COOPERATIVE NATIONAL PARK RESOURCES STUDIES UNIT

UNIVERSITY OF HAWAI'I AT MANOA

Department of Botany
3190 Maile Way
Honolulu, Hawai'i 96822

(808)956-3932

Technical Report 95

# ANNOTATED BIBLIOGRAPHY OF THE GENUS *PSIDIUM*, WITH EMPHASIS ON *P. CATTLEIANUM* (STRAWBERRY GUAVA) AND *P. GUAJAVA* (COMMON GUAVA), FOREST WEEDS IN HAWAI'I

Zella E. Ellshoff[1], Donald E. Gardner[1], Charles Wikler[2], and Clifford W. Smith[1]

[1]Department of Botany
3190 Maile Way
Honolulu, Hawai'i 96822

[2]Federal University of Parana
Caixa Postal 4088-82501
Curitiba, Parana, Brazil

UNIVERSITY OF HAWAI'I AT MANOA
NATIONAL PARK SERVICE

Cooperative Agreement
CA 8033-2-0001

May 1995

# TABLE OF CONTENTS

## ABSTRACT

The family Myrtaceae is well represented in Hawai'i by both native and introduced species. Two species of the genus *Psidium*, *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), are particularly significant as invasive alien weeds in Hawai'i, where they pose serious threats to native ecosystems. Whereas these species are native to South America, they have been widely distributed throughout warmer regions of the world because of their edible fruit. The Myrtaceae is divided into two subfamilies, Leptospermoideae and Myrtoideae, the latter of which includes *Psidium*.

The literature contains numerous references to these species considered both from the viewpoint of their desirability as fruit crops and as undesirable weedy invaders. An annotated bibliography of published references to the genus *Psidium*, with particular emphasis on strawberry and common guavas, was prepared to document both of these aspects, but in particular to provide information of possible use in control efforts in Hawai'i.

## INTRODUCTION

### Family Myrtaceae

The Myrtaceae or Myrtle family, is made up of about 140 genera and 3,000 or more species, native to tropical and subtropical areas worldwide and to temperate Australia. The family is divided into two subfamilies, the Leptospermoideae with capsular fruit and the Myrtoideae with berries or drupes (Cronquist 1981, Wagner *et al.* 1990).

Nine genera and 50 species of Myrtaceae currently occur in Hawai'i, where 42 of these species, including one Polynesian introduction, are naturalized. There are also one indigenous species and seven endemic species in Hawai'i (Wagner *et al.* 1990).

### Subfamily Leptospermoideae

The Leptospermoideae is charactered by a many-seeded capsule or sometimes a one-seeded nut and opposite or alternate leaves (Wagner *et al.* 1990). Dipoid chromosome numbers of members of this subfamily have consistently been found to be 2n=22 (Sem 1984). The subfamily is most developed in Australia, Malaysia, and Polynesia, and the largest genera include *Eucalpytus*, with 500 species, and *Melaleuca*, with 100 species. The Leptospermoideae is represented in Hawai'i by 35 natralized species and five endemic species in five genera: *Eucalyptus*, *Leptospermum*, *Lophostemon*, *Melaleuca*, and *Metrosideros*. A species of *Syncarpia* has also reportedly escaped from cultivation (Wagner *et al.* 1990).

*Eucalyptus*, or gum, are trees or shrubs, all but a few of the total 600 or more species of which are endemic to Australia. More than 90 species of *Eucalyptus* have been planted in the Hawaiian Island by foresters, and 30 of those have become naturalized, at least on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i (Chippendale 1990).

*Leptospermum* is a genus of 40 species, mostly from Australia but also found in Malaysia and New Zealand. Three species have been planted or are cultivated in Hawai'i and have become natualized on Kaua'i, O'ahu, and Lana'i (Wagner *et al.* 1990).

There are over 100 species of *Melaleuca*, occurring as shrubs or small trees native to Australia or Malaysia. One species, a tree, was extensively planted in forestry plantings and is now naturalized on Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i (Wagner *et al.* 1990).

*Metrosideros* is a genus of about 50 species of trees or shrubs native to the Pacific, from the Philippines to New Zealand and the Pacific Ocean high volcanic islands. One species is native to South Africa. Five species of *Metrosideros* are endemic to the Hawaiian Islands, occurring on all the main islands except Ni'ihau and Kaho'olawe. No introduced species are known to have become naturalized in Hawai'i (Dawson and Stemmermann 1990).

*Synacarpia* is a genus of five species native to the Moluccas and Australia. One species of this genus (*S. glomulifera*) has been planted by foresters on all the main islands except Ni'ihua and Kaho'olawe. It has reportedly escaped, at least on Moloka'i (Neal 1965, Wagner *et al.* 1990).

### Subfamily Myrtoideae

The Myrtoideae is characterized by a fleshy fruit (a berry or drupe) and opposite leaves (Wagner *et al.* 1990). Diploid chromosome numbers of members of this subfamily have been found to range from 2n=22 to 2n=88 (Sem 1984). The subfamily is most developed in tropical America, and the largest genera are *Eugenia*, with 600 species, *Myrcia*, with 300 species, *Syzygium*, with more than 200 species, and *Psidium*, with 100

species.

In Hawai'i, four genera of the Myrtoideae, *Eugenia*, *Psidium*, *Rhodomyrtus*, and *Syzygium*, are represented by seven naturalized species (including one Polynesian introduction), one indigenous species, and two enemic species.

Species of *Eugenia* are trees or shrubs which are native mostly to tropical and subtropical areas of the New World. Of a total of 550 or more species, three grow naturally in the Hawaiian Islands. *Eugenia koolauensis*, nioi, an endemic species, was formerly found on O'ahu and Moloka'i but has been collected only twice on O'ahu since 1950. It is very closely related to *E. reinwardtiana*, also called nioi, which is widely distributed in the Pacific and indigenous to Hawai'i, occurring on Kaua'i, O'ahu, Moloka'i, and Maui. *Eugenia uniflora*, Surinam cherry, is native to Brazil and was brought to Hawai'i for its fruit by 1871. It is now cultivated and naturalized on Midway Atoll and all the main islands except Ni'ihau and Kaho'olawe (Wagner *et al.* 1990).

*Rhodomyrtus* is a genus of about 20 species of trees or shrubs native from tropical Asia to the region of New Caledonia and Australia. *Rhodomyrtus tomentosa*, downy myrtle, is a shrub or tree native to the region from India to southeastern Asia and the Philippines. It is cultivated on all the main islands of Hawai'i and is naturalized on Kaua'i, O'ahu, and Hawai'i. It was reportedly introduced to Kaua'i before 1920 (Wagner *et al.* 1990).

*Syzygium* is a genus of perhaps 1,000 species of trees or shrubs native to the Old World tropics. *Syzygium cumini*, Java plum, a tree native to India, Ceylon, and Malaysia, is occasionally cultivated and has become naturalized on most main islands of Hawai'i (though not documented from Ni'ihau and Kaho'olawe). It has been cultivated since before 1971. *Syzygium jambos*, rose apple, is a tree which probably originated in malaysia and possibly southeastern Asia and is now widely cultivated and naturalized. It is rarely cultivated in Hawai'i, but it has become naturalized on most of the main islands (except not documented from Ni'ihau and Kaho'olawe). It was first brought to Hawai'i for its fruit from Rio de Janeiro on the "Blonde" in 1825. *Syzygium malaccense*, mountain apple, is a tree with a native range possibly in Malaysia to southeastern Asia. It is now widely cultivated and naturalized. It was brought to Hawai'i by the Polynesian immigrants and is now naturalized on Kaua'i, O'ahu, Moloka'i, and Maui, although Hillebrand (1965) reported it on all the main islands in 1888. *Syzygium sanwicensis*, 'ohi'a ha, is a tree or shrub endemic to the Hawaiian Islands and found on Kaua'i, O'ahu, Moloka'i, Lana'i, and Maui. Its relationships to other species of the genus are not known (Wagner *et al.* 1990).

**The Genus *Psidium***

*Psidium*, a name first published by Linnaeus, is a Neotropical genus of 100 to 150 species of shrubs or small trees. The name is derived from the Greek word *sidion*, which is the diminutive of *side*, the name for pomegranate (*Punica granatum*), the fruits of which are similar in shape to those of guava. Leaves are opposite or subopposite and pinnately nerved. Flowers are single or in groups of two or three (occasionally up to seven) and originate in the leaf axils. The hypanthium (a ring- or cup-shaped structure formed by the fusion of the lower parts of the calyx, corolla, and stamens) extends above the inferior ovary. The calyx, which remains attached to the fruit, is made up of four or five sepals which are separate or are fused and split when the flower opens. The corolla is made up of four or five often showy petals. The ovary is usually three- or four-celled

(sometimed two- to seven-celled) and has numerous ovules. The fruit is a spherical or pear-shaped berry containing numerous seeds with bony seedcoats (Wagner *et al.* 1990).

Kausel (1966) divided the genus *Psidium* into two subgenera based on whether the sepals are initially open or closed. Members of subgenus *Eupsidium* initially have a closed calyx and include *P. cuneatum, P. guajava, P. guineense*, and *P. kennedyanium*. Members of subgenus *Myrtopsidium* initially have an open calyx, with *P. incanum, P. luridum, P. missionum*, and *P. nutans* given as representative species. Kausel's subgenera did not gain widespread acceptance, however, (McVaugh 1968), and the subgenus to which *P. cattleianum* would belong under this system was not listed. Both *P. guajava* and *P. cattleianum* are widely naturalized in tropical areas around the world, including most of the main Hawaiian Islands (although not documented from Ni'ihau or Kaho'olawe). Both were introduced to Hawai'i in the early 1800s (Wagner *et al.* 1990).

***Psidium guajava*** -- *Psidium guajava*, common guava, or kuawa in Hawaiian, was first named by Linnaeus in 1753. The species is widely cultivated for its fruit and has become naturalized in tropical and subtropical areas worldwide, becoming a weedy pest in some countries. In Hawai'i, the species is cultivated as an agricultural crop upon which a small commercial industry has developed, and jams, jellies, and juice are made from the fruit. It was probably introduced in the early 1800s by Don Francisco de Paul Marin, who imported many nonnative plants to Hawai'i, and it had become naturalized by the late 1800s. Today, the species often forms dense thickets in disturbed lower elevation (up to 1,120 m) dry, mesic, and wet forests on most main islands. Seeds are spread by cattle, horses, birds, and pigs (Wagner *et al.* 1990).

Common guava is a shrub or tree up to 10 m tall with sharply four-angled or winged young branches. The oval leaves are leathery with impressed (upper surface) and raised (lower surface) veins. Flowers are usually solitary, though sometimes in clusters of two or three. The fruit is spherical to pear-shaped, measures 3 to 10 cm in diameter, and has an irregular surface and pink or cream-colored pulp. Chromosome number is often 2n=22, but counts of different cultivated varieties have been made ranging from 2n=21 to 2n=44. A sporadically occurring small-leaved form of common guava is referred to as Dr. Rant's guava *P. guajava* f. *cujavillus* (Wagner *et al.* 1990).

***Psidium cattleianum*** -- *Psidium cattleianum*, strawberry guava or waiawi 'ula'ula, was first named by Sabine (1821) and is native to Brazil. Synonyms include:

*Episyzygium oahuense* Suess. & A. Ludwig

*Psidium cattleianum* var. *cattleianum* f. *lucidum* Degener

*Psidium cattleianum* var. *littorale* (Raddi) Fosb.

*Psidium littorale* Raddi

*Psidium littorale* var. *lucidum* (Degener) Fosb.

The species is cultivated for its fruit, which is put to similar uses as is that of common guava (although not on a commercial scale) and as an ornamental tree often used in landscaping, and has become naturalized in tropical and subtropical areas of the world. The wood has been used for firewood and to produce charcoal (Diong 1982). Strawberry guava has become a serious weed pest in some countries. Both red and yellow fruited forms of the species are believed to have been first brought to Hawai'i in 1825 on the voyage of the "Blonde". *Psidium cattleianum* was reported escaping from cultivation by early 1900 (Diong 1982). Today, it is one of the most serious weeds in Hawai'i, naturalized on all the main islands and forming dense monotypic stands in disturbed mesic and wet forests

(Wagner *et al.* 1990). The species is also capable of invading undisturbed native forests (Huenneke and Vitousek 1990).

Strawberry guava is a shrub or tree up to 6 m tall with young branches which are circular in cross section. The leaves are oval and have scarcely raised veins. The flowers usually arise singly from the leaf axils. Berries are usually purplish red, though sometimes yellow, and are spherical to ellipsoid, 2 to 3 cm in diameter, with a smooth surface and white pulp (Wagner *et al.* 1990). Chromosome count is 2n=88, although reports of 2n=66 and 2n=77 have been made for a few plants (Hirano and Nakasone 1969a).

There has been some confusion as to which scientific name was first correctly published for the species. Sabine (1821) named the plant after William Cattley, who was the first person to successfully cultivate the species. The spelling *cattleyanum* sometimes appears in the older literature for the species name *cattleianum*. *Psidium littoralis* was published as the name for the species by Raddi in 1823. A difference in the date on the title page of the publication and the actual date the section including the name was published has caused confusion, but the currently accepted name is *P. cattleianum* (Wagner *et al.* 1990).

**Annotated Bibliography Commentary**

Whereas the bibliography includes most of the references found in the literature to the genus *Psidium*, and to strawberry guava and common guava in particular, some selectivity was exercised. It became apparent that numerous references appear in popular and semipopular Spanish and Portuguese language publications on the use and cultivation of guava as a fruit crop. Many of these references, and some to the botanical description of new species of *Psidium*, appeared so indirectly related to the objective of this report that they were omitted from the bibliography. The intent was to include as comprehensive a treatment as possible of applicable subject matter, but to avoid unnecessary divergence which would detract from the intended thrust. The numerous references in foreign languages contributed somewhat to the difficulty in fully evaluating the content of these publications. However, it is hoped that judgmental errors have been kept to a minimum regarding the selection of material to be reviewed in this report.

**Resource Management Considerations**

The specific management-related objective of this report is to discover and evaluate possible avenues of control for strawberry guava in natural areas of Hawai'i. Whereas both common and strawberry guavas are sufficiently serious weeds in these areas to be targets for biocontrol from a biological standpoint, the use of common guava as a popular fruit crop would present a conflict of interest and preclude any practical consideration of this species as a target of biocontrol efforts at this time. Newly introduced biocontrol agents, released in a classical program, cannot be restricted to politically defined areas and are free to spread through their ecological range. References in the bibliography to various herbicidal and mechanical approaches to the control, developed in Hawai'i and elsewhere, may provide the most useful information toward the control of common guava in natural areas, since chemical treatment and mechanical removal may be selectively applied. The close phylogenetic relationship, evident in this report, of strawberry guava to common guava detracts from the suitability of strawberry guava as a target for biocontrol. Difficulty may be encountered in obtaining biocontrol agents with sufficient virulence to significantly affect strawberry guava populations, while at the same time having the required narrow host specificity to be suitable for introduction into

Hawai'i. The bibliography contains numerous references to diseases and insects which affect the value of guava as a commercial crop (i.e., post harvest fruit diseases) but which do not appear to be useful as biocontrol agents. Strawberry guava was reported (Eward and Shanker 1964) to be resistant to one of the most serious diseases of common guava noted in the bibliography, vascular wilt caused by *Fusarium oxysporum* f. sp. *psidii*, and was reported to have usefulness as rootstock material for commercial guava in India.

Whereas attempts currently underway to discover acceptable biocontrol controls for strawberry guava in its native habitats (i.e., Paraná State, southern Brazil) should proceed, the lack of obviously suitable agents at present suggests that such controls, if eventually available, will be subjects of long-term research. Resource managers should therefore continue to pursue more labor intensive chemical and/or mechanical control approaches to the extent practical (as in special ecological areas) to manage populations of these weeds.

## ACKNOWLEDGEMENTS

The assistance of Rob Anderson and of the helpful reference librarians of the University of Hawai'i - Manoa library system in locating and obtaining many difficult-to-find references is gratefully acknowledged. This project was supported by biological control research funding from the National Park Service Division of Research and Resource Management and by the National Biological Service.

## Subject Category Summary of Literature Surveyed

**Biological Control:** 110, 134, 195, 229, 342, 347

**Biology and Ecology:** 17, 23, 53, 54, 64, 73, 76, 102, 105, 125, 130, 135, 142, 143, 144, 145, 146, 149, 172, 173, 174, 178, 208, 233, 261, 266, 289, 290, 291, 292, 293, 294, 303, 305, 307, 308, 316, 326, 346, 347, 348, 368, 374, 381, 382, 383, 384, 385

**Distribution:** 1, 26, 38, 39, 49, 60, 73, 74, 93, 95, 96, 101, 117, 118, 123, 128, 129, 142, 147, 149, 163, 167, 177, 178, 180, 181, 182, 183, 184, 192, 209, 210, 211, 212, 214, 215, 228, 234, 249, 254, 256, 261, 266, 267, 272, 277, 281, 289, 290, 310, 368, 381, 385

**Fruit or Timber Crop:** 2, 3, 4, 7, 8, 11, 12, 13, 14, 21, 28, 40, 43, 46, 49, 55, 57, 60, 73, 90, 91, 95, 96, 98, 108, 113, 114, 115, 124, 125, 128, 137, 147, 165, 166, 169, 170, 177, 178, 182, 186, 187, 190, 191, 194, 207, 213, 219, 221, 237, 241, 250, 251, 252, 253, 254, 256, 267, 268, 272, 275, 276, 281, 288, 296, 297, 299, 300, 315, 316, 329, 333, 338, 339, 343, 351, 363

**Genetics:** 16, 44, 131, 132, 133, 171, 193, 290, 291, 294, 312, 318, 368

**Herbicides:** 15, 36, 75, 109, 140, 157, 158, 159, 207, 223, 224, 226, 228, 238, 240, 255, 269, 282, 332, 345, 349, 376, 377, 378, 379, 380

**Insect Pests:** 6, 9, 12, 13, 14, 19, 20, 22, 24, 28, 29, 30, 31, 32, 33, 34, 37, 42, 43, 44, 55, 58, 59, 66, 69, 73, 94, 98, 104, 108, 110, 128, 134, 148, 151, 152, 153, 154, 165, 166, 169, 178, 179, 186, 189, 190, 205, 206, 213, 221, 222, 231, 235, 236, 239, 242, 251, 259, 278, 281, 288, 297,

300, 324, 325, 328, 330, 331, 350, 351, 354, 355, 356, 357, 358, 359, 360, 361, 362, 370, 371, 372, 373

**Morphology and Anatomy:** 17, 25, 61, 63, 97, 317

**Other Uses (e.g., Ethnobotanical, Folk Medicine):** 5, 156, 170, 178, 219, 340

**Pathogens and Diseases:** 3, 4, 12, 13, 14, 27, 28, 35, 45, 47, 50, 51, 52, 55, 62, 66, 68, 70, 72, 73, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 92, 106, 107, 110, 111, 112, 116, 117, 120, 121, 122, 128, 134, 135, 139, 141, 148, 150, 160, 161, 162, 164, 165, 166, 168, 169, 175, 176, 178, 186, 196, 197, 198, 199, 200, 201, 202, 216, 217, 218, 220, 227, 232, 237, 244, 245, 246, 247, 248, 250, 251, 252, 257, 258, 260, 262, 263, 264, 265, 270, 271, 273, 274, 280, 283, 286, 295, 296, 300, 301, 302, 303, 313, 314, 319, 320, 321, 322, 323, 329, 334, 335, 336, 337, 341, 344, 351, 352, 363, 364, 365, 366, 367, 369, 375

**Physiology:** 2, 3, 5, 7, 17, 23, 40, 41, 53, 54, 57, 97, 111, 112, 121, 124, 124, 178, 188, 203, 217, 220, 240, 243, 284, 285, 299, 304, 311, 317, 325, 340, 349, 353, 376, 377, 378, 382, 383

**Systematics and Taxonomy:** 1, 7, 26, 44, 48, 56, 61, 63, 64, 65, 71, 74, 91, 93, 95, 96, 99, 100, 101, 103, 113, 130, 137, 142, 155, 163, 167, 178, 181, 182, 185, 186, 193, 204, 209, 210, 211, 212, 230, 234, 256, 266, 277, 287, 299, 368

**Weediness:** 10, 15, 18, 41, 44, 67, 74, 75, 76, 102, 105, 118, 119, 126, 127, 129, 130, 135, 138, 140, 143, 144, 145, 146, 149, 157, 158, 159, 172, 173, 174, 208, 223, 224, 225, 228, 229, 233,

238, 249, 255, 269, 276, 282, 286, 290, 305, 306, 307, 308, 309, 326, 327, 332, 345, 346, 347, 348, 368, 374, 376, 377, 378, 379, 380, 384, 385

**Other Subjects (e.g., History of Introduction):** 5, 38, 91, 170, 186, 192, 279, 310

# Annotated Bibliography


1. **Adams, C. D. 1972. Flowering plants of Jamaica. University of the West Indies. Mona, Jamaica.**

   Species of *Psidium* found in Jamaica include *P. harrisianum* (endemic), *P. dumetorum* (endemic), *P. guajava*, *P. quineense* (possibly indigenous), *P. montanum* (endemic), *P. cattleianum*, and *P. albescens* (endemic). *Psidium cattleianum* was described as native to Brazil but naturalized in Jamaica, occurring in pasture thickets and hilltop woodlands at 1,500-3,000 ft. elevation. It was widely cultivated in Central and South America and the West Indies.

2. **Adenikinju, S. A. 1968. Effects of some growth regulators on fruit set and development in guava. Unpublished Master's thesis, University of Hawai'i Department of Horticulture.**

   Both common guava (*Psidium guajava*) and strawberry guava (*P. cattleianum*) were tested with various growth regulators for the effects on fruit set and development.

3. **Adisa, V. A. 1983. Metabolic changes in post-infected guava (*Psidium guajava*) fruits. Fitopatologia Brasileira 8(1):81-86.**

   The effects on several nutrients in post-harvested fruit of (*Psidium guajava*) infected with several rot-causing fungi were assessed. Certain nutrients were decreased in infected fruit, but some remained unaffected.

4. **Adisa, V. A. 1985. Fruit rot diseases of guava (*Psidium guajava*) in Nigeria. Indian Phytopathology 38(3):427-430.**

   "A survey of guava fruit rot diseases was conducted in 16 locations in Nigeria. Two types of rots, soft and dry, were recorded. *Aspergillus niger, Rhizoctonia solani, Colletotrichum gloeosporioides, Botryodiplodia theobromae, Erwinia* sp., *Rhizopus stolonifer, R. oryzae,* and *Choanephora cucurbitarum* were established as soft rot organisms; while *Aspergillus fumigatus, Penicillium* sp., *P. multicolor, Cladosporium* sp., *Fusarium equiseti,* and *F. oxysporum* were established as dry rot organisms. *Botryodiplodia theobromae* had the second highest average occurrence (18.1) while *Erwinia* sp. occurred in all the 16 locations surveyed hence it can be considered as the most important rot organism of guava fruit in Nigeria."

5. **Agrawal, M., S. K. Singh, J. Singh, and D. N. Rao. 1991. Biomonitoring of air pollution around urban and industrial sites. Journal of Environmental Biology 12(Special Issue):211-222.**

   Physiological, growth, and biochemical parameters for various plant species were assessed in this study. *Psidium guajava* was found to be useful as a bioaccumulator to monitor sulfur dioxide in the atmosphere.

6. **Ahmed, M. K. 1984. Scientific notes on the biology and life history of *Strepsicrates rhothia* Meyr. (Tortricidae, Lepidoptera), a pest of guava in Karachi. Pp. 259-262, *In*: Insect Pests of Important Crops in Pakistan. Government of Pakistan, Department of Plant Protection, Karachi.**

The guava leaf roller, *Strepsicrates rhothia*, was reported to cause serious damage to trees of common guava, *Psidium guajava*, its apparent preferred host. The larvae of the insect also fed on leaves of jamun, *Eugenia jambolana,* and mango, *Mangifera indica*. The life history of *S. rhothia* was described.

7. **Akamine, E. K., and T. Goo. 1979. Respiration and ethylene production in fruits of species and cultivars of *Psidium* and species of *Eugenia*. Journal of the American Society for Horticultural Science 104(5):632-635.**

Two cultivars of *Psidium guajava*, *P. cattleianum*, and *P. cattleianum* var. *lucidum*, and four species of *Eugenia* were assessed for respiratory behavior, which was discussed as a possible physiological tool for taxonomic differentiation.

8. **Andersen, O. 1988. As frutas silvestres Brasileiras. (Wild fruits of Brazil.) Globo, Rio de Janeiro. [in Portuguese]**

The author described some wild fruits of Brazil, including *Psidium cattleianum*, *P. araça*, and *P. guajava*, with information on their identification, seedling stages, climate and soil requirements, harvest practices, and uses. Some insects and fungi attacking guava were mentioned, including the fruit flies *Ceratitis capitata* and *Anastrepha* spp., which were noted from both strawberry guava and common guava. *Conotrachelus psidii* also attacks both species. *Timocratica albella* bores into the trunk of both species. The rust fungus *Puccinia* spp. was reported from both species.

9. **Annecke, D. P., and V. C. Moran. 1982. Guavas. Pp. 77-78, *In:* Insects and Mites of Cultivated Plants in South Africa. Butterworths, Durban/Pretoria.**

The following insects were listed as pests of cultivated guava (*Psidium guajava*) in South Africa:

Guava scale (*Pulvinaria psidii)*
Soft brown scale (*Coccus hesperidum)*
Striped mealybug (*Ferrisia virgata*)
Coconut bug (*Pseudotheraptus wayi*)
Guava thrips (*Heliothrips sylvanus*)
False codling moth (*Crytophlebia leucotreta*)
Mediterranean fruitfly (*Ceratitis capitata*)
Five-spotted fruitfly (*Pardalaspis quinaria*)
Coccid *(Nipaecoccus nipae*)

10. **Anonymous. 1962. Noxious weeds of Hawaii. Hawai'i Department of Agriculture,**

**Division of Plant Industry. Honolulu. 89 pp. (mimeographed)**

*Psidium guajava* was described as a noxious weed in Hawai'i which was purposely introduced in the early 1880s from Tropical America, probably for its fruit. It was considered noxious because it is a fast growing shrub which shades and crowds out forage plants, but has no forage value. Its spread was reported by birds, cattle, horses, wild pigs, and rodents which feed on the fruit and spread the seed in their droppings. Control had been accomplished through mechanical clearing by bulldozers, including chain dragging and disking. Herbicides containing 2,4-D or 2,4,5-T also have been used. Cost to remove various weeds, including both *P. guajava* and *P. cattleianum*, from areas of Hawai'i were estimated at almost $18 million in 1962. Guava was to be removed to prevent it from shading out forage plants.

**11. Anonymous. 1977. Pomar e ervas medicinais. Goiaba. Cultural, Abril. São Paulo. P. 104. [in Portuguese]**

Information on the cultivation of *Psidium guajava* as a fruit crop in Brazil was reported, including requirements of climate and soil, and suggested cultural and harvest practices.

**12. Anonymous. 1984. Muitas goiabas com bons tratos culturais. (Many guavas with good cultural fruits.) Dirigente Rural. Visão, São Paulo 23(10):29-30. [in Portuguese]**

Information on the cultivation of *Psidium guajava* was presented, including care of the seedling stage, fertilization, spacing, etc. Natural enemies listed were the insects *Anastrepha fraterculata*, *Ceratitis capitata*, and *Timocratica albella*. Guava rust, caused by the fungus *Puccinia psidii*, was listed as the principal disease.

**13. Anonymous. 1986. Culturas: Goiaba. Guava. Guia Rural Abril. P. 25. [in Portuguese]**

A popular article that discussed briefly many aspects on the culture of guava including the control of insects and diseases. These were not listed individually, however.

**14. Anonymous. 1991. Anuário da revista pomar. Goiaba. Guava. Abril. Pp. 327-328. [in Portuguese]**

A popular article with a more comprehensive discussion of many aspects on culture of common guava than is described in the above article in Guia Rural, including a more detailed discussion of insects and diseases in which the bacterium *Erwinia psidii* is specifically mentioned.

**15. Asian-Pacific Weed Science Society. Undated (1980s). Pasture-range weed problems in Hawai'i. Newsletter of the Asian-Pacific Weed Science Society, April. Pp. 1-2.**

*Psidium guajava* was reportedly susceptible to the herbicide 2,4-D in Hawai'i, but *P.*

*cattleianum* was not.

16. **Atchinson, E. 1947. Chromosome numbers in the Myrtaceae. American Journal of Botany 34:159-164.**

    Chromosome counts were 2n = 88 for *Psidium cattleianum* and 2n = 22 for *P. guajava*.

17. **Backes, A. 1971. Contribuiçã ao estudo da anatomia foliar e da fisiologia de *Psidium multiflorum* Camb. (Contribution to the study of leaf anatomy and physiology of *Psidium multiflorum* Camb.) Ciência e Cultura 23(3):297-303. [in Portuguese with English abstract]**

    The author found paracytic stomates in leaves of *Psidium multiflorum*, with lumens of the guard cells narrow in the middle portion and large at both ends. Transpiration was not restricted by these anatomical features. (Compare with Sousa 1971)

18. **Baijnath, H., S. Ramcharum, and S. Naicker. 1983. *Psidium* spp. (Myrtaceae): Very successful weeds. South African Journal of Botany 1(3):78.**

    *Psidium guajava* was described as a roadside weed along the Natal coast and in Mauritius. *Psidium araca* grows along the Natal coast and produces infertile, vigorous hybrids with *P. guajava*. *Psidium cattleianum* is a garden plant in Natal but is a noxious weed in certain areas of Mauritius. There appeared to be crossing between red- and yellow-fruited varieties.

19. **Balasubramanian, M., and P. Kalyanasundaram. 1972/1973. Studies on the incidence of tea mosquito bug, *Helopeltis antonii* S. on guava varieties. AUARA (Annamalai University Agricultural Research Annual) 4/5:158-161.**

    Tea mosquito bug is a pest of *Psidium guajava* in India, affecting some cultivars more than others.

20. **Bastos, J. A. M. 1982. Principais pragas das culturas e seus controles. (Principal insect pests of cultivated plants and their control). 2nd ed. Livraria Nobel, São Paulo. [in Portuguese]**

    The following insects were listed as infesting *Psidium guajava*:

    *Costalimaita ferruginea vulgata* (Lefévre)
    *Oiketicus kirbyi* Guild
    *Trogonoptera callinica* Schaus
    *Orthezia insignis* (Browne)
    *Atta laevigata* (F. Smith)

21. **Beaumont, J. H. 1953. Guava variety selection started. Hawai'i Farm Science 2(1):7.**

A collection of guava varieties and seedlings from many parts of the world was reportedly planted at the Waimanalo Experimental Farm (O'ahu, Hawai'i) for the purpose of selecting the most suitable types for production in Hawai'i as a fruit crop.

22. **Becker, Y. O. 1982. Stenomine moths of the neotropical genus *Timocratica* (Oecophoridae). Bulletin of the British Museum (Natural History), Entomological Series 45(3):211-306.**

The Neotropical moth genus *Timocratica* was revised. The genus includes 46 species from the gulf area of Mexico to northern Argentina. These insects bore into tree trunks and feed on the bark surrounding the entrance holes. One species, *T. palpis*, is a minor pest which bores into tree trunks during its larval stage, and severe infestations can cause death of the trunk or branches. A list of 47 host trees for *T. palpis* was given, but the moth is often found on members of the Myrtaceae (especially *Psidium*) and is common on guava in Brazil.

23. **Becwar, M. R., P. C. Stanwood, and K. W. Leonhardt. 1983. Dehydration effects on freezing characteristics and survival in liquid nitrogen of desiccation-tolerant and desiccation-sensitive seeds. Journal of the American Society of Horticultural Science 108(4):613-618.**

Both *Psidium cattleianum* and *P. guajava* were classified among a group of 10 tropical plant species whose seeds were desiccation-tolerant, capable of surviving low moisture content levels of 2-12%. Both species of *Psidium* also survived liquid nitrogen exposure in the desiccated state.

24. **Beevi, S. N., A. Visalakshi, K. K. R. Nair, K. S. Remamony, and N. M. Das. 1989. Guava as a potential host of *Paradasynus rostratus* Dist. (Coreidae) the coreid bug of coconut in Kerala. Entomon 14(3&4):363-364.**

Common guava is attacked by *Paradasynus rostratus* (Coreidae: Hemiptera), a serious pest of coconut in Kerala, India. Feeding by nymphs and adults of this insect was reported to result in malformed fruit.

25. **Bentham, G. 1970 (reprint). Supplemental papers to Bentham & Hooker's genera plantarum. J. Cramer Verlag; Wheldon & Wesley, Ltd.; Stechert-Hafner Service Agency, Inc. New York.**

Characteristic leaf shape and venation patterns were illustrated for a number of plant species, including *Psidium cattleianum* and *P. guajava*.

