

Hot topic: Multi-disease resistant chili lines for higher yields and income



Almost half of the world's 28.41 million tonnes* of chilies are produced in China, India, Indonesia and Thailand. Chili is a good source of cash for subsistence farmers, generating up to four times the income of cereal crops under optimal conditions and providing a major source of employment for women. However, average chili yields in the Asian tropics are generally low (about 5-10 t/ha) and unstable due to pre- and post-harvest diseases.

Severe yield losses are caused by insect-transmitted Cucumber mosaic virus (CMV), Chili veinal mottle virus (ChiVMV) and Chili leafcurl virus (CLCV) as well as fungal diseases such as anthracnose and Phytophthora blight and also bacterial wilt. Smallholder farmers often try to minimize yield losses by applying pesticide cocktails every 3-7 days. Improving the resistance of the crop to diseases is a more

sustainable option. If supplemented by improved crop management practices this can improve yields, reduce risks to farmers and produce a crop that is also safer for consumers.

“Understanding the diversity of the pathogens and their virulence is a prerequisite to developing stable multi-disease resistant lines,” says Dr. Sylvia Green, the virologist at AVRDC - The World Vegetable Center. In a German-funded project, pathogen isolates were collected in all participating countries, and tested against a broad array of lines with different resistance genes. Efficient specific diagnostic methods for all six pathogens, including molecular markers were developed and shared with the national partners.

The results evoke optimism. Multiple distinct strains of virus and pathogen species causing the diseases have been identified, and several sources of resistance have been detected. These resistant lines have been crossed by participating national agricultural research and extension systems with their preferred local chili cultivars. Advanced selections displaying resistance to as many as four of the target pathogens have been

identified, and are currently being multiplied and tested in farmers' fields, using improved management practices such as drip irrigation and starter solutions to further increase yields.

“Sources of resistance and multiple-disease resistant chili lines will be freely distributed as international public goods,” says Sylvia Green. “We hope that more than 30% of farmers will adopt the improved chili cultivars and management practices.” Chili yields are expected to increase by 20% and the area under production by 10%. Most importantly, pesticide inputs will be lowered significantly, improving the safety of chili farmers and their communities, reducing the environmental impact, and providing safer, lower cost chilies for all consumers.



Provided by Dr. Sylvia Green

* Source: FAO Statistics Division 2008, 26 September 2008

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New publications

... from the Pepper SDI Bulletin

Antignus, Y., Lachman, O., Pearlsman, M., Maslenin, L., Rosner, A. (2008). A new pathotype of Pepper mild mottle virus (PMMoV) overcomes the L4 resistance genotype of pepper cultivars. *PLANT DISEASE*. v.92 (7):1033-1037.

Castro, S.M., Saraiva, J.A., Lopes-da-Silva, J.A., Delgadillo, I., Van Loey, A., Smout, C., Hendrickx, M. (2008). Effect of thermal blanching and of high pressure treatments on sweet green and red bell pepper fruits (*Capsicum annuum* L.). *FOOD CHEMISTRY*. v.107 (4):1436-1449.

Glosier, B.R. (2008). A differential series of pepper (*Capsicum annuum*) lines delineates fourteen physiological races of *Phytophthora capsici*. *EUPHYTICA*. v.162(1):23-30.

Medina-Lara, F., Echevarria-Machado, I., Pacheco-Arjona, R., Ruiz-Lau, N., Guzman-Antonio, A., Martinez-Estevez, M. (2008). Influence of nitrogen and potassium fertilization on fruiting and capsaicin content in Habanero pepper (*Capsicum chinense* Jacq.). *HORTSCIENCE*. v.43(5):1549-1554.

Rajkumar, M., Lee, K.J., Freitas, H. (2008). Effects of chitin and salicylic acid on biological control activity of *Pseudomonas* spp. against damping off of pepper. *SOUTH AFRICAN JOURNAL OF BOTANY*. v.74(2):268-273.

Ronco, M.G., Ruscitti, M.F., Arango, M.C., Beltrano, J. (2008). Glyphosate and mycorrhization induce changes in plant growth and in root morphology and architecture in pepper plants (*Capsicum annuum* L.). *JOURNAL OF HORTICULTURAL SCIENCE & BIOTECHNOLOGY*. v.83(4):497-505.

