

**ON THE OCCASION OF COMMON BUNT (*TILLETIA CARIES* D.C. TUL.)
EPIDEMIC ON WHEAT IN CROATIA**

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ABSTRACT

In the time of harvest in July 1998 wheat infected with common bunt was observed on the fields in the Drava-Danube region of eastern Croatia that had been occupied. This disease can be caused by four *Tilletia* species. On wheat there are two more species that cause a different type of symptoms and they are: Dwarf bunt (*T. contraversa* Kühn, syn. *T. brevifaciens*, *T. nanifica*) and Karnal Bunt (*T. indica* Mitra, syn. *Neovossia indica*). Considering that in previous years a ship with wheat contaminated by *T. indica* circled around the Mediterranean, we had to exclude the presence of this, for many European countries, quarantine pathogen. After many analyses we found only *Tilletia caries*. Usually there was a strong infection, so the grain was not appropriate for human nor for cattle consumption. Therefore, 180 tons of wheat grain were destroyed. This almost forgotten, and after the introduction of fungicides for seed treating, almost exterminated disease causes minimal damage in countries which use treated seed.

Keywords: Common bunt, *Tilletia caries*, Wheat

IZVLEČEK

**OB EPIFITOCIČNEM POJAVU PŠENIČNE TRDE SNETI
(*TILLETIA CARIES* D.C. TUL.) V VZHODNI HRVAŠKI**

Pri žetvi v juliju leta 1998 je bila na njivah dravsko-donavskega območja, ki je bilo pod okupacijo, opažena pšenica, ki je bila okužena s pšenično trdo snetjo. To bolezen lahko povzroča več vrst glivic iz rodu *Tilletia*: 1. *Tilletia caries* (DC) Tul. (= *T. tritici* Bjerk Wint.); 2. *T. foetida* (Wallr.) Liro (= *T. laevis* Kühn, = *T. foetens* Berk. et Curt.); 3. *T. intermedia* (Gassner) Savul. (= *T. tritici* f. sp. *intermedia* Gassner); 4. *T. triticoides* Savul. Na pšenici se pojavljata še dve vrsti, ki pa povzročata drugačne simptome, to sta pritlikava snet (*T. controversa* Kühn (= *T. brevifaciens* Fisch., = *T. nanifica* (Wag.) Savul.) in Karnal bunt (*T. indica* Mitra (= *Neovossia indica* (Mitra) Mundkur). Ker je v prejšnjih letih po Sredozemlju plula ladja s pšenico, ki je bila okužena s *T. indica* Mitra, smo morali izključiti tudi možnost okužbe s to vrsto, ki je v številnih evropskih državah karantenski škodljivi organizem. Na podlagi številnih analiz je bilo ugotovljeno, da gre izključeno za vrsto *Tilletia caries* (DC.) Tul. Večinoma je bilo zrnje tako okuženo, da ni bilo ustrezno za človeško prehrano niti za krmo. Zato je bilo 180 t pšenice uničene. Ta že skoraj pozabljena in z uporabo fungicidov za razkuževanje semena tudi skoraj izkoreninjena bolezen, v državah, kjer uporabljajo za setev razkuženo seme, ne povzroča omembe vredne škode. V prispevku bodo predstavljena nova spoznanja o razvojnem krogu te glive in varstvenih ukrepah.

Ključne besede: trda snet, *Tilletia caries*, pšenica

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1 INTRODUCTION

During the harvest in 1998 wheat infected with common bunt was observed in the fields in the area of eastern Croatia that is under special state supervision. Owing to its appearance 180 tons of wheat infected with common bunt were destroyed. This disease can be caused by several species from the *Tilletia* genus: 1. *T. caries* (DC) Tul. = (*T. tritici* Bjerck Wint.), 2. *T. foetida* (Wallr.) Liro = (syn. *T. laevis*), 3. *T. intermedia* (Gassner) Savul., 4. *T. triticoïdes* Savul. Dwarf bunt (*T. contraversa* Kühn, syn. *T. brevifaciens* = *T. nanifica*) and Karnal bunt (*T. indica* Mitra, sin *Neovossia indica*) differ according to symptoms, disease cycle, control measures and importance for wheat production. *T. contraversa* was registered here once (Lušin, 1954), but did not appear after that, so it can be found on quarantine list A 2 (NN 87/94). *Tilletia indica* has not been determined on the European continent. Neither Dwarf bunt nor Karnal bunt is present in Croatia. All the mentioned *Tilletia* species differ morphologically (size and shape of teliospores) so it was necessary to obtain an expert determination of the cause. The developed changes on wheat and the damages in the Drava-Danube area of eastern Croatia were caused by *Tilletia caries* (*T. tritici*).

