CZECH MYCOL. 48 (1), 1995

Heat-resistant fungi

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Jesenská, Z. and Piecková, E.(1995): Heat-resistant fungi. – Czech Mycol. 48: 73–76

The survival of fungi from soil samples has been investigated after temperature of 60, 70, 80 and 90 °C in Sabouraud agar. The number of isolated propagules and species had significantly different quantities. The heat-resistant fungi are an economically and scientifically important group of fungi and represent a matter for further investigation.

Key words: Heat resistance, fungi,

Jesenská, Z. a Piecková, E. (1995): Termorezistentné huby. – Czech Mycol. 48: 73–76

Študovalo sa prežívanie húb zo vzoriek zeminy v Sabouraudovom agare pri teplotách 60, 70, 80, and 90 °C. Počet izolovaných zárodkov i druhov sa významne líšil. Termorezistentné huby sú ekonomicky a vedecky významnou skupinou húb a predstavujú objekt pre ďalší výzkum.

Heat-resistant species, which survive the heat treatments used in fruit and juice canning processes are an important group of fungi.

The spoilage of heat processed fruit is caused mainly by the species *Byssochlamys nivea, Neosartorya fischeri, Talaromyces flavus.*

Their ascospores survive temperatures of 70, 80, and 90 °C in most cases for a significant time.

In addition of these fungi *Talaromyces bacillisporus, Talaromyces trachyspermus, Eupenicillium brefeldianum* and *Eupenicillium lapidosum* have been isolated as spoilage organisms for canned foods, and *Eupenicillium levitum, Eupenicillium ehrlichii, Aspergillus quadricintus, Talaromyces striatus, Talaromyces emersonii, Talaromyces wortmanii, Byssochlamys verrucosa, Eleutherascus tuberculatus, Neosartorya aurata, Neosartorya aureola, Neosartorya hiratsukae, Neosartorya fennelliae, Neosartorya fischeri* var. *fischeri, Neosartorya fischeri* var. *glabra, Neosartorya fischeri* var. *spinosa, Neosartorya primulina, Neosartorya pseudofischeri, Neosartorya quadricincta, Neosartorya stramenia*, along with *Eurotium herbariorum* and *Eurotium chevalieri* may also be added to the list of these heat-resistant species.

Gilmaniella humicola was isolated from heat-treated soil from hothouses.

The role of the majority of these fungi in spoilage of foods has not been studied.

Searching for recourses of processed fruit contamination, we focused our attention on questions of occurrence of the heat-resistant fungi in the soil (Jesenská and

Piecková 1993, 1994, Jesenská et al. 1991, 1992 a,b, 1993, 1994, Piecková et al. 1994). The aim was, briefly said, to clarify certain questions of ecology of heat-resistant micromycetes. That might contribute to better protection of certain kind of foodstufs against undesirable activity of these fungi. It was necessary to find out to what degree poor sanitation in food industry and lack of working discipline on the one hand, and to what degree other, not quite known, objective factors are to blame for decay of a considerable portion of food supplies for people.

We examined samples of Slovak soil for fungi whose propagules are able to survive increased temperatures in Sabouraud agar with Bengal Rose for certain time.

Ten grams of soil yielded on average 178 and 102 colony forming propagules, those were able to survive in Sabouraud agar 70 and 80 °C/60 minutes and 32 colony forming propagules those were able to survive 90 °C/30 minutes.

In 32 soil samples taken from various localities of the Slovak republic and exposed to 70 °C for 60 min, *Eupenicillium baarnense* occurred most frequently – in 93 %, along with *Neosartorya fischeri* – in 90 % and *Talaromyces avellaneus* – in 68 % of samples. *Byssochlamys nivea* and *Gilmaniella humicola* were isolated from 34 %, *Talaromyces flavus* from 25% of samples.

The incidence of *Dichotomomyces cejpii, Talaromyces trachyspermus, Talaromyces bacillisporus* and *Nodulisporium* sp. was sporadic.

The survival of fungi from soil samples has been investigated after exposure to temperatures of 60, 70, 80 and 90 °C in Sabouraud agar in 10 minutes intervals.

I. *Aspergillus niger* group, *Chaetomium* sp., *Penicillium* sp. and *Scytalidium lignicola* were the least heat-resistant fungi – propagules survived 60 °C/60 min., did not survive 70 °C/10 min,
II. next group's *Aspergillus glaucus* group, *Byssochlamys nivea, Dichotomomyces cejpii, Gelasinospora* sp., *Rhizoctonium* sp. and *Talaromyces flavus* – propagules survived 70 °C/60 min., did not survive 80 °C/10 min,
III. *Aspergillus fumigatus, Aspergillus nidulans, Eupenicillium baarnense* and *Ulocladium* sp. – propagules survived 80 °C/60 min., did not survived 90 °C/10 min,
IV. *Acremonium sclerotigenum, Aspergillus ochraceus, Botryotrichum piluliferum, Byssochlamys fulva, Gilmaniella humicola, Neosartorya fischeri* – propagules survived 90 °C/10 min,
V. the most heat-resistant were *Nodulisporium* sp. and *Talaromyces avellaneus.* The propagules survived 90 °C/60 min.

Some of those fungi are not "really heat-resistant" species, but species capable of forming sclerotia, thick-walled cells, etc.

The isolates of *Nodulisporium* sp. did not form structures of the teleomorphic stage on our media used. However it is obvious that the species must exist in soil in

a form capable of resisting the effect of a temperature of as high as 90 °C for over 60 min.

The numbers of surviving propagules had significantly different quantities.

The survival ability of the heat-resistant fungi is usually determined by two means:

a) determination of the thermal death time (TDT), or of the final point and
b) multipoint methods – determination of the decimal reduction time (D) and z values.

Each of the methods have their own advantages and drawbacks.

We determined TDT for new heat-resistant species of fungi, namely for the strains of *Dichotomomyces cejpii, Gilmaniella humicola, Talaromyces avellaneus* and *Talaromyces bacillisporus.*

Their TDT values were compared under the same conditions in vitro with the TDT values of known heat-resistant species *Byssochlamys nivea, Neosartorya fischeri* and *Talaromyces flavus.*

All of the new species showed considerable resistance against higher temperatures in the Sabouraud medium. Their propagules withstood the exposure to the temperature of 70 °C/95 – 300 minutes.

The most resistant strain *Talaromyces avellaneus* withstood the temperature of 80 °C for up to 120 minutes, 90 °C for 10 min.

TDT values were in vitro affected by the number of propagules in the inoculum suspension.

The significance of new species of heat-resistant fungi for the canning industry is not sufficiently estimated till now.

We assume that their occurrence in mouldy canned fruits and juices can be overlooked and the isolated strain remain undeterminated.

Conclusion:

The group of the heat-resistant fungi represents a matter for scientific investigation: The heat-resistance mechanisms, the influence of different factor in heat-resistance, the germicidal control, physiological properties, secondary metabolites and others.

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