

ANNOTATED LIST OF BACTERIA AND FUNGI ON VEGETABLE CROPS IN THE PHILIPPINES

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ABSTRACT

Vegetable diseases were surveyed during the months of January through March in various provinces of the Philippines. Also the relevant literature was reviewed for diseases recorded on vegetables in the country. From 37 vegetable crops 135 bacterial and fungal pathogens are so far known and listed here. Among these 39 pathogens apparently have not been recorded before in the country, 37 were found in the literature only and were not seen in the field during the dry season or the areas visited. We assume that this list is not complete but is a critical up-date.

INTRODUCTION

This report is based on two surveys in March 1989 and January/February 1991 in major vegetable growing areas of the Philippines, and on a review of literature on vegetable diseases published from the Philippines. For the definition of "vegetables" we largely follow Tindall (1983). During the surveys collections were made in more than 400 fields. This material was studied in the laboratory to identify the pathogens in the symptoms found. For the identification authoritative key literature was generally used, e.g. M. B. Ellis, (1971, 1976), Chupp (1954) and Sutton (1980). In some cases, particularly for bacterial diseases, we relied on specific studies made by Filipino authors which reliably proved the presence of a particular species in the country, and on typical symptoms, exsudates and some isolations. Some of the reported species we did not see ourselves, but they are included in this list with their valid names. These species are indicated by a +. We also include some of the fungi which generally are considered saprophytic but were frequently found connected with distinct symptoms or decay. The ratings on occurrence and intensity are from our surveys during the dry seasons of 1989 and 1991.

A host index is appended.

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- 1 *Albugo candida* (Pers. ex Chev.) Kuntze, white rust on pechay, radish in Benguet; general but of little importance.
- 2 *A. ipomoeae - panduratae* (Schwein.) Swins., white rust on kangkong in Cebu and Cagayan de Oro.
- 3 *Alternaria alternata* (Fr.) Keissler, on sweet pepper, Vigan.
- 4 *A. brassicae* (Berk.) Sacc. (= *Macrosporium brassicae* Berk.), zonate leaf spot on broccoli, cabbage, cauliflower, Chinese cabbage, pechay and radish in Benguet, general during the dry season; and also in Bukidnon, rare; of little importance on broccoli, cabbage and cauliflower, occasionally more important on Chinese cabbage, also seen on pods of radish.
- 5 *A. brassicicola* (Schw.) Wiltshire, zonate dark leaf spot on broccoli, cabbage, cauliflower, mustard and pechay in Benguet, Cebu and Vigan. Very similar is the fungus causing a gray zonate leaf spot on cruciferous plants in the La Trinidad Valley reported by Fajardo & Palo (1934) as *A. herculae* (Ellis & Everh.) Elliot.
- 6 *A. cucumerina* (Ellis & Everh.) Elliot, leaf spot of cucumber, Baguio.
- 7 *A. dauci* (Kuehn) Skolko & Groves = *Macrosporium carotae* Ellis & Langlois, leaf spot and necrosis of carrot in Benguet and Cebu, rare and slight.
- 8 *A. longissima* Deighton & MacGarvie, on leaf spots of eggplant, Baguio; and okra, Los Banos.
- 9 *A. porri* (Ellis) Cif., purple blotch of onion in Benguet, Cebu and Vigan; common and sometimes severe.
- 10 *A. solani* Sorauer, zonate leaf spot of tomato; common in Bukidnon.
- 11 *A. tenuissima* (Kunze ex Pers.) Wiltshire, on drying onion leaves, San Fernando, Pampanga; on asparagus, Baguio; on pods of lima beans, Los Banos.
- 12 *A. cf. brassicae*, in leaf spots of Baguio beans at La Trinidad and Baguio; sweet peas at Buguias, Benguet; and in leafspots of eggplant in Pangasinan.

