDR 37: 95).

VIGNA SINENSIS. COWPEA: Warid and Plakidas reported exceptional heat tolerance for some viruses occurring naturally on cowpea in Oklahoma and Louisiana. (PDR 36: 380).

DISEASES OF FRUIT CROPS

CITRUS spp. CITRUS: Fomes applanatus, concentric canker and wood rot. Wood rot of citrus trees has been recognized in Florida for many years, but the form designated as concentric canker which is commonly associated with it and which , according to James F. L. Childs, is a phase of the same disease, appears not to have been recognized previously. The disease is not a limiting factor to the citrus industry but is unquestionably of considerable importance in the general deterioration of citrus orchards under Florida conditions. Control is largely a matter of prevention. (Phytopath. 43: 99).

Gummosis (an actinomycete associated). In Florida gum pockets were said to be a char-

acteristic feature of grapefruit trees affected with gummosis. An actinomycete has been found regularly in the gum pockets. Growth was extremely slow on all media tried. On inoculation into trunks and branches of mature grapefruit trees typical symptoms of gummosis were obtained. These results support Godfrey's implication of an actinomycete as the cause of gummosis. (James F. L. Childs, Phytopath. 43: 101).

Grant and Schneider reported initial evidence of the presence of tristeza, or quick decline virus disease, of Citrus in Florida. (Phytopath. 42: 51).

CITRUS LIMON. LEMON: Phytophthora citrophthora, brown rot. E. C. Calavan and others reported control of brown rot of lemon fruits in California by means of various fungicides. (Phytopath. 42: 512).

CITRUS SINENSIS. ORANGE: Phytophthora citrophthora, foot rot. Navel orange cuttings suffer more damage from Phytophthora root rot than do Valencia cuttings, according to observations in California by Halma and Opitz. (PDR 36: 413).

CYDONIA OBLONGA. QUINCE: See pear.

FICUS CARICA. FIG: Phomopsis cinerescens, canker, has been recognized in California for some time but in recent years it has become especially destructive, according to Harley English. The disease has been found on all important commercial varieties. Three strains of the causal fungus that differ in cultural characteristics and in pathogenicity have been isolated. (Phytopath. 42: 513).

FRAGARIA spp. STRAWBERRY: Botrytis cinerea, Botrytis rot. In Louisiana, Norman L. Horn reported that Orthocide 406 was the best fungicide used in a field screening test. Not only was the amount of fruit rot reduced, but plants treated with this material seemed more vigorous than the controls. (PDR 36: 309).

Gnomonia fragariae, stem-end rot. From their studies on the fungus associated with stem-end rot of strawberries in Michigan, Alexopoulos and Cation concluded that G. fragariae, though frequently associated with Dendrophoma obscurans and previously regarded as the perfect stage, is actually distinct. The only records outside of United States appear to be in Belgium, Germany, France, and Ontario, Canada. (Mycologia 44: 221).

Phytophthora fragariae, red stele. Sources of red stele root disease resistance in breeding strawberries in Oregon were listed and discussed by George F. Waldo. (PDR 37: 236).

Crown and root rot tentatively attributed to an unidentified fungus reported by Sherbakoff in 1924, has again been observed in Tennessee during the past five years. (Phytopath. 42: 283).

Virus diseases

P. W. Miller, reporting on preliminary tests of wild strawberries, F. ovalis and F. vesca, stated that limited data indicated that virus infection in the native strawberry species in eastern Oregon may be less than west of the Cascades. (PDR 36: 352). Wild plants of F. vesca and F. chiloensis from the California coast mostly far removed from cultivated strawberries showed little infection. (PDR 37: 20). According to C. P. Marcus, Jr. it was evident from a survey in Eastern United States that virus-infected wild strawberry plants constitute a source of infection for virus free commercial strawberry plantings. (PDR 36: 353).

C. P. Marcus, Jr., and P. W. Miller reported progress in the search for virus-free plants of cultivated strawberry varieties. Virus free plants have been found in varieties that comprise about 96 percent of the strawberry acreage in the United States. Virus-free plants of 29 varieties were obtained before 1952 and 5 more in 1952, in the Beltsville work. In Oregon virus-free plants of 6 other varieties were obtained, making a total of 40 virus-free varieties. (PDR 37: 90).

R. H. Fulton reported that the strawberry type 2 virus in the Robinson variety was not destroyed by heat treatments that could be endured by the plants tested. (PDR 36: 466).

Tobacco necrosis virus. J. P. Fulton reported a tobacco necrosis virus associated with strawberry plants. The virus apparently came in with plants of Fragaria vesca (East Malling clone). It was readily transmitted mechanically from strawberry tissue and did not produce symptoms in F. vesca. (PDR 36: 313).

Yellows. P. W. Miller reported results of various studies in Oregon concerned with insect transmission of the yellows virus complex. Cool temperatures seemed to lengthen persistence of the components of the strawberry yellows virus complex in the body of the vector

(Capitophorus fragaefolii). It is not definitely known why the viruses should live longer at cooler temperatures. It is thought, however, that the increased persistence is probably associated with a slowing up of biological reactions, enzymic and otherwise, in both the viruses and aphids. (PDR 36: 311). Studies on the percentage of strawberry plants infected with yellows virus complex by single strawberry aphids indicate that this insect is a less efficient vector than some other aphid vectors of viruses. The aphid Myzus solani was found colonizing on both wild and cultivated strawberries in the field but tests showed that it did not transmit the strawberry yellows virus complex. (PDR 37: 89).

Stunt. Skiles and King reported the presence of the relatively uncommon strawberry stunt virus of Zeller and Weaver in the Robinson variety in Minnesota. Symptoms induced in Fragaria vesca by this virus from Robinson could readily be distinguished from those due to yellows virus (type 1 virus Demaree and Marcus) from Marshall, and type 2 virus Demaree and Marcus from Wisconsin 537 variety, either in developmental or final stages. The stunt disease seems to be distinct from other virus diseases of strawberry. (PDR 36: 406).

MALUS SYLVESTRIS. APPLE: Cytospora leucostoma, canker. A survey in March 1952 in San Juan County, New Mexico, showed that a canker-forming fungus was causing severe damage in many apple orchards, the extent of damage in any one orchard depending on the percentage of Rome Beauty present. In one four-year-old orchard the disease killed 85 percent of the Rome Beauty trees and injured the remainder. Infection appeared to follow winter injury and sun scald. Isolates from active cankers proved to be C. leucostoma. In some orchards active cankers were removed by cutting away the infected bark, the wounds were treated with Bordeaux paste. Other growers checked enlargement by spraying the infected parts with 4-4-50 Bordeaux mixture at very high pressures. The force of the spray stream actually removed the infected bark and deposited a protective film of fungicide. (Leyendecker, P. L., PDR 36: 276).

Physalospora obtusa, black rot. A severe outbreak of black rot on fruit in Georgia followed a spring epidemic of fire blight. In cases with severe fire blight the source of inoculum was so great that the usual spray schedule was ineffective (Jack Taylor, PDR 36: 412). A similar relationship between fire blight and black rot leaf spot was reported from Delaware (see below under control). (PDR 36: 410, 37: 81).

Sclerotium rolfsii, southern blight. J. R. Shay reported a serious outbreak in 1952 on one-year apple nursery stock in a commercial nursery near Indianapolis. Southern blight had not previously been observed in this nursery. The organism is only rarely reported in Indiana. (PDR 37: 121).

Advances in Disease Control. Chandler and Thurston reported that tests of fungicides in Pennsylvania in 1951 and 1952 continued to show that several newer organic fungicides give control of apple scab (Venturia inequalis) equal to or better than that obtained with sulfur schedules. The newer materials reduced injury to both foliage and fruit. The authors used a glossmeter for measuring specular reflection from apples. In three successive seasons it was found that the glossiest apples were those sprayed with Crag Fruit Fungicide 341, with Orthocide 406, or with combinations of these and mercury. (Phytopath. 43: 108). R. W. Harriss quoted examples from his experience which showed that the most important factor in the control of apple scab was good soil drainage, followed by free air circulation, largely through pruning, and then keeping the soil in a state of balance to ensure hard, healthy wood. (Fruit Grower, 1952, 2951, pp. 865-866, 1952). Results of 1952 tests with fungicide mixtures for control of apple scab and rusts (Gymnosporangium juniperi-virginianae, G. clavipes) in the Hudson Valley of New York were reported by Palmiter and Emerson. In general the results of previous tests were confirmed. (PDR 37: 11).

Fire blight has been one of the principal limiting factors in the production of apples and pears in Colorado, according to W. D. Thomas, Jr. and W. J. Henderson. It causes an estimated annual loss of about 10 percent of the entire apple and pear crops in the State. In spray tests on apples and pears at several locations from 1947 to 1950 an application of Dithane Z-78 at 10 percent bloom and a subsequent application in the full-bloom stage reduced the incidence of current-season blossom and twig infection approximately 75 percent. In Colorado this spray method, together with sanitary pruning and treatment of hold-over cankers, has become a standard recommendation for fire-blight control. (PDR 36: 273).

Fire blight and frog-eye leaf spot (black rot) have been increasing in severity on susceptible varieties in Delaware for several years, according to Heuberger and Poulos, who state that control measures must be found or many orchards will be abandoned. In view of the known correlation between incidence of fire blight and black rot, control of the former should also

aid in control of the latter. In tests under epiphytotic conditions in 1952 two zineb fungicides (Dithane Z-78, Parzate) one manganese ethylene bis dithiocarbamate (Manzate), and one antibiotic (thiolutin), at specified concentrations, gave significant control of both diseases. Other materials were ineffective against one or both diseases. (PDR 36: 410, 37: 81).

Recently several apple diseases hitherto considered of minor importance have caused severe fruit losses in southern Indiana. They include blackpox (Helminthosporium papulosum), black rot (Physalospora obtusa), fly speck (Leptothyrium pomi), sooty blotch (Gloeodes pomigena), and Botryosphaeria rot (Botryosphaeria ribis). The financial loss caused by the last-named can be very large, and in general increase in incidence of all of these "summer diseases" has necessitated investigation of fungicides for their control. A difficulty is the injurious effect of many materials on the finish of some varieties such as Golden Delicious. In 1952, according to Lewis and Shay, fair success was obtained for the first time in controlling these troubles in the orchard and after harvest on this variety without finish injury. Captan gave best results. (PDR 37: 84). E. C. Sharvelle reported that captan not only did not injure but actually improved the finish of russet-sensitive varieties such as Golden Delicious and Grimes Golden.

PRUNUS spp. CHERRY: Yarwood and Harvey reported that California tests proved the claim of a grower that washing cherries with plain water improved the keeping quality. (PDR 36: 389).

PRUNUS spp. WILD PLUM: Phony peach (virus). Bruer and Shepard stated that the survey for phony disease in wild plum started in 1950 was still in progress. 1,8000 tests on material from 600 location in 83 counties of 11States had been made by the acid technique. The disease was found in Alabama, Arkansas, Georgia, Louisiana, Mississippi, North and South Carolina, Tennessee, and Texas. Prunus injucunda, P. munsoniana, and P. umbellata were added to the infected species. The distribution and intensity of infection in wild plum and in peach were roughly coincident and spread from the former to the latter was frequent in zones of general disease occurrence. As a step in control of phony disease in peach orchards, wild plum should be eliminated from orchard environs. (Phytopath. 42: 282).

PRUNUS PERSICA. PEACH: Clitocybe tabescens, root rot, is a disease of economic importance in Georgia peach orchards, according to E. F. Savage and others. A survey showed this root rot to be generally prevalent in peach orchards throughout both the major and minor peach growing sections of Georgia and to occur in both the Piedmont and Sandhill sections of South Carolina. In Georgia the disease is found mainly on land planted to peaches for periods ranging from 30 to 50 years. (PDR 37: 269).

A fungus tentatively identified as Diplodina is the cause of a fruit rot of peaches and may be potentially if not already important in the north Louisiana peach growing area, according to Norman L. Horn. The rot is a "brown rot" and symptoms are similar in some respects to those of the ordinary Monilinia brown rot. Possibly the disease has been present for some time and been confused with Monilinia. (PDR 36: 351).

Fusicoccum persicae, canker, has for several years caused havoc in two southeastern Massachusetts peach orchards according to E. F. Guba. Only the current season's terminal growth is susceptible to spore infections. The cankers are perennial and the branches die as they become completely girdled. In 1952 a protectant schedule of Ferbam followed by Thiuram or Orthocide almost completely prevented infections of new growth. Protection with the fungicides was supplemented with eradication of cankers and sanitation. (Phytopath. 43: 109).

Glomerella cingulata, anthracnose. Peterson and Dunegan reported that peach anthracnose, after an increase in severity each year from 1947 to 1950, virtually disappeared from central Georgia following the destruction of commercial blue lupin plantings by low temperatures in 1951. The apparent correlation between occurrence on lupin and on peach is based solely on circumstantial evidence. (Phytopath. 42: 343).

Xanthomonas pruni, bacterial leaf spot. It was demonstrated in York County, Pennsylvania, that mercury sprays gave indication of reducing bacterial leaf spot on peach foliage. (PDR 36:68). Experimental confirmation of presence of the bacterium in infected peach twigs was reported by Goldsworthy and Wilson, who suggest the name "black tip" to describe the early season symptoms most prevalent under Atlantic seaboard conditions. (PDR 36: 408). H. W. Anderson, however, still believes that "black tip" is less suitable than the not wholly satisfactory "spring canker" as a descriptive name for the combined symptoms of the overwintering phase of this bacterium on peach, at least as observed in Illinois. (PDR 37: 16).

Phony peach (virus). See above under plum.

Yellow leaf roll (virus). Jensen and others reported that this serious disease in northern California was transmitted by the widespread geminate leafhopper, Colladonus geminatus, in 31 greenhouse tests at the University of California, in 1950-1951. (Journ. Econ. Ent. 45: 335).

Winter injury. John H. Weinberger reported that the need for a nematode-resistant stock led to the limited commercial use of seedlings of peaches introduced from Yunnan Province, China. Susceptibility to some strains of nematodes and the extra cost of such stock have delayed the general adoption of this Yunnan stock in the Southeast. In tests in the springs of 1951 and 1952 at Fort Valley, Georgia it was found that 91 percent of the trees of all varieties on Yunnan stock were winter killed, compared with 7 percent of the trees on Lovell stock. It appears that in the Central Georgia region, at least, Yunnan rootstocks increase the susceptibility of varieties to winter injury. (PDR 36: 307).

PYRUS COMMUNIS. PEAR: Erwinia amylovora, blight. H. W. Anderson described a method for maintenance of virulent cultures of E. amylovora and suggested overwinter survival in mummied fruit. (PDR 36: 301). John C. Dunegan and others described a rapid method for mass inoculation of pear trees with the blight organism. The method should give a more precise test of susceptibility of a large number of trees than was hitherto possible with the time-consuming hand-inoculation procedure. (PDR 37: 14). For control in Colorado see above under apple.

Gymnosporangium sp. Paul D. Keener reported severe outbreaks of an unidentified species on quince, pear, and English hawthorn at higher elevations in Arizona. Several species of Juniperus were found in all the areas, and it was believed that some of these served as alternate hosts. Both winter and summer moisture were favorable during 1951 and 1952. (PDR 37: 235).

RUBUS OCCIDENTALIS. BLACK RASPBERRY: Mosaic (virus). Growing of black raspberries was a thriving industry in western Washington in former years. In the middle thirties there was a sharp decline in production and commercial blackberry growing was practically abandoned. Surveys showed that a virus disease was the cause of this sharp decline in production. In most of the areas where blackberries were grown the disease was widely distributed. Experiments showed that the chronic symptoms of "flecking", referred to as mild mosaic of red raspberries, were expressions of the black raspberry mosaic virus, and that the large green aphid, Amphorophora rubi, was the natural vector of the virus in the field. The virus was also recovered from the wild black raspberry, Rubus leucodermis. (Huber and Johnson, PDR 36: 239).

VACCINIUM spp. BLUEBERRY: Botrytis sp., twig tip blight of cultivated blueberries, has become of economic importance in western Washington, according to Eglitis, Johnson and Crowley. Inoculations were made into wounds in 1-year old twigs of the Jersey variety. Several strains of the fungus have been isolated from blueberries. (Phytopath. 42: 513).

VITIS spp. GRAPE: Guignardia bidwellii, black rot. In Illinois, Herbert C. Barrett described a large-scale method of inoculating grapes with the black rot organism. (PDR 37: 159).

Pierce's disease (virus). J. H. Freitag and others reported that six additional leafhopper vectors of the Pierce's disease virus were demonstrated, by transmission of the virus from infected grape and alfalfa plants to previously healthy grape and alfalfa test plants. Their work brings to a total of 20 the list of species of leafhoppers that have been shown to be vectors of Pierce's disease and includes the common species of the subfamily in all parts of California. Since these leafhoppers have not been commonly observed, they are not considered to be important in the dissemination of the virus to its economic host plants. However, they may be involved in the spread of virus to wild host plants which constitute a natural virus reservoir. (Phytopath. 42: 533).

DISEASES OF NUT CROPS

P. W. Miller reported on nut diseases in Oregon in 1952. (PDR 37: 18).

Xanthomonas juglandis and X. corylina, walnut bacteriosis and filbert bacteriosis. T. R. Aspitarte et al. report reaction of these bacteria in plate tests with some of the newer antibi-

otics and certain bactericides. The two organisms, which are practically identical culturally, showed some differences in their reaction to some materials. Development of resistant types of both organisms or else of loss of potency in the antibiotics was indicated by delayed (10 to 20 days) appearance of bacterial colonies in the originally completely cleared zones around discs holding certain antibiotics. (PDR 37: 263).

DISEASES OF ORNAMENTALS AND MISCELLANEOUS PLANTS

CHRYSANTHEMUM spp. CHRYSANTHEMUM: Chrysanthemum stunt (virus). Philip Brierley reported that the stunt virus showed exceptional heat tolerance, not only withstanding boiling but remaining as infective after this treatment as unboiled samples of the same virus preparation. The virus was still infective in dried leaves of the Mistletoe variety after eight weeks, the longest period tested. Alcohol preparations were as infective as distilled water ones. Therefore, it was suggested that flaming rather than alcohol should be used for sterilizing tools used in propagating plants. (PDR 36: 243). Reaction of various experimental hosts, including 76 species and varieties, largely members of the Compositae, to the chrysanthemum stunt virus was described by Brierley. Thirty-nine of these proved to be susceptible. Only seven of the susceptible kinds developed recognizable symptoms, including five species or varieties of Chrysanthemum and two species of Senecio. No test plant was found to equal the two chrysanthemum varieties Mistletoe and Blazing Gold. No evidence of seed transmission was found. (PDR 37: 343).

GLADIOLUS spp. GLADIOLUS: J. G. Bald reported California studies on control of gladiolus diseases by heat curing and dipping of corms. (Phytopath. 43: 141, 146, 151). Investigations on neck rot caused by Botrytis gladiolorum, also reported by Bald, showed that lesions develop mainly from inoculum carried on corms or from air-borne spores. A field study of neck rot in a crop relatively free from the leaf spot phase of Botrytis indicated that continued high humidity and temperature around 55°-65° F. favor the development of the disease. These are the same conditions that favor the leaf spot phase, but they exist at soil level and below rather than above. The effectiveness of certain protective reactions seemed to be related to temperature. (Phytopath. 43: 167).

J. G. Bald and R. N. Jefferson described injury to gladiolus corms associated with the root mite, Rhizoglyphus rhizophagus. Indications are that this root mite is a serious pest of gladiolus in southern California, partly because of its association with rotting organisms, or even with pathogens such as the organisms causing Fusarium basal rot and yellows, and bacterial scab. (PDR 36: 435).

Western aster yellows virus. R. O. Magie and others reported this virus in Oregon-grown gladiolus corms planted in Florida. They pointed out that the chief importance of the introduction of this virus into eastern United States lies in the menace to celery and zinnia in areas where only the eastern strain of the virus is known to occur. (PDR 36: 468).

HYDRANGEA sp. HYDRANGEA: Ringspot (virus). According to Brierley and Smith, a ringspot virus of unknown identity was isolated from hydrangea plants affected with a newly observed disease termed rugose mosaic. (PDR 36: 382).

IRIS spp. IRIS: Black rot (organism not yet identified). Gould and McLean reported that an unusual rot of certain ornamental bulbs has been under observation in western Washington since 1946. In early spring it appeared on bulbous iris in the form of wilting or a yellowing of one or more plants. In general the effect on hyacinths and tulips was similar to that on iris. (Phytopath. 42: 514).

IRIS FILIFOLIA. DUTCH IRIS: Sclerotium rolfsii, crown and stem rot. Frank A. Haasis reported experiments for the control of this pathogen on Dutch iris in North Carolina. Soil fumigation with chlorobromopropene reduced the amount of S. rolfsii in the soil but on the other hand thorough fumigation also permitted other inadvertently introduced pathogens to increase, apparently by destroying inhibitors. (PDR 36: 474).

MYRICA CAROLINENSIS. BAYBERRY: Bayberry-yellows virus. A yellows-type disease was observed in bayberry plants growing in Pemberton, New Jersey. The virus was transmitted by cleft-grafting and also by the agency of dodder (Cuscuta campestris and C. subinclusa) but not by juice inoculation. Ten species of leafhoppers were tested but failed to transmit the

virus, nor could it be transmitted through seeds of bayberry, periwinkle, or dodder. This virus was not identical with any of the known yellows viruses. (S. P. Raychaudhuri, Phytopath. 43: 15).

NARCISSUS sp. NARCISSUS: Observations on occurrence and control of the root-lesion nematode disease of narcissus in the Pacific Northwest was reported by Harold J. Jensen. This disease was especially important in Oregon where it was widespread. (PDR 37: 39).

ORCHIDACEAE: Virus diseases. A number of rare diseases believed to be of virus origin are described from California and reported by D. D. Jensen. (Calif. Agric. 6: 7, 15-16).

RHODENDRON spp. (AZALEA): Ovulinia azaleae, azalea petal blight, has done little damage in Maryland according to W. F. Jeffers. The relatively cold winter temperatures may be responsible for what appeared to be slow development of this disease in the State. (PDR 36: 301).

ROSA spp. ROSE: Peronospora sparsa, downy mildew. Kenneth F. Baker summarized the history and distribution of rose downy mildew and evaluated the factors involved in recent epidemics in California and Indiana. (PDR 37: 331).

Rosette (virus). This disease, according to Thomas and Scott, was found on Rosa rubrifolia grown as an ornamental in a Wyoming school planting and a native rose nearby. What seemed to be the same disease was found on a native rose, possibly R. pisocarpa, at about the same time in a mountainous area of Trinity County, California. Inoculations show that it is capable of causing severe damage to several of the species and varieties of roses commonly grown but thus far is only a potential threat to rose culture in California. (Phytopath. 43: 218).

SIDA spp.: Abutilon mosaic (virus). Evidence given by Costa and Bennett seemed sufficiently strong to justify the tentative assumption that infectious chlorosis of Malvaceae, or Abutilon mosaic, is widely distributed in Florida on species of Sida and that it is being spread there under natural conditions by the known insect vector, Bemisia tabaci. This insect was previously not known to be present in this country. It is the vector of a number of other viruses, none of which are known to occur in the United States. (PDR 37: 92).

ZANTEDESCHIA spp. CALLAS: Erwinia aroideae and E. carotovora, bacterial chalk rot. It appeared from certain studies as reported by Ark, Starr, and Sutton that the orgnaism responsible for chalk rot, a destructive disease of Z. elliottiana and Z. rehmanni, which are cultivated on a commercial scale in Santa Cruz County, California, was identical with E. carotovora. E. aroideae apparently is merely a strain of E. carotovora. The disease was most severe under conditions of high temperature and soil moisture. Chemical treatments of the corms failed to control the disease, but soil amendments with cow manure at the rate of 8 tons per acre reduced the incidence of infection from 55 to 5 percent. (Phytopath. 42: 320).

DISEASES OF SPECIAL CROPS

AGARICUS CAMPESTRIS. COMMON MUSHROOM: According to E. B. Lambert and T. T. Ayers the new "two-phase pasteurizing" system of mushroom culture gave better control of diseases and insects. This system has been followed in four successive crops in their experimental growing rooms. (PDR 36: 261).

ARACHIS HYPOGAEA. PEANUT: In central east Georgia, J. H. Machmer reported that severe chlorosis of peanut was noted in September 1950, and again in September 1951. After many collections of samples it was concluded that Criconemoides sp., a ring nematode, showed a major association with the so-called "peanut yellows" although other factors may have been involved. (PDR 37: 156).

Meloidogyne hapla, root knot. Control by soil fumigation and by crop rotation in North Carolina, where the disease is widespread in the peanut growing area, was reported by W. E. Cooper. (Proc. of So. Agri. Workers, p. 136. 1952).

BETA VULGARIS. SUGAR BEET: Lightning injury, as observed in Idaho, is described by Watson and Gessel to aid in the identification of this type of injury on sugar beets. (PDR 36: 487).

CARTHAMUS TINCTORIUS. SAFFLOWER: Phytophthora drechsleri, root rot. C. A. Thomas described a greenhouse method of evaluating resistance in safflower to Phytophthora root rot. (Phytopath. 42: 219).

Puccinia carthami, rust, appeared in an experimental planting at the Salt River Valley Farm of the Experiment Station, Mesa, Arizona. The severely affected plants were grown from seed of Nebraska variety No. 852 obtained from California and described as giving heavier yields. Earlier supplies of commercial seed were not affected. (PDR 36: 325).

Yellows (virus). G. H. Coons presented evidence to show that virus yellows, a serious disease of sugar and forage beets in Europe, is widespread on beets in the United States. (PDR 36: 356).

GOSSYPIUM spp. COTTON: P. B. Marsh described the alkali-centrifuge test, a useful measuring technique in the study of problems concerning cotton fiber deterioration. (PDR 37: 71).

S. G. Lehman reported the results of dusting tests for control of fungus damage to seed cotton in North Carolina in 1951. (PDR 36: 414).

Losses from cotton diseases in 1952 were compiled by the Cotton Disease Council's Committee on Disease Losses. (PDR 37: 175).

Meloidogyne incognita var. acrita, root-knot nematode, annually causes damage to a considerable acreage of cotton in some areas of the San Joaquin Valley. Results obtained from treatment with nematocides applied in the row indicated that this method gives promise of reducing the expense of soil treatment and still result in good control. (D. J. Raski and M. W. Allen. PDR 37: 193).

Rhizoctonia solani, damping off. Isolates of R. solani from cotton in Louisiana varied considerably in tolerance to high temperatures, according to Jack C. Schwegmann. (PDR 37: 178). In Alabama, Rhizoctonia blight was more destructive than observed for the past several years. (PDR 37: 179).

Thielaviopsis basicola, black root rot, was reported by Leyendecker on Pima 32 cotton in 1951, in two fields near Canutillo, Texas. This is the second record of the disease in the southwestern United States. (PDR 36: 53). P. J. Leyendecker, Jr. and others reported that the circumstances of the occurrence of black root rot on cotton in the Rio Grande Valley of Texas and New Mexico indicated that the organism is indigenous to the area. The increased acreage of American Egyptian cotton and the awareness of presence of the disease in the area possibly accounted for the expanded range of the black root rot. (PDR 37: 130).

Cold injury. Seedling losses were sufficiently serious to require replanting about 20 percent of the crop in several counties of the Sand Mountain area of northeastern Alabama. Damage was attributed mainly to a freak period of unfavorable low soil and air temperature, strong wind, sunshine, and excessive water loss from seedlings. (A. L. Smith et al. PDR 37: 179).

HIBISCUS CANNABINUS. KENAF: Colletotrichum hibisci, tip blight. In October 1951 this disease was observed in damaging proportions on commercial plantings in Florida, according to John R. Presley. A brief history of the disease was given. (PDR 36: 333).

Leveillula taurica f. hibisci, powdery mildew. The powdery mildew on kenaf in Florida was determined as this species by Wm. W. Diehl. (PDR 36: 52). Field and greenhouse observations indicated that the disease can easily and economically be controlled in south Florida by timely applications of elemental dusting sulfur in amounts sufficient to cover the plants. (Warren N. Stoner, PDR 36: 302).

LINUM USITATISSIMUM. FLAX: The response of flax varieties to seed treatment was reported by R. E. Atkins and C. S. Reddy. Results were obtained from several Iowa locations during the three year period 1950-1952. Plots treated with Ceresan M yielded somewhat more than Panogen treated plots in 1950 and 1952, while both had identical average yields in 1951. Average percentage increase of treated versus non-treated plots was of similar magnitude for the three seasons. (PDR 37: 330).

MENTHA spp. MINT: Puccinia menthae, rust. Under conditions favorable for its development, mint rust frequently causes serious damage in commercial fields. In 1950 it was serious

in Indiana and Michigan on spearmint, Mentha spicata, and Scotch mint, M. cardiaca. In 1949 and 1950 it attained epiphytotic proportions in Oregon and Washington on peppermint, M. piperita. The absence of rust on peppermint in Indiana and Michigan suggested possible existence of physiological races in this area, according to Baxter and Cummins. It was found that P. menthae is composed of at least 15 physiologic races in North America. The P-13 strain of spearmint proved to be immune from all 15 races. Deep fall plowing, elimination of exposed plant debris, and destruction of nearby wild or escaped hosts were suggested as possible measures in the control of the rust. (Phytopath. 43: 178).

Root and rhizome rot. C. E. Horner reported that during the winter and early spring of 1950-51 and 1951-52, peppermint in Western Oregon was affected by a root and rhizome rot, caused by a complex of several fungi. Rhizoctonia solani, Fusarium roseum, Fusarium sp., and Pythium sp. were consistently isolated and their pathogenicity established. (Phytopath. 42: 514).

NICOTIANA spp. TOBACCO: Fusarium oxysporum f. nicotianae, Fusarium wilt, was discovered August 14, 1952 in a single field of flue-cured tobacco in Pittsylvania County, Virginia. In this field, wilt was accompanied by severe root knot (Meloidogyne sp.) infestation. Wilt has been previously reported from Lee County, Virginia in Burley tobacco, but this is the first time it has been noted in flue-cured tobacco in Virginia. (W. A. Jenkins, PDR 36: 391).

Heterodera rostochiensis, golden nematode. Discovery in Connecticut of a tobacco-cyst nematode indistinguishable morphologically from the potato golden nematode made it advisable to reinvestigate the susceptibility of tobacco to the potato nematode. It was found that the potato golden nematode larvae readily enter tobacco roots but do not develop further. Evidence indicates dying and decomposition of the larvae in tobacco roots. (Feldmesser and Fassuliotis, PDR 36: 483; Mai, PDR 36: 485).

Macrophomina phaseoli, charcoal rot, was extremely prevalent in Virginia and was consistently associated with basal (shank) rotting of plants injured by the application of mineral oils for sucker control. (W. A. Jenkins, PDR 36: 368).

Peronospora tabacina, blue mold. P. J. Anderson described symptoms of blue mold, life history of the causal organism, and the influence of weather on the severity of attack. For control, the use of ferbam and zineb were recommended on both seedlings and plants in the field and satisfactory methods of application were indicated. (Circ. Conn. Agric. Exp. Stat. 181. 1952). On flue-cured tobacco in southside Virginia and portions of the old belt in North Carolina, according to Wilbert A. Jenkins, blue mold was rarely seen in "active" form during the entire plant bed season. "Dry weather" mold, characterized by scanty sporulation and chlorotic foliar spots dotted with necrotic lesions varying in size and number, was common, however. Climatic conditions apparently constituted the greatest factor this season in blue mold control. (PDR 36: 278). In an experiment to obtain more information on wind dissemination of sporangia of this fungus, R. A. Hyre reported that it appears safe to assume that inoculum for blue mold infection at Newark, Delaware had been wind-borne for at least 20 miles. (PDR 36: 335). In the final summary of the plant disease warning service (PDR Suppl. 217: 203) Miller and O'Brien stated that blue mold of tobacco appeared later than usual except in North Carolina, where one of the earliest appearances for the State was recorded. Blue mold developed in the field in Tennessee. Control treatments plus timeliness and proper application did much to reduce the disease.

Phytophthora parasitica var. nicotianae, black shank. Powers and Lucas reported variation within this fungus, which is generally considered to be a relatively stable organism. (PDR 36: 335).

Tobacco mosaic (virus). Schlegel, Gold, and Rawlins made the following summary: "Radiophosphorus (P^{32}) in young mosaic tobacco leaves inhibited virus formation and mosaic symptom expression. P^{32} activity of around 100 counts per second per mg. fresh weight of leaf tissue decreased virus formation to approximately half that in control leaves; 200 counts per second decreased it to around 1/4 that in controls. Levels of P^{32} of 200 or more counts visibly inhibited the terminal growth of stems and roots, but the enlargement of formed leaves was less susceptible to inhibition by P^{32}." (Phytopath. 43: 206).

PARTHENIUM ARGENTATUM. GUAYULE: Sclerotium bataticola, charcoal rot, is a common soil-borne fungus which infects many wild and cultivated plants in Texas during hot, dry weather. Conditions associated with attack on guayule in southwest Texas in 1951-52 are discussed by Don C. Norton and F. A. Frank. (PDR 37: 41).

SACCHARUM OFFICINARUM. SUGARCANE: Pratylenchus sp., nematode, has been found associated with root deterioration of sugarcane in the Louisiana field affected with the recently reported Sclerospora disease (sp. undet.) according to Wray Birchfield. The relation, if any, of the nematodes to the Sclerospora disease had not been determined. (PDR 37: 38).

SESAMUM ORIENTALE. SESAME: Fusarium wilt of sesame has been reported only recently in the United States. In 1948 it was found on a plantation in south Georgia where it was thought that the disease had been present for at least 15 years. On the basis of cross inoculation experiments, Joanne K. Armstrong and G. M. Armstrong concluded that the Fusarium causing wilt of sesame may be restricted in its pathogenicity to the one host. (PDR 37: 77).

DISEASES OF TREES AND SHRUBS

Winter injury to trees and shrubs was observed extensively in Illinois in 1952. The injury was attributed mainly to a sudden severe freeze which occurred in early November 1951. This was the coldest November in Illinois since the origination of state-wide records in 1890. (PDR 36: 389).

Results of fungicide tests for control of leaf diseases of shade trees in Illinois in 1951 and 1952 were summarized by J. C. Carter and P. F. Hoffman. (PDR 37: 114).

CASTANEA spp. CHESTNUT: Hans Nienstaedt reported tannin as a factor in the resistance of chestnut to the chestnut blight fungus, Endothia parasitica. (Phytopath. 43: 32).

CASTANEA DENTATA. CHESTNUT: Endoconidiophora fagacearum, oak wilt. Ernst and Bretz reported the American chestnut susceptible to the oak wilt fungus when artificially inoculated under greenhouse conditions. (PDR 37: 162).

CHAMAECYPARIS THYOIDES. ATLANTIC WHITE CEDAR: Fomes annosus, root rot. An examination of a small Atlantic white cedar plantation near Asheville, North Carolina, showed that two-thirds of the original 50 trees were dead or dying as a result of this fungus. (Toole and Boyce, PDR 36: 330).

CORNUS FLORIDA. DOGWOOD: Elsinoë corni, spot anthracnose. Because of the increasing demand for information on this disease and its control, several notes bearing on the disease were published by various authors. The States involved in the 1952 distribution were Florida, Georgia, North and South Carolina, and Maryland. (PDR 36: 292).

CRATAEGUS OXYACANTHA. ENGLISH HAWTHORN: Gymnosporangium sp. in Arizona; see pear in Fruit section.

LARIX spp. LARCH: Dasyscypha willkommii, European larch canker. In the resurvey for this canker in 1952 in Massachusetts, Fowler and Aldrich reported only three newly infected trees were found among thousands inspected. (PDR 37: 160).

PINUS spp. PINE: Cucurbitaria pithyophila, an entomogenous fungus, associated with pine, actually develops on a scale insect infesting pines, according to J. S. Boyce from Yale University, Connecticut. The actual relationship between the insect and the fungus is unknown. The fungus has been reported on Pinus flexilis from Colorado and Idaho, on P. monticola from British Columbia and Washington, and on P. strobus in several places in the east from New York to Georgia. It has not been recorded on P. lambertiana or on P. albicaulis. (PDR 36: 62).

Berch W. Henry described a root rot of southern pine nursery seedlings in a nursery near Brooklyn, Mississippi and its control by soil fumigation. It caused mortality in the seed bed, decreased production of plantable seedlings, and lowered survival of seedlings after transplanting to the forest. (Phytopath. 43: 81).

PINUS PONDEROSA var. SCOPULORUM. PONDEROSA PINE: Cronartium filamentosum, rust. Frank G. Hawksworth reported the pycnial stage of C. filamentosum on ponderosa pine at several locations in Arizona. Pycnia had not been observed in nature previously. Just why this stage was prominent in 1952 and why it was not found in previous years is an interesting question. Local weather conditions may be a determining factor. At the Grand Canyon pre-

cipitation during March and April was more than twice the normal amount; otherwise the first half of 1952 was nearly normal. (PDR 37: 246).

PINUS RESINOSA. RED PINE: Fomes annosus, root and butt rot,. caused dying of red pines in plantations in New York State, according to D. S. Welch and E. L. Stone. This disease has long been recognized as a serious problem in Europe, and perhaps may become similarly important in this country as plantations become older. (PDR 37: 247).

