Bactericidal Activity of Certain Volatile Scent Components of Heteropteran Bugs

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Bactericidal activity of some volatile scent components of Heteropteran bugs was assayed. Trans-hex-2-ethyl acetate, trans-2-hexenal and trans-hex-2-ethyl butyrate were highly bactericidal against both S. albus and E. coli, while 2-octen-1-al was toxic only against S. albus (gram +) bacteria.

Key Words: Heteropteran bugs, Scent components, Bactericide, E. coli, S. albus

Introduction
Certain heteropteran insects are known to secrete volatile fluids from the metathoracic and abdominal scent glands (Waterhouse & Gilby 1964, Carayon & Villiers 1968, Staddon 1979). The secretion of these glands is reported to be anti-respiratory (Canuto et al. 1985), carcinostatic (Schauenstein et al. 1977) and antimitotic (Surender et al. 1987). In our earlier communication, we have reported anti-fungal activity of these secretions (Surender et al. 1987). In the present investigation, the effect of secretions of scent glands on bacterial growth has been evaluated.

Materials and Methods
The scent secretions from the scent glands of bugs (Chrysocoris purpureus, Tessaratoma javanica and Halys dentatus) were collected and subjected to chemical analysis by GLC-MS and identified with the help of authentic samples obtained from ICN K & K Laboratories, New York. A few compounds from different heteropteran bugs Cimex lectularius and Amblypelta nitida (Waterhouse & Gilby 1964, Aldrich 1988) were also assayed.

For assaying bactericidal activity, cultures of Escherichia coli and Streptococcus albus were exposed to vapours of test compounds. Twenty ml of nutrient broth was suspended in a 100 ml Erlenmeyer flask containing glass vial (5 ml) steam sterilized for 30 min for three days. The flasks thus prepared were inoculated with respective bacteria and incubated at 37°C ± 1 for 72 hours. One ml of the test compound (as listed in table 1) was placed aseptically in glass vial and flasks were covered with the help of aluminium foil. Water in place of compound served as control. At the end of the incubation period, the growth of bacteria was determined by turbidity determination at 625 nm. Uninoculated medium and inoculated flasks at zero hour served as blanks.

<table>
<thead>
<tr>
<th>Compound</th>
<th>E. coli (-)</th>
<th>S. albus (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-hexanoic acid</td>
<td>0.22</td>
<td>0.40</td>
</tr>
<tr>
<td>n-octyl acetate</td>
<td>0.23</td>
<td>0.39</td>
</tr>
<tr>
<td>n-hexyl acetate</td>
<td>0.21</td>
<td>0.36</td>
</tr>
<tr>
<td>trans-hex-2-ethyl acetate</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>trans-hex-2-ethyl butyrate</td>
<td>0.24</td>
<td>0.38</td>
</tr>
<tr>
<td>trans-2-hexenal</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>trans-hept-2-enal</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td>2-octen-1-al</td>
<td>0.17</td>
<td>0.03</td>
</tr>
<tr>
<td>n-hexane</td>
<td>0.21</td>
<td>0.30</td>
</tr>
<tr>
<td>n-tridecan</td>
<td>0.25</td>
<td>0.37</td>
</tr>
<tr>
<td>n-dodecane</td>
<td>0.27</td>
<td>0.38</td>
</tr>
<tr>
<td>n-undecane</td>
<td>0.23</td>
<td>0.36</td>
</tr>
<tr>
<td>Control</td>
<td>0.29</td>
<td>0.38</td>
</tr>
</tbody>
</table>

* Growth expressed in optical density (OD)
Results and Discussion

*Trans* hex-2-enyl acetate is identified in the metathoracic scent glands of *Tessaratoma javanica* and is highly bactericidal and inhibited the growth both the bacteria under study (table 1). Janaiah et al. (1979) have also reported it as a protective against certain predators. The phenolics and hydrogen peroxide of aquatic bugs are secondarily evolved metathoracic gland secretions are probably important as antiseptics (Staddon 1979).

*Trans* hex-2-enal and *trans* hept-2-enal are reported from the secretions of scent glands of nymphs and adults of *T. javanica* and their action is corrosive on human skin and has lethal effect on the black and red ants (Janaiah et al. 1979). In the present study, the two compounds cause almost total inhibitions of growth of both the bacteria.

2-octen-1-ol a component of the secretion of metathoracic scent glands of *Cimex lectularius* L. and considered as alarming pheromone (Levinson & Bar Illan 1971, Levinson et al. 1974b) was found to inhibit the growth of *S. albus* but the inhibitory effect on *E. coli* was very low.

n-dodecane from the abdominal scent glands of *Chrysocoris purpureus* and *H. dentatus* is reported to aid in the penetration through the cuticle of the insect predators (Waterhouse & Gilby 1964, Janaiah et al. 1988). However, n-dodecane and n-tridecane were found to lack bactericidal activity.

5-hexanoic acid and n-octyl acetate which are volatile constituents of the scent glands of *Amblypelta nitida* (Baker et al. 1972), stimulated the growth of *S. albus*.

n-hexane and n-hexyl acetate which are components of secretions of metathoracic scent glands of coreoid bugs (Aldrich & Yone 1975) inhibited the spore germination of *Fusarium oxysporum* (Surender et al. 1987). These compounds were moderately toxic to *E. coli*. Rest of the compounds were either devoid of bactericidal activity or possessed low bactericidal activity.

From the present investigations, it is clear that these scent components act as defensive agents against the infection of certain bacteria. However, detail studies are desirable before reaching any decisive conclusion.

Acknowledgement

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