- 13 *Ampelomyces quisqualis* Ces., hyperparasite of powdery mildew. Found on *Oidium* sp. of chayote; very common and practically suppressing the mildew in the area around Baguio and La Trinidad. More slightly on powdery mildew of mungbean at Sta. Barbara, Pangasinan and on sitao in Bukidnon; on squash at La Trinidad, Cebu and Bukidnon, and on okra, Los Banos.
- 14 *Ascochyta abelmoschi* Harter, in leaf spots of okra, Asingan, Pangasinan and at Los Banos. *A. gossypii* and *A. phaseolorum* are also mentioned in the Rev. of Plant Pathology, but Weber (1973) and Holliday (1980) accept *A. abelmoschi*.
- 15 *A. cucumis* Fautr. & Roum. (= anamorph of *Didymella bryoniae* [Auerw.] Rehm), in leaf spots of cucumber, Agoo, La Union; associated with important damage.
- 16 *A. ? lycopersici* (Plowr.) Brunaud in leaf spots of eggplant Asingan, Pangasinan. If it is *A. lycopersici* then it would be the anamorph of *Didymella lycopersici* Klebahn. Another name in the literature (Baker & Stevens, 1931) is *Diplodia degenerans* Died.
- 17 *A. phaseolorum* Sacc., in small brown leaf spots of sitao, rare, Cebu; on pods of Baguio beans, rare, Cebu. *A. abelmoschi* is considered to be synonymous by some authors.
- 18 *A. pinodes* Jones (= anamorph of *Mycosphaerella pinodes* [Berk. & Brox.] Vestengr.) leaf spot and on stems of sweet peas, Benguet and Bukidnon; apparently more rarely occurring than *A. pisi*, found at 2,300 meters, also the perfect stage in March.
- 19 *A. pisi* Lib., zonate leaf spot of sweet peas and rot of the stems basis (wilt), Benguet, also in Bukidnon; common and at places severe.
- 20 *Ascochyta* sp., in leaf spots of chayote, Benguet; rare.
- 21 *Ascochyta* sp., in typical *Alternaria* spots of potato, Sayangan, Benguet, common there but slight (heavily sprayed). No *Ascochyta* sp. on potato is listed by Sutton (1980). Holliday (1980) refers to *Phoma destructiva* Plowr. as occurring in leaf spots similar to those caused by *Alternaria solani* Sorauer (CMI Descriptions No. 475).
- 22 + *Asteroma phaseolina* Brun., black pod rot of Phaseolus beans (Reinking, 1919).
- 23 + *Bremia lactucae* Regel, downy mildew of lettuce (Reinking, 1919).

- 24 +*Botrytis allii* Munn., on leaves of onion (Benigno & Quebral, 1977).
- 25 *Cercospora apii* Fres., leaf spot of celery, Benguet, less frequent than *Septoria apiicola*; also in Bukidnon.
- 26 *C. asparagi* Sacc., leaf spot and die-back of asparagus, Baguio; severe.
- 27 *C. brassicicola* P. Henn., leaf spot of Chinese cabbage, Cebu and of pechay and radish, Benguet; severe in two fields some kilometers apart. The specimen on pechay, however, does not fit well the CMI description of pathogenic Fungi and Bacteria No. 722, as conidiophores are indistinct, the rather short and slightly curved conidia had 3-4 septae only.
- 28 *C. canescens* Ellis & Martin, angular or round leaf spot, also on dead vines of Baguio beans and mungbeans; common and sometimes damaging, though in many cases it may be too late for serious yield losses.
- 29 *C. capsici* Heald & Wolf, frog-eye on leaves of hot pepper, Benguet, Pangasinan, Vigan and Bukidnon; not serious on leaves but it may cause fruit drop.
- 30 *C. carotae* (Pass.) Kasnowski & Siemaszko, leaf necrosis of carrots, Sayangan, Benguet; on lower leaves, not severe.
- 31 *C. citrullina* Cooke = *C. cucurbitae* Ellis & Everh., distinct leaf spot on ampalaya, chayote, patola and squash; common with, perhaps, a considerable pathogenic potential.
- 32 *C. coriandri* Jacz., leaf spot of coriander, Cebu.
- 33 *C. cruenta* Sacc. (= anamorph of *Mycosphaerella cruenta*), leaf spot on all beans, also on batao (*Lablab niger* = *Dolichus lablab*); common and sometimes severe, particularly on sitao and mungbean.
- 34 *C. duddiae* Welles, leaf spot of garlic, Vigan; common.
- 35 *C. ipomoeae* Wint., brown slightly zonate leaf spot of kangkong, Cebu and Cagayan de Oro.
- 36 *C. longissima* Cugini ex Trav., circular leaf spot of lettuce, Talisay, Cebu.