PINUS RIGIDA. PITCH PINE: Fomes annosus, root rot. Elmer R. Roth reported extensive rotting of the roots of two uprooted pitch pine trees located on the flood plain of the Swannanoa River near Asheville, North Carolina. The only living healthy roots were some small secondary roots that had formed near the ground level. (PDR 36: 330).

Hypoderma lethale, needle browning. C. L. Morris reported that of the fungicides tested under field conditions, two, Puratized Agricultural Spray and a fixed copper spray, gave practically complete control of this needle cast fungus on pitch pine in Pennsylvania. (PDR 37: 368).

PLATANUS OCCIDENTALIS. SYCAMORE: Gnomonia veneta, anthracnose. In Illinois, P. F. Hoffman reported results of fungicide tests for control of this disease in 1952. In contrast with the three preceding years when there was very little sycamore anthracnose the disease was prevalent throughout the State in 1952. Two organic mercury compounds, Puratized Agricultural Spray and Tag 331, were most effective. (PDR 37: 112).

POPULUS spp. ASPEN: Hypoxylon pruinatum, canker. R. L. Anderson reported factors influencing the incidence of Hypoxylon canker on aspen in the Lake States region. (Phytopath. 42: 463).

POPULUS TREMULOIDES var. AUREA. ASPEN: Fomes igniarius, wood rot. According to Paul D. Keener sporophores of wood-rotting fungi are of infrequent occurrence in Arizona. However, recently from one to numerous conks of this fungus were observed near the ground-level as well as high up on the common aspen. (PDR 37: 164).

PSEUDOTSUGA TAXIFOLIA. DOUGLAS FIR: Rhabdocline pseudotsugae, needle cast, was first discovered in Pennsylvania by Stambaugh and Bramble in January 1952 while conducting studies of Christmas tree plantings in Susquehanna County. The affected area was again examined on June 2, 1952 at which time the new season's needles were almost fully matured. The infected trees varied from 4 to 18 feet in height and were confined to a 50-foot wide strip planting 0.7 acres in extent. From a total of 592 trees in the planting, 225 or 40 percent were infected. Heavy infections were noted on 68 percent of the infected trees or 25 percent of the total stand. The infection seemed to be at least two years old. Approximately one-half million, uninfected young fir trees were situated in a field adjacent to the infected planting. A spray schedule was started on June 2 to control the spread of the disease to the adjacent field of young Douglas fir. (PDR 36: 292).

PYRACANTHA COCCINEA LALANDI. LALAND FIRETHORN: Fusicladium pirinum var. pyracanthae, scab. Puratized Agricultural Spray and Bordeaux mixture gave the best control of scab on Pyracantha in the three years of tests in Delaware, according to R. S. Cox. Timing appeared to be more important than the total number of applications. (PDR 37: 7).

QUERCUS spp. OAK: Endoconidiophora fagacearum (Chalara quercina), oak wilt. Numerous investigations on the development of the fungus, production of the perithecial stage, and possible means of long-distance spread were reported. According to Curl, Stessel, and Zuckerman visible growth of the fungus was found in Illinois as large subcortical mycelial mats on 22 wilt-killed oak trees during the autumn and winter of 1951 and the spring of 1952. Species of insects belonging to the families Scolytidae, Cerambycidae and Buprestidae were found beneath the bark of all trees having mycelial mats. (Phytopath. 43: 61). Stessel and Zuckerman report the first known observation of perithecia in nature, on a wilt-killed red oak in Illinois in October 1951. The perithecia were abundant on the mycelial mats beneath open cracks in the bark, which exposed the viable ascospores and endoconidia to the air. In spring of 1952 perithecia were found on additional trees. Association of various insects with the fertile mats suggests that some insect may act as dissemination agents. Observations indicate that viable asco-

spores are continuously available for distribution from October to May, and that mats and perithecia may remain viable over the winter. (Phytopath. 43: 65). Natural occurrence of perithecia was reported in 1952 from West Virginia. (Barnett et al., Phytopath. 42: 531; Staley and True, Phytopath. 42: 691) and Pennsylvania (Morris and Fergus, Phytopath. 42: 681). Distribution of affected trees in West Virginia indicates that vectors must be the principal means of spread there, and the perfect stage apparently has an important role in spread.

J. G. Leach, R. P. True, and C. K. Dorsey, West Virginia University, report that growth pressure of the fungus cushion resulting in bark cracks provides a mechanism for liberation of spores from beneath the bark and that insects can act as spermatizing agents. (Phytopath. 42: 537).

During investigation of the compatability of the oak wilt fungus isolates in Pennsylvania, it was found that inter-fertile strains existed in the State, according to Fergus and others. (PDR 36: 327).

In Illinois Eugene B. Himelick and others reported rodent feeding on mycelial pads of the oak wilt fungus. Mats exposed to rodent damage were producing perithecia and an abundance of conidia. They pointed out that it seems possible that rodents feeding on mats could become contaminated with the fungus and transfer it when feeding to healthy oaks. (PDR 37: 101). Development of mycelial mats during dry weather in Minnesota was reported by Robert N. Campbell and David W. French. Apparently these mats developed after the end of the growing season and during a prolonged drouth, indicating enough moisture under the bark of standing dead trees to permit fungus development in very dry weather, also a reservoir of inoculum. They also report evidence of rodent feeding on the mats. (PDR 37: 243).

Results of the effect of time and temperature on isolation of the oak wilt fungus from infected twig samples were reported by Bretz and Morison. (PDR 37: 162).

The progress of oak wilt investigations in Ohio in 1952 was reported by H. C. Young and others. Host range, longevity of the fungus, and effect of associated fungi were among the subjects studied. (PDR 37: 244).

Marvin Fowler summarized the 1952 surveys for oak wilt. (PDR 37: 104). The disease was not found in any additional States, but had spread within affected States.

Polyporus dryadeus, root rot. During a wind storm at Athens, Georgia, two large oaks were windthrown. Both trees had had fruiting bodies of this fungus at the base for several years. Because of the weakened root system, windthrow hazard is great in shade trees extensively rotted by P. dryadeus, according to W. A. Campbell and J. H. Miller. (PDR 36: 490).

QUERCUS ALBA. WHITE OAK: Gnomonia veneta, anthracnose. Charles L. Fergus stated that the relation of weather to the severity of white oak anthracnose in State College, Pennsylvania, and vicinity was studied during 1950, 1951, and 1952. The factor most closely related to severity was the number of days and hours of rain during late April and May, when buds were opening and leaves expanding. Severity was greater in 1952 in a park area where leaves and twigs were raked and removed, than under natural forest conditions. (Phytopath. 43: 103).

ULMUS spp. ELM: Ceratostomella ulmi, Dutch elm disease. In Massachusetts David H. Marsden presented evidence for the value of intelligent, sustained programs in local control of Dutch elm disease. (PDR 37:3). Richard J. Campana reported further spread of this disease in Illinois in 1952. During the year, 24 infected trees were found in seven counties. (PDR 37: 110).

Gloeosporium ulmicolum has been observed on the fruit of rock elm (U. thomasi) and variegated English elm (U. procera argenteo-variegata) for several seasons in the vicinity of Champaign-Urbana, Illinois. Although quite common on elm leaves, apparently it has not been reported on elm seed heretofore. (Ralph W. Ames, PDR 36: 301).

Phloem necrosis (virus). In Illinois various chemical tests were tried by Ralph W. Ames in the hope of finding a quick and certain method of detection of phloem necrosis in an elm tree before the tree reaches the stage when symptoms are evident. (PDR 36: 288).

WASHINGTONIA FILIFERA. PALM: An undetermined fungus disease that rots the trunks is threatening this only native palm of California. More than 20 trees have succumbed to the trunk-rotting disease. The causal fungus apparently enters the palm trunks through wounds or cracks. The disease seems to be associated with heavy watering. The fungus is similar to that which causes the brown rot gummosis disease in citrus trees. (Science New Letter 62: 29, July 12, 1952).

Evaluation and use of disease resistance by vegetable breeders is discussed by C. F. Andrus. (PDR 37: 206).

Tests reported by Wallen and Skolko showed that emergence from vegetable seed of low germination can be improved by treatment with suitable materials. (PDR 37: 66).

Sclerotinia sclerotiorum, rot. Lowland rice farming is a possible cultural control for S. sclerotiorum in the Everglades according to Warren N. Stoner and W. D. Moore. The quick thorough destruction of the sclerotia by flooding which is a part of lowland rice culture indicated that this economical method of control for sclerotiniose may be fitted into a satisfactory rotational program in the area, since rice may be grown on infested high-value vegetable land in summer. (PDR 37: 181). Stoner and Walter H. Thomas, Jr. reported a preliminary trial of lowland culture rice in rotation with vegetable crops as a means of reducing root knot (Meloidogyne incognita) nematode infestations in the Everglades. (PDR 37: 187).

Systox, an organic phosphate insecticide, controlled root-knot nematodes (Meloidogyne spp.) when used as a soil drench in certain concentrations in experiments reported by J. N. Sasser, but the possibility of toxic residues makes further investigation necessary before the chemical can be recommended for this purpose. Cucumbers and tomatoes were used as experimental plants. (PDR 36: 228).

APIUM GRAVEOLENS. CELERY: Paratylenchus hamatus. Lownsbery and others reported that P. hamatus has produced the same stunting and chlorosis of celery commonly associated with the nematode in the field. Disease severity was proportional to the P. hamatus population. Since populations have been found at pathogenic levels throughout the year, it was concluded that the nematode could survive New England winters. (Phytopath. 42: 651).

Septoria apii, late blight, is abundant in the soil of all major celery-growing sections of western Oregon, according to Edward K. Vaughan. It is present every year and frequently causes severe losses, particularly in celery grown for harvesting after the start of the fall rains. Spray and dust trials over the past four years have shown that the losses can be almost entirely prevented by timely application of fungicides. Ziram and tribasic copper sulphate have given the best control without evidence of phytotoxicity. (Phytopath. 42: 519).

Adaxial crack stem (boron deficiency), a serious disease of Utah type celery, has been observed in coastal California since 1945. The disease was reported particularly severe on Utah 10B, especially when grown under extremely high nitrogen fertilization. The disease may be controlled by applying water sprays of borax to celery foliage. (John T. Middleton and others. Phytopath. 42: 603).

ARMORACIA RUSTICANA. HORSERADISH: Albugo candida, white rust. The production of oospores of this fungus on leaves of horseradish has been obtained under greenhouse conditions in Illinois, according to R. M. Takeshita and others. This suggests a mode of overwintering of the pathogen in addition to persistence of systemic mycelia in the crown area. (PDR 36: 253).

BETA VULGARIS. BEET: Yellow-net (virus). D. M. McLean reported the occurrence of the yellow-net virus disease in table beet seed plants in northwestern Washington. The disease is caused apparently by the same virus that causes yellow-net of sugar beets in California. Only plants in the genus Beta have been experimentally infected with yellow-net virus. (PDR 36: 241).

Yellows (virus). A study of the occurrence, symptoms, and the insect relations of the virus causing virus yellows in table beet seed crops in the Pacific Northwest was reported by D. M. McLean. (PDR 37: 276).

BRASSICA OLERACEA var. CAPITATA. CABBAGE: Fusarium oxysporum f. conglutinans, yellows. Two new outbreaks occurred in Florida during the 1951-1952 growing season. Records show that over 1,000 acres of land in the Hastings area became heavily infested with yellows during the three-year period 1948 to 1951. During the last two years losses have been reduced, as growers have shifted from yellows-susceptible to yellows-resistant varieties for planting in infested land. (A. H. Eddins, PDR 36: 337).

Xanthomonas campestris, black rot. Studies on the transmission of black rot and survival of the causal organism in the soil were made at Hastings, Florida, from 1947 to 1951. Results reported by Eddins indicated that the organism mostly originated from infected seed. (PDR 37:

216). In Wisconsin, Cook, Larson, and Walker reported relation of the black rot pathogen to cabbage seed. Certain data were interpreted as confirmatory of field observations that epiphytotics in the crop often arise from a very few initially infected seedlings in the seed-bed in environments favorable for secondary spread. (Phytopath. 42: 316).

BRASSICA RAPA. TURNIP: Cercosporella albomaculans, leaf spot. J. O. Andes, of the Agricultural Experiment Station, at Knoxville, Tennessee reported fungicides for turnip-green leaf spot control. This disease is serious in some seasons, especially after the first cutting owing to build up of inoculum. (Proc. of So. Agri. Workers, Feb. 1952, pp. 129-130).

CAPSICUM FRUTESCENS var. GROSSUM. BELL PEPPER: Cladosporium herbarum, a transit and storage rot of California peppers was described by G. B. Ramsey and Barbara C. Heiberg. The rot has been found following injuries in peppers and also associated with other diseases such as Botrytis rot and Alternaria rot, but in most instances lesions appeared where there were no visible wounds and no other organism was present. (PDR 36: 481).

Cladosporium capsici, leaf spot, found in Georgia, has apparently not been reported before from this country. The disease appeared late, and therefore did not affect the fruits very badly. See also Table 2. (Miller and Taylor, PDR 36: 440).

Curly top (virus) was the only apparent cause of the killing or spoiling of about 80 percent of the bell pepper plants in a three-acre field near Lovington, New Mexico. Larger pepper plants in a large field near Littlefield, Texas showed about 1 percent of the plants with typical symptoms of curly top. (P. A. Young, PDR 36: 390).

CUCURBITS: CUCUMBER, MELON, SQUASH: Cladosporium cucumerinum, scab. In Wisconsin, Walker, Pierson, and Wiles reported two new scab-resistant cucumber varieties. (Phytopath. 43: 215),

Colletotrichum lagenarium, anthracnose. In Louisiana, J. G. Atkins and N. L. Horn reported a simple greenhouse method for evaluating fungicides for control of anthracnose on cucumber. Results were in agreement with those from field tests. (PDR 36: 270). Barnes and Epps reported evidence indicating two distinct types of resistance to anthracnose infection in cucumbers have been located, differing not only in the degree of resistance exhibited but also in mode of inheritance. (PDR 36: 479).

Erysiphe cichoracearum, powdery mildew. G. H. Godfrey in Texas reported effective control of cantaloupe powdery mildew with dinitro capryl phenyl crotonate. (Phytopath. 42: 335).

Pseudoperonospora cubensis, downy mildew, has two distinct biological forms, according to Hughes and Van Haltern. This is in keeping with the field observations of both Ellis, and Epps and Barnes who suggested this possibility. (PDR 36: 365). In the summary of the plant disease warning service for 1952, Miller and O'Brien stated that cucurbit downy mildew caused less damage than in any year since the initiation of the Warning Service in 1946. (PDR Suppl. 217: 203).

Cucurbit viruses. C. W. Anderson reported observations that may help to explain the distribution of cucurbit viruses in central Florida; the viruses concerned are watermelon and cucumber mosaic viruses, a mosaic virus from the wild plant Melothria, and another from cantaloupe resembling the South Carolina cantaloupe mosaic virus. (PDR 36: 377).

IPOMOEA BATATAS. SWEETPOTATO: Endoconidiophora fimbriata, black rot, is one of the most destructive and widely distributed diseases of sweetpotato in the United States. Pen Ching Cheo discussed varietal differences in susceptibility. (Phytopath. 43: 78).

Norman D. Dobie and others reported a new method for application of chloropicrin in warehouse fumigation in Oregon. Fusarium roseum was used to test the effectiveness of storage house disinfestation with chloropicrin applied in steam. (Phytopath. 42: 693).

Streptomyces ipomoea, soil rot, has gradually become more important during the past 30 years. At present it is the major disease of the crop in southeastern Iowa. Many fields have been abandoned for further sweetpotato culture because of the disease. Sulfur as a soil treatment was effective in controlling the disease. Total yields and plant vigor were often increased following sulfur treatment and the appearance of the fleshy roots was appreciably improved. (Hooker, W. J. and Lewis E. Peterson. Phytopath. 42: 583).

Internal cork (virus). According to L. W. Nielsen sweetpotato roots infected with the internal cork virus were grown in soils artificially heated from mid-September until early November, and more necrotic lesions developed in them than in similar roots grown in non-heated

soils. Storage temperature markedly influenced lesion development in diseased roots. Additional infected roots developed lesions and the lesions became larger and more numerous at storage temperatures of 70°, 85° and 94° F. In contrast, no additional lesions developed in roots stored at 55° F.; however, there was evidence that the lesions present enlarged slowly over a 7-month period. (Phytopath. 42: 625). The relation of temperature to internal cork development in stored sweetpotato roots was discussed by Robert Aycock and others. (Phytopath. 43: 50).

LACTUCA SATIVA. LETTUCE: Erysiphe cichoracearum, powdery mildew, caused reduction in yield and quality of lettuce in the Salinas Valley of California where it reappeared in the fall of 1951 exactly ten years after the same area had experienced the only other known field occurrence in the State, according to W. C. Snyder and others. (PDR 36: 321). Recurrence of this disease in California in 1952 and appearance of the perithecial stage of the fungus in the field suggested the origin of a race pathogenic to cultivated lettuce, according to Josue A. Deslandes and others. (PDR 37: 135).

Pseudomonas marginalis, soft rot. According to B. A. Friedman, bacteria considered to be identical with P. marginalis were isolated from leaves of plants of Arizona-grown head lettuce and Florida-grown escarole (Cichorium endivia) found affected with a slimy soft rot upon examination at the New York market. (Phytopath. 42: 112).

Mosaic (virus). Grogan, Welch and Bardin point out that it has been known for many years that common lettuce mosaic virus is seed-borne and several workers have suggested the use of disease-free seed as a control. However, this method of control had not been tested experimentally. Lettuce seed free of mosaic was used to plant experimental plots in commercial fields. Results of field trials showed that the spread of common mosaic under California conditions was mainly a local phenomenon and that the use of mosaic-free seed is an effective means of controlling the disease in large scale field plantings. (Phytopath. 42: 573).

LYCOPERSICON ESCULENTUM. TOMATO: The progress report of the National Screening Committee for Disease Resistance in the Tomato was prepared by L. J. Alexander and M. M. Hoover. The 1952 results demonstrated that a great deal of previously unrecognized valuable germ plasm exists, especially for resistance to diseases. (PDR 37: 317).

Manzate (manganese ethylene bis dithiocarbamate), according to J. D. Wilson, gave promise of being the nearest approach yet found to a fungicide that can be used singly to check those diseases for which the tomato is sprayed. Plots treated with Manzate produced fewer cull fruits and gave a higher yield of usable tomatoes than those treated with ziram or zineb. Manzate gave better control of anthracnose (Colletotrichum phomoides) than either ziram or zineb. In one experiment in which late blight destroyed 87 percent of the fruits in the untreated check plots, the loss was reduced to 10 percent by Manzate, to 12 percent by Parzate, and to 56 percent by Zerlate. (Ohio Farm and Home Research 37 (276): 41).

Fusarium oxysporum f. lycopersici, wilt. A new tomato variety, Homestead, developed by the U. S. Department of Agriculture, from crosses involving Victor, Pan American, Rutgers, and Dobbie's Champion was reported to be available for autumn and winter plantings. In tests over three years at the Homestead, Fort Pierce, and Gainesville Stations, Florida, and in other southern States this variety was resistant to wilt and highly productive. (Seed World, 71 (8): 44). Waggoner and Dimond reported that a continuing interest in the therapy of plant diseases led to attempts to cure a plant disease by ionizing radiation. In addition to evaluating plant radiotherapy, their studies provided unique information concerning the nature of disease. Because Fusarium is considerably more resistant to ionizing radiation than the host, it was predicted that therapy of Fusarium wilt could not be affected with a source of radiation external to the host. This prediction was verified by using gamma radiation from Co^{60}. Therapy of Fusarium wilt by internal sources of radiation seemed unlikely. Stems which had become necrotic from the effects of Fusarium no longer translocated appreciable amounts of phosphate to leaves and growing point. However, stems which were discolored translocated about as much phosphate to growing point and terminal leaves as healthy tomato stems. (Phytopath, 42: 599). The physiology of Fusarium wilt was discussed by R. P. Scheffer and J. C. Walker. (Phytopath. 43: 116).

Phytophthora infestans, late blight. According to Walter and Conover, two accessions of small-fruited tomato types used as ornamentals were observed to show a high degree of resistance to late blight in southern Florida. Performance of hybrid populations resulting from crossing these accessions with large-fruited susceptible breeding stocks has shown that the resistance is hereditary. (Phytopath. 42: 197). In the final summary (PDR Suppl. 217: 203)

of the plant disease warning service in 1952, Miller and O'Brien stated that late blight of potato and tomato was sparsely present over the eastern portion of the country but occurred in the north central States to about the same extent as during the past several years. Rainfall over most of the eastern part of the country during a large part of the growing season was light to moderate with drought conditions prevailing in some regions. This hot dry weather proved unfavorable for disease development and spread.

Purdy and Bardin reported infection of tomato plants by ascospores of Sclerotinia sclerotiorum through old flower parts. (PDR 37: 361).

J. W. Lesley and others reported that the Simi tomato, bred at Riverside, California, is resistant to Verticillium albo-atrum and Fusarium oxysporum f. lycopersici and has yielded well on infested soil in the coastal plain of southern California and in the Simi Valley. It originated from a cross between Riverside and N. D. 216-2-3 and is recommended particularly for processing on account of its fleshiness and deep red color. (Hilgardia 21: 289).

Curly top (virus). In fields in west Texas and New Mexico, abnormal tomato plants showed typical symptoms of the curly-top disease, which apparently killed or damaged 15 to 85 percent of the plants. (P. A. Young, PDR 36: 390). In California, H. M. Armitage reported the control of curly top virus in tomato and other agricultural crops by reducing populations of overwintering beet leafhoppers. (J. Econ. Ent. 45: 432).

Internal browning (? virus). High moisture content of the air which results possibly in water congestion of the tissue of the tomato fruit may be an important factor in the internal breakdown of the tomato tissue, according to greenhouse experiments reported by S. P. Raychaudhuri. (PDR 37: 220).

Hormone injury to tomato, pepper and Rudbeckia adjacent to a railroad right-of-way sprayed by a commercial organization for weed control was reported by P. A. Young. The particular compound used could not be determined. (PDR 37: 36).

P. A. Young described several disorders of tomato fruits in Texas, which were apparently favored by weather conditions and were unusually abundant, including catfaces on the sides of the fruits (PDR 37: 373); stem-end stripes, and vertebrae-crack lines. (PDR 37: 325).

PHASEOLUS LIMENSIS. LIMA BEAN: DeZeeuw and Andersen reported results of lima bean seed treatment trials in Michigan, 1951 to 1952. A noteworthy observation was made regarding Phygon XL as a seed protectant for lima beans. It caused blackening of the cotyledons and prevented the seed coat from splitting so that the cotyledons were restrained abnormally. (PDR 37: 69).

Phytophthora phaseoli, downy mildew was found in Delaware in late August and by September 10 it was present in all parts of the State. As weather conditions thereafter never did become very favorable for any extended period, the disease did not become epidemic. The total loss to the lima bean crop was estimated at less than 2 percent. Downy mildew appeared about the middle of July in Lancaster County, Pennsylvania and became general over the southeastern part of the State. The average loss was less than 1 percent. (PDR Suppl. 217: 212).

PHASEOLUS VULGARIS. BEAN: It was concluded from greenhouse and field studies that the fungi chiefly responsible for blights of snap bean in Georgia were Macrophomina phaseoli, Rhizoctonia solani, and Sclerotium rolfsii. Seed treatment failed to give practical control of these diseases in field trials. Field observations indicated that they may be avoided by early planting. (E. S. Luttrell and K. H. Garren. Phytopath. 42: 607).

Translocation of streptomycin in bean plants and its effect on bacterial blights (Pseudomonas medicaginis var. phaseolicola and Xanthomonas phaseoli) was reported by Mitchell, Zaumeyer and Andersen. (Science 115: 114).

Bean virus 2 (yellow). Afanasiev and Morris reported that bean plants of the Great Northern variety, which is resistant to bean virus 1, were infected in Montana by a virus causing drooping of leaflets, chlorotic spotting, and later general mottling, distortion, and crinkling of leaves; they gradually became dwarfed and spindly, grew slowly, bloomed later, and gave poor yields. The virus was not transmissible through the seed. The host differentiation, physical properties, and association of the virosis with white and yellow sweet clovers indicated that this disease is caused by bean virus 2 (yellow bean mosaic). (Phytopath. 42: 101).

Tobacco ringspot (virus). Cheo and Zaumeyer described a new severe strain of tobacco ringspot virus isolated from mottled bean pods collected in Virginia and Delaware. It infected all bean varieties tested and produced more severe necrotic symptoms than the McKinney strain of tobacco ringspot virus. (PDR 36: 459).

SOLANUM TUBEROSUM. POTATO: Fusarium sp., dry rot. Observations indicated that dry rot was more prevalent in stored potatoes treated with a sprout inhibitor than in untreated tubers stored under the same conditions. A histological study of tubers treated with certain sprout inhibitors showed that the normal healing of cut surfaces of potato tubers was delayed without interfering in any way with growth of Fusarium. The active agent contained in sprout inhibitors was found to be responsible for delay in the healing of wounds. (H. S. Cunningham, Phytopath. 43: 95).

Heterodera rostochiensis, golden nematode (see also under tobacco in Special Crops section). Bert Lear and W. F. Mai reported the use of methyl bromide for disinfesting burlap bags and machinery to help prevent spread of the golden nematode. (Phytopath. 42: 489).

Macrophomina phaseoli, charcoal rot, resulted in 33 to 50 percent loss of Irish Cobbler and Kennebec potato tubers in home gardens in the Knoxville, Tennessee area at the time of digging in early July. The potatoes had been left in the very hot, dry soil for two weeks or more after the vines had died. According to E. L. Felix tubers should not be left in the ground under very high temperature conditions. (PDR 36: 369).

Phytophthora infestans, late blight, see under Tomato.

Spongospora subterranea, powdery scab. Schultz reported that in Maine during the 1951 epiphytotic of late blight (Phytophthora infestans), blight-immune Kennebec potato tubers contracted late blight in the soil infested with S. subterranea. Experience has shown that the late blight fungus invades blight-immune tubers through injuries or wounds on the tubers. (Phytopath. 42: 343).

Bernard A. Friedman and Donald Folsom reported on storage behavior of Kennebec potatoes infected by Verticillium albo-atrum. (Phytopath. 43: 108).

Curly top (virus, Ruga verrucosans). N. J. Giddings reported curly top as quite prevalent in two fields of potatoes being grown for certified seed stock in California. Estimated infection was 8 to 10 percent. Estimated reduction in value for the two fields was $15,000, since they could not be sold for certified seed. (PDR 37: 167).

SPINACIA OLERACEA. SPINACH: Puccinia aristidae, orange rust, was a serious market disease of Colorado spinach in 1952, causing much loss in truck shipments to Chicago. Once infection occurs fields of spinach become worthless within a few days. Under the usual methods of handling spinach in Colorado, this rust can increase rapidly in transit. (Ramsey, Smith and Wright, PDR 36: 323).

DIVISION OF MYCOLOGY AND DISEASE SURVEY

THE PLANT DISEASE REPORTER

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Division of Mycology and Disease Survey

BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

AGRICULTURAL RESEARCH ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 221

DISTRIBUTION, SYMPTOMS AND CONTROL OF SOME OF THE MORE IMPORTANT PLANT DISEASES

Supplement 221 October 15, 1953

The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

Issued by

THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station Beltsville, Maryland

DISTRIBUTION, SYMPTOMS AND CONTROL OF SOME OF THE MORE IMPORTANT PLANT DISEASES

Plant Disease Reporter
Supplement 221 October 15, 1953

FOREWORD

The following list was compiled by the Yearbook of Agriculture Committee, with the assistance of many other persons, for inclusion in the Department of Agriculture Yearbook, 1953. Circumstances prevented its publication in the Yearbook.

The compilation has value even though perhaps the popular style makes it somewhat simplified for pathologists. It has been carefully thought out and represents much work. I believe you will find it to be helpful in supplying informational reference material to non-pathologists.

Diseases and hosts are mostly those occurring in the United States. Banana and rubber are the main exceptions.

The compilation was not intended to be complete, but was planned as a selected list of the important, economic, plant diseases. P.R.M.

TABLE OF CONTENTS

DISEASES OF CEREAL CROPS

HOST Disease and Cause Distribution	Symptoms	Control
BARLEY:		
Bacterial blight, a bacterium, Xanthomonas translucens North America	Narrow, linear, translucent and glossy lesions on leaf blades and sheaths	Crop rotation and seed treatment.
Covered smut, a fungus, Ustilago hordei General with barley	Barley heads converted into hard, black, smutted masses enclosed within thin membranes.	Seed treatment and resistant varieties.
Ergot, a fungus, Claviceps purpurea Temperate, humid and semi-humid areas.	A few to many kernels of a head are replaced by conspicuous blue-black sclerotial bodies.	Crop rotations and removal or cutting of weed grasses.
Fusarium blight or scab, fungi: Gibberella zeae and Fusarium spp. Temperate, humid and semi-humid areas. Head blight phase occurs in humid Eastern and Central States. Seedling blight and root rot phase extends into drier prairie and plains areas.	Heads dwarfed and compressed; blighted kernels shrunken; seed hulls lusterless, often bear salmon-colored fungus; seedlings blighted; roots rotted.	Resistant varieties offer best means of control. Clean seed and seed treatment help control seedling infection. Sanitation, rotation, and early planting help reduce crown infection and head blight.
Leaf rust, a fungus, Puccinia hordei Humid and semihumid areas.	Light, yellowish-brown rust pustules on leaf blades and sheaths; ruptured host epidermis around pustule generally inconspicuous.	Resistant varieties.
Mosaic, wheat mosaic viruses that overseason in soil Coincident with the soil-borne wheat mosaic viruses where winter barley is grown.	Leaf mottling and stunting of plants.	Resistant varieties.
Net blotch, a fungus, Pyrenophora teres Temperate, humid and semi-humid areas.	Leaves develop dark-brown stripes with a characteristic netted pattern.	Sanitation; crop rotation; seed treatment with standard mercury fungicides.
Nigra loose smut, a fungus, Ustilago nigra General with barley.	Powdery, smutted heads very similar to those of the nuda loose smut.	Seed treatment and resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
BARLEY cont.		
Nuda loose smut, a fungus, Ustilago nuda		
General in humid and semi-humid areas.	Normal heads replaced with black masses of powdery smut.	Treatment of seed with hot water.
Powdery mildew, a fungus, Erysiphe graminis		
Severe throughout the humid and semihumid areas of the world.	Cottony white growth on leaf blades, leaf sheaths, and floral bracts.	Use of resistant varieties is only practical control.
Scald, a fungus, Rhynchosporium secalis		
Cooler humid and semi-humid sections of North America.	Scaldlike blotches on leaf blades and sheaths.	Resistant varieties, crop rotation, and elimination of crop residue.
Spot blotch, a fungus, Helminthosporium sativum		
Widespread in North America.	Dark-brown blotches on leaves; kernels blackened at embryo end.	Resistant varieties, seed treatment with mercury compounds; sanitation and crop rotation.
Stem rust, a fungus, Puccinia graminis		
Throughout humid and semi-humid temperate regions.	Reddish-brown rust pustules on leaves and stem; ruptured epidermis of the host surrounds pustule.	Resistant varieties and barberry eradication.
Stripe, a fungus, Helminthosporium gramineum		
World-wide.	Yellow stripes on leaf blades and sheaths which later turn brown; infected tissues dry out and fray as leaves mature; heads fail to emerge in many diseased plants; culm length reduced.	Resistant varieties and seed treatment with mercurial fungicides.
Stripe mosaic (false stripe), a seed-borne virus		
Probably general with barley culture.	Chlorotic stripes, brown stripes, mosaic mottling, stunting of plants.	Use of seed from disease-free fields.
Stripe rust, a fungus, Puccinia glumarum		
Limited to areas of relatively cool summer temperatures and humid winters.	Narrow stripes of yellow rust on leaf blades, leaf sheaths, and floral bracts.	Resistant varieties.
Yellow dwarf, a virus		
California	Yellowing of leaves, stunting of plants.	Control of aphids that transmit the virus; possibly resistant varieties.
CORN:		
Bacterial leaf blight (Stewart's), a bacterium, Bacterium stewarti		
Throughout Corn Belt; Eastern and Southern States.	Long, irregular streaks running along veins of leaves killing them in severe cases and appearing to fire plants from bottom upward.	Resistant hybrids and varieties.

HOST Disease and Cause Distribution	Symptoms	Control
CORN cont.		
Brown spot, a fungus, Physoderma maydis Gulf States and occasionally South Atlantic States.	Golden to brown, smooth pustules on leaves, stalks, and sheaths; black rot sometimes causing stalks to break.	None. (Differences in resistance to its attack exist.)
Cob rot, fungi: Nigrospora sphaerica and N. oryzae Variable; all corn-growing areas, especially northwestern sections of Corn Belt.	Bleached, dull, chaffy kernels on ears that can be easily pressed into cob; ear easily broken; inside cobs and shanks shredded; black spores scattered over butt end of ear and tips of kernels; on mildly affected ears only base or tip of cob chocolate brown.	Use of hybrids well adapted to area is recommended.
Common smut, a fungus, Ustilago maydis All-corn growing areas	Conspicuous silver-white glistening knobs on any aboveground parts of plant that break later to become masses of black, sooty spores.	Balanced soil fertility to maintain uniform growth; clean cultivation and removal of diseased plants from field.
Crazy top, a fungus, Sclerospora macrospora Sporadically in southern Corn Belt.	Bunchy appearance of tassel due to replacement by numerous small leaves; stunting of plant; excessive tillering; narrow streaked leaves; barrenness.	None. Drainage of lower parts of fields recommended.
Dry or white ear rot A fungus, Diplodia zeae All principal corn areas, especially Eastern and Southeastern States, during warm, wet seasons.	Bleached husks and dropping of ears near soft-dough stage; rotting of shank; ear rot usually beginning at base and appearing grayish brown; kernels dried and cemented together, covered with white to gray growth; in light infections kernels only blackened at tip.	Resistant hybrids and varieties (no resistance is complete); rotation.
A fungus, Diplodia macrospora Southern States	Same as above; also spots on leaves.	Resistant hybrids and varieties (no resistance is complete); rotation.
Gray ear rot, a fungus, Physalospora zeae Corn Belt	Tightly cemented bleached husks, upright and gray at harvest; grayish-white mold between kernels at butt end of ear; pith slate gray with scattered black specks; kernels gray or with black streaks or flecks.	Resistant hybrids or varieties.

HOST Disease and Cause Distribution	Symptoms	Control
CORN cont.		
Head smut, a fungus, Sphacelotheca reiliana		
Pacific Coast States and scattered localities in Southwestern States.	Smut galls or knobs on tassels and ears of plant breaking into loose dark-brown spore masses.	Avoid planting in smutted field for 2 years; use treated certified seed; resistant hybrids and varieties.
Helminthosporium leaf spot, a fungus, Helminthosporium carbonum, race I.		
Corn Belt, on only a few strains of corn.	Small, tan to brownish spots with zonate pattern on all parts of plant, spots generally circular or oval and covered with black spores, especially on sheaths; also sometimes blackened ears.	Resistant hybrids or varieties.
Mosaic, sugarcane mosaic virus		
Central Gulf region, especially sugarcane-growing States.	Mosaic mottling of leaves or striping of light green surrounded by normal green tissue; suckering to a slight degree.	Tolerant hybrids or varieties; control of aphids that transmit virus.
Northern leaf blight, a fungus, Helminthosporium turcicum		
All corn-growing areas.	Long, elliptical greenish-brown spots on leaves beginning at bottom of plant and diminishing upwards; may destroy entire leaves making plants appear fired.	Resistant hybrids or varieties.
Pink ear rot, a fungus, Gibberella fujikuroi (Fusarium moniliforme)		
Corn Belt, especially western parts where dry weather prevails during growing season.	Pink, powdery rot scattered in spots, especially at tips of ears, appearing after kernels are dented, usually following injuries or exposure.	Resistant hybrids or varieties.
Red ear rot, a fungus, Gibberella zeae		
Corn Belt, particularly northern part; other corn-growing areas.	Ear rot usually beginning at tip, with reddish color to kernels and husks, sometimes cemented together.	Resistant hybrids and varieties; clean plowing to bury old stalks; rotation.
Rhizoctonia ear rot, a fungus, Rhizoctonia zeae		
Florida and neighboring States.	In early stages, ear covered with pink mold, later turns gray; tightly cemented husks.	None.
Root rots, fungi: Pythium arrhenomanes, Gibberella zeae, G. fujikuroi, Diplodia zeae		
Variable; over Corn Belt and southern corn areas.	Rotting of embryo and secondary rootlets; stunting of plants; reduction in vigor; premature death; lodging.	Crop rotation with plants immune from root-rotting fungi such as legumes; use of resistant hybrids and varieties.

