

A SURVEY OF PLANTHOPPER PESTS OF ECONOMICALLY IMPORTANT PLANTS (HOMOPTERA: FULGOROIDEA)

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ABSTRACT

Planthoppers are recorded as pests of 99 economic plants; 150 fulgoroid species in 16 families are listed as pests, 32 species in 3 families are vectors of plant pathogens. One species of acanaloniid is listed as a pest of 1 economic plant, 11 cixiids of 11 plants, 55 delphacids of 25 plants, 20 derbids of 10 plants, 4 dictyopharids of 3 plants, 1 eurybrachid of 1 plant, 18 flatids of 47 plants, 2 fulgorids of 3 plants, 1 hypochthonellid of 1 plant, 3 issids of 3 plants, 3 lophopids of 4 plants, 1 meenoplid of 3 plants, 1 nogodinid of 2 plants, 7 ricaniids of 10 plants, 6 tettigometrids of 10 plants, and 16 tropiduchids of 14 plants. Planthoppers have been increasing in importance as plant pests due to changes in control methods for major pests, the introduction of new crop varieties, and the development of new crop plants in the tropics.

INTRODUCTION

The economic importance of the Fulgoroidea as a whole has not been assessed since Osborn's brief paper of 1904 in which he suggested that planthoppers may be more injurious to crops than previously thought. Since that time it has been found that many planthoppers are indeed injurious to plants and may cause damage by their feeding and ovipositing activities. Feeding, even by a few individuals of *Nilaparvata lugens* (Stål) causes "hopper burn" of rice (Bae & Pathak 1970), and by large numbers results in extensive damage (Hinckley 1963); the saliva of some species is toxic to the host plant (Raatikainen 1967, 1970); and many species are vectors of plant viruses (Conti 1985) and a few vectors of mycoplasma-like organisms (O'Brien & Wilson 1985). Ovipositing in plant tissues may allow entrance of airborne pathogens (Williams 1957).

Many works have focused on the impact of particular planthoppers on specific crop plants, especially rice, sugarcane, maize, oats, wheat, barley, and coconut palms (see Table 2). The extensive literature on planthoppers that are vectors of plant pathogens has been summarized by Brčak (1979), Carter (1973), Conti (1985), Gumpf & Calavan (1981), Harris (1980, 1983), Lindsten (1979a,b), Ling *et al.* (1983), Mochida & Okada (1971, 1973), Nault & Knoke (1981), Ooka (1983), and Otake (1983).

The present paper represents an attempt to list those planthoppers that have been recorded as pests of economically important plants (Table 1), which we define as both crop and ornamental plants. References were obtained by conducting a computerized literature search of Biosis, Bibliography of Agriculture and Zoological Record; from Metcalf's (1942) Bibliography of the Homoptera, Vol. II; and from our personal literature collections. We have attempted to include all planthopper species known to be injurious to plants but do not provide an exhaustive literature review. For those species such as *N. lugens* for which a large literature exists we provide citations of summary works on life history (e. g., Bae & Pathak 1970, Den Hollander & Pathak 1981, Kenmore 1981), economic status (e. g., Otake 1983, Rivera *et al.* 1966), and taxonomy (e. g., Mochida & Okada 1979). We do not repeat the exhaustive lists of host plants in works such as Mochida & Okada's (1971, 1973) list of Japanese delphacids, Giffard's (1917) list of Hawaiian delphacids, or the catalogue of Cuban insects

that attack economic plants (Bruner et al. 1945a,b) unless evidence was given that the included planthopper species do indeed damage their host plants.

The decision to include species in Table 1 has been occasionally difficult. Those species that are plant pathogen vectors or have been documented to damage crops are listed; however, the economic status of a great number of species is not so obvious. Neiswander (1931) listed species of planthoppers from corn but indicated that all except Peregrinus maidis (Ashmead) are not considered pests; we did not use this reference in compiling our list as the only important planthopper pest listed was studied in great detail by others. Metcalfa pruinosa (Say) is recorded from 85 plant species (Wilson & McPherson 1980, 1981a) but has only been observed causing relatively minor damage to 5 species. We include this planthopper in the list because of its potential to cause injury but only list those few plants that this polyphagous insect has been recorded to damage. If the status as a pest is questionable we have indicated this by use of a question mark. The scientific names of plants listed in Table 1 are provided in Table 2. Some authors only listed common names which may be applied to several species (e. g., beans, mulberry, wheat). We have attempted to determine the genera and species to which they were referring; any errors in interpretation are ours.

There are several reasons for providing a list of planthopper pests. First, lists and catalogues are records of species diversity and, as such, are of great value to systematists and ecologists. Second, they summarize information for economic entomologists and agriculturalists and alert them to potential problems. Third, as Oman & Sailer (1986) have suggested, they may aid in stimulating research. Fourth, several factors point to the possibility of planthoppers becoming more important as plant pests in the future.

