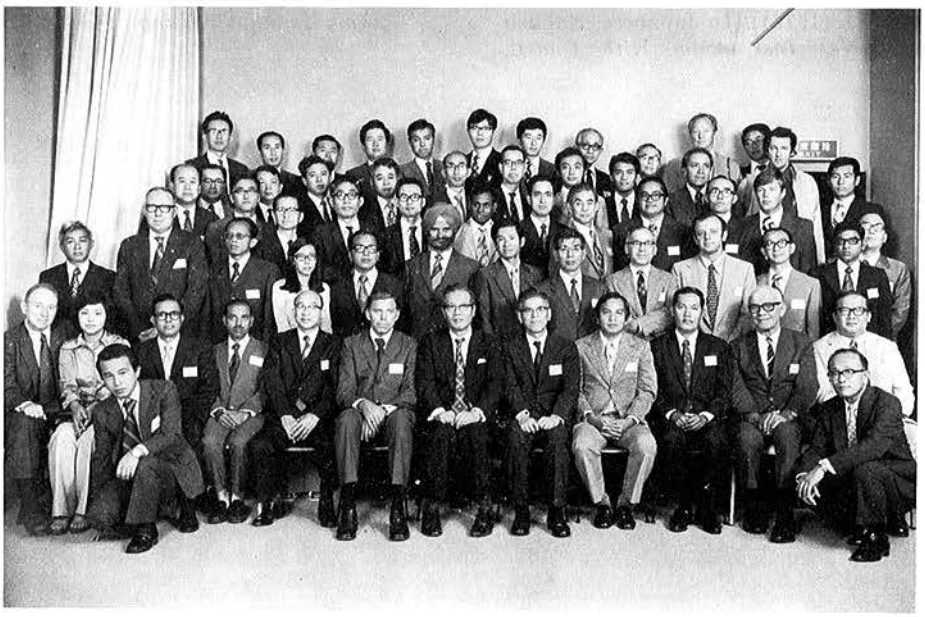
International Symposium on Downy Mildew of Maize

By Hiroshi FUJI

Department of Plant Pathology and Entomology, National Institute of Agricultural Science



Downy mildew is one of the most important diseases of maize, sugarcane, and sorghum in tropical and subtropical countries. Up to the present, nine species (2 genera) of fungi are found to cause downy mildew on maize, each of which shows specific host range and geographical distribution.

It occurs almost all around the world—Asia, Europe, Africa, Australia, North and South America. In Japan two species among these fungi are rather common on rice and foxtail millet but they cause only minor damage to maize.

Since several years ago, some Japanese plant breeders and plant pathologists have started their research work on this disease in tropical Asian countries, and now, it is a matter of big concern for Japanese agricultural scientists, too.

Since 1967 Tropical Agricultural Research Center (TARC), Ministry of Agriculture and Forestry, Japan, has held yearly international symposia on some specific topics of tropical agriculture. This fiscal year, downy mildew disease of maize was taken up as the topic, and the symposium was jointly sponsored by the Inter-Asian Corn Program (IACP; Rockefeller Foundation) and TARC.

The symposium was held during September 17 to 22, 1974, at Conference Hall, Do Sports Plaza, Kōtō-ku, Tokyo.

The number of participants from foreign countries was; 4 from the Philippines, 4 from India, 4 from Thailand, 3 from the United States, 3 from CIMMYT (Mexico), 1 each from Indonesia, Malaysia, Israel, Nepal, IACP headquarters, and Rockefeller Foundation, Including other foreign observers and

Japanese participants, total attendants were over 60.

The program of the symposium, and speakers in each session were as follows;

Session I Country Report (Sept. 17, 13:00–15:00)

Chairman; H. Fujii (Japan)

M. M. Payak (India); Downy mildews of maize in India.

D. M. Tantera (Indonesia); Corn downy mildew situation in Indonesia.

O. R. Exconde (Philippines); Corn in the Philippines.

A. Senanarong (Thailand); Present corn production status.

R. Kenneth (Israel); Problems with graminicolus downy mildews in Israel to date.

A. J. Ullstrup (U.S.); Sorghum downy mildew in the U.S.

M. V. Splitter (Nepal); Downy mildew disease in Nepal.

Session II Pathology (Sept. 17, 15:15–17:00, Sept. 18, 9:30–17:00)

Chairman; K. M. Safeeulla (India)
D. M. Tantera (Indonesia)
A. J. Ullstrup (U.S.)