- 37 *C. malayensis* Stev. & Solheim, in leaf spots of okra, Los Baños (See also M.B. Ellis, 1976).
- 38 +*C. melongenae* Welles, grayish brown, sometimes zonate leaf spot of eggplant (M.B. Ellis, 1976).
- 39 *C. petroselini* Sacc., leaf spot of parsley (kinsai), Baguio and Cebu.
- 40 *C. solani-melongenae* Chupp, leaf spot of eggplant, near Baguio and in Bukidnon; rare. The specimens with subhyaline conidia fit M.B. Ellis (1976) description of *C. solani-melongenae* better than *C. melongena* and *C. solanicola*, which both have hyaline conidia.
- 41 *C. solanicola* Atk., in typical Alternaria leaf spots of potato, Benguet. The conidiophores are not branched as in *Mycovellosiella concors* (Caspary) Deighton (= *Cercospora concors* Caspary).
- 42 *Choanephora cucurbitarum* (Berk. & Rav.) Thaxt., pod rot of sitao, Baguio; severe rot of young fruits of okra, Calamba.
- 43 +*Cladosporium cucumerinum* Ellis & Arth., scab or gummosis of cucumber (Benigno & Quebral, 1977).
- 44 *C. oxysporum* Berk. & Curt., in leaf necrosis of melon, St. Ana, Pampanga; in leaf spot of okra, Los Baños; and on decaying parts of ampalaya, Cebu.
- 45 *C. tenuissimum* Cooke, in leaf spots of sitao, Angat, Bulacan; on dead leaves of onion, San Fernando, Pampanga; not *C. magnusianum* (Jaap) M.B. Ellis or *C. allii-cepae* (Ranojevic) M.B. Ellis; on decaying vines of upo, Pampanga, also on rotting young fruits of upo, Pampanga. M. B. Ellis (1976) considers this species as being close to *C. oxysporum*.
- 46 *Cladosporium spp.*, leaf mold on eggplant in Pangasinan, Benguet, Pampanga and Bukidnon, common but not *Fulvia fulva*. Also found on leaf necrosis of patola, Pampanga, on okra, Benguet; in leaf spots and on dead plant parts of Baguio beans, Benguet, in leaf spots of squash, Pangasinan and Benguet.
- 47 *Colletotrichum circinans* (Berk.) Vogl., smudge of onion, Los Baños.
- 48 *C. gloeosporioides* Penz. (= anamorph of *Glomerella cingulata* [Stonem.] Spauld. & Schrenk.), fruit rot of sweet pepper, Baguio and Los Baños.

- 49 *C. lindemuthianum* (Sacc. & Magn.) Br. & Car., anthracnose on pods of Lima beans, Los Baños; and of Baguio beans, Bukidnon.
- 50 *C. orbiculare* (Berk. & Mont.) Arx = *C. lagenarium* (Pass.) Ellis & Halstedt, anthracnose, and possibly the cause of premature death of vines of chayote in Benguet; on petioles of ampalaya, Los Baños, apparently rare.
- 51 *Colletotrichum* sp., on pods of winged beans, very rare, Los Baños.
- 52 *Corynespora cassiicola* (Berk. & Curt.) Wei, in small leaf spots of sitao, Benguet (the fungus is known as pathogen on cowpea); on dying plant parts of ampalaya, Cebu and Pampanga; on upo, Pampanga; in distinct leaf spots of cucumber, Marcos Highway, Benguet; on moribund parts of winged beans, Los Baños.
- 53 *Curvularia lunata* (Wakker) Boedijn (= anamorph of *Cochliobolus lunatus* Nelson & Haasis), on leaves of garlic showing a yellowing, Los Baños.
- 54 *C. ovoidea* (Hiroe & Watan.) Muntanola, on rotting fruit and stem basis of sweet pepper, Vigan, rare.
- 55 *C. pallescens* Boedijn (= anamorph of *Cochliobolus pallescens* [Tsuda & Ueyama] Sivan.), in leaf spots of squash, Sta. Barbara, Pangasinan; sitao and okra, Los Baños.
- 56 +*Diplodia natalensis* Pole Evans (= anamorph of *Phyalospora rhodina* [Berk. & Curt.] Cooke), stem-end rot of melon and squash (Teodoro, 1959), gray fruit rot of squash (Benigno & Quebral, 1977), pod rot of mungbean (Ilag & Marfil, 1972) Los Baños. A *Phyalospora* sp. was found on pods of an unidentified bean species in Bukidnon.
- 57 +*D. phaseolina* Sacc., pod rot of Baguio bean (Baker & Stevens, 1931).
- 58 *Erysiphe cichoracearum* DC. ex Merat, as *Oidium* sp. on tomato, Benguet, Pangasinan, Pampanga, Los Baños and Bukidnon.
- 59 *E. heraclei* DC. ex St.-Am., powdery mildew of carrot (as *Oidium* sp.), slight in the BPI garden at Baguio.
- 60 *E. pisi* DC ex St.-Am. = *E. polygoni* DC. em. Salmon pro parte fide Kapoor, CMI Descript. No. 155. Powdery mildew of sweet peas (as *Oidium* sp.), common in high altitudes and at La Trinidad, Benguet and sometimes severe; also on stem bases in Bukidnon.

