

Diseases of Major Crops in Paraguay

Toshihiko KATUSBE* and Maria Isabel ROMERO**

* Research Division I, Tropical Agriculture Research Center (Tsukuba, Ibaraki, 305 Japan)

** Instituto Agronomico Nacional (Caacupe, Paraguay)

Abstract

Field surveys were undertaken to examine disease occurrences in major crops in Paraguay. The surveys covered 16 prefectures during the period 1986 to 1988. In the rice plants sampled, 11 species of fungal diseases were identified, while no bacterial and viral diseases were observed. Causal fungi of 3 species were recognized to be the most serious, and widely spread. In the 14 crops other than rice, including wheat, citrus, vegetables, root crops, industrial crops and flowers, more than 50 diseases brought about mostly by pathogens were identified. Among those diseases, 68% (35) were caused by fungi, 20% (10) by bacteria, 10% (5) by viruses, and 2% (1) by non-parasitic causes.

Discipline: Plant diseases

Additional key words: bacterial wilt of vegetables, ear blight of rice

Paraguay, an inland country in South America, has tropical conditions of climate in its central part, most of which consists of an extensive, flat plain. Economics of the country depends heavily on agricultural production, including crops, animal raising and forestry. Major products for exportation are soybean, cotton, vegetable oil, meat, leather and timbers.

The present paper attempts to briefly report some results of the surveys on major crop diseases in Paraguay, which surveys were undertaken during the period 1986 to 1988.

Diseases of paddy rice

Paddy rice is a comparatively new crop in Paraguay. The land may have a big potential for rice production from the viewpoint of soil, water and climatic conditions. The rice growers are, however, not enthusiastic at present in producing more rice, because the people in the country have a limited preference for rice-based diet, and the exportation

has some restrictions due to the lack of direct access to marine transportation.

Rice farming in Paraguay is executed in the form of a large scale enterprise. Rice cultivation starts with plowing of the lowland in vast pastures, being followed by direct sowing. It is generally subjected to a very extensive operation without any fertilizer application and weeding, but with a limited water-management. Rice plants are harvested with large-sized combine harvesters under a dry weather condition.

Rice diseases observed in paddy fields are listed in Table 1. Some diseases related to ear blight were observed all over the paddy areas, while blast disease and sheath blight incidences were scarce or only local. Neither bacterial nor viral diseases could be found at all even under repeated examinations.

Diseases of major crops

The field surveys undertaken covered 16 prefectures among a total of 19 prefectures in Paraguay,

The present paper is prepared on the basis of the results obtained from the surveys undertaken under the cooperative research project between the Japan International Cooperation Agency, Japan and the National Institute of Agriculture, Paraguay.

* Present address: 152-1, Hane, Ohda, Shimane, 699-22 Japan.

Table 1. Causal fungi of rice diseases found in paddy fields in Paraguay

(1) <i>Helminthosporium oryzae</i> * (Helminthosporium leaf spot)	(2) <i>Cercospora oryzae</i> * (Cercospora leaf spot)
(3) <i>Micronectirella nivalis</i> (Fusarium leaf spot)	(4) <i>Curvularia lunata</i> (Glume mold)
(5) <i>Pyricularia oryzae</i> (Blast)	(6) <i>Alternaria</i> spp. (False blast)
(7) <i>Nigrospora</i> sp.	(8) <i>Gibberella fujikuroi</i> (Bakanae disease)
(9) <i>Trichoderma viride</i>	(10) <i>Fusarium</i> sp.** (Scab)
(11) <i>Rhizoctonia solani</i> (Sheath blight)	

* Imperfect stage, only.

** Resemble *F. roseum*.

(1)–(4) : All over the paddy fields under the survey.

(5)–(7) : Moderate or local.

(8)–(11): Scarce.

except Chaco, Canindeyu and Cassapa. Serious diseases investigated in 14 major crops, beside rice, are listed in Table 2.

The disease incidences taking place with rather high frequencies are summarized as follows:

(1) Wheat: Brown rust is the most prevalent, being followed by glume blotch. Physiological disorders are also found, which might have been caused by low pH and aluminium excess of soils resulted from erosion.

