

Д-р Илија Каров



БОЛЕСТИ НА ОРИЗОТ

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## БОЛЕСТИ НА ОРИЗОТ

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Со големо задоволство оваа книга  
ја посветувам на ќерката  
Розе

*Секавање и особена благодарност на мојот ценет  
и почитуван сега покоен Проф. Д-р. Велко Николиќ  
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## ПРЕДГОВОР

Книгата "Болести на оризот" претставува прво издание во Р. Македонија, а издавач е ЈНУ Институт за јужни земјоделски култури - Струмица.

"Болести на оризот" би требало да ја исполни празнината којашто долго време се чувствуваше во домашната фитопатолошка литература. Голем број на испитувања се извршени во Институтот за ориз во Кочани, на земјоделскиот факултет во Нови Сад - СР Југославија и на универзитетот ТЕКСАС A&M, Беаумонт - САД. Направен е преглед на странска литература, објавени податоци во последните 100 години коишто практично во голема мера не беа достапни во нашата научна и стручна јавност.

Резимирајќи ги досегашните резултати за болестите на оризот на читателите им се овозможува на лесен и едноставен начин да дојдат до посакуваните податоци од оваа област. Верувам дека оваа монографија ќе влијае на проширувањето на стручното знаење на голем број агрономи и ќе поттикне поинтензивна научноистражувачка работа на многу сеуште непроучени проблеми во Р. Македонија.

Материјалот којшто е изнесен во оваа книга е поделен во неколку дела: 1. Болести коишто се причинети од габи (микоза); 2. Бактерии (бактериоза); 3. Вириси (виروзи); 4. Микроплазматски болести и 5. Нематоди (болести причинети од нематоди). Најголемиот простор е даден на болестите коишто се од поголемо економско значење во нашата држава. Опишани се и голем број на болести кои досега не се констатирани кај нас. Во делот којшто се однесува на отпорноста, најголемо внимание е посветено на природата на отпорноста и методиките на тестирање на отпорноста на оризот кон одредени патогени микроорганизми.

Голем број на фотографиите се оригинална сопственост на авторот, а мал број се позајмени од други автори и списанија. Користената литература при пишувањето на оваа монографија дава можност на други истражувачи кои сакаат да добијат подетални информации да можат на едноставен начин да дојдат до посакуваните податоци кои се проучувани, списанијата во коишто се објавени трудовите и слично.

# RICE DISEASES

by  
Ilija Karov

## SUMMARY

The author has summarized in this book the present knowledge on rice diseases in the world. He has paid a special attention to economically important diseases of rice in Macedonia. Likewise, he has described a certain number of diseases which have not been found in this country but have been cited in the world's literature.

The book consists of several chapters: fungus diseases, bacterial diseases, virus diseases and nematodes. At the end of explanation about each disease there is given a list of the most important sources of literature used.

Economically important diseases have been generally presented according to the following order: History and distribution, losses, symptoms of diseases, causal organism, morphology, physiology, varietal resistance and control.

In the part relating to the resistance, attention has been mainly devoted to the problems of nature of resistance and methods of artificial inoculation of rice by different parasites aiming to realise as better infection as possible for its application in breeding work.

The majority of illustrations added are the author's own sources which would together with other supplements make the identification of rice diseases considerably easier in the field from the practical point of view.

In this book the author wanted to give a short information on the fundamental problems of rice protection against the diseases in Macedonia for the specialists who are interested in them but do not know the language in which this book has been written.

Generally speaking, diseases in this country have a considerable effect on the reduction of yield and cause bad quality of rice. Dealing with these problems during recent 25 years, the author has come to the conclusion that the importance individual diseases on rice: Blast, Brown spot and Stem rot.

**Blast (*Pyricularia oryzae* Cav.)** Blast is one of the most important diseases of rice worldwide. Crop management greatly affects the disease. Losses and added costs for disease control are greatest where farmers practice intensive, high-input rice cultivation. In low-input, traditional agriculture, low soil levels of nitrogen limit disease development.

The pathogen produces lesions on all parts of the shoot but rarely attacks the leaf sheath. The characteristics of lesions on the leaf blades vary with environment and host resistance. When lesions first appear, they are often white to gray-green with darker green borders (Plates 1 and 1a). Older lesions are generally whitish to gray with necrotic borders (Plates 2, 2a, 2b). Their shape varies, but lesions are characteristically diamond-shaped (Plate 3). Lesion size varies with plant age and resistance. Necrotic spots are common on cultivars with major genes for resistance, but these spots may also be found intermixed with larger lesions on susceptible cultivars. Lesions on the leaf blades of plants at the reproductive stage are generally larger (2 cm long) than lesions on younger plants



(less than 1 cm long).

Infection of the panicle neck node, called neck blast or rotten neck blast, is the most destructive symptom in most environments where blast is a problem. Neck node infection and infection of the panicle branches and spikelet pedicels may occur together, or they may occur separately under some conditions. (Plates 4 and 5). Although the biochemical basis of the pathogenicity of the fungus is not clear, toxins are likely components of pathogenicity. A number of toxins from the pathogen have been identified, including  $\gamma$ -picolinic acid, tyrosol, two 3,4 dihydroisocoumarins, several naphthalenones, pyriculol, and tenuazonic acid.