HOST Disease and Cause Distribution	Symptoms	Control
CORN cont.		
Rust, a fungus, Puccinia sorghi		
All corn-growing areas	On leaves, small, reddish-brown pustules that break through surface and scatter powdery spores; near end of season pustules turn black.	None. (Differences in resistance to it by hybrids and varieties.)
Seedling blights, fungi: Aspergillus sp., Penicillium sp., Pythium arrhenomanes, Diplodia zeae, Gibberella zeae, Nigrospora oryzae, Fusarium moniliforme.		
Variable, depends on climate; throughout all corn-growing areas.	Failure of plant to emerge; blighting off after emergence; yellowing and wilting of leaves.	Use of sound, mature, treated seed; planting in warm soil; resistant hybrids or varieties.
Southern leaf blight, a fungus, Cochliobolus heterostrophus (Helminthosporium maydis)		
Southern Corn Belt and Southern States.	Small, buff to reddish brown, generally angular spots with zonate pattern on leaves; leaves may appear fired.	Resistant hybrids or varieties.
Stalk rots		
A fungus, Diplodia zeae		
Corn Belt, wherever corn is grown.	Maturing plants wilt while green; lower stalk darker; pith destroyed; stalks break over.	Use of resistant hybrids and varieties well adapted to area; balanced soil fertility.
A fungus, Gibberella zeae		
Northern Corn Belt and Northeastern States.	Rotting of crown or lower internodes; pinkish, shredded inner stalk.	Resistant hybrids and varieties; clean plowing to turn under residue; crop rotation.
A fungus, Pythium aphanidermatum (P. butleri).		
Corn areas in southern and eastern coastal States, and Southern Corn Belt.	Brown and soft rotting of stalks near ground sometimes twisting and falling over; follows high humidity and temperature.	None; rotations recommended.
Stalk rots, bacterial		
A bacterium, Erwinia dissolvens		
Southern Corn Belt and Southern States.	Brown, discolored soft area near base of stalk; pungent odor.	None; rotations recommended.
A bacterium, Pseudomonas alboprecipitans		
Southern Corn Belt and Southern States.	Dark-brown to black rot of nodes and internodes just above ear node; outer stalk with brownish-red streaks; inner stalk black but without pungent odor.	None.

HOST Disease and Cause Distribution	Symptoms	Control
CORN cont.		
Stunt, a virus		
California, Texas	Chlorotic spotting and streaking, banding to yellowing and bleaching of leaves; tassels deformed; some red in leaves and stalks; axillary proliferations; stunting.	Early planting to avoid leafhoppers that transmit virus.
FLAX		
Browning and stem break, a fungus, Polyspora lini		
General	Light-gray to brown, circular lesions on cotyledons lead to cankers on cotyledonary node and break-over of stem.	Seed treatment or use of disease-free seed; resistant varieties.
Fusarium wilt, a fungus, Fusarium oxysporum f. lini		
General with flax culture.	Yellow leaves, thick apical leaves, plants die and turn light brown.	Resistant varieties.
Heat canker, physiological		
Semihumid areas of high altitude and intense sunlight.	Heat near soil line kills cortical tissue and forms cankers that girdle stem; stem breaks over; invading organisms aggravate injury.	Early sowing; higher seeding rates; rows running east to west; sowing of flax-grain mixtures to produce more shade.
Pasmo, a fungus, Mycosphaerella linorum		
General.	Lesions on cotyledons and then on lower leaves; lesions are circular, greenish yellow to brown; later pycnidia develop on them.	Seed treatment; sanitation; deep plowing to cover straw; resistant varieties.
Powdery mildew, a fungus, Erysiphe cichoracearum		
North Central States; rare.	Superficial gray mycelium on leaves, stems, and floral structures.	Not serious enough to require control.
Rust, a fungus, Melampsora lini		
General with flax culture.	Light to orange-yellow aecia and pycnia on leaves and stems early in growing season; later uredia and uredospores appear, and then telia and teliospores form to overwinter the fungus.	Crop rotation; plowing under all crop refuse; thorough cleaning of seed to remove infected leaf particles; resistant varieties.
Seedling blight and root rot, a fungus, Pythium sp.		
Coexistent with flax.	Weak, dwarfed seedlings; lower leaves turn brown; soft brown rot of root.	Crop rotation and proper seed treatment.
OATS		
Apical and eyespot mosaic, soil-borne viruses		
North and South Carolina, Georgia, Alabama	Green to yellow mottling and eyespots on foliage; some stunting.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
OATS cont.		
Bacterial stripe blight, a bacterium, Pseudomonas striafaciens		
General.	Sunken water-soaked spots coalesced into stripes; bacterial exudate on leaves.	Crop rotation; seed treatment; resistant varieties.
Covered smut, a fungus, Ustilago kolleri		
General.	Smut replaces kernels within glumes.	Seed treatment and resistant varieties.
Crown rust, a fungus, Puccinia coronata		
General.	Orange-yellow uredia on leaves and stems; later dark telia.	Resistant varieties; eradication of Rhamnus spp.
Halo blight, a bacterium, Pseudomonas coronafaciens		
General in humid areas.	Small, green to light-brown, water-soaked lesions on leaves, sheaths, and floral bracts.	Seed treatment; sanitation; rotation.
Helminthosporium leaf blotch, a fungus, Pyrenophora avenae (Helminthosporium avenae).		
General.	Reddish-brown, oblong to linear leaf blotches with sunken centers and abundant conidia.	Resistant varieties.
Leaf reddening, barley yellow dwarf virus		
California.	Reddening and chlorosis of foliage; stunting.	Aphid control; resistant varieties.
Loose smut, a fungus, Ustilago avenae		
General.	Naked smut without glumes replaces kernels.	Seed treatment and resistant varieties.
Powdery mildew, a fungus, Erysiphe graminis avenae		
General.	Light-gray mold on leaves.	Resistant varieties.
Scab or fusarium blight, fungi: Fusarium and Gibberella spp.		
General.	Straw-colored blighted kernels with pinkish mass of mycelium and spores.	Rotation and resistant varieties.
Stem rust, a fungus, Puccinia graminis avenae		
General.	Reddish-brown spores in pustules on stem and leaves; later black teliospores.	Resistant varieties and barberry eradication.
RICE		
Black sheath rot, a fungus, Ophiobolus oryzinus		
Arkansas, Louisiana, Texas	Sheaths rot at water line in July-August.	None described.
Blast, a fungus, Piricularia oryzae		
General except California.	Dark spots on leaves and stems; stalks or heads break over.	Flooding of fields when spots appear; resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
RICE cont.		
Bordered sheath spot, a fungus, Rhizoctonia oryzae, R. solani, and R. zeae		
Louisiana, Texas, Arkansas, Colorado	Spots on sheath above water line, brown margins and cream color.	Fertility balance to prevent excessive vegetative growth.
Brown spot and rotten neck, a fungus, Helminthosporium oryzae		
Southern U. S.	Reddish-brown leaf spots, dried leaves, brown glumes, broken-over heads.	Seed treatment; resistant varieties.
Cercospora or narrow brown leaf spot, a fungus, Cercospora oryzae		
Arkansas, Louisiana, Texas.	Narrow brown spots on leaves in August and September.	Resistant varieties.
Kernel smut, a fungus, Neovossia horrida		
Arkansas, Louisiana, Texas.	A few smutted kernels on some heads.	None described.
Leaf smut, a fungus, Entyloma oryzae		
Arkansas, Louisiana, Texas.	Small black spots on leaves.	None described.
Root knot, a nematode, Meloidogyne sp. (Heterodera marioni)		
Arkansas.	Swollen roots; dwarfed yellow plants.	Rotation with immune crops.
Seedling blight, fungi: Sclerotium rolfsii, Helminthosporium oryzae, Curvularia lunata		
Gulf States rice area.	Poor emergence; seedlings diseased at soil surface, many killed.	Seed treatment; immediate submergence of land when blight appears.
Stem rot, fungi: Leptosphaeria salvinii, Helminthosporium sigmoideum irregulare		
Chiefly Arkansas and Louisiana; some in California and Texas.	Lesions on leaf sheaths near water line with black sclerotia on sheaths and stalks; heads break over.	Drainage of fields before culms are infected.
Straighthead, physiological		
Southern U. S.	Unfilled erect heads; dark-green leaves; poor root system.	Midseason drainage; proper soil management; rotation.
White tip, a nematode, Aphelenchoides oryzae		
General	Colorless leaf tips; distorted, sterile panicles.	Seed fumigation with methyl bromide to kill nematodes..
RYE		
Anthracnose, a fungus, Colletotrichum graminicola		
North Central States	Premature ripening or dying; bleaching then browning of culm bases and crown tissue; black acervuli on leaves and stems.	Crop rotation with legumes; improved soil fertility.

HOST Disease and Cause Distribution	Symptoms	Control
RYE cont.		
Bacterial blight, a bacterium, Xanthomonas translucens f. secalis		
General.	Water-soaked lesions on leaves, with bacterial exudate present.	Rotation; seed treatment; resistant selections.
Ergot, a fungus, Claviceps purpurea		
General.	Dark sclerotia in place of some kernels.	Crop rotation; destruction of grass hosts.
Fusarium blight or scab, fungi: Gibberella and Fusarium spp.		
Humid and semihumid rye areas.	Seedling blight, foot rot, and head blight.	Rotation; sanitation; seed treatment.
Leaf blotch, a fungus, Septoria secalis		
General.	Light-brown blotches with pycnidia.	Rotation; sanitation; seed treatment.
Leaf rust, a fungus, Puccinia rubigo-vera secalis		
General.	Orange-brown uredia on leaves and sheaths; telia beneath epidermis.	Resistant varieties; dusting.
Leaf scald, a fungus, Rhynchosporium secalis		
General.	Water-soaked, irregular, scaldlike blotches on leaves.	Rotation; spring burning of perennial grass hosts.
Nematode disease, a nematode, Anguina tritici		
Southeast U. S.	Small, hard, tan galls replace kernels.	Rotation with crops other than wheat; use of gall-free seed.
Septoria leaf blotch, a fungus, Septoria secalis		
General.	Brown pycnidia on leaf blotches.	Seed treatment; sanitation.
Snow mold, foot rot, and head blight, a fungus, Calonectria graminicola		
Northern wheat areas of U. S.	Crown rot, head blight, shriveled kernels.	Good drainage; rotation.
Stalk smut, a fungus, Urocystis occulta		
General.	Sori in parenchyma of stem beneath epidermis, which ruptures to release spores.	Seed treatment; rotation; resistant varieties.
Stem rust, a fungus, Puccinia graminis secalis		
General.	Pustules of red uredospores on stems and sheaths; later black overwintering teliospores.	Barberry eradication; dusting; resistant varieties; eradication of grass hosts.
Stripe rust, a fungus, Puccinia glumarum		
Pacific and intermountain areas.	Orange-yellow pustules uniting to form stripes on leaves.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
SORGHUM		
Anthracnose, a fungus, Colletotrichum graminicola		
Humid and semihumid areas.	Small spots, tan to reddish, enlarge to cover much of leaves; black pinpoint fruiting bodies among short hairs.	Clean culture and rotation, but chiefly resistant varieties.
Bacterial spot, a bacterium, Pseudomonas syringae		
Southeast U. S.	Dark-green spots turning to red, then light in center with red border.	Sanitation, seed treatment, and resistant varieties.
Bacterial streak, a bacterium, Xanthomonas holcicola		
General.	Narrow, water-soaked, translucent streaks with red-brown margins and beads of exudate.	Sanitation, seed treatment, and resistant varieties.
Bacterial stripe, a bacterium, Pseudomonas andropogoni		
General.	Irregular red stripes with exudate; scales on leaves.	Sanitation, seed treatment, and resistant varieties.
Charcoal rot, a fungus, Macrophomina phaseoli (Sclerotium bataticola)		
General.	Near maturity, premature ripening, inferior heads lightweight kernels, lodging, soft base with shredded interior, and black sclerotia on vascular strands.	Development of resistant varieties.
Colletotrichum stalk rot, a fungus, Colletotrichum graminicola		
Humid and semihumid areas.	Leaf stage usually precedes stalk rot; poor heads; stalks rot inside and break over.	Clean culture, rotation, and resistant varieties.
Covered kernel smut, a fungus, Sphacelotheca sorghi		
General.	Kernels replaced by smut galls.	Seed treatment and resistant varieties.
Fusarium stalk rot, a fungus, Gibberella fujikuroi (Fusarium moniliforme)		
General.	Similar to charcoal rot externally, but internally red to dark rot and no shredding or sclerotia.	Development of resistant varieties.
Gray leaf spot, a fungus, Cercospora sorghi		
Gulf States.	Long, narrow, reddish-purple or tan leaf spots.	Development of resistant varieties or strains.
Head smut, a fungus, Sphacelotheca reiliana		
Sporadic.	Head replaced by black spore mass.	Sanitation and resistant varieties.
Leaf blight, a fungus, Helminthosporium turcicum		
Humid and semihumid areas.	Can cause seed rot and seedling blight; on leaves reddish to tan spots merge to kill leaves; spores form in center.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
SORGHUM cont.		
Loose kernel smut, a fungus, Sphacelotheca cruenta		
General.	Stunting, excessive branching, and loose smut in heads.	Seed treatment and resistant varieties.
Periconia root rot, a fungus, Periconia circinata		
Southwest.	Stunting, yellowing of leaves, and premature death of plant.	Resistant varieties.
Rhizoctonia stalk rot, a fungus, Rhizoctonia solani		
Texas	Reddish pith, large brown sclerotia under leaf sheaths.	Clean culture, rotation, and resistant varieties.
Rough spot, a fungus, Ascochyta sorghina		
Southeast U. S.	Circular to oblong spots turning red or tan; tiny black pycnidia developing in spots.	Rotation and resistant varieties.
Rust, a fungus, Puccinia purpurea		
General.	Fruiting pustules with brown spores on leaves.	Resistant varieties.
Seed rot and seedling blight, fungi: species of Fusarium, Aspergillus, Penicillium, Rhizoctonia, etc.		
General.	Seed rot, damping-off, blighted seedlings, weak plants.	Seed selection and treatment; planting in warm, well-prepared soil.
Sooty stripe, a fungus, Ramulispora sorghi		
General.	Long, elliptical lesions with black sclerotia in tan center.	Development of resistant varieties or strains.
Target spot, a fungus, Helminthosporium sorghicola		
Southeast and Southern U. S.	Leaf lesions with light centers and alternate light and dark bands.	Development of resistant varieties or strains.
Weak neck, physiological		
General.	Early-maturing peduncle weakens and head breaks over.	Breeding for stronger peduncles.
Zonate leaf spot, a fungus, Gloeocercospora sorghi		
Southeast U. S.	Reddish-purple bands alternating with tan areas on leaf margin.	Seed treatment and resistant strains.
SWEET CORN:		
Bacterial wilt (Stewart's disease), a bacterium, Bacterium stewarti		
All corn-growing areas.	Young plants wilt as if lacking water; green leaves wilt and die, others become stunted with irregular streaks, produce nubbins or no ears; stalk will ooze yellow droplets if cut crosswise.	Resistant hybrids and varieties.

For other diseases see under corn.

HOST Disease and Cause Distribution	Symptoms	Control
WHEAT:		
Brown root rots, fungi: Gibberella zeae (Fusarium graminearum), Fusarium spp.		
General, especially in humid and semihumid areas.	Light to reddish-brown soft rot of roots and culms; seedling blight.	Seed cleaning and treatment; crop rotation; deep plowing of residues; balanced soil fertility.
Bunt or stinking smut, fungi: Tilletia caries and T. foetida		
Generally coexistent with wheat.	Smut balls replace kernels; fishy odor; T. caries stunts plants.	Seed treatment and resistant varieties.
Dry-land crown and root rot, fungi: Helminthosporium sativum and other species		
General.	Dark rot of roots, sheaths, culms, and crown tissue; seedling blight; leaf lesions; "black point" in seed.	Crop rotation; seed treatment; late fall seeding.
Dwarfing and greening, yellow dwarf virus		
California	Dwarfing and deep-green color.	Resistant varieties and aphid control.
Ergot, a fungus, Claviceps purpurea		
Humid areas	Dark sclerotia replace some kernels.	Rotation; elimination of grass hosts.
Leaf rust, a fungus, Puccinia rubigo-vera tritici		
General; severe in humid areas.	Uredospores on leaves; if severe, plants are killed.	Resistant varieties.
Loose smut, a fungus, Ustilago tritici		
General.	Black, loose smut mass, replaces kernels.	Hot-water seed treatment; resistant varieties.
Mosaic and rosette, soil-borne viruses		
Eastern U. S.	Leaf mottling and plant dwarfing.	Resistant varieties.
Nematode disease, a nematode, Anguina tritici		
Southeast U. S.	Plants stunted; leaves twisted and curled; hard dark galls replace kernels.	Rotations; use of seed free from galls.
Pythium root rot, fungi: Pythium spp., especially P. arrhenomanes		
General, especially in prairie soils.	Light-brown soft rot of roots, sheaths, and stalk; stunting; seedling blight; pale-green color.	Inadequate; rotation with legumes; balanced soil fertility.
Rhizoctonia blight, a fungus, Rhizoctonia solani		
General.	Stunting; rot of roots, crown, sheaths, and culms.	Rotation and balanced soil fertility.
Scab, a fungus, Gibberealla zeae (Fusarium graminearum)		
General, especially in humid areas.	Head blight, with salmon-colored fungus; also foot rot and seedling blight.	Crop rotation; sanitation; seed treatment; resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
WHEAT cont.		
Stem rust, a fungus, Puccinia graminis tritici		
Generally, coexistent with wheat.	Red uredospores on stems; later, black teliospores for overwintering.	Resistant varieties; barberry eradication.
Straw-breaker foot rot, fungi: Cercosporella herpotrichoides		
Columbia basin prairie soils.	Eyespot lesions; blackening and breaking of culms; lodging.	Rotation with legumes; light late seeding good soil preparation.
Streak mosaic, a virus		
Central U. S.	Dwarfing and leaf mottling.	None developed.
Striate mosaic, a virus		
South Dakota, Nebraska, Kansas	Dwarfing and leaf mottling.	None developed.
Stripe rust, a fungus, Puccinia glumarum		
Western U. S.	Orange-yellow pustules on stripes on leaves.	Resistant varieties.
Take-all, a fungus, Ophiobolus graminis		
General, but especially Kansas and Pacific Northwest.	Rotting and darkening of roots and crown; bleaching of leaves, culms, and heads.	Rotation with corn, oats, and legumes. Keep up level of potassium and phosphorus fertility.

DISEASES OF FIBER CROPS

HOST Disease and Cause Distribution	Symptoms	Control
COTTON:		
Anthracnose, a fungus, Glomerella gossypii		
Primarily in the Southeast but extends into Texas and Oklahoma.	Seedling blight, leaf spots, stem cankers and boll rots.	Destruction of diseased plant residues; rotation; and seed treatment.
Bacterial blight, a bacterium, Xanthomonas malvacearum		
Throughout the area where cotton is grown.	Water-soaked spots on cotyledons, leaves, and bolls; vein blight; cankers on stalk.	Destruction of diseased plant residues, use of resistant varieties, and seed treatment.
Boll rots, a large number of parasitic and saprophytic fungi and bacteria.		
Throughout the area where cotton is grown.	Sunken spots on surface and staining or destruction of interior of bolls.	Seed treatment and use of bacterial blight resistant varieties.
Fusarium wilt, a fungus, Fusarium oxysporum f. vasinfectum		
Primarily in the Southeast but extends into Texas and Oklahoma.	Stunting of plants; yellowing and wilting of leaves often followed by death of entire plant; brown to black discoloration of woody portion of stalk.	Use of resistant varieties, fumigation to reduce root knot and other nematodes, addition of humus to soil, use of fertilizers high in potash, crop rotations.
Root knot, nematodes or microscopic eelworms, Meloidogyne incognita		
Throughout the area where cotton is grown but principally on the lighter soils.	Loss of vigor, stunting or death of plants; roots covered with knots or galls at points of infection.	Fumigation with locally recommended soil fumigant; rotation with immune crops, clean fallow with deep summer tillage.
Root rot, a fungus, Phymatotrichum omnivorum		
In the highly calcareous soils of the Southwest.	Slight bronzing of leaves followed by sudden wilting and death of plants.	Fall plowing with phosphate additions and Hubam clover as winter cover crop or seed crop; rotation with grain crops or Hubam clover; heavy applications of organic manures in irrigated areas.
Damping-off and seedling diseases, complex of seed and soil-borne fungi and bacteria		
Throughout the area where cotton is grown.	Rotting of seed before germination, death of seedling before and after emergence, unthrifty seedlings and skippy stands.	Seed treatment, destruction of diseased plant residues, and use of blight-resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
COTTON cont.		
Root rot, a fungus, Sclerotium rolfsii		
Certain areas of Florida and Cuba.	Rotting of roots and base of plant with shredding of bark.	Avoid planting in infested areas.
Verticillium wilt, a fungus, Verticillium albo-atrum		
Throughout the Cotton Belt but primarily in the Mississippi Valley and the irrigated Southwest.	Stunting of plants; yellowish areas between principal veins and at margins of leaves; shedding of leaves, squares, and young bolls; brownish streaks in woody portion of plant.	Use of tolerant varieties; rotation with grain crops; use of cantaloup-type beds or extra high ridges to increase soil temperature; increase of plant populations. In irrigated areas avoid moisture stress after fruiting begins.
Ascochyta, or wet-weather, blight, a fungus, Asoschyta gossypii		
Principally in the Southeastern States.	Reddish-brown spots on leaves; brownish, elongate cankers on stem; generally unthrifty growth.	Destruction of diseased plant residues, seed treatment, early control of insects.
FLAX. See Flax in table on diseases of cereal crops.		
KENAF:		
Colletotrichum tip blight, a fungus, Colletotrichum hibisci		
Florida and Cuba.	Seedling blight tip blight and witches'-broom of older plants.	Seed treatment and use of resistant varieties or selections.
Root knot, nematodes or microscopic eelworms, Meloidogyne incognita		
Florida and Cuba in old cultivated areas and on lighter soils following truck crops.	Knots or galls on roots, stunted or dying plants.	Fumigation with soil fumigants such as Shell D-D or Dowfume W-40 or W-85.

HOST Disease and Cause Distribution	Symptoms	Control
AZALEA:		
Petal blight, a fungus, *Ovulinia azaleae*		
Maryland to Texas, California.	Brown spots on white flowers, white spots on colored flowers, extending to soft limp blight of whole blossom.	Frequent spraying during season of bloom.
CALLA LILY:		
Soft rot, a bacterium, *Erwinia carotovora*		
General.	Soft decay of rhizomes and bases of leaves and flower stalks.	Sorting and treatment of rhizomes.
Root rot, a fungus, *Phytophthora richardiae*		
General in greenhouses.	Rotting of roots, yellowing and drooping of leaves, spongy rot of rhizomes.	Sorting and treatment of rhizomes; soil treatment.
CAMELLIA:		
Dieback, a fungus, *Glomerella cingulata*		
Widespread.	Dieback and blackening of young shoots, cankers on older branches.	Pruning and spraying have possible value.
Flower blight, a fungus, *Sclerotinia camelliae*		
California, Georgia, Oregon, North Carolina.	Brown spots on petals expanding to brown blight of entire flower.	Ground sprays or destruction of fallen flowers.
Leaf gall, a fungus, *Exobasidium camelliae*		
Southeastern States.	Diseased leaves much enlarged and thickened, white below.	Picking and destruction of galls; sprays if necessary.
CARNATION:		
Bacterial wilt, a bacterium, *Pseudomonas caryophylli*		
General in greenhouses.	Grayish green leaves; wilting; root rot; yellow streaks in conductive tissues, diseased tissues sticky.	Use of cultured cuttings or cuttings from disease-free stock; soil treatment.
Collar blight, a fungus, *Alternaria dianthi*		
General.	Leaf spots, stem and branch rot; affected areas dark brown to black with fungus growth.	Sprays for outdoor plants or keep plants in greenhouse.
Fusarium wilt, a fungus, *Fusarium oxysporum* f. *dianthi*		
General.	Slow wilting, often in one side of plant; straw-yellow leaves; brown streaks in conductive tissue.	Use of cultured cuttings or cuttings from disease-free stock; soil treatment.
Stem rot, a fungus, *Rhizoctonia solani*		
General.	Soft moist decay of stem surface near soil line; wilting.	Shallow planting; soil treatment.

HOST Disease and Cause Distribution	Symptoms	Control
CARNATION cont.		
Rust, a fungus, Uromyces caryophyllinus		
General.	Chocolate-brown pustules in leaves and stems.	Avoid wetting leaves; spray.
CHINA ASTER:		
Wilt, a fungus, Fusarium oxysporum f. callistephi		
General.	Wilting; blackening of stem near soil line; browning of conductive tissue.	Resistant varieties or seed and soil treatment.
Yellows, a virus		
General.	Yellowing; many lateral shoots with upright growth; flowers bleached or green.	Use of cloth enclosures; insecticidal sprays help.
CHRYSANTHEMUM:		
Leaf spot, a fungus, Septoria chrysanthemi		
General in gardens.	Yellowish spots becoming brown to black with minute black dots near the centers.	Mulch around plants helps; sprays.
Leaf nematode, a nematode, Aphelenchoides ritzema-bosi		
Widespread in gardens.	Yellowish spots becoming brown to black, often delimited by veins to form wedge-shaped areas; leaves finally wither and droop.	Use of disease-free plants; soil treatment; sprays.
Wilt, a fungus, Verticillium albo-atrum		
General.	Leaves yellow then brown; sometimes dark streaks in conductive tissues of affected stems.	Use of disease-free plants; soil treatment; some varieties resistant.
Stunt, a virus		
General.	Plants small with small leaves and flowers; bronze and pink flowers become paler or yellow.	Use of disease-free plants. Avoid handling diseased and healthy plants in turn.
DAHLIA:		
Mosaic, a virus		
General.	Yellowing along leaf veins, mottling, marked stunting in some varieties.	Roguing and control of aphids or use of tolerant varieties.
GLADIOLUS:		
Fusarium rot, a fungus, Fusarium oxysporum f. gladioli		
General in warmer soils and climate.	Leaves yellow then brown; firm brown decay of corms in field or storage.	Sorting and treatment of corms; rotation.
Dry rot, a fungus, Stromatinia gladioli		
General in cooler soils and climate.	Neck rot with black dots in rotted area; dark-brown to black firm decay of corms, margins raised.	Sorting and treatment of corms; rapid curing after harvest; rotation.

HOST Disease and Cause Distribution	Symptoms	Control
GLADIOLUS cont.		
Botrytis blight, a fungus, Botrytis gladiolorum		
General in cooler soils and climate.	Brown blight and rot of leaves, stems, and flowers with gray mold in cool wet weather; neck rot; firm brown rot of corms in storage.	Sorting and treatment of corms; rapid curing after harvest; sprays to control leaf and flower blight.
Scab, a bacterium, Pseudomonas marginata		
General.	Neck rot; shallow horny circular lesions on corms that lift out easily; brown streaks in husks.	Sorting and treatment of corms; rotation.
Curvularia blight, a fungus, Curvularia lunata		
General, chiefly in warmer areas.	Tan-colored elliptical leaf spots with darker margins; flower blight; firm brown corm rot.	Sorting and treatment of corms; sprays.
Stemphylium leaf spot, a fungus, Stemphylium sp.		
General.	Red leaf spots. Some strains cause extensive leaf rot.	Sprays.
HOLLYHOCK:		
Rust, a fungus, Puccinia malvacearum		
General.	Orange to reddish pustules on lower leaf surfaces and stems; leaves wither and droop if heavily rusted.	Removal of infected parts in fall and in early spring; sprays.
IRIS:		
Soft rot, a bacterium, Erwinia carotovora		
General.	Rapid wet rot of rhizomes and leaf bases; wound pathogen often following iris borer.	Cut out rotted areas, treat, dry and replant every 3 or 4 years.
Leaf spot, a fungus, Didymellina macrospora		
General.	Light brown leaf spots with dark brown borders.	Removal of infected parts in fall; sprays.
Southern blight, a fungus, Sclerotium rolfsii		
Widespread in warm soils.	Crown rot of iris and many other plants with strands of mycelium and sclerotia resembling mustard seeds.	Removal of infected plants; soil treatment.
LILAC:		
Bacterial blight, a bacterium, Pseudomonas syringae		
Widespread.	Brown to black water-soaked spots in leaves and soft young shoots extending rapidly in cool wet weather.	Pruning to remove infected parts and improve air circulation.
Phytophthora blight, a fungus, Phytophthora cactorum		
Northeast, Middle West.	Brown blight of blossoms and soft young shoots in cool wet weather.	Pruning, sprays. Keep lilac and rhododendron apart.

HOST Disease and Cause Distribution	Symptoms	Control
LILAC cont.		
Mildew, a fungus, Microsphaera alni General.	Leaves, coated with white mycelium chiefly in late summer and fall.	Sprays or dusts. Syringe with hose.
LILY:		
Botrytis blight, a fungus, Botrytis elliptica General.	Small oval leaf spots to extensive blighting of leaves and flowers in susceptible species in moist weather.	Removal of infected parts; sprays.
Fusarium rot, a fungus, Fusarium oxysporum f. lilii General.	Brown rot separating bulb scales from the base, destroying bulbs of Madonna, Easter lilies, and others.	Sorting and treatment of bulbs; soil treatment.
Necrotic fleck, a virus complex General in Easter lily.	Pale to brown flecks in leaves with distortion of leaf surface; dwarfing; thin streaks in flowers.	Planting of disease-free stock at a distance from diseased lilies; control of aphids.
Rosette, a virus Rare in U. S.	Easter lilies short, pale green, with leaves curled downward.	Use of disease-free stock; control of aphids.
Dieback, a nematode, Aphelenchoides olesistus Pacific Northwest in Easter lily.	Leaves thickened and twisted, or turning brown and collapsing; flower buds distorted or killed.	Bulb treatment; roguing; rotation.
Scorch, physiogenic Pacific Northwest in Croft East lily.	Brown half-moon-shaped spots in leaves.	Avoid acid soils; supply nitrogen.
NARCISSUS:		
Basal rot, a fungus, Fusarium oxysporum f. narcissi General.	Soft brown rot of basal plate spreading into scales and destroying entire bulb in field or storage.	Sorting and treatment of bulbs; cool, well-ventilated storage; rotation; soil treatment.
Nematode, Ditylenchus spp. General.	In leaves yellowish pimples, twisting and rolling. Distortion of stems. Rotting of bulb scales resulting in brown ring as seen in cut bulb.	Sorting and treatment of bulbs; roguing; rotation; soil treatment.
Scorch, a fungus, Stagonospora curtisii General.	Reddish brown leaf spots first near tip, then general under warm moist conditions. Also on Amaryllis and relatives.	Bulb treatment; rotation; sprays.

HOST Disease and Cause Distribution	Symptoms	Control
NARCISSUS cont.		
Mosaic, a virus		
General.	Plants dwarfed. Leaves mottled or striped with light green to bright yellow, twisted, or with epidermis roughened in narrow bands. Flowers small, streaked.	Use disease-free stock, or rogue and control aphids.
Decline, a virus complex		
General.	Early maturity; after flowering, leaves show streaks of white, silver, or purple, or tips wither.	Use of disease-free stock, or roguing and control of aphids.
PEONY:		
Botrytis blight, a fungus, Botrytis paeoniae		
General.	Blight of young shoots as they emerge; bud blast; flower rot; leaf spot; in cool, wet weather the gray-brown fungus covers infected parts.	Removal of tops in fall; pick off infected parts; sprays.
Phytophthora blight, a fungus, Phytophthora cactorum		
Northeast, Middle West.	Blight of young shoots, leaves, and buds; cankers on older stems; wet rot of crowns; powdery spore masses of Botrytis are lacking.	Removal of tops in fall; pick off infected parts; sprays.
PHLOX		
Leaf blight, physiogenic		
Common in warmer areas.	Withering of leaves beginning with the lowermost; defoliation.	Use of seedlings or divisions rather than old clumps; mulches.
Mildew, a fungus, Erysiphe cichoracearum		
Common in late summer.	White powdery coating on both surfaces of leaves and on stems.	Sprays or dusts. Some varieties are resistant.
Leaf spots, fungi: Septoria divaricata, etc.		
Eastern States, Middle West.	Brown circular spots with light centers.	Removal of tops in fall; sprays if necessary.
RHODODENDRON:		
Sunscald and winter injury, physiogenic		
Widespread.	Brown areas near tips and margins of leaves; rolling of leaves; dieback of twigs and branches.	Protection from wind and direct sun during winter; water in fall.
Dieback, a fungus, Phytophthora cactorum		
Northeastern States.	Buds and young branches wilt and shrivel; leaves turn brown and roll; cankers in older branches; water-soaked leaf spots.	Pruning of old flowers and all infected parts; sprays. Keep lilac and rhododendron apart.

HOST Disease and Cause Distribution	Symptoms	Control
RHODODENDRON cont.		
Wilt, a fungus, Phytophthora cinnamomi		
New Jersey, New York, Pennsylvania	Leaves yellow, then wilted; roots rotted; brown stem rot at soil line. In young plants, chiefly in R. ponticum.	Removal of infected plants; avoid excess water; mulches.
ROSE:		
Black spot, a fungus, Diplocarpon rosae		
General.	Circular black leaf spots with fimbriate (fringed) margins; yellowing and defoliation usual, less in resistant varieties.	Spray or dust hybrid tea roses regularly. Some climbers and species are tolerant.
Mildew, a fungus, Sphaerotheca pannosa var. rosae		
General.	At first slight curling of leaves; later conspicuous white powdery coating on leaves, buds, and shoots.	Spray or dusts.
Brown canker, a fungus, Cryptosporella umbrina		
General.	Purple spots with light center in leaves and young canes, latter extending into long cankers and dieback in spring.	Removal of infected parts, especially in spring pruning; sprays or dusts as for black spot.
ROSE:		
Common canker, a fungus, Leptosphaeria coniothyrium		
General.	Small red or yellow spots in canes enlarge to girdling cankers dotted with black fruit bodies. Weak parasite invading pruning stubs and other wounds.	Removal of infected parts. Make clean cuts close above a node when pruning or cutting blooms.
Crown gall, a bacterium, Agrobacterium tumefaciens		
General.	Usually rounded galls or overgrowths at the soil line or less frequently on aerial stems. A wound parasite.	Avoid planting infected stock. Roguing, rotation, or soil treatment.
SNAPDRAGON:		
Rust, a fungus, Puccinia antirrhini		
General.	Chocolate-brown pustules in lower leaf surface and on stems.	Sprays. Resistance available against one form of rust.
Leaf spot, a fungus, Phyllosticta antirrhini		
Eastern and North Central States.	Brown circular spots in leaves and stems with black dot fruiting bodies; sometimes girdling cankers and stem rot.	Destruction of infected plants in fall; sprays.

HOST Disease and Cause Distribution	Symptoms	Control
SNAPDRAGON cont.		
Anthracnose, a fungus, Colletotrichum antirrhini Eastern and Southern States.	Gray spots with dark borders in leaves and stems, with girdling cankers and stem rot.	Destruction of infected plants in fall; sprays.
Wilt, a fungus, Verticillium albo-atrum Northern States, California.	Yellowing, wilting, slow death.	Avoid or treat infested soil.
SWEET PEA:		
Anthracnose, a fungus, Glomerella cingulata General, except Pacific Coast.	Blighting and shriveling of leaves, flower stalks, seed pods; general wilting and dieback.	Seed treatment; destruction of infected plants in fall.
Fasciation, a bacterium, Corynebacterium fascians Widespread.	Many short, thick, and flattened overgrowths from the stem near the soil line, with stunting of the plant.	Seed treatment; use of uncontaminated soil or soil treatment.
TULIP:		
Botrytis blight, a fungus, Botrytis tulipae General, except far South and Southwest.	Primary infection in crippled, dwarfed shoots covered with gray mold; secondary small pale spots in leaves and flowers; extensive rot of leaves and flowers under moist conditions.	Sorting and cleaning of bulbs; rotation; sprays.
Gray bulb rot, a fungus, Rhizoctonia tuliparum Northeastern and Pacific States.	Plants fail to emerge; bulbs rotted with massed fungus between the scales; flattened black sclerotia on bulbs and in soil.	Use of uncontaminated soil or soil treatment.
Flowerbreak, tulip-breaking virus General.	Flowers flamed or feathered with patterns of light and dark colors; leaves may show mottling.	Roguing; control of aphids.
Topple, physiogenic Greenhouse culture.	Part of the upper flower stalk just below the opening bloom becomes water-soaked and may exude droplets; later this area collapses and the flower topples over.	Calcium nitrate seems to reduce incidence of disease, but does not give complete control.

HOST Disease and Cause Distribution	Symptoms	Control
ZINNIA:		
Blight, a fungus, Alternaria zinniae		
Northeast, Colorado, South Carolina.	Reddish-brown spots with light centers in leaves and stems, enlarging to large brown leaf-blighted areas and girdling stem lesions.	Seed treatment; use of uncontaminated soil or soil treatment.
Mildew, a fungus, Erysiphe cichoracearum		
General.	White powdery fungus growth on leaf surfaces in late summer.	Destruction of infected plants in fall; sprays or dusts if necessary.