Planthoppers may increase in their importance because of introductions as in the cases of P. maidis (Brewbaker 1979), Sogatodes orizicola (Muir) (Atkins et al. 1958), Perkinsiella saccharicida Kirkaldy (Sosa 1985) and the repeated introductions of N. lugens to Korea and Japan (Claridge & Wilson 1982, Kuno 1973, Mochida & Okada 1979). Among native species there appears to be, as Fennah (1982b) stated, growing evidence of their ability to reach pest status when conditions permit.

As advances in biotechnology and biological control occur we may expect the development of new crop plant varieties and new non-chemical methods of pest control. The availability of new plant hybrids coupled with the use of chemical insecticides has resulted in the establishment of major pests which were formerly regarded as secondary pests as documented for N. lugens (Heinrichs & Mochida 1984, Kenmore 1981). In the industrialized nations it is possible that if chemical pesticide use is replaced by single target biocontrol agents then some minor pests, which are now controlled by general spraying for major pests, may become of increasing importance. This may be especially important in those delphacids that are capable of carrying plant pathogens. The increased use of native crops in the tropics may also reveal new or little noticed planthopper pests.

#### PLANTHOPPER FAMILIES AND PEST STATUS

One hundred fifty planthopper species in 16 families have been recorded as pests of 99 plants; this represents approximately 2% of the described species and is similar to the proportion of weevils that are considered pests (2.55% of the 16,000 New World species - C. W. O'Brien, personal communication). Thirty two species in 3 families are pathogen vectors of 19 plants (Table 1). Of particular importance, planthoppers are pathogen vectors of the five most important crops: rice, wheat, maize, barley, and potatoes. Brief descriptions and a key for the identification to family are provided by O'Brien & Wilson

(1985). Species numbers for each family given below are from O'Brien & Wilson (1985) unless otherwise indicated.

#### Acanaloniidae

This principally Nearctic family of 81 species is included within the Issidae by European workers but this has not been followed by most American workers (O'Brien & Wilson 1985). Acanalonia conica (Say) has been recorded as a pest of ginseng (Gossard 1911) (Table 1); it is often found in large numbers on a wide variety of plants and has the potential to reach pest status (Wilson & McPherson 1980, Wilson personal observation).

#### Cixiidae

This widespread family of 768 species includes 11 species recorded as pests of 11 plants (Table 1). Hyalesthes obsoletus Signoret, Myndus crudus Van Duzee, M. taffini Bonfils, and Oliarus atkinsoni Myers are vectors of mycoplasma-like organisms (MLO) of potatoes, tomatoes, palms and flax lily, among others (see Table 1). Since nymphs are subterranean, in some cases feeding on other host plants, control is difficult.

#### Delphacidae

This widespread family of 1835 species (Asche 1985) includes 55 species recorded as pests of 25 plants (Table 1). Of particular importance are the 27 species that are vectors of viruses or presumed viruses of 13 host plants. These include 9 virus vectors of rice, 3 of sugarcane, 1 of taro, 2 of coconut palms, 7 of maize and 9 of the cereals oats, wheat, barley and rye. Laodelphax striatellus (Fallen) has been implicated as a possible vector of an MLO of citrus (Gumpf & Calavan 1981); thus far, all the delphacid pathogen vectors that have been studied are vectors of viruses. The most important delphacid pests are N. lugens, P. maidis, L. striatellus, Sogatella furcifera (Horvath), Sogatodes orizicola (Muir), Javesella pellucida (Fabricius), Perkinsiella saccharacida Kirkaldy and Saccharosydne saccharivora (Westwood).

#### Derbidae

This widespread family of 733 species has no well documented pests but does include 20 species that have been recorded as injurious or potentially injurious to economic plants (Table 1). Hargreaves (1927) indicated that several derbids were abundant on coconut and oil palms and that they might be related to diseases observed in these plants.

#### Dictyopharidae

This widespread family of 489 species includes 4 pests of rice, sugarcane and cranberry (Table 1). Phylloscelis rubra Ball causes wilting and dieback in cranberry (Sirrime & Fulton 1914).

#### Eurybrachidae

This Old World tropical family of 173 species includes 1 pest of sandal.

#### Flatidae

This widespread family of 918 species includes 18 species considered pests of 47 plants. Flatids are polyphagous and often may be extremely abundant on a wide variety of plants. Some do little apparent damage to plants but their large numbers and the copious amounts of wax produced by nymphs are considered unsightly by some growers of ornamental plants (Mead 1965). Occasionally, these minor pests become important as in the case of M. pruinosa which injured citrus buds after the trees had been subjected to frost damage (Wene 1950). Several species are considered of some importance as pests: Geisha distinctissima (Walker) and Siphanta acuta (Walker) are injurious to fruit trees and Sephena cinerea Kirkaldy transmits a bacterial disease of apples (Myers 1923).

### Fulgoridae

Two of the 543 species of this primarily tropical family are considered pests of cacao, longan and mango (Table 1).