*Pyricularia oryzae* Cavara, is the cause of rice blast. The name *P. oryzae* Cav. has been used widely in the phytopathological literature, but for the fungus attacking rice, *P. oryzae* is morphologically indistinguishable from *P. grisea* which attacks other grasses. Both have the same teleomorph. Since these fungi are regarded as synonymous, the earlier name, *P. grisea*, is the correct name for the rice blast pathogen.

The teleomorph, *Magnaporthe grisea* (T. T. Hebert) Yaegashi & Udagawa, has not been found in nature. It is an ascomycete in the Physosporaleaceae that produces hyaline, fusiform, three-septate ascospores in unitunicate asci. The fungus is heterothallic with bipolar mating control, but there are additional genes controlling the sexual cycle. Nearly all rice field isolates are males and are unable to cross with one another, whereas many isolates from other grasses are hermaphroditic. Hermaphroditic laboratory strains to infect rice have been developed through crossing with nonrice isolates.

Complete resistance to blast, where the fungus is unable to cause sporulating lesions on the plant, is well known, but it also has been associated with spectacular breakdowns in cultivar resistance. This type of resistance is controlled by one or two genes and is generally effective for 2 or 3 years in environments conducive to disease. At least 13 genes for complete resistance have been identified. After the complete resistance of a cultivar has been overcome, the cultivar may exhibit either high susceptibility or some level of residual resistance.

Fungicides are often used for blast control in industrialized countries. The development of highly effective systemic fungicides, such as pyroquilon and tricyclazole, has opened new possibilities for controlling the disease in developing countries. These compounds have such high activity that seed treatments may result in long-term control of leaf blast. If seed treatments are effective, fungicides may be economical in many developing countries.

**Brown spot** is caused by *Cochliobolus myabeanus* (Ito & Kuribayashi) Drechs. ex Dastur, syn. *Helminthosporium oryzae* (Breda de Haan) and *Drechslera oryzae* (Breda de Haan) Subramanian and Jain. Brown spot occurs on upland and wetland rice in all major rice growing regions of the Republic of Macedonia.

Brown spot may be manifested as a seedling blight or as a foliar and glume disease of mature plants (plates 20, 21, 22, 23 and 24). On seedlings, the fungus produces small, circular, brown lesions, which may girdle the coleoptile and cause distortion of the primary and secondary leaves. In some cases, the fungus may also infect and cause a

black discoloration of the roots.

Conidiophores are single or in groups, straight to flexuous, sometimes geniculate, pale brown to olivaceous brown, lighter toward the apex, septate up to 750 µm long, and 8-10 µm wide. Conidia are fusoid, obclavate to sometimes almost cylindrical, generally curved, light brown to golden brown, 6-13 septate and 52-124 x 12-22 µm. (Plates 25, 26,).

**Downy Mildew** is caused by *Sclerophthora macrospora* (Sacc.) Thirum. (syn. *Sclerophthora macrospora* Sacc. The disease is considered to be of minor importance.

**Narrow Brown Leaf spot**, also known as *Cercospora* leaf spot is caused by *Cercospora oryzae* Miyake. Symptoms usually occur during the late growth stages and are characterized by short, elliptical to linear brown lesions on the leaf blades, 2-10 mm (Plates 28, 28a and 28b.)

**White Leaf Streak** is caused by *Mycovellosiella oryzae* (Deighton & Shaw) Deighton. (syn. *Ramularia oryzae* Deig)

**Leaf Smut** is caused by *Entyloma oryzae* Syd. & P. Syd. (syn. *Entyloma lineatum* (Cooke) Davis.

**Leaf Scald**, also known as leaf tip blight, leaf tip dying, brown leaf blight and leaf sheath browning. The anamorph, *Gerlachia oryzae* (Hashioka & Yokogi, syn. *Rhynchosporium oryzae*. The teleomorph, *Monographella albescens* (Thuem) Parkinson, syn. *Metasphaeria albescens* Thuem.

**Stem Rot** is a serious disease that occurs in most rice - growing regions of the world. Estimates of yield loss due to the disease range from 10 - 75 %

Stem Rot is caused by *Magnaporthe salvinii* (Catt) Krause & Webster (syn. *Leprosphaeria salvinii* Catt.) The fungus is most commonly found in its sclerotial state, *Sclerotium oryzae* Catt. The fungus also produces a conidial state, *Nakataea sigmoidea* (Cavara) Hara, (syn. *Vakrabeeja sigmoidea* (Cav.) Subr.

The first symptoms are generally observed in the field after the mid tillering stage. Initially, the disease appears as irregular, black lesions on the outer leaf sheaths at the waterline (Plates 35, 36, 37, 38, 39, 40, 41, 42 and 43). As the disease progresses, the lesions expand, and the fungus invades, forming lesions on the inner leaf sheaths.

