EFFECT OF TRICHLOROMA ISOLATES ON YIELDING OF WILD STRAINS OF COPRINUS COMATUS

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Abstract. The impact of infestation with Trichoderma aggressivum f. europeanum and Trichoderma longibrachiatum isolates on the yielding of three wild strains and one cultivated strain of Coprinus comatus was investigated. A significant yield reduction of C. comatus on substrates infested with the examined Trichoderma isolates was determined. The recorded percentage yield reduction was significantly higher in the case of the infestation with the T. aggressivum than with the T. longibrachiatum isolate.

Key words: Trichoderma spp., Coprinus comatus, wild strains, cultivated strain, yield

INTRODUCTION

The greatest losses in mushroom cultivation are brought about by fungi from the Trichoderma genus which cause green moulds (Mamoun et al. 2000). The most aggressive forms of the above-mentioned fungi were designated as Trichoderma aggressivum f. europeanum Th2 in Europe, and T. aggressivum f. aggressivum strain Th4 identified in North America (Williams et al., 2003). The above-mentioned strains constitute biotypes of a non-aggressive form of T. harzianum in relation to cultivated mushrooms. The aggressive strains differ from non-aggressive forms, primarily, by the speed of mycelium growth (Samuels et al. 2002; Sobieralski et al. 2009). The cultivation of Agaricus bisporus is technologically similar to the cultivation of Coprinus comatus. In the cultivation of A. bisporus, apart from the above-mentioned species of Trichoderma, the species T. atroviride and T. longibrachiatum also frequently occur (Szczech et al. 2008).

The objective of the performed investigations was to determine the influence of the substrate infestation with T. aggressivum f. europeanum and T. longibrachiatum isolates, on yielding of several wild strains and one cultivated strain of C. comatus.

MATERIALS AND METHODS

Both isolates of Trichoderma as well as C. comatus strains derived from the collection of cultivated mushrooms of the Department of Vegetable Crops, Poznań University of Life Sciences. Two Trichoderma isolates i.e. T. aggressivum f. europeanum T.a/c/KW/11/12 and T. longibrachiatum T.l/d/KW/3/27 obtained from mushroom farms, were used in the experiment. Identification of isolates was carried out at the Institute of Plant Genetics – the Poznań Branch of the Polish Academy of Sciences. The applied polymerase chain reaction (PCR) techniques, PCR multiplex and random amplification of polymorphic DNA (RAPD) revealed that the isolates used in the experiments belonged to the T. aggressivum f. europeanum and T. longibrachiatum biotypes. Three strains of C. comatus: Cop.KW/12/2, Cop. RM/9/6 and Cop.WS/12/8 obtained in 2009 from natural sites located in different regions of Poland as well as one cultivated strain Somycel 4030 were used in the experiments. Detailed methods and techniques of substrate and cover preparation along with conditions required during cultivation were given by Siwulski et al. (2001).

The results of the experiment were compared using the analysis of variance for factorial experiments at the level of significance α = 0.05 (the Newman-Keuls test).

RESULTS

The performed experiments revealed that the infestation of the cultivation substrate with the T. aggressivum f. europecum isolate resulted in a significant yield drop. The yields from the C. comatus strains obtained on the infested
substrate, fluctuated from 18 to 37 g/kg fresh matter of substrate (Fig. 1). Yield reduction varied widely from 26 to 59% (Table 1). Yields of the wild strains Cop.KW/12/2 and Cop.WS/12/8 as well as of the cultivated strain Somycel 4030 grown on the substrate infested with the above-mentioned isolate were reduced by similar values, namely: 56.1 and 59.0%. The response of the third wild strain – Cop.RM/9/6 was different and the yield drop amounted to only 26%.

Table 1. Reduction of yield (in %) of wild and cultivated strains of C. comatus grown on substrates infested with the T. aggressivum f. europaeum T.a/c/KW/11/12 isolate

<table>
<thead>
<tr>
<th>Strain + isolate</th>
<th>Yield reduction in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cop.KW/12/2 + T. aggressivum f. europaeum T.a/c/KW/11/12</td>
<td>58.1</td>
</tr>
<tr>
<td>T.a/c/KW/11/12</td>
<td></td>
</tr>
<tr>
<td>Cop.RM/9/6 + T. aggressivum f. europaeum T.a/c/KW/11/12</td>
<td>26.0</td>
</tr>
<tr>
<td>T.a/c/KW/11/12</td>
<td></td>
</tr>
<tr>
<td>Cop.WS/12/8 + T. aggressivum f. europaeum T.a/c/KW/11/12</td>
<td>56.1</td>
</tr>
<tr>
<td>T.a/c/KW/11/12</td>
<td></td>
</tr>
<tr>
<td>Som.4030 + T. aggressivum f. europaeum T.a/c/KW/11/12</td>
<td>59.0</td>
</tr>
<tr>
<td>T.a/c/KW/11/12</td>
<td></td>
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</tbody>
</table>