### Hypochthonellidae

The single species in this monotypic family feeds as subterranean adults and nymphs on the roots of tobacco in southern Africa (China & Fennah 1952).

### Issidae

Three of the 924 species of this worldwide family injure 3 plant species (Table 1). Asarcopus palmarum Horvath has been introduced to southwestern U. S. date palm plantations from North Africa (Stickney *et al.* 1950), Agalmatium grylloides (Fabricius) (= Hysteropterum flavescens (Olivier)) feeds on fig leaves in France (Picard 1921), and Sarima nigroclypeata Melichar damages sandal in India (Chatterjee 1933a).

### Lophopidae

Three of the 113 species of this primarily Old World tropical family are pests of 4 plants (Table 1). Pyrilla perpusilla (Walker) is a major pest of sugarcane and rice in India (Brar & Bains 1979, Rahman & Nath 1940) and Zophiuma lobulata Ghauri causes injury to coconut palms in Papua New Guinea (Smith 1980).

### Meenoplidae

One of the 53 species of this Old World family, Nisia nervosa (Motchulsky) (= N. atrovenosa Lethierry), is a minor pest of rice, taro and sugarcane (Table 1).

### Nogodinidae

One of the 186 species of this primarily tropical family has been recorded as a pest of maize and sugarcane in South America (Kramer 1976).

### Ricaniidae

Seven of the 352 species of this primarily tropical family are listed as pests of 10 plants (Table 1). Scolypopa australis (Walker) is very abundant on a variety of plants including passion-vine and, when feeding on the toxic plant tutu (Coriaria arborea Lindsay), was the source of poison honeydew which bees collected and used in the production of a highly toxic honey (Cumber 1966, Myers 1923, Palmer-Jones *et al.* 1947).

### Tettigometridae

Six of the 70 species of this almost exclusively Old World family have been recorded as pests of 10 plants (Table 1). Hilda patruelis (Stal) has become abundant on a variety of plants and reached pest status on peanuts (groundnuts) in Zimbabwe (Weaving 1980). Tettigometra obliqua (Panzer) has been implicated as a pest of rye (Torka 1905).

### Tropiduchidae

This widespread family of 280 species includes 16 species recorded as pests of 14 plants. Numicia viridis Muir has become an important pest of sugarcane in southern Africa (Carnegie 1980). Ommatissus binotatus lybicus DeBerg is a major pest of date palms in the Middle East and North Africa (Alfieri 1934, Dowson 1936, Hussain 1963).

## PLANTHOPPER HOST PLANTS

Table 2 summarizes the host plants of the pest species. The following is a brief account of the major plants listed. Rice is host to 32 planthoppers, 9 of which are viral vectors; Wilson & Claridge (1985) reviewed the relationship between rice and its planthopper pests. Sugarcane hosts 33 species, 3 of which are viral vectors, and maize hosts 13 species, 7 of which are viral vectors.

The cereals oats, wheat, barley and rye host 15 species, 9 of which are viral vectors. Coconut palm hosts 14 species, 4 of which are pathogen vectors (see review by M. R. Wilson in this volume) and taro hosts 5 species, 1 of which is a pathogen vector. Citrus hosts 10 species (and an additional possible pathogen vector).

A number of planthopper species are polyphagous or oligophagous. *J. pellucida*, *Sogatella suzezensis* (Matsumura) (= *S. vibix* (Haupt)), *S. furcifera* and *S. orizicola* are pests of several Graminae. However, some species may be more host specific than previously thought. Wilson & Claridge (1985) note that *P. perpusilla*, a sugarcane and rice pest, only attacks rice under favorable conditions. Furthermore, after detailed investigations, they suggest that *Leersia*-feeding populations of *N. lugens* are a separate species. Much work on taxonomy and host-plant relationships is necessary in order to clarify the many similar problems scattered throughout Tables 1 and 2.

Table 1. Planthopper pests of plants.