Sang, M.K., Chun, S.C., Kim, K.D. (2008). Biological control of *Phytophthora* blight of pepper by antagonistic rhizobacteria selected from a sequential screening procedure. *BIOLOGICAL CONTROL*. v.46(3):424-433.

Silvar, C., Merino, F., Diaz, J. (2008). Differential activation of defense-related genes in susceptible and resistant pepper cultivars infected with *Phytophthora capsici*. *JOURNAL OF PLANT PHYSIOLOGY*. v.165 (10):1120-1124.

Sy, O., Steiner, R., Bosland, P.W. (2008). Recombinant inbred line

differential identifies race-specific resistance to *Phytophthora* root rot in *Capsicum annuum*.

PHYTOPATHOLOGY. v.98(8):867-870.

Wei, X.L., Jeon, H.S., Han, K.S., Koh, Y.J., Hur, J.S. (2008). Antifungal activity of lichen-forming fungi against *Colletorichum acutatum* on hot pepper. *PLANT PATHOLOGY JOURNAL*. v.24(2):202-206.

... from Center staff

Somta, C., Somta, P., Tomooka, N., Ooi, P.A.C., Vaughan, D.A., Srinives, P. (2008).

Characterization of new sources of mungbean (*Vigna radiata* (L.) Wilczek) resistance to bruchids, *Callosobruchus* spp. (Coleoptera: Bruchidae). *JOURNAL OF STORED PRODUCTS RESEARCH* v.44(4):316-321.

Sanjaya, Hsiao, P.Y., Su, R.C., Ko, S.S., Tong, C.G., Yang, R.Y., Chan, M.T. (2008). Overexpression of *Arabidopsis thaliana* *tryptophan synthase beta 1* (*AtTSB1*) in *Arabidopsis* and tomato confers tolerance to cadmium stress. *PLANT, CELL AND ENVIRONMENT*. v.31 (8):1074-1085.

... New magazines available



We are pleased to announce that the new magazine **Discover Taiwan**: A publication of

The China Post (vol.1-7 & 9, 2002-2008) is now available in the library.

Discover Taiwan is a bi-annual journal compiled from the most interesting articles published on the travel page of The China Post over

the past two years. It's not just a travel guide, but also a compilation of the personal experiences of foreign travelers on their quest to find the real Formosa.

— Fang-chin Chen, Editorial and Library

CORNUCOPIA

Philippines Training Workshop on Vegetable Grafting Technology



This was part of the SANREM CRSP Project on Sustainable Vegetable Agroforestry Systems for Southeast Asian Watersheds funded by the U.S. Agency for International Development (USAID).

There were 35 participants in the training workshop in Claveria and another 30 participants attended the 2-day workshop in Lantapan, Bukidnon, Philippines on 18-19 September 2008.

— Dr. Manuel Palada, CEM Unit

The Center conducted a workshop on “Integrated Vegetable Grafting Technology for Managing Soil-Borne Diseases and Increasing

Tolerance to Flooding in the Hot-Wet Season” in Claveria, Misamis Oriental, Philippines for our farmer cooperators and national partners.

Solomon Islands Training on Integrated Crop, Soil and Pest Management

A training workshop on “Integrated Crop, Soil and Pest Management” was held between 26-29 August, 2008 at the Kastom Gaden Association (KGA), supported by the funding from the Australian Centre for International Research (ACIAR).

Mr. Jimi Saelea, Guest Speaker, Director of Research, Ministry of Agriculture and Livestock (MAL), Solomon Islands thanked “ACIAR and AVRDC for making this important training workshop possible,” saying that MAL as the major local partner “will do all it can to see that the project achieves its objectives.”

The training workshop had the “best mix” of basic and practical knowledge, and skills sharing experiences during field visits to some of the AVRDC collaborators, and from resource speakers from Taiwan, Australia, and Solomon

Islands. One of the MAL participants Ms. Mary Afuna said she had “learned a lot from the specialists and doctors who facilitated the training.” She also said that she appreciated the field visits as they really helped her to observe and identify problems and opportunities that needed to be addressed by local farmers.

