4. PLANT VIRUS DISEASES IN THE PHILIPPINES

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Plant viruses are one of the major set-backs in crop production in the Philippines. Some of these plant viruses are lethal to plant species they attack, whereas others are not.

In the "Host index of plant diseases in the Philippines", there are 1,279 plant diseases recorded from 1918 to 1975. Of these number, 137 diseases are caused by viruses. The majority is of the mosaic and yellow-type diseases and that aphids transmit most of these diseases, followed by leafhoppers and one species each for beetle, psyllid, thrips, and whitefly. No nematode, mite, or fungi have, so far, been reported as plant virus vectors in this country.

It seems, however, that of the 137 recorded diseases as caused by viruses, 2 are probably caused by viroids, 3 by mycoplasma, and 1 by a *Corynebacterium*.

Plant Species Attacked by Plant Viruses

Records in the Philippines show that there are 82 plant species in 72 genera and 32 families affected by plant viruses (Table 1). Fifty-five plant species have one virus

Table 1. Philippine plant virus diseases based on Plant Families, Genera and Species

Families, Genera & Species	Disease(s)
1. Amaranthaceae	
Alternanthera versicolor (Lem.) Hort.	Mosaic
Gomphrena globosa L.	Mosaic
2. Amaryllidaceae	
Eucharis grandiflora Planch. & Link	Mosaic
3. Apiaceae (Umbelliferae)	
Apium graveolens L. var. *dulce* DC	Dwarf, Mosaic, Yellows
4. Araceae	
Colocassia esculenta (L.) Schott.	Mosaic
5. Arecaceae (Palmae)	
Cocos nucifera L.	Cadang-cadang, Yellow ringspot
6. Asteraceae (Compositae)	
Chrysanthemum coronarium L.	Mosaic, Rosette, Stunt, Yellows
Dahlia sp.	Mosaic
Elephantopus mollis HBK.	Enation, Mosaic
Gerbera jamesonii Bolus ex Hook.	Mosaic
Pseudoelephantopus spicatus	Mosaic
Synedrella nodiflora (L). Gaertn.	Leaf curl, Mosaic

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Families, Genera & Species	Disease(s)
7. Balsaminaceae	
Impatiens balsamina L.	Mosaic
8. Brassicaceae	
Brassica hirta Moench	Mosaic
Brassica juncea (L.) Czern.	Mosaic
Brassica nigra (L.) Koch	Mosaic
Brassica pekinensis (Lour) Rupr.	Mosaic
Raphanus sativus L.	Mosaic
9. Bromeliaceae	
Ananas comosus (L.) Merr.	Yellow spot
10. Caesalpinaceae (Leguminosae)	
Cassia occidentalis L.	Mosaic
11. Cannaceae	
Canna indica L.	Mosaic
12. Caricaceae	
Carica papaya L.	Leaf curl, Mosaic
13. Caryophyllaceae	
Dianthus caryophyllus L.	Mosaic
14. Chenopodiaceae	
Spinacea oleracea L.	Mosaic
15. Convolvulaceae	
Impomoea batatas (L.) Lam.	Green dwarf, Mosaic, Vein yellowing, Stunting
16. Cucurbitaceae	
Benincasa hispida (Thunb.) Cogn.	Mosaic
Citrullus vulgaris Schrad.	Mosaic
Cucumis melo L.	Mosaic
Cucumis melo var. *cantalupensis* Naud.	Mosaic
Cucumis sativus L.	Mosaic
Cucurbita maxima Dcne.	Mosaic
Cucurbita pepo L.	Mosaic
Lagenaria siceraria (Molina) Standley	Mosaic
Luffa aegyptiaca Mill.	Mosaic
Momordica charantia L.	Mosaic
Sechium edule (Jacq.) Swartz	Mosaic
17. Euphorbiaceae	
Manihot esculenta Crantz	Mosaic, Witches' broom
18. Malvaceae	
Gossypium hirsutum L.	Interveinal yellowing, Leaf curl, Mosaic
19. Marantaceae	
Maranta arundinacea L.	Mosaic
20. Musaceae	
Musa sapientum (L.) Kuntze	Bunchy-top, Mosaic
Musa textilis Nee.	Bunchy-top, Mosaic
21. Nyctaginaceae	
Bougainvillea glabra Choisy	Mosaic