Planthopper Taxon	Plant Taxon (References) <sup>a,b,c</sup>	Locality <sup>d</sup>
<b>ACANALONIIDAE</b>		
1. <i>Acanalonia conica</i> (Say)	ginseng (61)	NA
<b>CIXIIDAE</b>		
2. <i>Euryphlepsia cocos</i> Muir	coconut palm (113)	AP
3. <i>Hyalesthes obsoletus</i> Signoret	potato* (26), tomato* (93), lavender* (93, 94), polyphagous* (18)	PA
4. <i>Kirbyana pagana</i> (Melichar)	sugarcane (137)	OR
5. <i>Myndus crudus</i> Van Duzee	coconut palm* (73, 164), Manila palm* (73), Pritchardia palm (74)	NA,NT
6. <i>Myndus taffini</i> Bonfils	coconut palm* (16, 80)	AP
7. <i>Oliarus annandalei cocosivora</i> Muir	coconut palm (?) (114)	OR
8. <i>Oliarus atkinsoni</i> Myers	flax lily* (39, 40)	AP
9. <i>Oliarus mori</i> Matsumura	mulberry (137)	OR
10. <i>Oliarus oryzae</i> Matsumura	sugarcane (137)	OR
11. <i>Oliarus</i> sp.	mango (150)	NT
12. <i>Pentastiridius apicalis</i> (Uhler)	rice (95)	OR
<b>DELPHACIDAE</b>		
13. <i>Chilodelphax albifascia</i> (Matsumura)	V (38, 90), rice* (38, 100), wheat, oats, maize, barley (125), fescue, orchard grass, sorghum (109)	PA
14. <i>Dicranotropis fumosa</i> Matsumura	sugarcane (137)	OR
15. <i>Dicranotropis hamata</i> (Boheman)	V (38, 66, 79), oats (132)	PA
16. <i>Eoeurysa flavocapitata</i> Muir	sugarcane (31, 33)	OR
17. <i>Falcotoya lyraeformis</i> (Matsumura)	rice (95, 96)	PA
18. <i>Harmalia anarcharsis</i> Fennah	rice (?) (160)	OR
19. <i>Javesella discolor</i> (Boheman)	V (38), oats (66)	PA
20. <i>Javesella dubia</i> (Kirschbaum)	V (38), tall oat-grass (18), wheat (66)	PA
21. <i>Javesella obscurella</i> (Boheman)	oats* (38), wheat* (66)	PA
22. <i>Javesella pellucida</i> (Fabricius)	V (38, 84, 97, 130), wheat* (4, 78, 108, 130), maize* (130), tall oat-grass*, barley* (18), oats* (78, 83, 108, 130)	NA,PA
23. <i>Laodelphax striatellus</i> (Fallen)	polyphagous* (10, 34, 135), barley* (37, 125), citrus* (?) (63), maize (38), rice* (100, 125), oats* (66, 125), wheat* (125)	OR,PA

24. <u>Liburnia graminicola</u> (Matsumura)	sugarcane (137)	OR
25. <u>Malaxodes farinosus</u> Fennah	molasses grass (?) (47)	ET
26. <u>Megadelphax sordidulus</u> (Stål)	oats, timothy* (68), wheat (131)	PA
27. <u>Megamelus davisii</u> Van Duzee	water lily (9, 163)	AP,NA
28. <u>Muellerianella fairmairei</u> (Perris)	V (38), oats*, wheat (125)	PA
29. <u>Nilaparvata bakeri</u> (Muir)	rice* (95, 100), <u>Leersia</u> (pers. comm. Claridge)	OR
30. <u>Nilaparvata lugens</u> (Stål)	rice* (11, 34, 43, 69, 70, 85, 89, 100, 111, 125, 134)	AP,OR
31. <u>Nilaparvata meander</u> Fennah	rice (160)	ET
32. <u>Nilaparvata muiri</u> China	rice* (96, 100), barnyard grass (96), <u>Leersia</u> (pers. comm. Claridge)	OR
33. <u>Nilaparvata wolcottii</u> Muir and Giffard	sugarcane (?) (111)	NT
34. <u>Opiconsiva sirokata</u> (Matsumura and Ishihara)	rice, barnyard grass (90, 96)	OR,PA
35. <u>Paradelphacodes paludosa</u> (Flor)	rice (95)	PA
36. <u>Peregrinus maidis</u> (Ashmead)	maize* (20, 117, 118, 147, AP,ET,OR,NA,NT 148), sorghum (34), kola (91)	AP,ET,OR,NA,NT
37. <u>Perkinsiella lalokensis</u> Muir	sugarcane (49)	AP
38. <u>Perkinsiella papuensis</u> Muir	sugarcane (49)	AP
39. <u>Perkinsiella rattlei</u> Muir	sugarcane (49)	AP
40. <u>Perkinsiella saccharacida</u> Kirkaldy	sugarcane* (23, 28, 38, 76, 115, 142, 147)	AP,ET,OR
41. <u>Perkinsiella sinensis</u> Kirkaldy	sugarcane (49)	AP,OR,PA
42. <u>Perkinsiella thompsoni</u> Muir	sugarcane (49)	PA
43. <u>Perkinsiella vastatrix</u> (Breddin)	sugarcane* (38, 76)	AP,ET,OR,PA
44. <u>Perkinsiella vitiensis</u> Kirkaldy	sugarcane* (38, 76)	AP
45. <u>Purohita cervina</u> Distant	bamboo (137)	OR
46. <u>Purohita taiwanensis</u> Muir	bamboo (137)	OR
47. <u>Saccharosydne procerus</u> (Matsumura)	rice (95), wild rice (44, 95)	PA
48. <u>Saccharosydne saccharivora</u> (Westwood)	sugarcane (105)	NA,NT
49. <u>Sogatella furcifera</u> (Horvath)	pangola grass* (15), rice (6, 34, 70), maize, millet (128)	AP,OR,PA
50. <u>Sogatella kolophon</u> (Kirkaldy)	maize*, barley* (62), coconut* palm (81), carrot (59)	AP,ET,OR,NA,NT
51. <u>Sogatella longifurcifera</u> (Esaki and Ishihara)	V (38), maize*, triticale (62), barnyard grass, rice (95)	AP,OR,PA
52. <u>Sogatella panicicola</u> (Ishihara)	rice (95)	PA
53. <u>Sogatella terryi</u> (Muir)	rice (96)	OR,PA
54. <u>Sogatella suzensis</u> (Matsumura)	maize*, barley, barnyard grass, oats, rice, rye, wheat (5)	ET,PA
55. <u>Sogatodes cubanus</u> (Crawford)	rice* (38, 54, 100), coconut palm* (81)	ET,NA,NT
56. <u>Sogatodes geranor</u> (Kirkaldy)	rice (?) (160)	OR
57. <u>Sogatodes orizicola</u> (Muir)	rice* (8, 27, 88, 92, 100, 112), barley*, oats*, rye*, wheat* (92)	NA,NT
58. <u>Sogatodes pusanus</u> (Distant)	rice (?) (160)	OR
59. <u>Tarophagus prosperina</u> (Kirkaldy)	taro* (34, 38, 107, 123)	AP,OR
60. <u>Terthron albovittatum</u> (Matsumura)	rice* (38, 96, 100), barnyard grass (96)	OR,PA
61. <u>Toya dryope</u> (Kirkaldy)	carrot (59)	AP
62. <u>Toya propinqua</u> (Fieber)	maize* (38, 101), barley (19), rice, sugarcane, barnyard grass, speargrass (96), Bermuda grass* (67, 101)	ET,NA,NT,OR,PA
63. <u>Tropidocephala brunnipennis</u> Signoret	rice (95)	AP,ET,OR,PA
64. <u>Tropidocephala formosana</u> Matsumura	sugarcane (137)	OR
65. <u>Tropidocephala saccharivorella</u> Matsumura	sugarcane (137)	OR
66. <u>Unkanodes sapporonus</u> (Matsumura)	rice* (38, 82, 100, 106)	OR,PA

