Uptake of Atmospheric Water by the Hen Flea *Ceratophyllus gallinae* (Schrank)

THE only insects known to take up atmospheric water actively are *Tenebrio* larvae[1], *Chortophaga* nymphs[2], and the prepupae of the tropical rat flea *Xenopsylla brasiliensis*[3]. The present observations add another example, the imago of the hen flea *Ceratophyllus gallinae*, and suggest a behavioural and ecological function for the phenomenon.

Imagines of *C. gallinae*, newly emerged from their cocoons and kept at 98 per cent relative humidity, did not lose weight as expected, but after 24 h had become heavier. This result was checked by following the daily weight changes of several groups of thirty newly emerged fleas, at various relative humidities maintained by saturated salt solution and sodium hydroxide methods[4]. The temperature was 28° C $\pm$ 1° C. The graph (Fig. 1) shows that gain in weight is limited to the first day after emergence, and that an effect is discernible down to 82 per cent relative humidity.

Drinking cannot explain the increase in weight, because condensation did not occur on the fleas' containers. An active process is almost certainly involved, for there are no known purely physical ways in which an insect can gain water from air at a relative humidity as low as 82 per cent. The sudden failure of uptake on the second day also suggests an active, rather than physical, mechanism.

The function of active uptake is probably related to the habit of the imago to remain quiescent within the cocoon during the winter or in other periods when a host is not available. During this time loss of water must be reduced to a minimum, not only to prevent death directly from desiccation but also to enable the flea to emerge efficiently from its cocoon. The behavioural emergence mechanisms are dependent on a sufficient turgidity of the abdomen, which acts to anchor the flea while it tears open the anterior pole of the cocoon with its clypeal tubercle. Partially desiccated fleas make all the correct emergence movements, but the loss of turgidity prevents the tubercle pressing hard enough to tear the cocoon wall. These fleas eventually die within the cocoon. Such behavioural failure was observed on many occasions both in the laboratory and in the field. Buxton[5] noted a similar failure in *Xenopsylla cheopis*.

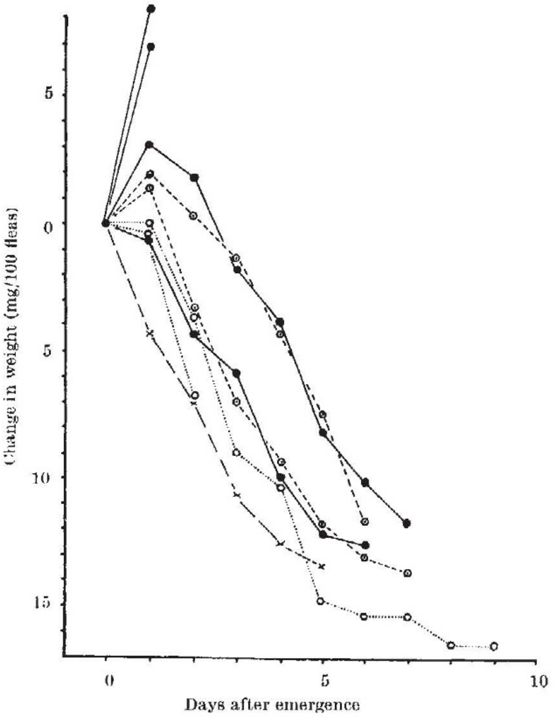

Fig. 1. Changes in the weight of adult *C. gallinae* after emergence from the cocoon. Relative humidity: ●—●, 98 per cent; ○- - -○, 92 per cent; ○· · · ·○, 82 per cent; × - - - - — ×, 33 per cent.

It is concluded that the mechanism of active uptake of water by the flea imago is probably largely concerned with opposing water loss during the cocooned resting stage, so permitting the effective operation of emergence behaviour. This conclusion is consistent with the switching off of active uptake soon after emergence has occurred. The cocooned imago forms the main resting stage of many flea species, including the plague vector *Xenopsylla*, and so it is quite possible that the mechanism of active uptake and its relationship to emergence behaviour may be a widespread feature of flea ecology.

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Effect of Coffee and Tea on Serum Lipids in the Rat

WE report experiments designed to distinguish the effects of the beverage and of sugar on the blood lipids of rats. Epidemiological investigations[1,2] have already shown an association between ischaemic heart disease and the taking of coffee. Acute experiments in man and dogs[3,4] indicate that caffeine produces a rise in free fatty acids in the blood, but no change in cholesterol or triglycerides. Our own investigations with patients[5], however, suggest that the association of heart disease with coffee (or tea) is more likely to be caused by the sugar taken with the coffee or tea than by the caffeine they contain.

Male hooded rats weighing about 120 g were assigned to two main groups of twenty-eight. All were given purified diets and water *ad libitum*; the dietary carbohydrate for one group was sucrose and for the other group was corn starch. Each of these main groups was divided into four sub-groups; one was given the control diet alone, the others had additions of coffee, or tea, or decaffeinated coffee. In an attempt to accentuate the possible effects of the supplements, an atherogenic diet was given: 25 per cent casein, 16 per cent hydrogenated coconut oil, 5 per cent mineral salts, 5 per cent cellulose powder, 1 per cent cholesterol, 1 per cent cholic acid, 47 per cent sucrose or corn starch. Because corn starch contains some corn oil, 0·56 per cent corn oil was added to the sucrose-containing diet.

The dried coffee was given at the rate of 2·3 g in 100 g of diet, and the dried tea at the rate of 1·0 g in 100 g of diet. The average daily intake of caffeine was about 22 mg from ordinary coffee, 0·8 mg from decaffeinated coffee and 12·5 mg from tea. The coffee was prepared according to a standard method[6], and then freeze-dried. The tea was a commercially available preparation recommended to be made up with 1·0 g of tea in a cup of 200 ml.

The amounts of tea or coffee were equivalent to about twelve cups a day for a 70 kg man, calculated for a 220 g rat (mean weight after 25 days on diet) from the formula metabolic weight = weight$^{\frac{3}{4}}$, or to about fifty-four cups of coffee or tea a day, calculated directly in proportion to body weight.

The rats were killed after 50 days, after an overnight fast. Blood was taken directly from the heart for assay of cholesterol, phospholipids, and total esterified acids[7-9]. Triglycerides were calculated by difference[10].

The three groups receiving the tea or coffee showed a transitory halt in weight gain during the first 3 days,