- 61 +*Erwinia carotovora* var. *carotovora*, (Jones) Dye, soft rot on cabbage, broccoli (possibly in connection with boron deficiency), Baguio, rare; severe on Chinese cabbage, Mantalongon, Cebu and in Bukidnon; soft root rot of parsley and carrot, Baguio, rare. Benigno & Quebral (1977) list soft rots attributed to this bacterium on cabbage, carrot, cauliflower, celery, cucumber, eggplant, garlic, lettuce, onion, pechay, pepper, potato, radish.
- 62 +*E. carotovora* var. *atroseptica* (Van Hall) Dye = *Bacillus phytophthorus* Appel (Reinking, 1919), black leg of potato, Cawayan, Bukidnon, also occurring in Benguet.
- 63 *Fulvia fulva* (Cooke) Cif. = *Cladosporium fulvum* Cooke, leaf mold of tomato, Pangasinan, common and sometimes severe; at Baguio in a greenhouse; at Vigan, slight.
- 64 *Fusarium acuminatum* Ell. & Ev., on rotting young fruits of upo, Pampanga; the primary cause of this severe condition may be another pathogen.
- 65 *F. moniliforme* Sheld. (= anamorph of *Gibberella fujikuroi* [Swa.] Wollenw.), stem-end rot of eggplant fruit, Los Baños.
- 66 +*F. oxysporum* Schlecht. with its formae speciales has been implicated vascular wilts of cabbage and cucumber (Teodoro, 1959). Benigno & Quebral (1977) list formae speciales in the Philippines for garlic (*cepae*), mungbean (*phaseoli*), melon (*melonis*), and tomato (*lycopersici*). We feel, that the entire wilt syndrome of vegetables in the Philippines needs a diagnostic revision. There is a tendency to assign wilts seen in the fields to bacterial wilt, which, if not applicable, does not consider other true vascular wilt pathogens, nor root and collar rot incitants, which may require different control measures. Micoso & Ilag (1977) isolated the fungus from fruit rots of sweet pepper at Los Baños; we found it in leaf spots of okra, Los Baños.
- 67 +*F. oxysporum* Schlecht. f. sp. *conglutinans* (Wr.) Snyder & Hansen, yellowish of cabbage (Teodoro, 1959).
- 68 *F. semitectum* Berk. & Rav., on rotting fruit of tomato, Pangasinan, rare; sweet pepper, near Vigan, rare.
- 69 +*F. solani* (Mart.) Appel. & Wr., isolated from fruit rots of *Capsicum annuum* at Los Baños (Micoso & Ilag, 1977). *F. solani* is also recorded as cause of a stem-end rot of muskmelon and of a stem rot of beans (Benigno & Quebral, 1977).

- 70 +*F. udum* (Berk.) Wr., bulb rot of onion at Los Baños and in Batangas (Gamo, 1929).
- 71 +*F. zonatum* (Sherb.) Wr., bulb rot of onion (Palo, 1929).
- 72 +*Helminthosporium lycopersici* Roldan, leaf blight of potato in Los Baños (Saiyanando & Celino, 1940). It could be *Corynospora cassicola* from the drawings published. This name is not accepted by M. B. Ellis (1971, 1976).
- 73 *Leptosphaeria* sp., in leaf spots of okra, Los Baños.
- 74 *Leptosphaerulina ?trifolii* (Rost.) Petr., on pods of Baguio beans, Cebu.
- 75 *Leveillula taurica* (Lev.) Arn., powdery mildew of sweet pepper, Bukidnon; severe in one field.
- 76 +*Melanconium lycopersici* Orillo, fruit rot, and on other plant parts of tomato (Orillo & Bombay, 1952).
- 77 *Monilinia* sp., in rotting young upo fruits, Los Baños.
- 78 *Oidium* spp., powdery mildew found on tomato (insignificant in Benguet, Pampanga, Los Baños), eggplant (insignificant in Pangasinan, Los Baños), ampalaya (hardly visible on lower leaf surfaces, causing yellow spots on the upper side; Bulacan, Los Baños, Cebu); chayote (with hyperparasite, Benguet), patola (Pampanga), squash (Benguet, Pangasinan, Pampanga, Cebu and Bukidnon, sometimes with the hyperparasite *A. quisqualis*), upo (Los Baños), watermelon (Vigan), okra (Pampanga, Los Baños, Cebu and Bukidnon), sitao (frequent in Pangasinan, Vigan, Pampanga, Los Baños, Cebu), mungbean (Pangasinan, Pampanga, Cagayan de Oro), cowpea (Bukidnon). Powdery mildews on tomato and okra is due to *Erysiphe cichoracearum* DC. ex Merat according to Quimio & Naduyan (1980). Powdery mildew of ampalaya (obviously a poor host), chayote, patola and squash, eggplant, mungbean and sitao are referred by Kapoor to *Sphaerotheca fuliginea* (Schlecht. ex Fr.) Poll. in CMI Descript. No. 159, who also cites okra as a host for this species.
- 79 *Peronospora parasitica* (Pers.) ex Fr., downy mildew of cabbage and Chinese cabbage in Benguet, Cebu and Bukidnon, widespread, may be serious on young plants; on radish in Benguet and Bulacan, common.

