PERMEABILITY OF CHEMOSENSILLUM-ASSOCIATED EXUDATES FOR LECTINS IN A PLANT-PARASITIC AND IN A FREE-LIVING NEMATODE

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Nematode chemosensilla are thought to be in direct contact with the environment. Their dendritic nerve extensions are located in body pores. The pores are filled with glycoprotein exudates that are produced in gland cells. The paired amphids and the six inner labial sensilla in the head region and the paired phasmids and male spicule receptors in the tail region are thought to possess chemosensitive functions (Wright, 1980). An inhibition of chemoreception after nematode treatment with lectins has been reported for the animal-parasitic Trichostrongylus colubrifonnis (Bone & Bottier, 1985) and for the free-living Panagrellus redivivus (Jansson & Nordbring-Hertz, 1984) and Caenorhabditis elegans (Jayaprakash et al., 1985). In these species, lectins are thought to inhibit chemoreception by binding to receptor molecules on the surface of dendritic nerve extensions of chemosensilla after they have diffused through the chemosensillum-associated exudates (Jansson, 1987). Lectins, however, had no effect on reception by males of the plant-parasitic Heterodera schachtii of the female sex pheromone (Aumann et al., 1990).

The present investigation was performed to test possible differences in lectin permeabilities for chemosensillum-associated exudates of plant-parasitic and free-living nematodes. For this purpose, the diffusion through the exudates of the lectins from Triticum vulgare (WGA), Helix pomatia (HPA), and Arachis hypogaea (PNA) was examined for females of P. redivivus and males of H. schachtii.

The TRITC (tetramethylrhodamine isothiocyanate) labelled lectins WGA, HPA and PNA were purchased from Sigma. After the nematodes had been washed three times with phosphate buffered saline, pH 6.8, they were incubated for 24-25.5 h with the different lectins (100 µg/ml) at room temperature in the dark. Shorter incubation times made the observation of lectin binding to P. redivivus exudates in amphidial and phasmidial canals and in the corresponding receptor cavities more difficult or even impossible. The specificity of lectin binding has not been tested because it was not of interest in these experiments. The experiments were performed three times with a total of at least 51 and up to 60 nematodes tested for each species/lectin combination. Lectin binding sites were observed fluorescence-microscopically after the incubation as described by Aumann and Wyss (1989).

Materials and methods

P. redivivus was reared under axenic conditions in a liquid medium containing 2 % (w/v) liver extract (Difco) and 4 % soya peptone (Oxoid). H. schachtii was reared as described by Aumann and Hashem (1993).
Table 1. Lectin binding sites on chemosensillum-associated exudates of *Panagrellus redivivus* females and *Heterodera schachtii* males.

<table>
<thead>
<tr>
<th>Lectin</th>
<th>Nematode</th>
<th>No. of nematodes tested</th>
<th>Percentage of nematodes with lectin binding sites</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Amphtds</td>
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<td></td>
<td></td>
<td></td>
<td>Apertures</td>
</tr>
<tr>
<td>WGA</td>
<td><em>P. redivivus</em></td>
<td>57</td>
<td>93.0</td>
</tr>
<tr>
<td></td>
<td><em>H. schachtii</em></td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>HPA</td>
<td><em>P. redivivus</em></td>
<td>51</td>
<td>88.2</td>
</tr>
<tr>
<td></td>
<td><em>H. schachtii</em></td>
<td>60</td>
<td>96.7</td>
</tr>
<tr>
<td>PNA</td>
<td><em>P. redivivus</em></td>
<td>58</td>
<td>10.3</td>
</tr>
<tr>
<td></td>
<td><em>H. schachtii</em></td>
<td>60</td>
<td>96.7</td>
</tr>
</tbody>
</table>

Discussion

In both species examined lectins seem to have bound to chemosensillum-associated exudates. In *H. schachtii* males lectin binding to phasmidial exudates was not observed (Table 1). This is supported by Carta and Baldwin (1990) who found no phasmids in males of this species. In contrast, the lectins bound to phasmidial exudates in *P. redivivus* females.

The species differences in permeability of chemosensillum-associated exudates for lectins (Table 1) may give an explanation for opposing experimental data. According to Jansson and Nordbring-Hertz (1984), the chemoreception of *P. redivivus* was inhibited after an incubation with the lectin from *Limulus polyphemus* (LPA). Jayaprakash et al. (1985) found an inhibition of chemoreception after treatment of *C. elegans* with LPA and the lectin from *Canavalia ensiformis* (Con A). The lectin from *Lens culinaris* (LCA) inhibited chemoreception of *T. colubriformis* (Bone & Bottjer, 1985). Conversely, Aumann et al. (1990) did not observe an effect of the lectins Con A, WGA, PNA, HPA and of the lectin from *Limax flavus* on *H. schachtii* male reception of the female sex pheromone. The lectin incubation times in the above-mentioned experiments were 25-100 fold shorter than that used in the present study for a reliable fluorescence microscopical visualization of lectin binding sites. Nevertheless it is supposed that in the present study a significant amount of lectins had diffused through the exudates of *P. redivivus* at the beginning of lectin incubation. In summary, the results support the hypothesis of Jansson (1987) that lectins can block chemoreception of *P. redivivus* by binding to membrane receptors of dendritic nerve extensions. Furthermore, the results indicate the occurrence of fundamental differences in the structure of chemosensillum-associated exudates between plant-parasitic and free-living nematodes.

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References


