SHORT COMMUNICATION

Entomological evaluation of ivermectin mass treatment against onchocerciasis

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To evaluate the impact of onchocerciasis control programmes on the annual transmission potential, it is customary to monitor the man-biting rate of vector Simulium (Diptera: Simuliidae) and the number of Onchocerca (Nematoda: Onchocercidae) infective larvae found in them (Walsh et al., 1978). In addition to the transmission of Onchocerca volvulus (Leuckart) causing human onchocerciasis, Simulium females may also be the vectors of various other species of Onchocerca which parasitize wild or domestic animals. The larvae of other Onchocerca spp. are difficult to distinguish from those of O. volvulus. Therefore, using routine methods in the field, it is not easy to determine the efficiency of a mass host chemotherapy campaign targeting only one Onchocerca species. To evaluate the impact of ivermectin on natural transmission of O. volvulus, we tried to improve the usual entomological index of infection by measuring lengths of Onchocerca larvae found in female blackflies (Simuliidae) collected on human bait.

Annual mass treatment with ivermectin has been carried out since 1987 in the Vina Valley, a savanna region of North Cameroon, involving about 20,000 people (Prod’hon et al., 1991). Ivermectin was given to eligible people at the target dosage of 150 kg per kilogram of body weight. Cover surveys of man-biting Simuliidae were performed 1 month before treatment; then done again during the 2 months following the campaign. From Simulium dissections, 1914 entire infective larvae of Onchocerca were measured (Table 1). The blackfly infection rate decreased significantly from 112.2 per 1000 parous S. damnosum s.l. before treatment to 52.1 after treatment (P < 0.05).

As shown graphically in Fig. 1, the frequency distribution of larva lengths differed before and after treatment (χ² = 240; d.f. = 14; P < 0.05). In the pre-treatment sample, the mean length of larvae was 716 ± 3 μm compared with 775 ± 4 μm in the post-treatment sample.

Substantial reduction of O. volvulus transmission by ivermectin treatment of the human host population has been demonstrated both under experimental (Cupp et al., 1986; Prod’hon et al., 1987, 1991; Cupp et al., 1989) and field conditions (Remme et al., 1989; Trpis et al., 1990). Whereas experimental trials were based on the development of carefully identified O. volvulus larvae in a particular Simulium species, field epidemiological studies considered the overall rate of any Onchocerca spp. infective larvae found in the head of captured blackflies. Careful morphological examination of infective larvae should distinguish between most of the Onchocerca species (Bain & Chabaud, 1986), but specific identification remains difficult under routine field conditions and larval length is not a suitable character for species identification.

The observed shift towards more of the larger size classes of Onchocerca infective larvae in blackflies after ivermectin treatment of the human host population could be due to several possibilities which should be investigated. The most likely cause(s) might be: (a) replacement of human O. volvulus by larger Onchocerca spp. as the prevalent infective larvae in S. damnosum s.l. females; (b) substitution between strains of O. volvulus with different size frequencies of infective larvae; (c) positive effects of iver-
Table 1. Size-classes of Onchocerca infective larvae found in the head of Simulium damnosum s.l. females captured on human bait in the Vina Valley of North Cameroon, before and after mass chemotherapy of the human population with ivermectin.

<table>
<thead>
<tr>
<th>Range of length (µm)</th>
<th>400</th>
<th>440</th>
<th>480</th>
<th>520</th>
<th>560</th>
<th>600</th>
<th>640</th>
<th>680</th>
<th>720</th>
<th>760</th>
<th>800</th>
<th>840</th>
<th>880</th>
<th>920</th>
<th>960</th>
<th>1000</th>
<th>1040</th>
<th>1080</th>
<th>1120</th>
<th>1160</th>
<th>1180</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of infective larvae</td>
<td></td>
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<td></td>
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<tr>
<td>Pre-treatment</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>10</td>
<td>61</td>
<td>140</td>
<td>169</td>
<td>166</td>
<td>132</td>
<td>152</td>
<td>101</td>
<td>42</td>
<td>22</td>
<td>12</td>
<td>14</td>
<td>19</td>
<td>8</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1057</td>
</tr>
<tr>
<td>Post-treatment</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>58</td>
<td>68</td>
<td>45</td>
<td>59</td>
<td>54</td>
<td>142</td>
<td>191</td>
<td>65</td>
<td>78</td>
<td>19</td>
<td>24</td>
<td>37</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>857</td>
</tr>
</tbody>
</table>

Fig. 1. Frequency distribution of size-classes of Onchocerca infective larvae found in the head of Simulium damnosum s.l. females captured on human bait in the Vina Valley of North Cameroon, before and after the mass treatment of the human population with ivermectin.

Ivermectin on the size of O. volvulus infective larvae, despite halving of the infection rate.

Bearing in mind the normal length range of O. volvulus infective larvae reported for Cameroon strains by Duke (1967), Franz & Renz (1980), Eichner & Renz (1990) and Wahl et al. (1991), we propose that, in the savanna of northern Cameroon, size-classes between 600 and 740 µm are the most sensitive to changes induced by ivermectin mass treatment. Apparently, the epidemiological impact of ivermectin is reflected by changes in the frequency distribution of infective larval length, increasing the mean length, with little effect on the absolute size range of Onchocerca infective larvae occurring naturally in the S. damnosum complex.

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References

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