- 80 +*P. destructor* (Berk.) Casp. ex Berk., downy mildew of onion; severe in Ilocos Norte (Agati et al., 1952).
- 81 *Phaeoisariopsis griseola* (Sacc.) Ferraris, angular leaf spots of Baguio beans, Benguet and Cebu; can be severe also on pods.
- 82 *Phaeoramularia* cf. *bruchiana* (Speg.) Deighton, leaf spot of eggplant, Bukidnon; symptom resembles leaf spots by *Cercospora solani melongenae*.
- 83 +*Phoma bakeriana* Sacc., on mature pods of *Vigna* spp. (Reinking, 1919).
- 84 *P. lingam* (Tode ex Fr.) Desm. (= anamorph of *Leptosphaeria maculans* (Desm.) Ces. & de Not.), leaf spot of cabbage, and Chinese cabbage.
- 85 +*P. tenastris* Hansen, pink rot of onion (Teodoro, 1959).
- 86 *Phoma* sp., fruit rot of sweet pepper, Los Baños. Orillo et al. (1959) give *P. destructiva* Plowr. as cause.
- 87 *Phomopsis capsici* (Magnaghi) Sacc. = *Phoma capsici* Magnaghi (= anamorph of *Diaporthe capsici* Punithalingam), die-back of peppers, and in fruit rots of pepper at Los Baños; spindle-shaped one-celled conidia with two distinct guttulae (see also CMI-Description No. 733).
- 88 *P. vexans* (Sacc. & Syd.) Harter, in leaf spots of eggplant, Sta. Barbara, Pangasinan, rare; stem canker, common; in Bulacan die-back in one field on about 10% of the plants.
- 89 +*Phyllachora phaseolina* Syd., tarspot of Baguio beans (Reinking, 1919).
- 90 *Phyllosticta hortorum* Speg., a minor leaf disease of eggplant at Los Baños (Ceomara, 1957), fruit rot of eggplant, Los Baños; in round, small leaf spots, in Cebu.
- 91 *Phyllosticta* sp., in zonate leaf spots, potato, BPI garden Baguio, rare. This may well be a *Phoma* sp. (Sutton (1980) lists the following *Phoma* spp. on leaves of *Solanum tuberosum*: *P. multirostrata* (Mathur et al.) Dorenbosch & Boerema, *P. pomorum* Thum. (e.g. from Sabah), *P. tropica* Schneiders & Boerema (e.g. from Fiji). In zonate leaf spots *P. andina* Turkensteen is described from Latin America. In leaf spots of okra, Los Baños.

- 92 +*Phytophthora capsici* Leonian, blight of pepper (Reinking, 1919).
- 93 *Ph. infestans* (Mont.) de Bary, late blight, of potato and tomato, Benguet and Bukidnon, severe in many places. Late blight is also reported on tomato in Pangasinan, but was not seen in the surveys.
- 94 +*Ph. parasitica* Dastur = *Ph. nicotianae* Breda de Haan, root and crown rot of chives in Cavite and of eggplant with wilting symptoms in Batangas, as well as fruit rot of eggplant in Bukidnon (courtesy Dr. P.H. Tsao); fruit rot of muskmelon (Benigno & Quebral, 1977). *Ph. melongenae* now is a synonym of *Ph. parasitica* fide Dr. P.H. Tsao.
- 95 +*Ph. phaseoli* Thaxt., downy mildew of Lima beans (Benigno & Quebral, 1977).
- 96 +*Phytophthora* sp., in crown rot of Chinese cabbage, Bukidnon (courtesy Dr. P.H. Tsao).
- 97 *Plasmidiophora brassicae* Woron., clubroot of cabbage and Chinese cabbage in Benguet, a very serious, still spreading disease. Occurs certainly on other brassicas as well, but was not seen during the survey.
- 98 *Pseudocercospora abelmoschi* (Ellis & Everh.) Deighton = *Cercospora abelmoschi* Ellis & Everh. = *C. hibisci* Tracy & Earle, leaf mold of okra; common, sometimes severe, but not damaging.
- 99 *P. fuligena* (Roldan) Deighton = *Cercospora fuligena* Roldan, leaf mold of tomato, Pangasinan; common but slight; in Bukidnon occasionally. According to Quimio (1985) this is one of the most severe diseases during rainy seasons at Los Baños.
- 100 +*P. psophocarpi* (Yen) Deighton = *Cercospora psophocarpi* Borlaza & Roldan, angular leaf spots of winged bean (*Psophocarpus*), Los Baños (Pua & Ilag, 1980).
- 101 *Pseudomonas syringae* pv. *lacymans* (Smith & Bryan) Young, Dye & Wilkie, angular leaf spot and fruit rot of patola, Cagayan de Oro.
- 102 *P. syringae* pv. *phaseolicola* (Burkholder) Young, Dye & Wilkie, halo blight of beans (leaves, pods), Mantalongon, Cebu, and Bukidnon; determination is based on halos. *Xanthomonas campestris* pv. *phaseoli* (E.F. Smith) Dowson is also reported from the Philippines (Reinking, 1919; Welles, 1922).