DISEASES OF SHADE TREES

HOST Disease and Cause Distribution	Symptoms	Control
AILANTHUS:		
Wilt, a fungus, Verticillium albo-atrum		
Wherever ailanthus grows.	Wilting and dying of leaves; branch and limb dieback; brownish streaks in wood.	Pruning of affected parts; fertilization; watering during dry weather; success of measures variable.
ARBORVITAE:		
Winter injury, cold and winter drying		
Wherever arborvitae grows.	Foliage turns brown in winter or spring.	Mulches over root area help to prevent.
Brown foliage in autumn, normal		
Wherever arborvitae grows.	Inner foliage turns yellow or brown in autumn and falls; outer leaves remain green.	None needed.
ASH:		
Anthracnose, a fungus, Gloeosporium aridum		
Wherever arborvitae grows.	Large, light-brown spots on leaves.	Usually not needed; where persistent spray with a fungicide.
Rust, a fungus, Puccinia peridermiospora		
Where ash and cord grasses grow in proximity.	In spring conspicuous swelling (galls) on leaves or twigs; later orange powdery spore masses on the galls.	Usually not necessary.
Wood decay, several species of fungi		
Everywhere with ash.	Softening, discoloration, crumbling of wood.	Tree surgery, pruning.
ASPEN: See Poplar.		
BASSWOOD: See Linden.		
BEECH:		
Leaf scorch, undetermined		
With beech everywhere.	Browning of leaves from margin inward usually during or following hot, dry weather.	Vigorous trees seem to be less affected than poorly growing trees.
Nectria canker, a bark louse, Cryptococcus fagi, followed by a fungus, Nectria coccinea		
New England, New York.	Small to large areas of dead bark on trunk; red pustules of spores; dead or dying branches or entire trees.	On shade trees spray with lime-sulfur to control the bark louse. For forest trees controls not sufficiently tested.
BIRCH:		
Nectria canker, a fungus, Nectria galligena		
With birch everywhere.	Cankers with concentric rings on trunks; trunks deformed; trees killed.	On shade trees cut out small cankers; sterilize and paint the wound.

HOST Disease and Cause Distribution	Symptoms	Control
BIRCH cont.		
Trunk decay, several fungi, Fomes igniarius common With birch everywhere.	Wood of trunk rotting; presence of fungus conks.	Tree surgery if decay not extensive.
Decline, not known New England.	General dying of tops and death of trees in forest stands.	None known.
BOXELDER: See Maple.		
BUCKEYE: See Horsechestnut.		
COTTONWOOD: See Poplar.		
DOGWOOD:		
Crown canker, a fungus, Phytophthora cactorum Reported from New Jersey, New York and Massachusetts. Probably occurs elsewhere.	Small, pale or sparse foliage with reddening and shriveling in summer; poor growth; dead bark at base of trunk.	Avoid injuries to base of trunk; sterilize and paint wounds; cut out small cankers. Serious and difficult to control.
Leaf and flower spots and blights, several fungi: Ascochyta cornicola Southern U. S.	Spots on leaves, shriveling, dropping.	Usually none necessary; spraying with a fungicide before disease appears probably effective.
Septoria cornicola With dogwood.	Leaf spots with purplish margins.	
Elsinoë corni Middle Atlantic seaboard.	Spots on twigs, flowers, fruits, leaves.	
Botrytis cinerea Probably widespread.	Aging flower petals and leaves touching them.	None necessary.
Mildew, a fungus, Phyllactinia corylea With dogwood.	Leaves appear to be covered with a white powder.	Comes late in season, no control needed.
DOUGLAS-FIR:		
Needle blight, a fungus, Rhabdocline pseudotsugae Northwest; on planted trees in the Northeast.	Reddish-brown spots on needles; defoliation.	Where justifiable spray with a fungicide.
Needle cast, a fungus, Adelopus gaumanni West; on planted trees in New England and New York.	Resembles needle blight but small black fungus fruiting bodies develop in rows on under side of needles.	Where justifiable spray with a fungicide 3 times at 2-week intervals beginning when new leaves develop in spring.
Wood decay, several species of fungi With the host.	Softening, shredding, crumbling of wood.	Tree surgery.

HOST Disease and Cause Distribution	Symptoms	Control
ELM:		
Black spot, a fungus, *Gnomonia ulmea*		
With elm.	Yellowing, falling leaves with sparse to very numerous spots, with the black fruiting bodies of the fungus on them.	Can be prevented by spraying with a fungicide.
Dieback, a fungus, *Dothiorella ulmi*		
General.	Wilting, yellowing, falling leaves in summer; dieback of branches; brown discoloration of current season's wood; cultures required for exact diagnosis.	Pruning affected parts and fertilization are usually effective.
Wilt, a fungus, *Verticillium albo-atrum*		
General.	Same as for dieback; on American and European species.	Pruning, fertilization, and watering during dry weather are sometimes effective.
Dutch elm disease, a fungus, *Ceratostomella ulmi*		
Northeastern U. S. west to Illinois and Missouri, south to Virginia; reported 1 year from Colorado.	Generally similar to dieback and wilt but more severe; laboratory cultures required for exact diagnosis; on all species of elm.	Spraying with DDT to control the bark beetles that spread the disease; destruction of elms infested with bark beetles. Asiatic elms generally resistant.
Wetwood or slime flux, a bacterium, *Erwinia nimipressuralis*		
With elm.	Slimy, commonly malodorous exudate from trunk or branches; on all species of elm.	No cure known; alleviated by installation of drain tubes in wood at or below site of fluxing
Phloem necrosis, a virus		
Central States.	Sudden yellowing and dropping of leaves and death of tree; inner bark discolored; on American elm.	Spraying with DDT to control *Scaphoideus luteolus*, a sucking insect that spreads the virus; resistant varieties.
Wood rots, several species of fungi		
With elm.	Decayed wood.	Tree surgery; pruning.
FIR:		
Twig blight, a fungus, *Rehmiellopsis balsamea*		
Northeastern States.	Yellowing of needles of new growth and dying of tips of twigs.	Beginning when leaf buds are half opened in spring, spray 3 times.
HAWTHORN:		
Juniper-hawthorn rust, a fungus, *Gymnosporangium globosum*		
Where hawthorn and juniper are growing in proximity.	Orange-red spots on leaves followed by defoliation in summer.	Beginning when rust galls swell on juniper, spray 3 times at 10-day intervals, with a fungicide.

HOST Disease and Cause Distribution	Symptoms	Control
HAWTHORN cont.		
Fire blight, a bacterium, Erwinia amylovora With hawthorn.	In spring, blossoms, leaves, and twigs die, become blackened, and appear as though scorched by fire; later cankers on larger branches.	Prune affected parts; cut out cankers. Spraying with a fungicide when blossoms are open probably would reduce severity. Avoid excessive stimulation of growth.
Leaf spot, a fungus, Fabraea maculata General.	Small, angular reddish spots on leaves in spring with possible defoliation later.	Beginning when buds open in spring spray 3 times at 7-to 10-day intervals with a fungicide.
HICKORY:		
Brooming, probably a fungus, Microstroma juglandis With hickory.	Excessive development of small twigs forming a compact cluster of branches.	None known.
HOLLY:		
Tar spot, a fungus, Phacidium curtisii South.	Black spots on leaves and berries.	In nurseries avoid crowding, turn under old leaves, remove lower branches. Spray with a fungicide in May to July.
HORSECHESTNUT:		
Leaf blotch, a fungus Guignardia aesculi With horsechestnut and buckeye.	Large, reddish brown spots on leaves; defoliation in summer.	Difficult. Beginning when leaf buds open spray 3 times at about 2-week intervals with a fungicide.
JUNIPER: See Redcedar		
LINDEN:		
Anthracnose, a fungus, Gnomonia tiliae With linden.	Irregular light-brown spots on leaves; small cankers on twigs; sometimes causing defoliation in wet seasons.	Usually not needed. If repeatedly severe, spray as for horsechestnut leaf blotch.
Black mold, several fungi, especially Fumago vagans With linden.	Heavy black moldlike growth on leaves; grows on the honeydew secreted by insects; occurs on many tree species.	Control of aphids and scale by spraying.
Leaf spot, a fungus, Cercospora microsora With linden.	Small, light-brown, circular spots on leaves.	Usually none needed.

HOST Disease and Cause Distribution	Symptoms	Control
LOCUST:		
Brooming, a virus Pennsylvania to Arkansas and North Carolina.	Excessive development of small twigs forming a dense cluster; on black locust.	None known.
Wood rot, a fungus, Fomes rimosus With black locust.	Decayed wood.	Tree surgery.
Canker, a fungus, Thyronectria austro-americana On honey locust.	Small cankers on twigs and branches, sometimes coalescing; reddish-brown discoloration in the wood.	Try pruning, fertilizing, and watering during dry weather.
LONDON PLANETREE:		
Canker stain, a fungus, Endoconidiophora fimbriata platani Mostly on street or park trees in a few Eastern States.	Yellowing, falling leaves in summer; sparse foliage; cankers on trunk; wood discolored.	Pruning from December through February; use of antiseptic wound paint; removal and destruction of trees with trunk cankers.
MAPLE:		
Anthracnose, a fungus, Gloeosporium apocryptum With maple	Spots on leaves of sugar maple, along veins of Norway maple.	If repeatedly severe spray 3 times at 2-week intervals beginning when buds are partly open.
Black mold, see under Linden.		
Bleeding canker, a fungus, Phytophthora cactorum Eastern States.	Wilting leaves; trunk cankers with reddish exudate.	Fertilization; cut out cankers and sterilize wound.
Leaf scorch, not known With maple.	Edges of leaves or all of leaf turns brown in summer.	Fertilization, watering, proper drainage. Control uncertain.
Leaf spot, a fungus, Phyllosticta minima With maple.	Circular spots, reddish in center and with purple border.	Usually none needed.
Tar spot, two fungi, Rhytisma acerinum and R. punctatum With maple.	Conspicuous large or speckled black spots on leaves.	Usually none needed.
Trunk cankers, several fungi including species of Nectria, Eutypella, Hypoxlon With maple.	Dead bark; depressed areas; concentric ridges of wood; deformation.	Pruning, tree surgery.

HOST Disease and Cause Distribution	Symptoms	Control
MAPLE cont.		
Wilt, a fungus, Verticillium albo-atrum		
With maple.	Wilting and dying of part or all of top; greenish streaks in sapwood.	Fungus is internal. Pruning of diseased parts; fertilization; watering during dry weather.
Wood rots, several species of fungi		
With maple.	Softening, crumbling, disintegration of wood.	Tree surgery.
MIMOSA:		
Wilt, a fungus, Fusarium perniciosum		
New Jersey to Georgia.	Wilting, drying, dropping of leaves and brownish discoloration of sapwood.	Resistant varieties.
OAK:		
Anthracnose, a fungus, Gnomonia veneta		
General.	Early-season leaf spotting and defoliation; cankers on twigs.	Preventive sprays with a fungicide if severe.
Leaf blister, a fungus, Taphrina coerulescens		
Commonly more severe in South than in North.	Roughly circular blister on leaves.	Sprays in late winter with a fungicide while trees are dormant.
Strumella canker, a fungus, Strumella coryneoidea		
With oak.	Rough cankers on trunks causing distortion.	On shade trees cankers can sometimes be cut away.
Wilt, a fungus, Endoconidiophora fagacearum		
Kansas, Nebraska, Iowa, Minnesota, Wisconsin, Illinois, Missouri, Arkansas, Tennessee, Kentucky, Indiana, Ohio, Michigan, West Virginia, Pennsylvania, Maryland, Virginia, North Carolina.	Wilting, discolored foliage with rapid death in the red oaks; slower spread in white oak.	In the forest destroy centers of disease.
Wood decay, several species of fungi		
With oak.	Softening, crumbling, disintegration of wood.	On shade trees, pruning and tree surgery; in second-growth stands, sprouts of low origin on old stump most likely to give sound trees.
PINE:		
Black mold, a fungus, Fumago vagans		
With pine.	Black mold growth over needles.	Fungus grows on sugary secretion of aphids or other insects. Sprays to control the insects.

HOST Disease and Cause Distribution	Symptoms	Control
PINE cont.		
Damping-off, Pythium and other fungi		
With pine.	Very young seedlings fall over and die, older seedlings turn brown but remain erect.	Choose acid soils for nursery sites; acidify soil.
Needle blights, several fungi; winter injury		
With pine.	Browning, drying, dropping of needles. If caused by fungi, small black fruiting bodies present.	Spraying for fungus diseases. Mulching, watering, proper choice of planting sites to prevent winter injury.
Needle rust, several species of rust fungi.		
With pine.	In spring conspicuous yellow to orange pustules on needles.	Usually not severe enough to require treatment.
White pine blister rust, a fungus, Cronartium ribicola		
Widespread on white pines.	Cankers on trunk or branches; death of parts above canker; orange-colored spore masses on cankered bark.	Removal of alternate host plants (currants and gooseberries) from vicinity of white pines. Pruning, tree surgery in special cases.
Wood decays, several species of fungi		
With pine.	Softening, shredding, crumbling, disintegration of wood.	Pruning, tree surgery.
POPLAR:		
Cankers, fungi: Cytospora chrysosperma, Dothichiza populea, Septoria musiva		
Widespread.	On woody parts, dead areas of bark, sapwood beneath often discolored; old cankers with exposed wood and layers of callous growth.	Weak trees especially susceptible to Cytospora; fertilization, pruning. Some hybrids susceptible to Septoria.
Leaf spots, several species of fungi		
With poplar.	Small to large spots of dead tissue on leaves.	Control usually not necessary.
Rust, several species of the fungus genus Melampsora		
With poplar.	In summer conspicuous yellow to orange pustules on under side of leaves. Alternate hosts are hemlock, larch, Douglas-fir.	Usually none needed.
Wetwood, bacteria		
With poplar.	Lombardy poplar especially susceptible. Dying begins in top, then spreads slowly over entire tree; wood water-soaked, disagreeable odor.	None known.

HOST Disease and Cause Distribution	Symptoms	Control
REDBUD:		
Canker, a fungus, Botryosphaeria ribis		
Atlantic seaboard from Connecticut to North Carolina; possibly elsewhere.	Sparse foliage dying on one or more limbs in summer; cankers on limbs and trunks, with cracked bark and callus tissue at edges.	Pruning; mulching, fertilization sometimes beneficial.
REDCEDAR:		
Cedar-apple rust, a fungus, Gymnosporangium juniperi-virginianae		
With redcedar and apple.	Galls that bear brightly colored, elongated, gelatinous spore masses during wet weather in spring; galls annual.	Preventive fungicidal sprays. Fungus has some stages on apple which see.
Cedar-hawthorn rust, a fungus, Gymnosporanium globosum		
With redcedar and hawthorn.	Globose galls on twigs; spore horns in spring; galls perennial.	Preventive fungicidal sprays.
SPRUCE:		
Canker, a fungus, Cytospora kunzei		
Widespread.	Cankers on branches; resinous exudate.	Pruning of diseased parts.
Decline, environmental		
Widespread.	On Norway and blue spruce; dieback of top, thin foliage.	Mulches around root area; fertilization; watering during dry periods.
SYCAMORE:		
Anthracnose, a fungus, Gnomonia veneta		
With sycamore.	Blight of leaves and twigs in spring; often heavy defoliation; twig cankers.	Difficult to control. Apply preventive organic mercury fungicidal sprays beginning when buds start to open.
TULIP-POPLAR:		
Black mold. (See under Linden.)		
WILLOW:		
Canker, a fungus Botryosphaeria ribis. See redbud.		
Crown gall, the bacterium Agrobacterium tumefaciens		
With willow.	Swellings on roots, trunk, branches.	No cure. Removal of galls sometimes improves appearance.
Scab, a fungus, Fusicladium saliciperdum		
Northeastern States.	In spring blackening and dying of leaves and twigs; trees often killed.	Difficult. Try four to five fungicidal sprays beginning just before buds open and continuing at 10- to 12-day intervals until about June 15.
Wood rots, several fungi		
With willow.	Softening, shredding, disintegration of wood.	Pruning, tree surgery when advisable.

DISEASES OF SPECIAL CROPS

HOST Disease and Cause Distribution	Symptoms	Control
MINT:		
Rust, a fungus, *Puccinia menthae* General with crop.	Yellow to brown pustules on stems and leaves.	Early cutting, possibly fungicides and resistant varieties.
Wilt, a fungus *Verticillium albo-atrum* Michigan, Indiana, Oregon.	Growth distortion plus leaf bronzing and wilting.	Resistant varieties a possibility.
SAFFLOWER:		
Root rot, a fungus, *Phytophthora drechsleri* General with crop.	Root decay.	Resistant varieties promising.
Rust, a fungus, *Puccinia carthami* Great Plains area, California.	Red-brown stem and leaf pustules.	Seed treatment; resistant varieties.

DISEASES OF RUBBER (HEVEA)

HOST Disease and Cause Distribution	Symptoms	Control
RUBBER (HEVEA):		
Black crust, a fungus, *Catacauma huberi* South America (confined largely to Amazon basin).	Shining black incrustations on underside of leaves.	Avoidance of especially susceptible clones.
Bud-patch infection, a fungus, *Diplodia theobromae* Mexico, Central and South America.	Death of bud patch.	Fungicidal dip.
Glomerella dieback, a fungus, *Glomerella cingulata* Lower Amazon.	Decay sets in at nodes and young shoots break off while leaves still green.	Application of fertilizer to induce better growth.
Moldy rot, a fungus, *Endoconidiophora fimbriata* Far East; southern Mexico.	Black panel rot, followed by a whitish mold.	Fungicidal paint.
Periconia blight of Hevea, a fungus, *Periconia heveae* Costa Rica; Bahia and the Amazon region of Brazil; Mexico.	Lesions on both petioles and leaves.	Practically disappears during the dry season.
Phytophthora leaf fall and twig dieback, a fungus, *Phytophthora palmivora* Throughout the Tropics.	Leaf fall, twig dieback, panel decay, and pod rot.	Fungicidal sprays; top budding with tolerant clones.
Pink disease, a fungus, *Corticium salmonicolor* Far East; west coast of Guatemala.	Pink incrustation of the bark, usually at a fork in the stem.	Treatment with coal-tar preparation to reduce inoculum.
South American leaf blight, a fungus, *Dothidella ulei* Mexico, Central and South America.	Small necrotic lesions on leaves; twig dieback.	Fungicidal sprays in nursery; top budding with blight-resistant clones.
Target leaf spot, a fungus, *Pellicularia filamentosa* South America.	Leaf lesions ranging up to 2 inches in diameter; silvery fungus threads on under surface.	Fungicidal sprays.

DISEASES OF SUGAR CROPS

HOST Disease and Cause Distribution	Symptoms	Control
SORGO:		
Anthracnose, a fungus, Colletotrichum graminicola		
General.	Small, round, red or purple leaf spots.	Resistant varieties.
Red rot, a fungus, Colletotrichum graminicola		
General.	Stalk rot-red, orange, or purple discoloration of the pith.	Resistant varieties.
Rust, a fungus, Puccinia purpurea		
General.	Raised, reddish pustules on leaf surfaces.	Resistant varieties.
Zonate leaf spot, a fungus, Gloeocercospora sorghi		
Florida, Louisiana, Georgia, Mississippi, and Texas.	Wide bands of reddish-purple alternating with straw-colored tissue on leaves.	Resistant varieties.
SUGAR BEET:		
Bacterial canker, a bacterium, Xanthomonas beticola		
General.	Irregular, rough galls (up to 3/4 inch diameter) on crown and other exposed parts of root; interior of overgrowth yellow.	Crop rotation.
Beet mosaic, a virus		
Nebraska, Colorado, and westward.	Yellow mottling or spotting on leaves, especially younger ones.	No control measures practiced.
Black root (acute type), fungi: Pythium spp., Pellicularia filamentosa, Phoma betae, Aphanomyces cochlioides		
General.	Very young seedlings topple over from death of root and hypocotyl; diseased parts turn black; pathogens may also kill seedlings as they emerge from seed ball.	Crop rotation with early fall plowing of legume crops before beets; liberal use of phosphate fertilizer; drainage; seed treatment; prompt cultivation of young plants.
Black root (chronic type), a fungus, Aphanomyces cochlioides		
General.	Young plants remaining in row and not damped-off show blackened lateral feeding roots; tip of main root may be killed, causing sprangling of roots.	Disease-resistant varieties.
Crown gall, a bacterium, Agrobacterium tumefaciens		
General.	Large, smooth galls (usually 1 to 4 inches or more in diameter) on roots; interior of overgrowth, white.	Crop rotation.

HOST Disease and Cause Distribution	Symptoms	Control
SUGAR BEET cont.		
Curly top, a virus West of Continental Divide; occasionally found in eastern Colorado, Nebraska, and neighboring States.	Up-curled leaves; older leaves have thickened veins, frequently with prickly outgrowths; youngest leaves have cleared veinlets; roots dwarfed; excessive number of feeding roots are formed ("hairy root"); when cut across, roots may show concentric black rings.	Resistant varieties.
Downy mildew, a fungus, Peronospora schachtii California, Oregon, and Washington.	Sooty gray growth of mold covers younger leaves; frequently bud is killed.	Resistant varieties.
Fusarium yellows, a fungus, Fusarium conglutinans betae Colorado, Nebraska, South Dakota, Montana, and Wyoming.	Wilting; foliage yellowed and dwarfed; central core of root discolored.	Crop rotation; heavy phosphate applications.
Leaf spot, a fungus, Cercospora beticola General.	Gray spots about 1/8 inch diameter on leaf blades, petioles, seed stalks and floral parts; spots on leaves may coalesce and cause blighting.	Resistant varieties.
Nematode, Heterodera schachtii General; most severe in West.	Affected plants wilt and remain stunted; roots of infected beets have numerous, small (pinhead size), lemon-shaped white bodies (the female nematodes); later, taproot shows same infection, but the bodies may be yellow or brown (the nematode cysts).	Prevention: Sugar beet crops should not be grown oftener than 1 crop in 5 years. Nonsusceptible crops kept free from weeds should be grown in interim.
Rhizoctonia crown rot, a fungus, Pellicularia filamentosa General.	Part or all of foliage dies and dries after the root becomes decayed, usually at crown.	Crop rotation; prevention of acute-type black root.
Rhizoctonia foliage blight, a fungus, Pellicularia filamentosa Maryland, Virginia, Michigan, Ohio, Minnesota, Nebraska, and Colorado.	Blackened, killed areas 1/2 to 3/4 inch across appear on leaf blades in early summer; soon surrounded by secondary killed areas. Outbreaks are associated with very rainy weather or periods of high humidity.	Crop rotation.

HOST Disease and Cause Distribution	Symptoms	Control
SUGAR BEET cont.		
Savoy, a virus		
Maryland, Virginia, and westward through Wyoming and Montana.	Leaves puckered, downcurled; resemble savoy cabbage. Veins thickened. Flesh of root glassy; in cross-section shows concentric black rings. Central core discolored.	No control measures practiced.
Storage rot, fungi: Phoma betae, Pellicularia filamentosa, Botrytis cinerea, Rhizopus nigricans, Fusarium spp.		
General.	Brown or black decay of sugar beets in factory storage piles.	Cooling of storage piles by ventilation with cold night air; resistant varieties.
Virus yellows, a virus		
California, Oregon, Washington, Utah, Colorado, Michigan, and Maryland.	Outer leaves yellowed, especially at the tips; they become thick and brittle.	Control of aphid vectors of the virus; removal of overwintering plants that are sources of virus.
SUGARCANE:		
Brown spot, a fungus, Cercospora longipes		
All areas.	Reddish-brown leaf spot with yellow areole.	Resistant varieties.
Chlorotic streak, a virus		
Louisiana.	Yellowish-white linear streaks with wavy outline on leaves.	Resistant varieties, roguing, and seed selection.
Eyespot, a fungus, Helminthosporium sacchari		
Florida, Georgia.	Straw-colored leaf spot extending into long streak or "runner".	Resistant varieties.
Pineapple disease, a fungus, Endoconidiophora paradoxa		
All areas.	Seed-piece rot (sooty black interior); pineapple odor.	Resistant varieties.
Mosaic, a virus		
All areas.	Irregular-shaped chlorotic areas distributed throughout the normal green tissue.	Resistant varieties, seed selection, and roguing.
Red rot, a fungus, Colletotrichum falcatum		
All areas.	Leaf spot (elongate red areas on midrib); seed-piece rot (longitudinal reddening interrupted by white patches).	Resistant varieties.
Root rot, fungi: Pythium arrhenomanes and other species		
All areas.	Soft, watery rot of root tips and rootlets.	Resistant varieties.

DISEASES OF TOBACCO

HOST Disease and Cause Distribution	Symptoms	Control
Bacterial wilt, a bacterium, Xanthomonas solanacearum		
South Atlantic area.	Wilt plus dark streaks in woody part of stem.	Resistant varieties and rotation.
Blackfire, a bacterium, Pseudomonas angulata		
Epidemic outbreaks may occur in Kentucky, Tennessee, Virginia, and North Carolina.	Dark-colored leaf spots, often angular.	Resistant varieties available soon.
Black root rot, a fungus, Thielaviopsis basicola		
All northern areas and extending south to include Tennessee and western North Carolina.	Dark-colored root lesions.	Resistant varieties.
Black shank, a fungus, Phytophthora parasitica var. nicotianae		
South Atlantic area, also Tennessee and Kentucky.	Wilt plus decay of roots and base of stalk.	Resistant varieties and rotation.
Blue mold, a fungus, Peronospora tabacina		
All major tobacco areas except Wisconsin.	Leaf spots with a fungus mold growth on the lower surface.	Regular spraying or dusting with a fungicide.
Fusarium wilt, a fungus, Fusarium oxysporum var. nicotianae		
Kentucky, South Carolina, North Carolina; occasional elsewhere.	Wilt on one side of plants.	Resistant varieties and rotation.
Mosaic, a virus		
All areas.	Green and yellow mottling conspicuous on young leaves.	Sanitation and resistant varieties.
Nematode root rot, a nematode, Pratylenchus sp.		
South Atlantic area.	Reddish-brown root decay.	Rotation and soil fumigation.
Root knot, a nematode, Meloidogyne sp.		
South Atlantic area.	Roots swollen and knotted.	Rotation and soil fumigation.
Wildfire, a bacterium, Pseudomonas tabaci		
Tennessee, Kentucky, Pennsylvania; occasionally severe in other areas.	Rounded leaf spots, often with a yellow border.	Fungicides in the plant bed; resistant varieties soon.

HOST Disease and Cause Distribution	Symptoms	Control
ASPARAGUS:		
Rust, a fungus, Puccinia asparagi		
Widespread.	Shoots produced after harvest develop pustules that break open and expose reddish-brown, powdery masses of spores; in fall, these pustules and others show black spore masses.	Destruction of volunteer plants near field; isolation of seedbeds from older plantings. Varieties Mary and Martha Washington have some resistance.
Wilt, a fungus, Fusarium sp.		
Widespread.	Yellowing, stunting, and often wilting of growing stalks.	Do not replant asparagus where disease has been severe.
BEAN:		
Common blight, bacteria: Xanthomonas phaseoli and X. phaseoli var. fuscans		
Widespread east of Continental Divide.	Small water-soaked leaf and pod spots; later large, brown dead areas on leaves and enlargement of pod spots.	Use of seed grown in arid sections; crop rotation.
Curly top, a virus		
Some Western States.	Seedlings killed; crinkling and cupping of older leaves; yellowing and stunting of plant.	Resistant varieties.
Halo blight, a bacterium, Pseudomonas phaseolicola		
Widespread east of Continental Divide.	Small, water-soaked leaf and pod spots; greenish-yellow circle around leaf spots; later large dead areas on leaves and enlargement of pod spots.	Use of seed grown in arid sections; crop rotation.
Mosaic, a virus		
Widespread.	Leaf mottling, blistering, and pod distortion.	Resistant varieties.
Powdery mildew, a fungus, Erysiphe polygoni		
Most important in Southeastern States.	White powdery areas on leaves.	Sulfur dusts.
Root rot, a fungus, Fusarium solani f. phaseoli		
Widespread.	Reddish discoloration of root.	Crop rotation.
Rust, a fungus, Uromyces phaseoli typica		
Florida, Mountain and Pacific Coast States.	Rusty pustules on leaves that turn black later in season.	Sulfur dusts.
Watery soft rot, a fungus, Sclerotinia sclerotiorum		
Some Southern, Mountain, and Pacific Northwest States.	Watery spots on leaves; masses of white fungus growth on stems and pods; black sclerotia formed in this mat.	Crop rotation.

HOST Disease and Cause Distribution	Symptoms	Control
BEAN, LIMA:		
Bacterial blight, bacteria: Xanthomonas phaseoli, Pseudomonas phaseolicola, P. syringae Widespread east of Continental Divide.	Same as common blight of bean.	Use of seed grown in arid sections.
Downy mildew, a fungus, Phytophthora phaseoli North Atlantic Seaboard.	White, cottony growth on pods, young leaves, shoots, and flowers.	Copper sprays.
Pod blight, a fungus, Diaporthe phaseolorum Eastern and Southern States.	Brown patches of irregular shape on leaves; dark-brown spots on pods.	Bordeaux mixture; crop rotation.
Root knot, a nematode, Meloidogyne spp. Southern States and California.	Fleshy irregular-shaped galls on roots.	Crop rotation.
Stem anthracnose, a fungus, Colletotrichum truncatum Southern States.	Brick-red discoloration of veins on under side of leaves; red spots on pods.	Use of seed grown in arid sections.
BEET:		
Black root, fungi: Pythium sp., Rhizoctonia solani, Pleospora betae, Aphanomyces cochlioides Widespread.	Damping-off of seedlings; black lesions on older roots; with some fungi, root decay.	Seed treatment with thiram, New Improved Ceresan, or Phygon; crop rotation and well-tilled seedbeds.
Boron deficiency, nonparasitic disease Northern States.	Young leaves turn black and die; root tissue shows black rings; cankers may appear on surface.	Application of borax to soil with fertilizer.
Cercospora spot, a fungus, Cercospora beticola Widespread.	Small, circular spots on leaves and petioles with definite margins deeper in color than surrounding tissue.	Crop rotation.
Curly top, a virus Some Western States.	Inward rolling of young leaves and puckering; older leaves turn yellow and die; necrosis of phloem tissue of root.	None.
Phoma leaf spot, a fungus, Phoma betae Widespread.	Some spotting on old leaves; dry, black rot of roots in storage.	Crop rotation; seed treatment as for black root.

BROCCOLI and BRUSSELS SPROUTS: Blackleg, Black rot, Clubroot. See under CABBAGE.

HOST Disease and Cause Distribution	Symptoms	Control
CABBAGE:		
Blackleg, a fungus, Phoma lingam Widespread.	Large spots with ashen-gray centers on leaves, stems, and seed pods; spots show black specks (pycnidia) on their surfaces; stem cankers at ground line extending to roots.	Three-year rotation. Western-grown seed is usually free from the blackleg fungus.
Black rot, a bacterium, Xanthomonas campestris Chiefly east of the Continental Divide.	Large V-shaped spots at leaf margins that turn brown and dry; veins darkened; affected leaves drop; soft rot bacteria enter through infected tissue and cause heads to rot.	See Blackleg. Also treat seed in hot water at 122° F. for 30 minutes.
Clubroot, a fungus, Plasmodiophora brassicae Northern United States.	Enlarged clublike swellings on roots.	Avoid infested soil; select clean soil for plant beds; avoid transfer of infectious soil or plant materials by farm implements or drainage water.
Downy mildew, a fungus, Peronospora parasitica Chiefly in coastal areas.	White downy growth of fungus on lower surface of leaves followed by yellow spotting on upper surface; most damaging in seedbeds.	Ferbam or Spergon sprays or dusts.
Mosaic, viruses Widespread.	Mottling and vein clearings with some necrotic spotting.	Isolation of seedbeds from plants that may serve as virus reservoirs.
Ring spot, a fungus, Mycosphaerella brassicicola Pacific Coast areas near sea. Damaging to seed crops.	Spotting of all above-ground parts of plants; spots are small, dark, and turn gray on leaves; small, black fungus fruiting bodies occur in concentric zones on the spots.	Disposal of infected crop refuse and rotation.
Sclerotinia disease, fungi: Sclerotinia sclerotiorum, Sclerotinia minor, and Sclerotinia intermedia Southern States and humid sections of Pacific Coast.	Fungus in soil infects stem and causes a watery soft rot with white cottony growth of fungus on stem; collapse of plant follows.	Crop rotation.
Yellows, a fungus, Fusarium oxysporum f. conglutinans Widespread.	One-sided yellowing of foliage beginning with the lower leaves; affected leaves drop and growth is checked; vascular bundles are blackened.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
CARROT:		
Bacterial blight, a bacterium, Xanthomonas carotae		
Chiefly in Southwestern States and California.	Brown, water-soaked spots on leaves that become brittle and have a yellow margin; some leaves are killed; roots develop elongate, craterlike dark spots.	Hot-water treatment of seed at 127° F. will disinfect seed. Avoid infested fields.
Bacterial soft rot (storage disease), a bacterium, Erwinia carotovora		
Widespread.	Soft watery decay of root.	Careful handling of crop.
Black rot, a fungus, Alternaria radicina		
Common on carrots in storage.	Leaf spotting similar to cercospora blight; roots in storage develop greenish-black to jet black decay; black moldy growth on surface.	Sanitation and crop rotation.
Cercospora blight, a fungus, Cercospora carotae		
Widespread.	Small chlorotic leaf spots which later enlarge and develop into spots with pale necrotic centers and dark borders.	Sprays or dusts with zineb, bordeaux mixture, or insoluble copper sprays; also rotation and sanitation.
Yellows, aster yellows virus		
Widespread.	Yellowing and vein clearing of young leaves; old leaves are twisted and yellowed.	DDT spray to kill leafhoppers that spread the virus.
CAULIFLOWER: Blackleg, Black rot, Clubroot, Downy mildew, Ring spot. See under CABBAGE.		
CELERY:		
Aster yellows, a virus (western strain of aster yellows virus)		
Common in California and has occurred in Middle West.	Stalks brittle and often twisted and cracked; leaves yellowed and distorted.	No effective control.
Bacterial blight, a bacterium, Pseudomonas apii		
Widespread.	Rusty-brown, irregularly circular spots; somewhat like small spots of late blight but have no dark specks in centers.	Control as for early blight.
Bacterial soft rot, a bacterium, Erwinia carotovora		
Widespread.	Soft, mushy decay in transit or storage following bruising or freezing in field; also follows blackheart injury.	Care in harvest and prompt cold storage.
Blackheart, nonparasitic disease caused by sudden saturation of soil with water		
Widespread.	Blackening and decay of leaves at heart of plant.	Prevent sudden increase of moisture in the soil.

HOST Disease and Cause Distribution	Symptoms	Control
CELERY cont.		
Early blight, a fungus, Cercospora apii		
Widespread.	Circular, yellowish spots that turn brown and may enlarge to 1/2 inch in diameter; elongated spots on leaf stalks.	Copper fungicides, zineb, nabam (with zinc sulfate), ferbam or ziram depending on local recommendation. Emerson Pascal is somewhat resistant.
Fusarium yellows, a fungus, Fusarium oxysporum f. apii		
In many celery-growing regions in the North and in Southern California.	Seedlings wilt suddenly; older plants show yellowing and are stunted; some root injury; plants finally collapse and die.	Resistant varieties.
Late blight, fungi: Septoria apii and S. apii-graveolentis		
Widespread.	Leaves develop many yellow spots that turn dark and have tiny black specks (pycnidia) on their surface; leaf stalks also are spotted.	Fungus is seedborne and usually dies before seed loses viability. Three-year-old seed is recommended. In the field use an 8-8-100 bordeaux mixture or copper dusts.
Mosaic, a virus		
Widespread.	Green and yellow mottling of leaves and stunting of plants; some viruses cause brown spotting of stalks.	Eradication of wild host plants near fields; insecticides to control aphid vectors.
Sclerotinia, fungi: Sclerotinia sclerotiorum, S. minor, and S. intermedia		
Most important in South but occurs on northern crops in storage.	Rot at base of crown and leaf stalks; tissues become watery, pinkish in color, and show a white growth of fungus; black sclerotial bodies are formed.	Difficult to control when climate favors the disease. In Florida, flooding land for 6-8 weeks in summer is best means of control.
CUCUMBER:		
Angular leaf spot, a bacterium, Pseudomonas lachrymans		
Humid and semihumid regions.	Small, water-soaked, angular spots that dry and become gray; fruits show water-soaked spots followed by brown rot of tissues under the spot.	Seed treatment by soaking for 5 minutes in a 1-1,000 solution of corrosive sublimate and rinsing in water. Crop rotation. Copper fungicides will check the disease.
Anthracnose, a fungus, Colletotrichum lagenarium		
East of Continental Divide.	Leaves show large, brown angular or circular spots; tan cankers on stems and petioles; on fruits, dark, circular, sunken spots with pinkish spore masses at center in moist weather.	Seed treatment as for angular leaf spot or Semesan dusts; ziram, ferbam, zineb, or nabam (used with zinc sulfate) sprays or dusts; crop rotation.

HOST Disease and Cause Distribution	Symptoms	Control
CUCUMBER cont.		
Bacterial wilt, a bacterium, Erwinia tracheiphila		
East of the Continental Divide; more common in Northern States than in the South.	Wilting begins with a single leaf and gradually extends until vine is killed.	Control of cucumber beetles that spread the bacteria. In small gardens, removing wilted plants is advisable.
Damping-off, fungi: Pythium spp. and Rhizoctonia solani		
Widespread.	Seed decay and wilting and death of young seedlings.	Dusting of seed with thiram, Semesan, or Spergon.
Downy mildew, a fungus, Pseudoperonospora cubensis		
Along Atlantic seaboard and Gulf Coast.	Leaves show many rather angular, yellow spots and wither and die.	Spray or dust with copper fungicides or with ziram, zineb, or nabam (with zinc sulfate).
Mosaic, a virus		
Widespread.	Yellow mottling of leaves and fruits; plants stunted and leaves of later growth dwarfed.	Resistant varieties. Perennial weeds carry the virus and should be destroyed near cucumber plantings.
Scab, a fungus, Cladosporium cucumerinum		
Chiefly in Northern States-Wisconsin to Maine.	Brown spotting of leaves; fruits show sunken, corky spots with olive-green spore masses in moist weather.	Resistant varieties; crop rotation.
EGGPLANT:		
Phomopsis blight, a fungus, Phomopsis vexans		
Widespread but most severe in South.	Brown, oval or irregular spots with gray centers on leaves; dark decay of fruits covering much of surface.	Crop rotation and resistant varieties.
Verticillium wilt, a fungus, Verticillium albo-atrum		
Common in Northern States.	Yellowing of lower leaves, discoloration of woody tissue of stem and stunting of plant.	No satisfactory control.
LETTUCE:		
Aster yellows, a virus		
Most serious in Northeastern States.	Yellowing and curling of inner leaves on which brown spots occur; in older plants one side only may be yellowed.	Insecticides to destroy the leafhopper that carries the virus.
Bottom rot, a fungus, Rhizoctonia solani		
Widespread; most common on muck land.	Dead spots appear on petioles and mid-ribs of leaves that touch soil; slimy, soft rot of head follows leaf infection.	Well-drained soil and rotation with crops such as sweet corn or onion that are not attacked by the fungus.