**Bakanae** is caused by *Gibberella fujikuroi* (Sawada) Fujikuroi (anamorph *Fusarium moniliforme* Sheld.).

The classic symptoms associated with bakanae is elongated, slender, pale seedlings may, however, also be stunted and chlorotic, exhibiting root and crown rot. Infected seedlings usually are killed. Older plants can also be infected and may exhibit abnormal elongation and produce no panicles or empty panicles.

**Sheath Blight**. The causal agent of sheath blight is *Rhizoctonia solani* Kühn,



teleomorph *Thanatephorus cucumeris* (Frank) Donk. Initial symptoms consist of circular, oblong, or ellipsoid, green-gray, water-soaked spots about 1 cm long that occur on the leaf sheaths near the waterline. The lesions enlarge to approximately 2-3 cm. in length and 1 cm in width, and the centers of the lesions become pale green. (Plaates 69-75)

**Sheath spot** - the disease is caused by *Rhizoctonia oryzae* Raker & Gooch. Mycelium of *R. oryzae* is like that of *R. solani*. Sclerotia of *R. oryzae*, in contrast to those of *R. solani*.

**Aggregate Sheath Spot** is caused by *Rhizoctonia oryzae-sativae* (Sawada).

**Sheath Rot** - is caused by *Sarocladium oryzae* (Sawada) Gams & Hawksw. (syn. *Acrocyndrum oryzae* Sawada) Lesions occur on the upper leaf sheaths, especially the flag leaf sheath.

**Crown Sheath Rot** is caused by *Gaeumannomyces graminis* var. *graminis* (Sacc.) Walker. Symptoms usually become evident at the time of internode elongation. The disease affects the leaf sheaths, causing a dark brown to black discoloration or lesion that extends upward from the crown.

**Sheath Blotch** is caused by *Pyrenochaeta oryzae* Shirai ex Miyake

**False Smut** is caused by *Ustilagoidea virens* (Cooke) Takah.

**Kernel Smut** is caused by *Tilletia barclayana* (Bref.) Sacc. & Syd. Symptoms is characterized by the replacement of the kernel endosperm with a black, sooty mass of spores, often termed chlamydospores.

**Minute Leaf and Grain Spot** - *Nigrospora oryzae*. *Nigrospora* species are common saprophytes of rice worldwide, occurring on senescent plant parts.

**Glume Blight** - is caused by *Phoma sorghina* (Sacc.) Boerema, Doreb. & Kesteren.

**Myrothecium Blotch** - has been reported from Italy and India. The disease is caused by *Mirothecium verrucaria* (Alb. & Schw.) Ditmar.

**Stackburn** is caused by *Alternaria padwickii* (Ganguly) Ellis, (syn. *Trichoconis padwickii* Ganguly).

## PART II BACTERIAL DISEASES

In this section, bacterial diseases are classified into three main group. The principal diseases in each of those groups are caused by bacteria that belong to a single genus.

Diseases of the foliar are caused by two *Xanthomonas* species:

**Bacterial Blight** - is caused by *Xanthomonas campestris* pv. *oryzae* (Ishiyama) Dye.

**Bacterial leaf. streak**-is caused by *Xanthomonas campestris* pv. *oryzicola* (Fang, Chen, Chu, Faan et Wu) Dye 1979 b.

Diseases of the seedling, sheat, and grain are caused by *Pseudomonas* species:

**Sheath Brown Rot** caused by *Pseudomonas fuscovaginae* Tanii, Miyajima.

**Bacterial Brown Stripe**, also known as bacterial stripe. Bacterial brown stripe symptoms is caused by *Pseudomonas syringae* pv. *panici* (Elliot) Young Due & Wilkie.

**Sheath Rot**, caused by *Pseudomonas syringae* pv. *syringae* Van Hall (syn. *P. oryzicola* Klement).

**Grain Rot** - is caused by *Pseudomonas glumae* Kurita & Tabei.

### Diseases Caused by Viruses and Mycoplasmalike Organisme

Rice dwarf phytoreovirus  
Rice stripe tenuivirus  
Rice black - streaked dwarf Fijivirus  
Rice hoja blanca tenuivirus  
Rice tungro baciliform Badnavirus  
Rice tungro spherical waikavirus  
Rice bunchy stund (?) phytoreovirus  
Rice gall dwarf phytoreovirus  
Rice grassy stund tenuivirus  
Rice ragged stund oryzavirus  
Wiltend stunt  
Mycoplasmalike organisms - Orange Leaf  
Rice yellow mottle sobemovirus  
Giallume  
Chlorotic streak  
Rice necrosis Mosaic bymovirus  
Rice transistory yellowing (?) nucleorhabdovirus  
Mycoplasmalike organisme - Yellow dwarf

### DISEASES CAUSED BY NEMATODES

Plant parasitic nematodes feed and reproduce on living plants and are capable of active migration in the rhizosphere, on aerial plant parts, and/or inside the plant.

More than 150 species of plant parasitic nematodes have been associated with rice or rice soils.

Those of economic importance on rice are:

*Aphelenchoides besseyi* Christie

*Ditylenchus angustus* (Butler) Filipjev

*Hirschmanniella oryzae* (Br. de Haan) Luc.

*Meloidogyne graminicola* Golden & Birchfield.