26. **Bentham, G., and J. D. Hooker. 1865. Genera plantarum. LXVII Myrtaceae. Lovell Reeve & Co., London. [in Latin]**

The genus *Psidium* was described as containing over 100 species, most of which occur in the American tropics and subtropics. Possibly one exceptional species is of tropical Asian origin.

27. **Bhargava, S. N., A. K. Ghosh, M. P. Srivastava, R. H. Singh, and R. N. Tandon. 1965. Studies of fungal diseases of some tropical fruits VII. Effect of temperature on the decay of mango, banana and guava caused by some important pathogens. Proceedings of the National Academy of Sciences, India. Volume 35, Section B, Part 4. Pp. 393-398.**

Among other fruits tested for postharvest decay, guava fruits were inoculated with *Pestalotia psidii, Botryodiplodia theobromae, Gloeosporium psidii,* and *Phoma psidii* and stored at different temperatures. At 10° C there was no rot, but at room temperature decay was very rapid with most fungi. Only fruits inoculated with *P. psidii* showed very little rot after 10 days incubation at 15° C. Rot was maximum in all cases at 30° C, but was retarded at 35° C.

28. **Bittenbender, H. C., K. G. Rohrbach, N. P. Kefford, and W. T. Harada (eds.). 1986. Guava industry analysis number 4. College of Tropical Agriculture and Human Resources, University of Hawai'i, Honolulu.**

Current trends in insect, disease, and weed control in commercial guava operations in Hawai'i were outlined. The University of Hawai'i College of Tropical Agriculture and Human Resources' guava breeding efforts were reported reduced during recent years of writing when the industry lagged. Hope was expressed that an improved market situation and new federal germplasm program would stimulate new efforts. A large number of insect pests for guava were reported, including mirids, Oriental and Mediterranean fruit flies, red-banded thrips, aphids, Chinese rose beetles, guava moth, spiraling whitefly, longlegged ants, and broad and false spider mites. Mucor fruit rot, caused by the fungus *Mucor hiemalis*, was the most serious disease in areas with high rainfall.

29. **Blackman, R. L., and V. R. Eastop. 1984. Aphids on the world's crops: An identification and information guide. John Wiley & Sons, New York.**

The following aphids were reported to infest guava:

*Aphis citricola*
*A. gossypii*
*Greenidea decaspermi*
*G. (Trichosiphon) formosana*
*Myzus persicae*
*Toxoptera aurantii (Aphis craccivora)*

30. **Bondar, G. 1913a. Broca das goiabeiras -- *Cratosomus* sp. (Bark borers of guava -- *Cratosomus* sp.) A Fazenda, Rio de Janeiro, Maio. Pp. 10-11. [in Portuguese]**

Beetles of the genus *Cratosomus* (family Curculionidae) were originally described as infesting members of the genus *Psidium* in Brazil.

31. **Bondar, G. 1913b. Insectos damninhos na agricultura. Fasciculo II. – Pragas das Myrtaceas fructiferas do Brasil. (Destructive agricultural insects. Part 2. Insect pests of myrtaceous fruits in Brazil.) Boletim de Agricultura. São Paulo. Pp. 434-470. [in Portuguese]**

The author described the following insects which infest species of the family Myrtaceae in Brazil:

*Polyrrhaphis grandini* (Coleoptera: Cerambycidae)
*Dorcacerus barbatus* (Coleoptera: Cerambycidae)
*Conognatha magnifica* (Coleoptera: Buprestidae)
*Cratosomus* sp. (Coleoptera: Curculionidae)
*Stenoma albella* (Lepidoptera: Xylorictidae)
*Siculades fulcata* (Lepidoptera: Geometridae)
*Pyrrhopyge* sp. (Lepidoptera: Hesperidae)
*Mimallo amilia* (Lepidoptera: Lacosomidae)
*Coroplastes janeirensis* (Homoptera: Coccidae)
*Aleyrodes horridus* (Homoptera: Aleyrodidae)

32. **Bondar, G. 1923. Gorgulho das goiabas e araçás. Conotrachelus psidii Marshall, sp. n. Correio Agricultura. (Weevils from guava and strawberry guava.) Bahia 1(12):325-326. [in Portuguese]**

*Conotrachelus psidii*, a beetle of the family Curculionidae which infests members of the genus *Psidium* in Brazil, was described.

33. **Borror, D. J., and D. M. Delong. 1988. Introdução ao estudo dos insectos. (Introduction to the study of insects.) Editora Edgard Blücher Ltda. [in Portuguese]**

*Pyrrophyge charybdis* (Hesperiideae: Leptdoptera) was reported to occur on *Psidium guajava* and *P. cattleianum* in Brazil.

34. **Boscán de, M. N. 1987. Las moscas de las frutas del género *Anastrepha* en Venezuela. (*Anastrepha* fruit flies in Venezuela). Instituto de Investigaciones Agrícolas Generales, Fondo Nacional de Investigaciones Agropecuarias, Maracay, Venezuela no. 23. Pp. 22-24. [in Spanish]**

The characteristics of the genus *Anastrepha* and the importance of these fruit flies were briefly described, and a list of more than 50 host plants, including *Psidium* spp., was presented. Control measures for *Anastrepha* fruit flies were described.

35. **Bose, S. K., and E. Müller. 1967. Central Himalayan fungi - II. Indian Phytopathology 20(2):135-138.**

Among other fungi, the authors reported *Cercospora sawada* on *Psidium guajava* in Jeolikote, District Naini Tal, where it was common between the altitudes of 1,000 to

1,300 meters above sea level, in the outer ranges of the Himalaya. The fungus occurred on plants of all ages, with those under 2 meters in height reportedly being very severely infected. The fungus caused irregular, reddish-brown spots on the upper surface of the leaves, with defoliation eventually resulting from severe infection.

**36. Bovey, R. W., C. C. Dowler, and J. D. Diaz-Colon. 1969. Response of tropical vegetation to herbicides. Weed Science 17:285-290.**

Wild stands of *Psidium guajava* in Puerto Rico were treated with several different herbicides, and post-application effectiveness was assessed. Cacodylic acid was one of the more effective defoliants within 2 weeks after treatment. Six months after treatment, the growth regulator herbicides 2,4-D; 2,4,5-T; or picloram were more effective than contact herbicides in controlling regrowth. In a mixed tropical forest including guava, most rapid desiccation and defoliation of vegetation resulted from application of diquat within 2 weeks after treatment. At 1 month after treatment and longer, a 1:1 mixture of the butyl ester of 2,4-D:2,4,5-T and a 2:2:1 mixture of the isooctyl esters of 2,4-D:2,4,5-T:picloram were the most effective.

**37. Bressan, S., and M. C. Teles. 1991. Host range and infestation by species of the genus *Anastrepha* (Diptera: Tephritidae) in the region of Ribeirao Preto, São Paulo, Brazil. Anales de la Sociedad Entomológica de Brasil 20(1):5-16. [in Portuguese]**

Seven species of fruit flies in the genus *Anastrepha* were found on 11 host plant species, seven of which were introduced species. Of these, *Psidium guajava* had one of the lowest infestation rates.

**38. Bretschneider, E. 1898. History of European botanical discoveries in China. Sampson Low, Marston, and Co., London.**

Samuel Brooks cultivated *Psidium cattleianum*, which was originally grown from seeds brought from China, although not a tree indigenous to China. John Lindley published a drawing of *P. cattleianum*, thought to be a native of China, in 1821; the plant was grown by Cattley and the publication was financed by him.

**39. Britton, N. L. 1918. Flora of Bermuda. Charles Scribner's Sons, New York.**

*Psidium guajava* and *P. cattleianum* were listed among the flora of Bermuda. They were described botanically and annotated as follows: *Psidium guajava* is commonly planted for its fruit and locally escaped from cultivation and naturalized. It is native to tropical America. *Psidium cattleianum*, locally known as purple guava, strawberry guava, or Brazilian guava is occasionally planted for its fruit. The common name "guava berry" has also been applied to this species, but this name actually belongs to *Eugenia floribunda*.

**40. Brown, B. I., and R. B. H. Wills. 1983. Post-harvest changes in guava fruit of different maturity. Scientific Horticulture (Amsterdam) 19(3/4):237-244.**

Two cultivars of *Psidium cattleianum* and six of *P. guajava* were studied. Fruits were harvested at four stages of development, and post-harvest changes in respiration were tallied. Differences between cultivars were observed in the post-harvest changes examined.

41. **Brown, R. L., C. S. Tang, and R. K. Nishimoto. 1983. Growth inhibition from guava root exudates. HortScience 18(3):316-318.**

This study, conducted to find whether roots of *Psidium guajava* produce substances inhibitory to plant growth, showed that they were inhibitory to root growth and seed germination of test plants (lettuce and bristly foxtail). Fractionation of the exudates revealed that neutral and acidic fractions were inhibitory, but the basic fraction had no effect.

42. **Buskin de M., N. 1987. *Anastrepha* fruit flies in Venezuela. FONAIAP Divulga - Fondo Nacional de Investigaciones Agropecuaries (Venezuela) 23:22-24. [in Spanish]**

Species of the fruit fly genus *Anastrepha* were reported as pests of crops in Venezuela. This article listed 50 host plants, including *Psidium* spp., and methods to control the flies.

43. **Butani, D. K. 1974. Insect pests of fruit crops and their control. II. Guava. Pesticides 8(11):26-30.**

This article listed insect pests of cultivated guava and methods to control them. The major pests in India included scale insects, fruit flies, bark-eating caterpillars, and castor capsule borer. Minor pests included mealy bugs, stem boers, anar butterfly aphid, cockchafer beetles, gray weevils, mites, birds, and other animals.

44. **Buwalda, J., and D. van der Wal. 1989. Population genetics in strawberry guava (*Psidium cattleianum*). Unpublished report of a study sponsored by R. Manshardt and M. Aradhya, University of Hawai'i, Honolulu. 24 pp.**

Starch gel electrophoresis was used to analyze 760 trees from 32 wild *Psidium cattleianum* populations from O'ahu, Hawai'i, Moloka'i, and Kaua'i. Three major isozyme phenotypes were found, and there was a lack of variation among specimens within each isozyme phenotype. The authors suggested that this was caused by an apomictic reproductive system, and that the lack of genetic variability could provide a vulnerability to help eradicate the species.

In accordance with the work of Hirano and Nakasone (1969b), *Psidium cattleianum* var. *cattleianum* was described as heptaploid with $2n=7x=77$. The odd ploidy level with too many chromosomes may often result in the production of aneuploids in the progeny if reproduction was sexual. Progenies raised from seed were genetically uniform, indicating the possibility of asexual seed production through apomixis. The

yellow types of strawberry guava (i.e., P. *cattleianum* var. *lucidum*) were reported as hexaploid with 2n=66 by Hirano and Nakasone 1969a & b), but as octaploid by Atchison (1947) and Smith-White (1948). These probably represent types "B" and "A", of P. *cattleianum* var. *lucidum*, respectively. The "B" type was found more prevalent on the islands of Hawai'i, Maui, and Kaua'i, with only a few individuals on the island of O'ahu. The "A" type was found on the islands of Kaua'i, Moloka'i, and O'ahu.

The authors reported that in its native home, strawberry guava is attacked by the insects *Pyrrophyge charybdis, Aleurodes cokerillae,* and *Stenoma albella.*

**45. Campbell, C. W. 1980. Susceptibility of *Psidium guajava* selections to injury by *Cephaleuros* sp. Plant Disease 64(11):1010-1011.**

*Psidium guajava* was reported susceptible to infection by a pathogenic green alga, *Cephaleuros* sp., which caused lesions on leaves, reducing photosynthesis and injuring foliage.

**46. Carnevali, A. 1976. The guava. Frutticoltura 38(12):29-33. [in Italian]**

Requirements for cultivation of *Psidium cattleianum* as a fruit crop, especially in Italy, were outlined.

**47. Castro, H. A. de, T. L. Drugner, C. H. F. Ideriha, M. S. C. Cappello, and A. B. Marchi. 1983. Cross inoculation of *Eucalyptus*, guava (*Psidium guajava*) and rose apple (*Syzygium jambos*) with *Puccinia psidii*. Fitopatologia Brasileira 8(3):491-498. [in Portuguese]**

Results of inoculation of the rust fungus *Puccinia psidii* from one species to another of three myrtaceous genera, including *Psidium guajava*, were compared in this study in Brazil. Each of the three hosts became infected, but some degree of specificity was also detected.

**48. Cattley, W. 1821. Account of a new *Psidium*. Transactions of the Royal Horticultural Society 4(t.11):315-317.**

*Psidium cattleianum* was originally described, being named for William Cattley. (original reference not seen.)

**49. Cavalcante, P. 1974. Frutos comestíveis da Amazônia. Avulsas, Museu Emílo Goeldi 2(27):27-30. [in Portuguese]**

Edible fruits of the Amazon were described, including *Psidium acutangulum, P. guajava,* and *P. guineensis.*

**50. Chand, J. N., P. C. Gupta, and R. L. Madaan. 1986. Diseases of guava, ber and phalsa in India. Pp. 235-261, *In*: Heywood, W. H., and J. McNeil (eds.),**

**Review of Tropical Plant Pathology, Vol. 2. Today and Tomorrow's Printers and Publishers, New Delhi, India.**

Diseases of three fruit crops in India, including *Psidium guajava*, were described. (original reference not seen.)

51. **Chattopadhyay, S. B. , and S. K. Bhattacharyya. 1966. Physiological studies on incitants of guava wilt *Fusarium solani* (Mart.) App. and Wr. emend Snyder and Hansen and *Macrophomina phaseoli* (Maubl.) Ashby. Indian Journal of Mycological Research 4(1&2):22-31.**

Studies were conducted of *Fusarium solani* and *Macrophomina phaseoli*, the reported incitants of guava wilt disease in West Bengal, India, to determine the effect of different factors on growth and reproduction. Optimum pH of both fungi was found to be 6.0. Optimum temperature for growth and sporulation of *F. solani* was between 25° and 30° C. That of *M. phaseoli* was 35° C. The optimum soil moisture for *F. solani* was 60% saturation, and was 40% for *M. phaseoli*. Growth of both fungi was reduced with increase or decrease in the moisture content.

52. **Chattopadhyay, S. B., and S. K. S. Gupta. 1955. Studies on wilt of *Psidium guajava* L., in West Bengal. The Indian Journal of Horticulture 12(2):76-79.**

Both *Rhizoctonia* sp., identified as *R. bataticola*, and *Fusarium* sp., identified as *F. solani*, were isolated from diseased guava plants and found capable of producing wilt in certain parts of West Bengal. The disease was considered a serious problem in commercial plantings. New seedlings or grafts planted in disease-prone areas showed stunted growth, rarely flowered, and often succumbed to the disease within a short time. Other guava diseases reported from India are *Fusarium* wilt caused by *F. oxysporum* f. *psidii* and a condition characterized by intraveinal chlorosis and dieback of leaders associated with zinc deficiency.

53. **Chezhiyan, N. 1988. Stigma receptivity, flower shedding, flower abnormality and pollination studies in *Psidium* sp. Madras Agricultural Journal (India) 75(1-2):29-32.**

This paper reported a study of stigma receptivity, flower shedding, flower abnormality, and pollination of *Psidium guajava*, *P. cujavillus*, *P. pumilum*, *P. polycarpum*, *P. cattleianum*, *P. cattleianum* var. *lucidum*, *P. molle*, and *P. friedrichsthalianum*.

54. **Chezhiyan, N., and C. Shanker. 1983. Fruit setting parthenocarpy flower and fruit drop in guava and its relatives. Progressive Horticulture 13(3):195-199.**

Several species of *Psidium*, including *P. guajava*, *P. cujavillus*, *P. pumilum*, *P. polycarpum*, *P. cattleianum*, *P. molle*, and *P. friedrichsthalianum*, were assessed for fruiting behavior.

55. **Chia, C. L., T. Tanaka, N. P. Kefford, I. G. Morison, and W. T. Harada (eds.). 1982. Guava industry analysis number 3. College of Tropical Agriculture and Human Resources, University of Hawai'i, Honolulu.**

This report covered current trends in insect, disease, and weed control in commercial guava operations in Hawai'i.

56. **Chippendale, G. M. 1990. *Eucalyptus*. Pp. 948-959, *In*: Wagner, W. L., D. R. Herbst, and S. H. Sohmer (eds.), Manual of the flowering plants of Hawai'i. University of Hawai'i Press and Bishop Museum Press, Honolulu.**

Although all but two of the approximately 600 species of *Eucalyptus* are endemic to Australia, 30 of the species have become naturalized in Hawai'i and as such represent a significant portion of the family Myrtaceae (to which guava also belongs) in Hawai'i.

57. **Chitarra, M. I. F., A. B. Chitarra, and V. D. Carevalho. 1981. Algumas características dos frutos de duas cultivares de goiabeiras (*Psidium guajava*, L.) em fase de maturação. (Ripening and maturation characteristics of fruit of two cultivars of guava (*Psidium guajava*, L.) Pp. 771-780, *In:* Congresso Brasileiro de Fruticultura, VI. Recife, Anais. SBF. [in Portuguese]**

The ripening curves of fruit of two cultivars (IAC-4 and Guanabara) of guava *(Psidium guajava)* were examined to determine the optimum time for harvest, and cultivars were selected with seed characteristics acceptable for fresh consumption and commercial production.

58. **Chiu, H.-T. 1990. Ethyl benzoate: An impact ovipositional attractant of oriental fruit fly, *Dacus dorsalis* Hendel. Chinese Journal of Entomology 10(4):375-388. [in Chinese]**

Active compounds were extracted from *Psidium guajava* fruit which attract the oriental fruit fly. Ethyl benzoate was found to be an ovipositional attractant to the insect.

59. **Clark, W. E. 1989. *Lonchophorellus* Clark, a new genus of neotropical Anthonomini (Coleoptera: Curculionidae). Coleopterist's Bulletin 43(3):279-289.**

*Lonchophorellus scylla*, a beetle which subsists on *Psidium cattleianum* in Brazil and Peru, was described.

60. **Cobley, L. S. 1976. An introduction to the botany of tropical crops. Longmans, Green and Co., London.**

*Psidium guajava* was described as a fruit crop native to Central America but is now found in all parts of the tropics. The seeds retain their viability for some time and are

easily spread by birds. The plants grow well in a variety of soil types and need little attention. The hardiness and drought resistance of guava have made this a common fruit in most tropical countries. In some parts of the world it has spread so extensively as to become almost a weed. Guava fruit is an excellent source of Vitamin C and also has Vitamin A, iron, calcium, and phosphorus. *Psidium cattleianum* was described as a smaller, bushier tree than *P. guajava*, with smaller dark red fruit known as strawberry guava. This species was stated to offer considerable possibilities for improvement as a fruit crop.

61. **Contin, L. F. 1972. Contribuição ao estudo anatômico de *Psidium hatschbachi* Legrand. (Contribution and study of the anatomy of *Psidium hatschbachi* Legrand.) Acta Biológica Paranaense 27(3/4):32. [in Portuguese]**

*Psidium hatschbachi* was described as a new species from southern Brazil. Anatomical studies were conducted of the roots, stems, and leaves, including petioles.

62. **Cook, A. A. 1975. Diseases of tropical and subtropical fruits and nuts. Guava: *Psidium guajava* L. Pp. 207-212. Hafner Press, a division of Macmillan Publishing Co., New York.**

Several diseases of common guava (*Psidium guajava*) in India were listed and described, and control measures were outlined. Guava twigs were affected by dieback, drying and defoliation associated with infection by the fungus *Hendersonula toruloidea*. The widespread fungus *Glomerella psidii* (*Gloeosporium psidii*) caused dieback symptoms od young shoots and fruit, and also caused necrotic leaf spots and fruit canker. Disease development was enhanced by high humidity. A less serious fruit canker or scab and leaf spot were also associated with *Pestalotia psidii*. More or less superficial blister-like lesions (also referred to as Kajji disease) resulted from the feeding puncture wounds of the capsid bug *Helopeltis antonii*, which were often associated with the above two fungi. *Fusarium* wilt, considered the most serious disease of guava in India, was reportedly confined to India. The causal fungus is *F. oxysporum* f. sp. *psidii*. Stylar end rot, a fruit disease caused by the fungus *Phomopsis* sp., was reported as infrequent. Algal leaf spot, caused by *Cephaleuros virescens*, leads to eventual death of leaf tissue. Fruit in all stages of development was also susceptible to infection by the alga, which produced largely superficial lesions and fruit cracks. Bark canker, caused by the fungus *Physalospora psidii*, and zinc deficiency were also reported as problematic in India.

63. **Corner, E. J. H. 1976. The seeds of dicotyledons. Vols. I & II. Cambridge University Press, Cambridge.**

This work provides detailed anatomical descriptions of the seeds of dicotyledonous plants, including those of *Psidium cattleianum* and *P. guajava* (Vol. I) and illustrates some of the anatomical distinctions between the seeds of these species (Vol. II).

64. **Corrêa, M. P. 1909. Flora do Brazil. Typographia da Estatistica, Rio de Janeiro. [in Portuguese]**

In his Flora of Brazil, the author listed, described, and outlined the range of *Psidium littorale* with the common name "araçá da praia", *P. incanescens*, with the common name "araçá felpudo", and *P. guayava*, with the common name "goyabeira branca".

65. **Cronquist, A. 1981. An integrated system of classification of flowering plants. Columbia University Press, New York.**

Distinguishing characteristics of the Myrtaceae were summarized. The family contains about 140 genera and 3,000 or more species in tropical and subtropical areas throughout the world as well as in temperate Australia. The two subfamilies are:

1. Myrtoideae, best developed in tropical America, usually with bilocular ovaries and baccate or sometimes drupaceous fruit, including *Eugenia* (600 species), *Myrcia* (300 species), *Syzygium* (over 200 species), and *Psidium* (100 species).
2. Leptosperomoideae, best developed in Australia, Malaysia, and Polynesia, usually with capsular and multiseeded or nutlike and one-seeded fruits. The subfamily is represented by *Eucalyptus* (500 species), *Heteropyxis* (3 species), and *Melaleuca* (100 species). *Heteropyxis* is sometimes separated into a third subfamily. The genus *Metrosideros*, represented in Hawai'i by the most prevalent native tree, *M. polymorpha,* was not mentioned in this discussion.

66. **Cuadra, R., and A. Quincosa. 1982. Potential of different *Psidium* species as sources for resistance of guava to *Meloidogyne*. Ciencias de la Agricultura 13:19-26. [in Spanish]**

*Psidium cattleianum*, *P. molle*, *P. guineensis*, and *P. guayabita* were highly susceptible to nematodes of the genus *Meloidogyne*. *Psidium friedrichsthalianum* and grafts of *P. guajava* onto it were highly resistant. Several species of *Meloidogyne* were parasitizing *Psidium* plantations in Cuba.

67. **Cuddihy, L. W., and C. P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. University of Hawai'i Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu.**

This book, based on an extensive review of literature regarding Hawaiian vegetation, summarized the agents of change in the vegetation and the results that have been wrought by human influences. *Psidium cattleianum* has been in Hawai'i since 1825. Unlike *P. guajava*, which also has become naturalized but occurs mainly in disturbed forests at lower elevations, strawberry guava can invade intact, higher elevation native forests. The species produces high numbers of viable seeds, but increase in area covered is mostly through suckering, which produces monotypic stands. Feral pigs feed on the fruits and disseminate seeds. They also disturb the soil, which encourages further invasion by the plant. Herbicidal applications are helpful but in heavily infested areas are not practical. Common guava is a commercial crop, so biological control was thought to be unlikely for economic reasons, but some insects showing

apparent preference to strawberry guava have been found in Brazil (citing Hodges 1988).

68. **Da Ponte, J. J., J. W. V. Lemos, F. E. De Castro, and L. Maria. 1976. Behavior of the tropical fruit plants in relation to the root-knot nematodes. Fitopatologia Brasileira 1(1):29-33. [in Portuguese with English summary]**

The response of 22 tropical fruit plants, including *Psidium guajava*, to the nematode species *Meloidogyne incognita, M. incognita,* and *M. hapla* was evaluated under greenhouse conditions in Brazil. Guava was among those apparently not infected as determined by visual inspection for root galls following inoculation. *Passiflora edulis* was among the fruit crops showing susceptibility.

69. **Das, G. P. 1990. Biology of *Dasychira mendosa* Hubner (Lymantriidae: Lepidoptera): Polyphagous pest in Bangladesh. Bangladesh Journal of Zoology 18(2):147-156.**

The biology of *Dasychira mendosa*, an insect pest of several plants in India, including *Psidium guajava*, was assessed in this laboratory study.

70. **Das Gupta, S. N., and J. N. Rai. 1947. Wilt disease of guava (*Psidium guyava* L.). Current Science 16(8):256-258.**

A wilt disease of common guava, then given as *Psidium guyava*, had been observed for several years at Lucknow, India, at the time of writing. The disease was reported to be rapidly becoming a menace to orchard owners. The symptoms were essentially the same as those described for other wilt diseases of vascular plants, resulting from root infection. Isolations from roots of affected plants yielded a prevalence of *Fusarium*, and subsequent seedling inoculation tests indicated strongly that this pathogen was the causal agent of the disease.

71. **Dawson, J. W., and L. Stemmermann. 1990. *Metrosideros*. Pp. 964-970, *In*: Wagner, W. L., D. R. Herbst, and S. H. Sohmer (eds.), Manual of the Flowering Plants of Hawai'i. University of Hawai'i Press and Bishop Museum Press, Honolulu.**

The genus *Metrosideros* was described as containing about 50 species from the Philippines through New Guinea and New Caledonia to New Zealand and out to the high volcanic islands of the Pacific. One outlying species occurs in South Africa. All five species of *Metrosideros* occurring in Hawai'i are endemic. The genus is of extreme importance in Hawaiian forests and as a member of the Myrtaceae, must be considered in any discussion of biocontrol of members of this family, such as strawberry guava.

72. **Decker, H. 1970. Further observations concerning the occurrence of parasitic nematodes in plants in Cuba. Wissenschaftliche Zeitschrift, Universität Rostock. Reihe Mathematik/ Naturwissenschaft 19(8):571-576.**

*Psidium cattleianum* was reported as one of the hosts of parasitic nematodes in Cuba.

73. **Decker, S. 1972. Fruticultura Brasileira. (Culture of Brazilian fruits.) EDANEE, São Paulo. Pp. 77, 143-146. [in Portuguese]**

The author presented an alphabetical list of Brazilian fruits, including *Psidium guajava* and other fruits called "araçá". Aspects of their botany, climatic requirements, and insects and disease organisms were described. Insects on guava included: *Conognatha magnifica*, *Polyrrhaphis grandini*, and *Ceratites capitata*. The rust fungus *Puccinia psidii* was mentioned in particular as a disease organism.

74. **Degener, O. 1945. Plants of Hawaii National Park illustrative of plants and customs of the South Seas. Edwards Brothers, Inc., Ann Arbor, Michigan.**

Degener described common guava (*Psidium guajava*), strawberry guava (*P. cattleianum*), and yellow-fruited strawberry guava (*P. cattleianum* var. *lucidum*), as three kinds of guava, each introduced, in Hawai'i National Park, which then included both Hawai'i Volcanoes and Haleakala National Parks. Common guava was probably introduced first to O'ahu by Don Francisco de Paula Marin, an early Spanish settler. At the time of writing, this species was found throughout the islands where it formed considerable thickets at lower elevations, although a few plants were known to occur within the park boundaries. The Sulphur Bank, near Kilauea Crater, was noted as apparently the highest elevation where common guava could live. The fruit was noted as one of the preferred foods of the Mediterranean fruit fly. Strawberry guava was described as more hardy than common guava and was more numerous at higher elevations, where the yellow-fruited variety also occurred. Both types of strawberry guava had acquired the Hawaiian name "waiawi", whereas the name of the common guava had been "corrupted into Hawaiian as 'kuawa'."

75. **Devine, W. T. 1977. A programme to exterminate introduced plants on Raoul Island. Biological Conservation 11(3):193-207.**

Raoul Island was described as a 2,938-hectare subtropical island under the jurisdiction of New Zealand. *Psidium littorale* (=*P. cattleianum*) and *P. guajava* were reported as alien pests on the island, and attempts to control them had been made with various herbicides. Tordon 2G granules in diesel oil was applied to cut stumps with variable results, but less than 50% success preventing resprouting.

76. **Diong, C. H. 1982. Population biology and management of the feral pig (*Sus scrofa*) in Kipahulu Valley, Maui. Unpublished Ph.D. dissertation, University of Hawai'i, Honolulu.**

This study of the population biology of feral pigs in Kipahulu Valley, Maui, showed that pigs utilize *Psidium cattleianum* fruit, which made up a major portion of their diet, only being exceeded by treefern. *Psidium cattleianum* was found in pig stomach contents for 8 months of the year, with highest percentages from September to December. Pig coats were combed and seeds found there germinated, but few strawberry guava seedlings resulted. Pig fecal matter from the field was planted to

assess seed contents, but few strawberry guava seedlings resulted. After fecal matter was washed, seeds were extracted and examined for scarification. Few seeds were significantly damaged. Stomach acids may help in leaching out inhibitory substances in the seed coat, however. Pigs may be building up a strawberry guava seed bank in the soil, which could be further dispersed through rainwash. Strawberry guava is dispersed mainly by birds and bats in Brazil, and birds help disperse the seeds in Hawai'i as well.

77. **Dube, H. C., and K. S. Bilgrami. 1966a. Morphology of the fruiting pustules in the genus *Pestalotia*. Mycopathologia et Mycologia Applicata 28(4):305-311.**

Common guava was listed as one of six hosts of *Pestalotia* representing fruit-producing trees of India. The morphology of the fruiting pustules was investigated, which were reported to develop mostly on the upper leaf surface, were crumpent, dome-shaped, superficial, resembling a typical acervulus.

78. **Dube, H. C., and K. S. Bilgrami. 1966b. *Pestalotia* or *Pestalotiopsis?* Mycopathologia et Mycologia Applicata 29(1&2):33-54.**

Morphology of the species of *Pestalotia* occurring on several hosts in India, including common guava, was examined in light of the suggestion that the fungus may actually belong to *Pestalotiopsis*, as defined to accommodate those fungi with 5-celled conidia. The isolate from guava reportedly did not resemble any of the available descriptions in detail of conidial morphology.

79. **Dwivedi, B. K., S. K. Malhotra, and S. L. Misra. 1987. Population of ectoparasites as influenced by certain edaphic factors in sub-humid regions around rhizosphere of certain fruit crops. Journal of Soil Biology and Ecology 7(1):7-19.**

Immediately after the rainy period the reproductive activity of the nematode *Tylenchorhynchus brassicae* around *Psidium guajava* roots was found to increase.

80. **Dwivedi, R. S., and R. R. Pandey. 1984. Studies on the wilt disease of guava (*Psidium guajava* L). Proceedings of the Seventy-First Session, Indian Science Congress Association, Part-III. Abstracts. Pp. 39-40.**

Trees in guava orchards of Varanasi Division, India, were found to be severely affected by wilt disease, with an average loss estimated at about 20%. Orchards showing 70% to 80% infection were not uncommon. A species of *Fusarium* was isolated from roots of diseased trees and its pathogenicity was tested against guava seedlings, with positive results. Root sections of inoculated plants revealed mycelial growth inside xylem vessels. Chlamydospores characteristic of *Fusarium* also were reportedly produced by the pathogen inside xylem vessels, causing plugging of the vascular bundles.

81. **Dwivedi, S. K. 1993. Soil solarization adversely affects some fungal pathogens causing wilt disease of guava (*Psidium guajava* L.). Soil Biology and Biochemistry**

**25(11):1635-1636.**

The author described the effects of soil solarization in reducing the population densities of three pathogenic fungi, *Fusarium oxysporum* f. sp. *psidii*, *F. solani*, and *Rhizoctonia solani* which cause serious wilt diseases of guava in India.

82. **Dwivedi, S. K., R. C. Mishra, and R. S. Dwivedi. 1988. Incidence of wilt disease of guava (*Psidium guajava* L.) in Varanasi, India. International Journal of Tropical Plant Diseases 6(2):213-216.**

The pathogenic fungi *Fusarium solani, F. longipes, F. moniliforme, F. oxysporum* f. sp. *psidii, Macrophomina phaseolina*, and *Rhizoctonia* sp. were reported to cause wilt disease of varieties of common guava in the area of Varanasi, India.

83. **Edward, J. C. 1960a. Wilt disease of guava. The Allahabad Farmer 34(5):289-293.**

The author reported and described a serious wilt disease of cultivated guava in the Uttar Pradesh region of India. In and around Allahabad, the disease was reportedly so devastating that guava orchards observed were sometimes completely destroyed. Symptoms included yellowing, drying, and shedding of leaves from the tree top downwards, followed by drying of branches in succession, resulting in the ultimate death of the entire tree. The period between onset of symptoms and death of the tree varied between 1 month to about 2 years. Young, as well as old trees were attacked. The disease was reported to by caused by a soil-borne fungus which penetrates the fine roots and establishes itself in the vascular tissues of the root, from which it advances into the vascular tissue of the stem. A toxin is produced by the fungus, which is responsible for the yellowing of leaves. The fungus may remain viable in the soil for long periods, making eradication impractical. Selecting resistant varieties of guava was suggested as the best approach toward the control of the wilt disease.