Families, Genera & Species	Disease(s)
Mrs. McLean	
22. Oleaceae	
Jasminum sp.	Mosaic, Vein chlorosis
23. Papilionaceae (Leguminosae)	
Arachis hypogaea L.	Mottle, Ringspot, Rosette
Calopogonium mucunoides Desv.	Mosaic
Centrosema pubescens Benth.	Mosaic
Crotalaria sp.	Mosaic
Desmodium gangeticum (L.) DC.	Mosaic
Glycine max (L.) Merr.	Mosaic
Pachyrrhizus erosus (L.) Urb.	Mosaic
Phaseolus aureus Roxb.	Mosaic, Yellow mosaic
Phaseolus lathyroides L.	Mosaic
Phaseolus vulgaris L.	Mosaic
Vigna unguiculata (L.) Walp	Curly top, Green mosaic, Little-leaf, Ringspot, Yellow mosaic
Vigna sesquipedalis (L.) Fruwirth.	Mosaic
24. Passifloraceae	
Passiflora foetida L.	Mosaic
25. Piperaceae	
Piper nigrum L.	Stunt
26. Poaceae (Graminae)	
Andropogon halepense (L). Brot.	Mosaic
Coix lacryma-jobi L.	Mosaic
Digitaria sanguinalis (L). Scop.	Mosaic
Echinochloa colonum (L.) Link	Mosaic
Imperata cylindrica (L.) Beauv.	Mosaic
Oryza sativa L.	Grassy stunt, Mosaic, Orange leaf, Tungro, Yellow dwarf
Panicum distachyum L.	Mosaic
Paspalum conjugatum Berg.	Mosaic
Rottboellia exaltata L.	Mosaic
Saccharum officinarum L.	Chlorotic streak, Fiji disease Mosaic, Ratoon stunt, Sereh
Sorghum vulgare Pers.	Fiji disease, Red stripe
Zea mays L.	Mosaic, Stripe
27. Rosaceae	
Fragaria chiloensis (L.) Duch.	Crinkle, Dwarf, Leaf-roll, Witches' broom, Yellows
Rosa spp.	Mosaic
28. Rubiaceae	
Borreria articularis (L.f.) F. N. Williams	Mosaic
Coffea spp.	Ringspot
Mussaenda philippica A. Rich	Mosaic

Families, Genera & Species	Disease(s)
29. Rutaceae	
Citrus spp.	Exocortis, Greening, Psorosis, Stem pitting, Tristeza, Xyloporosis
30. Sapindaceae	
Nephelium lappaceum L.	Chlorotic ringspot, Scally bark, Swollen trunk
31. Solanaceae	
Capsicum annuum L.	Mosaic
Lycopersicon esculentum Mill.	Big bud, Fern leaf, Mosaic, Yellow Leaf-curl
Nicotiana tabacum L.	Leaf curl, Mosaic
Petunia axillaria (Lamk.) BSP	Mosaic
Solanum tuberosum L.	Leaf roll, Mosaic
32. Vitaceae	
Vitis vinifera L.	Fan leaf, Interveinal chlorosis

disease each, 14 plant species have 2 diseases each, 5 plant species have 3 virus disease each, 4 plant species have 4 virus diseases each, 3 plant species have 5 virus diseases each, and 1 palnt species have 6 virus diseases. The families Cucurbitaceae, Papilionaceae (Leguminosae), and Poaceae (Graminae) have the most number of plant species infected by plant viruses.

