

MAIZE MOSAIC VIRUS --- Status Report Sept. 2010

1. STATUS OF MMV, Sept. 2010

We are currently having one of the more severe epidemics of MMV that I've seen in 50 years. It is reported on all islands and can be a killer. Here are a few recent photos:



2. WHAT IS MMV?

a. **The Disease:** MMV ('maize mosaic virus') is a serious dwarfing disease, originally called "maize stunt". It dwarfs entire plants (all tissues). It shortens husks to expose kernels. It causes a bold white striping on leaves (over veins).

b. **Host Plants:** Only on corn in Hawaii

c. **The Virus:** A rhabdovirus that is transmitted by a leafhopper. The virus cannot be moved mechanically or by aphids and other insects.

d. **The leafhopper:** *Peregrinus maidis* is named for maize (corn) and only likes corn. **Thus the hopper and virus succeed only when corn is available.** By planting every month of the year at Waimanalo for the past 35 years, we've been able to breed resistance very well. Once infected the hoppers carry the virus for life. They normally leave a corn plant very late in maturity.

e. **History:** MMV was introduced to Hawaii about a century ago.

f. **Severity:** When I came to Hawaii in 1961 this virus had ruined corn production on Oahu. I saw many sweet corn fields where not a single ear could be harvested. Severity is reduced in the rainy winter seasons when the hoppers are "flooded out".

g. **Control:** Resistance is the best control. All of CTAHR's corn varieties, inbreds, and hybrids are resistant (see www.ctahr.hawaii.edu/hfs). Very few commercial corns are resistant. Commercial seedsmen spray insecticides weekly following emergence.

3. WHAT TO DO?

- CTAHR should alert all extension staff to become familiar with this virus
- Growers should be encouraged to grow resistant hybrids.
- Industry should be encouraged to reveal information on MMV resistance of commercially sold hybrids in Hawaii.. My guess is they will only be tropical field corns.

4. BACKGROUND AND RESEARCH AT CTAHR

a. CTAHR began research on MMV in 1960, finding the resistance gene and breeding it into all CTAHR corns. Later, the resistance gene was mapped. Many of these publications are available as .pdfs from Brewbaker (see list below). Our evidence is that the Classic Maya civilization (300 – 800 AD) collapsed due to MMV (reference 111).

b. Current entomology research under Dr. Bressan and student Clesson Higashi focuses on epidemiology of the hopper and virus. Other research is focused on possible reduction of severity by planting resistant ground covers.

c. List of resistant hybrids from CTAHR: Please download www.ctahr.hawaii.edu/hfs and click on Seedstocks, then click on “fieldcornflyer” or “sweetcornflyer” for our favorites.