84. **Edward, J. C. 1960b. Variation in the guava wilt pathogen, *Fusarium oxysporum* f. *psidii*. Indian Phytopathology 13:30-36.**

Several isolates of the guava wilt fungus, *Fusarium oxysporum* f. *psidii*, were tested for pathogenicity on guava seedlings. It was concluded that the fungus exists in a variety of clonal forms that differ in pathogenicity and in morphological and cultural characteristics. No correlation was observed between cultural characteristics and pathogenicity.

85. **Edward, J. C. 1960c. Penetration and establishment of *Fusarium oxysporum* f. *psidii* in guava root. Indian Phytopathology 13:168-171.**

In experiments to determine the method of penetration and establishment of the guava wilt fungus, *Fusarium oxysporum* f. *psidii* in guava roots, guava seedlings were root-dip inoculated with spore suspensions of the fungus and root tissues subsequently examined histologically. It was determined that root hairs were not penetrated by the fungus. Direct penetration of the tap root by germinating individual spores, and *en*

*mass* penetration of the piliferous layer of tap roots by germ tubes of several spores were observed. Also, natural breaks in the piliferous layer caused by emergence of young secondary roots provided openings for entry by hyphae. Invasion of hyphae in secondary roots produced characteristic vascular discoloration.

86. **Edward, J. C. 1961. Root-stock trials for guava wilt control. The Allahabad Farmer 35(1):5-8.**

Wilt disease of guava caused by *Fusarium oxysporum* f. *psidii* was reported as the most serious of the diseases to which guava is susceptible. It often limited the cultivation of guava in Uttar Pradesh (India). The fungus is soil borne and attempts to control the disease over a decade had not been successful. Use of resistant root-stock was considered the only practical approach to control. Observations had indicated that all the varieties of guava in use in the region were susceptible, except the seedless variety. However, guava relatives, including *Psidium cattleinaum* var. *lucidum* (strawberry guava) and *Syzygium cuminii* reportedly had never been observed to be attacked by the disease. Inoculation experiments subsequently demonstrated that seedlings of *S. cuminii* were immune, but seedlings of strawberry guava were not available for testing. Variety 'Safeda' of common guava was successfully grafted to strawberry guava as the root-stock, demonstrating compatibility, and optimism was expressed that this graft combination "in all probability would be immune to wilt disease."

87. **Edward, J. C., and G. Shanker. 1964. Root-stock trial for guava (*Psidium guajava* L.). The Allahabad Farmer 38(6):249-250.**

*Syzygium cumminii, Lagerstroemia indica, Psidium cattleianum* (also as *P. molle*), *P. guianense,* Chinese guava (probably *P. friedrichsthalianum),* and wild Philippine guava were found to be resistant to *Fusarium* wilt of guava. In trials to assess their usefulness as rootstock material in wilt-infested plots, Chinese guava in particular was reported as being compatible with scions tests and of potential usefulness in combating the wilt disease.

88. **Edward, J. C., and R. N. Srivastava. 1957. Studies on guava wilt. The Allahabad Farmer 31(6):144-148.**

The guava wilt disease, caused by the soil-borne fungus *Fusarium oxysporum* f. *psidii*, was reported as perhaps the most serious disease of common guava, threatening its cultivation as a fruit crop in India. Although at the time of writing studies on guava wilt had been underway for about 3 years, no results had been obtained which were applicable to possible control approaches. Surveys of wilt severity in various orchards, and pathogenicity of isolates of *Fusarium* from these sites in the area of Kanpur were reported.

89. **Edward, J. C., Z. Naim, and G. Shanker. 1964. Canker and fruit-rot of guava (*Psidium guajava* L). The Allahabad Farmer 38(2):59-61.**

Several canker and fruit-rot diseases were reported from Uttar Pradesh, India, an areas of approximately 70,000 acres. Diseases to which guava is susceptible in India were listed as follows: Canker, caused by *Pestalotia psidii* reported from Bombay and Mysore; *Colletotrichum psidii* associated with mummified fruit in Uttar Pradesh; fruit canker associated with *Glomerella psidii*. Stylar end rot, caused by *Phomopsis*; fruit rot caused by *Botryodiplodia* sp. The authors further described symptoms of canker and fruit rot diseases caused by the above named fungi and reported experiments to determine relative susceptibility of guava varieties important in India.

**90. Engstrand, L. 1981. Guava (*Psidium guajava*). Svensk Botanisk Tidskrift 71(1):47-50. [in Swedish]**

Fruit of common guava (*Psidium guajava*) and strawberry guava (as *P. littorale*, synonym: *P. cattleianum*), were described and illustrated in color, as were blossoms of *P. littorale* var. *lucidum*. Other species of *Psidium*, including *P. pyriferum* and *P. pomiferum* were mentioned, as were P. friedrichsthalianum, *P. araca, P. microphyllum,* and *P. sartorianum*. Descriptions of the family Myrtaceae and of other prominent genera within the family, including *Eucalyptus, Syzygium,* and *Eugenia* were also provided. The article was written entirely in Swedish, making specific annotation difficult; however, the main thrust appeared to be the introduction and description of guava and its relatives as plants of botanical interest and/or as fruit crops. Insect predators or diseases were not discussed.

**91. Everett, T. H. 1981. The New York Botanical Garden illustrated encyclopedia of horticulture. Garland Publishing, New York.**

The genus name *Psidium* was adapted from "psidion", the classical Greek name of the pomegranate. Strawberry guava was reported as the hardiest species of the genus.

**92. Farr, D. F., G. F. Bills, G. P. Chamuris, and A. Y. Rossman. 1989. Fungi on plant and plant products in the United States. American Phytopathological Society Press, St. Paul, Minnesota.**

*Cercospora psidii* (Hyphomycetes) occurs on *Psidium* in Florida (type from Brazil), *Limaciniella psidii* (Loculoascomycetes) occurs on *Psidium* in Hawai'i, *Phyllosticta psidiicola* (Coelomycetes) occurs on *Psidium* in Hawai'i (type from Hawai'i), *Phomopsis psidii* (Coelomycetes) occurs on *Psidium* in Hawai'i and India, and *Sphaceloma psidii* (Coelomycetes) occurs on *Psidium* in Florida and Brazil.

The following Oomycetes were reported on species of *Psidium*:
*Phytophthora cinnamomi*, causing root rot, on *P. cattleianum* in Hawai'i.
*Phytophthora citricola*, causing fruit rot, on *Psidium guajava* in Hawai'i.
*Pythium* sp., causing root rot, on *P. guajava* in Florida.

The following Zygomycetes were reported on species of *Psidium*:
*Mucor hiemalis*, causing soft rot, on *P. guajava* in Hawai'i.
*Rhizopus stolonifer*, causing blossom-end and fruit rots, on *P. guajava* in Hawai'i.

The following Ascomycetes have been found on species of *Psidium*:
*Botryosphaeria dothidea*, causing twig dieback and brown rot of fruit, on *P. guajava* in Florida and Hawai'i.
*Botryosphaeria ribis* on limbs of *P. guajava* in Florida and Hawai'i.
*Diaporthe* sp. on limbs of *P. guajava* in Hawai'i.
*Glomerella cingulata*, causing fruit anthracnose, on *P. guajava* in Florida, Hawai'i, and Texas and on *P. cattleianum* in Florida.
*Guignardia* sp., causing blossom-end rot,on *P. guajava* in Hawai'i.
*Limaciniella psidii*, *Orbilia leucostigma*, *Seuratia globifera*, and *Trichothyrium reptans* have been found on leaves of *P. cattleianum* in Hawai'i.

The following Basidiomycetes on species of *Psidium*:
*Armillaria tabescens*, causing root rot, on *P. guajava* and *P. cattleianum* in Florida.
*Auricularia auricula*, *Crepidotus alabamensis*, *C. nephrodes*, and *Earliella scabrosa* on *P. guajava* in Hawai'i.
*Cyptotrama asparata* on branches of *Psidium* sp. in Hawai'i.
*Pellicularia koleroga*, causing thread blight, on *P. guajava* in Florida.
*Trametes versicolor*, causing wound rot, *P. guajava* and *Psidium* sp. in California.

The following Deuteromycetes have been found on species of *Psidium*:
*Alternaria citri*, causing fruit decay, on *P. guajava* and *Psidium* sp. in California.
*Alternaria* sp., causing leaf spot, on *P. guajava* in Florida.
*Atichia solaridiscoidea* on leaves of *P. cattleianum* in Hawai'i.
*Cercospora psidii*, causing leaf spot, on *P. guajava* in Florida.
*Colletotrichum gloeosporioides*, causing anthracnose, on *P. guajava* at an unknown location and in Florida and on *P. cattleianum* in Florida.
*Coryneum umbonatum*, causing stem canker,on *P. guajava* in Florida.
*Fusarium* sp., causing root rot,on *P. guajava* in Florida.
*Gliocephalotrichum bulbilium* on decaying wood of *P. guajava* in Hawai'i.
*Phoma* sp., causing blossom-end and fruit rots, on *P. guajava* in Florida and Hawai'i.
*Phomopsis psidii*, causing fruit spot, on *P. guajava* in Hawai'i.
*Phomopsis* sp., causing leaf spot, *P. guajava* in Florida.
*Phyllosticta psidiicola* on fruits of *P. guajava* in Hawai'i.
*Phymatotrichopsis omnivora*, causing root rot at an unknown location on *P. guajava*.
*Rhizoctonia solani*, causing thread blight, on *P. guajava* in Florida.
*Rhizoctonia* sp., causing root rot, on *P. guajava* in Hawai'i.
*Sphaceloma psidii*, causing spot anthracnose, on *P. guajava* in Florida.
*Triscelophorus monosporus* on leaf litter of *P. guajava* and *P. cattleianum* in Hawai'i.

**93. Fawcett, W., and A. B. Rendle. 1926. Flora of Jamaica. British Museum, London.**

Species of *Psidium* included among the flora of Jamaica were *P. guajava* (which was illustrated), *P. uine*gesnse, *P. montanum*, *P. albescens*, and *P. harrissianum*. Mention was made of *P. cattleianum*, which was described as "purple guava" a cultivated species and native of Brazil.

94. **Fernandes, G. W. 1987. Gall forming insects: Their economic importance and control. Revista Brasileira de Entomologia 31(3):379-398.**

The author listed common gall forming insects of interest to forestry and agriculture in Brazil. Those of economic importance to guava (*Psidium guajava*) were included.

95. **Ferreira, M. B. 1972. Gabirobas, pitangas e araçás. (Edible fruits of the genus *Psidium.)* Cerrado, Brasília 5(18):11-15. [in Portuguese]**

Edible fruits of Cerrada, Brazil, were listed, including those of the genus *Psidium*, with seven species: *P. bergiana, P. aerugineum, P. gardneriana, P. decussatum, P. grandifolium, P. incanescens* and *P. firnum. Psidium firnum* Berg was also described as a new species.

96. **Ferreira, M. B. 1973. Babirobas, araçás, amoreiras ecajús. (Edible fruits of the genus *Psidium.)* Cerrado, Brasília 5(19):25-29. [in Portuguese]**

Native plants of Cerrado, Brazil, including *Psidium bergianum,* were described.

97. **Ferri, M. G. 1971. Informaços es sobre transpiração e anatomia foliar de diversas mirtáceas. (Information on transpiration and foliar anatomy of several Myrtaceae.) Ciência e Cultura 23(3):313-316. [in Portuguese]**

The author discussed the behavior of several species of the Myrtaceae with regard to water relations and leaf anatomy. *Psidium guajava* and *P. multiflorum* were studied in particular.

98. **Fletcher, T. B. 1977. Some South Indian insects and other animals of importance considered especially from an economic point of view. M/S Bishen Singh Mahendra Pal Singh, Publ., Dehra Dun.**

The scale insect *Pulvinaria psidii* was reported to attack leaves of common guava in southern India, as well as *Ficus glomerata, Lagerstroemia lanceolata,* mango, loquat, and occasionally coffee. The author noted that when it occurred in large numbers such host trees may be greatly weakened or killed.

99. **Fosberg, F. R. 1941. Varieties of the strawberry guava. Proceedings of the Biological Society of Washington 54:179-180.**

In 1941, Fosberg considered *Psidium littorale* to be the correct name for strawberry guava. He also named the yellow-fruited plant *P. littorale* Raddi var. *lucidum* (Degener) Fosberg, and named another variety *P. littorale* var. *longipes*.

100. **Fosberg, F. R. 1962. Miscellaneous notes on Hawaiian plants -- 3. Occasional Papers of Bernice P. Bishop Museum 23(2):29-44.**

An earlier published name for strawberry guava was accepted here, and a new varietal

combination was published as follows:

*Psidium cattleianum* Sabine var. *cattleianum* f. *cattleianum*, for the red-fruited plant;

*P. cattleianum* var. *cattleianum* f. *lucidum* Degener, for the yellow-fruited plant;

*P. cattleianum* var. *littorale* (Raddi) Fosberg comb. nov. for the plant with long, narrow, translucent yellow fruits.

**101. Fosberg, F. R. 1971. *Psidium* (Myrtaceae) in Ceylon. Ceylon Journal of Science, Biological Science 9(2):58-60.**

A study of species of *Psidium* found in Sri Lanka was reported and a key provided. The original publication of *P. cattleianum* was by Sabine (Transactions of the Horticultural Society 4:31-317, t.11) in 1822. A synonym is *P. littorale*, published by Raddi (Opuscoli Scientifici 4:254, t.7, f.2) in 1822 or 1823. Common names given were Chinese guava or strawberry guava.

**102. Fosberg, F. R. 1972. Field guide to excursion III. 10th Pacific Science Congress, Honolulu, Hawai'i. Revised Edition. Published by the University of Hawai'i and Hawaiian Botanical Gardens Foundation, Inc.**

In his descriptions of the principal terrestrial ecosystems of Hawai'i, the author included *Psidium guajava* forest and scrub as follows:

"One of the commonest vegetation types in moist to wet areas at moderate to low elevations in the islands is a dense solid stand of the guava, introduced many years ago for its edible fruits and scattered by birds and pigs. It is now likely to be found almost anywhere below middle altitudes where vegetation on moist or wet land has been disturbed sufficiently to permit its establishment. Spreading and reproducing very rapidly from root sprouts, it is extremely difficult to eradicate. The trees are generally crooked, and diffusely branched, with smooth trunks and branches, and broad thin leaves. Their height, up to 10 m or more, seems almost in direct proportion to the available moisture, though guava spreads so rapidly that there are frequently areas of scrub stature that will develop into forest. In places there is an admixture of *Schinus terebinthifolius* and of *Leucaena leucocephala*. The ground is likely to be covered by *Commelina diffusa, Oplismenus hirtellus, Paspalum conjugatum,* or various ferns to a density more or less inversely proportional to that of the guava canopy. There is often an alternation between guava forest and *Aleurites* forest on slopes, with the *Aleurites* in the bottom of draws and gullies. It has principally replaced koa, mixed mesophytic, and mixed lowland forests."

In his description of *Psidium cattleianum* forest, Fosberg noted:

"In many wet or moist areas, especially in koa, lehua, and mixed lowland forest, *Psidium cattleianum* (strawberry guava), or in places, a related species, *P. littorale* (waiwi), has gained a foothold or been planted. *P. cattleianum*, especially, tends to spread rapidly and to form almost pure thickets or forests. It is well adapted

to growth in the wet forrest and its seeds are spread by birds and pigs. Structurally this type is about the same as the *Psidium guajava* forest, but the leaves are thicker and glossy, darker green. Where *P. littorale* is dominant the trunks are distinctly taller and straighter. Many shade tolerant species are able to establish themselves in this type..., and *Psidium littorale* is, by some, regarded as a valuable "nurse tree" in the process of restoring to abundance some of the native forest plants."

**103. Fosberg, F. R. 1988. Unpublished letter to Charles S. Hodges, dated June 6, 1988, regarding varieties of *Psidium cattleianum*.**

In response from the Smithsonian Institution's National Museum of Natural History to an inquiry concerning the current taxonomic placement of the forms and varieties of *Psidium cattleianum* Fosberg indicated that there still may be some confusion regarding the kinds of strawberry guava in Hawai'i, since some uncertainty exists as to which name should be applied to which plant even in their native habitat. Fosberg stated that he had previously accepted both *P. cattleianum* and *P. littorale* as legitimate names for distinctly different plants. However, based on information furnished by Hodges resulting from his recent expedition to Brazil in search of potential biocontrol agents for *P. cattleianum*, all previous names given to strawberry guava may be incorrect, and that the two plants introduced to Hawai'i may be without legitimate names. Hodges had also found the guava relative *P. longipetiolatum* in Brazil and inquired whether specimens of this species were available at the National Museum of Natural History. Fosberg replied that only one specimen of *P. longipetiolatum* was of file, which was definitely not the yellow-fruited plant from south-east O'ahu.

**104. Fujii, J. K., and H. A. Yoshida. 1981. Developmental biology of *Anua indiscriminata* in the laboratory. Proceedings of the Hawaiian Entomological Society 23(30):345-350.**

*Anua indiscriminata*, the guava moth, was found in Assam, Sri Lanka, and the Philippines. It was first reported in Hawai'i on O'ahu in 1974 and, at the time this article was written, had been found on all the islands except Moloka'i. Its larvae have been recorded as feeding on *Psidium cattleianum* and *P. guajava* in Hawai'i. Other recorded hosts elsewhere include *Eucalyptus*, *Carea*, and other Myrtaceae. It was reportedly a potential major defoliator of trees. This study characterized the moth's life cycle.

**105. Gagné, W. C., and L. W. Cuddihy. 1990. Vegetation. Pp. 45-114, *In*: Wagner, W. L., D. R. Herbst, and S. H. Sohmer, Manual of the flowering plants of Hawai'i, University of Hawai'i Press and Bishop Museum Press, Honolulu.**

In this section on vegetation of the Hawaiian Islands in the state's most recent flora, guava forest was said to be possibly successional to native forest and to require continual disturbance to be maintained. *Psidium cattleianum* was listed as a component of the following forest types: Hala Forest (Coastal Mesic Forest), several types of Lowland Mesic Shrublands, 'Ohi'a Lowland Mesic Forest (where,

particularly in the Puna and Ka'u districts of the island of Hawai'i, strawberry guava was one of the primary invaders following fire), Koa Mesic Forest (Lowland Mesic Forest), Guava forest (Lowland Mesic Forest), 'Ohi'a Lowland wet Shrubland (where strawberry guava has invaded following pig disturbance), Alien Wet Forest (Lowland Wet Forest), and 'Ohi'a/Hapu'u Tree Fern Forest (Montane Wet Forest).

*Psidium guajava* was specifically listed as a part of the Christmas Berry Forest (Lowland Mesic Forest), 'Ohi'a/Lama Wet Forest (Lowland Wet Forest), and Alien Wet Forest (Lowland Wet Forest), Hala Forest (Coastal Mesic Forest), Lowland Mesic Shrublands, Papala Kepau/Papala Riparian Forest (Lowland Mesic Forest), Kukui Forest (Lowland Mesic Forest), Guava Forest (Lowland Mesic Forest).

Guava (*Psidium*) Forest (Lowland Mesic Forest) was reportedly dominated by *P. cattleianum* and *P. guajava* and occurred on all the main islands except Koho'olawe. This forest type seemed to be ecologically separated from other communities. Strawberry Guava Forest dominated disturbed slopes and broad ridges at lower elevations of the older islands and was common above 1,000 m on Hawai'i and Maui. Common Guava Forest may be the predominant type up to 450 m and may share dominance with strawberry guava or form monotypic stands on ravine floors. Both types of guava forest were found to form dense canopies, and their seedlings appear to be shade tolerant. The seeds are adapted to being eaten by mammals, and feral pigs help to disperse the seeds.

**106. Galli, F. 1980. Doenças da goiabeira - *Psidium guajava* L. (Diseases of guava - *Psidium guajava* L.). Pp. 335-337, *In*: Galli *et al.* (eds.), Manual de Fitopatologia. Ceres, São Paulo. [in Portuguese]**

Diseases of *Psidium guajava* (as 'goiabeira'), with emphasis on guava rust (*Puccinia psidii*) in Brazil, were described. Also mentioned were fruit diseases caused by the fungi *Phyllosticta* sp., *Colletotrichum gloeosporioides*, and *Sphaceloma psidii*; and the bacterium *Pseudomonas* sp.

**107. Galli, F., H. Tokeshi, P. C. T. Carvalho, E. Balmer, H. Kimati, C. O. S. Cardoso, T. L. Krugner, E. J. B. N. Cardoso, and A. Bergamin. 1980. Manual de Fitopatologia. (Manual of Phytopathology.) Ceres, São Paulo. [in Portuguese]**

Diseases caused by the following fungi and bacteria were listed as occurring on *Psidium guajava*:

*Puccinia psidii*
*Colletotrichum gloeosporioides*
*Sphaceloma psidii*
*Phyllosticta guajavae*
*Pseudomonas* sp.

**108. Gallo, D., O. Nakano, S. Silveira Neto, R. P. L. Carvalho, G. S. Batista, F. Berti, J. R. P. Parra, R. A. Zucchi, S. B. Alves, J. D. Vendramin. 1988. Manual de**

**entomologia agrícola. (Manual of agricultural entomology.) Ceres, São Paulo. [in Portuguese]**

Insect pests of *Psidium guajava* (as 'goiabeira') and *P. cattleianum* (as 'araçazeiro') of specific plant structures (e.g., foliage, fruit, trunk) were listed, together with symptoms of their effects and recommended control measures.
Insects included:

(on *P. guajava*):
*Marshallius bonelli* (Curculionidae: Coleoptera)
*Taeniotes scalaris* (Cerambycidae: Coleoptera)
*Morgavella longispina* (Diaspididae: Homoptera)
*Asterolecanium pustulans* (Asterolecaniidae: Homoptera)

(on *P. cattleianum*): (note: families and orders were not listed in the reference but were added separately)
*Trachyderes thoracicus* (Cerambycidae: Coleoptera)
*Timocratica palpalis* (Stenomidae: Lepidoptera)
*Ceroplastes floridensis* (Coccidae: Homoptera)
*Costalimaita ferruginea vulgata* (Chrysomelidae: Coleoptera)
*Citheronia* (Citheronidae: Lepidoptera)
*Mimallo amilia* (Mimallonidae: Lepidoptera)
*Pyrrhopyge charybdis* (Hespeiidae: Lepidoptera)
*Triozoida* sp. (Psyllidae: Homoptera)
*Anastrepha obliqua* (Tephritidae: Diptera)
*A. fraterculus* (Tephritidae: Diptera)
*Ceratitis capitata* (Tephritidae: Diptera)
*Conotrachelus psidii* (Curculionidae: Coleoptera)
*Leptoglossus gonagra* (Coreidae: Hemiptera)

**109. Gardner, D. E. 1980. An evaluation of herbicidal methods of strawberry guava control in Kipahulu Valley. Pp. 63-69, *In*: Smith, C. W. (ed.), Resources Base Inventory of Kipahulu Valley Below 2000 Feet. The Nature Conservancy, Maui, Hawai'i.**

Various herbicides and application methods were tested on *Psidium cattleianum* in lower Kipahulu Valley adjacent to Haleakala National Park on Maui. Herbicides tested included Roundup, Tordon 22K, Broadside, and diesel oil. Basal stem treatment with Roundup was somewhat effective, but none of the approaches was suitable for widespread use in a native ecosystem.

**110. Gardner, D. E., and C. J. Davis. 1982. The prospects for biological control of nonnative plants in Hawaiian national parks. Cooperative National Park Resources Studies Unit, Technical Report 45. University of Hawai'i, Honolulu. 55 pp.**

The policy of forest weed control in national parks was discussed, identifying specific

widespread, aggressive weeds in Hawai'i's national parks and addressing the potential of their biological control with insect enemies and diseases identified in the literature as attacking the species in question or their near relatives. Strawberry guava was among the weed pests discussed. Strawberry guava shares several pathogens with common guava, and these included a parasitic alga, leaf and fruit spots (anthracnose), a root-rotting fungus, a rust, fruit rots, and scale insects.

**111. Ghosh, A. K., R. N. Tandon, S. N. Bhargava, and M. P. Srivastava. 1965. Vitamin C content of guava fruits after fungal infection. Die Naturwissenschaften 52:478.**

Just-ripe fruits of the "Safeda" variety of common guava were inoculated with *Pestalotia psidii, Phoma psidii,* and *Gloeosporium psidii,* following which samples of infected fruit were analyzed to determine changes in vitamin C content. Vitamin C concentration was found in general to decrease more rapidly in infected than in healthy fruit.

**112. Ghosh, A. K., R. N. Tandon, K. S. Bilgrami, and M. P. Srivastava. 1964. Studies on fungal diseases of some tropical fruits. II. Post infection changes in the sugar contents of some fruits. Phytopathologische Zeitschrift 50:283-288.**

Tropical fruits of economic value in India, including of common guava, were inoculated with pathogenic fungi to determine the effect on sugar content of infected tissue. Pathogens included *Pestalotia psidii, Phoma psidii, Gloeosporium psidii, Diplodia natanensis, Colletotrichum papayae, Botryodiplodia theobromae,* and *Fusarium* sp.

**113. Gomes, P. 1983. Fruticultura Brasileira. (Cultivated Fruits of Brazil.) 9th Edição, Livraria Nobel, São Paulo. [in Portuguese]**

Species of *Psidium* in Brazil were discussed, together with their common names, descriptions, and uses as fruit crops. Those listed were: 'araçazeiro coroa' (*P. cattleyanum*), 'araçazeiro-de-festa' (*P. multiflorum*), araçazeiro-de-flor-grande' (*P. aromaticum*), 'araçá-de-folha-grande' (*P. grandifolium*), 'araçá-de-pernambuco' (*P. pubescens*), and 'araçazeiro' (*P. araçá*).

**114. Gonzaga Neto, L. 1982. Estudos de métodos de produção de porta-enxerto e de enxertia de goiabeira (*Psidium guajava* L.). (Studies and evaluation of the methods of production of grafting of guava trees.) Viçosa -- Minas Gerais. Tese de Mestrado. (Master's thesis.) [in Portuguese]**

This thesis described and evaluated various aspects of the production of grafting stock for guava (*Psidium guajava*) as a fruit crop.

**115. Gonzalez, G., H. Lima, and D. Sourd. 1985. Physical and chemical study of fruits of 10 cultivars of guava (*Psidium guajava*). Ciencia y Tecnica en la Agricultura, Citricos y Otros Frutales 8(4):47-57. [in Spanish]**

Various characteristics of fruits of several varieties of *Psidium guajava* in Cuba were assessed for commercial use.

116. **Goos, R. D. 1978. Occurrence of *Triscelophorus monosporus* in upland sites on Oahu, Hawaii. Mycologia 70(1):188-189.**

The fungus *Triscelophorus monosporus* was isolated from leaf litter of *Psidium guajava*, *P. cattleianum*, *Acacia koa*, and *Ilex anomala*, and the distribution, ecology, and reproduction of the species were described. The fungus is generally known as a freshwater aquatic fungus, making its discovery in a terrestrial habitat unusual.

117. **Gorter, G. J. M. A. 1977. Index of plant pathogens and the diseases they cause in cultivated plants in South Africa. Government Printer, Pretoria, South Africa.**

Six fungal and one algal pathogen of *Psidium guajava* in South Africa were listed: Blossom-end rot, caused by *Botrytis cinerea*; algal leaf spot, caused by *Cephaleuros virescens*; scab, caused by *Cladosporium* sp.; anthracnose, caused by *Colletotrichum gloeosporioides* (*Glomerella cingulata*); fruit spot, caused by *Pestalotia psidii*); leaf spot, caused by *Phyllosticta psidii*; and black rot, caused by *Sphaeropsis* sp.

118. **Greenwood, W. 1944. Supplementary notes on the adventive and weed flora of the leeward coasts of Fiji. Journal of the Arnold Arboretum 25(3):397-405.**

As a supplement to a paper prepared the previous year documenting the weed flora of Fiji, the author listed eight plant species among the weeds and newly introduced plants to Fiji which had not yet been recorded from those islands. Strawberry guava was among these, as *"Psidium littorale* Raddi (1820) (*P. cattleianum* Sabine, 1821). Navua region, Viti Levu, May 1943."

119. **Greenwood, W. 1949. Notes on some Fijian weeds and introduced plants. Journal of the Arnold Arboretum 30:75-84.**

*Psidium cattleianum* was listed as naturalized in Fiji.

120. **Guba, E. F. 1932. Monograph of the genus *Pestalotia*. Part II. Mycologia 24(4):355-397.**

A technical description of the fungus *Pestalotia psidii* was included in a monograph of the genus *Pestalotia*. It was reported on fruits of *Psidium pomiferum* L. (=*P. guajava* L.) in Ecuador, September 1981, by G. de Lagerheim.

121. **Gupta, J. P., and M. S. Chatrath. 1979. Physiology of resistance to anthracnose in guava. Indian Phytopathology 32(1):64-67.**

The physiology of a guava cultivar in India susceptible to a fungal disease, fruit anthracnose, caused by *Colletotrichum gloeosporioides*, was compared with that of a resistant variety.

122. **Gupta, J. P., M. S. Chatrath, and A. M. Khan. 1973. Chemical control of fruit rot of guava caused by *Colletotrichum gloeosporioides*. Indian Phytopathology 26(4):650-653.**

Fruit rot of common guava, caused by *Colletotrichum gloeosporioides*, was reported to be one of the most serious post harvest diseases in India. Attempts to control this disease through the application of antibiotics and similar chemicals to prevent germination of conidia were reported. Of five antibiotics tested, tetracycline when given as post-inoculation dip treatment at 500 ppm for 20 minutes was determined to be effective for control of the disease.

123. **Gutierrez, H. G. 1974. An archaeological find and the genus *Psidium* (guava) in the Philippines. National Museum Publication 7. Manila, Philippines.**

A myrtaceous fruit which was reported as undoubtedly belonging to the genus *Psidium* was unearthed inside a 14th Century bowl excavated in an archaeological site in Bolinao, Pangasinan, Luzon. The species of *Psidium* represented by the fruit was not determined, however. This find was considered important in that it could possibly shed light on knowledge concerning the migration and introduction of guava, locally known as "bayabas", to the Philippines. *Psidium guajava* is known to have been introduced to the Philippines by the Spaniards from South America after 1521. However, it was not known whether the same species or some other forms might have been introduced earlier through Malaysia from India following other routes of migration.

124. **Hall, N. T., J. M. Smoot, R. J. Knight, Jr., and S. Magy. 1980. Protein and amino acid compositions of 10 tropical fruits by gas-liquid chromatography. Journal of Agricultural and Food Chemicals 28(6):1217-1221.**

The edible portions of 10 tropical fruits, including cattley guava (as *Psidium littorale*), were analyzed for protein and amino acid composition, which was compared with that of more "traditional fruits", such as apple, orange, peach, and apricot. Concentrations amino acids varied on an individual basis, but were mostly higher in tropical fruits than in the traditional fruits.

125. **Haq, F., M. S. Kahn, and I. Faridullah. 1973. Germination Trial on guava seed. Journal of Agricultural Research (Punjab) 11(3):121.**

The authors investigated different pre-planting treatments for improving germination of guava seed, including dipping in cold, luke warm, and hot water. The luke warm water treatment was found to be the most effective.

126. **Haselwood, E. L. and G. G. Motter (eds.). 1983. Handbook of Hawaiian weeds, 2nd ed. Revised and expanded by R. T. Hirano. University of Hawai'i Press, Honolulu, for Harold L. Lyon Arboretum.**

This is a reprint of the 1966 edition of Hawaiian Weeds with an addendum listing new

weeds which have become problems in Hawai'i since the original publication. *Psidium cattleianum*, *P. cattleianum* f. *lucidum*, and *P. guajava* were included in the addendum without description.

**127. Hawai'i Division of Plant Industry, Weed Branch. 1962. Noxious weeds of Hawai'i. Hawai'i Department of Agriculture, Honolulu.**

This unpublished report includes a two-page summary on *Psidium guajava*, with mention of *P. cattleianum* (as red or strawberry waiawi) and *P. cattleianum* f. *lucidum* (as yellow waiawi), with figures of area of infestation tallied by island and density, and estimated costs of clearing and control, with the total for all islands being $17,827,500. Guava was reported to infest areas also infested with joee, Christmasberry, lantana, melastoma, rose myrtle, java plum, cat's claw, elephantopus, hairy pluchea, and Hamakua pamakani.

**128. Hayes, W. B. 1955. Some problems in guava growing. The Allahabad Farmer 29(1):14-16.**

Common guava, *Psidium guajava*, was reported to have reached India by the beginning of the 17th century from its native habitat of tropical America. It was grown in the Allahabad region of India as early as 1820. Cultural and grafting practices, commercial varieties, and other information concerning the production of guava as a fruit crop in the Allahabad region were described. Pests and diseases of guava in that region were listed as a bark-eating caterpillar and leaf-eating weevils. A caterpillar destructive of buds on young trees similar to, if not identical with, the orange leaf caterpillar, *Psorosticha ziziphi*, was named in particular. Fungus diseases caused by *Gloeosporium psidii* and *Fusarium oxysporum* f. *psidii* were also named. The latter reportedly caused the most important disease and had been recently identified by the plant pathology department of the Uttar Pradesh government.