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- 103 *P. syringae* pv. *psi* (Sackett) Young, Dye & Wilkie, dark leaf spots (bacterial blight) of sweet peas, Benguet; common. Exsudates were found in the brown lesions and around these leaf spots.
- 104 *P. solanacearum* (E.F. Smith) E.F. Smith, bacterial wilt of eggplant, potato and tomato wherever these crops are grown in the country. Benigno & Quebral (1977) list the following host plants: ampalaya, beans, pepper, potato, squash and tomato. Later reports comprise cabbage, Chinese cabbage and pechay with biovar III of race 1 (Licardo & Valdez, 1989), cowpea (Quimio, 1974), winged beans with biovar III (Valdez & Almodovar, 1980, Quimio & de la Cruz, 1981) who found between morphovars of biovar III (race 1) differing pathogenicity to eggplant, tomato and pepper. And Alagad & Quimio (1981) could show that isolates from 11 hosts in the Philippines belong to 4 biovars with a distribution varying from each other. For cucurbit the possible involvement of *Erwinia tracheiphila* (E.F. Smith) Bergey et al. has to be looked into, as it is reported from the Philippines (Reinking, 1919). See also No. 66.
- 105 *Pseudoperonospora cubensis* (Berk. & Curt.) Rostow., downy mildew of ampalaya, cucumber, melon, patola, squash, upo and watermelon in most places where they are grown. A serious disease on cucumber.
- 106 +*Puccinia porri* (Sow.) Wint., rust of onion (Elayada, 1935).
- 107 +*P. tubulosa* (P. & G.) Arth., rust of eggplant (Palo, 1938).
- 108 *Pyrenophora* sp., on dead leaves of onion, Cebu.
- 109 +*Pythium aphanidermatum* (Edson) Fitzpatrick.
- 110 +*P. butleri* Subram.
- 111 +*P. debaryanum* Hesse.
- 112 +*P. deliense* Meurs.
- 113 +*P. irregulare* Busman.
- 114 +*P. myriotylum* Drechsler.
- 115 +*P. ultimum* Trow.

These species were isolated from soil sampled from various parts of the Philippines by Quimio & Abiley (1977) and are often implicated with rots of underground plant parts, and damping-off of various vegetables. *P. aphanidermatum* (cucumber, lettuce, pechay) as well as cottony leaves on eggplants and *P. debarvanum* (beans, cabbage, celery, lettuce, okra, peas, pepper, radish) are listed by Benigno & Quebral (1977) on vegetables in the Philippines.

- 116 *Rhizoctonia solani* Kühn (= anamorph of *Thanatephorus cucumeris* [Frank] Donk), damping-off, root and collar rots of potato, pepper and beans, Benguet, Pangasinan and Bukidnon. Causes also bottom rot of cabbage (Halos & Molina, 1980). The list of Benigno & Quebral (1977) contains the following diseases on vegetables: Damping-off (beans, cabbage, cauliflower, celery, eggplant, lettuce, pechay, potato, tomato, radish, squash), root rot (beans, peas), stem rot (carrot), stem canker (peas), blight or leaf spots (beans, eggplant, pepper), heart rot (cabbage), pod rot (beans) fruit rot (eggplant) and black scurf (potato).
- 117 *Rhizopus stolonifer* (Ehrenb. ex Fr.) Lind. = *R. nigricans* Ehrenb., in rotting fruit (black profuse mycelium) of tomato, Sta. Barbara, Pangasinan; rare.
- 118 *Sclerotinia sclerotiorum* (Lib.) de Bary, cottony rot of *Phaseolus vulgaris*, severe at Baguio and La Trinidad in 1991, not seen in 1989; on sitao at Agoo, La Union rare; soft root rot of parsley, Baguio, rare, but severe in patches. As *S. libertiana* Fuckel it was reported as cause of head watery rot of cabbage (Fajardo, 1934).
- 119 + *Sclerotium cepivorum* Berk., white rot of garlic and onion (Benigno & Quebral, 1977).
- 120 *S. rolfsii* Sacc. (= anamorph of *Corticium rolfsii* Curzi), damping-off seen on: mungbean, Benguet, rare; tomato, rare at Agoo, La Union, severe at San Fernando, Pampanga; sweet pepper, Vigan; rare on cabbage in Bukidnon. Benigno & Quebral (1977) list the following diseases caused by the pathogen on a number of hosts: Damping-off (ampalaya, beans, cabbage, cauliflower, celery, eggplant, lettuce, peas, pechay, potato, radish, squash), root rot/wilt (beans, eggplant, lettuce, pepper, potato), blight (eggplant, lettuce, onion).
- 121 *Septoria apiicola* Speg., leaf spot of celery, Benguet; common, but not always important. *S. apii* Rostrup and *S. apii-graveolens* Doragin are synonyms according to Suttons & Waterston, CMI Descript. No. 88.