C. G. Shaw (U.S.); Taxonomy of graminicolus downy mildews.

R. Tokura (Japan); Axenic or artificial culture of the downy mildew fungi of gramineous plants.

U. Pupipat (Thailand); Host geographic distribution and physiologic races of the maize downy mildews.

M. M. Payak (India); Epidemiology of maize downy mildews.

K. M. Safeeulla (India); Infection of maize by downy mildews.

I. J. Dogma Jr. (Philippines); Storage, maintenence, and viability of maize downy mildew fungi.

T. Kajiwara (Japan); Some experiments on downy mildew of maize.

R. Kenneth (Israel); Pathological aspects of sorghum downy mildew disease on maize and sorghums.

Session III Control measures (Sept. 19, 9:30–12:00)

Chairman; S. Jinahyon (Thailand)

O. R. Exconde (Philippines); Chemical control of maize downy mildew.

D. M. Tantera (Indonesia); Cultural practices to decrease losses due to corn downy mildew diseases.

Session IV Genetics and resistance breeding (Sept. 19, 13:00–17:00)

Chairman; J. Singh (India)

N. Mochizuki (Japan); Inheritance of host resistance to downy mildew disease of maize.

V. R. Carangal (Philippines); Regional activities for testing maize germ plasm.

B. Aday (Philippines); The Philippines program in breeding for resistance to downy mildew of maize.

S. Jinahyon (Thailand); Review on breeding work for downy mildew resistance in Thailand.

Session V General discussion on disease control (Sept. 20, 9:30–12:00)

Chairman; V. R. Carangal (Philippines)

S. Lal (India); Brown stripe and sugar cane downy mildews of maize.

R. A. Frederiksen (U.S.); Spot report.

S. Sriwatanapongse (Thailand); Breeding for downy mildew resistance in opaque-2 maize.

In each session, participants took part in active discussion, because both breeders and pathologists had a common interest in almost all of the topics presented. Some of them will be noted here.

Disease symptoms

Symptoms of maize induced by various downy mildew pathogens somewhat vary due to plant stage, amount of inoculum, species of pathogens, etc. For example, chlorotic striping is one of the earliest symptoms and is evident in *S. philippines*, *S. sacchari*, *S. sorghi*, and *S. maydis*, but less marked in

Sclerophthora macrospora and *rayssiae*. Necrosis of chlorotic area is especially characteristic of *Sclerophthora rayssiae*. In some maize varieties, leaf shredding is observed when infected with *S. sorghi*.

Stunting is another symptom associated with these diseases, but these are varying degrees depending on infection time, massiveness of infection, host genotype, and environment.

Sometimes elongation of parts such as in ear shanks may occur. Such contrast—stunting and elongation—within the same disease is very interesting.

Wilting is a common symptom of maize in Javanese downy mildew, *S. maydis*. *Sclerophthora macrospora* often incites tillering in corn and sorghum, sometimes 8–10 tillers.

Barrenness is common to all downy mildew which accounts for the losses in yield.

Geographic distribution

Among 9 downy mildew fungi, some are very widely distributed, and others are found only in a limited area. *S. graminicola* (graminicola or green ear downy mildew), *S. sorghi* (sorghum downy mildew), and *Sclerophthora macrospora* (crazy top) are the former, *S. maydis* (Javanese downy mildew), *S. spontanea* (spontaneous downy mildew), and *S. miscanthi* (leaf-splitting downy mildew) are the latter. Such variation in distribution is due to the physiological characteristics of each fungi, and its host range.

Economic importance in maize production, however, is independent from its geographic distribution because maize is not the original host for all of these fungi. Graminicola downy mildew or crazy top, for example, are most widely distributed, but little damage to maize.

Disease control

For the control of maize downy mildew, some commercial and experimental chemicals have been tested. However, none of them was satisfactory. Protection by those materials is needed especially from the time of emergence until plants are 4 to 6 weeks old.

Results on tests with Duter/Dithane M-45 combination spraying, and seed treatment with Demosan gave better results in the Philippines, but it costs too much to be acceptable to farmers.

It was reported from the United States that potassium azide effectively reduced soil-borne inoculum of *S. sorghi*, but it was not effective as a foliar fungicide.

Cultural practices such as time of planting, spacing distance, fertilizer or roguing were also discussed. Most effective control lies in the use of genetic resistance of the host. In this area, plant breeders and pathologists can cooperate most fruitfully.

Active and successful disease resistance

breeding programs are under way in India, Indonesia, the Philippines, Taiwan and Thailand. A seemingly high correlation of resistance to several downy mildews of maize appears to exist. Resistance seems to be polygenically determined, except one report from Taiwan that single dominant gene governs resistance to *S. sacchari*.

International cooperation

Under the auspices of IACP, the distribution of maize genotypes for testing in Southeast Asia and other countries (international downy mildew nursery program), and the interchange of information (downy mildew newsletter) have been under way. Further cooperation was requested by the participants.

Cooperation of Japan on downy mildew problem was also desired, especially on supplying necessary facilities or space for seed stock exchange plan in Asia.

Final program of the seminar was an observation tour to Sapporo, Hokkaido, 800 km north from Tokyo. It was a three-day field trip from Sept. 20 to 22, visiting the following institutions and farms; Hokkaido National Agricultural Experiment Station, dairy farms in Eniwa and Sapporo Research Center, Snow Brand Seed Co.