67. <u>Unkanodes tanasijevici</u> (Dlabola)	maize* (1, 38), sorghum, wheat (1)	PA
<b>DERBIDAE</b>		
68. <u>Cedusa vulgaris</u> (Fitch)	hawthorn (154)	NA
69. <u>Diostrombus dilatatus</u> (Westwood)	coconut palm (?), oil palm (?) (64)	ET
70. <u>Diostrombus luteus</u> (Muir)	oil palm (?) (64)	ET
71. <u>Diostrombus nitidus</u> Muir	coconut palm (?), oil palm (?) (64)	ET
72. <u>Diostrombus politus</u> Uhler	millet (35), potato, rice (95) sugarcane (137)	OR, PA
73. <u>Kamendaka albomaculata</u> Muir	coconut palm (?), oil palm (?) (64)	ET
74. <u>Kamendaka saccharivora</u> (Matsumura)	sugarcane (137)	OR
75. <u>Kamendaka spio</u> Fennah	taro (107)	AP
76. <u>Lamenia epiensis</u> Muir	cacao (16)	AP
77. <u>Lydda annetti</u> (Muir)	oil palm (?) (64)	ET
78. <u>Lydda cocos</u> Muir	coconut palm (?), oil palm (?) (64)	ET
79. <u>Lydda hargreavesi</u> Muir	oil palm (?) (64)	ET
80. <u>Lydda lineatipes</u> Muir	oil palm (?) (64)	ET
81. <u>Muiralevu africana</u> (Muir)	oil palm (?) (64)	ET
82. <u>Proutista fritillaris</u> (Boheman)	coconut palm (?) (64)	ET
83. <u>Proutista moesta</u> (Westwood)	maize, sugarcane (126)	AP, OR
84. <u>Pyrrhoneura saccharicida</u> Kirkaldy	taro (107)	AP
85. <u>Swezeyia lyricen</u> Kirkaldy	taro (107)	AP
86. <u>Vekunta nigrolineata</u> Muir	sugarcane (137)	OR
87. <u>Vekunta stigmata</u> Matsumura	sugarcane (137)	OR
<b>DICTYOPHARIDAE</b>		
88. <u>Dictyophara patruelis</u> (Stål)	rice, sugarcane (137)	OR
89. <u>Orthopagus helios</u> Melichar	sugarcane (137)	OR
90. <u>Phylloscelis rubra</u> Ball	cranberry (13, 45, 136, 140)	NA
91. <u>Raivuna sinica</u> (Walker)	rice, sugarcane (137)	OR
<b>EURYBRACHIDAE</b>		
92. <u>Eurybrachys tomentosa</u> (Fabricius)	sandal (30)	OR
<b>FLATIDAE</b>		
93. <u>Geisha distinctissima</u> (Walker)	apple, cherry, peach, pear (95), citrus, mulberry, tea (138), hemp (144)	OR, PA
94. <u>Ketumala thea</u> Ghauri	tea (56)	OR
95. <u>Lawana candida</u> (Fabricius)	albizia, cacao, coffee, dadap, kapok (71)	OR
96. <u>Lawana conspersa</u> (Walker)	candlenut, China wood-oil, citrus, indigo, pomelo (71)	OR
97. <u>Lawana imitata</u> (Melichar)	citrus, crepe myrtle, dracontomelon, euphoria, firmiana, lawsonia, lotus, orchids, peach, zizyphus (71), custard apple, hedge, jasmine, pink shower (72)	OR
98. <u>Melicharia obtusanguloides</u> Ghauri	tea (57)	OR
99. <u>Metcalfa pruinosa</u> (Say)	citrus (155), dahlia (103), ginseng (61), privet (156), salvia (152)	NA, NT
100. <u>Monoflata pallezens</u> (Stål)	coffee (42)	NT
101. <u>Ormenaria rufifascia</u> (Walker)	cabbage palm (104, 165), blue latan palm, Canary Island date palm, Chinese fan palm, fan palm, saw palmetto, scrub palmetto, Washington palm (104)	NA, NT
102. <u>Ormenis albigyna</u> Campos	cacao (24)	NT
103. <u>Ormenis</u> sp.	mango (149)	NT
104. <u>Sephena cinerea</u> Kirkaldy	apple* (116, 145)	AP
105. <u>Siphanta acuta</u> (Walker)	citrus, coffee, mango (36), guava (52)	AP, NA
106. <u>Siphanta angularis</u> Fletcher	avocado (52)	AP