Recording of Plant Virus Diseases

The reporting of the occurrence of plant virus diseases in the Philippines started as early as 1918. However, the recording of the diseases were not continuous particularly before the second world war. It was only in 1959 to date that the studies of plant virus diseases became more intensified (Table 2). In all there are 137 virus diseases recorded.

Table 2. Philippine plant virus diseases reported by year.

Year	Disease(s)
1918	Sugar cane Sereh disease
1920	Sugar cane Fiji disease, Sugar cane mosaic
1921	Citrus greening, Citrus psorosis, Tobacco mosaic
1924	Balsam mosaic, Pechay mosaic
1925	Banana bunchy-top
1926	Tomato mosaic
1930	Abaca bunchy-top
1932	Sincamas mosaic
1934	Abaca mosaic, Bean mosaic, Celery dwarf & yellows, Cotton mosaic, Cucumber mosaic, Pepper mosaic, Squash mosaic, Strawberry dwarf, Strawberry yellows, Tomato fern-leaf, Upo mosaic
1935	Pineapple yellow spot
1937	Coconut cadang-cadang
1939	Rice tungro
1941	Canna mosaic

Year	Disease(s)
1947	Soybean mosaic
1948	Corn yellow stripe
1949	Corn mosaic
1951	Ampalaya mosaic, Mustard mosaic
1964	Sugar cane chlorotic streak, Sugar cane ratoon stunt
1965	Cassia mosaic, Elephantopus mollis enation, Passiflora mosaic, Phaseolus lathyroides mosaic, Rice grassy stunt
1966	Centrosema mosaic, Citrus exocortis, Digitaria mosaic, Paspalum mosaic, Rice yellow dwarf, Sweet potato vein yellowing & stunting, Tomato big bud
1967	Citrus stem pitting, Citrus xyloporosis, Rambutan chlorotic ringspot
1968	Rambutan scaly bark & swollen trunk
1969	Dahlia mosaic, Jasmine mosaic, Rose mosaic
1970	Mungbean mosaic, Patola mosaic
1972	Synedrella leaf curl, Tomato yellow leaf curl
1973	Sorghum red stripe
1974	Cassava mosaic, Cowpea green mosaic, Cowpea ringspot, Cowpea yellow mosaic, Mungbean yellow mosaic, Peanut mottle, Peanut rosette, Sweet potato green dwarf, Sweet potato mosaic, Witches' broom
1975	Cowpea little-leaf, Grapevine fanleaf, Peanut ringspot

Vectors of Plant Viruses

Table 3 shows that all the plant viruses whose vectors were established by experiments were insect-borne, although one virus, the grapevine fanleaf virus might be nematode-borne. Of the 137 plant viruses recorded, 52 are insectborne. Thirty-six of these are transmitted by aphids, 8 by leafhoppers, 6 by whiteflies, 1 by beetle, 1 by psyllid and 1 by thrips (Table 3).

Table 3. Insect vectors of plant viruses reported in the Philippines.

Vectors	Plant viruses transmitted
A. Aphids	
1. *Aphis craccivora*	Bean mosaic virus, Bush sitao mosaic virus, Calopogonium mosaic virus, Centrosema mosaic virus, Cowpea little-leaf, Mungbean mosaic virus, Peanut mottle virus, Phaseolus lathyroides mosaic virus, Soybean mosaic virus
2. *Aphis glycines*	Soybean mosaic virus
3. *Aphis gossypii*	Abaca mosaic virus, Arrowroot mosaic virus, Banana mosaic virus, Borreria mosaic virus, Calopogonium mosaic virus, Canna mosaic virus, Centrosema mosaic virus, Citrus risteza