HOST Disease and Cause Distribution	Symptoms	Control
LETTUCE cont.		
Downy mildew, a fungus, Bremia lactucae Widespread.	Yellow areas on upper surface of leaf and downy white growth on under side; spots turn brown.	Spraying or dusting of plant beds with ferbam or zineb.
Drop, fungi: Sclerotinia sclerotiorum and S. minor Widespread.	Under moist conditions the outer leaves wilt and there is a slimy rot of the plant; cottony fungus growth on stem near soil.	Use well-drained soil and avoid crowding plants in the field. In the greenhouse, sterilize soil.
Mosaic, a virus Widespread.	Mottling and yellowing of leaves and stunting of plants.	Use insecticides to destroy aphids that transmit the virus.
Tipburn, nonparasitic disease Widespread.	Brown discoloration of leaf tissue at the margins of the leaves.	Several recently introduced varieties are somewhat less susceptible than older ones.
MUSKMELON:		
Alternaria leaf blight, a fungus, Alternaria cucumerina Widespread.	Leaves develop small, tan spots that enlarge and show concentric markings.	Spray or dust with ziram, zineb, or spray with nabam (used with zinc sulfate); crop rotation.
Anthracnose, a fungus, Colletotrichum lagenarium Widespread.	Brown, circular or angular spots on leaves; spots on stems and petioles; dark, sunken spots on fruits with pinkish spore masses in centers in moist weather.	Dusting seed with Semesan or soaking for 5 minutes in a 1-1,000 solution of corrosive sublimate and rinsing in water; spray or dust as for alternaria spot; crop rotation.
Bacterial wilt. See under CUCUMBER.		
Damping-off, fungi: Pythium spp. and Rhizoctonia solani Widespread.	Seed decay and wilting and death of young seedlings.	Dusting of seed with thiram, Semesan, or Spergon.
Downy mildew, a fungus, Pseudoperonospora cubensis Chiefly along Atlantic seaboard.	Yellow to reddish-brown spots on under side of leaves; on lower sides a purplish mildew. Leaves wither and curl upward.	Spray or dust with copper fungicides, ziram, or zineb; or spray with nabam (used with zinc sulfate).

HOST Disease and Cause Distribution	Symptoms	Control
MUSKMELON cont.		
Fusarium wilt, a fungus, Fusarium oxysporum f. melonis Northern States.	Wilting of one or more branches; leaves turn brown; streaks on stems; plant finally dies.	Resistant varieties; crop rotation.
Powdery mildew, a fungus, Erisyphe cichoracearum Most important in Southern California.	White growth of fungus on leaves and stems.	Resistant varieties. Sulfur effective but causes injury at high temperatures.
ONION:		
Bacterial soft rot, a bacterium, Erwinia carotovora Widespread in storage.	Slimy yellow rotting of bulbs.	Mature crop well and cure bulbs thoroughly before storage. Careful sorting at harvest and at packing.
Downy mildew, a fungus, Peronospora destructor In most States where onions are grown.	Violet downy spots on leaves; plants may be dwarfed, distorted, and pale green.	Avoid poorly drained soils; dust with mixture of zineb and sulfur.
Neck rot, fungi: Botrytis allii, B. byssoidea, B. squamosa Widespread in storage.	Softening at neck of bulb followed by grayish mold; later formation of small, hard, black sclerotia.	Grow colored rather than white varieties; allow tops to mature before harvest. Artificial curing reduces losses.
Pink root, a fungus, Pyrenochaeta terrestris Widespread.	Affected roots turn pink, shrivel, and die; bulbs are small.	Do not plant on severely infested soil.
Purple blotch, a fungus, Alternaria porri Southern and irrigated areas.	Small, white, sunken lesions with purple centers which enlarge and girdle leaf; leaves and stems fall over.	No field control. Storage measures as for neck rot.
Smudge, a fungus, Colletotrichum circinans Northeastern and Midwestern States.	Smudgy, roughly circular spots on scales of bulb; dark green at first, becoming black with age.	Use colored varieties; protect from rain after harvest; cure promptly.
Smut, a fungus, Urocystis cepulae Northern States.	Raised blisters near base of scales which break open and expose black powdery masses of spores.	Dilute formaldehyde applied to soil with the seed; Arasan seed treatment.

HOST Disease and Cause Distribution	Symptoms	Control
PEA:		
Aphanomyces root rot, a fungus, Aphanomyces euteiches Widespread.	Decay of root and stem 1 to 2 inches above ground; outer portion of root slips readily from central cylinder; leaves shrivel and plant may die.	Long crop rotations; fertile, well-drained soil.
Ascochyta blight, fungi: Ascochyta pisi, A. pinodella, Mycosphaerella pinodes Widespread east of Continental Divide.	Tan leaf spots with brown borders; on pods, circular sunken spots. Black to purplish streaks on stem.	Use of seed grown in semi-arid sections of West.
Bacterial blight, a bacterium, Pseudomonas pisi Widespread.	Water-soaked leaf, stem, and pod spotting; later the infected spots turn brown.	Use of seed grown in semi-arid sections of West.
Fusarium root rot, a fungus, Fusarium solani f. pisi Widespread.	Dark-brown to brick-red discoloration of roots.	Crop rotation.
Fusarium wilt, a fungus, Fusarium oxysporum f. pisi Midwestern and Northwestern States.	Downward curling of leaflets, stunting and wilting of plant, and orange-brown discoloration of vascular system.	Resistant varieties.
Mosaic, a virus Widespread.	Mottling and malformation of leaves and stunting of plant.	Control of the pea aphid (the vector) and eradication of legumes growing wild close to pea fields.
Powdery mildew, a fungus, Erysiphe polygoni Widespread.	White, powdery, dustlike coating on leaves, stems, and pods.	Sulfur dusts.
PEPPER:		
Anthracnose, a fungus, Gloeosporium piperatum Widespread.	Fruits with large, dark, circular, sunken spots; salmon-colored masses of spores appear in center of spots in moist weather.	Seed disinfection as for bacterial spot; application of zineb, nabam (with zinc sulfate), or ziram.
Bacterial spot, a bacterium, Xanthomonas vesicatoria Widespread; chiefly on sweet peppers.	Leaf spots with light centers and dark margins; if numerous, remain brown. Severely spotted leaves yellow and drop. Fruits with small, brown, roughened, corky spots.	Seed treatment by soaking for 5 minutes in 1-2,000 solution of corrosive sublimate and rinsing in water; crop rotation.

HOST Disease and Cause Distribution	Symptoms	Control
PEPPER cont.		
Bacterial wilt, a bacterium, Xanthomonas solanacearum		
Chiefly in Southeastern States.	General wilting and collapse of plants with little yellowing of leaves.	Crop rotation; well-drained soil.
Blossom-end rot, nonparasitic disease		
Widespread on sweet peppers.	Water-soaked spots that become dry, light-colored, and papery. Fungi often invade spots and cause them to become dark.	Avoid soils that dry out quickly after rain. If plants can be watered, maintain an even soil moisture supply.
Cercospora leaf spot, a fungus, Cercospora capsici		
Chiefly in Southeastern States on sweet and hot peppers.	Large circular or oblong spots on leaves and stems; spots with dark-brown margins and gray centers; severely infected leaves drop.	Seed treatment as for anthracnose. Where severe, use zineb, nabam (with zinc sulfate), or ziram.
Mosaic, viruses		
Widespread.	Varying types of yellow and green leaf mottling, curling, and distortion; fruits may be yellowed, shriveled, or mottled.	Destruction of perennial weeds near seedbeds; insecticides to destroy insect carriers; resistant varieties.
POTATO:		
Black leg, a bacterium, Erwinia atroseptica		
Widespread.	Soft rot or a dark shriveling at base of stem; tubers from diseased plants may decay.	Destruction of potato refuse piles to prevent spread of disease from them; planting of seed as soon as cut or holding in cool, ventilated place.
Common scab, a fungus, Streptomyces scabies		
Widespread.	Tubers have superficial, roughened areas or more deeply pitted, corky, rough spots.	Clean seed; crop rotation; treatment of seed tubers. Tolerant varieties are available.
Early blight, a fungus, Alternaria solani		
Widespread, chiefly east of Continental Divide.	Leaves develop dark-brown, oval or angular spots with concentric markings; older foliage often killed; shallow dry rot of tubers.	Zineb or nabam (with zinc sulfate) sprays or dusts.
Fusarium wilt and tuber rot, a fungus, Fusarium spp.		
Widespread.	Yellowing and wilting of plants and browning or dry rot of tubers.	Certified seed tubers; crop rotation.

HOST Disease and Cause Distribution	Symptoms	Control
POTATO cont.		
Late blight, a fungus, Phytophthora infestans Widespread; chiefly in humid areas.	Large, dark, water-soaked spots, turning brown with white mildew on surface in moist weather; brown dry rot of tuber that may become soft in storage.	Resistant varieties; bordeaux mixture, zineb, or nabam (with zinc sulfate) sprays.
Leaf roll, a virus Widespread.	Leaflets roll upward and inward; leaves are tough and leathery; plants are stunted; net necrosis of tubers.	Certified seed tubers. Resistant varieties available.
Mosaic diseases, viruses Widespread.	Various types of leaf mottling, curling, or crinkling; plants usually somewhat stunted and yields reduced.	Certified seed; insecticides to destroy aphids that transmit viruses. Some varieties are resistant to certain mosaic viruses.
Rhizoctonia, a fungus, Rhizoctonia solani Widespread.	Killing of sprouts before emergence; stems are cankered and may produce aerial tubers; tubers have small, black areas on surface.	Clean seed stock. Shallow planting reduces stem decay.
Ringrot, a bacterium, Corynebacterium sepedonicum Widespread.	Yellowing, marginal browning, and drooping of leaflets; cut tubers show brown discoloration of vascular ring and a bacterial ooze.	Certified seed. If disease occurs, disinfect bins, crates, bags, and cultivating machinery. Disinfect knives frequently when cutting seed tubers. Tolerant varieties available.
Southern bacterial wilt, a bacterium, Xanthomonas solanacearum Chiefly in Southeastern States.	Bronzing and shriveling of leaflets; wilting and death of plant; brown decay of tubers.	Use certified seed and avoid infested soil. A few varieties are moderately resistant.
RADISH:		
Black root, a fungus, Aphanomyces raphani Widespread.	Black patches on roots, extending below surface. Most important on long-rooted icicle type varieties.	Crop rotation. Do not plant long-rooted varieties where disease has been severe.
White rust, a fungus, Albugo candida Widespread.	Raised, white, shiny pustules that merge to form large patches on leaves.	No effective control.

HOST Disease and Cause Distribution	Symptoms	Control
RHUBARB:		
Anthracnose, a fungus, Colletotrichum erumpens Widespread.	Oval, translucent spots with black centers on stalks.	No effective control.
Ascochyta leaf spot, a fungus, Ascochyta rhei East of Continental Divide.	Large, circular, dark spots whose centers crack and tear.	No effective control.
Crown rot, fungi: Phytophthora cactorum and P. parasitica Eastern States.	Brown sunken spots at base of leaf stalks followed by collapse of leaves. Rapid rotting of crown.	Dig and destroy infected plants; spray with bordeaux mixture.
SPINACH:		
Damping-off, fungi: Pythium spp. and Rhizoctonia solani Widespread.	Decay of germinating seed and wilting and death of seedlings after emergence.	Seed treatment with thiram, Phygon, cuprous oxide, or zinc oxide.
Downy mildew, a fungus, Peronospora effusa Widespread in coastal areas.	Pale yellow spots on leaves, with grayish-purple, downy growth on their under surfaces in moist weather.	No very satisfactory control.
Mosaic, viruses Widespread.	Leaves mottled with yellow; plants stunted.	Resistant varieties.
White rust, a fungus, Albugo occidentalis Serious in Texas, Arkansas, and Oklahoma.	White, blisterlike pustules, chiefly on lower sides of leaves.	No satisfactory control.
SQUASH AND PUMPKIN:		
Bacterial wilt, downy mildew, mosaic, powdery mildew, same as with cucumber Widespread.	Similar to those on cucumber.	As with cucumber, but no resistant varieties.
SWEETPOTATO:		
Black rot, a fungus, Endoconidiophora fimbriata Widespread in storage.	Small, black spots on stems below and at soil line; dark-green to black, circular, depressed spots with a shallow decay in fleshy roots.	Clean planting stock and disinfection for 10 minutes in 1-1,000 corrosive sublimate or in a 2 1/2 percent borax solution. Sanitation, rotation, and careful sorting before storage.
Internal cork, a virus Widespread in Southeastern States.	Ring spot, bronzing, and some drop of leaves; black, hard, corky spots in fleshy roots.	No satisfactory control.

HOST Disease and Cause Distribution	Symptoms	Control
SWEETPOTATO cont.		
Scurf, a fungus, Monilochaetes infuscans Widespread.	Brown, discolored spots on fleshy roots that may cover entire surface; shrinkage in storage.	Careful selection of seed stock; seed treatment with corrosive sublimate as for black rot; crop rotation.
Soft rot, a fungus, Rhizopus nigricans Widespread in storage.	Soft, watery rot of fleshy tissue which shows dark tufts of fungus growth; sometimes tissues shrink causing a dry rot.	Sanitation of storage rooms. Avoid bruising or wounding the roots; store at proper temperature.
Soil rot, a fungus, Streptomyces ipomoea Widespread.	Leaves small and pale green; black specks on fibrous roots and underground stem; sweetpotatoes show pits with jagged margins.	No adequate control. Use clean seed and rotate crop.
Stem rot, a fungus, Fusarium oxysporum f. batatas Widespread.	Yellowing of young leaves; blackening of inner tissues and rupturing of stem; when cut, fleshy roots show blackened ring.	Clean seed stock; crop rotation. Use clean soil for bedding and treat seed stock as for black rot.
TOMATO:		
Anthracnose, a fungus, Colletotrichum phomoides Central and Atlantic States.	Slightly depressed spots about 1/2 inch in diameter on fruits; concentric rings and pinkish spore masses in center of spots in wet weather.	Crop rotation and ziram or zineb sprays.
Bacterial wilt, a bacterium, Xanthomonas solanacearum Chiefly in Southeastern States.	Entire plant wilts without yellowing of leaves; water-soaked decay of stem.	Crop rotation. No resistant varieties.
Blossom-end rot, nonparasitic Widespread.	Large, dark, sunken, leathery spots at blossom end of fruits.	Avoid excessive use of nitrogenous fertilizers and use ample quantities of super-phosphate.
Curly top, a virus West of Continental Divide.	Seedlings yellow and die; leaves of larger plants are rolled upward and twisted; foliage stiff and leathery; stems abnormally erect; veins have purplish color.	No satisfactory control. Very close planting will reduce amount of disease.

HOST Disease and Cause Distribution	Symptoms	Control
TOMATO cont.		
Early blight, a fungus, Alternaria solani Widespread.	On leaves, many dark-brown spots that enlarge and show targetlike markings; cankers on stems girdle seedlings; fruits with large, dry, rotted spots at stem end.	Dust seed with 0.5 percent New Improved Ceresan; spray or dust with ziram or zineb, or spray with nabam (used with zinc sulfate).
Fusarium wilt, a fungus, Fusarium oxysporum f. lycopersici Widespread.	Gradual yellowing and wilting of foliage beginning with lower leaves; plants eventually die.	Resistant varieties; crop rotation.
Gray leaf spot, a fungus, Stemphylium solani Southeastern, Atlantic, and Central States.	Many small, dark brown spots that become grayish-brown and tear across; leaves yellow and drop.	Spray with copper fungicides, zineb or nabam (with zinc sulfate).
Late blight, a fungus, Phytophthora infestans In humid regions, particularly east of the Mississippi River.	Dark, water-soaked spots on leaves that turn brown and have white mildew on under sides in moist weather; large, dark decayed spots on fruits.	Spray with copper fungicides, zineb or nabam (used with zinc sulfate). Ziram and ferbam do not control late blight.
Mosaic, viruses Widespread.	Green and yellow mottling of leaves which often are curled, distorted, and dwarfed.	No very adequate control.
Septoria leaf spot, a fungus, Septoria lycopersici Atlantic and Central States as far south as South Carolina and Arkansas.	On leaves, many small, circular spots with gray centers covered with tiny dark specks.	Removal or turning under of diseased tomato vines in fall; crop rotation; spray or dust with copper fungicides, zineb, or nabam (with zinc sulfate).
Verticillium wilt, a fungus, Verticillium albo-atrum California, Utah, and some Northeastern States.	Yellowing, wilting, and loss of older leaves; plants wilt slightly during day but usually do not die.	Crop rotation; resistant varieties.
WATERMELON:		
Anthracnose, a fungus, Colletotrichum lagenarium East of Continental Divide.	Black spots on leaves that kill much of the foliage; circular, sunken spots on fruits with tan or pink masses of spores at center.	Seed treatment and sprays or dusts as recommended for cucumber anthracnose.

HOST Disease and Cause Distribution	Symptoms	Control
WATERMELON cont.		
Downy mildew, a fungus, Pseudoperonospora cubensis		
Chiefly along Atlantic seaboard.	Yellowish spots that later turn dark and may show purplish growth of fungus on under surface.	Spray or dust with copper fungicides or with ziram, zineb, or nabam (with zinc sulfate).
Fusarium wilt, a fungus, Fusarium oxysporum f. niveum		
Widespread.	Wilting and death of plants; fungus produces white, cottony growth on stems of dying vines.	Resistant varieties.
Stem-end rot, a fungus, Diplodia natalensis		
Chiefly in Southern States.	Soft, slimy decay of fruit whose surface becomes dark and shriveled; commonly starts at stem end.	Avoid injuring fruits in handling; after loading in car, cut stem and apply copper sulfate-starch paste to freshly cut surface.

DISEASES OF FORAGE LEGUMES

HOST Disease and Cause Distribution	Symptoms	Control
ALL FORAGE LEGUMES:		
Root knot nematode, *Meloidogyne* spp. General in South	Root swellings, stunting	Resistant varieties.
Southern blight, a fungus, *Sclerotium rolfsii* General in South	Decay at base of stem; formation of white mold and sclerotia on affected area	No control.
ALFALFA:		
Anthracnose, a fungus, *Colletotrichum trifolii* Eastern and Central States	Stem girdle and crown rot	Resistant varieties.
Bacterial wilt, a bacterium, *Corynebacterium insidiosum* Northern States, Southwest, California	Plants stunted and die	Resistant varieties.
Crown rot, a fungus, *Sclerotinia trifoliorum* General	Late-winter or early-spring wilt	Resistant varieties; rotation; deep plowing.
Damping-off, fungi: *Pythium* spp. General	Seedlings fail to emerge or break over and die	Seed treatment sometimes helpful; well-drained area.
Downy mildew, a fungus, *Peronospora trifoliorum* General	Leaves yellow and curl, purplish downy growth on under side	Resistant varieties.
Dwarf, a virus California and Arizona	Stunting, root discoloration, death	Resistant varieties
Leaf spot, a fungus, *Pseudopeziza medicaginis* General	Brown spots with raised disk in center	Clipping before serious; resistant varieties.
Root and crown rots, Fungi: *Fusarium* spp., *Rhizoctonia solani* General	Plants wilt and die	Rotation; good drainage.
Rust, a fungus, *Uromyces striatus medicaginis* General	Brown pustules	No control.
Spring black stem, a fungus, *Ascochyta imperfecta* Eastern and Central States	Leaf spot and stem blackening	Sanitation; clipping before serious.
Stem nematode, *Ditylenchus dipsaci* Western States	Dwarfing, shortened internodes, crown rot	Resistant varieties.
Summer black stem, a fungus, *Cercospora zebrina* General	Leaf spot, blackening of upper stems	No control.

HOST Disease and Cause Distribution	Symptoms	Control
ALFALFA cont.		
Target spot, a fungus, Pleospora herbarum (Stemphylium botryosum).		
Eastern States	Leaf spot with concentric rings.	No control.
Witches'-broom, a virus		
Washington, Utah, Arizona, Idaho, Oregon	Erect, bunchy growth	Community-wide plowing under of old diseased stand and reseeding.
Yellow leaf blotch, a fungus, Pyrenopeziza medicaginis		
General	Angular, yellow blotches between veins.	Clipping before serious.
CLOVERS:		
Crown rot. See under ALFALFA		
Damping-off, fungi: Pythium spp.		
General	Seedlings fail to emerge or break over and die.	Seed treatment sometimes helpful.
Leaf spot, a fungus, Cercospora zebrina		
General	Round to angular, reddish-brown spots.	Rotation; sanitation.
Mosaic, many viruses		
General	Mottling; yellow streaking or blotching; leaf distortion.	No control.
Root and crown rots. See under ALFALFA.		
Root rot, fungi: Fusarium spp., Rhizoctonia solani, Phoma sp.		
General	Plants wilt and die; roots discolored.	Rotation; adequate fertility.
Rust, fungi: Uromyces trifolii hybridi (alsike), U. trifolii fallens (red), U. trifolii repentis (white)		
General	Brown pustules on leaves and stems.	Resistant varieties.
Sooty blotch, a fungus, Cymadothea trifolii		
General	Elevated black patches on under side of leaves.	Clipping before severe.
Summer black stem. See Leaf spot.		
CLOVER, LADINO WHITE:		
Leaf spot, a fungus, Curvularia trifolii		
East, Pennsylvania to Florida	Leaf and petiole wilt.	Clipping before severe.
Pepper spot, a fungus, Pseudoplea trifolii		
General, eastern half of U. S.	Numerous, tiny, sunken black spots on leaves and petioles.	No control.

HOST Disease and Cause Distribution	Symptoms	Control
CLOVER, RED:		
Black patch, unidentified fungus Southeast and Wisconsin	Leaf spot and blight of heads.	Rotation; seed treatment.
Leaf spot, a fungus, Pseudopeziza trifolii General	Leaf spot with small, raised disk in center.	Resistant varieties.
Northern anthracnose, a fungus, Kabatiella caulivora General in northern clover belt.	Leaf scorch, stem killing.	Resistant varieties.
Powdery mildew, a fungus, Erysiphe polygoni General	White, powdery growth on leaf.	Resistant varieties.
Southern anthracnose, a fungus, Colletotrichum trifolii General in southern clover belt.	Leaf scorch, stem killing	Resistant varieties.
Spring black stem, a fungus, Phoma trifolii General	Leaf spot and stem discoloration.	Rotation, sanitation.
Target spot, a fungus, Stemphylium sarcinaeforme General	Leaf spot with concentric rings.	Resistant varieties.
COWPEA:		
Bacterial blight, a bacterium, Xanthomonas vignicola South	Stem blight.	Resistant varieties.
Root and crown rots. See under ALFALFA.		
KUDZU:		
Root rot, a fungus, Rhizoctonia solani South	Roots brown, plants killed.	No control.
LESPEDEZA:		
Bacterial wilt, a bacterium, Xanthomonas lespedezae. General where crop is grown.	Wilt of individual shoots.	Resistant varieties.
Powdery mildew, a fungus, Microsphaera diffusa General where crop is grown.	Powdery white growth on leaves.	Resistant varieties.
LUPINE:		
Anthracnose, a fungus, Glomerella cingulata Southeastern States	Girdling stem lesions	Rotation, disease-free seed.
Brown spot, a fungus, Ceratophorum setosum Southeastern States	Black spots on leaves and stems.	Rotation.

HOST Disease and Cause Distribution	Symptoms	Control
SOYBEAN:		
Bacterial blight, a bacterium, Pseudomonas glycinea		
General	Leaf lesions.	Resistant varieties.
Bacterial pustule, a bacterium, Xanthomonas phaseoli		
General	Leaf lesions.	Resistant varieties.
Brown stem rot, a fungus, Cephalosporium gregatum		
Midwest	Browning inside stems	Rotation.
Bud blight, a virus		
General, principally Midwest.	Leaf mottling, terminal and lateral bud blight.	No control.
Frogeye leaf spot, a fungus, Cercospora sojina		
General	Gray to tan leaf and pod spot.	Rotation; resistant varieties.
Mosaic, a virus		
General	Leaf mottling, terminal and lateral bud blight.	No control.
Purple seed stain, a fungus, Cercospora kikuchii		
General	Seed discolored pink to dark purple.	No control.
Stem canker, a fungus, Diaporthe phaseolorum var. batatatis.		
Midwest	Brown, sunken lesion girdles stem.	Rotation; sanitation.
Wildfire, a bacterium, Pseudomonas tabaci		
General.	Leaf lesions	Resistant varieties.
Yellow mosaic, a virus		
General, principally Midwest	Leaf mottling, terminal and lateral bud blight.	No control.
SWEETCLOVER:		
Black stem, a fungus, Mycosphaerella lethalis		
Eastern and Central U. S.	Leaf spot and stem blackening.	Clipping before serious; rotation.
Stem canker, a fungus, Ascochyta caulicola		
Central States	Silvery, white cankers on stems.	No control.
TREFOILS:		
Foliar blight, a fungus, Rhizoctonia solani		
General wherever grown	Leaves turn gray and wilt, stems killed.	No control.
VETCHES:		
Anthracnose, a fungus, Colletotrichum villosum		
General in South	Linear stem lesions.	Rotation; resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
VETCHES cont.		
Black stem, fungi: Ascochyta pinodella, Mycosphaerella pinodes		
General in South	Stem blackening.	Rotation; disease-free seed.
Leaf spot, a fungus, Botrytis cinerea		
General in South, occasionally elsewhere where crop is grown.	Small, dark-red spots on leaves.	Rotation; resistant varieties.
Root rot, a fungus, Aphanomyces euteiches		
General in South	Dwarfing, darkened roots	Resistant varieties.
WINTER PEA:		
Black stem. See under VETCHES.		
Leaf blotch, a fungus, Septori pisi		
General in South	Leaves yellow and turn brown.	Rotation
Root rot. See under VETCHES.		

DISEASES OF GRASSES

HOST Disease and Cause Distribution	Symptoms	Control
ALL GRASSES:		
Anthracnose, a fungus, Colletotrichum graminicola		
General	Light-tan lesions with dark specks on leaves and stems.	Adequate soil fertility; rotation; sanitation.
Bacterial streak, a bacterium, Xanthomonas translucens		
General	Translucent to yellowish streaks on leaves.	Resistant varieties.
Brown stripe, a fungus, Scolecotrichum graminis		
General	Brown to dark-purple streaks having gray centers with black dots in rows.	Resistant varieties.
Bunt. See Seed smuts.		
Crown rust, a fungus, Puccinia coronata		
General; most abundant in Mississippi Valley and Northeast.	Orange pustules, principally on leaves.	Resistant varieties and barberry eradication.
Downy mildew, fungi: Sclerospora spp.		
General	White, downy growth on leaves which turn yellow	Rotation; seed treatment.
Dwarf smut. See Seed smuts.		
Ergot, fungi: Claviceps spp.		
General	Black, sclerotial bodies replace seeds.	Ergot-free seed; deep plowing.
Eyespot, a fungus, Mastigosporium rubrieosum		
Northwestern States	Gray spots with red or purple border.	No control.
Flag smuts. See Stripe smuts.		
Grass seed nematode, Anguina spp.		
Great Plains and West	Seeds transformed into purple or black galls.	Clean seed; burning; rotation.
Head smut, fungi: Sorosporium, Sphacelotheca, and Ustilago spp.		
General	Seed heads black and smutty.	Resistant varieties; sometimes seed treatment.
Leaf blotch, fungi: Septoria spp.		
General	Gray to brown spots along leaf blades.	Rotation; sanitation.
Leaf rusts, fungi: Puccinia rubigo-vera agropyri, P. rubigo-vera apocrypta, P. rubigo-vera impatientis, P. rubigo-vera agropyrina.		
General	Reddish-brown to orange pustules, principally on leaves.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
ALL GRASSES cont.		
Leaf scald, a fungus, Rhizoctonia solani South	Large, bleached to tan areas on leaves.	Resistant varieties.
Loose smut. See Head smut.		
Pink snow mold, a fungus, Fusarium nivale Northern and western States	Leaves in winter formed into pink or straw-colored mats.	Select fields with good drainage.
Powdery mildew, a fungus, Erysiphe graminis General	White, dusty patches on leaves.	Resistant varieties.
Root rot, fungi: Fusarium spp., Helminthosporium spp., Rhizoctonia solani General	Plants stunted; roots discolored or rotted off.	Fall seeding where practical; good fertility.
Scald, fungi: Rhynchosporium orthosporum, R. secalis General	Grayish blotches on leaf blade and sheath.	Resistant varieties.
Seed smuts, fungi: Tilletia spp. General	Smut "balls" replacing seeds in heads.	Seed treatment; resistant varieties.
Seedling blight and root rot, fungi: Pythium spp. General	Seedlings damp-off, wilt suddenly, and die.	Well-drained soil; sometimes seed treatment.
Speckled snow mold, fungi: Typhula spp. Northern States	Gray rot of leaves in mid- to late-winter, tiny black sclerotia on dead leaves.	Chemical treatment on lawn or golf turfs.
Spot or blister smuts, fungi: Entyloma spp. General	Flat to slightly raised oval spots on leaves.	No control.
Stem rusts, fungi: Puccinia graminis tritici, P. graminis avenae, P. graminis secalis, P. graminis poae, P. graminis phlei-pratensis General	Reddish-brown to black pustules, chiefly on stems.	Resistant varieties and eradication of barberry.
Stem smuts, fungi: Ustilago spp. General, but principally west of Mississippi River.	Brown to black smutty areas on internodes of stems.	Resistant varieties.
Stripe rust, a fungus, Puccinia glumarum Rocky Mountain States and westward.	Yellow pustules in rows or stripes.	Resistant varieties.
Stripe smuts, fungi: Ustilago and Urocystis spp. General	Gray to black stripes of varying length on leaves causing curling and shredding.	Seed treatment; resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
BERMUDA-GRASS:		
Leaf spot, fungi: Helminthosporium giganteum, H. cynodontis		
South	Zonate eyespot; bleaching and withering of leaf tips.	No control.
BLUEGRASSES:		
Leaf rust, a fungus, Puccinia poae-sudeticae		
General	Orange-red pustules on leaves and occasionally stems.	Resistant varieties.
BROMEGRASSES:		
Brown spot, a fungus, Helminthosporium bromi		
Northern half of U. S.	Dark-brown to purple spots surrounded by yellow border.	Resistant varieties.
Chocolate leaf spot or bacterial blight, a bacterium, Pseudomonas coronafaciens var. atropurpurea		
General	Grayish to purple-brown streaks on leaves.	Resistant varieties.
Leaf spot, a fungus, Selenophoma bromigena		
Central and Western States	Circular to irregular gray spots with brown borders.	Rotation; resistant varieties.
BUFFALOGRASS:		
Leaf and glume spot, false smut, a fungus, Cercospora seminalis		
Great Plains and West	Olive-green smutty growth on seed spikelets.	No control.
FOXTAIL MILLET:		
Gray leaf spot, a fungus, Piricularia grisea		
Central, Eastern, and Southern States.	Small, gray, circular to oval spots on leaves.	No control.
ORCHARDGRASS:		
Leaf spot, a fungus, Stagonospora maculata		
Northeastern States	Small, elongate, dark-brown to purple spots.	Resistant varieties.
PERENNIAL RYEGRASS:		
Blind seed disease, a fungus, Phialea temulenta		
Oregon and Washington	Normal-appearing seeds fail to germinate.	Burning; disease-free seed; deep plowing.
REDTOP:		
Red leaf spot, a fungus, Helminthosporium erythrospilum		
General	Straw-colored spots with reddish or brownish border.	No control.
SUDANGRASS, JOHNSONGRASS, SORGHUMS:		
Bacterial streak, a bacterium, Xanthomonas holcicola		
General	Narrow, red to brown irregular streaks.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
Bacterial stripe, a bacterium, Pseudomonas andropogoni		
General	Long, purplish-red to brown or tan stripes on leaves.	Resistant varieties.
Leaf blight, a fungus, Helminthosporium turcicum		
General	Large, gray to straw-colored lesions.	Resistant varieties.
Zonate leaf spot, a fungus, Gloeocercospora sorghi		
South	Large, reddish-purple to tan zonate spots.	Resistant varieties.
TALL FESCUE:		
Net blotch, a fungus, Helminthosporium dictyoides		
General	Dark-brown, netlike leaf discoloration.	Resistant varieties.
TIMOTHY:		
Eyespot, a fungus, Heterosporium phlei		
General	Small, oval, light-colored spots with narrow, violet or brown border.	Resistant varieties.

HOST Disease and Cause Distribution	Symptoms	Control
APPLE:		
Armillaria root rot, a fungus, Armillaria mellea		
General	Kills portion or entire tree, leaves collapse.	Difficult; avoid planting in newly cleared land.
Bitter pit, nonparasitic		
Throughout world	Small sunken spots, generally on lower half of apple.	Difficult; avoid excessive irrigation and nitrogen fertilization.
Bitter rot, a fungus, Glomerella cingulata		
Common in Southern States east of Rocky Mountains	Rapid, destructive rot of fruit; diseased portion covered with concentric rings of sticky spore masses.	Bordeaux mixture or ferbam sprays starting in June.
Black rot, a fungus, Physalospora obtusa		
General	Leaf spot causing excessive defoliation; affected fruit holds shape and has rings of color but no spores on surface.	Removal of all deadwood. Sprays for apple scab will hold disease in check.
Blotch, a fungus, Phyllosticta solitaria		
General in southern portion of apple region east of Continental Divide	Blotchy spots on fruit; cankers on twigs; at times a tiny spot on leaves.	Bordeaux mixture or ferbam sprays.
Brown rot, a fungus, Monilinia fructicola		
Occurs only occasionally in humid sections	Fruit rot; circular rings of gray spores.	Sulfur spray or dust.
Crown gall, a bacterium, Agrobacterium tumefaciens		
General, particularly on nursery stock	Rough galls on stem and roots.	Difficult once established in orchard; avoid planting diseased nursery stock.
Fire blight, a bacterium, Erwinia amylovora		
General	Kills twigs, leaves, and sometimes entire tree.	Difficult; avoid overfertilization; cut out all dead twigs and branches. Weak bordeaux spray during blossom period is sometimes beneficial.
Jonathan spot, nonparasitic		
General	Small, brown, roughly circular spots. Mainly on Jonathan variety but similar spots occur on many others.	Prompt cold storage after picking. Disease is primarily a transit and storage problem.
Mosaic, a virus		
Scattered throughout the world	Yellowish to white irregular areas on leaf; sometimes veins are chlorotic (white) while rest of leaf has normal green color.	Do not propagate from diseased trees; plant only clean stock.

HOST Disease and Cause Distribution	Symptoms	Control
APPLE cont.		
Northwestern anthracnose and perennial canker, fungi: Neofabraea malicorticis and N. perennans		
Pacific Northwest	Cankers on trees and bull's-eye type of fruit rot.	Control of woolly aphid reduces cankers on trees. Sprays during summer and washing harvested fruit reduce storage losses.
Phytophthora rot, a fungus, Phytophthora cactorum		
Scattered but more prevalent in Far West	Light-brown rot of fruit and cankers on trunk of tree.	Losses in market can be prevented by not selling fallen fruit. Trunk canker difficult to control.
Pink rot, a fungus, Cephalothecium roseum		
Common storage problem	Commonly associated with scab lesions; rotted spots remain firm and dry.	Storage below 50° F.
Powdery mildew, a fungus, Podosphaera leucotricha		
Common on nursery stock but mainly important in West on bearing trees	Leaves and shoots covered with grayish or white felt-like patches of mycelium; fruit reduced in size and skin russeted.	Liquid lime-sulfur or finely divided sulfur sprays during early part of growing season.
Rust, fungi: Gymnosporangium juniperi-virginianae, G. globosum, and G. clavipes		
Widespread	Galls on cedar leaves (cedar-apples); orange spots on leaves, clusters of cuplike structures on lower leaf surface; similar structures on fruit; symptoms vary with fungus involved.	Removal of cedar trees; if possible; ferbam sprays (1 - 1 1/2 lbs.) at pink, petal fall, and 10 days later for apple trees.
Scald, nonparasitic		
Widely distributed	A storage and transit problem. Skin of fruit is affected and area beneath is brown for 1/4 inch or more.	Prompt storage; oiled wrappers or shredded oiled paper in containers for fruit.
Sooty blotch, a fungus, Gloeodes pomigena		
Widespread	Irregular sooty patches or spots on fruit.	Bordeaux mixture or ferbam sprays.
Scab, a fungus, Venturia inaequalis		
Everywhere apples are grown except in very dry regions	Brown velvetlike spots on leaves, blossoms, fruit, and at times twigs; spots may cause misshapen fruit.	Regular spray schedule using sulfur during early part of growing season.
Spongy dry rot, a fungus, Colletotrichum fructus		
Observed in North Carolina, Massachusetts, New York, West Virginia, Pennsylvania, and Indiana.	Small black spots scattered over surface of apple, usually on fallen fruit.	No special procedures have been developed. Regular spray schedule should hold losses to a minimum.