**129. Henderson, L. 1989. Invasive alien woody plants of Natal and the northeastern Orange Free State [South Africa]. Bothalia 19(2):237-262.**

*Psidium guajava* was the third most prominent invasive plant of 130 species, invading roadside and veld (field) habitats in this area of southern Africa. The potential for increase in cover of this and other species was considered to be great. Strawberry guava was also mentioned as an invasive species.

**130. Hillebrand, W. 1965. Flora of the Hawaiian Islands. Facsimile of the edition of 1888. Hafner Publishing Company, New York.**

In his 1888 treatment of the Hawaiian flora, Hillebrand noted that *Psidium guajava* had become naturalized in many parts of Hawai'i, forming thickets to the exclusion of other plants in some valleys. *Psidium cattleianum* was also mentioned.

**131. Hirano, R. T. 1967. Chromosomal and pollination studies as related to intra-specific and inter-specific compatibility in the genus *Psidium*. Master's thesis, University**

**of Hawai'i, Honolulu.**

The following results were obtained in this study:
Pollen of *Psidium cattleianum* var. *lucidum* could not be germinated.
Chromosome counts were made --
*P. cattleianum* (2n=77; Based on two specimens)
*P. cattleianum* var. *lucidum* (2n=66; based on one specimen)
*P. cujavillus* (2n=44)
*P. guineense* (2n=44)
*P. friedrichsthalianum* (2n=44,66)
*P. polycarpum* (2n=22)
*P. guajava* -- several cultivars (2n=21,22,24,25,33)
*P. cattleianum* and *P. cattleianum* var. *lucidum* could be crossed in both directions.
*P. guajava* could not be crossed with *P. cattleianum* or with *P. cattleianum* var. *lucidum*.
*P. cattleianum* and *P. cattleianum* var. *lucidum* could not be crossed with *P. guineense*, *P. cujavillum*, or *P. friedrichsthalianum*.

132. **Hirano, R. T., and H. Y. Nakasone. 1969a. Chromosome numbers of ten species and clones in the genus *Psidium*. Journal of the American Society for Horticultural Science 94(2):83-86.**

Polyploidy within *Psidium guajava* was reportedly uncommon but the genus *Psidium* itself is represented by di-, tetra-, hexa-, and octoploid species. For *P. guajava* and *P. polycarpum* 2n=22; for *P. guineense* and *P. cujavillus* 2n=44; for *P. friedrichsthalianum* 2n=66. Although reports of 2n=88 have been made for the chromosome number of *Psidium cattleianum* and its botanical form, *P. cattleianum* f. *lucidum*, two plants of *P. cattleianum* were found to be heptaploid with 2n=77 and three plants of *P. cattleianum* f. *lucidum* were hexaploid with 2n=66 in this study. *Psidium guineense* and *P. cujavillus* were introduced into Hawai'i as such, but similarities in chromosomes as well as in vegetative characters between these species casts some doubt as to their identities.

133. **Hirano, R. T., and H. Y. Nakasone. 1969b. Pollen germination and compatibility studies of some *Psidium* species. Journal of the American Society for Horticultural Science 94(3):287-289.**

*Psidium cattleianum*, *P. cattleianum* f. *lucidum*, *P. guajava*, *P. guineense*, *P. cujavillus*, and *P. friedrichsthalianum* were subjects of pollen germination and crossing studies. Pollen of *P. guajava* (cultivars used had n=22 and n=33) generally had high germination rates, which were higher than those for species with higher chromosome numbers. *Psidium cattleianum* and *P. cattleianum* f. *lucidum*, with reports of n=88, were sometimes found to be heptaploid (*P. cattleianum*, 2n=77) and hexaploid (*P. cattleianum* f. *lucidum*, 2n=66). Pollen of *P. cattleianum* showed 32% germination, while that of *P. cattleianum* f. *lucidum* failed to germinate. Pollen tubes of *P. cattleianum* were shorter than those of other species.

134. **Hodges, C. S. 1988. Preliminary exploration for potential biological control agents for *Psidium cattleianum*. Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu. Technical Report 66. 32 pp.**

A 2-week trip to Brazil in 1988 was made to begin assessment of biological control agents for *Psidium cattleianum*. This species was not found as a component of intact native forests, but in brush fields which resulted from cutting the forest. It was not found in monotypic stands, but rather as scattered individuals or in small groups or clumps. The species is cultivated as an ornamental, the fruit is eaten, and the wood is used for fuel. In the areas of Brazil visited, the red-fruited form was rarely found, and then usually in cultivation; the yellow-fruited type was found by far most commonly. Fungi and fungal diseases found on strawberry guava in Brazil included: an unidentified leaf spot; a tarspot fungus (possibly *Phyllachora subcircinans*); and the eucalyptus canker fungus (*Cryphonectria cubensis*), produced after insect damage. A considerable amount of insect damage was noted on the foliage of plants, including at least four species of scale; at least four species of leaf rollers; leaf miner; at least three kinds of leaf galls; several types of leaf feeders; several types of fruit feeders; and sawyers. In areas where *Psidium guajava* and *P. cattleianum* occurred together, *P. cattleianum* was the more heavily insect-damaged species.

135. **Hodges, C. S., A. C. Alfenas, and F. A. Ferreira. 1986. The conspecificity of *Cryphonectria cubensis* and *Endothia eugeniae*. Mycologia 78(3):343-350.**

*Psidium cattleianum* and *P. guajava* were included among other potential hosts inoculated with *Cryphonectria cubensis* to demonstrate that this fungus was conspecific with *Endothia eugeniae*, which was known to attack a number of myrtaceous hosts.

136. **Hodges, C. S., K. T. Adee, J. D. Stein, H. B. Wood, and R. D. Doty. 1986. Decline of ohia (*Metrosideros polymorpha*) in Hawai'i: A review. General Technical Report PSW-86. Pacific Southwest Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture, Berkeley, California. 22 pp.**

*Psidium cattleianum* was reported to be capable of displacing 'ohi'a (*Metrosideros polymorpha*) in native Hawaiian forests and that further spread could be slowed by reduction of feral pig populations.

137. **Hoehne, F. C. 1946. Frutas indígenas. (Indigenous fruits.) Instituto de Botânica, Publicação da Série "D", São Paulo. Pp. 54-55, 60. [in Portuguese]**

Characteristics of the family Myrtaceae were described, and the following species of *Psidium* were cited in particular:
*P. guajava* var. *pyriferum*, *P. guajava* var. *pomiperum*, *P. pumilum* (common names 'araçá', 'araçá-iba', 'araçá-mirim', 'araçá do campo', or 'goiaba rasteira'); *P. cattleianum* was listed with the common name 'araçá da paraia'.

138. **Holm, L., J. V. Pancho, J. P. Herberger, and D. L. Plucknett. 1979. A geographical**

**atlas of world weeds. John Wiley and Sons, New York.**

In this 1979 list, *Psidium cattleianum* was designated as a common weed in Hawai'i, while *P. guajava* was designated a serious weed.

139. **Horst, R. K. 1990. Westcott's plant disease handbook. Fifth edition. Van Nostrand Reinhold, New York.**

Pathogens reported as causing diseases which affect guava (*Psidium guajava*) include the following:
*Alternaria citri* (fruit rot, California)
*Cephaleuros virescens* (algal leaf spot, Florida)
*Clitocybe tabescens* (root rot, Florida)
*Glomerella cingulata* (anthracnose, Florida)
*Meloidogyne* sp. (root knot nematode, Florida)
*Pellicularia koleroga* (thread blight, Florida)
*Phymatotrichum omnivorum* (root rot, Texas)
*Polyporus versicolor* (wound rot, Florida)
*Radopholus similis* (burrowing nematode, Florida)
*Rhizopus stolonifera* (fruit rot, Hawai'i)

140. **Hosaka, E. Y., and A. Thistle. 1954. Noxious plants of the Hawaiian ranges. University of Hawai'i Extension Bulletin 62. 39 pp.**

*Psidium cattleianum*, as "strawberry guava" or "waiawi", was illustrated and described, along with a number of other noxious plants, as a native of Brazil which has become a pest in Hawai'i because of its ability to form dense, solid stands and to crowd out other plants. Dissemination was reported to be by fruits eaten by wild pigs and birds, which scatter the seeds. It was reported from all islands at the time of writing, where it was found in local clumps. It is controlled by the herbicide 2,4-D.

141. **Hossain, M. S., and M. B. Meah. 1992. Prevalence and control of guava fruit anthracnose. Tropical Pest Management 38(2):181-185.**

The prevalence of guava (*Psidium guajava*) fruit anthracnose was surveyed in three major guava-producing areas of Bangladesh during 1987 and 1988. All trees examined and 90-100% of fruits were found to be severely diseased. *Pestalotiopsis psidii, Colletotrichum gloeosporioides,* and *Botryodiplodia theobromae* were reported as the major causal fungi. Various fungicides and methods of application were tested as effective controls for these diseases.

142. **Howard, R. A. 1989. Flora of the Lesser Antilles. Leeward and Windward Islands. Vol. 5 Dicotyledoneae -- Part 2. Arnold Arboretum, Harvard University.**

The genus *Psidium* was described botanically and characterized as a genus of about 100 species in tropical and subtropical America, some widely cultivated and naturalized in warm regions. Among other *Psidium* spp. in the Lesser Antilles, *P.*

*guajava* was described with the synonyms *P. pumilum* var. *guadalupense*, *P. guajava* var. *pumilum*, and *P. guajava* var. *cujavillum*. Common names for the locality are "guava", "white guava", "goyave", "kwiyábu", "goyavier", and "gwiyav". *Psidium cattleianum*, with the synonym *P. littorale*, was described as having come to the Lesser Antilles as seed from China, the type being from a plant cultivated in England. It was listed as probably native to southeastern Brazil, and is cultivated throughout the tropics, where it is often established. Common names given were "goyavier prune" and "goyavier de St. Martin".

**143. Huenneke, L. F. 1988. Response of native Hawaiian shrubs to disturbance. Grant application for The Charles A. Lindbergh Fund, Inc. 5 pp.**

Research carried out on disturbance-adapted, early successional species has revealed reproductive strategies consisting of prolific seedling establishment in disturbed environment and vegetative spread from underground parts. The reproductive strategy of *Psidium cattleianum* appears to conform to this generality. The study was proposed to investigate reproductive strategies of native Hawaiian shrubs in comparison with those of nonnative invaders.

**144. Huenneke, L. F. 1989. Contribution of sprouting behavior to population persistence in woody species (Abstract). American Journal of Botany (Supplement) 76(6):84-85.**

*Psidium cattleianum* produced suckers in Hawaiian forests following stem damage of a severity which would have killed other small plants. This seemed to enhance monospecific stands above mere seedling establishment.

**145. Huenneke, L. F. 1991. Population biology of an invading tree, *Psidium cattleianum*, in Hawai'i Volcanoes National Park. Pp. 177-188, *In*: Center, T. D., R. F. Doren, R. L. Hofstetter, R. L. Meyers, and L. D. Whiteaker (eds.). Proceedings of the Symposium on Exotic Pest Plants; U. S. Department of the Interior, National Park Service; November 2-4, 1988; Miami, Florida.**

*Psidium cattleianum* was reported to colonize roadsides and other disturbed sites as well as little-disturbed forested areas. In this study, five strawberry guava stands at elevations between 150 and 915 m were measured monthly to determine phenological stage, and stand structure was assessed. Reproductive activity was highest in August and September; active shoot growth was greatest in August. Stem density was highest at intermediate elevations. Seed germination trials were carried out in the laboratory and in the field. Germination rates were high over a wide range of temperatures and moisture regimes in laboratory tests, but very low in field trials. At all elevations, both seedlings and suckers were observed, and growth rates and survivorship were measured in the field. Stems damaged from falling forest litter were able to survive and even send up multiple shoots, in contrast with observed native seedlings, which did not survive. *Psidium cattleianum* possesses a number of traits characteristic of opportunistic invaders, but apparently its clonal growth habit is most responsible for its success in invading and dominating intact native forests.

146. **Huenneke, L. F., and P. M. Vitousek. 1990. Seedling and clonal recruitment of the invasive tree *Psidium cattleianum*: Implications for management of native Hawaiian forests. Biological Conservation 53:199-211.**

Seeds of *Psidium cattleianum* were found to be abundantly produced, and they germinated rapidly and well without scarification. *Psidium cattleianum* seedlings occurred in the same sites as native seedlings, usually in undisturbed sites. Both seedlings and suckers occur, but suckers may give this species the edge in dominating native forests. Although enhanced by dispersal by animals and soil disturbance produced by feral pigs, germination and establishment of *P. cattleianum* are not dependent on these agents.

147. **Inoue, M. T., C V. Roderjan, and Y. S. Kuniyoshi. 1984. Projeto Madeira do Paraná. (Woody vegetation of Paraná State.) Fundação de Pesquísas Florestais do Paraná. [in Portuguese]**

The authors described the trees of the southern Brazilian state of Paraná, including *Psidium guajava, P. cattleianum*, and other species of *Psidium* occurring in that region.

148. **Ito, P. J., R. Kunimoto, and W. H. Ko. 1979. Transmission of *Mucor* rot of guava fruits by three species of fruit flies. Tropical Agriculture 56(1):49-52.**

Fungal rot of cultivated *Psidium guajava* fruit by fruit flies in Hawai'i was studied, sanitation through removal in infected material was shown to greatly reduce the percentage of diseased fruit.

149. **Jacobi, J. D., and F. R. Warshauer. 1992. Distribution of six alien plant species in upland habitats on the island of Hawai'i. Pp. 155-188, *In*: Stone, C. P., C. W. Smith, and J. T. Tunison, (eds.), Alien Plant Invasions in Native Ecosystems of Hawai'i: Management and Research. University of Hawai'i Press, Honolulu.**

Strawberry guava (*Psidium cattleianum*) was included in a study of six invasive alien plant species in upper elevation habitats on the island of Hawai'i. Strawberry guava was brought to Hawai'i as a fruit tree from its native Brazil about 1825 (citing St. John 1973), where it is now found on the six largest islands of Hawai'i. The seeds are widely dispersed by many species of birds and other animals, such as the feral pig. Fruits of strawberry guava and other species of *Psidium* are regularly used by local residents as food or food ingredients. Despite its local importance as a fruit tree, strawberry guava was recognized as a serious threat to native forest ecosystems below 1,500 m elevation. The National Park Service considers it a species that needs to be controlled or eliminated within parks. Of the six alien plant species considered in this study, strawberry guava had the most widespread distribution. This tree was predicted to be able to occupy 50% of the stations sampled in the study, limited primarily by elevation. "The relative evenness of its current distribution around the island of Hawai'i probably reflects the length of time it has been established there. If

left uncontrolled, the major distributional change expected over time would be a filling-in of the area within the present geographical range of this species."

150. **Jain, S. S. 1956. A preliminary note on the inactivation of *Fusarium oxysporum* f. *psidii* in guava plants by chemotherapeutic treatment. The Indian Journal of Horticulture 13:102-104.**

Wilt disease of guava in Uttar Prasesh, India, caused by *Fusarium oxysporum* f. *psidii*, a pathogen which is systemic and soil borne, was considered best controlled by use of resistant varieties. However, injection of therapeutic chemicals into stems of otherwise susceptible trees appeared to show promise as an alternate control method. Apparently healthy trees injected with 0.1% 8-quinolinol sulphate appeared to resist wilting caused by the disease for at least 1 year. The same chemical, when injected into slightly wilted plants was found to be effective in their partial recovery.

151. **Jiron, L. F., and I. Hedstrom. 1988. Occurrence of fruit flies of the genera *Anastrepha* and *Ceratitis* (Diptera: Tephritidae), and their host plant availability in Costa Rica. Florida Entomologist 71(1):62-73.**

The fruit fly *Anastrepha striata* was reported to infest *Psidium guajava*, *P. friedrichsthalianum*, and *P. savanarum* in Costa Rica.

152. **Jiron, L. F., and I. Hedstrom. 1991. Population fluctuations of economic species of *Anastrepha* (Diptera: Tephritidae) related to mango fruiting phenology in Costa Rica. Florida Entomologist 74(1):98-105.**

*Anastrepha obliqua* was the fruit fly species found most closely associated with mango, while *A. striata* was found associated with *Psidium guajava*. Abundance of the flies was highest when more mature fruit of the host plants was available.

153. **Jiron, L. F., and R. Zeledon. 1979. The genus *Anastrepha* (Diptera: Tephritidae) in the most popular fruits of Costa Rica and its implication in human pseudomyiasis. Revista de Biología Tropical 27(1):155-160. [in Spanish with English summary]**

Three species of the genus *Anastrepha* were found in nine fruits, including *Psidium guajava*, *P. savannarum*, and *P. friedrichsthalianum*. Larvae in the fruit often cause intestinal problems following consumption, especially in children.

154. **Johnson, W. T., and H. H. Lyon. 1976. Insects that feed on trees and shrubs; an illustrated practical guide. Comstock Publishing Associates, Ithaca, New York.**

The following insects were listed as attacking *Psidium guajava*:

*Hemiberlesia rapax* (Coccidae: Homoptera) (greedy scale, attacking stems, twigs, leaves, or fruit)

*Aspidiotus hederae* (Diaspididae: Homoptera) (ivy scale, attacking bark, leaves, and fruit)

155. **Joly, A. B. 1991. Botânica: Introdução a taxonomia vegetal. Editora Nacional Biblioteca Universitária. (Botany: Introduction to the taxonomy of vegetation types.) Série 3, Vol. 4. [in Portuguese]**

Characteristics of the family Myrtaceae were described, including mention of *Psidium guajava* and *P. cattleianum.*

156. **Kaaiakamanu, D. M., and J. K. Akina. 1922. Hawaiian herbs of medicinal value. (Translated from original compilations by Akaiko Akana). Honolulu Star-Bulletin, November.**

*Psidium guajava*, with the common name "kuawa", was listed among other herbs occurring in Hawai'i considered to have medicinal properties. Guava was reported to grow abundantly anywhere in the islands. As a remedy, guava was recommended for deep cuts, sprains, and other injuries due to accidents. Guava leaves, roots and juice were also recommended for use, variously in combination with other herbs, for a number of other ailments, with instructions provided for the medicinal preparations.

157. **Kageler, D., and D. E. Gardner. 1985. Tests for the control of strawberry guava (*Psidium cattleianum*) using Garlon 4, Tordon 22K and Tordon RTU. Unpublished report to the superintendent of Hawai'i Volcanoes National Park. 6 pp.**

Twenty-eight plots were established containing a total of 97 strawberry guava trees in Hawai'i Volcanoes National Park. Tests were performed using the following herbicides on cut stumps: Garlon 4, Tordon 22K, and Tordon RTU. A single herbicidal application was generally as effective as two. All treatments were 100% effective after 1 year except for the single treatment of Garlon 4. Some death or decline of surrounding plants of *Canthium odoratum*, *Wikstroemia* sp., and *Schinus terebinthifolius* was noted.

158. **Kageler, D., and D. E. Gardner. 1987. Results of tests toward the control of strawberry guava (*Psidium cattleianum* Sabine). Unpublished report submitted to the superintendent, Hawai'i Volcanoes National Park. 4 pp.**

Three study sites were established at lower elevations in or near Hawai'i Volcanoes National Park containing a total of 474 trees. The following herbicides were applied using bark frilling, Hypohatchet, or cut stump techniques: Roundup (glyphosate), Tordon 22K (picloram), Broadside (monosodium methanearsonate), and gasoline. Tordon 22K was found most effective for controlling strawberry guava. The cut stump application technique, particularly when the tree was cut off close to the ground, was the best method. A single treatment was sufficient for control.

159. **Kageler, D., D. E. Gardner, and E. P. Eldredge. 1987. Tests for the control of**

**strawberry guava (*Psidium cattleianum*) using Garlon 4, Tordon 22K and Tordon RTU. Unpublished report to the superintendent of Hawai'i Volcanoes National Park. 5 pp.**

A long-term followup report of the herbicidal tests on strawberry guava established in 1984 and initially reported in 1985 by Kageler and Gardner noted little change in vigor ratings for the treated plants. Recommendations were that further testing be conducted with the same herbicides to determine minimum concentrations that would achieve the same results.

160. **Kapoor, I. J. 1970. Effect of hydrogen-ion concentration and temperature on the growth and reproduction of three "fruit rot" fungi. Indian Phytopathology 23(3):526-532.**

Two environmental factors, pH and temperature, were investigated to determine their effects on the growth of three serious fruit pathogens in India, *Macrophoma allahabadensis, Curvularia tuberculata, and Drechslera saustraliense*. The first two are pathogens of common guava. Slight variation in these factors were found to induce marked differences in growth and reproduction of the fungus in artificial culture. The most suitable temperature for the growth of the guava pathogens was 30° C. The optimum pH's for *M. allahabadensis* and *C. tuberculata* were 5.0 and 6.5, respectively.

161. **Kapoor, I. J., and R. N. Tandon. 1970a. Occurrence of *Curvularia tuberculata* Jain on stored fruits of *Psidium guajava* L. Sydowia 24:201-202.**

The fungus *Curvularia tuberculata* was reportedly newly isolated from guava (*Psidium guajava*) fruits stored in local markets in India. Previously, *C. tuberculata* had been reported as causing die-back disease of citrus in India. The disease on guava caused by the fungus appeared as a circular honey-yellow spot, which later changed to brown, on the surface of the fruit, followed by decay enhanced by secondary organisms. The fungus as isolated from guava fruit and grown in pure culture was described, and pathogenicity was demonstrated by reinoculation of fruit from the cultures.

162. **Kapoor, I. J., and R. N. Tandon. 1970b. A new species of *Macrophoma* causing fruit rot of guava (*Psidium guajava*). Indian Phytopathology 23(1):122-125.**

A new fruit rot disease, associated with a new species of *Macrophoma*, described as *M. allahabadensis*, was reported of post-harvest fruit. This was considered the first report of a disease associated with a species of *Macrophoma* on guava in India or elsewhere.

163. **Kausel, E. 1966. Lista de las Mirtaceas y Leptospermaceaes Argentinas. (List of Argentinian Myrtaceae and Leptospermaceae.) Lilloa 32:323-368. [in Spanish]**

The author provided a list of the members of the Myrtaceae found in Argentina.

Included in the genus *Psidium* were *P. guajava*, *P. guineense*, *P. cuneatum*, *P. kennedyanum*, *P. luridum*, *P. incanum*, *P. pubifolium*, *P. missionum*, and *P. nutans*. The genus is divided into two subgenera, *Eupsidium* (with calyx closed initially), and *Myrtopsidium* (with calyx strongly open from the beginning).

**164. Kaushik, D. P. Thakur, and J. N. Chand. 1972. Parasitism and control of *Pestalotia psidii* causing cankerous disease of ripe guava fruits. Indian Phytopathology 25:61-64.**

Among the fungi reported to be associated with post-harvest decay of guava fruits, the fruit canker fungus, *Pestalotia psidii*, caused major damage. Fruit storage at temperatures below 15° C and below 50% relative humidity was found to prevent the disease.

**165. Kefford, N. P., R. M. Bullock, and W. T. Harada (eds.). 1977. Guava; summary paper. College of Tropical Agriculture and Human Resources, University of Hawai'i, Honolulu.**

Current trends in crop protection and management for commercial guava operations in Hawai'i were outlined. Several insect and mite pests were listed, and *Mucor* and *Guiginardia* fruit rot noted as major disease problems of guava in Hawai'i. Noxious weeds were also identified as a potential problem in guava orchards. Two cultivars, "Beaumont" and "La hua Kula" were (newly?) available for commercial production.

**166. Kefford, N. P., W. T. Harada, and R. M. Bullock (eds.). 1979. Guava industry analysis number 2. College of Tropical Agriculture and Human Resources, University of Hawai'i, Honolulu.**

Current trends in insect and disease control in commercial production of common guava in Hawai'i were reported. Insects, including the red-banded thrips, green scale, Chinese rose beetle, guava moth, Mediterranean and Oriental fruit flies, and a newly established whitefly (*Aleurodicus dispersus*) were reported to be capable of limiting guava production. Mucor fruit rot, firm rot of fruit, fruit spot, and twig blight were described as serious diseases affecting the guava industry in Hawai'i.

**167. Kiaerskou, H. 1893. Enumeratio Myrtacearum Brasiliensium. *In*: Warming, E. (ed.), Symbolarum ad Floram Brasiliae Centralis Cognoscandam, Gjellerup, Copenhagen 29:1-200. [in Latin]**

The previously published *Psidium cattleianum* (as *P. cattleyanum*) and *P. cattleianum* var. *coriacea* were included in this list of the Myrtaceae of Brazil.

**168. Ko, W. H., R. K. Kunimoto, and W. T. Nishijima. 1982. Fruit rot of guava (*Psidium guajava*) caused by *Phytophthora citricola*. Plant Disease 66(9):854-855.**

A grayish-brown fruit rot, caused by the fungus *Phytophthora citricola*, was reported at Waiakea-Uka on the island of Hawai'i. Mature fruit appeared less susceptible to

the disease than did immature fruit.

169. **Koller, O. C. 1979. Cultura da goiabeira. (Culture of guava.) Agropecuária, Porto Alegre. [in Portuguese]**

Requirements were outlined for the cultivation of guava (*Psidium guajava*), including a discussion of economic importance, climate, soil, cultural practices, uses, and control of insects, which were listed as follows:

*Anastrepha fraterculus*
*Ceratitis capitata*
*Timocratica albella*
*Ceroplastes floridensis*
*C. grandis*
*Conotrachelus psidii*
*Leptoglossus gonagra*
*L. stigma*

and disease organisms:
*Phyllosticta guajavae*
*Colletotrichum gloeosporioides*
*Sphaceloma psidii*
*Puccinia psidii*

170. **Krauss, B. H. 1974. Guava (kuawa). Pp. 106-109, *In*: Ethnobotany of Hawai'i. University of Hawai'i Department of Botany, Honolulu.**

*Psidium guajava*, originated from Tropical America (Central America and northern part of South America). It was brought to Hawai'i by Don Francisco de Paula Marin, either on his first trip in 1791 or somewhat later. Marin, a Spaniard, brought many tropical plants of economic value to Hawai'i. Three types of guava were recognized by the Hawaiians: "kuawa-lemi" (lemon-guava), "kuawa-momona" (custard-apple-like guava), and "kuawa-ke'oke'o" (white guava). The fruit is high in iron, calcium, phosphorus, and vitamin C. Hawaiians used leaf buds of the species to make an astringent medicinal tea for sore throats and other ailments. Both red and yellow fruited forms of *P. cattleianum* were also mentioned.

171. **Kumar, L. S. S., and S. G. Ranade. 1952. Autotriploidy in guava (*Psidium guajava*, Linn.). Current Science 21(3):75-76.**

The chromosome number 2n=22 has been reported for guava. A seedless variety was found to have a somatic complement of 33 chromosomes, which appeared to be the first record of triploidy, and therefore of polyploidy, in guava.

172. **Lamoureux, C. H. 1968. The vascular plants of Kipahulu Valley, Maui. Pp. 23-54, *In*: Warner, R. E. (ed.), Scientific Report of the Kipahulu Valley Expedition, The Nature Conservancy; Arlington, Virginia.**

In a comprehensive inventory of the flora of Kipahulu Valley, east Maui, both *Psidium guajava* and *P. cattleianum* were listed. Kipahulu Valley was a relatively undisturbed natural area adjacent to Haleakala National Park at the time of writing, but has since been incorporated into the park.

173. **Lamoureux, C. H., and L. Stemmermann. 1976. Report of the Kipahulu bicentennial expedition, June 26-29, 1976. Technical Report 11. Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu. 21 pp.**

*Psidium cattleianum* was reported as having spread considerably in Kipahulu Valley since the original vegetation surveys were completed 10 years previously.

174. **LaRosa, A. M., C. W. Smith, and D. E. Gardner. 1987. Role of alien and native birds in dissemination of firetree (*Myrica faya* Ait. -- Myricaceae) and associated plants in Hawaii. Pacific Science 39(4):372-378.**

Although this study mostly concerned fayatree *(Myrica faya)*, two species of captive birds were also fed fruits of *Psidium cattleianum* and *P. guajava*. Mynas had a low preference for *P. cattleianum* and would not eat *P. guajava*. Japanese white-eyes had a medium preference for *P. cattleianum* and a low preference for *P. guajava*. Seeds recovered from scat had a slightly lower germination rate than did the controls.

175. **Leu, L. S., and C. W. Kao. 1979. Artificial inoculation of guava (*Psidium guajava* cultivar Pei-Pa) with *Myxosporium psidii*. Plant Disease Reporter 63(12):1077-1079.**

Guava cultivar Pei-Pa showed good resistance to the fungal disease caused by *Myxosporium psidii* in artificially inoculated trees.

176. **Leu, L. S., C. W. Kao, C. C. Wang, W. J. Liang, and S. P. Y. Hsieh. 1979. *Myxosporium* wilt of guava (*Psidium guajava*) and its control. Plant Disease Reporter 63(12):1075-1077.**

*Myxosporium psidii*, a fungal wound parasite which invades xylem vessels, was reported to cause defoliation, wilt and death of guava trees. Controls included removing infected trees and use of fungicide on wounds.

177. **Li, H. L., and T. C. Huan. 1979. Flora of Taiwan. Vol. 6. Epoch Publishing Co., Taiwan.**

*Psidium cattleianum* was reportedly introduced to Taiwan as a cultivated plant.

178. **Lim, T. K., and K. K. Chong. 1990. Guava in Malaysia: Production, pests and diseases. Tropical Press SDN. BBHD., Kuala Lumpur, Malaysia.**

The authors provided a comprehensive, well-illustrated treatment of guava as a fruit

crop in Malaysia, including information on the following subjects:

Origin and distribution, major world producers, current status, constraints and prospects, economic significance, nutritive value and biochemical composition, products and byproducts, medicinal uses, botanical classification, cultivars of *Psidium guajava*, agroecological requirements, and horticultural procedures and management.

Other species of *Psidium* were noted, including *P. friedrichsthalianum*, *P. littorale*, *P. littorale* var. *longipes*, *P. cattleianum*, *P. cattleianum* var. *lucidum*, *P. guineense*, *P. polycarpum*, *P. cujavillis*, *P. montanum*, *P. microphyllum*, *P. fluviatile*, and *P. guayabita*.

Diseases and disorders, included:

Seedling and root diseases, damping-off of seedlings, *Sclerotium se*edling rot *Phytophthora* foliar blight and dieback, root knot nematode, white root disease, red root disease, brown root disease, leaf and shoot diseases, pink disease, *Cephaleuros* algal spot, lichens and other epiphytic algae, sooty mold *Aschersonia* fungus, mosaic virus disease, fruit diseases, anthracnose, stylar end ring rot, *Pestalotiopsis* scabby fruit canker *Lasiodiplo*dia fruit rot *Phytophthora* fruit rot, *Botryosphaeria* brown fruit rot, *Rhizopus* fruit rot, *Cylindrocladium* fruit rot *Guignardia* fruit spot, and post-harvest diseases.

Vascular epiphytes *Thrixspermum trichoglottis* and *Drymoglossum piloselloides*.

Physiologic disorders pesticide phytotoxicity, sun scorching, and nutrient deficiency.

Pests included:

Fruit flies (Diptera: Tephritidae), mirids (Hemiptera: Miridae), thrips (Thysanoptera: Thripidae), mealybugs, scale insects and other cocciods, whiteflies (Homoptera: Aleyrodidae), aphids (Homoptera: Aphididae), lepidopteran pests and other defoliators, ants (Hymenoptera: Formicidae), mites (class Arachnida: order Acarina), and slugs and snails.

**179. Lima, A. da Costa. 1916. Sobre alguns Chalcidideos parasitas de sementes de Myrtaceas. (Concerning some chalcids parasitic in seeds of Myrtaceae.) Arquivos do Museu Nacional do Rio de Janeiro 19:193-203. [in Portuguese]**

A study was reported of the seed chalcids (insects) *Syntomaspis myrtacearum*, *Prodecatoma* sp., and *Eurytoma* sp. parasitic on seeds of *P. guajava*, *P. oligospermum*, and *P. petrosum*.

**180. Lindley, J. 1824. Notes. Botanical Register 10:200.**

The author made early reference to *Psidium cattleianum* as being traceable back to the New World and not actually native to China.

181. **Liogier, A. H., and L. F. Martorell. 1982. Flora of Puerto Rico and adjacent islands: A systematic synopsis. Editorial de la Universidad de Puerto Rico, San Juan.**

*Psidium guajava* was reported as common in thickets and hillsides in Puerto Rico. *Psidium cattleianum*, listed as a synonym of *P. littorale* var. *longipes*, reportedly native to Brazil, was occasionally planted and escaped cultivation in Puerto Rico. Other species of *Psidium* reported include *P. amplexicaule, P. insulanum*, and *P. sintenisii*, the latter two being endemic to Puerto Rico.