Vectors	Plant viruses transmitted
	virus, Cogon mosaic virus, Corn mosaic virus, Cotton interveinal yellowing virus, Cucumber mosaic virus, Digitaria mosaic virus, Echinochloa mosaic virus, Elephantopus mosaic virus, Job-tears mosaic virus, Muskmelon mosaic virus, Panicum mosaic virus, Paspalum mosaic virus, Pechay mosaic virus, *Phaseolus lathyroides* mosaic virus, Rottboellia mosaic virus, Watermelon mosaic virus
4. *Aphis rumici*	Bush sitao mosaic virus
5. *Carolinaia cyperitera*	Sugar cane mosaic virus
6. *Hysteroneura setariae*	Soybean mosaic virus, Sugar cane mosaic virus
7. *Longuinguis sacchari*	Sorghum red stripe virus
8. *Macrosiphum solanifolii*	Bush sitao mosaic virus
9. *Myzus persicae*	Soybean mosaic virus
10. *Melanophis endosacchari*	Soybean mosaic virus
11. *Pentalonia caladii*	Abaca bunchy-top virus
12. *Pentalonia nigronervosa*	Abaca bunchy-top virus, Banana bunchy-top virus
13. *Rhopalosiphum maidis*	Abaca mosaic virus, Banana mosaic virus, Calopogonium mosaic virus, Canna mosaic virus, Cogon mosaic virus, Corn mosaic virus, Cowpea mosaic virus, Digitaria mosaic virus, Echinochloa mosaic virus, Panicum mosaic virus, Pechay mosaic virus, Rottboellia mosaic virus, Sorghum red stripe virus, Sugar cane mosaic virus
14. *Rhopalosiphum nymphaeae*	Abaca mosaic virus, Paspalum mosaic virus
15. *Rhopalosiphum prunifoliae*	Abaca mosaic virus
16. *Rhopalosiphum pseudobrassicae*	Pechay mosaic virus
17. *Toxoptera aurantii*	Citrus tristeza virus
18. *Toxoptera citricidus*	Citrus tristeza virus, Citrus greening virus *Phaseolus lathyroides* mosaic virus
19. *Toxoptera graminum*	Sugar cane mosaic virus
B. Beetle	
Ceratia similis?	Squash mosaic virus
C. *Leafhoppers*	
1. *Nephotettix malayanus*	Rice tungro & yellow dwarf
2. *N. nigropectus*	Rice tungro & yellow dwarf
3. *N. parvus*	Rice tungro & yellow dwarf
4. *N. virescens*	Rice tungro & yellow dwarf
5. *Recilia dorsalis*	Rice tungro & orange leaf
6. *Nilaparvata lugens*	Rice grassy stunt
7. *Perkinsiella maidis*	Corn yellow stripe
8. *Perkinsiella vastatrix*	Fiji disease of sorghum, Fiji disease of sugar

Vectors	Plant viruses transmitted
	cane
D. Psyllid	
Diaphorina citri	Citrus greening virus
E. Thrips	
Thrips tabaci	Pineapple yellow spot
F. Whitefly	
Bemisia tabaci	Cotton leaf curl virus, Papaya leaf curl virus, *Pseudoelephantopus spicatus leaf* enation virus, Tobacco leaf curl virus, Tomato yellow leaf curl virus

As regards to the virus-vector relationships, only the abaca and banana bunchy-top viruses are circulative or persistent in their aphid vectors, all the other aphid-borne viruses are stylet-borne or non-persistent. In the case of the leafhopper-borne viruses only the rice tungro virus is non-persistent, the rest are all of persistent-type. The whitefly-transmitted viruses are semi-persistent. The relationships of the beetle, psyllid and thrips-transmitted viruses were not established.

Other Modes of Transmission

Of the remaining 85 plant viruses with unknown vectors 52 have no specified modes of transmission, 18 are transmitted by sap, 7 by grafting or budding, 5 by vegetative plant parts, like stem cuttings and corms, and 3 through the seeds. There are many viruses with known vectors that are also transmitted mechanically by sap, through the seed, by grafting and through vegetative parts (Table 4).

Table 4. Specific virus disease per kind of crop and their reported modes of transmission in the Philippines.

