

with mixed populations, the ratio of the two species is not yet fully determined for ponds of different productivity.

It may be of interest to direct attention to the fact that *Tilapia melanopleura* Dum. is a good agent in malaria control. The fish eliminate the floating and semi-submerged vegetation, which are breeding places of the malaria-carrying *A. gambiae* and *A. funestus*. Further, the fry eat mosquito larvae.

All over the country the cultivation of both these *Tilapia* is growing rapidly. Nearly all the ponds and dams are stocked with fry coming from the *Tilapia*-strains of this Station. Some fingerlings have already been sent abroad.

Further details concerning the biology and the culture of these *Tilapia* will be published in the annual report of the Station.

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<sup>1</sup> Hickling, C. F., *Nature*, **161**, 748 (1948).

<sup>2</sup> Copley, Hugh, Review of Kenya Fisheries (1947).

<sup>3</sup> Vaughan Jones, T., Game and Tsetse Control Dept. Ann. Rep. 1944.

<sup>4</sup> Union of South Africa, Inland Fisheries Dept., Ann. Rep. 1944.

<sup>5</sup> Huet, M., Actes du Congrès Limnologique, Suisse 1948 (in the press).

<sup>6</sup> De Bont, A. F., Halain, C. P., Huet, M., and Hulot, A., Min. des Col. Belgique (1948).

<sup>7</sup> Vaughan Jones, T., Game and Tsetse Control Dept. Ann. Rep. 1948.

### Amino-Acids in the Hæmolymph of the Dragon-fly Nymph, *Aeschna cyanea*

ALTHOUGH it is well known that the non-protein nitrogen content of insect hæmolymph is high and that a large proportion of it is present as amino-acids, few investigations have been made as to their nature. Florin and Duchateau<sup>1</sup> showed that the hæmolymph of *Dytiscus marginalis* contained small quantities of histidine and tyrosine, and reported the absence of arginine, tryptophane, phenylalanine and cystine. A more thorough analysis by Ussing<sup>2</sup> revealed the presence in the blood of *Melolontha vulgaris* of lysine, arginine, histidine, tyrosine, leucine, valine, tryptophane and almost certainly hydroxyproline. The latter is also present in the blood of *Oryctes nasicornis*.

We have investigated the hæmolymph of *Aeschna cyanea*, using the technique of partition chromatography on filter paper of Consden, Gordon and Martin<sup>3</sup>.

Small quantities of blood (about 3 mm.<sup>3</sup>) run on a partition chromatogram, using water-saturated phenol as solvent, gave coloured spots with ninhydrin, the  $R_F$  values of which (0.38 and 0.55) corresponded with those of glycine and alanine. With increased amounts of blood, spots corresponding in position to leucine or isoleucine, valine and proline were found.

To detect the presence of amino-acids occurring in smaller amounts, concentrated extracts were prepared by evaporating the blood from one larva (about 100 mm.<sup>3</sup>) to dryness in a vacuum desiccator, suspending in about 15 mm.<sup>3</sup> of 60 per cent alcohol, centrifuging, and using the supernatant solution. Thus the amino-acids were concentrated while the protein and most of the inorganic salts remained undissolved. The nitrogen content of the whole blood was determined by an ultra-micro-Kjeldahl method on a small sample (0.7 mm.<sup>3</sup>) removed before concentration. A typical result was: total nitrogen, 529; protein nitrogen, 311; non-protein nitrogen, 218 mgm. per cent. Amino-acids identified: serine,

glycine, lysine, alanine, tyrosine, valine, leucine or isoleucine, proline.

Since proline is easily recognized by its ninhydrin colour and because the  $R_F$  values were sometimes lower than expected, values for every spot were recalculated using the proline spot as standard ( $R_F$  value = 1.0).

The results were confirmed by running simultaneously a blood extract, and a blood extract to which was added one or more of the suspected amino-acids.

The results for a number of different animals are summarized in the accompanying table.

$R_F$ -values at room temperature

Amino-acid	Pure amino-acid	Pure amino-acid in blood	Blood extract (animal 15B)	Blood extracts: average for 16 runs
Serine	0.36	0.36	0.37	0.36
Glycine	0.45	0.44	0.44	0.44
Lysine	—	0.55	0.54	0.53
Alanine	0.63	0.64	0.65	0.65
Tyrosine	0.70	0.72	0.75	0.72
Valine	0.85	—	0.87	0.86
Leucine or isoleucine	0.94	—	0.94	0.93
Proline	1.00	—	1.00	1.00

From these experiments and those with untreated blood it appears that glycine, alanine, valine and leucine are present in the greatest concentration. Proline and tyrosine occur in moderate amounts and serine and lysine in small quantities.

Confirmation of these results was provided by the two-dimensional technique using phenol and collidine as solvents, except that no serine was demonstrated. Arginine and lysine are possibly present, and relatively large amounts of a substance, possibly a peptide, which runs at the same speed as alanine in phenol but somewhat slower in collidine.

Further experiments are in progress on the blood of other insects, and attempts are being made to obtain quantitative results.

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<sup>1</sup> Florin, M., and Duchateau, G., *Bull. Acad. Roy. Belg., Cl. Sci.*, **28**, 373 (1942).

<sup>2</sup> Ussing, H., *Acta physiol. Scand.*, **11**, 61 (1946).

<sup>3</sup> Consden, R., Gordon, A. H., and Martin, A. J. P., *Biochem. J.*, **38**, 224 (1944).

### Growth of *Culex molestus* under Sterile Conditions

*Aedes aegypti* and *Culex pipiens* are the only two mosquitoes which have hitherto been reared from egg to adult under sterile conditions. It is interesting to note that the autogenous *Culex molestus* can also be bred without difficulty on sterile media. The following media were found suitable for this purpose (all experiments were carried out at a temperature of 28° C.).

(1) Dried or fresh yeast (autoclaved) 1.2 gm. to 15 ml. distilled water to which 25 eggs of *C. molestus* were added under sterile conditions. On this medium the mosquitoes developed from eggs to adult in 10.5–13 days; but the adults were not viable.

(2) Water, dried yeast and the following vitamins: thiamin, riboflavin, pantothenic acid, niacin, pyrid-