In the training workshop the resource speakers were Project Manager Dr. M. C. Palada, Soil Scientist Dr. Ma, Dr. Gerard Kelly, Mr. Joini Tutua, AVI Volunteer Ms. Nathalie Baxter and the Site Coordinator for AVRDC-SI. Dr. R.



C. Joshi. The training workshop was coordinated by the AVRDC-SI staff members and was part of the Project HORT/2005/077- Integrated Crop Management Package for Sustainable Smallholder Gardens in Solomon Islands.

— Dr. Ravindra C. Joshi, Site Coordinator, Smallholder Gardens Project, Solomon Islands

PEOPLE

New staff — Dr. Andreas Ebert, Genebank Manager, GRSU



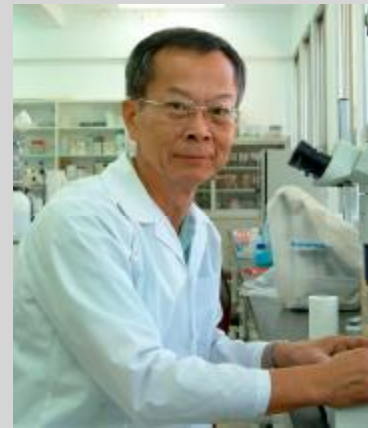
Dr. Andreas Ebert, Genebank Manager, Genetic Resources and Seed Unit accompanied by his wife (Ingrid)

will arrive at HQ on Sunday, 28 September 2008. His initial appointment is for two years until 30 September 2010. Dr. and Mrs. Ebert will stay in the House 813 (Ext. 813) on the campus, and his office will be located in the GRSU

Building with extension number 530.

— *Dr. Yang-Fu Chang, Deputy Director General for Administration and Services*

SKETCH



Name: Tien-cheng Wang

Home: Taiwan

Position: Mycologist

Why do you do?

I was born in Shanhua and this is my hometown. My parents are typical farmers and they planted rice, sweet potato, sugarcane and vegetables as their major crops every year. I learned a lot from them, and I saw that diseases and insects could cause severe yield losses in both vegetables and field crops under tropical climates. No effective control techniques were available for us. So I thought I could be a plant doctor to help farmers manage the pests and to increase their income.

Later, I was very fortunate to be able to enter the Department of Plant Pathology in National Chung Hsing University after a rigorous competition for places. I am one of

only two of my classmates who have been continuously working in plant pathology since 1969. I really enjoy completing research work that produces benefits for farmers. At present, my research is focused on fungal diseases including the characterization of pathogen population diversity and breeding for resistance.

Why do you do it at AVRDC?

In 1973, I left the Taiwan Sugar Corporation and joined AVRDC because it was the only international center in Taiwan. I studied the diseases of legume crops in the first half of my time here and then moved onto the diseases of vegetable crops. Our accomplishments in managing mungbean powdery mildew and Cercospora leaf spot as well as soybean rust made a great contribution to both the breeding program and to farmers. These successes encouraged me to continue working at this Center.

I have enjoyed the team research on resistance breeding very much and learned a lot from each scientist involved. Through international collaboration with our partners in developing countries, we can share our techniques and materials to benefit vegetable producing farmers.

What's the next?

To develop an effective integrated disease management strategy for targeted fungal diseases in tomato, peppers, cucurbits and soybean in Southeast Asia, South Asia, Africa, China and DPR of Korea. In addition, to accomplish the molecular characterization of each targeted fungal pathogen to better understand the genetic diversity of their populations.

Your favorite experience at the Center

Our mycology group has studied Asian soybean rust epidemiology for several years. We not only established a valuable database for use by scientists around the world but also developed several lines with a high level of rust-tolerance. Severe Asian soybean rust has spread from Asia to Africa, then to South America and finally to the USA in 2004. No resistant local cultivars were left. Our materials have exhibited durable resistance in Asia, Africa and America so they have become very popular with both public and private breeders recently. This is because we correctly selected soybean for rust-tolerance.

Favorite vegetable(s)

My favorite vegetables are sweet potato and luffa.