107. <u>Siphanta eberhardi</u> Fletcher	avocado, guava, jackfruit, mango (52)	AP
108. <u>Siphanta glauca</u> Fletcher	jackfruit (52)	AP
109. <u>Siphanta griseoviridis</u> Fletcher	lychee (52)	AP
110. <u>Siphanta hebes</u> (Walker)	citrus (52)	AP
<b>FULGORIDAE</b>		
111. <u>Phrictus diadema</u> (L.)	cacao (139)	NT
112. <u>Pyrops candalaria</u> (L.)	longan, mango (86)	OR
<b>HYPOCHTHONELLIDAE</b>		
113. <u>Hypochthonella caeca</u> China and Fennah	tobacco (32)	ET
<b>ISSIDAE</b>		
114. <u>Agalmatium grylloides</u> (Fabricius)	fig (129)	PA
115. <u>Asarcopus palmarum</u> Horvath	date palm (143)	ET, NA, PA
116. <u>Sarima nigroclypeata</u> Melichar	sandal (29)	OR
<b>LOPHOPIDAE</b>		
117. <u>Painella simmondsi</u> Muir	coconut palm (141)	AP
118. <u>Pyrilla perpusilla</u> (Walker)	sugarcane (17, 133, 160), rice (82, 160), maize (133)	OR
119. <u>Zophiuma lobulata</u> Ghauri	coconut palm (55, 141)	AP
<b>MEENOPLIDAE</b>		
120. <u>Nisia nervosa</u> (Motschulsky)	rice (14, 82, 160), taro (107), sugarcane (160)	AP, ET, OR, PA
<b>NOGODINIDAE</b>		
121. <u>Bladina molorchus</u> Fennah	maize, sugarcane (87)	NT
<b>RICANIIDAE</b>		
122. <u>Ricania fenestrata</u> (Fabricius)	tea (57)	OR
123. <u>Ricania insularis</u> Lallemand	cacao (121)	ET
124. <u>Ricania japonica</u> Melichar	bean, mulberry (95), tea (137), hemp (144)	OR, PA
125. <u>Ricania speculum</u> (Walker)	citrus (102), kapok (151)	OR
126. <u>Ricania taeniata</u> Stål	bean, rice (95), sugarcane (137)	OR, PA
127. <u>Ricanoptera opaca</u> Distant	tea (77)	OR
128. <u>Scolytopa australis</u> (Walker)	passion-vine (41, 53), polyphagous (116), poison honeydew (41, 127)	AP
<b>TETTIGOMETRIDAE</b>		
129. <u>Egropa breviceps</u> (Stål)	guanabana (12)	OR
130. <u>Hilda patruelis</u> (Stål)	peanuts, cashew, sunflower (153)	ET
131. <u>Hilda undata</u> (Walker)	citrus, solanum, tephrosia (2)	ET
132. <u>Tettigometra hexaspina</u> Kolenati	poppy (153)	PA
133. <u>Tettigometra obliqua</u> (Panzer)	rye (146)	PA
134. <u>Tettigometra</u> spp.	cereals (153)	PA
<b>TROPIDUCHIDAE</b>		
135. <u>Alcestis ingens</u> Fennah	cacao (?) (50)	NT
136. <u>Athestia chariclo</u> (Fennah)	Chamaedorea palm (?) (48)	NT
137. <u>Leptovanua telamon</u> Fennah	breadfruit (51)	AP
138. <u>Mesepora onukii</u> (Matsumura)	fruit trees (51), citrus (137)	OR, PA
139. <u>Neotangia angustata</u> (Uhler)	coffee (51)	NT
140. <u>Neurotmeta sponsa</u> (Guerin-Meneville)	guava (51)	NA, NT
141. <u>Numicia gauhati</u> Wilson	rice (?) (158)	OR
142. <u>Numicia graminivora</u> Ghauri	golf turf grass (51, 58)	OR
143. <u>Numicia maculosa</u> (Distant)	sugarcane (51)	OR
144. <u>Numicia pusana</u> Ghauri	sugarcane (58), rice (?) (158)	OR