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unknown
1. Abaca (*Musa textils* Nee)					
Bunchy-top	—	Aphid		Veg. part	
Mosaic		Aphid		Veg. part	
2. African daisy (*Gerbera jamesonii* Bolus ex Hook)					
Mosaic					
3. Aguingay (*Rottboellia exaltata* L.)					
Mosaic					
4. Amaranth globe (*Gomphrena globosa* L.)					
Mosaic					
5. Amazon lily (*Eucharis grandiflora* Planch & Link)					
Mosaic					
6. Ampalaya (*Momordica charantia* L.)					
Mosaic					

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unknown
7. Arrowroot (*Maranta arundinacea* L.)					
Mosaic		Aphid		Veg. part	
8. Balsam (*Impatiens balsamina* L.)					
Mosaic					
9. Banana (*Musa sapientum* (L.) Kuntze)					
Bunchy-top	—	Aphid		Veg. part	
Mosaic		Aphid		Veg. part	
10. Bean (*Phaseolus vulgaris* L.)					
Mosaic		Aphid			
11. Beardgrass (*Andropogon halepense* (L.) Brot.)					
Mosaic					
12. Black pepper (*Piper nigrum* L.)					
Stunt	—	—		Grafting	
13. *Borreria articularis* (L.f.) F. N. Williams					
Mosaic		Aphid			
14. *Bougainvillea glabra*					
Mosaic	(?)			Grafting	
15. *Calopogonium muconoides* Desv.					
Mosaic		Aphid	—		
16. *Canna indica* L.					
Mosaic		Aphid		Veg. part.	
17. Cantaloupe (*Cucumis melo* v. *cantalupensis* Naud.)					
Mosaic					
18. Carnation (*Dianthus caryophyllus* L.)					
Mosaic					
Streak					
Yellows					
19. Cassava (*Manihot utilisima* Pohl.)					
Mosaic					
Witches' broom					
20. Celery (*Apium graveolens* L. var. *dulce* DC)					
Dwarf					
Mosaic					
Yellows					
21. *Centrosema pubescens* Benth.					
Mosaic		Aphid			
22. *Chrysanthemum coronarium* L.					
Mosaic					
Rosette					
Stunt					
Yellows					

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unknown
23. *Citrus* spp.					
Exocortis (Viroid)				Budding	
Greening (Mycoplasma?)		Psyllid		Budding	
Psorosis				Tissue, Grafting	
Stem pitting				Tissue, Grafting	
Tristeza		Aphid		Tissue, Grafting	
Xyloporosis				Budding	
24. Coconut (*Cocos nucifera* L.)					
Cadang-cadang (Viroid?)	(?)	—	—		
Yellow ringspot					
25. Coffee (*Coffea* spp.)					
Ringspot	—				
26. Coffee senna (*Cassia occidentalis* L.)					
Mosaic					
27. Cogon (*Imperata cylindrica* (L.) Beauv.)					
Mosaic		Aphid			
28. Corn (*Zea mays* L.)					
Mosaic		Aphid			
Stripe	—	Leaf-hopper			
29. Cotton (*Gossypium hirsutum* L.)					
Intervenial yellowing		Aphid		Grafting	
Leaf curl		White-fly			
Mosaic					
30. Cowpea (*Vigna unguiculata* (L.) Walp.)					
Curly-top					
Green mosaic		Aphid			
Little leaf		Aphid			
Ringspot		?			
Yellow mosaic		?			
31. Crabgrass (*Digitaria sanguinalis* (L.) Scop.)					
Mosaic		Aphid			
32. *Crotalaria* sp.					
Mosaic					
33. Cucumber (*Cucumis sativus* L.)					
Mosaic		Aphid			
34. Culape (*Paspalum conjugatum* Berg.)					
Mosaic		Aphid			
35. Cutcharitas (*Alternanthera versicolor* (Lem.) Hort.)					
Mosaic					