(2) Soybean: Bacterial diseases and stem rot are serious. Viral diseases also occur with light symptoms. There is a great concern about their expanded outbreaks in future, because the viral diseases are seed-borne.

(3) Tomato: Bacterial wilt infection is not so heavy, but high incidences of bacterial spot are observed. Among the fungal diseases, septoria blight and early blight break out occasionally on a large scale.

(4) Citrus: A heavy outbreak of canker is observed in some orchards. Viral diseases distribute all over the fields. These diseases can spread through grafting propagation and soil transmission as well.

(5) Strawberry: Latent virus diseases are widely spread and fusarium wilt is also found. Gray mold, a post-harvest disease, occurs extensively.

(6) Sugarcane: Smut and white streak are observed.

Virus-like symptoms were recognized frequently, but they had to be identified yet.

(7) Mango: Leaf spot incidences take place. Anthracnose was also found with causal fungus at its imperfect stage only.

(8) Peanut: Leaf spot under its imperfect stage of the causal fungus was observed.

(9) Cotton: Anthracnose, fusarium wilt and bacterial blight are frequently observed.

In the surveys of 14 major crops, excluding rice plants, more than 50 kinds of diseases were identified. They contained 34 fungal diseases, 10 bacterial diseases, 5 viral diseases and one physiological disorder, which were 68, 20, 5 and 2%, respectively.

Discussion

Among the rice diseases observed in the survey, ear blight distributed all over the paddy fields. The main reason for this might be closely associated with practices of water management and nitrogen fertilization, since in the fields which were under an adequate water control and nitrogen application, no ear blight diseases could be found. Blast and sheath blight disease, however, might take place irrespective of these managements.

In regard to bacterial and viral diseases of rice in Paraguay, no incidences were observed in the survey, the duration of which was only two years though. However, it is very likely that even if bacterial and viral diseases are not present at this moment, they might distribute in limited areas in future. Such a limitation could be provided by ecological conditions of rice fields which are generally under a rotation system with an interval of a few years. This system is expected to hamper extensive survival of vectors of these diseases.

Regarding the control methods for fungal diseases in other major crops, adoption of resistant varieties should be the first priority in practices, though there are some effective fungicides available for control. For effective and economic disease control, cultural methods will also have to be employed. In the case of bacterial diseases in Paraguay, the symptoms are generally much severer than those in the temperate zone. The bacteriocides are not satisfactorily effective at present. These diseases in this country are therefore classified as "recalcitrant". As regards the viral diseases, problems are related not only to limited