145. <u>Numicia viridis</u> Muir	sugarcane (25)	ET
146. <u>Ommatissus binotatus lybicus</u> DeBerg	date palm (3, 46, 75)	PA
147. <u>Swezeyaria viridana</u> Metcalf	breadfruit (51)	AP
148. <u>Tambinia theivora</u> Fennah	tea (?) (51)	OR
149. <u>Tambinia verticalis</u> Distant	coconut palm (159)	OR
150. <u>Tangia viridis</u> (Walker)	grapefruit (51)	NT

a \* = pathogen vector of host plant indicated

b V = pathogen vector, host plant not indicated by author

c (?) = questionable pest status

d AP = Australo-Pacific, ET = Ethiopian, NA = Nearctic, NT = Neotropical, OR = Oriental, PA = Palearctic

Table 2. Economically important host plants and their planthopper pests.

Host plant taxon - Planthopper pests<sup>a</sup>

Albizia ( <u>Albizzia</u> sp.) - 95
Apple ( <u>Malus</u> sp.) - 93, 104
Avocado ( <u>Persea americana</u> Mill.) - 106, 107
Bamboo ( <u>Bambusa</u> sp.) - 45, 46
Barley ( <u>Hordeum vulgare</u> L.) - 13, 22, 23, 50, 54, 57, 62
Barnyard grass ( <u>Echinochloa crusgalli</u> (L.) Beauv.) - 32, 34, 51, 54, 55, 60, 62
Bean (? <u>Phaseolus</u> sp.) - 124, 126
Bermudagrass ( <u>Cynodon dactylon</u> (L.) Pers.) - 62
Blue latan palm ( <u>Latania loddigesii</u> Mart.) - 101
Breadfruit ( <u>Artocarpus altilis</u> (Park) Fusb.) - 137, 147
Cabbage palm ( <u>Sabal palmetto</u> (Walt.)) - 101
Cacao ( <u>Theobroma cacao</u> L.) - 76, 95, 102, 111, 123, 135
Canary Island date palm ( <u>Phoenix canariensis</u> Hort.) - 101
Candlenut ( <u>Aleurites triloba</u> Forst.) - 96
Carrot ( <u>Daucus carota</u> L.) - 50, 61
Cashew ( <u>Anacardium occidentale</u> L.) - 130
Chamaedorea palm ( <u>Chamaedorea</u> sp.) - 136
Cherry ( <u>Prunus</u> sp.) - 93
China wood oil ( <u>Aleurites</u> sp.) - 96
Chinese fan palm ( <u>Livistonia chinensis</u> (Jacq.) R. Br. & Mart.) - 101
Citrus ( <u>Citrus</u> sp.) - 23(?), 93, 96, 97, 99, 105, 110, 125, 131, 138
Coconut palm ( <u>Cocos nucifera</u> L.) - 2, 5, 6, 7, 50, 55, 69, 71, 73, 78, 82, 117, 119, 149
Coffee ( <u>Coffea</u> sp.) - 95, 100, 105, 139
Cranberry ( <u>Vaccinium macrocarpum</u> Ait.) - 90
Crepe myrtle ( <u>Lagerstroemia indica</u> L.) - 97
Custard apple ( <u>Annona</u> sp.) - 97
Date palm ( <u>Phoenix dactylifera</u> L.) - 115, 146
Dadap ( <u>Erythrina indica</u> Lam.) - 95
Dahlia ( <u>Dahlia</u> sp.) - 99
Dracontomelon ( <u>Dracontomelon sinense</u> Stapf.) - 97
Euphoria ( <u>Euphoria longana</u> Lam.) - 97
Fan palm ( <u>Pritchardia</u> sp.) - 101
Fescue ( <u>Festuca arundinacea</u> Schreb.) - 13
Fig ( <u>Ficus</u> sp.) - 114
Firmiana ( <u>Firmiana simplex</u> (L.)) - 97
Flax lily ( <u>Phormium tenax</u> Forst.) - 8
Ginseng ( <u>Panax quinquefolium</u> L.) - 1, 99
Golf turf grass (unidentified in Fennah 1982b & Ghauri 1976) - 142
Grapefruit ( <u>Citrus X paradisi</u> Macf.) - 150
Guava ( <u>Psidium guajava</u> L.) - 105, 107, 140
Guanabana ( <u>Annona squamosa</u> L.) - 129