182. **Little, E. L., and R. G. Skolmen. 1989. Common forest trees of Hawaii (native and introduced). Agriculture Handbook 679, U. S. Forest Service, Washington, D. C.**

Descriptions and drawings of both *Psidium cattleianum* and *P. guajava* as they occur in Hawai'i were included.

183. **Lombardo, A. 1964. Flora arborea y arborescente del Uruguay. (Tree and shrub flora of Uruguay.) 2° Edición. Museo Nacional de Historia Natural, Montevideo, Uruguay. [in Spanish]**

*Psidium cattleianum*, with the synonym *P. littorale*, was described in Uruguay, where the common name "arazá" was given.

184. **Lowe, R. T. 1868. A manual of flora of Madeira and the adjacent Porto Santo and Desertas. London.**

*Psidium cattleianum* was reported as having been introduced to Madeira and adjacent islands.

185. **Mabberley, D. J. 1989. The plant-book. Cambridge University Press, New York.**

This dictionary-style entry reported that there are 100 species in the genus *Psidium*.

186. **MacCaughey, V. 1917. The guavas of the Hawaiian Islands. Bulletin of the Torrey Botanical Club 44:513-524.**

This early Twentieth Century article provided an overview of the history and kinds of guava grown in Hawai'i. Of interest is the fact that guavas, and particularly *Psidium cattleianum*, were seriously infested with the Mediterranean fruit fly (*Ceratitis capitata*) before insect parasites lowered their numbers as a result of biological control efforts. The common white mealy bug (*Pseudococcus nipae*), which also infested other fruit trees, and several species of aphids were reportedly very common on guava foliage. Other insects found on guava were the cottony guava scale (*Pulvinaria psidii*), the pepper-tree scale (*Aspidiotus lantaniae)*, Fuller's rose beetle (*Aramigus fulleri*), and a bark beetle (*Xyleborus affinis).* A number of fungus diseases were reported to occur on guava, but none appeared to affect the tree significantly. Those mentioned specifically were the sooty mold (*Meliola camilliae)* and guava fruit-rot

caused by *Glomerella psidii.*

*Psidium cattleianum* was listed among other species of *Psidium*, with the notation: "This plant is often called in English the strawberry guava, probably a native of eastern Brazil, but often cultivated elsewhere in the tropics. It is included here for comparison; I have not seen any specimens from our area, although the plant doubtless occurs there." For a description, MacCaughey referred the reader to Fieldiana: Botany 24:391. 1963; for discussion of the nomenclature of the species, to Fosberg, F. R. 1941. Proceedings of the Biological Society of Washington 54:179-180; and Schroeder, C. A. 1946. Journal of the Arnold Arboretum 27:314-315.

187. **Mainieri, C. 1983. Manual de identificação das principais madeiras comerciais Brasileiras. (Manual for the identification of principal commercial timber trees of Brazil.) IPT. [in Portuguese]**

*Psidium cattleianum* was included in this manual for the identification of Brazilian trees of commercial value.

188. **Makhija, M., O. P. Dhankhar, and R. S. Singhrot. 1980. Effect of soil salinity levels on growth and leaf mineral composition of guava (*Psidium guajava* L.). Haryana Journal of Horticultural Science 9(1-2):21-25.**

Guava was reported as one of the most popular fruits grown in India, being widely cultivated in arid and semiarid areas. Aside from the guava wilt disease, salinity of soil and ground water was considered a major problem for its successful cultivation. Six-month old guava seedlings grown for 15 months in artificially salinized soils showed lower survival and a decrease in growth with increasing saline levels. Increasing levels of salinity caused significant increase in the Cl, Na, Ca, and Mg content of foliage, causing significant reduction in growth. The specific injury due to accumulation of Cl and Na in toxic concentrations in the plant tissue and nutrient imbalance were considered the chief effects of salinity.

189. **Malavasi, A., J. S. Morgante, and R. J. Prokopy. 1983. Distribution and activities of *Anastrepha fraterculus* (Diptera: Tephritidae) flies on host and nonhost trees. Annals of the Entomological Society of America 76(2):286-292.**

Behavioral characteristics of a South American fruit fly were recorded on host trees, including *Psidium* spp., with and without fruit, and on nonhost trees without fruit.

190. **Mani, M., and A. Krishnamoorthy. 1990. Evaluation of the exotic predator *Cryptolaemus montrouzieri* Muls. (Coccinellidae, Coleoptera) in the suppression of green shield scale, *Chloropulvinaria psidii* (Maskell) (Coccidae, Hemiptera) on guava. Entomon 15(1/2):45-48.**

*Cryptolaemus montrouzieri*, a predator of the green shield scale, a serious pest of *Psidium guajava* in India, fed on eggs of the scale and suppressed it after controlled release in field conditions.

191. **Manica, I., L. Alvarenga, T. J. Caixeta, J. R. C. Purcino, and L. A. Lichtemberg. 1981. Competição entre dez varidades de goiaba (*Psidium guajava* L.) na Jaíba (Janaúba), Minas Gerais. (Comparison of ten varieties of guava *(Psidium guajava* L.*)* in Jaíba (Janaúba), Minas Gerais (Brazil).) Pp. 781-791, *In:* Congresso Brasileiro de Fruticultura, VI. Recife, Anais. SBF. [in Portuguese]**

The fruit production performance of ten varieties of guava *(Psidium guajava)* in Jaíba, Minas Gerais State, Brazil, was evaluated. The varieties were: 'Goiaba Ouro', 'São José Periforme', 'Brune Branca', 'Pirassununga Vermelha', 'Brune Vermelha', 'Goiaba de Campos', 'Pere Branca', 'IAC-4', 'Goiaba Pera', and 'Tetraplóide de Limeira'.

192. **Mann, H. H. 1868. Flora of the Hawaiian Islands. Proceedings of the Essex Institute.**

This early flora stated that *Psidium guajava* was "very abundantly introduced and naturalized in many places," but it did not include *P. cattleianum.*

193. **Manshardt, R. and K. M. Aradhya. 1990. Genetic uniformity in strawberry guava (*Psidium cattleianum*). Abstract 3053. Abstracts of Contributed Papers, 23rd International Horticulture Congress, Florence, Italy.**

Three major morphotypes of *Psidium cattleianum* f. *cattleianum* (red-fruited) and two types of f. *lucidum* (medium-sized tree with spindle-shaped fruits and smaller tree with spherical fruits) differed from each other in each of five polymorphic isozyme systems. There was no within-morphotype variation. A fourth isozyme phenotype was found in plants with orange fruits and intermediate morphology, which seems to represent an intervarietal hybrid. Seedlings from each of the four types were found to have isozyme phenotypes the same as the maternal parent. These results probably indicate that apomixis is the major method of propagation but that sexual reproduction occurs infrequently.

194. **Maranca, G. 1983. Fruticultura comercial: Mamão, goiaba e abacai. (Commercial fruit growing: Papaya, guava, and pineapple.) 3rd ed. Nobel, São Paulo. [in Portuguese]**

Information was included on the properties and uses of the fruit of guava, papaya, and pineapple. The botany, climate, soil, cultural practices, and similar information is presented on these fruit crops, including diseases and insects (listed by common names only) affecting the commercial production of *Psidium guajava.*

195. **Markin, G. P. 1990. Unpublished letter to Charles Hodges, dated February 16, 1990, regarding Brazilian support of biological control of strawberry guava. Copy sent to C. W. Smith.**

Markin outlined a plan for a student in Brazil to systematically assess possible insect controls for *Psidium cattleianum* in Hawai'i. Year One would focus on a systematic collection and comparison of insects affecting either or both *P. cattleianum* and *P.*

*guajava* in areas where they grow together. The second year would focus on detailing the biology of three insects which seem to be promising for biological control. During the third year insects would be tested on other species and attempts would be made to introduce some to quarantine in Hawai'i to begin testing of local species. Years Four to Ten would involve a continuation of testing and the eventual choice of five insects for release in Hawai'i.

196. **Marlatt, R. B., and C. W. Campbell. 1980. Susceptibility of *Psidium guajava* selections to injury by *Cephaleuros* sp. Plant Disease 64(11):1010-1011.**

*Cephaleuros* sp., a pathogenic green alga, was reported to severely injure foliage of *Psidium guajava* in Florida. Different cultivars have varying susceptibility.

197. **Martinez, A. P. 1973. Guava diseases. Hawaii Agricultural Experiment Station Miscellaneous Publication 111, p. 8.**

(See the annotation under University of Hawai'i, 1973.)

198. **Mathur, R. L., and S. S. Jain. 1960. Selecting guavas for wilt resistance. Proceedings of the National Academy of Sciences, India.**

Wilt was described as one of the worst diseases of cultivated guava, killing nearly one fourth of trees in the orchards of Uttar Pradesh (India). The disease first appeared in the Babakkarpur area of Allahabad (state), and since that time hardly any guava orchard had not been affected by it. *Cephalosporium* and *Fusarium* had been associated with the disease and the causal fungus was later described as *F. oxysporum* f. *psidii*. The need for developing resistant stocks which also produced high quality fruit was emphasized. Resistance screening resulted in a list of 49 guava varieties from which those showing promise for use in breeding programs could be selected.

199. **Mathur, R. L., and R. D. Singh. 1959. *Torula* stage of *Hendersonula toruloidea* Nattrass on twigs of *Psidium guajava* L. -- a new record. Current Science 28:124-125.**

A fungus of the genus *Torula* was described which caused branch wilt disease of Persian walnuts. This pathogen was later found to be conspecific with *Hendersonula toruloidea*, which was reported to cause similar twig die-back of common guava.

200. **Mathur, R. L., and R. D. Singh. 1964. Pycnidial stage of *endersonula toruloidea* on twigs of *Psidium guajava* in artificial culture. Indian Phytopathology 17:216-217.**

The *Torula* stage of *Hendersonula toruloidea*, isolated from dying guava *(Psidium guajava)* twigs had been previously reported from India. The pycnidial stage of the fungus was reported and described in the current article. The fungus grew profusely on twigs giving rise to arthrospores and about 1.5 months produced erumpent stromatic balls on the surface of the bark. Within 3 months the pycnidia and pycnospores of *H. toruloidea* were observed.

**201. Mathur, R. S. 1956. Guava diseases in India. Indian. Journal of Horticulture 13(1):26-29.**

At the time of writing, at least one deficiency disease and a number of fungal diseases had been reported on common guava, grown as a fruit crop in India. Wilting was first observed in the Babakkarpur area of Allahabad in 1935 and subsequently caused extensive damage in Uttar Pradesh and had spread to several additional regions. Both *Cephalosporium* sp. and *Fusarium* were initially isolated from diseased plants, the latter of which was identified as *F. oxysporum* f. *psidii*. The *Cephalosporium* isolate was later suspected as being merely a developmental stage of the *Fusarium*. A serious fruit canker caused by *Pestalotia psidii* (later changed to *Pestalotiopsis psidii*) was reportedly very common in several states of India. Canker or scab, caused by *Glomerella psidii* (or *Colletotrichum psidii*) was also reported. Other fungi causing minor damage were *Meliola psidii* (black mildew) on fruits, *Pleosphaeropsis psidii* on twigs, *Cercospora* sp. on leaves, and *Gloeosporium psidii* causing dieback of guava trees. An algal leaf spot was caused by *Cephaleuros* sp. A bibliography of references to these and related subjects was provided.

**202. Mathur, R. S. 1961. Say halt to wilt in your guavas. Indian Horticulture 5:13.**

Guava wilt was considered perhaps the most deadly of the various diseases of common guava, causing heavy and recurrent losses to orchardists. The disease was reportedly first noticed in 1935 in an orchard in Babakkarpur in Uttar Pradesh, India. The causative fungus, *Fusarium oxysporum* f. *psidii*, was described, as were the symptoms and progressive history of the disease. Since the disease is soil-borne, it was considered difficult to control, although soil treatment with lime and gypsum had given encouraging results. The use of genetically resistant varieties as root stock material was suggested as the most effective potential approach for the long term, widespread control of the disease. Work completed and underway at the time of writing in development of such resistant varieties was described.

**203. Matsuo, T., N. Hanamure, K. Shimoi, Y. Nakamura, and I. Tomita. 1994. Identification of (+)-gallocatechin as a bio-antimutagenic compound in *Psidium guajava* leaves. Phytochemistry 36(4):1027-1029.**

In an effort to find new bioantimutagenic compounds of plant origin, especially fruits, vegetables, and crude drugs, the authors investigated guava leaves, from which (+)-gallocatechin was isolated as a bio-antimutagenic compound.

**204. Mattos, J. R. 1981. Novidades taxonômicas em plantas do Brasil. (New taxa of plants in Brazil.) Loefgrenia 76:3. [in Portuguese]**

*Psidium cattleyanum* var. *pyriformis* was published as a new variety in Brazil.

**205. Mau, R. F. L., and W. C. Mitchell. 1978. Development and reproduction of the Oriental stink bug, *Plautia stali* (Hemiptera: Pentatomidae). Annals of the Entomological Society of America 71(5):756-757.**

*Plautia stali* was reported as a potential pest of *Psidium* spp. in Hawai'i. Developmental details of this insect were examined here.

206. **Mau, R. F. L., and K. Nishijima. 1989. Development of the transparent winged plant bug, *Hyalopeplus pellucidus* (Stal), a pest of cultivated guava in Hawaii. Proceedings of the Hawaiian Entomological Society 29:139-141.**

*Hyalopeplus pellucidus* was reported on all Hawaiian islands from sea level to the mountains and has been recorded on several native plant species as well as common guava and avocado. The authors characterized the life cycle of this insect and established it as an important pest of guava. A direct relationship between feeding injury and the abscission of flower buds was indicated by cage studies.

207. **Maurya, R.K., and G. Shankar. (Undated). Screening trial of herbicides for guava, karna and kagzi lime seed bed. Pp. 32-33, *In*: Abstracts of Papers, Annual Conference of Indian Society of Weed Science, 1982.**

This study was directed at finding effective herbicides for weeds in fruit crop seedbeds and also reported their effects on the crop plants. *Psidium guajava* was least affected by 2,4-D and most affected by atrazine.

208. **McKenney, M. P., L. T. Gill, D. E. Coleman, and D. A. Jordan. 1990. Index to the slide bank of Hawaii's native biota. Moanalua Gardens Foundation, Honolulu.**

A slide bank was established to provide photos for use by Hawai'i's educators. A slide of *Psidium cattleianum* was included as an example of one of the threats to native ecosystems.

209. **McVaugh, R. 1963a. Flora of Guatemala, Part VII. Fieldiana: Botany 24(3):283-405.**

A complete taxonomic description of *Psidium cattleianum* was given. The species was originally published as *P. cattleianum* Sabine, (Transactions of the Royal Horticultural Society 4:314) in 1821. *Psidium littorale* Raddi (Opuscoli Scientifici, Bologna 4:254) in 1821 was considered a synonym. Common names are 'guayaba', 'guayaba japonesa', and 'strawberry guava'. It was reported to be cultivated around Cobán (at about 1,300 m elevation) and doubtless elsewhere in Guatemala and planted infrequently in Central America. It is native probably to the lowlands of eastern Brazil. *Psidium cattleianum* is called 'cas dulce' in Costa Rica. Apparently native plants from eastern Paraná to São Paulo are usually glabrous whereas cultivated specimens from northern South America and Central America are often pubescent. Leaves sometimes suggest from their size and shape a possible admixture of genes from *P. sartorianum*.

210. **McVaugh, R. 1963b. Tropical American Myrtaceae, II. Notes on generic concepts and descriptions of previously unrecognized species. Fieldiana: Botany 29(8):393-532.**

The author provided a comprehensive treatment of the genera of Myrtaceae in Central

America, Mexico, and the West Indies as the first revision of this group since the early work of Berg (1856-1862). The genus *Psidium* was delimited according to taxonomic concepts current at the time of writing. *Psidium guajava* was mentioned as the best example of the genus *Psidium* with conspicuously large flowers, the calyx closed or nearly closed in bud, and the ovary 3- to 5-locular. The author noted that, unfortunately, none of these characteristics is consistent within the genus, and none is distinctive.

**211. McVaugh, R. 1968. The genera of American Myrtaceae -- an interim report. Taxon 17(4):354-418.**

*Psidium* was described as a member of the pimentoid subtribe of the Myrtaceae, having a C-shaped or uncinate embryo, hard or bony seeds, and the calyx splitting between the lobes at anthesis. Except for a few species which have become widespread through cultivation, most species of the genus occur as native plants. Most species are from central and southeastern Brazil, but there are a few from the West Indies, a few from continental North America, about 15 from northern South America, a few from the Andes, and a few from southern Brazil. Numerous species described by Berg (1856-1862 Linneae) from Central and southeastern Brazil have not been adequately studied since his time. Contrary to what other authors have accepted as a distinguishing characteristic (see Kausel 1966), McVaugh found no sharp distinction in *Psidium* between groups of species with closed buds and those with open buds.

**212. McVaugh, R. 1969. Myrtaceae. *In*: Maguire, B. (ed.), The botany of the Guayana Highland -- Part VIII. Memoirs of the New York Botanical Garden 18(2):55-286.**

The reader was referred to McVaugh (Fieldiana: Botany 24:391. 1963) for a complete description of *Psidium cattleianum*, and to Fosberg (Proceedings of the Biological Society of Washington 54:179-180. 1941) and Schroeder (Journal of the Arnold Arboretum 27:314-315. 1946) for a discussion of the nomenclature. *Psidium guajava* L., Species Plantarum, 470, 1753, was described as one of the best known cultivated plants in the tropics. A description was given in Publications of the Field Museum of Natural History, Botanical Series 13(4) [Flora of Peru]:794. 1958.

**213. Menezes Mariconi, F. A. 1952. Alguns percevejos das frutas. (Some plant insects on fruit trees.) Biológico 18:181-187. [in Portuguese]**

In a study at Campinas (Brazil), four species of plant insects were observed attacking guava flower buds and fruits. *Leptoglossus gonagra, L. fasciatus*, and *L. stigma* were common, while *Holymenia clavigera* was rare. Notes were provided on their distribution, economic importance, host plants, biology, and morphology of the adults.

**214. Merrill, E. D. 1954. The botany of Cook's voyages. Chronica Botanica 14(5/6):161-383.**

*Psidium guajava* was reportedly not present in Tahiti or other areas of Polynesia prior to the time of European contact. The author also stated that what is referred to as "Chinese guava" is actually a variety of *P. guajava* which was brought to China after Magellan's travels by way of the Philippines.

215. **Merrill, E. D., and L. M. Perry. 1938. The Myrtaceae of China. Journal of the Arnold Arboretum 19(3):181-247.**

*Psidium cattleianum* and *P. guajava* were included among the Myrtaceae of China. The authors stated that *P. cattleianum* was thought to have reached China early, perhaps brought by the Portuguese, after which it was taken to Europe.

216. **Midha, S. K., and J. S. Chohan. 1967. Factors affecting the production of pectinolytic enzymes by *Gloeosporium psidii*, the causal agent of fruit rot of guava (*Psidium guajava* L.). Indian Phytopathology 20:215-219.**

Pectinolytic enzymes were described as important in the ability of fungi to cause rots. The ability of the guava fruit anthracnose fungus *Gloeosporium psidii* to produce pectinolytic enzymes was reported to be influenced by several environmental and nutritional factors. Specifically, *G. psidii* produced maximum amounts of pectinolytic enzymes in potato-yeast-extract medium. The optimum temperature for enzyme production was 20° C. Production was maximum at pH 5.0, and maximum activity was at pH 4.5. The optimum range of carbon to nitrogen ratio for enzyme production was 38:52.

217. **Midha, S. K., and J. S. Chohan. 1968. Chemical basis for incipient infection caused by *Gloeosporium psidii* in guava fruits. Journal of Research, Punjab Agricultural University 5(3):395-400.**

*Gloeosporium psidii*, the cause of a serious fruit rot of common guava, was known to remain dormant for about 3 months in young infected fruit and to resume activity to cause rot during the process of ripening. The reason for this behavior, whether due to hardness of young fruit or to nutritional deficiencies in immature fruit was investigated. Growth of *G. psidii* was reported to be significantly increased with increasing amounts of glucose in the basal medium. Absence of nitrogen from the basal medium reduced the growth of the fungus by about 75 percent. A fructose/glucose ratio of 0.5 at pH 4.0, a condition occurring in mature guava fruits, enabled the pathogen to cause maximum damage. The results therefore indicated a nutritional basis for activity of the fungus in mature fruit.

218. **Midha, S. K., and J. S. Chohan. 1971. Relative efficacy of fungicides against *Colletotrichum gloeosporioides* the causal agent of fruit rot of guava (*Psidium guajava* L.). Indian Journal of Mycology and Plant Pathology 1(1):15-19.**

Twelve fungicides were screened for their effectiveness in controlling guava fruit rot in India, caused by *Colletotrichum gloeosporioides*. Five of the chemicals were found to be good protectants in pre-inoculation sprays.

**219. Miller, C. D., D. Bazore, and M. Bartow. 1976. Fruits of Hawaii. University of Hawai'i Press, Honolulu.**

This nontechnical book provided a summary of the history of both *Psidium cattleianum* and *P. guajava* and numerous recipes for using the fruits.

**220. Mishra, A. S., and G. P. Rao. 1988. Inhibition of tobacco mosaic virus by root extracts of higher plants. Phytophylactica 30(1):93-94.**

Complete inhibition of tobacco mosaic virus was achieved by treatment with a crude aqueous root extract of *Psidium guajava*. Other plants also were tested.

**221. Mitchell, W. C. 1973. Insect and mite pests of guava. Hawaii Agricultural Experiment Station Miscellaneous Publication 111, pp. 8-10.**

(See the annotation under University of Hawai'i, 1973.)

**222. Morgante, J. S. 1991. Mosca-das-frutas (Tephritidae): Característcas biológicas, deteção e controle. (Fruit flies (Tephritidae): Biological characteristics, detection, and control.) Boletim Ténico de Recomendaçoes para os Perímetros Irrigados do Vale do São Francisco, No. 2. [in Portuguese]**

Biological characteristics, detection, and control of the fruit flies (*Anastrepha fraterculus*: Tephritidae) which attack Myrtaceae, especially members of the genus *Psidium*, were discussed.

**223. Motooka, P. S. 1981. Chemical weed control in pastures and ranges of Hawaii. Research Extension Series 009, College of Tropical Agriculture and Human Resources, University of Hawai'i, Honolulu. 12 pp.**

*Psidium guajava* (common guava), *P. cattleianum* (red strawberry guava), and *P. cattleianum* f. *lucidum* (yellow strawberry guava) were among many weed species listed of pastures and ranges of Hawai'i. Herbicides tested for their control were 2,4-D for yellow strawberry guava. Basal treatment gave moderate response, but the tree was resistant to foliar spray according to Ripperton and Hanson (1952). Nicholls *et al.* (1971) tested 2,4,5-T injection but Motooka did not report the results. Ripperton and Hanson (1952) and Tam (1947) also tested 2,4-D foliar and basal application on common guava but the success rate was not reported.

**224. Motooka, P. S., G. Nagai, and L. Ching. 1983. Cut-surface application of glyphosate to control tropical brush species. P. 96, *In*: Abstracts. 1983 Meeting of the Weed Science Society of America.**

Glyphosate was applied to notches in the trunks of *Psidium guajava, P. cattleianum, Leucaena leucocephala, Eugenia jambos*, and *Schinus terebinthifolius* and was found to be effective on all but *E. jambos*. 2,4-D was a less expensive chemical and more effective on *P. guajava*.

225. **Motooka, P. S., D. L. Plucknett, and D. B. Sakai. 1969. Weed problems in pastures and ranges in Hawaii. Pp. 95-98, *In*: Romanowaki, R. R., Jr., D. L. Plucknett, and H. F. Clay (eds.), Proceedings, First Asian-Pacific Weed Control Interchange, June 12-22, 1967, University of Hawai'i, Honolulu.**

*Psidium guajava* was listed and described as one of the serious weedy pests of Hawaiian pastures and ranges. In a 1952 survey, guava was reported to cover 90% of all areas on which weed control was practiced. It was reportedly found on all islands below 760 m elevation where rainfall is at least 760 mm. Guava fruit, with many hard seeds, is consumed by birds and other animals which disseminate the tree. Guava is a tough, woody shrub which sprouts readily from roots left after mechanical clearing operations.

226. **Motooka, P. S., D. F. Saiki, D. L. Plucknett, O. R. Younge, and R. E. Daehler. 1967. Aerial herbicidal control of Hawaii jungle vegetation. Hawai'i Agricultural Experiment Station Bulletin 140.**

This study compared the effectiveness of several herbicides on such "jungle vegetation" in Hawai'i as *Psidium guajava* and 'ohi'a (*Metrosideros polymorpha*). *Psidium cattleianum* was not tested.

227. **Moura, R. M. de, and A. M. de Moura. 1989. Root-knot disease on guava: A severe disease in Pernambuco, Brazil. Nematologia Brasileira (Brazil) 13:13-19. [in Portuguese]**

*Meloidogyne incognita* was identified as the species of root-knot nematode in guava (*Psidium guajava*) in Pernambuco, Brazil. This species was also parasitic on sugar cane, which was grown 20 years before guava was introduced for cultivation.

228. **Mune, T. L., and J. W. Parham. 1956. The declared noxious weeds of Fiji and their control. Bulletin 31, Department of Agriculture, Fiji.**

*Psidium guajava* was listed and described among the noxious weeds of Fiji, with general and botanical descriptions and history of distribution. According to historic records, a single Chilean guava plant was introduced from the Melbourne Botanical Gardens in 1863. The tree was planted on Nanu-i-cake island, off the Ra coast. At the time of writing, guava had become naturalized throughout the colony. Little hope was expressed for its control, with the possibility that its total eradication may never be achieved.

229. **Nafus, D., and I. Schreiner. 1989. Biological control activities in the Mariana Islands from 1911 to 1988. Micronesica, Journal of the University of Guam 22(1):65-106.**

Only two nonaquatic flowering plants, *Lantana camara* and *Chromolaena odorata*, were discussed. Whereas *Psidium guajava* was considered a weed in Guam, biological control of this tree had not yet been attempted.

230. **Naithani, S. P., and H. C. Srivastava. 1965. Systematic studies of some species of *Psidium* and different varieties of *P. guajava* Linn. of Allahabad. The Allahabad Farmer 39(2):65-69.**

A table comparing characteristics of several varieties of *Psidium guajava* was included in this article, with mention of *P. cattleianum* var. *lucidum*, *P. guineense*, and *P. chinensis*.

231. **Narang, D. D., and G. S. Mann. 1983. Insect pests of guava. Progressive Farming (India) 19(10):9,13.**

Pests of *Psidium guajava*, including fruit flies, bark-eating caterpillars, cockchafer beetles, guava shoot borer, fruit borer, aphids, thrips, and coccids, were described, as well as the damage they cause and recommendations for their control.

232. **Narasimhan, M. J. 1939. Fruit spot of guava (*Pestalozzia psidii*). P. 172, *In:* Mycology Section; Annual Report of the Mycological Department for the Year 1936-37, Mysore State.**

*Pestalozzia* and *Gloeosporium* were isolated from diseased guava fruits and grown in pure culture, but attempts to reinoculate fresh, unripe fruit were unsuccessful despite repeated attempts. Spraying infected trees with 1% Bordeaux mixture was reported very effective in controlling the diseases where they occurred near Bangalore, India.

233. **National Park Service. 1986. Natural resources management plant and environmental assessment, revised January 1986. Hawai'i Volcanoes National Park.**

*Psidium cattleianum* was identified as a widespread invasive alien species with the potential to increase in its threat to native habitats. Its control or elimination, if possible, from areas of Hawai'i Volcanoes National Park was desirable.

234. **Neal, M. C. 1965. In gardens of Hawaii. Bernice P. Bishop Museum Special Publication 50. Bishop Museum Press, Honolulu.**

This semipopular treatment of cultivated plants in Hawai'i covers members of the Myrtaceae, including *Psidium guajava* and *P. cattleianum*, found in the state as of 1965.

235. **Neck, R. W. 1978. Bionomic notes on the blood-spot skipper [Hesperiidae *Phocideas lilea sanguinea*]. Journal of the Lepidoptera Society 32(2):107-110.**

*Psidium cattleianum* was reported as a larval food plant of the blood-spot skipper butterfly in Texas. Some observations of the life cycle of the insect were also included.

236. **Neck, R. W. 1981. Leaf selection for oviposition sites by a tropical skipper butterfly *Phocides lilea sanguinea*. Journal of the Lepidoptera Society 35(3):240-242.**

The age of leaves of *Psidium cattleianum* was correlated with egg-laying behavior of the tropical skipper butterfly in Texas.

237. **Nema, K. G., and G. P. Agarwal. 1960. Fungi causing plant diseases at Jabalpur (Madhya Pradesh) – IV. Proceedings of the National Academy of Sciences, India. Volume 30, Section B, Part 1. Pp. 55-58.**

In a compilation of crop diseases and the fungi that cause them in the area of Jabalpur (Madhya Pradesh), India, *Colletotrichum psidii* was reported on fruits of *Psidium guajava* at Adhartal.

238. **Nicholls, D. F., D. L. Plucknett, W. G. Purdy III, and R. Engelhard. 1971. Recent research in control of woody plants in Hawaiian pasture and range land. Pp. 340-353, *In*: Proceedings of the Third Asian-Pacific Weed Science Society Conference.**

Research of types, methods, and effectiveness of herbicidal control of brush species in Hawai'i, including *Psidium cattleianum* and *P. guajava*, was discussed. Strawberry guava, listed as being among the major woody weeds of Hawai'i's pasture and rangeland, was completely controlled in a small test with stem injection of 2,4,5-T in an unspecified amount. Other weeds tested included *Dodonaea* spp., *Lantana* sp., *Eupatorium riparium, Schinus terebinthifolius, Myrica faya, Melastoma* sp., *Rubus penetrans*, and *Hibiscus tiliaceus*.

239. **Nielsen, R. M. 1990. Preliminary observations on the behavior of adults of *Anastrepha striata* Schiner under laboratory conditions. Brenesia 0(32):27-32. [in Spanish with English summary]**

Individuals of *Anastrepha striata* were found to be more likely to lay eggs on *Psidium guajava* and *P. friedrichsthalianum* than on *P. dulcis*, *Persea americana* (avocado), or *Mangifera indica* (mango). Time of activity was recorded. Temperature and amount of light were manipulated as variables.

240. **Nishimoto, R. K. 1983. Some mechanisms to enhance foliar absorption of herbicides. Proceedings of the Asian-Pacific Weed Science Society Conference, November 29-December 2, 1983; Manila, Philippines.**

In areas with high rainfall, herbicides were often washed off leaves and were thus less effective. Surfactants, oils, salt and phosphate ester additives, and differential concentrate applications of herbicides can increase the effect in rainy areas. Particular references to guava include the fact that *Psidium guajava* was relatively tolerant to paraquat, which could be washed off the foliage as late as 2 hours after application. Absorption of the potassium salt of picloram in *P. cattleianum* leaves was enhanced by ammonium sulfate.

241. **Ochse, J. J., J. Soule, M. J. Dijkonan, and C. Wehlburg. 1961. Tropical and subtropical agriculture. Vol. I. MacMillan Co., New York.**

The authors included a section on *Psidium guajava* among the tropical and subtropical fruit crops discussed, with mention of *P. cattleianum* and several other less often cultivated species. *Psidium cattleianum* was described as perhaps the hardiest species of the genus, surviving -5° C.

242. **Ohashi, O. S., J. C. Souza, P. R. Reis, and L. O. Salgado. 1981. Dados biológicos de *Ceroplastes janeirensis* (Gray, 1830) (Homoptera, Coccidae), praga de goiabeira no sul de Minas Gerais. (Biological data of *Ceroplastes janeirensis*, a pest of guava in southern Minas Gerais (state of Brazil).) Pp. 792-800, *In*: Congresso Brasileiro de Fruticultura, VI. Recife, Anais. SBF. [in Portuguese]**

A severe attack of guava by *Ceroplastes janeirensis* (Homoptera: Coccidae) was described in the southern part of Brazil's Minas Gerais State in 1978-1979. This may have been due to an excessive use of fungicides for the control of rust, causing a biological imbalance and depressing the effect of entomogenous fungi, such as *Verticillium* sp., a natural enemy of the nymphs of *C. janeirensis*.

243. **Okuda, T., T. Yoshida, T. Hatano, K. Yazaki, and M. Ashida. 1982. Ellagitannins of the Casuarinaceae, Stachyuraceae, and Myrtaceae. Phytochemistry (Oxford) 21(12):2871-2874.**

Ellagitannins and related polyphenols found in *Casuarina* and *Stachyurus* were also found in species of *Psidium* and other members of the Myrtaceae. Both *Psidium guajava* and *P. cattleianum* were examined.