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unkonwn
36. *Dahlia* sp.					
Mosaic					
37. *Desmodium gangeticum* (L.) DC.					
Mosaic					
38. *Elephantopus mollis* HBK					
Enation				Grafting	
Mosaic		Aphid			
39. Gabi (*Colocasia esculenta* (L.) Schott)					
Mosaic					
40. Grapevine (*Vitis vinifera* L.)					
Fanleaf				Nematode (?)	
Interveinal chlorosis					
41. Hairy crabgrass (*Digitaria sanguinalis* non (L.) Scop. (Back))					
Mosaic					
42. Irish potato (*Solanum tuberosum* L.)					
Leaf roll					
Mosaic					
43. Jasmine (*Jasminum* sp.)					
Mosaic					
Vein chlorosis					
44. Job-tears (*Coix lacryma-jobi* L.)					
Mosaic		Aphid			
45. Jungle-rice (*Echinochloa colonum* (L.) Link)					
Mosaic		Aphid			
46. Kahoi-dalaga (*Mussaenda philippica* Rich.)					
Mosaic					
47. Kondol (*Benincasa hispida* (Thunb.) Cogn.)					
Mosaic					
48. Mungbean (*Phaseolus aureus* Roxb.)					
Mosaic		Aphid			
Yellow mosaic		White-fly(?)			
49. Muskmelon (*Cucumis melo* L.)					
Mosaic		Aphid			
50. Mustards (*Brassica hirta* Moench; *B. juncea* (L.) Czern; *B. nigra* (L.) Koch.)					
Mosaic					
51. *Panicum distachym* L. Mosaic					
Mosaic		Aphid			

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unknown
52. Papaya (*Carica papaya* L.)					
Leaf curl		White-fly(?)			
Mosaic					
53. Passion flower (*Passiflora foetida* L.)					
Mosaic					
54. Patola (*Luffa aegyptiaca* Mill.)					
Mosaic					
55. Peanut (*Arachis hypogea* L.)					
Mottle		Aphid			
Ringspot					
Rosette		Aphid(?)			
56. Pechay (*Brassica pekinensis* (Lour.) Rupr.)					
Mosaic		Aphid			
57. Pepper (*Capsicum annuum* L.)					
Green mosaic					
Yellow mosaic					
58. Petunia (*Petunia axillaria* (Lamk.) BSP.)					
Mosaic					
59. *Phaseolus lathyroides* L.					
Mosaic		Aphid			
60. Pineapple (*Ananas comosus* (L.) Merr.)					
Yellow spot	—	Thrips			
61. *Pseudoelephantopus spicatus*					
Enation	—	White-fly	—	Grafting	
62. Pumpkin (*Cucurbita pepo* L.)					
Mosaic					
63. Radish (*Raphanus sativus* L.)					
Mosaic					
64. Rambutan (*Nephelium lappaceum* L.)					
Chlorotic ringspot(?)	—				
Scally bark(?)					
Swollen trunk(?)					
65. Rice (*Oryza sativa* L.)					
Grassy stunt (Mycoplasma?)	—	Brown Plant-hopper	—		
Mosaic					
Orange leaf	—	Leaf-hopper	—		
Tungro	—	Leaf-hopper	—		
Yellow dwarf (Mycoplasma?)	—	Leaf-hopper	—		
66. Rose (*Rosa* spp.)					
Mosaic				Veg. part	