HOST Disease and Cause Distribution	Symptoms	Control
APPLE cont.		
Water core, nonparasitic		
General; especially prevalent in dry areas.	Flesh becomes water-soaked and frequently is hard and glossy; sometimes only core region is affected.	Prompt picking of fruit; especially exposed fruit on southwest side of tree.
APRICOT:		
Black spot, a bacterium, Xanthomonas pruni		
Common east of Rocky Mountains.	Spots on leaves, shot-hole effect; rough spots on fruit; cankers on twigs.	Difficult; no very satisfactory control known.
Brown rot, a fungus, Monilinia laxa		
General along Pacific coast	Blighting of blossoms and rot of fruit.	Copper spray before buds open in spring.
Coryneum fruit spot, a fungus, Coryneum carpophilum		
Common west of Rocky Mountains.	Spots on leaves; reddish spots with dark centers on on fruit.	Bordeaux mixture spray in fall and following spring.
Rust, fungi: Tranzschelia pruni-spinosae and T. discolor		
General, especially in Pacific Coast States.	Yellow spots on upper surface of leaves, reddish-brown, dusty pustules on lower surface; severe defoliation frequent.	No satisfactory control measure because of extreme sensitivity of apricot to sulfur sprays.
Scab, a fungus, Cladosporium carpophilum		
General	Black spots on fruit and pale-gray blotches on twigs.	Not important enough to require special treatment.
Silver leaf, a fungus, Stereum purpureum		
Scattered	Peculiar ashen-gray color of leaves; no fruit produced.	No satisfactory method known; avoid injuries to trees.
Yellows, a virus		
Scattered	Short willowlike shoots with small pale leaves.	Removal and destruction of affected trees.
AVOCADO:		
Anthracnose, a fungus, Colletotrichum gloeosporioides		
Florida and California	Black spots on fruit.	Bordeaux mixture sprays.
Blotch, a fungus, Cercospora purpurea		
Florida	Small, brown, slightly sunken spots on fruit; small angular spots on leaves.	Bordeaux mixture, cuprous oxide, or basic copper sulfate spray.
Cankers, fungi: Phytophthora cactorum and P. cinnamomi		
California and Florida	Cankers on trunk and rootstock.	High budding of susceptible varieties; pruning of diseased tissue and painting with bordeaux paste.

HOST Disease and Cause Distribution	Symptoms	Control
AVOCADO cont.		
Deficiency, nonparasitic Scattered in California and Florida.	Zinc deficiency causes little-leaf condition; lack of iron causes yellowing of leaf; excess of chlorides may cause tipburn of leaves.	Supplying, in a spray, small quantities of element missing. Difficult to control injury from excess of chlorides.
Dothiorella rot, a fungus, Botryosphaeria ribis (Imperfect stage, Dothiorella gregaria) California and Florida	Small brown or purplish-brown spots appear on ripe fruit after it has been harvested.	Removal of dead twigs and leaves; bordeaux mixture or certain organic sprays (Crag fungicide 658, and zineb); picking before fruit reaches peak of maturity.
Powdery mildew, a fungus, Oidium sp. Occasionally in Florida	White powdery spots on lower surface of leaf; tender tips of shoots are killed back.	Lime-sulfur spray or sulfur dust.
Root rot, a fungus, Phytophthora cinnamomi Widespread in tropics	Trees gradually deteriorate, become less green, branches die back; roots are blackened and brittle; tree dies.	No adequate control measures known. Avoid planting on poorly drained soils.
Scab, a fungus, Sphaceloma perseae Florida	Raised, corky brown spots on fruit; similar spots on leaves and twigs.	Bordeaux mixture or cuprous oxide sprays.
Sun blotch, a virus California and rarely in Florida.	Yellow to red streaks on mature fruit; yellow streaks on green stems and branches.	Disease-free wood for propagation; removal of all trees showing symptoms.
Verticillium rot, a fungus, Verticillium albo-atrum California and Florida	Sudden wilting and collapse of trees.	Avoid planting on infected land; do not interplant with susceptible crops; do not use affected trees as source of budwood.
BANANA:		
Bacterial wilt, a bacterium, Xanthomonas solanacearum General	Leaves turn yellow or white; individual "fingers" may be dwarfed or turn black.	Removal of all banana trash and deep plowing to expose ground to sun.
Bunchy top, a virus General except in Caribbean region and West Africa.	New leaves short; with up-curved margins; leaves stiff and upright; fruit rarely produced.	Roguing of diseased plants.

HOST Disease and Cause Distribution	Symptoms	Control
BANANA cont.		
Cigar-end disease, a fungus, Stachylidium theobromae		
General.	Tip of bananas shrinks and turns gray to black.	Very few fruit usually involved; no special measures.
Elephantiasis, not definitely established -- several fungi and bacteria reported to be involved		
Occurs on newly planted land; in Western Hemisphere.	Bottom or top of rhizome enlarges, separating leaves.	Same as for bacterial wilt.
Finger, neck, and stalk rots, fungi: Thielaviopsis paradoxa and Gloeosporium musarum		
Western Hemisphere	Fruit stem invaded; fruit discolored and rotted.	Cover cut surface of stalk with fungicide paste; clean and treat all machinery that handles fruit.
Heart leaf disease, not definitely established		
Frequent in new plantings	Heart leaf fails to unroll, wilts, and develops rotted patches.	Plant recovers in well-fertilized plantings.
Panama disease, a fungus, Fusarium oxysporum cubense		
Widespread in Tropics	Leaves wither and drop; entire plant killed. Pseudostem splits; vascular bundles discolored.	Difficult; flood land with 3 feet of water for 6 months.
Sigatoka disease, a fungus, Mycosphaerella musicola		
Worldwide in Tropics	Streaks and black, elliptical spots on leaves. Appears first on fourth or fifth leaf.	10-10-100 bordeaux mixture spray at 7- to 14-day intervals.
Squirter, a fungus, Nigrospora sphaerica		
Common in Australia; occasionally in Caribbean region.	Fruit rots with pulp decomposed into dark thick fluid.	Fungicidal dip for fruit.
BLACKBERRY:		
Anthracnose, a fungus, Elsinoë veneta		
General	Spots with gray centers and purple-brown margins on canes; fruit and leaves rarely attacked.	Pruning of diseased canes; bordeaux mixture spray.
Cane rust, a fungus, Kuehneola uredinis		
General	Canes split and dry out; leaves attacked in late summer. Does not prevent blossoming.	Fungus does not infect roots; plants do not have to be dug up and destroyed; merely remove and burn diseased canes.
Crown gall, a bacterium, Agrobacterium tumefaciens		
General	Galls develop at base of canes as well as some distance above ground.	Plant only disease-free nursery stock; dig and destroy badly infected plants.

HOST Disease and Cause	Symptoms	Control
BLACKBERRY cont.		
Double blossom, a fungus, Cercosporella rubi		
General in Southern States	Witches'-brooms form on stems. Flower buds larger petals wrinkled and twisted.	Only control is removal and destruction of double blossoms.
Leaf blight, a fungus, Mycosphaerella dubia		
Scattered locations in South	Leaves are spotted; turn brown as though scorched.	Spray for anthracnose will control leaf blight.
Leaf spot, a fungus, Mycosphaerella rubi		
General	Spots on leaves with purple margins and gray centers.	Spray for anthracnose will control.
Orange rust, a fungus, Gymnoconia interstitialis		
General	In early spring leaves are covered with orange, blister-like pustules filled with spores. Prevents blossoming.	Removal of all rust-infected plants; regular inspection of plantings to detect disease.
BLUEBERRY:		
Botrytis blight, a fungus, Botrytis cinerea		
Widespread	Blossom clusters blighted, tip of shoots infected, fruit rots.	No satisfactory control known.
Leaf spot (double spot), a fungus, Dothichiza caroliniana		
Common in Southeastern States.	Spots on leaves.	Bordeaux mixture spray.
Mummy berry, a fungus, Monilinia urnula		
Widespread	Young leaves and flower buds affected. Fruit changed into hard inedible mummies.	Ziram spray in spring to protect young buds.
Powdery mildew, a fungus, Microsphaera pedicillata		
Widespread in Eastern States.	Leaves covered with web of fungus growth and killed.	Wettable sulfur or bordeaux mixture sprays.
Rust (leaf), a fungus, Pucciniastrum myrtilli		
Common in range of alternate host (hemlock).	Small irregular dark-brown spots with dusty pustules.	Copper-lime dusts.
Stem canker, a fungus, Physalospora corticis		
General in Southeastern States	Cankers on bark of stems and branches.	Difficult to control; resistant varieties only logical solution.
Stunt, a virus		
Eastern States	Dwarfs bush; small leaves, abnormally colored; fruit small, poor quality.	Removal of diseased plants; DDT to control leafhopper that spreads disease.
Tip blight, a fungus, Diaporthe vaccinii		
In Eastern States and Washington.	Tips of twig infected and die.	None developed.

HOST Disease and Cause	Symptoms	Control
BLUEBERRY cont.		
Witches'-broom, a fungus, Pucciniastrum goeppertianum		
Widespread	Whorls of short swollen branches develop.	None known; infected portions should be removed.
CHERRY:		
Black knot, a fungus, Dibotryon morbosum		
General	Hard, black, rough fungus growths develop on shoots, branches, and sometimes trunk.	Pruning of diseased areas; bordeaux mixture spray in dormant season; removal of affected wild trees near orchard.
Brown rot, a fungus, Monilinia fructicola		
General	Blossoms sometimes blighted but disease commonly rots fruit as it begins to ripen.	Usually controlled by sprays for leaf spot. Application of sulfur just as fruit begins to color very helpful.
Leaf spot, a fungus, Coccomyces hiemalis		
General	Brown spots develop on leaves; tree can be defoliated rapidly.	Spray sour cherries with lime-sulfur or copper compounds. Never use copper sprays on sweet cherries.
Powdery mildew, a fungus, Podosphaera oxyacanthae		
General	Small, round, whitish blotches on leaves and shoots; affected part covered by feltlike fungus growth.	Sprays for leaf spot generally keep disease under control.
Yellows, a virus		
Northeastern States	Green and yellow mottling of leaves followed by waves of defoliation 3-4 weeks after petal fall.	Certified virus-free nursery stock.
CITRUS:		
Deficiency diseases, nonparasitic		
Severe in some sections	Vary with particular element that is deficient.	Addition of required element either as spray or in fertilizer.
Gummosis, nonparasitic		
General	Gum pockets under bark; large areas sometimes involved.	Keep trees in vigorous growing condition.
Melanose, a fungus, Diaporthe citri		
Common in Florida, rare in California	Raised, rough, brown spots develop on fruit, leaves, and twigs.	Bordeaux mixture spray.

HOST Disease and Cause	Symptoms	Control
CITRUS cont.		
Psorosis, a virus		
General in California and Florida.	Small areas of bark and branches die; bark cracks; affected trees slowly go out of production.	Select budwood only from psorosis-free trees.
Scab, a fungus, Elsinoë fawcetti		
General	Irregular warty outgrowths that have light-brown or grayish tips.	Bordeaux mixture spray.
Stem-end rot, fungi: Phomopsis citri, Diplodia natalensis		
General	Fruit decay starting at stem end and gradually involving entire fruit. A storage and market disease.	Prompt cooling and marketing of fruit.
Tristeza and quick decline, a virus		
In most citrus sections throughout world.	Food-conducting tissues of stem collapse; stem pitting develops; trees rapidly decline and die.	Disease-tolerant root-stocks and disease-free buds to produce new trees.
CRANBERRY:		
False-blossom, a virus		
Wisconsin, Massachusetts and New Jersey.	Erect flowers with short petals and enlarged greenish calyx lobes; no fruit produced.	Production of resistant varieties.
Fruit rots, eight species of fungi		
General	Berries rot on vines and in storage.	Ferbam spray at beginning and end of blossom period.
Oxygen deficiency, physiological lack of oxygen caused by flooding bogs		
General	All parts of plant may be injured or killed.	Control flooding of bogs; do not allow water to get too deep; keep oxygen content of water above 5.7 p.p.m.
FIG:		
Anthracnose, a fungus, Glomerella cingulata		
General	Sunken discolored spots on fruit, frequently covered with pink spore masses; gray sunken spots on leaves.	No special procedure has been developed; remove and destroy infected fruit.
Leaf blight, a fungus, Corticium sp.		
General	Yellow water-soaked areas on leaves, finally silvery white on upper surface, web of fungus growth on lower surface. Also affects twigs and fruit.	Destroy all affected leaves, twigs, and fruit.

HOST Disease and Cause	Symptoms	Control
FIG cont.		
Root rot, a fungus, Phymatotrichum omnivorum		
Localized areas in Southwest.	Leaves wilt and bush dies within a few days; roots are decayed.	None; fig should not be planted in areas where fungus is known to occur.
Rust, a fungus, Physopella fici		
General	Light-colored pustles with powdery spore masses form on under side of leaf.	Bordeaux mixture sprays starting in June at intervals of 3-4 weeks until end of growing season.
GRAPE:		
Anthracnose, a fungus, Elsinoë ampelina		
Eastern States especially in the South.	Dark-brown, small spots on leaves; spots on fruit have dark center (bird's-eye rot).	Removal of all diseased parts of vine; lime-sulfur and then bordeaux mixture sprays.
Black rot, a fungus, Guignardia bidwellii		
General east of Rocky Mountains.	Circular spots on leaves, petioles, shoots, blossoms; fruit rapidly destroyed, shrivels into mummies.	Bordeaux mixture or ferbam spray.
Dead arm, a fungus, Cryptosporella viticola		
General in Northeastern States.	Canker on branch (arm) or trunk; leaves yellow, small, crimped; affected portion dies; fruit sometimes affected.	Systematic removal of all diseased parts followed by spraying with bordeaux mixture or ferbam.
Downy mildew, a fungus, Plasmopara viticola		
Common in Eastern States.	Light-yellow, roughly circular spots on leaves; downy fungus growth on lower surface of leaves; fruit may be covered with fungus growth.	Bordeaux mixture of fixed coppers plus lime.
Powdery mildew, a fungus, Uncinula necator		
General; particularly destructive in Pacific Coast States.	Superficial, grayish-white fungus growth on leaves, shoots, and fruit; fungus grows on upper surface of leaves.	Copper fungicides in East; sulfur spray or dusts in West.
PEACH:		
Armillaria root rot, a fungus, Armillaria mellea		
General	Tree goes into slow decline and dies; roots rotted.	No very satisfactory method developed.
Bacterial spot, a bacterium, Xanthomonas pruni		
General east of Rocky Mountains.	Small, purple, angular spots on leaves; rough cracks on fruit.	Difficult; spraying with zinc-lime holds disease in check.

HOST Disease and Cause	Symptoms	Control
PEACH cont.		
Brown rot, a fungus, *Monilinia fructicola*		
General	Blights blossoms; cankers on twigs; fruit rots rapidly, covered with gray spore masses.	Sulfur spray or dust; control of plum curculio.
Clitocybe root rot, a fungus, *Clitocybe tabescens*		
Scattered, especially in Southeast.	Affected trees slowly lose vigor; roots destroyed.	No control measures developed.
Cold injury, low temperatures		
General	Buds may be killed in spring; branches, limbs, and even entire trees may be killed during winter.	Keep trees growing vigorously, control diseases, prevent defoliation.
Constriction disease, a fungus, *Diaporthe* sp.		
Eastern seaboard	Cankers form at base of buds; twigs girdled and killed.	No satisfactory procedure known.
Coryneum blight, a fungus, *Coryneum carpophilum*		
General along Pacific coast; occasionally noted in East.	Gumming cankers on twigs, spots on leaves; small spots with white centers on fruit.	Bordeaux mixture spray during winter.
Crown gall, a bacterium, *Agrobacterium tumefaciens*		
General	Galls on roots and crown. Important in nursery stock.	Disease-free planting stock.
Dieback, a fungus, *Valsa leucostoma*		
General	Fungus occurs on woody parts of tree as result of other injuries.	Keep trees growing vigorously; prune carefully to avoid sunscald.
Leaf curl, a fungus, *Taphrina deformans*		
General	Unfolding leaves distorted in spring; young shoots may be swollen; red welts on fruit.	Readily controlled by spray of lime-sulfur or bordeaux mixture in dormant season.
Little peach, a virus		
Northeastern States	Fruit ripens later than normal, leaves light green, rolled, and drooped.	Trees never recover and should be removed.
Phony, a virus		
Widespread in Southeast.	Trees stunted; leaves frequently dark green; fruit insipid, small.	Only control available is removal of diseased trees.
Rosette, a virus		
Scattered in South.	Twigs shortened producing whorls or rosettes; tree killed.	Immediate removal of diseased trees.

HOST Disease and Cause	Symptoms	Control
PEACH cont.		
Rust, a fungus, Tranzschelia discolor		
General	Yellow spots on leaves, dusty brown pustules of spores on lower surface; fruit attacked in California.	Controlled in West by sulfur sprays.
Scab, a fungus, Cladosporium carpophilum		
General	Brown to black spots on fruit, frequently around stem; in severe cases fruit is cracked; numerous spots on twigs.	Sulfur spray 4 to 5 weeks after petals drop.
Yellows, a virus		
Eastern and Central States; rare south of Virginia.	Premature ripening of fruit, red spots on fruit; willowlike shoots with small pale leaves.	Affected trees never recover; remove immediately.
PEAR:		
Fire blight, a bacterium, Erwinia amylovora		
General	Kills blossom clusters, twigs, limbs, and even entire trees.	Difficult; remove all blighted shoots, do not overfertilize.
Leaf blight, a fungus, Fabraea maculata		
General	Carmine-red spots on leaves that turn dark brown; similar spots on fruit.	Ferbam, lime-sulfur or bordeaux mixture sprays. Ferbam causes the least injury to leaves.
Leaf spot, a fungus, Mycosphaerella sentina		
General in Eastern States.	Only leaves are affected; spots have well-defined, angular margins and grayish-white centers.	Sprays recommended for leaf blight will also control this disease.
Scab, a fungus, Venturia pyrina		
General	Olive-colored spots on fruit, leaves, and twigs; skin of fruit cracks; fruit frequently distorted.	Bordeaux mixture or sulfur spray. Ferbam and ziram now used by commercial growers in West.
Stony pit, a virus		
Prevalent in Northwest; scattered cases in East.	Fruit develops sunken spots and becomes much distorted; flesh at base of pit hard. Particularly common on Bosc variety.	No control known; Bosc trees frequently top-worked to Bartlett which does not show symptoms.
PECAN:		
Bunch disease, a virus		
Mississippi, Texas, Oklahoma, and Louisiana.	Broomlike groups of small branches and shoots.	No method known; do not propagate from diseased trees.

HOST Disease and Cause	Symptoms	Control
PECAN cont.		
Crown gall, a bacterium, Agrobacterium tumefaciens		
General	Rough swellings on roots and at base of trunk; nursery trees frequently affected.	Avoid planting diseased nursery stock.
Leaf diseases, various fungi		
Throughout Southern States.	Spots of various types on leaves; some defoliation.	Do not plant trees too closely; keep trees growing vigorously. Scab sprays will control these troubles.
Scab, a fungus, Cladosporium effusum		
Throughout Southern States.	Premature defoliation; nuts shrivel and are destroyed.	Removal of old diseased leaves and nuts in early spring; pruning; low lime bordeaux mixture spray followed by sprays of ziram or zineb.
Rosette, nutritional (lack of zinc)		
Throughout Southern States.	Yellow mottling and crinkling of leaves; dwarf leaves; twigs and branches in top of tree die.	Zinc sulfate spray, 2 lbs. to 100 gallons (number of applications depends upon severity of disease). Zinc sulfate applied to soil also beneficial.
PLUM:		
Black knot, a fungus, Dibotryon morbosum		
General	Galls or knots on twigs and branches.	Removal of diseased parts; bordeaux mixture spray during winter.
Black spot, a bacterium, Xanthomonas pruni		
General east of Rocky Mountains.	Purple spots on leaves; dark roughened spots on fruit; large cankers on twigs and branches.	Difficult; do not plant Japanese varieties in areas where disease occurs.
Brown rot, a fungus, Monilinia fructicola		
General	See under Peach	See under Peach.
Plum pockets, a fungus, Taphrina sp.		
General	Fruit enlarged, hollow, and spongy; no seed; young leaves and shoots swollen and distorted.	Lime-sulfur or bordeaux mixture spray during dormant period.
Rosette, a virus		
In South	See under Peach	Destruction of all affected trees.
Rust, a fungus, Tranzschelia pruni-spinosae and T. discolor		
General	Yellow spots on leaves and pustules of brown spores on lower surface of leaves.	Definite control procedures not developed.

HOST Disease and Cause	Symptoms	Control
PLUM cont.		
Yellows, a virus		
Scattered in northern half of country east of Rocky Mountains.	See under Peach.	Removal and destruction of all affected trees.
QUINCE:		
Fire blight, a bacterium, Erwinia amylovora		
General	Killing of young shoots, leaves, and blossom clusters.	Difficult; no satisfactory method known.
Fruit spot, a fungus, Mycosphaerella pomi		
General in Eastern States.	Dark blotchlike spots form, usually more numerous around blossom end.	Ferbam spray in late June and again in July.
Leaf blight, a fungus, Fabraea maculata		
General	Roughly circular spots on leaves and black spots on fruit.	Ferbam spray several times during growing season.
Rust, a fungus, Gymnosporangium clavipes		
Common in Eastern States.	Orange fringelike growths develop on fruit and frequently on twigs.	Removal of cedar trees; ferbam spray on quince in spring.
RASPBERRY:		
Anthracnose, a fungus, Elsinoë veneta		
General	Circular, red-brown, sunken spots on canes; light-colored spots on leaves; fruit infected, misshapen, and worthless.	Removal and destruction of affected canes; lime-sulfur or dinitro spray in dormant season; ferbam during growing season.
Blue stem, a fungus, Verticillium albo-atrum		
General	Lower leaves turn yellow and die; entire plant wilts and canes turn blue.	Use only healthy plants; do not interplant with tomatoes or potatoes; remove infected plants; drench soil with fungicide.
Leaf spot, a fungus, Septoria rubi		
General in Eastern States.	Brown or purple spots on leaves; severe defoliation.	Destruction of affected leaves; sprays as given for anthracnose.
Mild streak, a virus		
General	Only on black varieties. Canes have discolored stripes; plants rarely killed.	Keep new plantings isolated, use only disease-free stock; destroy diseased plants.
Mosaic, a virus		
General	Green type: Mottled pattern of light and dark green areas on leaves. Yellow type: Entire leaf turns bright yellow.	Destroy infected plants; use only disease-free planting stock; control aphids.

HOST Disease and Cause	Symptoms	Control
RASPBERRY cont.		
Orange rust, a fungus, Gymnoconia interstitialis		
General	Leaves covered with bright orange mass of powdery spores.	Remove and burn infected plants; destroy nearby wild plants.
Severe streak, a virus		
General	Similar to mild-streak except symptoms more severe and plants soon die.	Same as for mild streak.
Spur blight, a fungus, Didymella applanata		
General in Eastern States.	Reddish-brown areas on stem around buds; canes sometimes killed.	Remove old canes; keep plants open for air circulation; use lime-sulfur in winter and ferbam for summer sprays.
STRAWBERRY:		
Botrytis rot, a fungus, Botrytis sp.		
General	All parts above ground affected but fruit severely damaged; small brown spots develop and berry is soon rotted.	No satisfactory control procedure; do not allow affected fruit to be mixed with sound berries.
Crinkle, a virus		
Mainly in Pacific Northwest.	Crinkling or wrinkling of leaves; leaves flecked with yellow.	Development of virus-free plants.
Leaf spot, a fungus, Mycosphaerella fragariae		
General	Small purple or red spots form on leaves; spots may fuse and leaves turn brown and die.	Difficult; spraying with bordeaux mixture gives some control.
Powdery mildew, a fungus, Sphaerotheca humuli		
General	Leaves curl and are covered with powdery, white fungus growth; affected fruit dries and does not mature.	Difficult; probably spraying with sulfur will control.
Red stele, a fungus, Phytophthora fragariae		
General	Central portion (vascular cylinder) of roots has red color; small roots killed; plants stunted; leaves wilt.	Development of disease-resistant varieties only control known.
Stunt, a virus		
General	Leaf petioles shorter than normal, remain upright; no yellowing of leaf surface.	Development of virus-free plants.
Yellows, a virus		
General	Leaves cupped upward, yellow edges; plants stunted.	Development of virus-free plants.

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Division of Mycology and Disease Survey
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FRUIT VIRUS DISEASES IN NEW YORK IN RETROSPECT

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Plant Industry Station Beltsville, Maryland

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HISTORY

The so-called yellow-leaf-drop or physiological-yellow-leaf condition on Montmorency cherry was first reported by Stewart (77) as being of concern in New York State. Subsequently Gloyer and Glasgow (19) reported on the premature defoliation of cherry trees in relation to winter injury. When the present study was undertaken very little was known about stone fruit viruses and virtually nothing was recorded on cherry. In 1942 a handbook (44) was published which brought together information concerning virus diseases affecting stone fruits including cherries. Nine years later a revised handbook was published (1).

A preliminary survey involving visits to every fruit growing district was made of the New York fruit disease situation in 1932. Notes were taken on abnormalities of the various fruits. The most impressive condition observed was a so-called "winter injury" prevalent on the stone fruits, and a systematic mapping or case history study was planned for it. The unfruitful dwarf-leaf condition on Italian prunes was mapped in a few Niagara County orchards. Later, graft transmission demonstrated its virus nature (78). The writer assisted F. M. Blodgett in re-mapping his apple mosaic orchards. A peach condition simulating little-peach was mapped and followed in Ulster County for several years but was not reported.

Sour and sweet cherry orchards were revisited in the spring of 1933 and several in Ontario and Wayne Counties were mapped for yellow-leaf symptoms. In that year Montmorency cherry trees were found to be shedding numerous yellow and yellow-green leaves about July 1. More than half of the leaves of some trees were on the ground. Over 40 percent of the mapped trees in the "Red Jacket" orchard studied in earlier "winter injury" investigations were designated, after conference with Stewart, as having the so-called physiological yellow-leaf or leaf-drop condition (77). Judging by the inactive buds and stubby terminals on many of the trees, they were suffering from an internal-injury condition.

At the beginning of June 1934 another cherry orchard survey was made, in more counties. The Red Jacket and several other sour cherry orchards were revisited and remapped. At this time true winter injury from the unprecedented cold of the 1933-1934 winter season was evident. One after-effect of the extreme cold was tree death. Another was the development of the silver leaf disease on young Montmorency trees in Orleans County (20). All of these conditions further confused the symptom picture. About June 1, a ring-shaped spot or mottle had developed on some sour cherry trees, some of which had shown yellows symptoms the year before. When revisited late in June mild yellows was again evident on a few of the trees that had shown abundant symptoms in 1933. Thus in 1934 mild yellows symptoms or none appeared on trees with marked yellows the year before, and yellows was present on trees that had shown ringspot symptoms earlier the same season. The appearance and the masking or disappearance of the yellows and ringspot symptoms between seasons was indeed confusing, but a tentative hypothesis was adopted of a variable single causal entity or a mixture of two or more entities of a virus nature.

A ringspot, shot-hole, or tatter-leaf condition was first observed in 1932 in several sweet cherry orchards, of which those near Sodus in Wayne County were selected for further study. Subsequently the affected trees displayed a varied pattern with regard to winter-injury, tatter-leaf, and fruit set. On Yellow Spanish the leaf symptom expression was severe in 1933 and relatively masked in 1934. The extremely cold winter of 1933-1934 killed some of the sweet cherry trees and severely injured many others. Thus surviving trees that had been mapped for typical leaf symptoms with some winter injury in the 1933 season were definitely suffering from more severe winter injury in 1934. Obviously, therefore, the tree injury could be only in part

of suspected virus origin. Heavy pruning after the severe cold of 1933-1934 stimulated new growth on affected trees, but the devitalization later found to be due to virus was of course not corrected and resulted in declining productivity.

In 1935 donation by Dansville nurserymen of a considerable quantity of surplus stone-fruit nursery trees for experimental purposes added much to the test planting started at Ithaca in 1934. Propagating materials from two cherry orchards were indexed into some of the dormant test trees by grafting shortly after planting but before growth started. A few buds from diseased orchard trees were also grafted into test trees after growth had started. When observations were made in the spring of 1936, yellows symptoms developed on over 30 percent of the graft-inoculated trees, but approximately 8 percent of the ungrafted check trees also showed yellows symptoms. The occurrence of trees showing symptoms in the checks suggested the need for reorientation of the studies to include observations in the nursery sources of the trees. Properly timed visits to cherry nurseries at Dansville, Geneva, and Honeyoye Falls in 1937 and succeeding years revealed that yellows symptoms were present in nurseries on two-year-old trees. The yellow leaf-drop in the nurseries resembled the condition in orchards and was considered the same disease, but with reservations because symptoms sometimes showed up later in nurseries. This was especially true for the one-year-old nursery trees on which symptoms were manifested only rarely and several weeks after their usual appearance in orchards.

As the greenhouse studies on plum viruses were tapered off in 1937, work was started on cherry viruses. None of the Red June or Burbank plums tested were entirely free from a line-pattern symptom condition later described by Cation (8). Subsequent studies were limited to Italian and Lombard plums. By this time there was circumstantial evidence from the studies on prune dwarf that nurserymen were supplying growers with masked-virus-infected stone fruits, such as line-pattern virosis in Red June and Burbank plums, prune dwarf in Damson plums, and the yellows complex in sour cherries.

To add to the confusion, under greenhouse conditions graft-inoculated sour cherry trees almost invariably failed to develop yellows symptoms. However, after transfer to outdoor test plantings, typical symptoms developed on infected trees during the following growing season. The masking effect of warm temperatures had been reported before in the literature on potato viruses. The only cherry yellows symptoms ever encountered were in the coolest greenhouse (below 65° F.) early in the season. The trees abruptly stopped developing yellows symptoms because the temperature could not be maintained below 68° F. For currant mosaic also it was found later that typical symptoms never developed at 70° and above. Cherry ringspot symptoms, however, usually developed on about one-half of the yellows-inoculated trees regardless of temperature and even on trees for which the bud inoculum came from trees marked as healthy on orchard maps, indicating that another virus must be present. This masking further confused the virus story, and made the indexing of orchard trees for presence of virus necessary before employing their budwood in propagation practice. Probably the most significant step stimulated by this situation was the initiation of attempts to discover other test plants that would be more suitable for indexing in the greenhouse.

The complicated causation factor was not obscured by the central fact that the causal entity, while nonlethal, was definitely devitalizing to the orchard trees and markedly reduced their productivity. Judging by the mapping and other records, the diseased trees never recovered. Little of publishable nature was obtained at the end of the first five years of study, but the expression "winter injury" was definitely taking on a more tangible meaning, with the hitherto unknown causal entities about to be demonstrated and announced. The study of cherry viruses was not aided to any great extent by the concurrent studies on other viruses such as prune dwarf (30, 78), line pattern on plum, peach viruses (24, 47), and currant mosaic (21, 22). Masked infection seemed even more prevalent in plum than in cherry viruses and with less devitalizing effects on most host species.

This report will present a résumé of the results from selected studies on the nature and identity of the virus diseases on sour and sweet cherries and other fruits as carried out in New York and in which the writer participated during the decade from 1935 to 1944.

MATERIALS AND METHODS

Numerous experiments were conducted in orchards, experimental plantings, and in the greenhouse. The orchard experiments were performed in the principal sour cherry counties of Wayne, Monroe, Orleans, Niagara, and Ontario in Western New York, chiefly bordering Lake Ontario. For greenhouse and experimental plantings one and two-year-old cherry trees were used, obtained from reputable nurseries and presumably free from disease. Rootstocks were obtained

from nurseries or grown from seeds obtained from seed-producing nurseries in Virginia and from the Pacific Coast. For satisfactory germination of rootstock seeds, suitable seed treatments were required[1].

Dormant grafts were frequently used in transmission tests from cherry to cherry. The usual procedure was to graft dormant scions on stock plants that were dormant or beginning to break dormancy as evidenced by the swelling of the buds. After the breaking of dormancy and loosening of the bark the bud graft proved more practical than the "whip" or "bark patch" grafts, although all three were used in numerous tests.

When employing the rapid-transmission technique (25), especially on peach seedlings, vigorously growing young plants between 16 and 24 inches tall were ordinarily used and bud grafts were made midway on the stem. Pruning just above the inserted bud stimulated new growth at the lateral buds, which ordinarily intensified the symptom expression by its directional effect on the movement and multiplication of the virus and the production of more succulent growth.

Other information on materials and methods will be found in the text.

INCIDENCE AND NATURAL SPREAD OF CHERRY VIRUS DISEASES

The incidence of sour cherry virus diseases was recorded by making maps annually of several orchards in five different counties. The orchards ranged in age from one to 18 years. Sweet cherry orchards were mapped in two counties. In two Montmorency orchards where detailed records were kept for over five years and an indexing check was made in the last year, 1943, every tree was positive for disease. In a typical orchard, when the first map was made in 1938 approximately 38 percent of the trees were marked as having cherry yellows symptoms. The symptomless trees were recorded as healthy. In 1943, at the end of five years, the total of 207 trees was classified under five headings (Table 1). By indexing on Montmorency cherry it was conclusively demonstrated that the apparently healthy trees were all masking the ringspot virus and that not a single tree in the total of 207 was virus-free. This proved to be the case in several other old orchards which were indexed. No young orchard soon after planting failed to show at least a small percentage of diseased trees (yellows or ringspot). In studies on numerous young orchards maps made on succeeding years always showed an increase in the number of diseased trees with time. No diseased tree was ever observed to recover.

Table 1. Summary record of virus disease incidence in Orchard A (Orleans) in 1943.

Virus Symptoms - Complex (Yellows - Ringspot)	Symbol	Trees: Number	Trees: Percentage	Indexing results (1943)
Severe yellows	YYYY	99	47.9	
Moderate yellows	YYY	56	27.1	
Mild yellows	YY	25	12.0	
Trace yellows	Y	15	7.2	
Apparently healthy	O	12	5.8	All RS*
	Totals	207	100.0	

* Ringspot

Cherry Yellows: One characteristic of cherry yellows virosis is its relatively slow spread

[1]The cold period for breaking dormancy of Prunus seed varies between species and may be effected by after-ripening treatments. It ordinarily takes about four months in moist peat at 40°F. to break dormancy of P. cerasi seed, about three months for P. mahaleb, and about six weeks for P. persica.

in orchards (44, 50). However, a more rapid spread may occur (72). Results were variable from orchard to orchard because change in environment may profoundly influence the activities of the vector, the identity of which still remains unknown. The results on spread obtained in New York orchards correspond to those observed in other places. One difficulty in measuring natural spread is the variability in sequence of developments taking place in trees of different ages. In young trees the sequence is simple. An older tree, instead of developing symptoms throughout in one or two years, may take as long as seven years from the beginning of an infection until the entire tree is involved, by which time it has reached the permanently unprofitable stage.

Seasonal developmental effects are also a factor, as Keitt and Moore (51) have demonstrated. When growing conditions are not conducive for prominent symptoms and the fungus leaf spot (Higginsia [Coccomyces] hiemalis) disease gets out of control, as happened in 1943, it is not uncommon for the trees to show no outward symptoms of yellows, especially in early stages of infection. The most reliable method of evaluation of spread in orchards is to make disease maps annually over a period of five to ten years, as has been done. The common incidence of 1 to 5 percent of disease in young orchards the first year from planting and of 40 to 90 percent in old orchards tells the yellows story, which, however, is greatly complicated by ringspot.

Ringspot and Yellows: One striking characteristic of ringspot virus disease is its relatively rapid spread in young Montmorency orchards, especially on Mazzard roots. One clear-cut case will be cited, that of a young orchard of 396 Montmorency trees on Mazzard roots planted in 1939. One tree showed stunting with positive but mild ringspot symptoms in 1940. The smaller size and the somewhat masked ringspot symptoms plus the shorter terminal growth were evidence that the tree had come diseased from the nursery. One other tree had conspicuous yellows symptoms in 1940, also indicative of nursery origin. Also, these trees were propagated from bud wood certified as disease-free by indexing. The yellows tree was eradicated in 1941. In 1942 another tree developed yellows symptoms and in 1943 a third tree, with the number increasing to six in 1944. These diseased trees were distributed at random as no two trees were closer than ten spaces apart.

FIGURE 1. Ringspot -- Severe ringspot "shock" symptoms on Montmorency cherry on Mazzard rootstocks. This photograph was taken in mid-summer after partial recovery.