244. **Ooka, J. J. 1980. Guava (*Psidium guajava*) fruit rot caused by *Rhizopus stolonifer* in Hawaii, USA. Plant Disease 64(4):412-413.**

Fruit rot, caused by the fungus *Rhizopus stolonifer*, was newly reported on mature green to fully ripe fruits of common guava under cultivation as a fruit crop on the Hawaiian island of Kaua'i. Oviposition by fruit flies may have provided entry wounds through which infection of ripe fruits occurred.

245. **Pandey, R. R. 1990. Succession of microfungi on leaves of *Psidium guajava* L. Bulletin of the Torrey Botanical Club 117(2):153-162.**

The phylloplane mycoflora of common guava was studied from the bud stage to leaf fall in summer, rainy, and winter seasons using a combination of cultural methods. In general, the number of fungi on leaves increased from the time of bud opening to senescence, but declined at leaf fall. The bud and unexpanded leaves were colonized by a limited range of fungi such as *Alternaria alternata, aureobasidium pullulans, Aspergillus niger, Cladosporium cladosporioides, Epicoccum purpurascens,* pink yeasts and white yeasts. Four consistently pathogenic species: *Colletotrichum gloeosporioides, Fusarium oxysporum* f. sp. *psidii, Pestalotia psidii,* and *Phoma psidii* were consistently present during all seasons.

246. **Pandey, R. R., and R. S. Dwivedi. 1984. Seasonal incidence of phylloplane mycoflora**

**of guava (*Psidium guajava*) with reference to fungal pathogens. Acta Botanica Indica 12(1):1-8.**

The fungi colonizing the phylloplane (leaf surface) and internal tissues of guava *(Psidium guajava)* leaves were studied from bud stage to senescence in summer, rainy, and winter seasons in India. The total numbers of fungi were highest in the rainy season and lowest during the summer. Fungi were categorized into three groups, those exclusively seasonal, those sensitive to the season, and those insensitive to the season. *Pestalotia psidii*, *Fusarium oxysporum* f. sp. *psidii*, and *Colletotrichum gloeosporioides* were isolated from the foliage in different seasons in different levels of dominance. The number of phylloplane microflora increased with leaf age.

247. **Pandey, R. R., and R. S. Dwivedi. 1985. *Fusarium oxysporum* f. sp. *psidii* as a pathogen causing wilt of guava (*Psidium guajava*) in Varanasi district, India. Phytopathologische Zeitschrift 114(3):243-248.**

Wilt disease of *Psidium guajava* caused by *Fusarium oxysporum* f. sp. *psidii* resulted in chlorosis, seedling wilt, and leaf abscission. Hyphae were found in the xylem of infected plants.

248. **Pandey, R. R., D. K. Arora, R. C. Dubey. 1993. Antagonistic interactions between fungal pathogens and phylloplane fungi of guava. Mycopathologia 124:31-39.**

Phylloplane fungi of guava (*Psidium guajava*) were screened for their antagonistic activities against two pathogenic fungi, *Colletotrichum gloeosporioides* and *Pestalotia psidii*, both *in vitro* and *in vivo*. Cultural filtrates of *Aspergillus niger, Fusarium oxysporum,* and *Penicillium citrinum* caused more than 50% reduction in growth of *C. gloeosporioides*. Filtrates of *Cephalosporium roseo-griseum* and *F. oxysporum* were most effective in reducing the growth of *P. psidii.* Volatiles from cultures of phylloplane fungi also inhibited the growth of the two pathogens.

249. **Parham, J. W. 1958. The weeds of Fiji. Department of Agriculture Bulletin 35, Suva, Fiji.**

*Psidium cattleianum* was listed among the weeds of Fiji. The fruit was described as green and pyriform and 0.5 - 0.75 inch long and 0.5 inch wide.

250. **Patel, M. K., M. N. Kamat, and G. M. Hingorani. 1951. *Pestalotia psidii* Pat. on guava. Indian Phytopathology 3:165-176.**

Common guava (*Psidium guajava*) was reported as a native of South America which had become an important fruit crop in India. Cultivated trees were reportedly usually free from diseases, except for a fruit canker caused by the fungus *Pestalotia psidii*, and a bark canker caused by *Physalospora psidii*. The current investigation was directed at *P. psidii*, which was stated to have been known in India for a long time but had not been previously investigated. The disease was described as most severe during periods of high humidity and rainfall, occurring on green fruits and rarely on

leaves. Cankers on fruits, depending on the variety, may be large, raised, and numerous. Infection were first noted as minute, brown or rust-colored, unbroken, circular necrotic areas. In advanced stages the lesions tear open in a circinate manner, with an elevated margin and a depressed center, giving a crater-like appearance. The disease was reported to severely impair the marketability of the fruit.

**251. Pereira, F. M., and M. Martinez, Jr. 1986. Goiabas para industrialização. (Guava for industrialization.) Legis Summa, Jaboticabal. [in Potuguese]**

Information was included in this book on properties and uses of guava (*Psidium guajava*) fruit, as well as varieties, soil conditions, climate, and cultural practices recommended for commercial production. Insects and diseases affecting guava production were listed as follows:

Insects of primary importance:
*Timocratica albella* (Lepidoptera: Stenomidae)
*Trachyderes thoracicus* (Coleoptera: Cerambycidae)
*Costalimaita ferruginea vulgata* (Coleoptera: Chrysomelidae)
*Triozoida* sp. (Homoptera: Psyllidae)
*Conotrachelus psidii* (Coleoptera: Curculionidae)
*Anastrepha fraterculus* (Diptera: Tephritidae)
*Ceratitis capitata* (Diptera: Tephritidae)
scales of the genera *Ceroplastes, Coccus, Pulvinaria, Saissetia*, etc.

Insects of secondary importance:
*Citheronia laocoon*
*Mimallo amilia*
*Pachycoris torridus*
*Holymenia clavigera*
*Leptoglossus fasciatus*
*L. gonagra*
*L. stigma*

Other insects and nematodes were discussed by common name.

Disease agents included:
*Puccinia psidii*
*Colletotrichum gloeosporioides*
*Erwinia psidii*

In addition, a list of disease agents of guava reported in the scientific literature was included.

on trunks and large branches:
*Botryosphaeria dothidea, Myxosporium psidii*
on young and mature fruit:

*Diplodia natalensis*
on mature fruit:
*Pestalotia psidii, Mucor hiemalis, Aspergillus awamori, Phytophthora nicotianae, Gloeosporium psidii, Rhizopus nigricans, Phoma psidii, Botryodiplodia theobromae,* and *Phomopsis destructum*
on leaves:
*Cephaleurus virenscens*

252. **Petit-R., P. 1990. A survey of plant parasitic nematodes associated with fruit trees of economic importance in Venezuela. Fitopatologia Venezuela 3(1):2-5. [in Spanish with English summary]**

Plant parasitic nematodes associated with 10 tropical fruit species, including *Psidium guajava*, were surveyed in this study.

253. **Pinto, A. C. Q. 1975. Comportamento de variedades eseleçoes de goiabeiras *(Psidium guajava* L.) no estado do Bahia. Estudo preliminar. (Preliminary study of varieties and selections of guava *(Psidium guajava* L.) in the state of Bahia.) Pp. 407-411, *In*: Congresso Brasileiro do Fruticultukra, 3°. Campinas, Anais. SBF. [in Portuguese]**

Certain varieties and selections of guava (*Psidium guajava*) were evaluated as fruit crops in Brazil. The cultivars reported were 'Ruby Supreme', 'Supreme', 'Webber Supreme', 'Patillo', 'Selection I', 'Branca Arredondada', 'Rosa Arredondada', and 'Creme Arredondada'.

254. **Pittier, H. 1926. Manual de las plantas usuales de Venezuela. (Manual of the useful plants of Venezuela.) Litografía del Comerico, Caracas, Venezuela. [in Spanish]**

In a compilation of common plants of Venezuela, *Psidium guajava* was listed with the common name 'guayabo casero', and *P. cattleianum* as 'guayabo peruano'.

255. **Plucknett, D. L. 1969. Use of herbicides in conservation and development of brush-infested tropical wetlands. Proceedings, Second Asian-Pacific Weed Control Interchange 2:370a-k.**

The desiccant herbicide diquat was applied to strawberry guava leaves with unsatisfactory results. Strawberry guava was referred to by the local name 'waiawi', which usually refers to the yellow-fruited form of *Psidium cattleianum* in Hawai'i. The author stated "Waiawi (is) a very difficult species to control because of the heavy, waxy leaves", making herbicide absorption difficult.

256. **Popenoe, W. 1934. The guava (*Psidium guajava*, L.). P. 278, *In*: Manual of Tropical and Subtropical Fruits. The Macmillan Company, New York.**

This book included short treatments of *Psidium cattleianum* and *P. guajava* and

mentioned several other species of *Psidium* as fruit crops. Strawberry guava was reported to be native to Brazil and was taken to China early, probably by the Portuguese. It was then taken from China to Europe. Common names for *P. cattleianum* include Cattley guava and Chinese guava, and it is known as 'araça da praia' and 'araça vermelho' in Brazil. Synonyms include *P. littorale* and *P. variabile*. A yellow-fruited variety of the species (var. *lucidum*) is also reportedly grown. No major diseases or insect predators were reported to attack strawberry guava.

**257. Prasad, N., R. L. Mathur, I. S. Chattri. 1966. Studies on the control of zinc deficiency of guava in Rajasthan. Indian Journal of Agricultural Science 36(4):201-209.**

A serious disease of guava *(Psidium guajava)*, characterized by interveinal leaf chlorosis, reduced size and leatheriness in leaves, suppression of plant growth, dieback of branches, production of few or no flowers, and drying and cracking of fruits was reported in Pushkar Valley, near Ajmer in Rajasthan, India. Foliar Spraying with zinc sulfate was found to correct the problem. The current study was carried out to determine the correct timing of spray intervals and the effectiveness of soil application and trunk injection as treatment techniques.

**258. Prasad, N., P. R. Mehta, and S. B. Lal. 1952. *Fusarium* wilt of guava (*Psidium guajava* L.) in Uttar Pradesh, India. Nature 169(2):753.**

A wilt disease of guava was first reported from the Allahabad district of the state of Uttar Pradesh in India. The diseased had reportedly advanced very rapidly within a few years to become a threat to about 20,000 square miles of guava cultivation land. The cause of the disease had been a matter of controversy, with the fungi *Fusarium* sp. and *Cephalosporium* sp. considered by different investigators as potential causal agents. The authors concluded that the disease was a vascular wilt *Fusarium,* and proposed the name *F. oxysporum* f. *psidii* for the fungus.

**259. Prates, H. S. 1987. The oriental fruit fly - *Dacus dorsalis* Hendel (Diptera: Tephritidae). Laranja 1(8):67-81. [in Portuguese]**

Guava was reported as one of the preferred food plants of the oriental fruit fly but this insect had not yet been detected in Brazil. Host plants, distribution, biology, control methods, and measures to prevent it from entering Brazil were discussed.

**260. Rai, J. N. 1956. Stylar end rot of the guava fruit (Psidium guajava Linn.). Proceedings of the Indian Academy of Sciences. 33(1)Section B:55-61.**

A review of literature available at the time of writing (1955) indicated that in India, four serious diseases of guava fruit were recognized: canker caused by *Physalospora psidii*, anthracnose caused by *Pestalozia psidii* and *Gloeosporium psidii*, and fruit rot due to *Phytophthora parasitica*. Algal leaf spot, *Botrytis* rot, and anthracnose due to *Glomerella cingulata* were infectious diseases reported from abroad. In the current study, stylar end rot was described as an additional disease of fruit caused by a species of *Phomopsis*.

261. **Rambo, B. 1954. História da flora do litoral Riograndense. (History of the flora of coastal Rio Grande do Sul.) Sellowia -- Anais Botanicos No. 6. Pp. 142-172. [in Portuguese with German abstract]**

*Psidium cattleianum* (as *P. cattleyanum*) was listed among 1,072 plant species from a 30,000 square kilometer area of the Rio Grande do Sul region of southern Brazil. Only 24% of the species were considered to be native to Rio Grande do Sul. It appeared that none of the remainder, including *P. cattleianum*, had originated in this area but had migrated from the surrounding regions. The same situation also applied to extension of the Rio Grande Coast south from St. Catarina and to the northeast from Uruguay. This inward migration of species was reportedly clearly indicated on the basis of plant distribution and geological evidence.

262. **Rao, V. G. 1966. An account of the market and storage diseases of fruits and vegetables in Bombay - Maharashtra (India). Mycopathologia et Mycologia Applicata 28(1&2):165-176.**

As part of a compilation of storage diseases of fruits and vegetables in various markets in Bombay, India, the author listed the following diseases for common guava:

Black spot, caused by *Colletotrichum psidii*
Pink rot, caused by *Trichothecium roseum*
Fruit canker, caused by *Pestalotia psidii*
Ripe rot, caused by *Phoma psidii*
Ripe rot, caused by *Gloeosporium psidii*
Waxy rot, caused by *Geotrichum candidum* and *Verticillium* sp.

263. **Raychaudhuri, S. P., T. K. Nariani, and H. C. Joshi. 1961. Deficiency disease of guava in Rajasthan and its control. Indian Phytopathology 14:134-138.**

Following the initial report of a serious zinc deficiency disease in guava orchards in Pushkar Valley, Ajmer (India) additional guava producing regions of India were surveyed for the disease. None of the orchards surveyed was found to be free from the disease and incidence in some orchards was 100%. The disease was controllable by foliar spraying or soil application with zinc sulphate. Shoot and trunk injections with zinc sulphate were also locally effective in the branches on the side of the trunk injection site.

264. **Razak, A. R., and T. K. Lim. 1987. Occurrence of the root-knot nematode *Meloidogyne incognita* on guava in Malaysia. Pertanika 10(3):265-270.**

*Meloidogyne incognita* was newly recognized as a disease-causing nematode of the fruit crop *Psidium guajava* in Malaysia. The nematode caused growth decline in the plant.

265. **Reddy, S. R., and S. M. Reddy. 1981. Cellulase production by three leaf spot fungi.**

**Proceedings of the Indian Natural Science Academy; Part B; Biological Sciences 47(6):915-918.**

*Helminthosporium bolmii*, *Phaeotrichochonis crotallariae*, and *Myrothecium roridum* were three leaf spot-causing fungi isolated from *Psidium guajava* in India. Physiological aspects of the fungi were assayed, and effects of fungicides and antifungal antibiotics on cellulase production were evaluated.

266. **Reitz, P. R., R. M. Klein, and A. Reis. 1983. Flora catarinense (*Psidium*). (Flora of Catarina (*Psidium*).) Sellowia 35:684-715. [in Portuguese]**

Several common names for *Psidium cattleianum* in its native country were listed: 'araçá-amarelo', 'araçá-vermelho', 'araçázeiro', 'araçá-do-campo', and 'araçá-manteiga'. Notes on ecology and distribution of *Psidium*, and a key to the species were provided.

267. **Reitz, P. R., R. M. Klein, and A. Reis. 1988. Projeto Madeira do Rio Grande do Sul. (Timber Project of Rio Grande do Sul.) Secretaria de Estado da Agricultura e Abastecimento. [in Portuguese]**

The distribution of *Psidium cattleianum* in Rio Grande do Sul (Brazil), and a list of other species of *Psidium* commonly called 'araça' from the region was provided.

268. **Riley, J. M. 1973. Growing rare fruit in northern California. California Rare Fruit Growers' Yearbook 5:67-90.**

Climatic requirements and culture practices for the production of *Psidium cattleianum* and other edible fruits in California were described.

269. **Ripperton, J. C., and N. S. Hanson. 1952. The control of woody plants on Hawaiian ranges. Hawaiian Sugar Planters' Association Progress Notes 78.**

Control of woody plants in Hawai'i was discussed, including mention of *Psidium guajava* and *P. cattleianum* control with 2,4-D. Strawberry guava was reported to be resistant to foliar application of 2,4-D, but basal application of the herbicide resulted in moderate control success.

270. **Roa, D. P. C., S. C. Agrawal, and S. B. Saksena. 1976. *Phomopsis destructum* on *Psidium guajava* fruits in India. Mycologia 68:1132-1132.**

The fungus *Phomopsis destructum* was reported on guava in India, causing a serious fruit rot.

271. **Rodrigues Neto, J., C. F. Robbs, and T. Yamashiro. 1987. A bacterial disease of guava (*Psidium guajava*) caused by *Erwinia psidii* sp. nov. Fitopatologia Brasileira 12(4):345-350.**

The authors described a bacterial disease of *Psidium guajava* first observed in Brazil in 1982. The disease caused collapse of vascular tissues and dieback of branches and twigs, as well as affecting leaves, blossoms, and green fruits.

272. **Roig y Mesa, J. T. 1953. Diccionario botanico de nombres vulgares Cubanos. Tomo II. (Dictionary of common names of plants in Cuba. Volume II.) 2da. Edicion Ampliada y Corregida. Seoane, Fernandez y Cia, Habana. [in Spanish]**

The common name of *Psidium cattleianum* in Cuba was given as 'guayabita fresa', whereas the common name of *P. guajava* was 'guayaba'. The common names of a number of other species of *Psidium* were also listed.

273. **Ruehle, G. D. 1936. An epiphytotic of algal spot in South Florida. Plant Disease Reporter 20:221-222.**

Host plants, including *Psidium guajava*, of the partially parasitic alga *Cephaleuros (virescens) mycoides* were reported in southern Florida. On guava, spots caused by the alga were observed only on the leaves, whereas on mango (*Mangifera indica*), another host, spots also occurred on twigs.

274. **Ruehle, G. D. 1941. Algal leaf and fruit spot of guava. Phytopathology 31:95-96.**

The alga *Cephaleuros virescens* was reported to occur as an epiphyte on leaves of many plants, becoming almost parasitic on some economically important hosts. On common guava (*Psidium guajava*), leaf and fruit infections were reported as particularly severe.

275. **Ruehle, G. D. 1948. The common guava -- a neglected fruit with a promising future. Economic Botany 2(3):306-325.**

A summary of the history, uses, processing, cultural requirements, propagation, diseases, and research underway on *Psidium guajava* at the time of writing was presented, from the position of promoting guava as an economic fruit crop.

276. **Russ, G. W. 1929. A study of natural regeneration in some introduced species of trees. The Hawaiian Forester and Agriculturist 26:117-124.**

Strawberry guava (as *Psidium cattleyanum*) was discussed as one of six species of introduced trees to Hawai'i which were spread by birds or animals (i.e., mammals). Large specimens of strawberry guava were also reportedly observed which had been planted in yards in the Manoa area of O'ahu as cultivated fruit trees.

277. **St. John, H. 1973. List and summary of the flowering plants in the Hawaiian Islands. Pacific Tropical Botanical Garden Memoir 1. Lawai, Hawai'i.**

St. John included the following species of *Psidium* in his checklist of plants in Hawai'i:

*P. cattleianum* Sabine var. *cattleianum* f. *cattleianum*, with the common names 'purple strawberry guava', 'cattley guava', and 'waiawi-'ulu'ula'; cultivated, introduced to Hawai'i from Brazil in 1825;
*P. cattleinaum* f. *ludidum* Deg., with the common names 'yellow strawberry guava', 'yellow cattley guava', 'waiawi'; an escaped cultigen, introduced to Hawai'i in 1939;
*P. cattleinaum* var. *littorale* (Raddi) Fosb.; an escaped cultigen from Brazil, introduced to Hawai'i in 1962;
*P. guajava* L. f. *guajava*, with the common names 'guava' and 'kuawa'; cultivated in Hawai'i, established in tropical America;
*P. guajava* var. *cujavillus* (Burm. f.) Deg. & Deg., with the common name 'Rant's guava'; cultivated in Amboina.

278. **Salamão-Ioriatti, M. C. S. 1991. Contribuição para oestudo da biologia dos braconideos, parasitóides das moscas das frutas, *Anastrepha* spp., em cultura de *Psidium guajava* L. (Contribution to the study of the biology of braconids parasitic on fruit flies, *Anastrepha* spp., growing on *Psidium guajava* L.) *In*: Congresso Brasileiro de Zoologia, 18., Salvador. Resumos. Salvador, Sociedade Brasileira de Zoologia, 1991. P. 148. [in Portuguese]**

Parasitism of fruit flies which attack guava *(Psidium guajava)* fruit by members of the genus *Anastrapha*, hymenopteran insects of the family Braconidae, was reported in Brazil. In experiments in which the braconid *Doryctobracon aureotus* was placed with guava infested with *Anastrapha* spp., early results indicated high rates of parasitism.

279. **Salvador, J. do L. G. 1986. Comportamento de espécies florestais nativas em àreas de depleção do reservatórios. (Behavior of native forest species in depleted areas around reservoirs.) Instituto de Pesquisas e Estudos Florestais No. 33. Pp. 73-78. [in Portuguese]**

Observations of eight native species, including *Psidium cattleianum*, in ornamental plantings on the shoreline of a reservoir in São Paulo, Brazil, indicated that most did not survive following flooding to warrant their further use for this purpose. Only two of the species tested, of which *P. cattleianum* was not one, showed adequate survival under these conditions.

280. **Salzedas, L. F., and S. M. Rodrigues Netto. 1985. Ocorrência do cancro da goiabeira (*Botryosphaeria dothidea* (Moug. ex Fr.) Ces. & De Not.) na região de Araçatuba, estado de São Paulo. (Occurrence of guava canker (*Botryosphaeria dothidea* (Moug. ex Fr.) Ces. & De Not.) in Araçatuba, São Paulo State (Brazil).) Biológico 51(11):295-297. [in Portuguese]**

A fungal disease which produced lesions accompanied by depression and splitting of the bark was observed on trunks and branches of guava trees in Brazil. Whereas fruiting bodies of the perfect state of the fungus (*Botryosphaeria dothidea*) were observed on infected bark, only the imperfect state (*Dothiorella* sp.) was produced in

pure culture.

281. **Sanchotene, M. C. C. 1985. Frutíferas nativas úteis a fauna na Arborização Urbana. (Native fruit useful to the fauna in street landscaping.) FEPLAM, Porto Alegre. Pp. 214-218. [in Portuguese]**

*Psidium cattleianum* (as *P. cattleyanum*) was described from the standpoint of its use as a fruit crop in Brazil, including its biological description, range, phenology, and cultural practices. Synonyms listed for *P. cattleianum* were: *P. littorale*, *P. variabile*, *P. coriaceum* var. *obovatum*, *P. coriaceum* var. *grandifolium*, and *P. cattleianum* var. *coriaceum*. Popular names listed were: 'araçá', 'araçá-do-campo', 'araçá-amarelo', 'araçá-vermelho', 'araçá-doce', 'araçá-manteiga', 'araçázeiro', 'araçá-de-comer', 'araçá-da-praia', 'araçá-pera', 'araçá-rosa', 'araçá-de-coroa', 'araçá-saiyu e guayabo amarillo, na Argetina'; 'araza, no Uruguai'; 'Calcuta-guava para os Anglo-indianos'; 'Chinaguava, na Inglaterra'; 'govavier de St. Martin, em Guadalupe'; 'goyavier fraise, na França'; 'goyavier prune, na Martinica'; and 'purple-guava, na Jamáica'.

It is native to eastern South America, from the montane zone of eastern Uruguay. In Brazil it occurs from Minas Gerais to Rio Grande do Sul where it is found in the central valley, lower elevations of the northeastern mountains, coastline, fields on montane plateaus, and northeastern and southeastern faces at higher elevations. It is widely cultivated, but some local natural populations were identified.

Fruits were reportedly attacked by *Stenoma albella* (white orchard butterfly), galls were caused by scales and problems reported with cerambicid beetles.

282. **Santos, G. L., L. W. Cuddihy, and C. P. Stone. 1989. Cut stump, frill and basal bark treatments of triclopyr on strawberry guava. P. 134, *In*: Progress Report, Western Society of the Weed Science Conference, March 14-16, 1989, Honolulu, Hawai'i.**

The herbicide triclopyr had been found effective in controlling *Psidium cattleianum* in dry areas of Hawai'i. In this study the effectiveness of this herbicide was tested in Kipahulu Valley of Haleakala National Park on Maui, an area of high rainfall. Two types of undiluted treatments were effective on inhibition of resprouting and cambium kill, but remaining slash produced enough roots and shoots to negate the effect. Native plants monitored in the area showed no ill effects.

283. **Sarbhoy, A. K., and D. K. Agarwai. 1987. Four new leaf spot diseases from northern India. India Section B (Biological Science) 57(3):317-318.**

The leaf spot-causing fungus *Pestalotiopsis psidii* was found for the first time in India infecting *Psidium guajava*. Actual damage to the tree, if any, was not described.

284. **Sastry, M. V. 1965a. Biochemical studies in the physiology of guava Part II: Major chemical changes. Indian Food Packer 19(3):5-10.**

Synthesis of cell wall materials and of sugars were reported to be among the important chemical changes occurring in fruit of common guava during the first 60 days of growth. Increase in cell volume and cell matter after this period is a result of cell enlargement and accumulation of cell sap in vacuoles. The quantity of pectins increased rapidly during the ripening period. The starch content decreased with decrease in pH except in the early stages. Predominance of fructose over glucose is maintained throughout the growth period. Proteins were found to increase gradually until cessation of fruit growth.

**285. Sastry, M. V. 1965b. Biochemical studies in the physiology of guava Part III: Minor chemical changes. Indian Food Packer 19(5):5-8.**

In a study to determine minor chemical changes in guava fruit during the growth process, a major portion of the minerals in was found to be taken into the fruit at very early stages of development. A correlation was found between potash content and carbohydrates at the maximum growth period of fruit (i.e., from 60 to 120 days). Phosphorus appeared to be present in the inorganic form in the initial stages and to change to the organic form in the final stages of fruit development. Changes in tannin were similar to those of carbohydrates. The total tannin content in ripe fruits was quite high, but astringency is not detected due to the rapid formation of sugars in ripe fruit.

**286. Schmidt, S. K., and K. M. Scow. 1986. Mycorrhizal fungi on the Galapagos Islands [Ecuador]. Biotropica 18(3):236-240.**

Comparisons of rates of infestation with vesicular-arbuscular mycorrhizal (VAM) fungi on Santa Cruz Island in the Galapagos Islands showed the presence of the fungi in the roots of at least some plants from all vegetation zones. Infestation was highest in moister areas, and especially prevalent in aggressive invaders, such as *Cinchona succirubra* and *Psidium guajava*.

**287. Schroeder, C. A. 1946. Priority of the species *Psidium cattleianum* Sabine. Journal of the Arnold Arboretum 27:314-315.**

The author provided evidence that the binomial '*Psidium cattleianum* Sabine' should be used for the species rather than '*P. littorale* Raddi.'

**288. Schroeder, C. A., and J. E. Coit. 1944. The cattley (commonly known as the strawberry guava). Yearbook of the California Avocado Society 1944:44-47.**

The 'cattley guavas,' known at the time of writing as *Psidium littorale* for the red form, and *P. littorale lucidum* for the yellow form, were discussed from the standpoint of their desirability as a fruit crop in southern California. The 'cattley' was described as native to Brazil, but came to the U. S. by way of Europe. The red form was reported to have been grown in southern California for many years as an evergreen ornamental. Its advantages over "true" guava (i.e., *P. guajava*) were its much wider adaptability to variable soil and moisture conditions, and much greater

frost resistance. The red form was reported capable of withstanding temperatures as low as 22° F. The yellow form was less widely grown because of its greater susceptibility to frost.

"There is no record of any disease affecting this plant, in California at least, and its only insect enemy appears to be the greenhouse thrips (*Heliothrips haemorrhoidalis*), which occurs only occasionally and is quite easily controlled by spraying."

289. **Seabra, J. J. D. A. 1949. Flora das dunas (Apontamentos sobre a flora pasmofila das dunas de Itapoan - Bahfa). (Flora of the dunes of Itapoan, Bahía State, Brazil.) Lilloa 20:187-192. [in Portuguese with English abstract]**

The genus *Psidium* was listed as a floral component of the dunes of Itapoan, Bahía State, Brazil, in association with other familiar genera such as *Anacardium, Passiflora, Miconia, Tibouchina, Jacaranda, Lantana, Opuntia, Waltheria,* and *Schinus*.

290. **Sem, G. S. 1984. A population study and distribution of strawberry guava (*Psidium cattleianum* Sabine) in Hawai'i Volcanoes National Park, Hawai'i. Master's thesis, University of Hawai'i, Honolulu.**

The genus *Psidium* was reported as a member of the subfamily Myrtoideae, which had chromosome counts of 2n=22 to 2n=88, as compared with members of the Leptospermoideae, with 2n=22. *Psidium guajava* had a count of 2n=22, and *P. cattleianum* 2n=88 (although counts of 66 and 77 had been found). The reported native range of *P. cattleianum* was from Rio de Janeiro, Minas Gerais, Brazil, to Uruguay. Strawberry guava was characterized as a serious weed in Hawai'i, Mauritius, Reunion, and the Seychelles and also has become naturalized in Fiji, India, Ghana, the Solomons, Tanzania, Cuba, Florida, New Caledonia, Madagascar, Trinidad, Bermuda, Jamaica, Sri Lanka, Guatemala, and Australia (Queensland). Strawberry guava was reported capable of tolerating temperatures as low as -5° C and to be drought-resistant. This study concluded that the feral pig appeared to be a major vector in dispersing the plant. Plants at lower altitudes showed a higher percentage of senescence than did those at higher altitudes.

291. **Seth, J. N. 1959. Causes of seedlessness in *Psidium guajava* L. Horticultural Advance 3:82-88.**

Seedless varieties were reportedly common in *Psidium guajava*. The condition of seedlessness is related to many factors, of which self-incompatibility and chromosomal abnormalities were considered to be the major ones. The variety 'Seedless' was diploid with n=22. Both embryo sac and pollen grains were found to be functional, but the percentage of viable pollen grains was low. The meiotic division was highly abnormal showing monovalent and bivalent laggards as well as bridging of chromosomes, indicating the hybrid origin of the variety and explaining the low pollen grain fertility.

292. **Seth, J. N. 1962a. Studies on floral biology of *Psidium* species. I. Flowering habit, time and duration of flowering, period of floral bud development and fruit maturity and stages of bud development. Annual Report of Horticultural Research Institution, Saharanpur. Pp. 55-64.**

The author provided a detailed report of floral and fruiting aspects of the phenology of common guava in India.

293. **Seth, J. N. 1962b. Floral biological studies in *Psidium*. II. Anthesis and dehiscence of anthers, pollen studies, stigma receptivity, fertilization and fruit-setting. Horticultural Advance 4:110-136.**

The author reported a detailed study of floral anthesis, dehiscence of anthers, pollen morphology and pollination, stigma receptivity, fertilization, and fruit setting in five species of *Psidium*: *P. guajava, P. ghineense, P. molle, P. chinense,* and *P. cattleianum* f. var. *lucidum.*

294. **Seth, J. N. 1963. Morphological and cross-incompatibility studies in some species of *Psidium*. Agra University Journal of Research 12:193-197.**

As a basis for hybridization and improvement of cultivated *Psidium guajava,* comparative studies were made of the floral morphology, floral biology, incompatibility, cytology, embryology, and seed development of *P. guajava, P. guineense, P. chinense, P. molle,* and *P. cattleianum* var. *lucidum.* Floral biology of all the species was reported to be very similar to one another. *Psidium cattleianum* differed slightly in several ways from the other species, however:

1. Maturation of floral buds and fruits was most rapid in this species.
2. Anthers dehisced after anthesis rather than before as in the other species.
3. Pollen had the lowest viability.
4. Optimum temperature for pollen germination was lower (25° C as opposed to 30° C for the other species).
5. Pollen longevity was shortest, the stigma becoming receptive the day the flower opens, remaining so for up to 72 hrs. (in other species, the stigma became receptive the day after anthesis and remained so up to 32 hrs.).
6. When *P. cattleianum* var. *lucidum* and *P. guajava* were crossed, the fruits were seedless.
7. *Puccinia cattleianum* var. *lucidum* was reported to be octaploid (as compared with *P. molle,* which was tetraploid and the other above-listed species, which were diploids of 2n=22).

295. **Shakir, A. S., M. A. Nasir, and S. T. Sahi. 1991. Anthracnose of guava - a new record in Pakistan. Pakistan Journal of Agricultural Science 28(2):211.**

During 1990 the fruits and branches of common guava (*Psidium guajava*) trees in orchards of Faisalabad, Pakistan, were found to be affected with an anthracnose disease caused by *Gloeosporium psidii.* Descriptions of the disease and the fungus were provided.

296. **Shanker, G. 1961. Some problems of Guava (*Psidium guajava* Linn.) cultivation in Uttar Pradesh. The Allahabad Farmer 35:(1)1-3.**

The author stated that guava was one of the most important fruit crops in Uttar Pradesh (India) and to a lesser extent in other parts of the country. Problems with the cultivation of guava were discussed, including those involving grafting and the breaking of limbs due to weight of the mature fruit. The guava wilt disease, caused by *Fusarium oxysporum* f. *psidii* was reportedly spreading at a rapid rate and was considered the most serious problem in guava cultivation. No direct control measures were known for this soil-borne disease, but removal of infected trees and use of propagation material from those orchards which were free from the were recommended to contain the disease. The author suggested that relatives of common guava such as Cattley guava (*Psidium cattleianum*) and Guinea guava (*P. guineese*), which may be free of wilt disease, be tried as rootstock.