- 122 *S. lycopersici* Speg., leaf spot of tomato (a local variety), Mantalongon, Cebu; rare.
- 123 *S. petroselinii* Desm., leaf spot of parsley, Baguio; rare.
- 124 *S. vignae* P. Henn., small brown leaf spot of sitao, Cebu and Bukidnon.
- 125 + *Sphaceloma* sp., scab on mungbean at Los Baños, Isabela, Pampanga (Ilag & Marfil, 1980).
- 126 *Sphaerellopsis filum* (Biv.-Bern. ex Fr.) Sutton = *Darlucal filum* Biv.-Bern. ex Fr., hyperparasite of *Uromyces appendiculatus*, Cebu; an ubiquitous rust hyperparasite, but rather rare on *U. appendiculatus* in the Philippines.
- 127 *Stemphylium botryosum* Wallr. (= anamorph of *Pleospora herbarum* [Pers. ex Fr.] Rabenh.), both seen on decaying lower leaves of sweet peas, Englanda, Benguet; also on beans and on dying onion leaves, Los Baños.
- 128 + *S. lycopersici* (Enjoji) Yamamoto, Opina et al. (1980) and Valdez & Opina (1980) report *S. lycopersici* on tomato and pepper at Los Baños.
- 129 + *Spongopora subterranea* (Wallr.) Lagerh. f. sp. subterranea Tomlinson, powdery scab of potato, Benguet.
- 130 + *Streptomyces scabies* (Thaxter) Waksman & Henrici, common scab of potato, Benguet.
- 131 *Synchytrium psophocarpi* (Racib.) Gaeumann = *Woroninella psophocarpi* Racib., orange gall of winged bean, Los Baños.
- 132 + *Urocystis cepulae* Frost., smut of onions and garlic (Elayada, 1935).
- 133 *Uromyces appendiculatus* (Pers.) Unger, rust (mostly as uredospores, occasionally as teliospores) of Baguio bean, sitao and mungbean, Benguet, Bulacan, Bukidnon and Cagayan de Oro; common, and sometimes severe; on mungbean also near San Fernando, Pampanga.
- 134 *Xanthomonas campestris* pv. *campestris* (Pammel) Dowson, black rot of broccoli, cabbage, mustard and pechay in Benguet, Cebu, and Bukidnon; can be serious during the rainy season; on radish, Angat, Bulacan, cabbage, Benguet, common.

- 135 *X. campestris* pv. *vesicatoria* (Doidge) Dye, bacterial leaf spot and scab on fruits, one of the most severe diseases of tomato at Los Baños (Quimio, 1985), leaf spots also seen on peppers, Vigan and Los Baños. The "bacterial leaf spot" of tomato found in the Economic Garden of Los Baños could be due to this pathogen, but an untypical *Erwinia* sp. was isolated.

Found after the completion of the manuscript:

- 136 *Botrytis cinerea* Pass., gray mold on lettuce, near Km. 26, Mountain Trail, Benguet.

HOST INDEX

(Pathogens are listed by their numbers in the above list)

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BIBLIOGRAPHY

1. Agati, J.A., G.M. Garcia, P.A. Rodrigo (1952): *Studies on control of downy mildew blight of onion in the Philippines particularly in Ilocos Norte*. Philipp. J. Agric. 17, 153-181.
2. Alagad Jr., C.K. & A.J. Quimio (1981): *Subspecific classification of Pseudomonas solanacearum in the Philippines*. Philipp. Phytopathology 17, 7 (Abstract).
3. Baker, C.F. & F.L. Stevens (1931): *Second supplement to the list of lower fungi of the Philippine Islands*. Philipp. J. Sci. 46, 479-536.
4. Benigno, D.R.A. & F.C. Quebral (1977): *Host index of plant diseases in the Philippines*. IFA Research, Training & Extension Program, UPLB.
5. Ceomara, V.S. (1957): *Phyllosticta leaf spot of eggplant*. Philipp. Agric. 41, 37-52.
6. Chupp, C. (1954): *Monograph of the fungus genus Cercospora*. Ithaca, New York.
7. CMI Descriptions of pathogenic fungi and bacteria (1964-1990): Commonwealth Mycological Institute, Kew, Surrey, U.K.
8. Elayada, A. (1935): *Bermuda onion (Allium cepa)*. Philipp. J. Agric. 6, 175-193.
9. Ellis, M.B. (1971): *Dematiaceous hyphomycetes*. Commonwealth Mycological Institute, Kew, Surrey, U.K.
10. Ellis, M.B. (1976): *More dematiaceous hyphomycetes*. Commonwealth Mycological Institute, Kew, Surrey, U.K.
11. Fajardo, T.G. (1934): *Plant disease problems confronting track farmers in Trinidad Valley and vicinity of Baguio, Mt. Province, Phil. Islands*. Philipp. J. Sci. 53, 67-95.
12. Fajardo, T.G. & M.A. Palo (1934): *A serious leaf spot of chinese celery cabbage, Wongbok, and other cruciferous plants in the Trinidad Valley, Mt. Province, Luzon*. Philipp. J. Agric. 5, 143-156.
13. Gamo, E.B. (1929): *A Fusarium bulb rot of onion*. Philipp. Agric. 17, 647 (Abstract).