The number of ringspot infections totaled 2 in 1941, 8 in 1942, 36 in 1943, and 105 in 1944. The new ringspot infections were very conspicuous, with the "shock" symptoms consisting of a severe shredding of leaves (Figure 1) and occasional dieback. As in the greenhouse and test planting trials, in the year following the initial shock the necrotic symptoms were much milder, but stunting of growth and reduction of leaf size, called small leaf, were characteristic. The

fruits set well but were smaller in size and darker in color than normal. These ringspot infections definitely decreased the vitality and productivity of the trees, from the start. In this orchard the origins of both diseases (yellows and ringspot) were definitely traced to single infected trees that came from the nursery. None of the wild Prunus species growing in the fence row at the south end of the orchard showed any evidence of disease and when indexed none showed evidence of harboring a virus. This case is cited because the complete story was known from the selection of disease-free budwood for nursery propagation in 1937 through 1944 when the observations ceased.

An interesting sidelight was the frequent development of Mazzard suckers under the vigorous young trees in the orchard. In every case without exception when the "shock" symptoms were showing on the Montmorency foliage, severe tatter-leaf symptoms were present also on the P. avium suckers. The writer has suspected for a long time that the vector may prefer the Mazzard to the Mahaleb rootstock, which could account for the more rapid spread when the Mazzard suckers are present, especially early in the season before mowing of the growth between and under the trees just before fruit-picking time.

INCIDENCE OF VIRUS SYMPTOMS IN NURSERIES

Before the general cherry virus disease nursery eradication program was initiated in 1939, yellows-diseased trees were frequently encountered in nursery plantings where budwood had been obtained from orchards. When nursery-grown budwood was used almost invariably a small percentage of individual nursery trees would have yellows or ringspot and it was concluded that diseased rootstocks could be the source in such instances. When incidence was more abundant, the diseased trees ordinarily occurred in series of four to seven according to the number of buds taken from each individual diseased budstick from orchard sources.

Records taken at several nurseries in the same and succeeding years revealed percentages of disease ranging from a fraction of 1 percent to over 90 percent in one nursery containing the Chase variety. In one nursery planting of second-year trees of the Chase variety, consisting of nine rows with 2995 trees, over 95 percent had yellow-leaf-drop symptoms. In 3 1/2 rows of the Early Richmond variety containing 910 trees, for which budwood came from the nursery, only about 3 percent were diseased. In another block of Early Richmond budded from a grower's orchard, with 4 1/2 rows and 1102 trees, over 90 percent showed yellow-leaf-drop symptoms. In two rows of 496 trees of English Morello budded from a grower's orchard about 51 percent showed typical yellow-leaf symptoms. The remainder of this nursery planting of over 30,000 trees, except for two rows of Chase cherry of about 250 trees with over 90 percent showing symptoms, were practically healthy with less than 5 percent of disease in any single row. These relatively disease-free trees had all been propagated from nursery budwood. The nursery cited had customarily propagated from budwood furnished by the larger growers as a special service up to this time. After this visit the Chase variety was completely eradicated along with all affected plants of the other varieties.

Numerous other cases could be cited where disease incidence was much less. In another nursery occasional clumps of diseased trees in groups of three to seven showed a total disease incidence of about 20 percent when the budwood came from growers' orchards. Here again incidence was always small, less than 5 percent, when the budwood came from the nursery; also, diseased trees occurred individually and were widely separated from each other by healthy trees.

The first nursery inspections were made with the full confidence of the nurserymen and in cooperation with the State Department of Agriculture and its horticultural inspectors. In fact, by assisting in the mapping the inspectors were trained in the method of identification employed by the regulatory service before the announcement in early 1940 that yellows was a virus disease. Once the hazards of imported budwood were explained to the nurserymen its use was quickly abandoned. Thereafter all nurserymen took practically all budwood from inspected and certified nursery blocks of trees. In exceptional instances a few budsticks were obtained from marked trees in growing orchards which the college had indexed and certified for freedom from virus before use in propagation. Subsequently serious incidence of virus infections in nurseries was easily traceable to budwood obtained from growers' orchards.

The role of cherry rootstocks in virus transmission and incidence has been reported in detail (43). Studies on the possibility of origin of the virus in rootstocks were conducted from several angles. Receiving attention from the start were: first the presence of chlorotic or virus symptoms on seedling foliage during the first or second year of growth from seed, and second the appearance of single or isolated affected trees in the nursery during the first or second year from grafting. The chlorotic stipple spot and the chlorotic ring or line spot have been regularly observed in Mahaleb rootstock but never on Mazzard. However, tatter leaf (43)

has been observed on Mazzard in nurseries to the extent of about 2 percent. The incidence of a low percentage of the chlorotic symptoms on Mahaleb rootstocks and of tatter leaf on Mazzard rootstocks in seedling and variety plantings is obviously a demonstration of seed transmission of these abnormalities. The occurrence of isolated diseased trees in nurseries is also strong evidence implicating the rootstock (seed) as source or origin of the virus. During summer inspection in an outstanding cherry nursery in Michigan where scion sources were carefully checked, the writer observed single individual sour cherry trees with yellows and ringspot symptoms in the nursery rows, ranging from 1 to 5 percent.

The fact that seedling rootstock samples of Mahaleb cherry from certain sources contain more of the chlorosis trouble than others, suggests the possibility that some virus is being picked up from wild plants adjoining the planting. Numerous Prunus species growing wild in nature have been indexed on peach seedlings for the presence of cherry yellows virus, but with negative results. Occasionally, however, the ringspot virus has been obtained from P. virginiana among others.

Judging from surveys of relatively large plantings, the occurrence of isolated diseased plants in seedlings and in nursery varietal plantings accounts for the fact that in young orchards the percentage of diseased trees is usually small at first and gradually increases with time. Observations in nurseries over a period of seven years showed that both scions and rootstocks contribute to the kind and amount of cherry viruses that are released to the trade (25, 26, 27, 29, 32, 33, 34, 35, 36, 37, 38, 43). The scion avenue was relatively easy to control. Virus infection from scions was eliminated by indexing and certifying sources for use by nurserymen. Nursery inspectors were trained to recognize and watch for the more obvious symptoms (28).

LOCATION OF VIRUS IN BUDSTICKS

In studies on transmission of any virus it is important to know its approximate location in the plant, especially in relation to symptom expression. The indexing technique (23), labeled "rapid transmission technique", used so successfully for the peach viruses (X-disease, mosaic, rosette) was also tested in studies on cherry viruses and with some success. It was assumed that in a growing terminal the virus will be present when symptoms are showing. However, yellows symptoms rarely showed on sour cherries under greenhouse conditions owing to prevailing temperatures above 65° F. In addition ringspot symptoms on cherries were always masked after the initial shock symptoms. Hence it was desirable to employ a different medium, such as peach seedlings, as an indexing host in an attempt to get positive results by which to evaluate virus presence (28).

Indexing was employed first to check for the presence of virus in orchard trees during the period of heavy leaf drop. It was noted that at this stage leaf drop included leaves with little or no yellowing visible. This expression suggested that the yellows virus could be present in the absence of symptoms under orchard conditions, and also where symptoms were masked during high temperatures whether in the greenhouse or in the field. Several indexing experiments verified this conclusion with the production of stunting and rosette on peach seedlings from cherry buds below, at, and above the leaf last showing yellows symptoms while still attached to the tree. The results were variable as between experiments and frequently indicated presence of more than one virus. Dieback and bark cankers on peach were found to represent the presence of ringspot virus. Cherry buds taken from the axils of symptomless leaves frequently indexed for ringspot, yellows, or ringspot-yellows. When pruning was not employed the indexed peach seedlings usually remained symptomless for the remainder of the growing season, which demonstrates the importance of the "rapid transmission" technique.

SEED TRANSMISSION OF CHERRY VIRUSES

The seedborne nature of cherry viruses was postulated when only isolated individual cherry trees developed symptoms in nurseries and when affected Mazzard and Mahaleb seedlings were first observed in nursery plantings in 1938 and 1939. However, in the first nursery observations it was recognized that wild Prunus species in the vicinity could be a contributing factor. The first report on the seedborne nature of the so-called tatter-leaf or ringspot virus disease was made by Hildebrand (43). This report was based on studies conducted at a nursery experimental planting at Dansville, New York during 1942 and 1943. Out of the composite sample from many sources, less than 2 percent of the Mazzard seedlings that grew developed tatter-leaf symptoms on the first growth. The high seed mortality, however, presumably was caused by virus devitalization below the point of embryo survival. The presence of large Mazzard

(P. avium) trees showing symptoms in the vicinity of diseased sour and sweet cherry orchards raised the question whether the virus went to or came from this source. Seeds from such trees when germinated always had a very high mortality and a small percentage of tatter-leaf infections appeared in the few trees (seedlings) that grew.

Cochran (15) reported passage of the ringspot virus through Mazzard cherry seeds. In June dormantized stored cherry seeds at about two months after planting were showing some leaves with crowded ring patterns. Of 467 commercial Mazzard seedlings that grew, 25 or 5.39 percent developed symptoms. This is another good demonstration that the ringspot virus can invade and be carried in Mazzard seeds.

Cation (10, 11) demonstrated seed transmission of sour cherry ringspot and yellows-complex viruses. Mahaleb and Montmorency seed collected from trees apparently infected with yellows-complex were germinated in February and grown for four months in the greenhouse. Grafts made from the Mahaleb seedlings to peach seedlings in the field indicated over 20 percent transmission with half of the infected peach trees showing ringspot and the other half showing typical rosette (cherry yellows) symptoms. Similar inoculations with Montmorency seedlings resulted in more than 20 percent disease transmission, but only the ringspot virus was transmitted through the Montmorency cherry seed. It was demonstrated that at least 10 percent of the Mahaleb seeds transmitted the ringspot virus and at least 8.7 percent transmitted the cherry yellows-complex. The cherry yellows-complex was not transmitted through Montmorency seed in the first experiments, but at least 30 percent of the seeds carried the ringspot virus. This is the first detailed account of seed transmission of cherry yellows-virus complex. It emphasizes the need for a disease-free source of seedlings in programs of stone fruit virus certification, and particularly for cherry understocks. It is possible that Cation's indexing technique with peach seedlings revealed some of the milder ringspot strains that would have been totally masked on sour cherry. In conclusion, the vitally important fact is that viruses of cherry are seedborne, which makes the rootstock of importance equal to if not greater than the scion source, particularly because seeds and seedlings cross State boundaries.

SYMPTOMATOLOGY

Yellows and ringspot, the two most important cherry virus diseases, have been observed in every commercial orchard under observation in New York. From the beginning of this study in 1933, these symptoms were frequently observed on Montmorency, Early Richmond, English Morello, and Chase. In the orchard mappings for symptoms, the Montmorency and Early Richmond varieties were more conspicuously affected by this virus complex than English Morello. Presumably this could be due to their more vigorous growth. However, in one exceptional case in 1939 yellow leaf defoliation in a vigorous cultivated orchard was practically as severe on English Morello as on Montmorency with over 50 percent defoliation on many trees. In all other years the leaf loss has been much less on English Morello.

In 1941 the yellows symptoms were showing during the first week of June, or about two weeks in advance of the average season, which had ranged from June 16 to July 6 during the preceding 13 years. By the last week of June 1941, leaf drop had practically ceased on Montmorency and Early Richmond, but symptoms were still developing strongly on English Morello. This had been the customary sequence with English Morello lagging behind the others by about a week.

Both yellows and ringspot symptoms frequently occur on the same tree, as determined by mappings made to show ringspot appearance as the leaves unfold and yellows about one month later. On occasional trees other symptoms were observed such as green-ring yellows, rosette, and mottle. Neither of these orchards were associated with X-disease of peach. Evidence indicates that the yellow-red or X-disease virus has been present in sour cherry orchards since at least as early as 1938 (Stoddard et al., in 1) although its identity was first proved in 1947 (Palmiter and Parker (67) and Parker and Palmiter (68)). X-disease is observed to be most abundant in the part of the orchard adjacent to diseased chokecherries. The symptoms include delayed bloom, extensive June fruit drop especially on English Morello, and failure of remaining fruit to mature with full color and flavor.

Following is a resume of symptoms of the respective viruses of sour and sweet cherries.

Yellows: Yellows is the most conspicuous sour cherry virus disease. Two symptoms are abrupt seasonal yellowing of the leaves accompanied by defoliation usually during the month of June. Yellows on Montmorency cherry is illustrated in Figures 2 and 3 from two severely infected terminals at the beginning and the end of the yellow-leaf-drop season in 1941. Young

infected trees rather quickly developed the advanced "weeping" symptoms characterized by the death and loss of fruit buds where leaves had fallen prematurely. Figure 4 illustrates the second-season performance of a bud in the axil of a defoliated yellow leaf marked by string on a first-year tree while the yellow leaf was still attached in midseason. Note the extreme dwarfing and delayed development of the bud. In older trees several years usually pass before the advanced stage of devitalization is reached. Eventually only the previous season's terminal growth sets and bears fruit, but both fruits and leaves may be larger than normal in size. Nursery trees usually delay or fail to produce yellow leaf symptoms on the first season's growth after budding. In the second season, which is usually the last in the nursery, symptoms usually appear coincidently with those in orchards. Nursery inspectors have been advised to make the June inspection with great care since subsequent inspections in July and later will locate only a small number of diseased trees.

The character of the yellow leaf condition on diseased orchard trees in late July or August, which is several weeks after the main wave of leaf drop, is illustrated in Figure 5. It shows the typical shoot condition on yellows trees on August 15, 1941. The continued development of yellow leaf during the summer of 1941 was correlated with and conditioned by temperatures low enough to favor symptoms, which appeared as late as October.

Ringspot: Ringspot is a widespread, nonlethal, and often masked disease which attacks sour and sweet cherries whether on Mahaleb (Prunus mahaleb) or Mazzard (P. avium) roots. Other names for it are "shredded leaf" and "little leaf". Typical early stage symptoms of ringspot are illustrated in Figure 6. Note the dark, concentric rings on the upper leaf surface visible only by reflected light. This photograph was made one month after grafting at about the time the leaves are unfolding in the spring. After the dark rings become necrotic, 9 to 14 days later, the symptoms by both reflected and transmitted light are illustrated in Figure 7. While there is a great deal of recovery of symptom-showing leaves and complete masking on later formed leaves, the necrotic symptoms on Montmorency persist to the end of the growing season with some tendency for some leaves to have a metallic tinge (Figure 8).

Following inoculation into healthy trees, necrotic ringspot and terminal dieback are produced in a short period of time followed by recovery from conspicuous symptoms. Despite masking of the spot and dieback necrotic symptoms the affected cherry trees showed a reduced vitality making them shorter lived, more subject to winter injury, and less productive of fruit, with the leaves and fruits smaller in size than normal.

On peach seedlings some strains of ringspot produce a striking dieback and bark canker when the rapid transmission technique is employed (Hildebrand, 23). Some strains of ringspot may leave the peach symptomless. When certain strains of ringspot virus were inoculated into Montmorency trees much more conspicuous and severe symptoms were produced in trees on Mazzard than on Mahaleb roots. Of great significance is the relatively high percentage of orchard trees carrying ringspot virus partially to completely masked for spot symptoms. Young diseased trees are shy bearers. In general the symptoms develop a few days later in the English Morello and Chase varieties. Figure 9 (the middle leaf) illustrates a cherry leaf with ringspot visible and showing the "yellows" shape, being more elongate and larger than normal. This illustration shows the combined effects of two viruses.

Green-Ring Yellows: Green-ring yellows or mottle (Rasmussen, 70) is relatively uncommon in New York State. Based on observations in 1940 it was relatively more prevalent in Michigan and Wisconsin. Figure 10 shows typical green-ring yellows symptoms with deep green rings (from 1/8 to 1/4 inch in diameter) on a yellow background. These symptoms occur a few days later than yellows. Spots vary considerably in character with some being nearly circular and others in irregular bands. Incidentally fungus leaf spot was much less serious on green-ring yellows trees than on others (Hildebrand, 38). Affected trees have leaves approximately normal in size, larger than for ringspot and smaller than for yellows. This virus seems less devitalizing to the trees with much less leaf fall under New York conditions.

Rosette or Vein-Clearing: Rosette has been encountered relatively infrequently in New York cherry orchards. A single case was reported from Canada (Willison, Berkeley, and Chamberlain, 82). Typical foliage symptoms are shown in Figure 11. The leaves are narrowed, cupped, distorted, brittle, thickened, stiff, less pubescent and sometimes bronzed. It illustrates the advanced rosette stages at the terminals with leaves crowded into a cluster. Vein clearing may be marked in the advanced stages of disease (Figure 12). Rosetted trees are so barren of fruit that orchardists remove them promptly because of their unproductivity.

FIGURE 2. Yellows -- Yellow-leaf symptoms beginning to appear on June 3, 1941, two weeks in advance of regular time. The first leaves to turn yellow were at the base of the spur on the small, first-formed leaves, which dropped when the stem was jarred.

FIGURE 3. Yellows -- Characteristic yellow leaf symptoms on June 30, 1941, at close of leaf-drop season.

FIGURE 4. Yellows -- Extreme dwarfing and delayed development of a bud (marked by string above and below) which developed at the axil of a yellow leaf on a first-year tree in the nursery in late July 1941 and was inactive as the 1942 season got under way.

FIGURE 5. Yellows -- Typical condition of certain shoots on yellows-infected Montmorency trees on August 15, 1941, two months after the main period of leaf drop.

FIGURE 6. Ringspot -- Dark concentric rings on upper surface of leaf visible by reflected light only. This early stage of ringspot usually appears within one month after graft transmission. (Photographed March 27, 1942)

FIGURE 7. Ringspot -- Necrotic ringspot and shot-hole stage which follows one to two weeks after the earlier (Fig. 6) ringspot stage and sometimes within one month from grafting.

FIGURE 8. Ringspot -- Typical late season symptoms (September 17, 1941) of ringspot disease on Montmorency. Such leaves remain attached to stem and do not drop until end of season.

FIGURE 9. Ringspot -- Typical ringspot leaf symptoms resulting from graft inoculation with diseased material (left to right) from Wisconsin, New York, and Michigan, about two months after inoculation. The middle leaf shows the "yellows" shape.

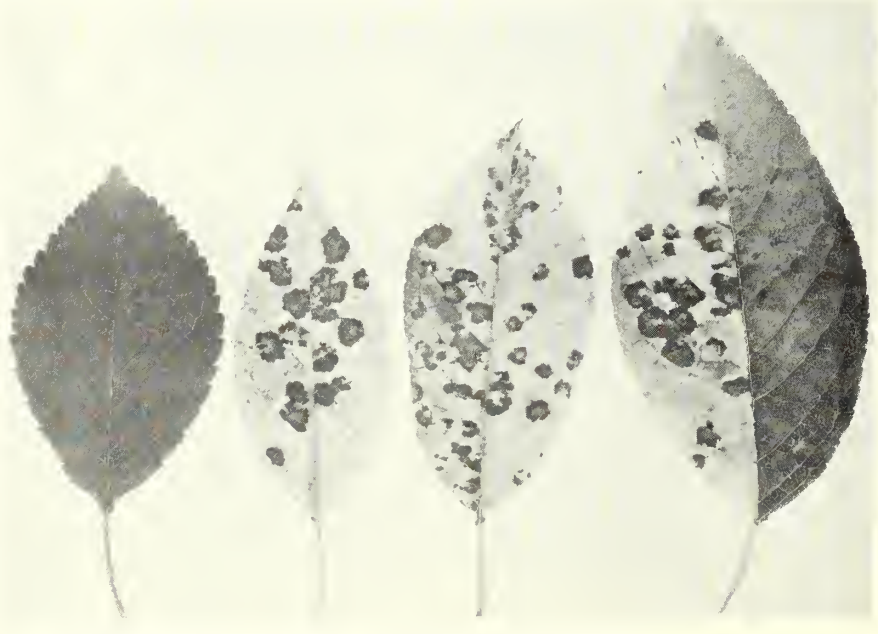

FIGURE 10. Green-ring yellows -- Typical green-ring mottle or yellows symptoms on Montmorency cherry in early July 1942.

FIGURE 11. Vein-clearing or rosette virosis of Montmorency -- Brittle, dwarfed, crinkly, erect leaves occur as rosettes on the terminals. Photograph September 17, 1941.

FIGURE 12. Vein-clearing or rosette virosis of Montmorency cherry showing typical vein-clearing, leaf shape and size. Photograph September 17, 1941.

FIGURE 13. Cherry mottle symptoms found on the foliage of Montmorency cherry trees, associated with an abnormal fruit condition, in Niagara County. Photograph July 15, 1942.

FIGURE 14. Typical ringspot, shothole, or tatter-leaf symptoms on sweet cherry.

FIGURE 15. Common early season leaf symptoms of virus disease on Yellow Spanish sweet cherry showing adverse effect on fruit set.

FIGURE 16. Sweet cherry ringspot (chlorotic and necrotic) symptoms on Yellow Spanish, September 17, 1941.

FIGURE 17. Typical chlorotic followed by necrotic ringspot symptoms on naturally infected trees of Prunus avium in Wayne County during July, 1943.

FIGURE 18. Sweet cherry mottle, characterized by chlorotic spotting of foliage, on Yellow Spanish on September 17, 1941.

FIGURE 19. Sweet cherry crinkle, a seed-borne, bud-perpetuated condition of Mazzard cherry (healthy leaf at right).

FIGURE 20. Severe necrotic (shock) symptoms induced on first new growth of Montmorency cherry when grafted in dormancy with scion from ringspot-infected Montmorency orchard tree (on left) and scion from Mahaleb rootstock of another infected tree (on right). Note that the scions are symptomless.

FIGURE 21. Terminal killing or blighting accompanying severe necrotic ringspot and shothole on Montmorency in this case affecting all terminals except scion at top center. Note that recovery is progressing within about two months from grafting.

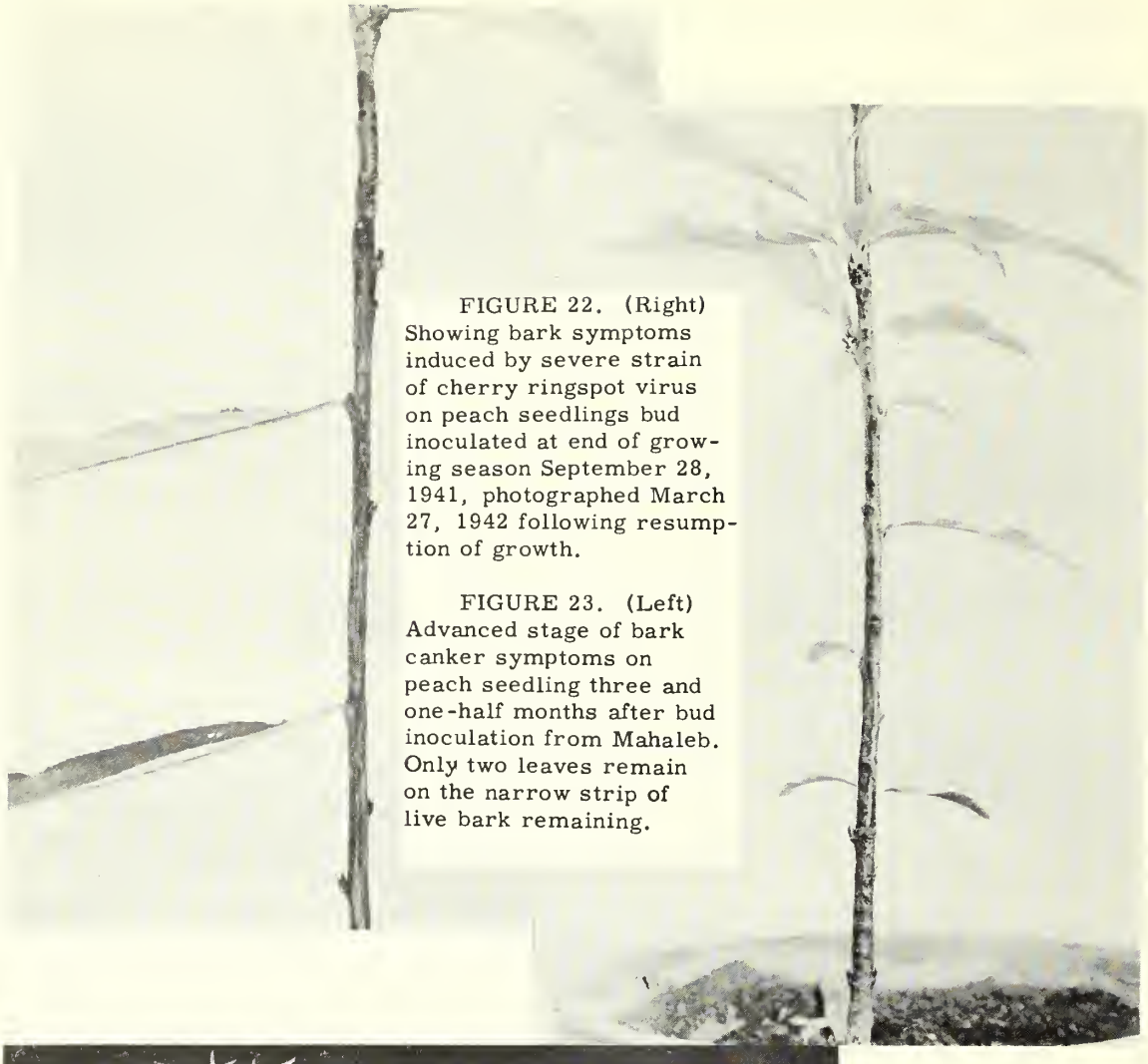

FIGURE 22. (Right) Showing bark symptoms induced by severe strain of cherry ringspot virus on peach seedlings bud inoculated at end of growing season September 28, 1941, photographed March 27, 1942 following resumption of growth.

FIGURE 23. (Left) Advanced stage of bark canker symptoms on peach seedling three and one-half months after bud inoculation from Mahaleb. Only two leaves remain on the narrow strip of live bark remaining.

FIGURE 24. Early symptoms on peach seedlings three weeks after bud inoculation, (A) with cherry yellows, and (B) with cherry ringspot.

FIGURE 25. On left, rosette symptoms on peach seedling at three weeks resulting from bud inoculation with cherry yellows compared with dieback from bud inoculation with cherry ringspot (on right), with healthy budded check in the middle.

FIGURE 26. Early stage symptoms on peach seedlings (budded in late fall 1941 and photographed March 27, 1942) consisting (a) of dieback and recovery from ringspot, (b) stunted erect rosette growth from vein-clearing rosette virus, and (c) yellows type of rosette growth.

FIGURE 27. Leaf spot symptoms on Elberta peach about one month after bud inoculation from yellows-affected Montmorency cherry (Photographed April 14, 1941).

FIGURE 28. Symptoms in peach seedlings of cherry yellows strains: (A), strain 2 with practically normal growth except for mosaic leaf symptoms on terminal leaves; (B), strain 1, showing dwarfed and rosetted growth. (Photographed November 14, 1941, three months after inoculation).

FIGURE 29. Striking mosaic patterns manifested by the cherry yellows strain 2 virus in leaves at certain stages of peach seedling development, otherwise normal except when growth stops or is retarded.

FIGURE 30. Extreme tatter leaf symptoms on Black Giant sweet cherry.

FIGURE 31. Severe tatter leaf on Black Tartarian sweet cherry.

FIGURE 32. Sour cherry necrotic ringspot showing leaf symptoms induced on Black Tartarian sweet cherry employing budwood from Yellow Spanish sweet cherry (A) and Montmorency sour cherry (B, C, D) in three different experimental orchards. Photographed July 6, 1942.

FIGURE 33. Sour cherry necrotic ringspot foliage symptoms on Napoleon sweet cherry induced by budding from masked Montmorency showing reddish to purple bordered ringspots, some of which later became necrotic. Photographed July 6, 1942.

FIGURE 34. Bark symptoms on Napoleon sweet cherry and Rochester peach (A) Bark blisters taken from trunk of Napoleon cherry; (B) dieback and stem canker on Napoleon shoot; (C) stem cankers and dieback on Rochester peach. All caused by sour cherry necrotic ringspot. Photographed July 6, 1942.

FIGURE 35. Sour cherry necrotic ringspot, necrotic symptoms (cankers and dieback) on Rochester peach (A), and on Black Tartarian sweet cherry (B). Photographed July 6, 1942.

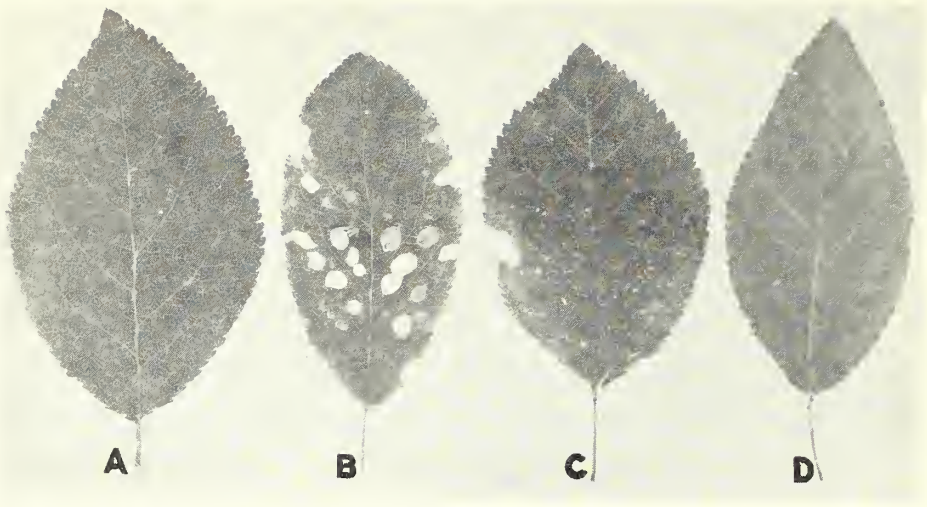

FIGURE 36. Foliage condition on Lombard plum (A), Italian prune (B), Bradshaw plum (C), and Shropshire Damson (D) resulting from grafting from Lombard which contained a latent virosis. Only Italian showed severe necrotic spotting. Bradshaw developed tiny necrotic spots.

FIGURE 37. Prune dwarf foliage symptoms induced on Montmorency cherry showing dark and light green rings and distortion and partial recovery.

FIGURE 38. Chlorotic ringspot and distortion, identity undetermined, on myrobalan plum seedlings used as rootstocks for plums.

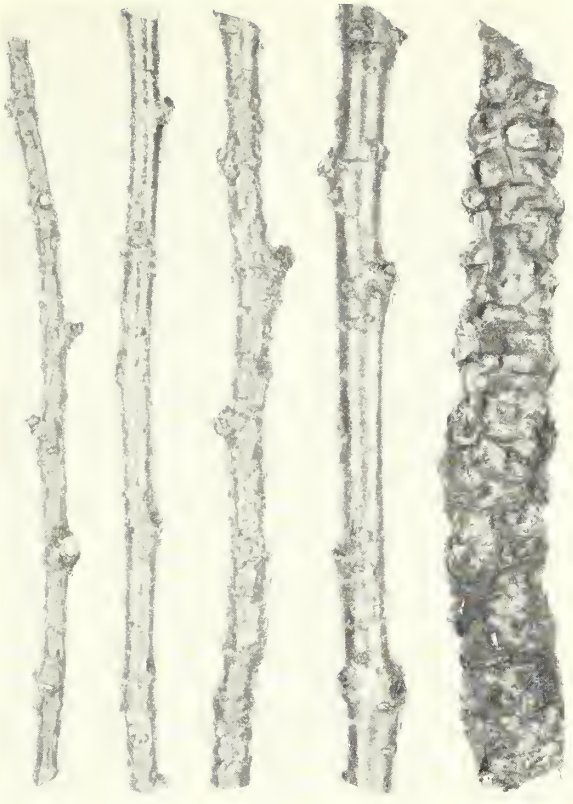

FIGURE 39. Rough bark condition on flowering cherry of unknown identity received from Mineola on Long Island and photographed April 5, 1937.

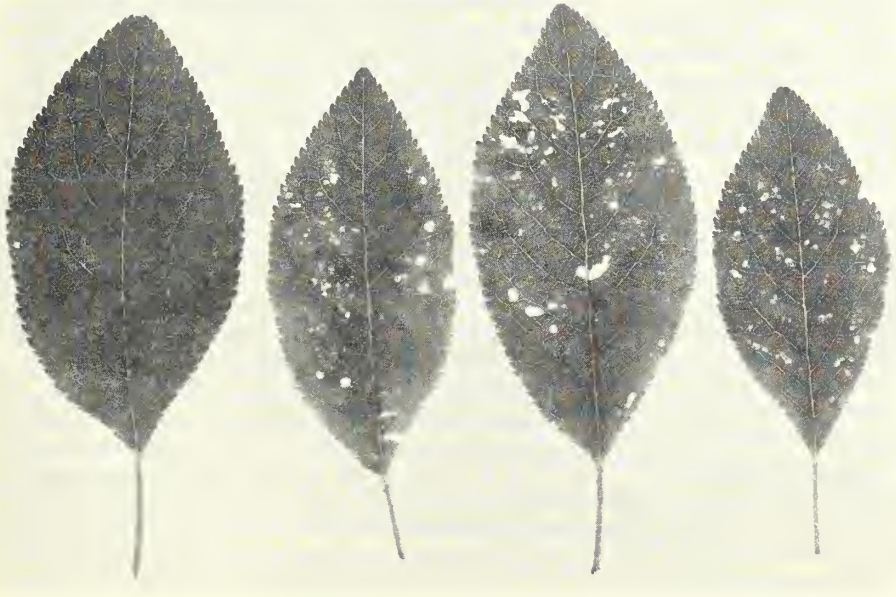

FIGURE 40. Foliage symptoms of Lombard plum latent virosis on Stanley prune, consisting of leaf spot and shot-hole about one year after grafting. Photographed April 11, 1944.

Bloom is delayed and few fruits are set. Rosetted trees also frequently contain ringspot virus, based on indexing tests.

Mottle of Sour Cherry: Two kinds of mottle conditions have been observed on sour cherries. One mottle becomes pronounced as the fruits progress toward maturity. Montmorency foliage (Figure 13) shows a very unusual type of chlorosis with a greenish yellow background peppered with green specks. An abnormal fruit condition associated with this foliage condition was under observation for five years; the cherries were pale red or pink in color and with firm flesh comparable to that of sweet cherries but low in sugar and insipid. The fruits were otherwise normal in size and shape. Symptoms were observed only on Montmorency in Niagara County on Mazzard roots. Induced symptoms on peach seedlings were very mild; however, older leaves became mottled, turned yellow, and fell to the ground.

The second mottle condition was observed for four years early in the growing season in a Montmorency orchard on Mazzard roots in Monroe County. Foliation was delayed with the small early-formed leaves mottled and distorted. The poor fruit-set was due in part at least to poor pollination weather. Symptoms and indexing showed that a small percentage of trees had ringspot virus.

Tatter-Leaf: The so-called tatter-leaf (shredded-leaf, lace-leaf, etc.) is essentially a ringspot disease (possibly identical to ringspot of sour cherry). Ringspots develop early in the season and the spots drop out to form the shothole condition. It is significant that practically identical symptoms result whether the inoculum comes from affected Yellow Spanish sweet cherry or Montmorency sour cherry trees. The sequence starts out with chlorotic ringspots followed by necrosis and shothole (Figure 14). The effect on fruit set is illustrated in Figure 15. Late season (mid-September) symptoms are shown in Figure 16. Affected trees may be masked in whole or in part, after the initial shock symptoms (81). This disease causes reduced yields and shortens the tree life span by making it more subject to winter injury. The foliage on P. avium roots, whether as seedlings in the nursery, as rootstocks in sweet cherry orchards, or as rootstocks in Montmorency orchards, shows practically identical symptoms. Symptoms have been observed on sweet cherry varieties Yellow Spanish, Napoleon, Black Giant, Black Tartarian, Windsor, and Stark's Gold, and on Mazzard seedlings. Practically identical symptoms have been observed on large P. avium trees in the vicinity of cherry orchards (Figure 17).

Sweet Cherry Mottle: The mottle disease (Figure 18) is characterized by a chlorotic mottling of the foliage usually not accompanied by necrosis and shothole except when mixed with the tatter-leaf virus. It can be distinguished from tatter-leaf, just as yellows is readily distinguished from ringspot in Montmorency, by indexing on Italian prune (see below, Indexing on Italian prune etc.). Mottle occurs relatively infrequently in sweet cherry and therefore is of minor economic importance.

Crinkle: Leaf crinkle symptoms have been found associated with the Mazzard rootstock in the Northeast (Figure 19). It appears to be a genetic condition, being seedborne and bud-perpetuated, but not bud-transmissible. Crinkle has been observed in seedlings grown under controlled conditions in the greenhouse, in nursery plantings, and also on sprouts growing up from the Mazzard rootstocks of sweet cherry and Montmorency cherry trees in orchard plantings. Relatively few seedlings, 5 percent or less, show symptoms. A crinkle symptom has been observed in certain sweet cherry varieties in commercial plantings in the Pacific Northwest, where it occurs on the scion variety and is probably a distinct disease.

SELECTED INDEXING EXPERIMENTS

Indexing Cherry Viruses on Montmorency: The indexing experiments, conducted principally in the greenhouse and employing the dormant grafting technique, proved extremely reliable for demonstrating the presence of the common ringspot virus whether or not in mixture with the yellows virus. In small dormant one- or two-year-old cherry trees at the begining of the greenhouse growing season, symptoms of ringspot regularly appeared on the first new growth and usually within 10 to 18 days from grafting. Ordinarily the graft scions grew also and these were invariably symptomless for ringspot. Figure 20 illustrates the symptomless character of the scion growth when indexed from an orchard Montmorency tree (A) and a Mahaleb rootstock tree (B) previously inoculated and infected with ringspot virus from an orchard tree. It should be noted that the inoculated Montmorency tree developed striking shock symptoms

followed by symptomless growth upon recovery. Necrotic leafspot and terminal dieback, and the symptomless growth following these severe shock symptoms are illustrated in Figure 21. Similar but not exactly identical symptoms were produced in Montmorency by indexing with tatter-leaf from sweet cherry.

