

EVALUATION PROCEDURES FOR THE INTENSITY OF DISEASE OCCURRENCE IN SUNFLOWER

M. AČIMOVIĆ

Institute of Field and Vegetable
Crops, 21000 Novi Sad, Yugoslavia

At the third Consultation of the F.A.O. Research Network on Sunflower held at Versailles, France, from 22 to 27 October 1979, the liaison centre of sunflower disease mapping subnetwork has been changed to the Institute of Field and Vegetable Crops of Novi Sad, Yugoslavia. The new liaison centre has decided to use the same methodology for disease evaluation, with the purpose of keeping up-to-date the European maps of sunflower diseases and even of extending the area covered to as many extra-European countries as possible. For facilitating this task, the liaison centre has been entrusted to work out a method of evaluation of sunflower disease intensity to be followed by all subnetwork members when gathering data for the mapping of sunflower diseases in their countries. If a uniform method is followed, data coming from different countries will be easily compared and useful conclusions drawn. These conclusions could in turn be used as a guideline for an efficacious prevention and control of the most important diseases in all countries participating in this project.

Since all sunflower growing countries have their specific conditions with respect to soil type, climate, cultivars grown, cultural practices applied, even crop parasites, the disease occurrence and severity is different in, and specific for each country. In this situation, a uniform method of evaluation of sunflower disease intensity should emphasize the most economically important problems of each region or country.

It is well-known that sunflower is attacked by a variety of parasites and that it is difficult to establish a uniform method of evaluation for all diseases caused by these parasites. Sunflower pathologists have to adjust their evaluation procedures whenever parasites and diseases not included in this paper are encountered. Knowing that each phytopathologist has his own preferences regarding the method of work, we

tried to formulate a universal method which would be acceptable to all participants. Here are its main points :

DATE OF CHECKING AND EVALUATION

Sunflower plots should be checked three times during the growing season :

1. before the budding stage ;
2. 10 days after full flowering ;
3. 20 — 15 days before harvest.

If all three checks cannot be performed, the first and the third are compulsory.

METHOD OF CHECKING

The method of checking depends on the plot size. If the plots are small, 0.5 to 10 ha, the best method is to check 20 plants at five spots (a total of 100 plants) along a diagonal of each plot. Five plots or 500 plants should be checked and evaluated in each region.

If the plot size ranges between 10 and 100 ha, 100 plants at five spots (a total of 500 plants) should be checked along a diagonal of each plot, or 100 plants in five plots.

If the plot size exceeds 100 ha, 100 plants at five spots (a total of 500 plants) should be checked along a diagonal of the plot.

If the conformation of plots or other natural obstacles impede the checking along a diagonal of the plot, the evaluator should resort to a method closest to the one proposed but feasible in the given conditions.

METHOD OF EVALUATION

Downy mildew (Plasmopara helianthi Novot.). During the first check, the number of systemically infected (dwarfed) plants should be coun-

ted. The average number of infected plants should be expressed in percentages.

During the second and third check, evaluate the occurrence of the disease on the leaves of normally developed plants on the scale from 0 to 4.

Leaf and stem spot (*Alternaria helianthi* (Hansf.) Tub. and Nish., *Alternaria (tenuis) alternata* (Fr.) Keiss, *Alternaria zinniae* Pape, *Phoma oleracea* var. *helianthi tuberosi* Sacc (*Phoma* sp.), *Septoria helianthi* Ell. et Kell., *Erysiphe cichoracearum* D.C., and rust (*Puccinia helianthi* Schw.) should be evaluated on the scale from 0 to 4.

Wilt (*Verticillium alboatrum* R. et B., *Verticillium dahliae* Kleb., *Rhizoctonia solani* Kühn, *Fusarium* spp., *Sclerotium bataticola* Taub., *Sclerotinia sclerotiorum* Fuckel., *Sclerotinia rolfsii* Sacc., *Botrytis cinerea* Pers., bacteria, etc.). Count the number of wilted plants, calculate the average percentage.

State the time of occurrence of wilt and the stage of plant development for each parasite.

For the parasites which first attack the root and later the other plant parts: stem, leaf, head (*Sclerotinia sclerotiorum*, *Botrytis cinerea*), evaluate the intensity of infection on the scale from 0 to 4.

Head rot (*Sclerotinia sclerotiorum*, *Botrytis cinerea*, *Rhizopus* spp., *Alternaria helianthi*, etc.). Evaluate the intensity of infection on the scale from 0 to 4.

Dodder (*Cuscuta* spp.); evaluate the infestation on 100 plants in five spots (a total of 500 plants) on the scale from 0 to 4.

Broomrape (*Orobanche* spp.); evaluate the infestation on 20 plants in five spots (a total of 100 plants). The total number of broomrape plants on 100 host plants should be divided by 100 to obtain the average number of broomrape plants per one sunflower plant.

