

epithelium is evident. Very small quantities were found in the blood.

Our results confirm those of Goodbody⁸ and Nolfi¹⁰ on the amount of uric acid contained in renal concretions. Uric acid is the most important compound of the concretions and homarine is the essential UV absorbing substance of the renal sac fluid. Our results agree with those of Gasteiger et al.¹² when related to the wet weight of the whole animals. The homarine quantities in the isolated renal sac

and in the whole animal are about equal: this substance is thus specifically located to the renal sac in *Molgula manhatensis*. Its absence from ascidians families which have no renal vesicles¹³ supports this idea. The renal sac fluid of molgulids is not excreted outside and homarine concentrations may be the result of an accumulation. Its presence at a level of 40 mosmole/l should be related to a role in the osmotic adjustment of the renal sac medium to osmotic pressures of blood and sea water¹¹.

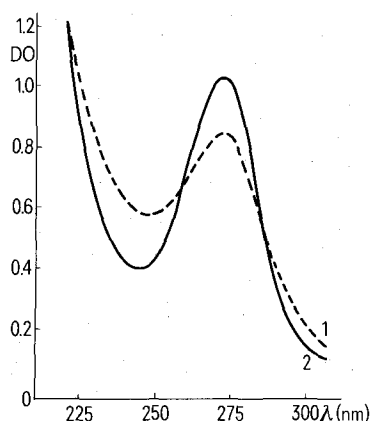


Fig. 2. UV absorption spectrum (λ in nm) of renal sac fluid: 1 in primary extracts of the renal fluid (dil. 500); 2 after TLC and elution of the R_f 0.53 band.

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Olfactory sensitivity in *Aulacophora foveicollis* Lucas (Coleoptera: Chrysomellidae) in relation to its host plant

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Summary. Food-perception ability of *Aulacophora foveicollis* is adversely affected by bilateral antennectomy, but remains unaffected by unilateral antennectomy.

Interesting informations on the chemosensory relationship between *Epilachna vigintioctopunctata* Fabr. (Coleoptera: Coccinellidae) and its host plant *Luffa aegyptiaca* Mill (Cucurbitaceae)¹ prompted us to undertake the study on the same aspect with respect to another beetle pest, *Aulacophora foveicollis*, and one of its cucurbitaceous hosts, *Lagenaria vulgaris*.

Methods and materials. This investigation was carried on adult *A. foveicollis* of mixed age and sex. The technique and the general lay out of the experiments, reported by Krishna and Sinha¹, were followed in the present study with alteration in the duration of the experimental period. Instead of 1 h observation period¹, it was restricted to 15 min, because the maiden biting response of normal as well as the antennectomized insects, occurring only during the first 15 min, was taken into account by Krishna and Sinha¹ to explain the chemosensory relationship between *E. vigintioctopunctata* and *L. aegyptiaca*.

The parts of *Lagenaria vulgaris* preferred in this study, were flowers and leaves – the best choices among all the parts of the plant². Experiments, with respect to each category of beetles viz., normal, with left antenna amputated, with right antenna amputated and with both antennae amputated, involved 50 individuals, utilising one in each replicate.

Results and discussion. It is very obvious from the table that extirpation of either of the antenna of *Aulacophora foveicollis* hardly makes any difference in the biting response of this beetle, while removal of both drastically minimises it. These observations tally closely with the findings of Krishna and Sinha¹ on *Epilachna vigintioctopunctata* and thus fully conform to the interpretations given by them, which can be summarized in relation to *A. foveicollis*, as stated below. The number of olfactory receptors located on single

Relative numerical strength of the different groups of *Aulacophora foveicollis* showing the only biting response on either flower or leaf of *Lagenaria vulgaris*

Group of the insects	Number of individuals comprising each group	Number of individuals showing the biting response during 15-min observation period
A	50	23
B	50	24
C	50	21
D	50	4

A, Insects with both antennae intact; B, insects with right antenna removed; C, insects with left antenna removed; D, insects with both antennae removed.

antenna is amply adequate to guide the unilaterally antennectomized insects to the food choices, as evident by very minor and negligible numerical differences in maiden biting response between unilaterally antennectomized and normal individuals.

It may be seen from the extremely poor biting response by the bilaterally antennectomized beetles, in comparison to normal or unilaterally antennectomized ones, that the antennal chemoreceptors perform as main olfactory sensilla in the insects' food-plant finding, while the maxillary and labial chemoreceptors, if at all present, exhibit only a secondary role. Besides, the antennal chemoreceptors seem to be chiefly associated with the attraction of the pest towards its food plant and not with the 'avoidance' as

suggested by Thorsteinson³ based on Chin's⁴ work on the Colorado potato beetle, *Leptinotarsa decimlineata* (say) (Coleoptera: Chrysomellidae).

