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UPOV

TC/XV/4

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0065

INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

GENEVA

TECHNICAL COMMITTEE

Fifteenth Session
Geneva, March 18 and 19, 1980

HARMONIZATION AND COOPERATION IN THE TESTING OF RESISTANCE TO DISEASES

Document prepared by the Office of the Union

1. During its fourteenth session (November 1979), the Technical Committee discussed the question of harmonization and cooperation in the testing of resistance to diseases. It was agreed to discuss this problem further during the fifteenth session of the Technical Committee on the basis of a working paper (see document TC/XIV/5, paragraph 24).

2. The Annexes to this document contain the working paper prepared by the Chairman of the Technical Working Party for Agricultural Crops.

[Two Annexes follow]

Harmonization and Cooperation in the Testing of Resistance to Diseases

The Technical Committee asked for the following points to be discussed in the Technical Working Parties during their coming sessions:

a. to list in their field of competence the diseases to which resistance could in their opinion be used for distinguishing varieties for the granting of plant breeders' rights,

b. to note whether, in the various Technical Working Parties, agreement on the methods of testing, including the methods of maintaining the biotypes, was possible, and

c. to identify where further cooperation was useful.

As a background for discussion in the Technical Committee a preliminary paper has been prepared by the Technical Working Party for Agricultural Crops based on answers received from different members of that Working Party.

The Roman number allotted to each disease is used thereafter for the sake of convenience in connection with the comments given on each question asked.

The Technical Questionnaire, which the members were asked to comment on, is presented in Annex II to this document.

A Summary of the Comments Received from Different Member States

Questions 1 and 2

Number given to the disease	Country	Denomination of the disease	Species (Host)
I	France	Flax Rust (Melampsora limi)	Flax, Linseed
II	"	Downy mildew (Plasmopare Heliantii)	Sunflower
III	"	Verticillium Wilt (Verticil. albo-atrum)	Lucerne
IV	"	Stem Nematode (Ditylenchus dipsaci)	Lucerne
V	"	Leaf Spot (Cercospora baeticola)	Sugar beet
VI	South Africa	Northern Leaf Blight (Bipolaris tursica)	Maize
VII	"	Southern Leaf Blight (Bipolaris maydis)	Maize
VIII	United Kingdom	Mildew (Erysiphe graminis)	Wheat, Barley, Oats
IX	"	Yellow Rust (Puccinia striiformis)	Wheat, Barley
X	"	Brown Rust (Puccinia recondita)	Wheat
XI	"	Brown Rust (Puccinia hordeii)	Barley
XII	"	Crown Rust (Puccinia coronata)	Oats
XIII	"	Crown Rust (Puccinia coronata)	Perennial Ryegrass
XIV	"	Lucerne Wilt (Verticillium albo-atrum)	Lucerne
XV	"	Pea Wilt (Fusarium oxysporum f. pisi)	Pea
XVI	Denmark	Mildew (Erysiphe graminis)	Wheat, Barley
XVII	"	Cereal Cyst Neamtode (Heterodera avenae)	Barley, Oats

Question 3

Disease Number	Test Method
I, III	Artificial infection of young plants in growth chamber.
II	Artificial infection of seed and incubation of young plants in growth chamber.
IV	Artificial infection of young plants in growth chamber or in glasshouse.
V	Contamination of plants in the field.
VI, VII	A small quantity of milled infected leaves is dropped into the funnel of the plant at the 10-12 leaf stage. Under dry conditions moist conditions are created with a mist spray through microjet nozzles.
VIII, IX, X, XI, XII, XIII, XVI	Seedling leaves are inoculated with dry spores and plants are kept in controlled environment cabinets. Seedlings are replicated, with controls present, disease reactions are recorded on a 0-4 scale, and results are analysed.
XIV	Roots of seedlings are dipped into a water suspension of spores and the seedlings kept in a glasshouse.
XV	Suspension of spores is added to pots of damaged seedlings and roots.
XVII	Artificial infection of plants grown in pipes with soil infested with cysts. Disease reaction is recorded at the milk development stage of kernels by counting the number of cysts on the roots of each plant.

Question 4

Disease Number	Definition of the Biotype of the Disease
I	Two different "strains". One is called "race Wiera", the other is called "race Reina".
II	Only one biotype exists in France (the US "Red River" biotype is unknown in France) but there are two different genes of resistance (immunity or hypersensitivity).
III, IV, V	Collected directly from an infested crop.
VIII, IX, X, XI, XII	Defined according to the United Kingdom Cereal Pathogen Virulence Survey Annual Reports.
XIII, XIV	NIAB or WPBS isolate.
XV	Races 1 and 2 used (NIAB collection).
XVI	Defined according to the virulence on the corresponding gene(s) for resistance of the host.
XVII	Races I and II.

Question 5

Disease Number	Storage of the Biotypes - Method
I	On living material kept in two different growth chambers.
II, IV, XVI	On living material kept in a growth chamber.
III	Artificial medium in "Roux Bottle" kept in a refrigerator.

V	Artificial medium kept in a refrigerator.
VI, VII	Infected leaves collected the previous season, kept in bins in cold storage.
VIII	Kept on detached leaves or re-isolated from the pathogen population. Obtained from the UK CPVS.
IX, X, XI, XII, XIII	Vacuum dried and stored in sealed glass tubes.
XIV	In culture tubes.
XV	Agar culture.
XVII	Kept in the soil in a field plot where a susceptible oat variety is grown each year for multiplication of the nematode cysts. The two races are kept at a certain distance from each other to prevent contamination.