Table 2. Causal pathogens of major crop diseases in Paraguay

Major crops and diseases	
(1) Wheat and Oat (Trigo y Avena)	iii) Virus and Viroid
i) <i>Puccinia recondita</i> (Brown rust)	a) Citrus tristeza virus (Tristeza)
ii) <i>Puccinia graminis</i> f. sp. <i>tritici</i> (Stem rust)	b) Citrus exocortis viroid (Exocortis)
iii) <i>Erysiphe graminis</i> (Powdery mildew)	c) Citrus psorosis virus (Psorosis)
iv) <i>Leptosphaeria nodorum</i> (Glume blotch)	d) Citrus mosaic virus (Mosaic)
v) <i>Helminthosporium tritici-vulgaris</i> (Yellow spot)	iv) <i>Xanthomonas campestris</i> pv. <i>citri</i> (Canker)
vi) <i>Puccinia coronata</i> (Crown rust)	v) Escaldadura (Enfermedad fisiológica)
(2) Potato (Papa)	(7) Sweet pepper (Pimiento dulce)
i) <i>Alternaria solani</i> (Early blight)	i) <i>Phytophthora capsici</i> (Phytophthora blight)
ii) <i>Rhizoctonia solani</i> (Black scurf)	ii) <i>Xanthomonas campestris</i> pv. <i>vesicatoria</i> (Bacterial spot)
iii) <i>Colletotrichum atramentarium</i> (Anthracnose)	(8) Strawberry (Frutilla)
iv) <i>Pseudomonas solanacearum</i> (Bacterial wilt)	i) <i>Verticillium albo-atrum</i> (Verticillium wilt)
v) <i>Phytophthora infestans</i> (Late blight)	ii) <i>Marssonina potentillae</i> (Leaf blight)
vi) <i>Fusarium solani</i> (Dry rot)	iii) <i>Fusarium oxysporum</i> f. sp. <i>fragaiae</i> (Fusarium wilt)
(3) Soybean (Soja)	iv) <i>Botrytis cinerea</i> (Gray mold)
i) <i>Macrophomina phaseoli</i> (Charcoal rot)	(9) Cassava (Mandioca)
ii) <i>Xanthomonas campestris</i> pv. <i>phaseoli</i> (Bacterial pustule)	i) <i>Xanthomonas campestris</i> pv. <i>manihotis</i> (Bacterial blight)
iii) <i>Pseudomonas glycinea</i> var. <i>japonica</i> (Bacterial blight)	ii) <i>Cercospora</i> spp. (Leaf spot)
iv) <i>Peronospora manshurica</i> (Downy mildew)	(10) Sugarcane (Caña de Azúcar)
v) <i>Corticium rolfsii</i> (Stem rot)	i) <i>Ustilago scitaminea</i> (Smut)
vi) Virus (Mosaic)	ii) <i>Xanthomonas albilineans</i> (White streak)
(4) Tomato (Tomate)	(11) Mango (Mango)
i) <i>Pseudomonas solanacearum</i> (Bacterial wilt)	i) <i>Pestalotia manginiferae</i> (Leaf spot)
ii) <i>Xanthomonas campestris</i> pv. <i>vesicatoria</i> (Bacterial spot)	ii) <i>Colletotrichum gloeosporioides</i> * (Anthracnose) (<i>Gloeosporium mangiferae</i>)
iii) <i>Septoria lycopersici</i> (Leaf spot)	(12) Peanut (Maní)
iv) <i>Alternaria solani</i> (Early spot)	i) <i>Cercospora personata</i> * (Leaf spot) (<i>Mycosphaerella berkeleyi</i>)
(5) Melon and Watermelon (Melón y Sandía)	(13) Cotton (Algodón)
i) <i>Colletotrichum lagenarium</i> (Anthracnose)	i) <i>Colletotrichum gossypii</i> * (Anthracnose) (<i>Glomerella gossypii</i>)
ii) <i>Phytophthora nicotianae</i> var. <i>parasitica</i> (Phytophthora rot)	ii) <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> (Fusarium wilt)
iii) <i>Sclerotinia sclerotiorum</i> (Cottony rot)	iii) <i>Xanthomonas campestris</i> pv. <i>malvacearum</i> (Bacterial blight)
iv) <i>Fusarium oxysporum</i> f. sp. <i>niveum</i> (Fusarium wilt)	(14) Rose (Rosa)
(6) Citrus fruit (Cítricos)	i) <i>Diplocarpon rosae</i> (Black spot)
i) <i>Elsinoe fawcetti</i> (Scab)	
ii) <i>Phytophthora citrophthora</i> (Brown rot)	

* Imperfect stage, only.

awareness by the farmers, but also to lack of qualified specialists on these diseases. To cope with these problems, appropriate programs for training specialists will have to be formulated. There is a great importance of controlling existing diseases on one hand, careful attention should be paid to the

quarantine system on the other, so that it could be more functional and effective in preventing the possible invasion of new pathogens, which might be brought in by the seeds and seedlings imported from overseas.

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(Received for publication, Nov. 5, 1990)

Enfermedades de los Principales Cultivos del Paraguay

Resumen

Se llevaron a cabo estudios de campo para investigar la incidencia de enfermedades en los principales cultivos del Paraguay. Los estudios se llevaron a cabo en 16 Departamentos durante los años 1986-1988. En las plantas de arroz muestreadas, se identificaron 11 especies de enfermedades fungales, no habiéndose observado enfermedades causadas por bacterias o virus. Tves enfermedades de tipo fungal fueron las más serias, estando asimismo ampliamente diseminadas. En los otros 14 cultivos que incluyeron, trigo, cítricos, verduras, tuberculos, cultivos industriales y flores, se identificaron más de 50 enfermedades provocadas por patógenos. Entre estas enfermedades, 68% (35) fueron causadas por hongos, 20% (10) por bacterias, 10% (5) por virus y 2% (1) fueron debidas a causas no parasitarias.