297. **Shanker, G., and B. A. David. 1979. Guava varieties and its relatives differ in susceptibility to the guava stem girdling and boring bark caterpillar, *Indarbela* sp. Indarbelidae: Lepidoptera. Allahabad Farmer (India) 50(3):327-329.**

*Indarbela* sp., a bark-feeding caterpillar was found to damage or kill shoots of *Psidium guajava*. Different cultivars of common guava were affected to different degrees, but *P. cattleianum*, *P. cujavallis*, *P. molle*, and *P. freidrichsthalianum* were not affected.

298. **Shanker, G., R. N. Srivastava, R. B. Singh, and J. C. Edward. 1964. Occurrence of tetraploidy in guava (*Psidium guajava* L.). Allahabad Farmer (India) 38(6):247-248.**

A guava tree seedling was found which appeared more vigorous and larger than associated seedlings. Smears of pollen mother cells indicated that the tree was tetraploid, with 4n=44, instead of the more frequent triploid (3n=33) or diploid (2n=22). Both seedless and seeded fruits were produced by the tree. The cause of seedlessness was under study since tetraploidy normally does not cause seedlessness.

299. **Shastri, P. N., and N. V. Shastri. 1975. Studies of pectin methyl esterase activity during development and ripening of guava fruit. Journal of Food Science and Technology, India 12(1):42-43.**

Enzyme activity of one cultivar of common guava was assessed during fruit development and ripening.

300. **Shigeura, G. T., and R. M. Bullock. 1983. Guava (*Psidium guajava* L.) in Hawaii – history and production. Research Extension Series 035. College of Tropical Agriculture and Human Resources, University of Hawai'i, Honolulu. 28 pp.**

Guava (*Psidium guajava*) was discussed from the standpoint of its promotion as an economically significant fruit crop in Hawai'i. The botany, climatic requirements,

cultivars, insects, diseases, and weeds as related to its commercial cultivation in Hawai'i were systematically reviewed. *Psidium cattleianum* was also mentioned as a desirable crop in that it was reported to produce distinctly flavored and delicious fruit. The short developmental period required for fruit production was described as a useful trait for mechanical harvesting.

**301. Sidek, Z., and T. K. Lim. 1990. Occurrence of a mosaic virus in guava. Pertanika 13(3):357-359.**

Leaves of a cultivar (Burma Red) of *Psidium guajava* were found to exhibit mosaic symptoms in Malaysia. Virus particles were subsequently found which could be mechanically transmitted to seedlings of cultivar Kampuchea. The new virus was tentatively designated guava mosaic virus.

**302. Sinclair, W. A., H. H. Lyon, and W. T. Johnson. 1987. Diseases of trees and shrubs. Comstock Publishing Associates, Ithaca, New York.**

Pathogens, and the diseases caused by them affecting guava (*Psidium guajava*) were listed as follows:

*Armillaria tabescens* (mushroom root rot, characterized by mushrooms at the base of the tree);
*Botryosphaeria dothidea* (a fungus causing cankers and dieback);
*Cephaleuros virescens* (algal leaf spot, causing damage to leaves or bark);
*Glomerella cingulata* (anthracnose, a fungal disease causing seedling blight, blossom blight, leaf spots, leaf and shoot blight, fruit rot, cankers, dieback of twigs and branches, and death of entire plants);
*Hendersonula toruloidea* (dieback, a fungal disease causing cankers, wilting, and dieback of scattered limbs).

**303. Singh, A. K., and R. K. Pathak. 1992. Sodicity and salinity effect on guava (*Psidium guajava*). Indian Journal of Agricultural Sciences 62(3):220-223.**

Sodicity (sodium toxicity) and salinity were reported as significant problems in arid and semi-arid regions where guava is cultivated as a major fruit crop in India. Tests were undertaken to determine the effect of different sodicity and salinity levels on plant establishment, and survival and growth performance of seedlings and plants of the variety 'Sadar'.

**304. Singh, K. V., and R. K. Pathak. 1984. Effect of leaf extracts of some higher plants on spore germination of Ustilago maydis and Ustilago nuda. Fitoterapia 55(4):318-320.**

Extracts of *Psidium guajava* and of nine species in other genera were reported to be totally fungitoxic against the two species of *Ustilago* (smut fungi) which damage maize and barley crops.

305. **Smathers, G. A. 1968. A preliminary survey of the phytogeography of Kipahulu Valley. Pp. 55-86, *In*: Warner, R. E. (ed.), Scientific Report of the Kipahulu Valley Expedition, Maui, Hawai'i, August, 1967. The Nature Conservancy; Arlington, Virginia. 184 pp.**

The author conducted a study of the topographic vegetation profile of the lower Kipahulu Valley, then an undisturbed natural area adjacent to Haleakala National Park (West Maui, Hawai'i). The study area has since been incorporated into the park. A number of segments of the profile were designated to represent different vegetation types. *Psidium guajava* and *P. cattleianum* were listed among other native and nonnative vegetation types for some of the segments. Man's influence in contributing to the vegetation types (i.e., through introduction of alien species) was noted.

306. **Smith, C. W. 1982. Towards a resource management plan for Kipahulu Valley. Pp. 152-155, *In*: Proceedings of the 4th Conference in Natural Sciences, Hawai'i Volcanoes National Park. National Park Resources Studies Unit, University of Hawai'i, Honolulu.**

Controlling *Psidium cattleianum*, along with controlling feral pigs, is a major goal in management of Kipahulu Valley region of Haleakala National Park. Other alien influences to be controlled were goats, African tulip tree (*Spathodea campanulata*), and roseapple (*Eugenia jambos*).

307. **Smith, C. W. 1985. Impact of alien plants on Hawai'i's native biota. Pp. 180-250, *In*: Stone, C. P., and J. M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu.**

Of 4,600 species of plants introduced to Hawai'i in the last 200 years, 86 were reported to have become serious pests in native ecosystems, with *Psidium cattleianum* as one of the worst offenders and the worst pest in rain forests. Strawberry guava first forms thickets, then dense forests under which other plants have difficulty growing. Feral pigs reportedly extend the range of the plant by depositing seeds in their feces in areas they have disturbed. Fruit-eating birds also disseminate the seeds to non-disturbed forest areas. Many mature 'ohi'a and koa forests were reported to have a dense understory of strawberry guava. A strawberry guava forest may eventually "crash", as has been seen in areas other than Hawai'i, resulting in erosion or invasion by other weeds.

308. **Smith, C. W. 1989. Non-native plants. Pp. 60-69, *In*: Stone, C. P., and D. B. Stone (eds.), Conservation Biology in Hawai'i. University of Hawai'i Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu.**

Feral pigs and *Psidium cattleianum* were reported to share a mutualistic relationship. Strawberry guava was introduced to Hawai'i in 1821 for its fruit and at the time of writing was considered probably the most prevalent woody weed in the state.

309. **Smith, C. W. 1990. Weed management in Hawaii's national parks. Monographs of Systematic Botany, Missouri Botanical Garden 32:223-234.**

*Psidium cattleianum* was reported as one of the 12 worst weeds in the Kalaupapa, Haleakala, and Hawai'i Volcanoes national parks in Hawai'i. Several strategies for controlling weeds in the national parks were discussed in a general way.

310. **Smith, R. F. 1971. The results of a preliminary investigation of early plant introductions into Hawai'i. Unpublished manuscript.**

*Psidium guajava* was reported to have been introduced to the Hawaiian Islands shortly after European contact, in about 1791.

311. **Smith, R. M., and S. Stwatibau. 1975. Sesquiterpene hydrocarbons of Fijian guavas. Phytochemistry (Oxford) 14(9):2013-2015.**

It was reportedly possible to classify wild guava trees (*Psidium guajava*) in Fiji into three main chemotypes on the basis of the relative amounts of sesquiterpene hydrocarbons present in the leaf essential oils.

312. **Smith-White, S. 1948. Cytological studies in the Myrtaceae. Proceedings of the Linnean Society of New South Wales 73:16-36.**

Chromosome numbers of Australian members of the Myrtaceae were reported. A tree of the Brazilian species *Psidium cattleianum* growing in the Sydney Botanic Gardens was of interest and included in the study because of its high polyploidy. A haploid chromosome number of ca. 40-44 was reported for it and it was thought to be octoploid, or approximately so. Chromosome behavior appeared regular, with pollen mother cells notable for their large size and width of the meiotic spindles. Atchison (1947) showed that this high number was found in several species of the genus, although other species were diploids.

313. **Sohi, H. S. 1975. Anthracnose in tropical fruits. Pp. 193-204, *In*: Raychandhuri, S. P., A. Varma, K. S. Bhargava, and B. S. Mehrotra (eds.). Advances in Mycology and Plant Pathology. Published by R. N. Tandon's Birthday Celebration Committee, New Delhi.**

Anthracnose of guava, caused by *Gloeosporium psidii* (= *Glomerella psidii*) was also referred to as dieback, twig blight, wither tip, or fruit spot. The disease was reported as capable of attacking all parts of the plant except the roots and produces different types of symptoms depending on the part attacked and environmental factors. It was reported from Uttar Pradesh, Punjab, and Karnataka states of India. *Glomerella cingulata* and *Pestalotia psidii* were also found associated with the disease in those locations. The disease was characterized as being favored by humid weather, and high humidity is essential for its spread, which is brought about be wind or rain.

314. **Sohi, H. S., and T. S Sridhar. 1971. Controlling fruit rot of guava. Indian**

**Horticulture 16(1):9-10, 23.**

Fruit rot, caused by *Phytophthora parasitica*, was reported as one of the more serious fungal diseases of guava fruit in Mysore State of India during the rainy season. The disease was reported to also occur in Tamil Nadu, Andhra Prasesh, and Maharashtra States, where it can cause considerable damage to fruits, resulting in low productivity. Fungicides were recommended for control of the disease which had little or no of the phytotoxic effects which copper-containing fungicides often have.

315. **Somarriba, E. 1988a. Guava (*Psidium guajava* L.) trees in a pasture: Population model, sensitivity analyses, and applications. Agroforestry Systems 6(1):3-17.**

The author reported that guava trees were grown in cattle pastures in Costa Rica as a commercial crop. The economic advantage of this cultural practice was discussed.

316. **Somarriba, E. 1988b. Pasture growth and floristic composition under the shade of guava (*Psidium guajava* L.) trees in Costa Rica. Agroforestry Systems 6(2):153-162.**

The growth of other plants in Costa Rican pastures was correlated with presence or absence of guava grown as a fruit crop in pastures.

317. **Sousa, A. V. G. 1971. Contribuição ao estudo da anatomia foliar e da fisiologia de *Psidium guajava* Raddi. (Contribution to the study of leaf anatomy and physiology of *Psidium guajava* Raddi.) Ciência e Cultura 23(3):373-382. [in Portuguese with English abstract]**

This paper reported a study of leaf anatomy and transpiration characteristics of *Psidium guajava*. The stomates were of a paracytic type; the guard cell had a narrow lumen in the middle, with both ends enlarged. There was no restriction of water consumption during the periods of observation. Cuticular transpiration and saturation deficit were kept at a low level. (Compare with Backes 1971).

318. **Srivastava, H. C. 1977. Cytological studies in *Psidium friedrichsthalianum* Niedenzu. Cytologia (Tokyo) 42(3/4)395-400.**

*Psidium friedrichsthalianum* was reported as a diploid species with 2n=22, several chromosome abnormalities, and pollen fertility of 50%.

319. **Srivastava, M. P., and R. N. Tandon. 1969. Studies on *Botryodiplodia* rot of guava. Indian Phytopathology 22(2):268-269.**

*Botryodiplodia* rot of guava, caused by *B. theobromae*, was reported as one of the most common and widely occurring diseases of guava in India. The disease is primarily a post-harvest problem, causing considerable damage during storage and transit of fruit. No satisfactory control was obtained as a result of pre- and post-inoculation dips with nystatin, an antifungal antibiotic.

320. **Srivastava, M. P., and R. N. Tandon. 1969b. Postharvest diseases of guava in India. Plant Disease Reporter 53(3):206-208.**

Six postharvest fruit diseases of guava in India were described, including anthracnose, caused by *Gloeosporium psidii; Botryodiplodia* rot, caused by *B. theobromae*; fruit canker, caused by *Pestalotia psidii;* stylar-end rot, caused by *Phomopsis psidii; Phoma* rot, caused by *P. psidii;* and *Rhizopus* rot, caused by *R. nigricans*.

321. **Srivastava, M. P., and R. N. Tandon. 1970. Factors affecting growth, sporulation and spore germination of three isolates of *Botryodiplodia theobromae* I. Effect of pH and temperature. Proceedings of the National Academy of Sciences of India Volume 40, Number 4, Section B. Pp. 43-48.**

Temperature and pH were stated to have a profound effect on the metabolism of fungi. These factors were investigated on three isolates of *Botryodiplodia theobromae* which were responsible for rots of tropical fruits, including common guava. The optimum pH for growth and sporulation of all isolates was 6, whereas the optimum for the guava isolate was 5-6.5. The optimum temperature for growth was 25° C and 30° C for sporulation.

322. **Srivastava, M. P., R. N. Tandon, K. S. Bilgrami, and A. K. Ghosh. 1964. Studies on fungal diseases of some tropical fruits I. A list of fungi isolated from fruits and fruit trees. Phytopathologische Zeitschrift 50:250-261.**

In a compilation of fungal diseases of fruit trees in the region of Allahabad, India, the authors listed the following diseases of *Psidium guajava*:

Fruit rot (*Alternaria tenuis*)
Leaf spot (*Curvularia lunata, Nigrospora oryzae*)
Mummified fruit (*Cytospora* sp.)
Leaf spot and fruit rot (*Diplodia natalensis, Gloeosporium psidii, Phyllosticta psidii*)
Soil and root disease (*Fusarium oxysporum*)
Leaf spot, fruit rot, and mummified fruit (*Pestalotia psidii*)
Fruit rot and mummified fruit (*Phoma psidii*)

Diseases of *P. chinensis:*

Leaf spot, fruit and flower rot (*Gloeosporium psidii, Pestalotia psidii*)

323. **Stammer, E. E. 1991. Occorrência de bactérias e fungos fitopatogênicos no estado do Paraná. (Occurrence of phytopathogenic bacteria and fungi in Paraná State.) Departamento de Fiscalização. Centro de Diagnóstico Marcos Enrietti. P. 53. [in Portuguese]**

Diseases occurring on *Psidium guajava* in the state of Paraná in southern Brazil were listed. Two principal disease-causing fungi were *Colletotrichum gloeosporioides*,

causing spots on twigs and foliage, and the rust fungus *Puccinia psidii*, which infected fruit and foliage.

**324. Stark, J. D., R. I. Vargas, and R. K. Thalman. 1991. Diversity and abundance of oriental fruit fly parasitoids (Hymenoptera: Braconidae) in guava orchards in Kaua'i, Hawai'i. Journal of Economic Entomology 84(5):1460-1467.**

The effects of orchard canopy fogging and fruit collections on abundance of oriental fruit fly (*Dacus dorsalis*) and associated parasitoids (four species were found) in guava orchards of Kaua'i, Hawai'i, were assessed.

**325. Stein, U., and F. Klingauf. 1990. Insecticidal effect of plant extracts from tropical and subtropical species: Traditional methods are good as long as they are effective. Applied Entomology 110(2):160-166.**

*Psidium guajava* was one of the plant species from which extracts were prepared for assessment of possible insecticidal activity. Only extracts from pyrethrum flowers and avocado leaves were effective against *Myzus persicae* and *Plutella xylostella*.

**326. Stone, C. P. 1985. Alien animals in Hawai'i's native ecosystems: Toward controlling the adverse effects of introduced vertebrates. Pps. 251-297, *In*: Stone, C. P., and J. M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Cooperative National Park Resources Studies Unit. University of Hawai'i Press, Honolulu.**

Feral pigs were reported to have a mutualistic relationship with strawberry guava in Hawaiian forests. Mongooses were also reported as agents of dispersal of strawberry guava.

**327. Stone, C. P., P. K. Higashino, L. W. Cuddihy, and S. J. Anderson. 1991. Preliminary survey of feral ungulate and alien and rare plant occurrence on Hakalau Forest National Wildlife Refuge. Cooperative National Park Resources Studies Unit Technical Report 81, University of Hawai'i, Honolulu.**

*Psidium cattleianum* was reported as not yet present in Hawai'i's Hakalau Forest National Wildlife Refuge at the time of writing, but it was recognized as a potential invader.

**328. Suárez, E., and R. Calvo. 1989. Formacion de agallas en los frutos del güisaro (*Psidium guineense* Swartz) (Myrtaceae) y su relacion con los microhimenopteros *Prodecatoma* sp. (Eurytomidae) y *Torymus* sp. (Torymidae). (Gall formation on fruits of *Psidium guineense* in relation to the microhymenopteran *Prodecatoma* sp. (Eurytomidae) and *Torymus* sp. (Torymidae).) Brenesia 31:43-52. [in Spanish with English summary]**

Fruit production and gall formation associated with the insects *Prodecatoma* sp. and *Torymus* sp. were recorded for a 12-month period on *Psidium guineense* in Costa

Rica. Larvae of both insects were found inside the seeds enclosed in the galls, one larva per seed. Both occurred all year but peaked at the end of the wet season. The emergence phenology of *Prodecatoma* sp. was found to coincide with the flowering phenology of the host, and that of *Torymus* sp. with the fruit (ripening?) phenology. *Torymus* sp. was found to be a possible parasite of *Prodecatoma* sp.

329. **Suhag, L. S. 1976. Observations on guava decline in Haraytana and its control. Pesticides 10(11):42-44.**

Possible reasons for a serious decline of cultivated guava trees in the Hissar District of India were considered and treatment for regeneration of trees was outlined. Affected trees showed change in leaf color to reddish brown, twig defoliation, and death of twigs was initiated from the center of the branch and extended both upward and downward, associated with discoloration of the conducting tissue. Two fungi, *Rhizoctonia* sp. and *Fusarium* sp. were cultured from affected tissues, but reinoculation tests did not confirm pathogenicity. A grub was also detected in the pith of declining branches, the identity of which was not known at the time of writing. Possible physiologic causes for the decline were also investigated.

330. **Suplicy, F. N., A. S. Sampaio, I. Myazaki, E. A. Antran, D. A. Oliveira, and A. A. Veiga. 1984. Study of the factors determining the susceptibility to attack by 'fruit flies' *Anastrepha* spp., in five varieties of guava. Biologico 50(8):169-176. [in Portuguese]**

Fruit flies in the genus *Anastrepha* infested different cultivars of *Psidium guajava* in Brazil, and this was correlated with several factors of the fruit and the environment.

331. **Swanson, R. W., and R. M. Baranowski. 1972. Host range and infestation by the Caribbean fruit fly, *Anastrepha suspense* (Diptera: Tephritidae), in South Florida. Proceedings of the Florida State Horticultural Society 85:271-274.**

*Psidium cattleianum* and *P. guajava* were listed as two of 84 hosts for the Caribbean fruit fly in southern Florida.

332. **Tam, R. K. 1947. Comparative herbicidal value of 2,4-dichlorophenoxyactic acid and 2,4,5-trichlorophenoxyacetic acid on some herbaceous weeds, shrubs, and trees under Hawaiian conditions. Botanical Gazette 109(2):194-203.**

When tested on some weedy species of trees and shrubs in Hawai'i, the herbicide 2,4,5-T was observed to be more toxic than was 2,4-D. Target species included eucalyptus (*Eucalyptus citriodora*), popolo (*Solanum nodiflorum*), sensitive plant (*Mimosa pudica*), Christmasberry (*Schinus terebinthifolius*), lantana (*Lantana camara*), false ironwood (*Casuarina equisetifolia*), algaroba (*Prosopis chilensis*), Java plum (*Eugenia jambolana*), and cat's-claw (*Caesalpinia sepiaria*). Common guava (*Psidium guajava*) was an exception, being damaged more by 2,4-D than by 2,4,5-T.

333. **Tamaro, D. 1984. Tratado de fruticultura. (Treatise on fruit culture.) Gustavo Gili,**

**Barcelona, Spain. [in Spanish]**

The author included information on the cultivation of *Psidium guajava* var. *pyuriferum, P. guajava* var. *pompiperum,* and *P. cattleianum* as fruit crops, including climatic and soil factors, planting and cultural practices, and the harvest and uses of the fruit.

**334. Tandon, I. N. 1961. A new seedling blight of guava and its control. Indian Phytopathology 14:102-103.**

A severe seedling blight of common guava was observed in a greenhouse where guava hybrids were raised from experimental purposes. Isolations from the diseased leaves and stems yielded a species of *Rhizoctonia* which had not previously been reported in this host. The disease was apparent of seedlings up to 4 months old, whereas older plants appeared mostly unaffected. The disease was most apparent during humid weather, and was rarely observed during dry periods. Symptoms appeared as brownish spots, which spread rapidly covering the entire leaf surface of upper leaves. The disease spread from upper to lower leaves and stem, eventually killing the entire seedling. A variety of fungicides was tested for control, with Ferbam 0.3 % found as the most effective.

**335. Tandon, I. R. (N.?), and B. B. Singh. 1970. Studies on anthracnose of guava and its control. Indian Phytopathology 22(3):322-326.**

A serious anthracnose disease of guava caused by *Gloeosporium psidii* was recognized by the appearance of spots on the fruit during the rainy season at Saharanpur (India). The fungus was isolated from twigs and leaves as well as fruit spots. Inoculations of healthy seedlings with isolates of the fungus in pure culture confirmed the identity of the disease. In field tests of fungicides, B. M. 3:3:50, copper oxychloride and cuprous oxide sprayed at weekly intervals was found effective in reducing the disease.

**336. Tandon, R. N., and R. K. Agarwala. 1954a. Pathological studies of *Gloeosporium psidii* causing die-back of guavas. Proceedings of the Indian Academy of Sciences 40(4)Section B:102-109.**

A high death rate of branches and wilting of guava trees was reported from the region of Allahabad, India, for the last few years previous to the time of writing. The losses were observed during the rainy season on newly developing twigs, with hardly any plants free from the disease. The suspected pathogen was *Gloeosporium psidii* which was shown to be pathogenic in inoculation studies. The studies also confirmed that humidity played an important role in disease severity. Healthy fruit was found to become infected and rotten upon mere contact with diseased fruit. Cross inoculation tests indicated that *G. psidii* was specific in its pathogenicity to guava.

**337. Tandon, R. N., and R. K. Agarwala. 1954b. Carbon requirements of *Gloeosporium psidii* causing die-back of guavas. Proceedings of the National Academy of Sciences, India. Volume 24, Part 5, Section B. Pp. 183-188.**

Based upon the premise that carbon, among other elements, is necessary for the growth of fungi, the authors investigated quantitatively the carbon requirements of *Gloeosporium psidii* to find information that may be helpful in controlling the anthracnose disease of guava. Sixteen sugars and alcohols were tested as carbon sources, and compared with growth in the absence of carbon. *Gloeosporium psidii* was found to grow best on mannitol and dulcitol of the carbon sources tested. Maltose and sucrose did not favor sporulation although they produced good vegetative growth.

**338. Teaotia, S. S., and K. P. S. Phogat. 1971. Effect of rootstocks on growth, yield and quality in guava (*Psidium guajava*). Progressive Horticulture 2(4):37-45.**

A cultivar of common guava was grafted onto rootstocks of different species of *Psidium*. Tree height and fruit yield were greatest for those scions grafted onto *P. cattleianum.*

**339. Teho, F. 1971. Plants of Hawaii; how to grow them. The Petroglyph Press, Ltd., Hilo, Hawai'i.**

A one-page summary of *Psidium guajava* cultivation, particularly in the home garden, was included in this semipopular article.

**340. Theoduloz, C., L. Franco, E. Ferro, and G. S. Hirschmann. 1988. Xanthine oxidase inhibitory activity of Paraguayan Myrtaceae. Journal of Ethnopharmacology 24 (2/3):179-184.**

Several Parguayan species of Myrtaceae, including *Psidium guajava, P. guineense,* and *P. luridum,* were assessed for xanthine oxidase inhibitory activity. These species were reportedly used in folk medicine to treat gout.

**341. Thind, K. S., and R. S. Sandhu. 1956. Studies on the nutrition of *Gloeosporium psidii* (G. Del.) Sacc., the incitant of the guava (*Psidium guajava* L.) anthracnose. Indian Phytopathology 9:207-208.**

*Gloeosporium psidii* was reported to cause serious losses in ripe guava fruits in the area of Amritsar City, India. In in vitro experiments to determine the optimum conditions for the fungus, best growth occurred at 24-28° C, and the optimum pH range was 6-8.

**342. Thistle, A. 1957. The biological control of noxious plant species in Hawaii. World Crops 9:447-449.**

Although *Psidium* spp. were recognized elsewhere as seriously invasive weeds in Hawai'i, their failure to be included in this otherwise comprehensive article on the biological control of noxious plants in Hawai'i is considered a conspicuous omission.

**343. Tiscornia, J. R. 1971. Cultivo de plantas frutales. (Cultivation of fruit plants.)**

**Albatros, Buenos Aires. [in Spanish]**

The cultivation of species of guava as fruit crops was described, including *Psidium cattleianum* (as *P. littorale*), *P. guajava* var. *pyriferum,* and *P. guajava* var. *pompiperum.*

**344. Tokeshi, H., R. M. Valdebenito, and A. S. Dias. 1980. Occurrence of a bacterial disease of guava in São Paulo state. Summa Phytopathologica 6(1/2):85-87. [in Portuguese]**

A species of the bacterial genus *Pseudomonas* was reportedly responsible for disease and decline of *Psidium guajava* in the state of São Paulo, Brazil.

**345. Tschirley, F. H., F. T. Hernandez, and C. C. Dowler. 1967. Seasonal susceptibility of guava to selected herbicides. Weeds 15:217-219.**

Guava (*Psidium guajava*) was reportedly an important test species for tropical woody plant control because of its invasive potential in tropical pastures, where the fruits were readily consumed by livestock and the viable seeds passed through the digestive tract, from which they were widely spread. Guava was considered a serious weed problem in the coastal and lower mountain grazing areas of Puerto Rico and other islands of the Caribbean. This species was characterized as resistant to most herbicides and cutting with a machete had been the principal means of control although the ability of the plant to resprout prolifically made this method largely impractical. Woody plant control research in temperate zones has shown that successful control with herbicides is dependent on proper season of treatment, but the present study was undertaken to determine whether season of treatment is important in tropical zones where the climate is more uniform.

The study, conducted near Mayaguez, Puerto Rico, included treatment at 2-week intervals with a 1:1 ratio of 2,4-D and 2,4,5-T, showed guava to be more susceptible during the wet season than during the dry season. Greater susceptibility is related to a plant condition characterized by many new leaves but little or no terminal twig elongation. A similar pattern of defoliation response was caused by the herbicides dicamba and picloram, but the period of maximum susceptibility based on defoliation percentages 1 year after treatment occurred later in the season.

**346. Tunison, T. (Undated). *Psidium cattleianum*, noxious weed report. Unpublished report. Nature Conservancy of Hawai'i, Honolulu.**

This is a database printout from the Nature Conservancy of Hawai'i which included a variety of information about *Psidium cattleianum*, a noxious weed which preserve managers were seeking to control. Summaries of the following topics were included: description, habitat, biology/ecology, threats to and recovery potential of the environment, biological monitoring, research, management, and stewardship needs. Although mostly a summary of references on the subject, a few unique facts were reported:

1. A survey on the island of Hawai'i (Jacobi and Warshauer 1992) found strawberry guava from 100 to 1,300 m elevation in areas receiving 1,250 to 7,000 mm (50 to 275 inches) of rainfall per year in 23 different vegetation types from dry grassland and scrub to tall native rain forest. It was most abundant in wet 'ohi'a-tree fern rain forest and wet 'ohi'a-koa rain forest.
2. Yellow-fruited forms are more common at lower elevations in Hawai'i Volcanoes National Park (HAVO), and red-fruited forms dominate at higher elevations.
3. Little work has been done on removal of strawberry guava and assessment for the ability of native plants to return. Strawberry guava was removed from a 15 x 15 m degraded site by Tomich. After 10 years native ferns and a few native trees had become reestablished. In areas of HAVO, guava understory has been removed from forest with intact canopy, but extent of recovery was still uncertain at the time of writing.
4. Removal of feral pigs was the first priority in the control of strawberry guava because they disperse such huge quantities of seeds. Other priorities include manual removal and search for biological control agents.

**347. Tunison, J. T. 1991. Strategies and successes in controlling alien plants in an Hawaiian national park. Pp. 353-376, *In*: Center, T. D., R. F. Doren, R. L. Hofstetter, R. L. Meyers, and L. D. Whiteaker (eds.). Proceedings of the Symposium on Exotic Pest Plants; U. S. Department of the Interior, National Park Service; November 2-4, 1988; Miami, Florida.**

Control of certain particularly troublesome alien plant species in Hawai'i Volcanoes National Park was discussed from the perspective of special ecological areas (SEAs). Through the SEA concept, areas selected to represent particularly valuable or unique habitats within the park are intensively managed where it would not be possible to manage the entire park area. *Psidium cattleianum* was one of three invasive species (among fayatree and kahili ginger) whose control required all of the time allocated for weed control in SEAs. *Psidium cattleianum* was targeted for biocontrol research. *Psidium guajava* was also listed as an invasive weed in park areas. Because of its value as a fruit crop, biological control of this species would not be feasible for the foreseeable future. *Psidium guajava* was listed as widespread, but under control in some SEAs.

**348. Tunison, J. T., L. D. Whiteaker, L. W. Cuddihy, A. M. LaRosa, D. V. Kageler, M. R. Gates, N. G. Zimmer, and L. Stemmermann. 1992. The distribution of selected localized alien plant species in Hawai'i Volcanoes National Park. Cooperative National Park Resources Studies Unit Technical Report 84, University of Hawai'i, Honolulu.**

This study concentrated on assessing the distribution of localized alien plant species in Hawai'i Volcanoes National Park. *Psidium cattleianum* was one of the major invasive weeds in the study areas. Some widespread species, including *P. cattleianum*, were under control in special ecological areas of the park at the time of writing.

**349. Turner, D. J., and M. P. C. Loader. 1972. Some increases in efficacy of foliage applied**

**herbicidal salts due to addition of ammonium ions. Pp. 654-660, *In*: Proceedings of the 11th British Weed Control Conference.**

Increases in phytotoxicity of the herbicide picloram on *Psidium guajava* were noted with additional ammonium salts.

**350. Ullah, G. M. R., and S. H. Chowdhury. 1990. Biology of the cottony-maple scale, *Pulvinaria psidii* Maskell (Coccidae: Coccoidae). Chittagong University Studies, Part II, Science 14(2):127-136.**

Cottony-maple scale (*Pulvinaria psidii*) was reported as a very destructive insect in India. In this study, insects were reared on *Psidium guajava* leaves so that the biology of the species could be investigated.

**351. University of Hawai'i. 1973. CTA statewide guava industry seminar. Cooperative Extension Service and Hawai'i Agricultural Experiment Station. Miscellaneous Publication 111.**

The suitability of *Psidium guajava* as a fruit crop in Hawai'i was presented. Cultural practices and other aspects of guava cultivation were discussed, as were a list of diseases, insects, and mites which have been reported to attack guava in tropical areas around the world. Only a few of these were actually known from Hawai'i. Included were leaf spots caused by the sooty molds *Asterina psidii* and *Meliola psidii*, algal leaf spot caused by *Cephaleuros virescens*, fungal leaf spot caused by *Cercospora psidii*, and the rust fungus *Puccinia psidii*. Three fungi were reported as fruit rot-producing agents on guava: *Alternaria tenuis*, *Colletotrichum gloeosporioides* which causes anthracnose, and stem-end rot caused by *Phoma* sp. Wood rotting fungi included *Botryosphaeria ribis*, causing branch canker; mushroom root rot, *Clitocybe tabescens*; thread blight, *Pellicularia koleroga*; root rot, *Phymatotrichum omnivorum*; wound rot, *Polyporus versicolor*; and heart rot, *Trametes corrugata*. The root knot nematode, *Meloidogyne incognita*, also was reportedly known to attack guava.

About 15 species of insects and two species of mites were known from Hawai'i on guava at the time of writing. Reports of these did not always distinguish between *P. guajava* and *P. cattleianum* as hosts. Included were rose beetles, *Adoretus sinicus*; melon aphid, *Aphis gossypii*; green scales, *Coccus viridus*; flower thrips, *Frankliniella* spp.; red-banded thrips, *Selenothrips rubrocinctus*; mealybugs, *Nipaecoccus nipae*; spider mites, *Brevipalpus phoenicis* and *Eotetranychus sexmaculatus*. Fruit flies, *Dacus dorsalis*, and Mediterranean fruit fly, *Ceratitis capitata* have also been reported. Growing tips are attacked by the long-horned grasshopper, *Conocephalus saltator*. The torpedo bug, *Siphanta acuta* was reported feeding on young fruit.