The figures in the scale 0 — 4 stand for:

- 0 = healthy plants;
- 1 = damages of infected plants ranging to 25% (weak attack);
- 2 = damages on infected plants ranging from 26 to 50% (medium attack);
- 3 = damages on infected plants ranging from 51 to 75% (strong attack); and
- 4 = damages on infected plants ranging from 76 to 100% (very strong attack).

Intensive attacks by leaf spot and rust cause a premature senescence of the leaves which may reduce the yield by as much as 25%.

For the systemic infections by *Plasmopara helianthi*, early wilt, and a complete head rot, when the plants do not produce any seed, mark the intensity of infection 4, where the number of infected plants also stands for the extent of damage.

The evaluation of broomrape attack:

Weak attack: 1 — 20 broomrape plants per one host plant;

Medium attack: 21 — 40 broomrape plants per one host plant;

Strong attack: over 40 broomrape plants per one host plant.

The values of the attack by downy mildew, wilt, and head rot should be expressed as a percentage of the infected plants.

For spot, rust, and other diseases rated on the scale 0 — 4, the intensity of the attack may be evaluated directly in percentages (0 = healthy plants, 1 = damages to 25%, 2 = damages from 26 to 50%, 3 = damages from 51 to 75%, and 4 = damages from 76 to 100%). The average percentage of damage should be calculated on the basis of the number of the evaluated plants. When using the scale 0—4, it would be even better to calculate the extent of damage by McKinney's formula:

$$I = \frac{\sum (n \times k)}{N \times K} \times 100.$$

I = infection index;

n = number of plants per category;

k = number of categories;

N = total number of evaluated plants;

K = number of accounted categories;

Σ = sum of products.

Category of damage	No. of plants per category
0	6
1	19
2	58
3	105
4	125
Total number of evaluated plants	312

A concrete application of McKinney's formula:

$$I = \frac{(19 \times 1) + (58 \times 2) + (105 \times 3) + (125 \times 4)}{312 \times 4} \times 100 = 76.1\%.$$

The figure 76.1% is the index of damage, i.e. the mean value of the intensity of disease occurrence on the examined plants. This figure helps us approximate the actual damage caused by the disease on sunflower plants. The accuracy of the infection index increases with the increase of the number of plants examined.

This method of evaluation is particularly suitable for varietal and agrotechnical trials, when determining differences in susceptibility towards a parasite. It is sufficient to calculate

the index of disease damage for the varieties grown in the same conditions to obtain a correct insight on their susceptibility because the index also signifies the degree of susceptibility.

For the diseases which cannot be estimated by the above method, use the simplest method :

- weak occurrence,
- medium occurrence,
- strong occurrence.

Besides the diseases of biological nature, caused by pathogenic fungi, bacteria, and viruses, symptoms will be encountered on sunflower plants which cannot be determined either in field or laboratory. When such a disease is encountered, it is necessary to note the date of finding, location of occurrence, detailed description of disease symptoms, and the area on which the disease was distributed. Infected plants should be photographed, possibly to make color slides.

If sunflower plots are situated on loose or compacted soils, attention should be paid to the manifestation of diseases ensuing from the depletion of certain microelements (boron, zinc, magnesium, etc.) and unfavourable edaphic factors.

Certain parasites frequently attack the sunflower plants simultaneously, as is the case with the agents of spot, wilt, and head rot. It is necessary to report the dominant agent as well as those less important.

All diseases occurring on sunflower plants should be photographed to make color slides in two copies : one copy for the author, another to be sent to the liaison centre for publication.

MÉTHODES D'ÉVALUATION DE L'INTENSITÉ DE LA MANIFESTATION DES MALADIES DU TOURNESOL

Résumé

Afin d'obtenir et de rapporter plus aisément les données nécessaires à l'élaboration de la carte des maladies du tournesol en Europe et au dehors de l'Europe, le Centre de liaison de Novi Sad du sous-réseau qui s'occupe de cette investigation commune, a élaboré une méthode unique d'évaluation de l'intensité des maladies du tournesol qui est accessible à tous les participants. La méthode indique le moment de l'évaluation, la dimension des parcelles et le nombre des plantes à examiner, l'échelle de notation des principales maladies, l'estimation de l'index d'infection selon McKinney. Des indications sont données sur la méthode de notation et d'évaluation des maladies nouvelles, identifiées pour la première fois dans une certaine région.

MÉTODOS DE EVALUACION DE LA INTENSIDAD DE MANIFESTACION DE LAS ENFERMEDADES DE GIRASOL

Resúmen

Con vistas a facilitar la recolección y relato de los datos necesarios para configurar el mapa de enfermedades del girasol en Europa y en otros países fuera de Europa, el Centro de relación de Novi Sad de la subred encargada con esta investigación común, elaboró un método único, accesible a todos los participantes, para evaluar la intensidad de las enfermedades del girasol. El método especifica el momento de evaluación, la dimensión de las parcelas y el número de plantas examinadas, la escala de anotación para las principales enfermedades, la calculación del índice de infección según la fórmula McKinney.

Le hacen indicaciones respecto al procedimiento de anotación y evaluación de unas enfermedades recientes, identificadas por primera vez en el país o región respectiva.