Inhibitory effects of vitamins A and C on mycelial growth and aflatoxin production by *Aspergillus parasiticus*

R.J. VERMA, P.J. RAVAL, D.N. MEHTA and H.C. DUBE*

Department of Zoology, University School of Sciences, Gujarat University, Ahmedabad 380 009

**Keywords**: Aflatoxin, vitamin A, vitamin C

Aflatoxins are food-borne toxicants produced by fungal growth especially of *Aspergillus flavus* and *A. parasiticus*. Though the presence of aflatoxin has been recorded from all over the world, comparatively higher concentrations are recorded in tropics due to congenial environmental conditions for moldy growth and aflatoxin production. It is a well known hepatotoxic, carcinogenic, mutagenic and teratogenic agent (2,4,6). Looking upon aflatoxin toxicities in mammals and its higher concentrations in food/feed stuffs, especially in tropics, it is of utmost importance to test various agents which can restrict fungal growth and aflatoxin production.

Many investigators have shown that fungal infestation depends upon the nature and composition of foodstuffs on which they grow (1). It may also be due to the presence of some micronutrients. In the present investigation, we report inhibitory effects of vitamins A and C on mycelial growth and aflatoxin production by *A. parasiticus* in SMKY medium.

SMKY liquid medium (25 ml) was taken in 250 ml Erlenmeyer flasks and autoclaved. Spore suspension (0.5 ml of \(10^5\) spores/ml) prepared from 5-day old culture of *Aspergillus parasiticus* (NRRL 3240) was used for inoculating the medium under aseptic condition (3). To test efficacy of the micronutrients on mycelial growth and aflatoxin production, various concentrations of vitamin A (500 - 1500 IU/ml) or vitamin C (0.5 - 10.0 mg/ml) were aseptically added prior to inoculation in the medium. At the end of incubation period (10 days at 28±2°C), flasks were autoclaved and content of the flasks were filtered through Whatman filter paper 41. Culture filtrates were extracted and quantified for aflatoxin concentrations (5). Mycelial mat on filter paper was dried in hot air oven and weighed. Students 't' test was used for statistical analysis of the data.

Addition of vitamin A or C in SMKY liquid medium significantly inhibited aflatoxin production by *A. parasiticus* which could be correlated with decreased mycelial mass as evidenced by decreased mycelial mat. Addition of 1500 IU/ml or higher concentrations completely inhibited mycelial growth and aflatoxin production. Reduction in toxin production could be directly correlated with decreased mycelial mass as evidenced by dry mycelial mat.
Table 1: Effect of vitamin A on mycelial growth and aflatoxin production by *Aspergillus parasiticus*

<table>
<thead>
<tr>
<th>Vit. A (IU/ml medium)</th>
<th>Dry mycelial weight (mg/flask)</th>
<th>Aflatoxin concentration (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>B₁</td>
</tr>
<tr>
<td>0</td>
<td>2884</td>
<td>4.27</td>
</tr>
<tr>
<td>± 72</td>
<td>± 0.44</td>
<td>± 0.02</td>
</tr>
<tr>
<td>500</td>
<td>2572</td>
<td>2.07</td>
</tr>
<tr>
<td>± 93</td>
<td>± 0.01</td>
<td>± 0.02</td>
</tr>
<tr>
<td>1000</td>
<td>1611</td>
<td>0.39</td>
</tr>
<tr>
<td>± 32</td>
<td>± 0.01</td>
<td>± 0.01</td>
</tr>
</tbody>
</table>

Values are mean ± S.E.M.; n = 4

Significant at the level a: \( P < 0.001 \); b: \( P < 0.01 \).

Table 2: Effect of vitamin C on mycelial growth and aflatoxin production by *Aspergillus parasiticus*

<table>
<thead>
<tr>
<th>Vit. C (mg/ml medium)</th>
<th>Dry mycelial weight (mg/flask)</th>
<th>Aflatoxin concentration (µg/ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>B₁</td>
</tr>
<tr>
<td>0</td>
<td>2884</td>
<td>4.27</td>
</tr>
<tr>
<td>± 72</td>
<td>± 0.44</td>
<td>± 0.02</td>
</tr>
<tr>
<td>0.5</td>
<td>2489</td>
<td>3.11</td>
</tr>
<tr>
<td>± 106</td>
<td>± 0.02</td>
<td>± 0.04</td>
</tr>
<tr>
<td>1.0</td>
<td>2348</td>
<td>1.88</td>
</tr>
<tr>
<td>± 97</td>
<td>± 0.02</td>
<td>± 0.01</td>
</tr>
<tr>
<td>5.0</td>
<td>2177</td>
<td>1.16</td>
</tr>
<tr>
<td>± 99</td>
<td>± 0.02</td>
<td>± 0.02</td>
</tr>
<tr>
<td>10.0</td>
<td>2060</td>
<td>0.37</td>
</tr>
<tr>
<td>± 53</td>
<td>± 0.01</td>
<td>± 0.01</td>
</tr>
</tbody>
</table>

Values are mean ± S.E.M.; n = 4

Significant at the level a: \( P < 0.001 \); b: \( P < 0.01 \); c: \( P < 0.05 \).

The lower concentrations of vitamin C were comparatively more effective than higher concentrations in decreasing aflatoxin production and mycelial mass. Although addition of 10.0 mg/ml concentration of vitamin C decreased mycelial mass by only 29%, the decrease in aflatoxin production was about 90% (Tables 1, 2).

Exact mechanism responsible for such inhibition of toxin production is not clearly understood. It may be assigned to combined effects of decrease in mycelial growth, retarded synthesis and/or release of toxin. It is evident from the fact that aflatoxin is secondary metabolites produced at the onset of stationary phase of fungal cultures.

Presence of vitamins A and C tested in the present investigation, which contribute a part of
human food and are present in many food products, can significantly retard mycelial growth and aflatoxin production. Moreover, these materials are not harmful to human beings, rather they are beneficial.

REFERENCES

Received for publication August 7, 1995.