**352. Uppal, B. A. 1936. India: A serious disease of guava in Bombay. P. 30, *In*: International Review of Agriculture. Published by the International Institute of Agriculture, Rome; 27th Year, No. 5.**

A very serious disease of common guava had reportedly recently (at the time of

writing) broken out in Dholka in North Gujarat (India). The disease was characterized as attacking bark with infection spreading rapidly along the stem. Bark became dry, cracked, and ultimately was shed, resulting in the death of the affected branch. With time, infection spread to other branches and death of the tree eventually occurred. Large numbers of perithecia of the causal fungus were reported found scattered over the dead bark. The disease was reportedly caused by *Physalospora psidii*, a fungus which at the time had not been previously reported in India.

353. **Utsunomiya, N. 1988. Increase in cold hardiness induced by water stress in young *Psidium* seedlings. Journal of the Japanese Society of Horticultural Science 57(1):28-33.**

Seedings of *Psidium cattleianum* var. *lucidum, P. guineense, P. polycarpum, P. friedrichsthalianum*, and cultivars of *P. guajava* grown under normal and water-stressed conditions were frozen. *Psidium cattleianum* var. *lucidum* and *P. guineense* were the most cold tolerant, and specimens of all species grown under water-stress conditions were more cold tolerant than were those grown under normal water regimes.

354. **Van der Meulen, T. 1992. Assessment of damage caused by the coconut bug *Pseudotheraptus wayi* (Brown) (Hemiptera: Coreidae) on guavas. Fruits 47(2):317-320.**

Damage caused by the coconut bug, *Pseudotheraptus wayi*, on guava in the Nelspruit area of South Africa was assessed. This insect was reported to be indigenous to East Africa on coconuts. It was reported for the first time in South Africa in 1977 on mangoes and guavas. Subsequently it has been known to attack macadamia, avocado, and mango as well. Damage to guava fruits is caused by both nymphs and adults. Indications were that between 20% and 40% of aborted fruits were dropped due to coconut bug damage rather than to natural fruit thinning. These observations indicated that the coconut bug had become a pest of economic importance on guava in South Africa.

355. **Vargas, R. I., and H. B. Chang. 1991. Evaluation of oviposition stimulants for mass production of melon fly, oriental fruit fly, and Mediterranean fruit fly (Diptera: Tephritidae). Journal of Economic Entomology 84(6):1695-1698.**

This study assessed various fruit juices, including that of *Psidium guajava*, in attracting egg-laying behavior of melon fly (*Dacus cucurbitae*), oriental fruit fly (*D. dorsalis*), and Mediterranean fruit fly (*Ceratitis capitata*) for use in the mass production of the insects.

356. **Vargas, R. I., and T. Nishida. 1989. Spatial distribution of Mediterranean fruit fly (Diptera: Tephritidae) throughout west Oahu [Hawaii, USA]: Development of eradication strategies. Proceedings of the Hawaiian Entomological Society 29(0):85-96.**

Hawai'i was reported as the only state in which *Ceratitis capitata*, the Mediterranean fruit fly, occurred as the time of writing. The insect was reported to have reached California several times but expenditures of millions of dollars have prevented its establishment there. Distribution of the Mediterranean fruit fly in Hawai'i was in patches throughout the island of O'ahu, and strategies were being developed to eradicate the insect through introduction of sterile individuals. In this study, the insect was found to be more widespread on O'ahu than previously thought. Coffee was the most important host of the insect, but the fruit fly was found also on *Psidium cattleianum* and *P. guajava* throughout gulches and uplands of the Waianae mountain range.

357. **Vargas, R. I., E. J. Harris, and T. Nishida. 1983. Distribution and seasonal occurrence of *Ceratitis capitata* (Wiedmann) (Diptera: Tephritidae) on the island of Kaua'i in the Hawaiian Islands. Environmental Entomology 12(2):303-310.**

Three major food plants of *Ceratitis capitata* in Hawai'i were found to be coffee, strawberry guava, and peach. The fly is usually absent from native forests in Hawai'i unless *Psidium cattleianum* had invaded.

358. **Vargas, R. I., T. Nishida, and J. W. Beardsley. 1983. Distribution and abundance of *Dacus dorsalis* (Diptera: Tephritidae) in native and exotic forest areas on Kauai. Environmental Entomology 12(4):1185-1889.**

The presence of the oriental fruit fly in native Hawaiian forests was primarily associated with infestations of *Psidium cattleianum* and *P. guajava*. One suggestion for the reduction of infestations in native forest areas was that small concentrations of host plants in upper elevation native forests be destroyed. The presence of fruit flies in the native forest was thought to have possibly damaging effects on endemic Hawaiian insects, birds, and snails.

359. **Vargas, R. I., J. D. Stark, and T. Nishida. 1989. Abundance, distribution, and dispersion indices of the oriental fruit fly and melon fly (Diptera: Tephritidae) on Kauai, Hawaiian Islands. Journal of Economic Entomology 82(6):1609-1615.**

The Oriental fruit fly (*Dacus dorsalis*) was captured more often on the windward side of Kaua'i, and melon fly (*D. cucurbitae*) more often on the leeward side. The peak capture time for Oriental fruit fly was during spring and fall after guava (*Psidium guajava* and *P. cattleianum*) had fruited, with more captures outside crop areas than inside. The fruit fly problem in Hawai'i was reported to cause restrictions to the export of fruit from the state, which could be a means of introduction of the flies to the U. S. mainland.

360. **Vargas, R. I., J. D. Stark, and T. Nishida. 1990. Population dynamic, habitat preference, and seasonal distribution patterns of Oriental fruit fly and melon fly (Diptera: Tephritidae) in an agricultural area. Environmental Entomology 19(6):1820-1828.**

Oriental fruit fly (*Dacus dorsalis*) and melon fly (*D. cucurbitae*) population dynamics were studied from 1987 to 1989. The main hosts of Oriental fruit fly were found to be *Psidium cattleianum* and *P. guajava*. The main host of melon fly were cultivated crops on truck farms. When there were most fruits on the guava hosts, there were more Oriental fruit flies found on the farm crops.

361. **Vargas, R. I., J. D. Stark, R. J. Prokopy, and T. A. Green. 1991. Response of Oriental fruit fly (Diptera: Tephritidae) and associated parasitoides (Hymenoptera: Braconidae) to different-color spheres. Journal of Economic Entomology 84(5):1503-1507.**

Yellow and white spheres placed in *Psidium guajava* trees to trap the Oriental fruit fly and its parasitoides were more effective than were spheres of other colors.

362. **Vargas, R. I., J. D. Stark, G. K. Uchida, and M. Purcell. 1973. Opiine parasitoids (Hymenoptera: Braconidae) of Oriental fruit fly (Diptera: Tephritidae) on Kauai Island, Hawaii: Islandwide relative abundance and parasitism rate in wild and orchard guava habitats. Environmental Entomology 22(1):246-253.**

During a 2-year survey of Kaua'i, four species of opiine parasitoids were recovered from host fruits infested with *Bactrocera dorsalis, Biosteres arisanus, Diachasmimorpha longicaudata, Psyttalia incisi*, and *Biosteres vandenboschi*. Wild common guava (*Psidium guajava)*, and strawberry guava *(P. cattleianum*) were the most prevalent hosts found to be infested with the Oriental fruit fly. Population studies in a commercial common guava orchard indicated that Oriental fruit fly infestation of fruits was correlated with infestation of wild common guava fruits in surrounding wild habitats.

363. **Vasudeva, R. S. 1954. Recent developments in plant diseases in India. FAO Plant Protection Bulletin 3(2):22-23.**

Among other crop diseases in India, a previously unrecorded disease causing heavy losses of common guava crops was described. The disease was reported to cause stunting of shoots, extreme reduction of leaf size, and defoliation. Flower development in diseased plants was severely restricted, and any fruits produced on affected shoots became cracked and dry. Possible causes of the disease were suggested to be a virus or a nutrient deficiency.

364. **Vasudeva, R. S., and S. P. Raychaudhuri. 1954. Guava disease in Pushkar Valley and its control. Indian Phytopathology 7:78-81.**

A disease of guava was reported in the Pushkar area of Ajmer, India, was characterized by interveinal leaf chlorosis, reduction in leaf size, suppression of growth, and die back of twigs. The disease was diagnosed as resulting from zinc deficiency and was treated by application of foliar sprays of zinc sulfate.

365. **Venkatakrishniah, N. S. 1952. *Glomerella psidii* (Del.) Sheld. and *Pestalotia psidii* Pat. associated with a cankerous disease of guava. Proceedings of the Indian**

**Academy of Science Volume 36, Part 3, Section B. Pp. 129-134.**

Although *Glomerella psidii* had been implicated in guava anthracnose elsewhere, there appeared to be no record of this pathogen in India at the time of writing. *Glomerella psidii* had been reported in the Philippines to very similar to *G. cingulata*. A serious canker or scab disease of guava fruits in the Mysore area of India was investigated to determine if the cause was a previously unrecognized such as *G. psidii*. The disease was found to be associated with two fungi, *Colletotrichum psidii* and *Pestalotia psidii*. *Colletotrichum psidii* developed a perithecial stage in pure culture for the first time in India, which corresponded closely to *G. psidii*.

**366. Venkatakrishniah, N. S. 1954. *Pestalotiopsis psidii* on *Psidium guava*. Current Science 23(5):164-165.**

The fungus *Pestalotia psidii* Pat. was previously described as occurring on fruits and leaves of guava (as *Psidium guava*) in association with another fungus, *Glomerella psidii*. As a result of a taxonomic revision, *P. psidii* was proposed to be renamed *Pestalotiopsis psidii* (Pat.) Venkatakrishniah.

**367. Viégas, A. P. 1961. Indice de fungos da América do Sul. (Index of the fungi of South America.) Instituto Agronômico, Campinas, São Paulo, Brasil. [in Portuguese]**

In this host index, the fungi listed were:

On *Psidium araçá*:
*Aschersonia* sp., *Asterostroma fulvum, Cercospora psidii, Colletotrichum gloeosporioides, Meliola psidii, Opasterinella puiggarii, Phyllachora tropicalis, Pleurotus magnificus,* and *Puccinia psidii*

On *P. cattleianum*:
*Catacauma subsircinalis*

On *P. fluviatile:*
*Phyllachora tropicalis*

On *P. guajava:*
*Acrostalagmus albus, Aegerita werberi, Aschersonia paraensis, A. turbinata, Aschersonia sp., Ascochyta psidii, Asterina psidii, Asterinella puiggarii, Catacauma goyazense, Cercospora sawadae, Colletotrichum gloeosporioides, Elsinoe pitangae, Epicoccum sp., Fusarium sp., Glomerella cingulata, Gnomonia psidium, Hypocrella epiphilla, Hypocrella turbinata, Meliola amphitricha, M. psidii, Penicillium candidum, Pestolatia glandicola, Phyllachora caienensis, P. subopaca, P. tropicalis, Phyllosticta guajavae, Phyllosticta sp., Placosphaeria guajavae, Puccinia psidii, Rosellinia sp., Septobasidium saccardinum, ?Seuratia coffeicola, Sphaceloma psidii, Syncephalis ubatubensis, Trichomerium portoricense, Tubercularia? leptosperma, Valsa guayavae,* and *Zythia psidii*

On *P. laurifolium:*
*Asterinella puiggarii*

On *Psidium* sp.:
*Aschersonia flavo-citrina, Asterinella puiggarii, Calonectria hoehnelii, Catacauma goyazense, C. subcircinans, Catacuma* sp., *Cercospora usteriana, Gloeosporium fructus-psidii, Gnomonia psidium, Lembosia patouillardii, Lophodermium subtropicale, Marasimus petalinus, M. amphitricha, M. olecranonis, M. psidii, Phoma psidii, Phyllachora cayennensis, P. tropicalis, Pleurotus magnificus, Puccinii psidii, Pycnopeltis circinata, Scolecopelits psidii, Spegazzinia meliolicola, Trabutia ?cayennensis, Xylaria aristata, X. aristata var. hirsuta,* and *X. axifera*

On *P. thea:*
*Catacauma tropicalis, Phyllachora tropicalis*

368. **Wagner, W. L., D. R. Herbst, and S. H. Sohmer. 1990. Manual of the flowering plants of Hawai'i. University of Hawai'i Press and Bishop Museum Press, Honolulu.**

The treatment of the genus *Psidium* in this book contained the following details about strawberry guava:
1. Synonyms of *P. cattleianum*:
   *Episyzygium oahuense* Suess. & A. Ludwig
   *P. cattleianum* var. *cattleianum* f. *lucidum* Degener
   *P. cattleianum* var. *littorale* (Raddi) Fosb.
   *P. littorale* Raddi
   *P. littorale* var. *lucidum* (Degener) Fosb.
2. Common names of *P. cattleianum* in Hawai'i:
   'strawberry guava', 'waiawi', or ''ula'ula'
3. A description of the species.
4. A chromosome count of 2n=88.
5. "Native to the Neotropics and now widely cultivated and naturalized in tropical and subtropical areas of the world; in Hawai'i naturalized and often forming dense monotypic stands in disturbed mesic forest and wet forest, 15-1,220 m, on all of the main islands except not reported from Ni'ihau or Kaho'olawe."
6. Degener (1939) thought the species was originally introduced in 1825 as '*Psidium chinense*' and brought to Hawai'i on the voyage of the 'Blonde'.
7. One of the most serious weeds in Hawai'i, strawberry guava is spread by pigs and birds, producing dense growth and allelopathic chemicals which discourage other plants from growing in the area.
8. Three forms occur in Hawai'i --
   (1) the common red-fruited type;
   (2) *P. cattleianum* f. *lucidum*, a yellow-fruited type which is a narrow tree with fruit larger than the red-fruited form;
   (3) *P. cattleianum* var. *littorale*, a yellow-fruited type which is a large spreading tree with ellipsoid-obconical fruit.

A drawing of the species and a treatment of *P. guajava*, the one other species of the genus naturalized in Hawai'i, were also included.

**369. Wellman, F. L. 1977. Dictionary of tropical American crops and their disease. The Scarecrow Press, Inc., Metuchen, New Jersey.**

This reference included an extensive list of diseases of *Psidium cattleianum* and *P. guajava*. The common names for guava were given as 'guayaba' in Spanish, 'goiabeira' in Portuguese, and 'guava' in English. The author stated that these two species appeared to be about equally diseased by the same parasites where he had been able to study them in mixed plantings, an observation which may have application to biocontrol research in Hawai'i for the control of strawberry guava.

Fungi and diseases caused by fungi, as well as diseases caused by nematodes and parasitic flowering plants, were listed as follows:

*Acrostalagmus albus* F.; fungus fruiting on old foliage. Dominican Republic.

*Aegerita webberi* Fauc.; fungus of whitefly on guava. Florida, Central America.

*Aschersonia cubense* Berk. & Curt.; fungus parasite on scale-like insect on guava. Colombia, El Salvador. *A. parensis* P. Henn.; fungus of guava insect. Brazil. *A. turbinata* Berk.; fungus of a sucking insect on guava (but of special note since the fungus also diseases the host). Dominican Republic.

*Asterina psidii* Ryan; black leaf patches. Puerto Rico. *A. psychotriae* Ryan; black patch (But over-grown by several other fungi). Dominican Republic. ?*A. puiggarii* Speg. (see *Opeasterinella).*

*Asterolibertia crustacea* Hansf.; on leaf. Dominican Republic.

*Botryodiplodia theobromae* Pat. (*Diplodia*) = *Botryosphaeria quercuum* (Schw.) Sacc.; dieback, twig and branch canker. Reports from Honduras, El Salvador but undoubtedly widespread.

*Botryosphaeria dothidea* (Moug.) Ces. & deNot.; canker and branch dieback. Florida.

*Capnodium* (see *Hypocapnodium*)

*Catacauma subcircinans* (Speg.) Th. & Syd. is given as causing scab-like leaf spots in some countries. (See, in this connection, *Plyllachora subcircinans).*

*Caudella psidii* Ryan = *Asterinella puiggari* (Speg.) Th.; black patches but not scabs on leaf. Reported in West Indies, and in some lists considered possible synonym of *Phyllachora subcircinans,* see mention of this under that binomial.

*Cephaleuros virescens* Kunze; algal scurf-spot of leaf, fruit malformation (often primary injury by this parasite is followed by secondary fruit rotting organisms). Common in moist areas, from subtropical USA to southern South America.

*Cephalosporium lecanii* Zimm.; a fungus on a scale insect. Widespread.

*Cercospora psidii* Rang.; leaf spots on upper surface of leaf. Brazil, Puerto Rico, Florida. *C. sawadae* Yama.; spot disease on lower leaf surface. Brazil.

*Clitocybe tabescens* (Scop.)Bres. = *Armilariella tabescens* (Scop.) Sing.; root and crown rot. California.

*Colletotrichum gloeosporioides* Penz. (perfect state sometimes found in *Glomerella cingulata* (Stonem.) Sp. & Schr.). Synonyms: *Colletotrichum psidii* Pull., *C. psidii* Curzi, *Glomerella refomaculans* Berk., *G. psidii* Del.; cause of common anthracnose lesions of leaves, twigs, fruits. Neotropics.

*Elsinoe pitangae* Bitanc. & Jenk. is the asco-state of *Sphaceloma psidii* (see below).

*Fomes fructicum* Speg.; heartrot of trunk. Argentina. (Heartrot of old trunk, with

*Fomes* sp., fruiting bodies seen in both Guatemala and Costa Rica).

*Fusarium* spp. (two kinds, one *roseum*-like and other *solani*-like); associated with twig and branch disease. Costa Rica, Honduras, Puerto Rico, probably widespread.

*Ganoderma* sp.; stumprot. Puerto Rico.

*Glomerella* (see *Colletotrichum)*

*Hypocapnodium guajavae* (Bern.) Speg. = *Capnodium guajava* Bern. or *Limacinia guajavae* (Bern.) Sacc. & Trott.; sooty molds. Neotropics.

*Linhartia hoehnelii* Rehm; rare leaf spot. Brazil.

*Lophodermium subtropicale Speg.;* branch disease. Argentina.

Loranthaceae, numerous genera and species are found on wild and cultivated guavas in areas where bird vectors are common. (A few of these phanerogamic parasites are noted in this list, these and many others are seen as abundant in some situations where birds abound near jungle growths).

*Meliola psidii* Fr. = *M. amphitrica* Fr.; common black mildew and leaf patches. Neotropics (favored by partial shade and moist conditions).

*Meloidogyne* spp.; root knot nematode to which guavas seem somewhat tolerant. Widespread.

*Mycena citricolor* (Berk. & Curt.) Sacc.; luminescent leaf spot (natural occurrence in high mountain rain forest). Puerto Rico.

*Opeasterinella puiggarii* Speg., synonyms: *Asterina puiggarii* Speg. and *Asterinella puiggarii* (Speg.) Th.; black mildew on leaves. Paraguay and nearby countries. (Possibly *Caudally psidii* is a synonym).

*Oryctanthus cordifolius* Urb.; phanerogamic parasite on guava branches. El Salvador, Guatemala.

*Pellicularia koleroga* Cke.; branch disease and leaf rot. Collected in Costa Rica, Guatemala, Panama, and Puerto Rico, reported from Florida.

*Penicillium* spp.; fruit rots. Widespread.

*Pestalotia glandicola* Guba, *P. psidii* Pat., and *P. funerea* Desm. fruit diseases, leaf and twig lesions. Reports from Cuba, Ecuador, Brazil, Peru, Puerto Rico, Honduras, Costa Rica, no doubt more widespread.

*Phoma psidii* P. Henn.; black lesion on leaf. Scattered.

*Phoradendron* spp., flowering bushes parasitic on host branches: *P. acinacifolium* Mart. & Eichl. in Surinam. *P. gracilispicum* Trel. in Costa Rica, Colombia, Venezuela. *P. obtusissimum* Eichl. in Surinam. *P. rensoni* Trel. in El Salvador.

*Phyllachora cayennensis* (Fr.) Cke.; leaf spots. Brazil, Surinam. *P. goyazensis* P. Henn. = *Catacauma goyazensis* (Cke.) Th. & Syd.; dull black tarspot. Bolivia, Brazil, Colombia, Cuatemala, Honduras, Costa Rica, Paraguay. *P. subcircinans* Speg. = *Catacauma subcircinans* (Speg.) Th. & Syd.; a shiny black tarspot, when immature a more diffuse growth. Brazil, Argentina, Paraguay, West Indies. *P. tropicalis* Speg.; leaf spots with scab-like stroma on both upper and lower leaf surfaces. Brazil, Argentina, Colombia, Panama, Venezuela.

*Phyllosticta aracaicola* Bat.; small leaf spot. Brazil. *P. guajavae* Viégas; leaf spot. Brazil.

*Phymatotrichum omnivorum* (Shear) dug.; rootrot. Texas.

*Physalospora* sp.; on foliage. Brazil.

*Phytophthora cinnamon* Raids; rootrot. Honduras.

*Placosphaeria guajavae* Bat.; leaf disease. Brazil.

*Pleurotus magnificusi* Rick; agaric on decayed wood. South America.

*Polyporus versicolor* L.; trunk rot. California.

*Porella* sp.; leafsmother from small leafy liverwort. Costa Rica.

*Psittacanthus calycalatus* Don; large red-flowered parasitic bush on main trunk of host. El Salvador.

*Puccinia psidii* Wint. = *P. sugneurophila* Speg.; defoliating rust on foliage, and attacks fruit (favored by moderate warm temperatures and high relative humidity). Believed to be widespread in distribution, special reports from Puerto Rico, Cuba, Costa Rica, jamaica, Trinidad, Ecuador, Colombia, Brazil, Argentina, Uruguay. *Pyconpeltis circinata* Bat. & Cayao; spots on leaves. Brazil.

*Rosellinia bunodes* (Berk. & Br.) Sacc. and *R. pepo* Pat.; root diseases. Central America.

*Scolecopeltis psidii* Bat.; leaf infection. Brazil.

*Septobasidium saccardinum* March.; felt-disease. Scattered.

(?*Septoria rufomaculans* Berk.; reported to be the imperfect state of *Glomerella refomaculansi* Sp. & Schr. = from later work *C. cingulata* (Stonem.) Sp. & Schr.).

*Spegazzinia meliolicola* P. Henn.; hyperparasite of black mildew disease fungus.

*Spaceloma psidii* Bitanc. & Jenk.; conidial phase of an *Elsinoe,* causing spot anthracnose-scab on foliate and fruit. Reports from Florida, Brazil, probably widespread.

*Strigula complanata* Fée; white lichen-spot. Widespread.

*Struthanthus marginatus* Blume; weeping vine-like woody branch parasite. Paraguay, Brazil. *S. orbicularis* Blume; another vine-like woody branch parasite. El Salvador, Guatemala.

*Syncephalis ubatubensisi* Viégas; fruit rot. Brazil.

*Tondusia fuscata* Bat.; leaf mildew. Brazil.

*Trabutia cayennensis* Sacc. and *T. tropi*calis Speg.; leaf lesions. South America.

*Trichomerium portoricensis* Speg.; leaf black mold disease. Puerto Rico. *T. psidii* Bat.; leaf black mold. Brazil.

*Tubercularia leptosperma* Speg.; branch bark disease. Paraguay.

*Valsa guayavae* P. Henn.; in dieback complex. Central and South America.

*Zythia psidii* Bat.; branch disease. Brazil.

370. **Wen, H. C., and H. S. Lee. 1985. Seasonal occurrence of the shoot insects and their control on guava. Journal of Agricultural Research of China 34(1):105-109. [in Chinese]**

Four shoot-infesting insects of *Psidium guajava* cultivated in Taiwan were studied for seasonal variation with the objective of control.

371. **Wikler, C. 1995. Aspectos bioecológicos de *Eurytoma* sp. causador de galha-do-romo do araçazeiro, *Psidium cattlienaum* Sabine, 1821. (Aspects of the bioecology of *Eurytoma* sp., cause of the stem gall of strawberry guava, *Psidium cattlienaum* Sabine, 1821.) Unpublished Master's thesis, Laboratory of Forest Protection, University of Paraná, Curitiba, Brazil. [in Portuguese]**

The study focused on ecological aspects of the strawberry guava stem-galling insect *Eurytoma* sp. (Hymenoptera: Eurytomidae) under laboratory and field conditions, to determine the potential usefulness of this insect as a biocontrol agent. Larval activity was found to be the principal cause of damage to the host. No natural enemies were reported for the insect while it was within the gall. Following emergence of the adult from the gall, the gall dries and the distal portion of the stem dies, resulting in significant damage to the tree.

372. **Wikler, C., J. H. Pedrosa-Macedo, and R. S. Godefroid. 1991. Insetos associados às mirtáceas nativas. (Insects associated with native Myrtaceae.) Pp. 271-278, *In*: Congresso Florestal do Paraná, III; Curitiba, 1991. Anais.APEF/APRE. [in Portuguese]**

This paper reported a survey of insects capable of causing damage to roots, stems, buds, leaves, flowers, and fruits of members of the Myrtaceae indigenous to Brazil, with emphasis on araçá (*Psidium cattleianum*) and *P. guajava*.

The following orders and families were collected:

Thysanura -- Lepismatidae
Orthoptera -- Tettigonidae, Proscopidae, Acrididae, Membracidae
Mantodea -- Mantidae
Blattariae -- Blattidae
Dermaptera -- Labiidae
Psocoptera -- (not identified)
Thysanoptera -- Thripidae
Hemiptera -- Pyrrhocoridae, Reduviidae, Pentatomidae, Cimicidae, Lygaeidae, Coreidae
Homoptera -- (not identified), Coccidae, Cercopidae, Cicadellidae, Ciccadidae
Coleoptera -- Curculionidae, Cerambycidae, Anobiidae, Coccinellidae, Chrysomelidae, Nilionidae, Dasytidae, Carabidae, Staphylinidae, Lycidae, Buprestidae, Cantharidae, Elateridae, Scarabaeidae, Lampyridae, Scolytidae
Lepidoptera -- Lycaenidae
Diptera -- Tephritidae, Muscidae

Hymenoptera -- Ichneumonidae, Chalcididae, Formicidae, Sphecidae, Vespidae

**373. Williams, D. J. 1985. Some scale insects (Hom., Cocoidea) from the island of Nauru. Entomologist's Monthly Magazine 121(1448/1451):53.**

New records for scale insects in Nauru, an island in Micronesia, were published in this paper. These included, *Icerya seychellarum, Coccus viridis*, and *Parasaissetia nigra*, which were found on *Psidium littorale* (=*P. cattleianum*).

**374. Williams, J. 1990. The coastal woodland of Hawaii Volcanoes National Park: Vegetation recovery in a stressed ecosystem. Cooperative National Park Resources Studies Unit Technical Report 72. University of Hawai'i, Honolulu.**

The occurrence of strawberry guava as an invasive alien species was documented in several areas of the stressed ecosystem of Hawai'i Volcanoes National Park.

**375. Williamson, D. 1975. Diseases of guava. Pp. 179-191, *In*: Raychandhuri, S. P., A. Varma, K. S. Bhargava, and B. S. Mehrotra (eds.). Advances in Mycology and Plant Pathology. Published by R. N. Tandon's Birthday Celebration Committee, New Delhi.**

*Psidium* guajava was described as a much favored and valuable fruit in India, to which increasingly more attention has been paid to the study of pre- and post-harvest diseases. Descriptions of the following guava fruit diseases were listed as significant in India: *Botryodiplodia* rot, caused by *B. theobromae*; *Curvularia* rot, caused by *C. tuberculata*; *Macrophoma* rot, caused by *M. allahabadensis*; stylar-end rot, caused by *Phomopsis psidii*; grey blight and fruit canker, caused by *Pestalotia psidii*; leaf spot, caused by *Cercospora sawada;* guava wilt, caused by *Fusarium oxysporum* f. *psidii;* seedling blight, caused by *Rhizoctonia* sp. A table of some of the less common diseases of guava in India was provided:

Fruit rot caused by:

*Alternaria tenuis*
*Aspergillus niger*
*Colletotrichum higginsianum*
*Diplodia gossypina*
*D. natalensis*
*Fusidium viride*
*Phoma psidii*
*Phyllosticta psidii*
*Rhizopus nigricans*
*Phytophthora parasitica*
*Trichothecium roseum*
*Verticillium* sp.

Fruit mummification caused by:

*Cytospora* sp.
*Phoma psidii*

Leaf infection caused by:

*Asteroma psidii*
*Meliola psidii*
*Ciliochorella indica*
*Curvularia lunata*
*Diplodia natalensis*
*Nigrospora oryzae*
*Phyllosticta psidii*

Twig blight caused by:

*Hendersonula toruloidea*

376. **Wilson, B. J. 1974. Ammonium sulphate enhancement of picloram herbicidal activity and absorption in two guava species and dwarf beans. Ph.D. dissertation, University of Hawai'i, Honolulu.**

*Psidium cattleianum, P. guajava*, and dwarf bean plants in a test plot were used in a study to compare absorption of the herbicide picloram with and without the added application of ammonium sulphate. The ammonium sulphate appeared to have a direct physical effect on the absorption pathway through leaves. Enhancement of herbicidal activity was obtained through the use of this inorganic salt adjuvant.

377. **Wilson, B. J., and R. K. Nishimoto. 1974a. Ammonium sulfate enhancement of picloram absorption by detached leaves. Weed Science 23(4):297-301.**

This paper described the chemical absorption of picloram into *Psidium cattleianum* leaves.

378. **Wilson, B. J., and R. K. Nishimoto. 1974b. Ammonium sulphate enhancement of picloram activity and absorption in strawberry guava (*Psidium cattleianum*). (Abstract). Proceedings of the Western Society of Weed Science 27:40.**

A greenhouse study using *Psidium cattleianum* seedlings and leaves showed that salts of ammonium sulphate increased the absorption of picloram and thus the effectiveness of the herbicide.

379. **Wilson, B. J., and R. K. Nishimoto. 1975a. Ammonium sulfate enhancement of picloram activity and absorption. Weed Science 23(4):289-296.**

The herbicidal activity of picloram, a defoliant, was assessed on seedlings of *Psidium cattleianum, P. guajava*, and dwarf bean with the addition of ammonium sulfate. The objective of this study was to better control common guava and strawberry guava by

enhancing picloram activity with the addition of an inorganic salt. The defoliant was less active on strawberry guava than on common guava.

380. **Wilson, B. J., and R. K. Nishimoto. 1975b. Ammonium sulfate enhancement in picloram absorption by detached leaves. Weed Science 23(4):297-301.**

The absorption of picloram in detached leaves of *Psidium cattleianum* and other species was found to be increased with and the addition of ammonium sulfate.

381. **Wyse-Jackson, P. S. 1990. *Nesocodon mauritianus* (Campanulaceae). Kew Magazine 7(3):113-117.**

A single population of *Nesocodon mauritianus*, an endangered species of Campanulaceae, was reported to remain in Mauritius at the time of writing. Surrounding native forest was heavily infested with invasive exotic (alien) species. Of these, especially *Psidium cattleianum* was considered to pose a threat to the survival of *N. mauritianus*. The common name 'Chinese guava' was used for *P. cattleianum*.

382. **Yamashiroya, V. 1985. The allelopathic effect of the *Psidium cattleianum, Psidium guajava*, and *Psidium lucidum* root extraction on the germination of anuenue lettuce seeds. Unpublished report submitted to A. Mori, SPEBE -- Chaminade University of Honolulu.**

*Psidium cattleianum* was found to exude more allelochemicals from the roots than did *P. lucidum* (with the second greatest amount) or *P. guajava* (third greatest amount) as indicated by the effects of root exudates on germination of lettuce seeds. The implication was that allelopathy may be more responsible for the inhibition of neighboring plants than are factors such as light, water, nutrients, and predation in the field.

383. **Yamashiroya, V. 1986. The allelopathic effects of *Psidium cattleianum* leaves on the seed germination of anuenue lettuce seeds. Unpublished report submitted to the Cooperative National Park Resources Studies Unit, University of Hawai'i, Honolulu.**

This study confirmed that leaf cuticle and leaf tissue of *Psidium cattleianum* contribute to the allelopathic effects exerted by this species on seed germination of other species.

384. **Yoshinaga, A. 1980. Upper Kipahulu Valley weed survey. Cooperative National Park Resources Studies Unit, Technical Report 33, University of Hawai'i, Honolulu.**

The most serious threat to Upper Kipahulu Valley on the Hawaiian island of Maui was reported to be strawberry guava (*Psidium cattleianum).* Feral pigs were the principal vector spreading the weed. The author recommended controlling feral pigs, eradicating strawberry guava, and establishing a buffer zone between the upper and lower valley to lessen invasion of alien species. Because strawberry guava is frost resistant, it was reportedly capable of invading higher elevations than could many

other tropical weeds.

385. **Yoshinaga, A. 1981. Upper Kipahulu Valley weed survey. Cooperative National Park Resources Studies Unit, Supplement to Technical Report 33, University of Hawai'i, Honolulu.**

This technical report supplement included maps of the distribution of species in Kipahulu Valley, Maui, including *Psidium cattleianum* and *P. guajava*.