2 DAMAGES

Common bunt on wheat has been known from ancient times. Until the first decades of this century, together with rust this was the most important wheat disease. Until the appearance of chemical agents for seed treatment and their appliance the damages from this disease were great, which numerous data confirm. In North America and Europe the last large infection in 1920 caused a yield loss of up to 80%. In Croatia in the fifties an infection of 10-20% was a regular phenomenon, which meant a loss of 175-500 kg/ha. (Potočanac & Kišpatić, 1948). Our measurements have shown that 1000 grains of healthy wheat weigh 43.6g while the same number of grains of the same variety infected with common bunt weigh only 15,0 g. Considering that infected grains are useless we may well say that each infected grain and each infected ear presents lost yield. The damages are not only in yield but also in flour quality. The teliospores contain trimethylamine, a volatile malodorous chemical that has a fishy smell. Even a small percentage of grains infected with common bunt gives flour that is of unsatisfactory quality. The flour is darker and smells of dried fish. Modern protection methods have greatly reduced the importance of this disease. It has become an economically insignificant disease in countries with progressive agriculture. However, the problem of common bunt remains in countries where there is no organised transfer of expert insights to the agricultural producer and in countries with a low national income per inhabitant. A large percentage (25-60%) of infected plants can still be recorded in Nepal, Afghanistan (1974), Iran and Syria. In Turkey on 15% of the areas an average infection of 28% of ears has been determined (Bicici, 1991). Since 1993 the damages in Yugoslavia have been 10-20% annually (Jevtić *et al.*, 1997). According to more recent assessments the losses are from 0,5% (Iren, 1981, Bulletin OEPP) to 1% (Yarham, 1991) in countries in which the seed is treated. When there is a strong contamination of wheat with spores of common bunt workers in mills and in the final processing can get allergic reactions or asthmatic problems. Intensive feeding of domestic animals can sometimes lead to various disorders. In experiments with pigs weighing 35-100 kg that had 0,5-0,9% of grains infected with common bunt added to their food, health problems were not observed but the fattening period was prolonged and the food consumption increased by 11-13%. The autopsy of the pigs did not show any changes (Westermann, 1988). On the toxicity of

spores Ožegović states the following data: "The pigs had what was described as haemorrhagic glomerulonephritis, although there are reports suggesting that pigs can take 200-400 g daily with no significant changes. With larger doses rabbits die 1-4 hours after intake. Poultry and birds suffer from haemolytic gastroenteritis, reduced egg production, weight loss, reduced food intake, poorer food usage if it contains 20-40% of spores infected with common bunt. (Ožegović and Pepeljnjak, 1995)". There are also contrary opinions (Fisher and Holton, 1957).

3 CONSEQUENCES IN CROATIA

Damages from this disease developed on mercantile wheat only in the area under special state supervision in eastern Slavonia. Some producers had wheat that was so infected that it could not be used for human or animal consumption or for manufacturing. This is why decree (Bulletin, 122/98) was ordered for all the contaminated wheat to be destroyed. The Ministry of Agriculture and Forestry compensated the producers for damages. On this occasion 180 tons of wheat were destroyed. At the same time the control of wheat seed health was intensified. In addition to customary laboratory examinations a special method was introduced for determining the *Tilletia* species. In 15 laboratories 2200 samples of wheat seed were analysed. Among them 44 samples were contaminated with *T. tritici*. According to the Regulation on the obligatory health examination of crops (NN 53/91) the tolerance for wheat seed is zero, so the 44 samples were not acknowledged as seed merchandise.

4 SYMPTOMS

While wheat is maturing, the ear stands upright because it is lighter than ears carrying healthy grains. The glumes in the ear are spread out. If we take a grain out of the ear we can see that it is somewhat shorter and wider than the healthy grain. This is why the strands stand away from the ear spindle giving the whole ear a "bristled" look. In one ear usually all the grains are infected. The infected grains preserve the pericarp and their interior is filled with a dark purple to almost black powder that smells of dried fish. The dark purple powder are numerous teliospores (chlamydospores). In one grain infected with common bunt there can be 4-6 million spores. The leaves have a stronger waxy coating and are therefore blue-green in colour. The plants mature later, so the infected ears remain green longer. When the infection is weaker these changes are usually overlooked.

5 DISEASE CYCLE

Teliospores, originally in soil or placed there on contaminated seed, germinate in response to moisture. Cool temperatures (5-10°C) favor spore germination and production of infectious hyphae, which penetrate coleoptiles before seedlings emerge. In growing host plants, the pathogen progresses to and inhabits terminal meristematic tissues, especially the flower primordia of the spike. In susceptible cultivars, mycelium inhabits the developing ovary and displaces all tissues within the pericarp. At harvest, mature bunt balls are broken and teliospores are released to contaminate soil and seed. Teliospores are dispersed by wind and especially by their association with seed. Dispersal on seed is especially important in distributing new strains of bunt fungi. The hosts of this pathogen are species

from the following geni: *Aegilops*, *Agropyron*, *Bromus*, *Elymus*, *Hordeum*, *Poa*, *Secale*, *Sitanion*, *Triticum* and *Triticale* (Mordue & Waller, 1981). Among those mentioned, in Croatia many species can be found as weeds.

6 RECOMMENDED CONTROL MEASURES

Growing relatively resistant cultivars is definitely the most efficient and ecologically most acceptable measure. Unfortunately, we do not have data on variety sensitivity or resistance for the wheat sown in Croatia. Using healthy seed is certainly an important factor. Considering that the parasite can also survive in the soil, crop rotation is a measure that should be used. Weed control, especially those weeds that are hosts to this pathogen should be good farming practice. The infection efficiency depends on the sowing depth. When the sowing depth was up to 1 cm the infection was 1,3-16,9 % and when it was 7 cm - 86,7 % (Gešele, 1978), so this fact should be taken into account. Greater infections can be expected if the temperatures during germination until sprouting are between 5-10 °C and the soil moisture 30-60%. Fast wheat germination and sprouting should be achieved by sowing times so as to avoid an attack of *T. caries*. Winter cereals should be sown at earlier and spring ones late in spring. Seed treating is the safest measure and is undertaken not only because of the *Tilletia* species but also because of other microorganisms on the seed and those from the soil that can inhabit the seed or infect the shoot. In order to decrease the danger of further spreading of common bunt we recommend:

- 1) Wheat health management.
- 2) Sowing declared seed for which the origin, variety and quality are known and in the same time is treated.
- 3) Obligatory seed treatment with fungicides.

Besides efficient fungicides it is necessary that they be applied in the full recommended dosage. Also, it is equally important to achieve a complete and uniform coating of the seeds with the fungicide.

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