5. PUBLICATIONS ON MMV FROM CTAHR

35. Brewbaker, J. L. 1965. Breeding sweet corn hybrids for Hawaii. *Hawaii Farm Sci.* 14:1-3.
38. *Brewbaker, J. L., and Flaviano Aquilizan. 1965. Genetics of resistance in maize to a mosaic-stripe virus transmitted by *Peregrinus maidis*. *Crop Sci.* 5:412-415.
41. Brewbaker, J. L. 1965. Year-round corn in Hawaii. *Maize Genetics Coop. Newsletter* 39:78-79.
42. Brewbaker, J. L., and Flaviano Aquilizan. 1965. Genetic resistance to a mosaic-stripe disease transmitted by *Peregrinus maidis*. *Maize Genetics Coop. Newsletter* 39:80-81.
48. Brewbaker, J. L., Joseph A. Crozier, Philip J. Ito, and David D. F. Williams. 1966. Performance trials of commercial sweet corn hybrids and varieties in Hawaii, 1962-1965. *Hawaii Agric. Exp. Sta. Tech. Progress Rep.* 149:22 pp.
65. Brewbaker, J. L. and D. Elizabeth Hamill. 1967. Winter corn seed production on the island of Molokai, Hawaii. *Hawaii Agri. Exp. Sta. Tech. Progress Rept.* 160:11 pp.
66. Nakagawa, Yukio and J. L. Brewbaker. 1967. Growing sweet corn in Hawaii. *Univ. Hawaii Coop. Ext. Serv. Leaflet* 120.
71. Brewbaker, J. L. 1968. H38 and H68, Hawaiian sweet corn hybrids. *Hawaii Agric. Exp. Sta. Circ.* 66:11 pp.
73. Brewbaker, J. L. (ed). 1969. Corn seed production in Hawaii; Present problems and future potential. *Proc., 1st Hawaii Seed Industry Conference. UH Misc. Publ.* 61:72 pp.
74. Gilbert, James C., J. L. Brewbaker, J. S. Tanaka, J. T. Chinn, R. W. Hartmann, J. A. Crozier, Jr., and P. J. Ito. 1969. Vegetable improvement at the Hawaii Agricultural Experiment Station. *HAES Res. Rept.* 175:16 pp.
77. Brewbaker, J. L. 1971. Breeding tropical supersweet corn. *Hawaii Farm Sci.* 20:7-10.
85. Brewbaker, J. L. 1972. Hello "Kalakoa". *Hawaii Farm Sci.* 21:8.
92. Brewbaker, J. L. (ed) 1975. Corn and sorghum diseases and insect pests in Hawaii. *Hawaii Agric. Exp. Sta. Misc. Public.* 122:22pp.
94. Brewbaker, J. L. 1974. Continuous genetic conversions and breeding of corn in a neutral environment. *Proc. Amer. Seed Trade Assoc. Corn and Sorghum Res. Conf.* 29:118-133.
96. Brewbaker, J. L. and Nuren Banafunzi. 1975. Hawaiian Super-sweet #6 Corn. *Hort Science* 10:427-428.
106. *Brewbaker, J. L. 1977. Hawaiian Super-sweet #9 Corn. *HortScience* 12:355-356.
111. *Brewbaker, J. L. 1979. Diseases of maize in the wet lowland tropics and the collapse of the Classic Maya civilization. *Economic Botany* 33:101-118.
119. Brewbaker, J. L. 1981. Resistance to maize mosaic virus. *In* D. T. Gordon, J. K. Knoke, and G. E. Scott (eds) *Virus and Viruslike Diseases of Maize in the United States*. OARDC, Wooster, Ohio. *So. Coop. Series Bull.* 247:145-151.
125. Brewbaker, J. L. (ed.) 1982. *Crop Improvement in Hawaii: Past, Present and Future*. Hawaii Inst. Trop. Agric. Human Res. Misc. Public. 180:35pp. (Includes articles "Corn" by Brewbaker and J. R. Thompson, and "Forage and Forest Legumes" by Brewbaker and P. P. Rotar).
133. Brewbaker, J. L. 1983. Breeding for Disease Resistance. *In* T. Kommedahl and P. Williams (eds.) *Challenging Problems in Plant Health*. Amer. Phytopathological Society, St. Paul, Minn. Chap 41, pp. 441-449.
152. Toler, R. W., A. J. Bockholt and J. L. Brewbaker. 1986. Maize mosaic virus and its effect on maize inbreds and hybrids. *Texas Agric. Exp. Sta. Misc. Public.* MP-1604. 14pp.
171. Kim, S. K., J. L. Brewbaker and A. R. Hallauer. 1988. Insect and disease resistance from tropical maize for use in temperate zone hybrids. *Proc. Corn and Sorghum Research Conf.* 43:194-226.
175. Brewbaker, J. L., M. L. Logrono and S. K. Kim. 1989. The MIR (Maize Inbred Resistance) trials: Performance of tropical-adapted maize inbreds. *Hawaii Inst. Trop. Agric. Human Resources Research Series* 62. 27pp.
178. Kratky, B. A., G. Stevens and J. L. Brewbaker. 1989. Suitability of the sweet corn cvs. Hawaiian Supersweet No. 9 and 10 for once-over harvesting. *J. Haw'n. Pacific Agric.* 2:19-21.
192. * Brewbaker, J. L., S. K. Kim and M. L. Logrono. 1991. Resistance of tropical maize inbreds to major virus and virus-like diseases. *Maydica* 36:257-265.
196. Brewbaker, J. L. 1992. Resistance of tropical maize inbreds to major virus and fungal diseases. *In* S. C. Hsieh (ed.) *The Impact of Biological Research on Agricultural Productivity*. Taichung Dist. Agriculture Improvement Sta. and SABRAO, Taichung, Taiwan. pp. 85-94.