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14. Halos, P.M. & G.C. Molina (1980): *Chemical control of bottom rot of cabbage*. Philipp. Phytopathology 16, 14 (Abstract).
15. Holliday, P. (1980): *Fungus diseases of tropical crops*. Cambridge University Press.
16. Ilag, L.L. & V.E. Marfil (1977): *Diplodia pod rot of mungbean*. Philipp. Agric. 61, 186-191.
17. Ilag, L.L. & V.E. Marfil (1980): *Occurrence of mungbean scab in the Philippines*. Philipp. Phytopathology 10, 5 (Abstract).
18. Licardo, O.A. & R.B. Valdez (1989): *Bacterial wilt of crucifers*. Philipp. Phytopathology 25, 67 (Abstract).
19. Micoso, R.S. & L.L. Ilag (1977): *Fruit rot of pepper caused by Fusarium spp.* Philipp. Phytopathology 13, 14-23.
20. Opina, Nenita L. & Tricita H. Quimio (1989): *Gray leaf spot of tomato and pepper caused by Stemphylium lycopersici (Enjoji) Yamamoto*. Philipp. Phytopathology 16, 16-26.
21. Orillo, F.T. & B.B. Bombay (1952): *Melanconium fruit rot of tomato*. Philipp. Agric. 36, 114-130.
22. Orillo, F.T., L.A. Schafer, B.A. Revilla (1959): *Common diseases of vegetable crops and their control in the Philippines*. UPLB CA Technical Bull. 4.
23. Palo, M.A. (1929): *A Fusarium causing bulb rot on onion in the Philippines*. Philipp. Agric. 17, 301-316.
24. Palo, M.A. (1938): *Eggplant diseases and their control*. Philipp. J. Agric. 9, 403-413.
25. Pua, Araceli & L.L. Ilag (1980): *Growth and sporulation of Pseudocercospora psophocarpi (Yen) Deighton at different media, temperature and pH*. Philipp. Phytopathology 16, 119-152.
26. Quimio, A.J. (1974): *Cowpea, new host of Pseudomonas solanacearum E.F. Smith in the Philippines*. Philipp. Agric. 58, 200-204.
27. Quimio, A.J. (1985): *Control of tomato foliar diseases with chlorothalonil, mancozeb, cupric hydroxide, and mancozeb + cupric hydroxide*. Philipp. Phytopathology 21, 15 (Abstract).

28. Quimio, A.J. & A.R. de la Cruz (1981): *Virulence of different morphovars of biovar III of Pseudomonas solanacearum of three solanaceous crops*. Philipp. Phytopathology 17, 7 (Abstract).
29. Quimio, T.H. & L.E. Abiley (1977): *Pythium from Philippine soil*. Philipp. Phytopathology 13, 54-73.
30. Quimio, T.H. & M.M. Naduyan (1980): *Note: Powdery mildew of tomato caused by Erysiphe cichoracearum DC. ex Merat*. Philipp. Phytopathology 16, 67-70.
31. Reinking, O.A. (1919): *Host index of diseases of economic plants in the Philippines*. Philipp. Agric. 8, 38-54.
32. Saiyanando, C. & M.S. Celino (1940): *Leaf blight of potato*. Philipp. Agric. 29, 365-377.
33. Sutton, B.C. (1980): *The Coelomycetes*. Commonwealth Mycological Institute, Kew, Surrey, U.K.
34. Teodoro, N.G. (1959): *Plant diseases*. Agro. and Industrial Life, 21 in various fascicles.
35. Tindall, H.D. (1983): *Vegetables in the tropics*. MacMillan Education Ltd, Houndmills, London.
36. Valdez, R.B. & O.B. Almodovar (1980): *Bacterial wilt of winged beans*. Philipp. Agric. 63, 15-19.
37. Valdez, R.B. & N.L. Opina (1980): *Gray leaf spot of tomato in the Philippines*. Philipp. J. Biol. 9, 81-87.
38. Weber, G.F. (1973): *Bacterial and fungal diseases of plants in the tropics*. Univ. Florida Press, Gainesville.
39. Welles, C.G. (1922): *Identification of bacteria pathogenic to plants previously reported from the Philippine Islands*. Philipp. J. Sci. 20, 279-285.