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The relationship of phosphodiesterase and cyclic AMP to the process of fluid secretion in the salivary glands of the ixodid tick *Amblyomma americanum*¹

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Summary. Phosphodiesterase (PDE) activity in the salivary glands of the female *Amblyomma americanum* decreased as the tick progressed from a slow to a rapid phase of feeding, while the rate of fluid secretion increased when glands were stimulated with cyclic AMP and theophylline. Dopamine stimulated PDE activity and an 'inhibitory' factor was found in glands obtained from rapidly engorging ticks which decreased PDE activity. These findings are discussed as they relate to the process of fluid secretion by salivary glands of feeding ixodid ticks.

Female ixodid ticks must have effective osmoregulatory systems because of their ability to concentrate large blood meals, and are excellent animals in which to study the problem of ion and water balance.

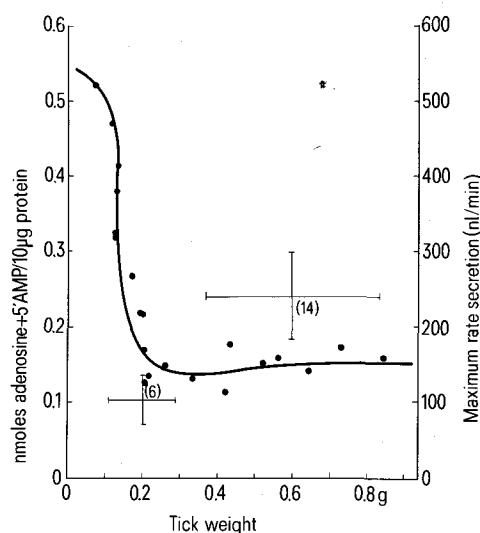
In the process of concentrating its blood meal, excess fluid moves across the gut epithelium and is expelled via the salivary glands back into the host^{2,3}. We have recently obtained evidence that implicates both cyclic AMP (cAMP) and Ca^{+2} in the process of salivary gland fluid secretion in females of the lone star tick *Amblyomma americanum*⁴⁻¹⁰. Kaufman¹¹ and Sauer et. al.¹⁰ have demonstrated that if salivary glands of female ixodid ticks are stimulated in vitro with catecholamines, the rate of fluid secretion is highest in glands obtained from rapidly engorging ticks. Catecholamines may stimulate fluid secretion by causing an increase in the steady state level of cAMP which acts as an intracellular second messenger mediating the signal of the primary transmitter¹². Recently, we reported that cAMP mimics the stimulatory effect of catecholamines^{5,6}. Furthermore, changes in levels or activity of cAMP, adenylyl cyclase and/or phosphodiesterase (PDE) may change as states of engorgement change. In this preliminary communication, we report the relationship of phosphodiesterase and cAMP to the process of fluid secretion by salivary glands of the female lone star tick.

Materials and methods. Female *A. americanum* in 2 phases of feeding were used; a slow phase lasting 6-12 days (weight increased from ~4 mg to ~300 mg) and a rapid phase lasting 12-24 h (weight increased from ~300 mg to ~800 mg). Pairs of salivary glands were dissected out in 50 mM Tris-HCl buffer containing 5 mM $MgCl_2$ adjusted to pH 8. After dissection, glands were placed in small glass homogenizers containing 250 μ l of Tris buffer and homogenized. Some homogenates of salivary glands from the 2 feeding phases were pooled prior to assay.

Additional tick salivary gland pairs were dissected in a Ringer solution with MOPS buffer to retain maximal secretory ability⁸. One gland was bathed in Ringer solution and prestimulated with 10^{-6} M dopamine for 5 min, rinsed

with Tris buffer and homogenized as before. The other gland was incubated in the same solution but without dopamine and served as the control.

PDE activity was measured by taking 50 μ l of salivary gland homogenate added to $\frac{1}{2}$ dram glass vials containing 6 nmoles cAMP in 10 μ l of Tris buffer and trace amounts of H^3 cAMP. Reactions were allowed to proceed for 10 min at



Effect of tick weight upon salivary gland PDE activity (●) and maximal secretion rate by in vitro salivary glands stimulated with cyclic AMP (10^{-2} M) and theophylline (10^{-2} M). Horizontal lines represent weight range of ticks from which glands were obtained (0.105-0.289 g in slowly feeding ticks and 0.364-0.825 g in rapidly feeding ticks). Vertical lines represent \pm SD of the maximum rate of secretion. Numerals in parenthesis indicate numbers of experiments.