212. Ming, R., M.D. McMullen, J.L. Brewbaker, R.C. Pratt, H.G. Moon, T. Musket and D.T. Kyetere. 1995. RFLP mapping of maize mosaic virus resistance gene. *Maize Genetics Coop. Newsletter* 69:59.
220. * Brewbaker, J. L. 1997. Registration of 13 maize-mosaic virus resistant tropically-adapted maize parental inbred lines. *Crop Sci.* 37:637-638.
221. * Ming, R., J. L. Brewbaker, R. C. Pratt, T. A. Musket, and M. D. McMullen. 1997. Molecular mapping of a major gene conferring resistance to maize mosaic virus. *Theor. Appl. Gen.* 95:271.275.
228. * Brewbaker, J.L. 1998. Disease-resistant tropical sweet corn populations. *HortSci.* 33(7): 1262-1264.
238. * Moon, H. G., J. L. Brewbaker and X.W. Lu. 1999. Major QTLs for disease and insect resistance identified among recombinant inbred lines from tropical maize hybrids. *Maydica* 44:301-311.
250. *Scully, B.T., J. L. Brewbaker, J.K. Pataky, W.F. Tracy and M.E. Smith. 2001. NE-EDR *sh2*; A yellow *shrunk* 2 sweet corn population with disease resistance from exotic sources. *HortSci.* 36(6):1149-1151
252. *Brewbaker, J.L. and B.T. Scully. 2002. NE-EDR*su1* and NE-EDR*bt1*, disease-resistant sweet corn populations with *sugary1* and *brittle1* endosperms. *HortSci.* 37(3):600-602.
253. *Brewbaker, J.L. 2003. *Corn Production in the Tropics – The Hawaii Experience*. CTAHR, UH Manoa, Honolulu. 74 pp.
257. *Brewbaker, J. L. 2006. Hawaiian Supersweet Silver. *HortSci* 41(6):1508-1509.
258. Brewbaker, J. L., I. F. Martin and Taweesak Pulam. 2006. Development of supersweet maize adapted to the tropics. *In* “Breeding for Success; Diversity in Action”, C.F.Mercer (ed). Proc. 13th Australasian Plant Breeding Conference, Christchurch, New Zealand, April 2006. pp. 44-49.
262. *Brewbaker, J. L and A. D. Josue. 2007. Registration of 27 maize parental inbred lines resistant to maize mosaic virus. *Crop Sci.* 47(1):459-461.
263. *Brewbaker, J. L., I. F. Martin and Taweesak Pulam. 2007. Genetics and breeding of sweet corn adapted to the tropics. Conference on Genetics, Breeding, Planting and Industrialization of Sweet and Waxy Corn, Guangzhou, Guangdong, China, Nov. 26-28, 2007. pp. 1-19.
265. Brewbaker, J. L. (and co-authors) 2008. “Fields of dreams—Hawaii’s agronomic crops” (Brewbaker and T.J.K. Radovich), pp.36-7; “In the beginning was the seed” (Brewbaker) pp. 38-39; “Eat your veggies—Improving Hawaii’s vegetables” (Radovich and Brewbaker) pp. 40-41; “Agroforestry—Native forests and tree plantations” (J.B. Friday and Brewbaker), pp. 94-95. *In* “Hawaii’s College of Tropical Agriculture and Human Resources; Celebrating the First 100 Years”. B. M. Brennan and J. R. Hollyer (eds), CTAHR, U. Hawaii, Honolulu. 291 pp.
266. Brewbaker, J. L. 2008. Sweet Corn. CTAHR FactSheet.
269. Brewbaker, J. L. 2009. Registration of nine maize populations resistant to tropical diseases. *J. Plant Registration* 3:10-13.
277. Brewbaker, J. L. 2010. Six tropical supersweet inbreds of maize. *HortSci* 45(9):000-000.