

## PECULIARITIES OF INFECTION AND FORMS OF SUNFLOWER DOWNY MILDEW

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First in our country downy mildew was found in Zaccarpathian region, and in 1950-1951 in Moldavia and in Krasnodar region. For the short period of time the infection enveloped large areas of sunflower plantings.

Naturally, the appearance of downy mildew in sunflower plantings first in the East European countries and then in the Soviet Union draw the attention of soviet and foreign scientists. Parallely with the earlier published works by M. Nishimura, P. A. Joung and H. E. Morris, W. E. Sackston there appeared new publications in biology of causal organism and development of measures of its control. The works conducted by N.S. Novotel'nova, A.Y Panchenko, N.D. Novikova, V.P. Yagodkina, I.V. Bogovik and other scientists of our country made a valuable contribution in study of the infection. Great success was achieved by G.V. Pustovoi in breeding sunflower varieties with a group immunity, to the most dangerous sunflower diseases and pests.

Nowadays, hybrids, immune to downy mildew and other diseases and pests pass competitive variety testing at our institute.

In my report there will be given summarized results of research work in peculiarities of sunflower inoculation with downy mildew causal organism, in forms of infection and on the base of that - in some peculiarities of spreading of the infection.

Downy mildew of sunflower has many different forms, two of them being the most contrast : typical display with clear outward symptoms and latent duration of the disease characterised by lack of the outward symptoms, as the fungus is localized in roots and in the lower part of the stem.

Infection of sunflower with causal organism of downy mildew (oospores) is in direct dependence upon rainfalls in certain periods of plants initial growth and the forms of disease-upon time of infection.

When rainfalls occur in the seedling stage, while its formation and emergence of cotylédony leaves from soil, infection through roots causes the typical symptoms of the disease. Rainfalls in the period from emergence till formation of the 1-st pair of true leaves also favour the infection, but here as a rule, the latent duration of the disease is observed.

Dependance of the forms of the disease upon the period of inoculation was studied in natural environment against infections background and confirmed in greenhouse experiments. Inoculation through roots

in the phase of cotyledonary leaves (seedlings) caused typical display in 13,5 % of plants and latent - in 80,0 %. Inoculation conducted in the phase of first pair of true leaves caused no typical evidences ; latent duration of the disease observed in 10,6 % of plants and inoculation in the phase of 2 pairs of true leaves showed the lack of both forms.

While latent duration of the disease caused by sunflower inoculation with fungus zoospores through roots in the period of cotyledonary leaves opening, the fungus in the process of diffusional spreading penetrates in internodes between cotyledonary leaves and the 1-st pair of true leaves. In later periods of inoculation it penetrated no further than the border of cotyledonary leaves.

The observed forms of sunflower downy mildew inoculation show the tissue specialization by pathogenic agent and its prevalence in young growing tissues proved by N.S. Novotel'nova (1960, 1966). Sunflower having been inoculated through roots at the earliest period of growth, mycelium of fungus easily reached meristematic tissues and then penetrated in young permanent sunflower tissues, causing the typical evidences of the disease.

When inoculation through roots occurred in comparatively later periods of time (emergence - the 1-st pair of true leaves) mycelium had to overcome a considerable distance to meristematic tissues ; it collided with older tissues, differing from young ones in physiological and biochemical processes and was delayed in the lower part of the plant without causing a serious damage to it. In this case the bulk of plant had the latent form of infection.

Critical period of susceptibility when sunflower is inoculated through roots lasts from emergence to appearance of the 1-st pair of true leaves.

While disease study there were found two new forms of sunflower heads affection.

The 1-st late form of display, when infected plants do not differ from healthy ones in height and head diameter but have outward characters of infection - a spot with dried up flowers and small seeds on the right side and corresponding chlorotic area with thickened tissue - on the left side. A dark-brown spot of seed cells is clearly seen against the light-brown background of threshed head.

The 2-nd - late form of latent duration of the disease. The essence of the form is the fact that a maternal plant passes the causal organism to its progenies without any outer symptoms. Daughterly plant, also, does not show any outward characters of the disease. In the whole period of the development it is in the state of latent infection. Late form of the latent duration of the disease appears only in plants, growing jointly with sunflower having typical characters of downy mildew. Thus, in special experiment conducted progenies of seeds gathered from plants having no outward symptoms, but grown in surrounding of infected plants, had 14 % plants with latent duration of the disease. Progenies of seeds gathered from plants grown in fields free of infected sunflower were quite healthy.

As late form of display of the disease so late form of latent duration of the disease were caused by second infection.

In order to expose the most vulnerable phases in the process of sunflower growth and development when late forms of disease may arise inoculation of plants with fungous zoospores and subsequent control of transference of the causal organism to their progenies was carried out on an isolated plot (Table 1).

The greatest affection of progenies was observed in the period of head formation. This occurred due to the favourable conditions for inoculation. The forming head is covered with multiple row involucre bracts, which promote long-term moisture preservation.

In subsequent phases (head opening, initial and full flowering) conditions for infection become worse. Involucre bracts promote long-term preservation of drops of moisture only in heads edges. That is why in late form of the latent duration of the disease the bulk of affected seeds (12,6 %) was at the edge of a head. In the middle zone only 6 % of seeds were affected and in the central part - none.

Seeds of plants with the late form of latent duration of the disease do not differ in size from

healthy seeds and thus present a serious danger as carriers of the initial vector in new regions. Determination of this form has a great significance in correct understanding of the ways of the initial vector's spreading.

Table 1 - Influence of the time of head inoculation on infection of progenies.

Time of inoculation	Latent affection of progenies % (p + mp)
Formation of heads	56.6 ± 4.7
Head opening	19.8 ± 3.9
Initial flowering	16.8 ± 3.5
Full flowering	6.1 ± 1.5
Control	0

Emergence of focuses of infection in new regions is conditioned, mainly, by the following cycle of pathogene spreading : late form of the latent duration of the disease - latent infection of progenies - typical symptoms during subsequent sowing in the same field.

In order to prevent the presence of fungus zoosporangia in air and hence, the appearance of late forms of affection, it is of great importance to move off affected plants in the phase of 3-4 pairs of true leaves and even later. This method should be fulfilled obligatory in all plantings and in surrounding sunflower fields.