Effect of Temperature on Aflatoxin Production in Mucuna pruriens Seeds

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This paper describes the effect of temperature on the level of aflatoxin production in Mucuna pruriens seeds. The highest level of aflatoxin B₁ (1.75 μg/g) was detected in the samples incubated at 25°C for three weeks. At 20, 30, and 35°C, aflatoxin levels were 0.30 to 0.56, 0.37 to 1.20, and 0.26 to 0.65 μg/g, respectively. The lowest concentration of aflatoxin B₁ (0.10 to 0.29 μg/g) was produced at 15°C.

The seeds of Mucuna pruriens (L.) DC, having astringent, aphrodisiac, alexipharmic, laxative, and antihelminthic properties, are also useful against scorpion sting, fever, and gonorrhea (4). During storage, as with cereals or grains, plant parts of medicinal significance are influenced by moisture contents of the substrates, relative humidity, and temperature, which ultimately play a vital role in the development of storage fungi. The moisture content of the Mucuna seeds is 17%, a level reported (11) to be favorable for growth of Aspergillus flavus and for aflatoxin production. Most of the fungi grow luxuriantly at between 20 and 30°C (1). A. flavus exhibits optimum growth between 36 and 38°C (range, 6 to 46°C) (7, 12). The optimum temperature for aflatoxin production by A. flavus ranges between 25 and 35°C (10).

Several earlier workers have reported (3, 5) the effect of temperature on aflatoxin production in various food and agricultural commodities. There are some reports indicating aflatoxin contamination in plant parts of medicinal value (9); however, the effect of temperature has not been studied so far. The present investigation, therefore, was carried out to observe the effect of temperature on aflatoxin production in Mucuna seeds, keeping their medicinal value in view.

A 100-g surface-sterilized (2% NaOCl, 10 min) seed sample was infected with a 10-ml inoculum (containing 2 × 10³ spores per ml) of an A. flavus strain having aflatoxin B₁ and B₂ production potential in sterilized flasks. Flasks were incubated for 7, 14, 21, and 28 days in incubators at various temperatures, i.e., 15, 20, 25, 30, and 35°C. At 7-day intervals, the infected samples were washed with sterilized distilled water, oven dried at 60°C for 48 h, and powdered for aflatoxin analysis by a standard method (13). Aflatoxins were qualitatively detected on thin-layer chromatography plates with toluene-isooamyl alcohol-methanol (90:32:2, vol/vol/vol) as the solvent system (8), and aflatoxin B₁ was quantitated by a spectrophotometric procedure (6). The presence of aflatoxin was also confirmed chemically by derivatization with trifluoroacetic acid (15) and by spraying with 50% sulfuric acid.

The highest levels (0.67 to 1.75 μg/g) of aflatoxin B₁ were detected in the samples incubated at 25°C in week 3 of incubation (Table 1). However, the aflatoxin levels ranged from 0.30 to 0.56, 0.37 to 1.20, and 0.26 to 0.65 μg/g in the samples stored at 20, 30, and 35°C, respectively, within the same period. The lowest concentration (0.10 to 0.29 μg/g) of aflatoxin B₁ was produced at 15°C. However, no visible growth of fungus or aflatoxin production was observed at 10°C. In addition to temperature, the incubation period had a marked influence on aflatoxin production. At almost all temperatures, maximum production of aflatoxin B₁ was found in week 3 of incubation; thereafter, production decreased, indicating that some aflatoxin was either degraded or reabsorbed by the fungus (2). Earlier studies (3, 14) have also shown the highest levels of toxin production to be in peanuts stored at temperatures of 25 to 35°C for 21 days. The results also reflect that a temperature of 25°C is more suitable for production of aflatoxin B₁ in Mucuna seeds; thus, it may be inhibited to a considerable extent by controlling the temperature during storage.

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LITERATURE CITED


TABLE 1. Effect of temperature on aflatoxin production in Mucuna seeds

<table>
<thead>
<tr>
<th>Incubation period (wk)</th>
<th>Aflatoxin B₁ level (μg/g) after incubation at:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15°C</td>
</tr>
<tr>
<td>1</td>
<td>0.10</td>
</tr>
<tr>
<td>2</td>
<td>0.29</td>
</tr>
<tr>
<td>3</td>
<td>0.21</td>
</tr>
<tr>
<td>4</td>
<td>0.15</td>
</tr>
</tbody>
</table>

* The effect of the incubation period on aflatoxin production was significant only at the 5% level, whereas temperature was significant at both the 5 and 1% levels.

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