Hawthorn (Crataegus sp.) - 68  
 Hedge (Duranta repens L.) - 97  
 Hemp (Cannabis sativa L.) - 93, 124  
 Indigo (Indigofera sp.) - 96  
 Jackfruit (Artocarpus sp.) - 107, 108  
 Jasmine (Jasminum multiflorum Andr.) - 97  
 Kapok (Ceiba pentandra (L.) Gaertn.) - 95, 125  
 Kola (Cola sp.) - 36  
 Lawsonia (Lawsonia inermis L.) - 97  
 Lavender (Lavandula hybrida Rev.) - 3  
 Longan - (Nephelium longana Camb.) - 112  
 Lotus (Nelumbium speciosum Willd.) - 97  
 Lychee (Litchi chinensis Sonn.) - 109  
 Maize (Zea mays L.) - 13, 22, 23, 36, 49, 50, 51, 54, 62, 67, 83, 118, 121  
 Mango (Mangifera indica L.) - 11, 103, 105, 107, 112  
 Manila palm (Vietchia merrillii (Becc.) H. E. Moore) - 5  
 Millet (Setaria italica (L.) Beauv.) - 49, 72  
 Molasses grass (Melinis minutiflora Beauv.) - 25  
 Mulberry (unidentified by authors) - 9, 93, 124  
 Oats (Avena sativa L.) - 13, 15, 19, 20, 21, 22, 23, 26, 28, 54, 57  
 Oil palm (Elaeis guineensis Jacq.) - 69, 70, 71, 73, 77, 78, 79, 80, 81  
 Orchard grass (Dactylis glomerata L.) - 13  
 Orchids (unidentified in Hoffman 1935) - 97  
 Pangola grass (Digitaria decumbens Stent.) - 49  
 Passion-vine (Passiflora edulis Sims.) - 128  
 Peach (Prunus persica (L.) Patsch.) - 93, 97  
 Peanut (Arachis hypogaea L.) - 130  
 Pink shower (Cassia nodosa Buch.-Ham) - 97  
 Pomelo (Citrus maxima (Burm.) Merrill) - 96  
 Poppy (Papaver sp.) - 132  
 Potato (Solanum tuberosum L.) - 3, 72  
 Pritchardia palm (Pritchardia thurstonii F. Muell. & Drude) - 5  
 Privet (Ligustrum amurense Carr.) - 99  
 Rice (Oryza sativa L.) - 12, 13, 17, 18, 23, 29, 30, 31, 32, 34, 35, 47, 51, 52, 53, 54, 55, 56, 57, 58, 60, 62, 63, 66, 72, 88, 91, 118, 120, 126, 141, 144  
 Rye (Secale cereale L.) - 54, 57, 133  
 Salvia (Salvia sp.) - 99  
 Sandal (Santalum album L.) - 92, 116  
 Saw palmetto (Serenoa repens (Bartr.) Small) - 101  
 Scrub palmetto (Sabal etonia Swingle) - 101  
 Sorghum (Sorghum halepense (L.) Pers.) - 13, 36, 67  
 Solanum (Solanum verbascifolium L.) - 131  
 Speargrass (Poa annua L.) - 62  
 Sugarcane (Saccharum officinarum L.) - 4, 10, 14, 16, 24, 33, 37, 38, 39, 40, 41, 42, 43, 44, 48, 49, 62, 64, 65, 72, 74, 83, 86, 87, 88, 89, 91, 117, 119, 120, 125, 142, 144  
 Sunflower (Helianthus sp.) - 30  
 Tall oat-grass (Arrhenatherum elatius (L.) Mert. & Koch.) - 20, 22  
 Taro (Colocasia esculenta (L.) Schott) - 59, 75, 84, 85, 119  
 Tea (Camellia sinensis (L.) Kuntze) - 93, 94, 98, 127, 148  
 Tephrosia (Tephrosia candida (Robx.)) - 130  
 Timothy (Phleum pratense L.) - 26  
 Tobacco (Nicotiana tabacum L.) - 113  
 Triticale (X Tritosecale) - 51  
 Tomato (Lycopersicon lycopersicon (L.) Karst. & Farw.) - 3  
 Washington palm (Washingtonia robusta H. Wendl.) - 101  
 Water Lily (Nuphar advena (Ait.) Ait.) - 27  
 Wheat (Triticum spp.) - 13, 20, 21, 22, 23, 26, 28, 54, 57, 67  
 Wild rice (Zizania caduciflora (Turcz.) Hand.-Mazz., Z. latifolia (Griseb.) Turcz.) - 47  
 Zizyphus (Zizyphus vulgaris Lam.) - 97

<sup>a</sup>Numbers refer to planthopper species listed in far left column of Table 1.

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