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unknown
67. Sayote (*Sechium edule* (Jacq.) Swartz.)					
Mosaic					
68. Sincamas (*Pachyrrhizus erosus* (L.) Urb.)					
Mosaic				Veg. part	
69. Sitao (*Vigna sesquipedalis* (L.) Fruwirth)					
Mosaic		—			
70. *Sorghum* (*Sorghum vulgare* Pers.)					
Fiji disease		Leaf-hopper			
Mosaic or red stripe		Aphid	—		
71. Sour paspalum (*Paspalum conjugatum* Berg)					
Mosaic					
72. Soybean (*Glycine max.* (L.) Merr.)					
Mosaic		Aphid			
73. Spinach (*Spinacea oleracea* L.)					
Mosaic					
74. Squash (*Cucurbita maxima* Dcne)					
Mosaic		Beetle(?)			
75. Strawberry (*Fragaria chiloensis* (L.) Duch. var. *ananassa* Duch.					
Crinkle					
Dwarf					
Leaf roll					
Witches' broom					
Yellows					
76. Sugar cane (*Saccharum officinarum* L.)					
Chlorotic streak				Veg. part	
Fiji disease		Leaf-hopper		Veg. part	
Mosaic (=Yellow stripe)		Aphid		Pin-prick Veg. part	
Ratoon stunt (Coryne-bacterium?)				Veg. part	
Sereh				Veg. part	
77. Sweet potato (*Ipomoea batatas* (L.) Lam.					
Green dwarf				Veg. part	
Mosaic				Veg. part	
Vein yellowing				Veg. part	
Stunting				Veg. part	
78. *Synedrella nodiflora* (L.) Gaertn.					
Leaf curl					
Mosaic					
79. Tobacco (*Nicotiana tabacum* L.)					
Leaf curl (=Kroepoek)	—	White-fly			
Mosaic					

Crop and disease	Modes of transmission				
	Sap	Insect	Seed	Others	Unspecified or unknown
80. Tomato (*Lycopersicon esculentum* Mill.)					
Big bud					
Fern leaf					
Mosaic		Aphid			
Yellow leaf curl	—	White-fly			
81. Upo (*Lagenaria siceraria* (Molina) Standley)					
Mosaic					
82. Watermelon (*Citrullus vulgaris* Schrad.)					
Mosaic		Aphid			

Conclusion

Most reports of plant virus diseases in the Philippines tell only the occurrence of the disease and the description of the symptoms expressed by the plants affected. Only the diseases which had caused great damage to plants were studied in depth which includes their modes of transmission, host ranges, physical properties and control.

The plant viruses that are considered of economic importance to Philippine agriculture today are abaca bunchy-top and mosaic viruses, bean mosaic virus, citrus tristeza virus, cowpea little-leaf virus, cucumber mosaic virus, peanut rosette virus, rice tungro virus, sugar cane mosaic virus, tobacco mosaic virus, tomato leaf curl and mosaic viruses and watermelon mosaic virus.

Reference

BENIGNO, D. A. & QUEBRAL, F. C. (1976). Host index of plant diseases in the Philippines. National Research Council of the Philippines Research Project I.E.–58 (Terminal Report).

Discussion

H. Kitajima, Japan: As you have shown in your slide, Cadang-cadang disease of coconut is still severe in Philippines?

Answer: Yes, it is still spreading to new areas.

W. P. Ting, Malaysia: 1. I would like to ask Dr. Benigno whether there is evidence that Cadang-cadang affect oil palm.

2. Are dwarf coconnuts also susceptible to the disease?

Answer: 1. Yes, according to reports of experiments.

2. Yes.

T. Soelaeman, Indonesia: Do you control greening with tetracycline antibiotics?

Answer: Yes, it is controlled by antibiotics.

K. Yora, Japan: You have two viroid diseases. One is Cadang-cadang disease, what is another one? What is the disease caused by Coryneform bacteria?

Answer: 1. Citrus exocortis.

2. Ratoon stunt of sugar cane.

N. Yamada, Japan: I understand the Cadang-cadang disease originated in one island and spread to neighboring islands from year to year. Is the disease still spreading rapidly to wider areas?

Answer: Yes.

Soelaeman Tirtawidjaja, Indonesia: Is there any relationship between Cadang-cadang and coconut lethal yellowing?

Answer: Lethal yellowing of coconut in Florida is mycoplasma. Cadang-cadang disease of coconut in the Philippines was not controlled by antibiotics.