Analysing the yielding of C. comatus strains on substrates infested with the T. longibrachiatum isolate, showed a yield range of from 21 g/kg fresh matter of the substrate in the case of strain Cop.RM/9/6 to 65 g/kg fresh matter of the substrate in the case of the cultivated Somycel 4030 strain (Fig. 2). Both wild strains and the cultivated strain of C. comatus grown on substrates infested with T. longibrachiatum isolate responded with significant yield drops which, in the case of Cop.KW/12/2, Cop.WS/12/8 as well as Somycel 4030 strains, ranged from 21.9 to 30.7%. Yields of the Cop.RM/9/6 strain were considerably lower and the recorded percentage yield drop amounted to 63.8% (Table 2).

Table 2. Reduction of yield (in %) of wild and cultivated strains of C. comatus grown on substrates infested with the T. longibrachiatum T.l/d/KW/3/27 isolate

<table>
<thead>
<tr>
<th>Strain + isolate</th>
<th>Yield reduction in %</th>
</tr>
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<tbody>
<tr>
<td>Cop.KW/12/2 + T. longibrachiatum T.l/d/KW/3/27</td>
<td>30.7</td>
</tr>
<tr>
<td>Cop.RM/9/6 + T. longibrachiatum T.l/d/KW/3/27</td>
<td>63.8</td>
</tr>
<tr>
<td>Cop.WS/12/8 + T. longibrachiatum T.l/d/KW/3/27</td>
<td>21.9</td>
</tr>
<tr>
<td>Som.4030 + T. longibrachiatum T.l/d/KW/3/27</td>
<td>27.8</td>
</tr>
</tbody>
</table>

Means followed by the same letter do not differ significantly according to Newman-Keuls’s test at p = 0.05

Fig. 1. Yielding of wild and cultivated strains of C. comatus grown on substrates infested with the T. aggressivum f. europaeum T.a/c/KW/11/12 isolate

Means followed by the same letter do not differ significantly according to Newman-Keuls’s test at p = 0.05

Fig. 2. Yielding of wild and cultivated strains of C. comatus grown on substrates infested with the T. longibrachiatum T.l/d/KW/3/27 isolate
DISCUSSION

Cultivation facilities in which mushrooms are cultivated are characterised by relatively high temperatures and air humidity in addition to large quantities of organic matter favouring the development of various species and forms of *Trichoderma* (Grogan 2005). Results obtained in the discussed experiments corroborate information presented in a number of earlier investigations carried out both in Poland and abroad, regarding the impact of fungi of the *Trichoderma* spp. on yields of the common mushroom mycelium. Researchers demonstrated a considerable decline of yields of *A. bitorquis* in the case of its infestation with the *T. aggressivum* *f. europaeum* isolate (Sobieralski et al. 2010a). Moreover, they also demonstrated that the response of the common mushroom strains, gathered from natural sites, to substrate infestation with the examined *T. aggressivum* *f. europaeum* isolates, varied significantly. The observed yield drops ranged from 23.1 to 84%. The researchers also further demonstrated considerable yield reductions in other mushroom species, among others: *A. bisporus* (Sobieralski et al. 2009), *P. ostreatus* (Siwulski et al. 2009) and *P. eryngii* (Sobieralski et al. 2010b).

Recent investigations carried out by Frużyńska-Jóźwiak et al. (2010) revealed that *C. comatus* strains can exhibit certain defense mechanisms in relation to *T. aggressivum* and *T. longibrachiatum* isolates. It was found in the above experiments that growth inhibition of the *C. comatus* mycelium by the *T. longibrachiatum* and *T. atroviride* species was much smaller than by *T. aggressivum*.

In the performed experiments the recorded declined of the *C. comatus* yield was considerably higher in the case of the infestation with *T. aggressivum* than with the *T. longibrachiatum* isolate. Moreover, the obtained results showed that the response of the examined strains expressed by the percentage drop in yields could be specific for individual strains. An interesting observation was that the Cop.RM/9/6 strain growing on the substrate infested with the *T. aggressivum* *f. europaeum* isolate responded to it with relatively small reduction of yields in comparison with other examined wild strains as well as the cultivated strain. On the other hand, the above strain infested with the *T. longibrachiatum* isolate responded with a significantly higher decline of yields in comparison with the remaining *C. comatus* strains. Earlier investigations carried out by Siwulski et al. (2009) and Sobieralski et al. (2010b) demonstrated no defensive mechanisms in strains of common mushrooms and oyster mushrooms to *T. aggressivum*. Some *C. comatus* strains derived from natural sites exhibited small yield reductions in response to the infestation with fungi of the *Trichoderma* spp. and, therefore, can be potentially useful in creative breeding of *C. comatus*.

REFERENCES


