HOUSEFLIES: EFFECTS OF AGE ON OLFACTORY RESPONSES

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Summary
The olfactory system of sexually immature 1-day-old flies is already functional. No clear differences exist between the responses of their olfactory cells and those of sexually mature flies to amylacetate, 3-methylphenol, 2-pentanone and R(+)-limonene. However, the sensitivity to 1-octen-3-ol is lower in young flies than in old flies.

INTRODUCTION

Houseflies are a nuisance to man and animals and are potential vectors of pathogens. During the first 2 days after emergence, houseflies are less active and less attracted to UV-lamps than flies that are more than 2 days old (R.C. Smallelegange, personal communication). Houseflies become sexually mature after 2 days (Adams & Hintz, 1969; Dillwith et al. 1983). The efficiency of reducing fly populations could be greatly improved when flies would be caught before eggs are deposited. The sensitivity of olfactory receptors may vary depending on developmental stage in a number of different insect species (Blaney et al., 1986). Investigations were done to determine whether in houseflies differences in odour sensitivity exist between sexually immature and sexually mature flies.

MATERIALS AND METHODS

Responses of individual antennal olfactory cells of 1-day-old flies (0-20 hours after emergence) and of flies which were 4-25 day old were recorded on stimulation with 1-octen-3-ol, amylacetate, 2-pentanone, 3-methylphenol and R(+)-limonene. Different doses were prepared by dilution in silicon oil in decadic steps. An intact fly was immobilized in a Finn-pipette with its head protruding out of the tip. Activity of odour receptor cells was recorded with glass micropipette/Ag-AgCl electrodes filled with Ringer solution, using the surface-contact technique (Den Otter et al., 1980). Odour was presented by blowing air for 0.2 second through a Pasteur pipette into an airflow directed towards the fly. The Pasteur pipette contained a filterpaper with 25 µl silicon oil in which a certain dose of a chemical had been dissolved. The response of the cell was determined by subtracting the average spike frequency in the 3 seconds before presentation of the stimulus from the maximum response frequency (also in spikes/second) in 0.1 second during the stimulation.
RESULTS

Responses of 29 cells of 1-day-old flies and 96 cells of mature flies were recorded. 9 flies of 1 day old (4 male and 5 female) and 16 mature flies (5 male and 11 female) were used. Up to 4 cells could be distinguished in a single recording by selecting on the amplitudes of the spikes.

Figure 1 shows the dose-response curves of the chemicals tested. It appeared that the responses of mature flies to the highest two doses and to $10^3$ mg of 1-octen-3-ol (Fig.1a) are significantly higher than the responses of 1-day-old flies. The threshold concentration (lowest dose at which the response is significantly higher than to control) lies between $10^{-4}$ and $10^2$ mg for old flies and the threshold concentration for young flies between $10^{-2}$ and $10^{-1}$ mg.

The responses to amylacetate, 3-methylphenol and R(+) -limonene do not differ significantly between young and old flies. For amylacetate and R(+) -limonene the threshold concentration lies between 0.01 and 0.1 mg, whereas for 3-methylphenol a threshold concentration between 0.1 and 1 mg is found.

The responses to the high doses of 2-pentanone do not differ between young and old flies, only the response to 0.01 mg is significantly different. The threshold concentration for old flies, however, lies between 0.1 and 1 mg, but the lowest dose for young flies is still significantly higher than control (p=0.048).

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**Figure 1.** Dose-response curves of the reactions of antennal olfactory cells to different chemicals. A: responses to 1-octen-3-ol from 32 cells of mature flies and 16 cells of 1-day-old flies; 34 cells of mature flies and 13 cells of 1-day-old flies did not respond to any dose of the chemical and are omitted from the graph. B: amylacetate. Mature flies n=44, no response n=17. 1-day-old flies n=17, no response n=6.
Figure 1 (continued). C: 3-methylphenol. Mature flies n=5, no response n=27. 1-day-old flies n=6, no response n=19. D: R(+)-limonene. Mature flies n=21, no response n=18. 1-day-old flies n=13, no response n=16. E: 2-pentanone. Mature flies n=21, no response n=22. 1-day-old flies n=13, no response n=17.

DISCUSSION

The results show that 1-day-old flies can smell amylacetate, 3-methylphenol and R(+)-limonene as good as mature flies. They are even more sensitive than mature flies to low doses of 2-pentanone. This suggests that these odours may attract or repel both young flies and old flies. The sensitivity to 1-octen-3-ol, however, is lower in young than in old flies, the latter being 100 times more sensitive to this chemical. One should take care in comparing the doses of the different chemicals. Since the vapour pressures may differ considerably, different concentrations of the different chemicals are present in the air at the same dose. This causes problems in determining absolute threshold concentrations, but does not affect comparisons between young and old flies.
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REFERENCES