It was possible to index unknown materials to small cherry trees early in the growing season by bud inoculation accompanied by pruning and extra fertilization to induce new growth. However, this method was impractical. Instead, emphasis was given to the rapid transmission indexing technique employing peach seedlings.

Indexing Sour Cherry Viruses on Peach Seedlings: Peach seedlings and the Elberta and Rochester peach varieties appear to be about equally susceptible to the cherry yellows and ringspot viruses, according to numerous indexing experiments.

Ringspot -- The considerable variability in expression of cherry ringspot virus symptoms on peach seedlings even in very uniform groups of seedlings, indicated the existence of several strains of the ringspot virus, ranging from severe to mild. How definite and stable these apparent strains might be was never ascertained. However, in a few recorded instances, severe strains seemed to maintain their severity and weak strains their mildness. The most severe strain induced a bark canker illustrated in Figure 22, with a more advanced stage in Figure 23. Note that many leaves have been dropped and the stem has been girdled except for a very narrow strip of the bark.

Ringspot and Yellows -- Note the typical stunting and rosette condition of seedling peach trees and the early appearance of symptoms in Figure 24 which compares yellows and ringspot three weeks after inoculation. The contrast in symptoms is even better shown in Figure 25 where at about three weeks after inoculation the ringspot virus has caused the drooping of leaves from death of the stem (dieback). Figure 26 shows a comparison of early stage symptoms on peach seedlings: at A, dieback and symptomless new growth for ringspot, B, stunted, erect, rosette type of growth for vein-clearing rosette virus, and C, typical rosette for yellows. The vein-clearing rosette virus produced the greatest stunting of peach seedlings, as well shown in this illustration.

Yellows -- Figure 27 illustrates the leaf spot symptoms one month after inoculation produced on Elberta peach by indexing from an affected orchard Montmorency tree. Chlorotic rings followed by necrosis and shothole occurred on the first-borne leaves. Later leaves were symptomless for spots but developed into rosettes.

There is evidence for the existence of strains of the yellows virus in Montmorency cherry (32). Figure 28 shows two peach seedlings three months after bud inoculation: B dwarfed and rosetted as is typical for strain 1 of cherry yellows virus, and A with practically normal growth except for mosaic symptoms on terminal leaves as growth stops. The character of the mosaiced peach leaves is illustrated in Figure 29. Because it has been obtained when indexing peach seedlings with buds from certain orchard trees affected by yellows, this reaction is considered diagnostic of what has been called strain 2 of the cherry yellows virus. The puzzling fact about this strain is that striking mosaic patterns along with some dwarfing and distortion are most likely to appear at occasional times when growth is checked. Otherwise the growth will appear normal. In preliminary work these symptoms appeared only when the temperature was low. Because of inability to control greenhouse temperature this study was postponed indefinitely.

Indexing Cherry Viruses on Sweet Cherry: Every sweet cherry orchard mapped contained tatter-leaf disease, but only occasionally were mottle symptoms observed. In several instances both diseases occurred in the same trees.

Tatter-leaf symptoms were observed on and in every case reproduced by indexing from P. avium, including the varieties Napoleon, Yellow Spanish, Black Tartarian, Windsor, and Stark's Gold, and Mazzard seedlings. Figures 30 and 31 show severe symptoms on Black Giant and on Black Tartarian, respectively. Compare these illustrations with Figure 32 which shows sour cherry necrotic ringspot symptoms (B, C, D) on Black Tartarian compared with Yellow Spanish sweet cherry strain (A), and Figure 33 of sour cherry necrotic ringspot on Napoleon.

Figure 34 shows severe terminal dieback and stem canker on Napoleon sweet cherry (B) and Rochester peach (C) indexed with sour cherry necrotic ringspot. The bark blisters taken from the trunk of Napoleon (A) would later develop into cankers. Figure 35 illustrates necrotic ringspot symptoms (cankers and dieback) on Rochester peach (A) and Black Tartarian cherry (B). The virus source was a light-bearing, completely masked Montmorency.

Indexing on Italian Prune and Lombard Plum: When Lombard plum was indexed on three other plum varieties, a latent virosis was revealed (Figure 36) on Italian prunes. Comparative studies with the prune dwarf virus, ten different cultures of the sour cherry yellows and ringspot viruses alone or mixed, two cultures of the sweet cherry chlorotic spot or mottle virus, and two cultures of the sweet cherry tatter-leaf virus, demonstrated that strain 1 of the sour cherry yellows virus and the sweet cherry chlorotic spot or mottle virus produced symptoms simulating prune dwarf on Italian prune and Lombard plum. When indexed back to Montmorency cherry the yellows strain of prune dwarf reproduced typical yellows symptoms whereas yellows developed on only one of three trees receiving the cherry mottle strain of prune dwarf. Unfortunately this work was terminated before the relation between these two strains was worked out.

When true prune dwarf virus was indexed on Montmorency cherry an unusual symptom pattern developed, as shown in Figure 37, consisting of chlorosis, distortion, and some necrotic spotting. The complete story here also was unattained.

Other Plants Tested for Indexing Hosts: A chlorotic leaf spot symptom was observed on chokecherry (Prunus virginiana) in fence rows in New York and in Wisconsin in 1940. This diffuse chlorotic condition was reproduced by grafting chokecherry with scions or buds from diseased sour cherry. These symptoms were found to represent the ringspot virus of the complex. The fact that some symptomless chokecherry plants mask the ringspot virus is evidence that the chlorotic ringspot phase is the "shock" phase of the disease, showing only for a period after inoculation has taken place.

The pin cherry (P. pensylvanica) has been observed in fence rows with a chlorotic symptom pattern. These symptoms were mild and varied somewhat from plant to plant and were similar to those following inoculation under controlled conditions in the greenhouse. Both symptomed and symptomless trees have been observed adjoining diseased cherry orchards.

The rum cherry (P. serotina) has been occasionally observed with a reddish yellow symptom pattern but has never been found susceptible to any of the sour or sweet cherry viruses.

The Mazzard cherry (P. avium) ordinarily does not produce symptoms when bud-inoculated with the yellows virus, but is very susceptible to ringspot.

The Mahaleb cherry (P. mahaleb) may sometimes show a chlorotic stipple spot or a chlorotic ringspot and line pattern. The former seems to be associated with cherry yellows and the latter with cherry ringspot. At other times no symptoms may show or recovery may follow mild symptoms.

Doubtful symptoms were sometimes induced on myrobalan plum (P. cerasifera) following inoculation with cherry viruses. Figure 38 is a chlorotic ringspot or asteroid spot condition rather prevalent on myrobalan rootstocks. Its true identity has not been ascertained.

TRANSMISSION STUDIES

The first transmission experiment was started in the spring of 1935 in a special planting principally of Montmorency trees donated by Dansville nurserymen. In 1934 approximately 100 trees were planted, spaced about 4 feet apart in rows 6 feet apart. Ten dormant scions, taken from orchards that had been mapped for disease incidence, were grafted into 20 trees in late April 1935, just as growth was beginning. Later, as yellows symptoms were appearing in the mapped orchards in the severe yellow leaf drop year of 1935, budsticks were collected and indexed by budding into 20 additional trees. Thus a total of 40 trees was inoculated. No symptoms were observed during 1935. In late June 1936 observations revealed positive yellow leaf drop symptoms on 12, or 30 percent, of the inoculated trees. Of the 40 uninoculated check trees, two showed positive yellows symptoms with abundant leaf drop and two others were labeled as diseased although only a small number of yellow leaves developed. The presence of symptoms on the check trees was indeed confusing. Owing to unforeseen circumstances this young experimental planting was moved to a new location in early July and practically all of the trees died from the shock of moving. This misfortune prevented making further observations on graft transmission results and the experiment was lost.

Because of the presence of yellows trees among the check trees in this experiment several nurseries were visited in 1937, 1938, and 1939 to determine whether the disease was present and originated in them. In 1937 and 1938 the presence of a considerable amount of fungus leaf spot obscured the yellows symptoms although some healthy (fungus-free) locations showed occasional two-year-old trees with yellow leaf drop.

The question as to how the nurseries acquired the disease in the first place remained unanswered until the following year. Most nurserymen maintained budwood sources in their own

plantings from which the propagating materials were taken in August or early September each year. With one exception this was the type of planting visited until 1939. In the one exception it was found that budwood was obtained from a cherry grower. It was learned that certain large cherry growers were supplying certain nurseries with budsticks from their orchards to be grown on contract for them. Visits to these nurseries in 1939 revealed abundant symptoms. Thus the disease was unwittingly introduced into the nurseries from orchards and then returned to the growers' new plantings which explained why large commercial orchardists usually experienced greater trouble. Some of the newly planted orchards employing such materials were mapped and used in subsequent studies on incidence, spread, and multiplication of the cherry virus complex.

Greenhouse transmission studies on cherry yellows during 1937 and 1938 were disappointing because symptoms were not produced in the greenhouse. When trees inoculated in 1937 failed to produce symptoms in 1937 or 1938 it was decided to transplant these trees to the outdoor test planting in 1938. Thus it was discovered that over 70 percent of the bud-inoculated trees of 1937 and 1938 were showing symptoms in 1939 and that the transmission technique was not at fault.

Starting in 1939 numerous transmission studies were conducted both in the greenhouse and in the field on the virus complex in sour cherries, employing mainly the Montmorency variety.

In 1940 a comparison was made of the field symptoms on cherries and other stonefruits during late June and early July in New York, Ontario, Michigan, and Wisconsin. In the important particulars the symptoms were essentially identical in all the locations. For verification propagating materials were obtained from some locations for comparative studies under controlled conditions in the greenhouse at Ithaca, New York.

Comparative Interstate Transmission Experiment: A graft transmission comparative study was started in January 1941 employing four sour cherry bud sources from Wisconsin, five from New York, and two from Michigan. Three graft inoculations, each consisting of two scions per tree, were made on February 10 from each source to individual Montmorency trees. Striking "shock" ringspot symptoms were showing on all but six of the 33 trees employed within 12 to 24 days after grafting. As was to be expected no yellows symptoms developed in the greenhouse because of the prevailing temperatures (68° F. or above). While in a good growing condition the trees were transplanted to the field on May 22, 1941 with two trees developing yellow leaves on June 6. A year later final field observations were made on yellows symptoms with the result that all four Wisconsin sources, one Michigan source, and three New York sources involved the same diseases.

Samples of the same source materials for the comparative study were bud-indexed on small Elberta peach trees on March 6, 1941, employing two trees for each sample. Chlorotic and necrotic ringspot were observed on some of the youngest peach leaves but otherwise the plants were relatively symptomless the remainder of the growing season. In a later check the symptom-showing trees developed rosette, indicating that the ringspots were an early stage of cherry yellows symptoms which developed the following year.

On April 23 another greenhouse transmission experiment was conducted employing the same cherry bud sources from Wisconsin, Michigan, and New York, and budding each source in triplicate from dormant cherry to peach seedlings. Seven days after budding the peach seedlings were topped back to the diseased bud about midway on the stem to stimulate a new spurt of growth. Symptoms were showing on May 18 or 18 days after the shock treatment. It is of interest that all of the bud sources that produced ringspot symptoms on cherry induced dieback and sometimes bark canker on peach seedlings. Also, all of the sources that induced yellows on cherry produced a stunting and rosette on peach seedlings. This is strong evidence that the rapid transmission technique (Hildebrand 23), involving topping, speeds the appearance of symptoms and aids in evaluating orchard trees for suitability as bud propagating sources for nursery plantings in the same season.

The symptoms on peach seedlings, while speeded by topping, were not so well defined as those on Montmorency sour cherry. Dieback usually indicated the presence of ringspot virus and rosette of the yellows virus, but some peach seedlings showed no symptoms after indexing and topping. Also, following the shock phase of ringspot the seedlings were symptomless. The presence of virus strains and the existence of variability in the seedlings themselves could account for variations in degree of severity of expression. It is significant, however, that all of the sources except one gave positive results by indexing on peach and correspond to the graft-indexing results on Montmorency cherry in all other particulars. Moreover, the rapid transmission technique for yellows gave results within a month whereas nearly a year longer was required to complete the experiment on cherry.

As an example of the regular transmission experiments, on April 21, 1941, 11 cherry tree bud sources from mapped orchards were indexed on peach seedlings in triplicate and one week later were cut back to the diseased bud insertion. From all sources except one, two kinds of symptoms had usually developed within one month's time. The symptoms were dieback and rosette or a combination of them. Tentatively the rosette was interpreted as a symptom of yellows and dieback as a symptom of ringspot. This was the technique employed to demonstrate the presence or absence of virus in orchard cherry trees to be employed for propagating purposes in the nurseries.

Many such routine experiments were conducted in an attempt to refine the method and improve its reliability, especially when checking for certification of any materials to be employed in nurseries. A confusing element has been the considerable variability in symptoms, which suggests strain differences in the viruses, from severe to very mild or symptomless. A problem posed from the beginning of this study was the separation of yellows from ringspot. Numerous experiments have revealed no reliable selective host. Although Italian prune indexes for yellows and not for ringspot, it was not determined whether ringspot virus had been eliminated, but this is a possibility for investigation. The fact that sweet cherry mottle when indexed on Italian prune also produced small strap-shape leaves suggests a relationship to sour cherry yellows (36). Known cases where cherry yellows failed to induce rosette on peach seedlings, while parallelling the failure of Montmorency to produce yellow leaf symptoms at temperatures above 65° F., also gave supporting evidence for a strain 2 of the yellows virus with which growth is normal except at low temperatures when mosaic symptoms occurred. The frequent association of ringspot with yellows still leaves us with no means of separation to date. It is easy to find orchard trees with only ringspot symptoms, but extremely difficult to locate a tree showing only yellows symptoms and be certain that yellows is the only virus present. Two trees located over a period of five years, when indexed on Montmorency cherry or seedling peach, never gave evidence of ringspot virus presence. However, the possibility remains that a mild masked ringspot could have been present and undetected. Also there was the possibility that a strain of ringspot may be an essential component of yellows.

EFFECT OF TEMPERATURE ON YELLOWS SYMPTOMS

Sour cherry trees receiving buds from infected orchard trees in 1938 developed yellow leaf drop symptoms on only a few leaves in the coolest greenhouse. During May these trees were transplanted to a test planting for further observation and to check on the transmission technique. No further symptoms developed during 1938.

To further check on temperature the 1939 transmission experiment employed 24 Montmorency trees graft-inoculated with yellows scions in late January with one-half of the trees being placed respectively in the cool (about 65° F.) and warm (above 70° F.) sections. Ringspot symptoms developed on the new growth in both sections but yellows failed to develop in either place except for possibly a trace (1 and 2 leaves partly yellowed) on two trees in the coolest location. Here again the trees were transplanted to the test planting where no further symptoms developed in 1939. A similar experiment was repeated in 1941, using 20 small graft-inoculated trees, with similar indefinite results for yellows symptoms in the greenhouse. By transplanting the trees to the experimental field planting for subsequent observations evidence was obtained to help clarify the temperature effects. The significant fact was the development of typical yellows symptoms outdoors the year following transplanting in late May of the respective years. The fact that ringspot developed symptoms irrespective of temperature was evidence that the yellows and ringspot symptoms represented two distinct virus entities. Another angle is that yellows, by virtue of its longer incubation period, would not show symptoms during the interval under test.

The parallelism observed between currant mosaic and cherry yellows viruses deserves investigation. In red currant the mosaic (yellows) was masked at ordinary greenhouse temperatures (above 68° F.). This was discovered when transmission tests were attempted in the greenhouse in 1939-40. However, this masking revealed the presence of ringspot symptoms never visible on currant when mosaic was showing. It was further determined that the currant ringspot virus was mechanically transmissible, representing the first natural source of tomato ringspot virus (tobacco ringspot No. 2) ever determined. As the result of the successful mechanical transfer of a ringspot virus from the perennial woody currant to herbaceous plants (22, 42), mechanical inoculations were attempted from tender unfolding ringspotted Montmorency cherry leaves to Turkish tobacco, tomato, muskmelon, peppers, cowpeas, aster, and beans; in all cases with negative results. This experiment was repeated in 1942 on the same plants, except

beans and cowpeas, but with negative results.

The subsequent report by Moore et al. (61) of the successful mechanical transmission of cherry virus to cucumber is of great significance in this connection.

Keitt and Moore (51) and Moore and Keitt (63, 64) demonstrated a masking of yellows symptoms when trees that received diseased buds were held at high temperatures. They observed yellows symptoms freely expressed in the bud-inoculated trees held in the greenhouse at 16° C. (60.8° F.), whereas practically no symptoms developed at 20° C. (68° F.) and above. Their results suggest a partial to complete masking of yellows symptoms above 61° F. These reports clarified the role of temperature in yellow leaf expression.

Mills (58) reported the relation between prevailing low and high temperatures and the variable expression of yellows symptoms observed in orchards in the State of New York. His data suggest that the chief factor governing the expression of yellows symptoms in the orchard during the growing season is the temperature which prevails during the 30-day period following the petal fall stage. Thus symptoms are more liable to appear when the bloom comes early in the season. Incidentally, symptom expression seems independent of the temperatures that prevail after yellows symptoms first appear, of the amount of rainfall, and of the incidence of cherry fungus leaf spot. Mills states that no data he had available proves or disproves spread of cherry yellows virus after the young trees are set in the orchard.

EFFECTS OF FERTILIZATION AND PRUNING ON VIRUS INFECTED MONTMORENCY

Starting in 1934, before the nature of cherry viruses was known, one large cherry grower in consultation with the writer adopted the practice of extra fertilization to correct the imperfect growth and poor productivity of many so-called winter-injured trees in one large Montmorency orchard. The supplementary fertilization experiment was discontinued at the end of eight years, in 1941, because yields could not be increased thereby (39). The defective trees decreased in yield each year and many which fell below the productive level for profitable yields were removed. Occasional new trees receiving the treatment conformed to the usual experience of decline in vigor with time after infection. Besides yellows and ringspot, which were present in a large majority of the trees, there were nine trees with green-ring yellows and two non-bearing trees with rosette.

Heavy pruning likewise produced no benefits. Dehorning of 20 of the severely diseased unprofitable trees stimulated new growth which was even less productive than before pruning.

Incidentally, a complicating factor of scorch and bronzing of the foliage was also encountered in the orchard over a period of years. Certain marked trees that received muriate of potash (at 4 lb. per tree) starting in 1941 showed a very significant decrease in these symptoms in the second season when the trees received a second application of this same material. By the time the third application would have been given the symptoms had practically disappeared, making it unnecessary. No effect of this treatment was noted on the virus symptoms since the potassium-deficiency symptoms usually occur in July and August and are separated by many weeks from ringspot symptoms in May and yellows symptoms in June.

According to Rasmussen and Cation (72) sprays, fertilizers, and cultural practices had no visible effects on virus diseases of sour cherries. Cain and Parker (7) presented evidence from one sour cherry orchard growing in sod that trees receiving 15 lb. ammonium sulfate annually for three years compared to those receiving 5 lb., at different degrees of virus severity, showed some improvement in growth, fruit set, and yield. The fact that a treble dose of nitrogen proved of benefit on a grass sod suggests that the 5 lb. dose was below the optimum for good tree growth, rather than of benefit in reducing the virus effects.

ECONOMIC IMPORTANCE

Cherry yellows is the most conspicuous and probably the most economically important virus disease of sour cherries in Northeastern United States. Judging from a survey made in 1940 it and ringspot are apparently well distributed in commercial plantings, affecting as many as 90 percent of the trees in the older orchards in New York, Michigan, and Wisconsin at that time.

Yield records have been kept in a number of orchards for at least three years. The age of tree is of primary importance in relation to yields. Young trees infected on or before transplanting to the orchard ordinarily will never produce profitable commercial yields of fruit, therefore such trees should be eradicated or removed immediately. Moreover such trees also serve as reservoirs of the virus facilitating new infections. Moore (60) and Rasmussen and Cation (71, 72) reported on the adverse relation of sour cherry yellows to yield.

In an orchard in Wayne County yield records were taken on Montmorency trees on Mazzard roots, selected to represent four stages in yellows development: ?healthy (trace of symptoms), mild symptoms, moderate symptoms, and severe symptoms. Good representative material was located in 15 out of 48 rows in the orchard and yields were kept over the three-year period from 1941 to 1943. The results show average yields as follows: ?healthy 932, mild 76.8, moderate 50.2, and severe 37.9 pounds. It should be borne in mind that a large factor in the reduction of yields was the ringspot virus in many of the trees, which intensifies the devitalization effects from yellows.

An orchard in Orleans County was selected to illustrate Montmorency on Mahaleb roots: it was the most productive orchard encountered in the State, with some trees producing over 500 pounds in 1942. It was relatively free from complicating troubles such as winter injury, poorly drained soil, or lack of uniformity of soil, but had a mild form of ringspot expression on a number of trees. Because of such uniformity one row of 27 trees served as a cross-section of the orchard. Relatively symptomless trees used as checks were compared with others showing slight to heavy leaf drop in the early, medium, and advanced stages of disease. Some of the trees were showing heavy leaf drop for the first time whereas, at the other extreme, heavy leaf drop had been noted for about five years previously. The latter trees were beginning to show the type of growth characteristic of the advanced stage of disease with practically all of the fruit borne on the previous season's terminal growth.

Table 2 gives the yields, fruit size, and soluble solids of the fruits on four comparable trees showing trace, mild, moderate, and severe yellows symptoms in 1942. It is doubted that the slightly greater total soluble solids for the diseased trees was significant especially since the fruit color suffered somewhat and ringspot virus was frequently present though masked.

Table 3 gives the yields of ten trees in five different yellows disease classifications in two other rows of the same orchard selected because all groups were represented. Also, some of the trees in all the classifications contained ringspot virus almost if not completely masked. This partly explains why trees recorded as healthy showed yields ranging from 215 to 502 pounds and comparable ranges for the other classifications. Upon indexing it was found that selected lower yielding trees showing only a trace or mild yellows symptoms invariably contained ringspot. Also, yearly fluctuation in the severity of yellows symptoms proved to be the case in this orchard. The most significant feature about this orchard was the vigor and productivity of the trees on an ideal cherry soil which was well drained and fertile.

The only other Montmorency orchard on Mahaleb roots that gave comparable high yields is located in southern Michigan.

STONE FRUIT VIRUS DISEASE CONTROL

Nursery Control: The single expedient of employing only inspector-approved budwood has enabled New York nurseries to supply the trade with trees containing a very low percentage incidence of disease from the very beginning of the program in 1939. The nurserymen took pride in cooperating with the inspection service and with the college and immediately ceased to employ propagating materials other than those certified by the State inspectors. Propagating materials from orchards were indexed directly or indirectly at the laboratory or test planting to establish freedom from disease. The test planting in the nursery community financed by the nurserymen was a far-sighted educational move to convince doubting-Thomases of the insurance protection thus afforded. To effectuate this program the inspectors were thoroughly familiarized with symptoms. The small percentage incidence of disease which persisted in young orchards was undoubtedly traceable to the rootstock source of virus. Most of these trees could have been eradicated during the second year of nursery growth by repeated tree by tree inspection. In other words, it was recommended that the nursery plantings be inspected at monthly intervals during the growing season. The most serious stumbling block to such inspection was the frequently heavy fungus leaf drop that masked or obscured the virus symptoms. The nurserymen had this problem well in hand at the time the writer left this work in 1944.

In a few cases the investigator, in cooperation with an inspector, followed developments in a limited number of nursery plantings throughout the season. When individual leaves became creamy white or yellow after the leaf-drop season had passed the trees were labeled for sending to the experimental planting at Ithaca at digging time in the autumn. Thus, in a few cases, the buds in the axils of defoliated yellow leaves were marked and their history followed. Early defoliation weakened the buds making them subject to a type of winter injury in which the bud was killed outright or came through the winter in a very weakened condition (Figure 4). This is why bearing trees infected with yellows virus, where increasing numbers of leaves drop

Table 2. Fruit yields in pounds, fruit size in number of fruits per pound, and percent total soluble solids in a very productive Montmorency orchard on Mahaleb roots. All stages of cherry yellows are represented from a trace to severe symptoms with ringspot present but largely masked.

? Healthy-trace			Trace-mild			Mild-moderate			Moderate-severe		
Yield per tree (lb.)	Number fruit per lb.	Percent soluble solids	Yield per tree (lb.)	Number fruit per lb.	Percent soluble solids	Yield per tree (lb.)	Number fruit per lb.	Percent soluble solids	Yield per tree (lb.)	Number fruit per lb.	Percent soluble solids
293	109	13.2	222	122	18.8	125	90	13.6	91	74	15.8
270	89	14.4	206	84	13.4	148	95	17.6	95	90	15.8
259	100	15.4	223	81	15.4	122	90	15.4	89	89	15.6
286	110	16.6	215	84	15.8	154	89	15.4	90	76	15.2
Average 277	102	14.9	216.5	93	15.8	137.2	91	15.5	91.2	82	15.6

Table 3. Yields of fruits on ten trees in five different yellows disease classifications (same orchard as Table 2).

Disease severity	? Healthy	Trace	Mild	Moderate	Severe
Range in yield[a]	215-502 lb.	176-362 lb.	240-372 lb.	206-299 lb.	90-150 lb.
Average yield	345 lb.	269 lb.	270 lb.	242 lb.	129 lb.

[a] Under "? Healthy" and "Trace" disease classifications the lowest yielding trees had marked ringspot symptoms which was not true for the "Mild", "Moderate" and "Severe" classifications.

prematurely on succeeding years, have their defoliated stems denuded of fruit and leaf buds. Thus trees in an advanced stage of disease will bear fruit almost exclusively on the previous season's growth.

In the case of cherry ringspot virus, before uninspected orchard budwood was prohibited, skips were occasionally observed in nursery plantings. On closer inspection the surviving Mahaleb rootstocks showed leaf symptoms of a line-pattern character (43). Subsequent experiments were conducted, budding Montmorency on some of the diseased Mahaleb rootstocks with fair success. However, reciprocal experiments using diseased Montmorency budwood on healthy Mahaleb consistently resulted in bud failure. It is indicated that Mahaleb rootstock is an obstacle to the introduction of necrotic ringspot into the nursery from orchard sources. When the Mazzard rootstock was employed, however, there was a low but consistent percentage of sweet cherry bud survival. This may explain why the sour cherry suffers more from ringspot when on Mazzard roots.

The eradication of diseased trees from the nursery is the most important control of the cherry viruses (yellows and ringspot). By 1944 this practice was being followed for the fifth year in New York (35) with excellent results.

Since sour cherries are commonly grown for two seasons before digging, the nursery inspectors have two seasons in which to find infected trees. Inspections were started in mid-June and continued at monthly intervals until autumn (September). The value of an extended inspection is most important in the young trees, the first season following budding, because not infrequently first symptoms may be delayed until August, September, October, or even till the second season. Also, not infrequently only one leaf may appear on a given tree during the first season's growth, the chlorosis is more of a cream than yellow, and the leaves persist longer late in the season.

Orchard Control: When the orchard becomes unprofitable there is no alternative to removing all the trees. In the young orchard within two years from planting the recommendation is the immediate removal of all trees showing virus symptoms. According to observations in a considerable number of such orchards planted to trees propagated from known inspected nursery plantings, the incidence of disease was never over 5 percent and usually less. It takes the skill of the investigator or trained inspector to tag the plants for removal. Replants made at this time at a minimum of expense will soon be very close in size and age to the other trees.

The removal of diseased trees in orchards that have reached the unprofitable stage of production and replanting with young healthy trees was tested in one large sour cherry orchard over a period of five years, and unsuccessfully. The results suggest that such a procedure should be discouraged. The young sour cherry replants readily contracted disease, showing the severe symptom stage (yellows) within two or three years, making the small replants practically worthless by fruit-bearing time. Consequently there was no alternative to their removal.

To be profitable bearing trees should average 100 pounds or more fruit per year. The best plan according to most New York growers is to keep the bearing orchard until unproductive and then to pull the entire orchard. According to Rasmussen and Cation (72), if removal is planned it should be on a locality or district basis unless the individual orchard is isolated.

A number of variables are inherent in the cherry industry. New York has no well-standardized strains of Montmorency but Michigan has made progress in this direction (Gardner, 18). There are upright growing trees, the weeping type, and a number of strains falling in between. The virus diseases confuse the picture by influencing the type of growth. Yellows virus alone induces a weeping or tendril type of growth. Ringspot virus induces an upright stubby terminal type of growth. Both viruses stunt the trees; ringspot by reducing the size of leaves and fruits; yellows by denuding leaves while at the same time increasing the size of both fruit and leaves. Certain selections of Montmorency (Rasmussen and Cation, 72) vary in their susceptibility to disease. It is the writer's opinion that the rootstock plays an important role. The propagation of nursery trees from disease-free, highly-productive strains or selections promises to become an important control measure.

The rosette virus never assumes much importance in sour cherry orchards for several reasons. The bloom is delayed and many of the pistils are aborted with resulting small yields. Many growers call such trees "bastards" and promptly remove them.

Admixture of Rootstocks: In New York it was rather conventional horticultural practice to recommend Mazzard roots in soils that were not ideal for the more demanding Mahaleb. When reduction in yield of certain trees was encountered it was argued by some growers that this could be explained by an admixture of roots. That is, the nurserymen had supplied some trees on the Mahaleb rather than Mazzard rootstocks to account for the greatly reduced yields (to

30 percent or less of a crop). To check on the validity of this contention a quick method was employed for determining what kind of rootstocks were present under typically diseased trees.

Tests were conducted in one orchard in June 1941 employing root samples from four relatively symptomless and four yellow leaf trees. All of the roots tested[2] reacted positively to the typical tannin reaction for Mazzard roots regardless of the unthriftiness of the diseased trees. Hence unthriftiness was not correlated with presence of Mahaleb roots but rather with Mazzard roots.

DISCUSSION AND CONCLUSION

The cherry virus complex has been present in cherry orchards in Central and Northeastern United States and adjoining Canada for over 35 years (Stewart, 77). Before and since Keitt and Clayton (48, 49) demonstrated its virus nature numerous studies on stone fruit viruses have been reported including Berkeley (2); Berkeley and Willison (3); Cation (8, 9); Cation and Boyer (12); Chamberlain, Willison, and Berkeley (13); Gloyer and Glasgow (19); Hildebrand (23 to 43, inclusive); Hildebrand and Mills (46); Hildebrand and Palmiter (47); Keitt and Clayton (50); Keitt and Moore (51); Mills (58); Moore (59, 60); Moore and Keitt (62, 63, 64, 65); Moore, Boyle, and Keitt (61); Palmiter and Hildebrand (66); Rasmussen (69, 70); Rasmussen and Cation (71, 72); Willison (80); Willison and Berkeley (81); Willison, Berkeley, and Chamberlain (82); Thomas and Hildebrand (78).

Similar but different virus complexes are also present in other parts of the country on stone fruits -- Blodgett (4); Bodine (5); Clayton (14); Cochran (15); Cochran and Hutchins (17); Lott (52, 53, 54); Richards (75); Richards, Hutchins and Reeves (76); Zeller (83); Zeller, Milbrath, and Cody (84). It is significant that in a relatively short span of years by concerted effort a large number of stone fruit virus diseases could be brought into focus to the point of identification (Hildebrand, Berkeley, and Cation (44); Anon. (1)).

Some would lead us to believe that these virus diseases are new, that somehow they just popped up. All of the viruses discussed here were present when this investigation was begun except yellow-red virosis of peach, for which there is circumstantial evidence that it came from the Orient on an ornamental cherry. Modern horticultural practices have facilitated the spread and dissemination of virus diseases. Some of the new strains of cherries possessed certain fruit and growth characteristics because they harbored viruses. It became a custon to go to orchards for budwood. In some such fashion the promising Chase (Morello type) cherry became completely viruliferous and we witnessed its demise.

In an attempt to get at the root of the so-called "winter injury" problem, experimental Montmorency cherry trees supplied by nurseries were planted at Ithaca in 1934. They were indexed with diseased orchard materials in 1935. The following year yellows symptoms were showing both on the graft-inoculated and the checks. Thus the cherry yellow leaf drop was traced to the nursery source. Visits to fruit nurseries for three successive years (1937-1939) clearly delineated the nursery story; how growers contracted with nurseries to get choice materials propagated under contract. Thus unwittingly the diseases were multiplied. Investigators everywhere soon found that most devitalizing abnormalities in foliage and stem character and in growth vitality were caused by viruses. In testing a new Michigan peach variety a New York nurseryman unknowingly received also a virus disease (24).

The chief obstacle to studying viruses was the mode of transmission and the consequent long incubation periods. Progress was slow until more rapid transmission or indexing techniques were developed (23, 25). Under greenhouse conditions it was possible to propagate almost at will and year-round studies were conducted, especially when employing peach seedlings.

Studies on virus movement (33, 34, 45) was an aid in reducing incubation periods to one month or less, which expedited progress.

Mechanical transmission by Moore, Boyle and Keitt (61) of sour cherry ringspot to cucumber gave further support to the belief that most ringspots are mechanically transmissible (22). Dodder transmission was also given a trial (42), with some success for peach but not cherry viruses.

One stubborn obstacle is lack of knowledge on insect vectors. The difficulty of determining the insect vector of phony peach was ably demonstrated by Turner (79) and associates after concerted studies over a span of years. Fortunately, since most virus troubles are encountered in orchards, the vectors can be largely circumvented by employing disease-free plants.

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[2]The test solution employed was ferric ammonium sulfate dissolved in water. The dark purplish black color imparted to the yellowish-orange FAS solution demonstrated a high tannin content which is characteristic and diagnostic of Mazzard roots.

Disease-free trees cannot be achieved unless or until both the roots and scions are certified disease-free. Attempts to obtain support for making visits to rootstock seed sources between 1940 and 1943 were unavailing. The objective of a seed certification program across state lines did not receive active support. The certification of budwood is relatively easy because most of it comes from the local nursery, but rootstocks crossing state lines make the problem regional or national. There is no doubt that certain fruit viruses are seedborne (43, 16, 10, 11). Finally, to be effective the certification program should include careful early season orchard inspection for the two years immediately following planting. The suggestion of Rasmussen and Cation (72) for a zonal eradication program for old orchards is commendable.

Milbrath and Zeller (55) reported a rough bark disease of flowering cherry in Oregon to be a virus disease. It is of interest that the same or a similar trouble (Figure 39) is also present on the East Coast, as about five years before their report the writer had received similar specimens from which he was unable to isolate either bacteria or fungi.

The cross-inoculation test planting at Ithaca gave the most valuable year-to-year record of stone fruit viruses of any undertaking. In it each virus isolate could be cross-indexed or cross-inoculated on nine standard varieties (Montmorency sour cherry, Bing, Black Tartarian, and Napoleon sweet cherries, Elberta and Rochester peach varieties, and Damson, Lombard, and Italian plums) and one to four rootstocks (Mahaleb, Mazzard, Myrobalan, and peach seedlings). Some varieties were added or changed during the years. This test planting was invaluable for host range studies; to mention only one illustration it revealed the susceptibility of the new Stanley prune to Lombard plum latent virosis (Figure 40). It facilitated the strain studies on prune dwarf (36). Presumably healthy myrobalan plum seedlings developed mottle and asteroid spot symptoms (40). So also were the other seedlings revealing symptoms of seed-borne conditions.

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UNITED STATES DEPARTMENT OF AGRICULTURE

SUPPLEMENT 223

INDEX TO SUPPLEMENTS 219-222, 1953

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Section of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE REPORTER SUPPLEMENT

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SECTION OF MYCOLOGY AND DISEASE SURVEY

INDEX TO PLANT DISEASE REPORTER SUPPLEMENTS 219-222, 1953

Compiled by Nellie W. Nance

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Plant Industry Station, Beltsville, Maryland

Supplement 223
Index to Supplements, 1953

LIST OF SUPPLEMENTS

Supplement 219. A check list of Alaskan fungi. pp. 1-70. February 15, 1953. By Edith K. CASH. This includes a host index.

Supplement 220. Some new and important plant disease occurrences and developments in the United States in 1952. pp. 72-103. August 15, 1953. Compiled by NELLIE W. NANCE.

Supplement 221. Distribution, symptoms and control of some of the more important plant diseases. pp. 106-181. This list was compiled by the YEARBOOK OF AGRICULTURE COMMITTEE, with the assistance of many other persons, for inclusion in the Department of Agriculture Yearbook, 1953. Circumstances prevented its publication in the Yearbook. Diseases and hosts are mostly those occurring in the United States. See its table of contents.

Supplement 222. Fruit virus diseases in New York in retrospect. pp. 185-223. By E. M. HILDEBRAND.

Supplement 223. Index to Supplements 219-222. pp. 227-235. (Issued June 15, 1954). By NELLIE W. NANCE.

SUBJECT AND AUTHOR INDEX

ERRATA

On page 93, 3d paragraph, 1st line, read Rhododendron spp., instead of Rhodendron spp.
On page 80, Table 2, read Geranium viscosissimum instead of Geranium viscossissimum.

SECTION OF MYCOLOGY AND DISEASE SURVEY