Question 6

Disease Number	The Host-Pathogen Relationship
I, III, IV, XVI, XVII	No problem.
II	No problem with the "immunity" gene, a little more for the hypersensitivity.
V	Yes. Depending on the climate during the "incubation".
VI, VII	Yes. Method is limited to genetically homogeneous material. In other words it works with single cross varieties but gives problems with double cross hybrids.
VIII, IX, X, XI, XII, XIII	Reaction varies due to varying temperatures; a controlled environment cabinet is therefore required.
IX	Variety may not be homogeneous for rust resistance.
XIII	Host resistance may vary and all seedlings may not be resistant, i.e. variety may not be homogeneous for rust resistance.
XIV	It is difficult to measure presence of fungus with a vascular pathogen and therefore host reaction has to be measured using a descriptive key.
XV	Variation of host cultivar.

Question 7

Disease Number	The Storage of the Biotypes
I, II, III, IV, V, VI, VII, XVI, XVII	No problem.
VIII	Mildew can only be maintained on living material and therefore isolates with the required virulent gene(s) are best re-isolated from the pathogen population.
IX, X, XI, XII	The isolates keep for many years in the sealed tubes but the virulent genes can be re-isolated from the pathogen population.
XIII	The isolates keep in the sealed glass tubes.
XIV	Re-inoculations through plants is required to ensure pathogenicity.
XV	Loss of pathogenicity of culture.

Question 8

Disease Number/ State	The Use of the Results from the Disease Tests for Distinction of Two Varieties
I, II, V, XVI, XVII	Used as an independent characteristic.
III, IV	Used as an additional characteristic to other morphological characteristics.
VI, VII	Used as an independent characteristic if the results are reliable.
United Kingdom	In the UK we have used disease tests in both ways but their normal application would be as a special test to determine distinctness in those cases for which morphological characteristics have not been decisive.

Question 9

Disease Number/ State	Cooperation Between Different UPOV Member States
I, II	As the storage of the biotypes is really expensive, there are only advantages in cooperation between countries.
III, V	The method needs more standardization before being used in cooperation between countries.
IV	The method needs comparison and standardization between countries before being used.
VI, VII	Cooperation would be advantageous; however, we have problems with different seasons, distances and differing climatic conditions in R.S.A. and Europe.
United Kingdom	We feel that cooperation is possible since the tests take place under controlled conditions. On the one hand, the advantages of cooperation would be the avoidance of the expense of setting up costly facilities. On the other hand, a country which carries out the tests might be faced with an irregular and at times unacceptable demand. There may also be difficulties in obtaining/importing non-indigenous pathogens. In a country which did not have its own test facilities there are also likely to be problems, subsequent to registration, relating to the authentication and checking of varietal purity in seed stocks of varieties for which distinctness was dependent upon disease tests.
Denmark	Cooperation would be most advantageous between those member States which are facing the same disease problems in practice and where there is an identical population of biotypes. Cooperation between member States would demand a better or a complete harmonization of the reference collection of varieties.

Question 10

Disease Number/ State	Other Comments
France: I	Although the biotype or biotypes of each "strain" are not exactly known, it is a really suitable test.
France: II	It is a really suitable test.
France: III, IV, V	Varieties are not homogeneous in their resistance or susceptibility.

United Kingdom	The problem of uniformity deserves some comments. We are of the opinion that the interpretation of uniformity in disease reaction would need to take account of the crop in question. For self-fertilized crops such as cereals, for example, it would seem reasonable to expect complete uniformity in the reaction of all plants whether it be susceptibility, moderate resistance or full resistance. However, for grasses and other cross-fertilized crops, limits defined statistically would probably be necessary. In the UK we have a precedent for accepting varieties showing, say, 80% resistance and 20% susceptibility as being different from a variety showing 50% resistance to the same pathogen. This may not be entirely satisfactory but we feel that at least for the time being, each case should be considered on its merits. Some discussion and exchange of experience on this point would be very beneficial.
Germany (Fed. Rep. of)	If there are possibilities of performing specific tests on biotypes under controlled conditions, we will use such tests where necessary. On the basis of bilateral agreements which would have to be published in our gazette, we would also be ready to take over such test results of other UPOV member States. In order to supervise the maintenance of the variety too, however, there should be facilities to perform these tests in our own country after granting plant breeders' rights. Otherwise the other member States should perform these tests too, though for the time being the bilateral agreements do not provide tests for the other member State after granting plant breeders' rights.
South Africa	The usefulness of disease tests of agricultural varieties for DUS is limited to material where a gene for gene relationship is applicable.
Denmark	At the present moment we are testing a smaller number of plants in the disease tests than of the different morphological characteristics for homogeneity. Only results with a homogeneous reaction of each biotype are used for distinction between two varieties.

[Annex II follows]

ANNEX II

TECHNICAL WORKING PARTY FOR AGRICULTURAL CROPS

Disease Tests of Agricultural Varieties

Questionnaires

1. Denomination of the disease (also in Latin):

2. Species (host):

3. Test method (give a short description):

4. Definition of the biotype of the disease:

5. Storage of the biotypes - method:

6. The host-pathogen relationship.
   Do you have any problems? If so, please specify:

7. The storage of the biotypes.
   Do you have any problems in keeping the origin of the biotype? If so, please specify:

8. The use of the results from your disease tests for distinction of two varieties:
   (a) As an additional characteristic to other morphological characteristics.
   (b) As an independent characteristic.

9. Cooperation between different UPOV member States.
   Please give your comments on the possibilities and the advantages/ disadvantages:

10. Please give any other comments or information on the matter you may wish to supply:

[End of Annex II
and of document]