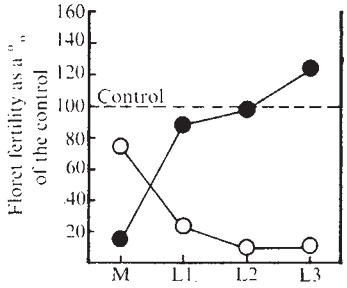

Fig. 2 The effects of a 2-week exposure to short days imposed at the awn-initial stage C ●——● and the later stages of awn differentiation D ○——○, on the fertility of the florets of main shoot ears M, and the leaf 1, 2 and 3 tiller ears (L1, L2, L3). Fertility in all ears is calculated as (Grain No.)/(Floret No.) × 100 and is plotted as a percentage of the control value.

on the cross pollinated side were considerably higher (Table 2). It seems, therefore, that the short day treatment had not affected the development of the embryo sac and that its effect on floret fertility was exerted by the induction of male sterility.

It is intriguing to consider why main shoot ears were affected by treatment C but not treatment D. It seems unlikely that the plants became unreceptive to the short day stimuli during treatment D, as the fertility of the florets of the lateral ears was markedly reduced by such treatment. It would seem more likely that pollen development is sensitive to short days only at certain stages and that in the main shoot ears these coincided with the exposure to short days in treatment C but not treatment D. The actual stages of pollen development covered by treatment C range from mitosis of the pollen mother cells at the start of treatment to the first prophase of meiosis at the end of treatment. As male and female meiosis have been shown to be synchronous in barley[5], the embryo sac mother cell would have been at a comparable stage at the end of the treatment period.

Although any stage in the span of development covered by treatment C could be the critical process which is sensitive to short days, it may prove to be the stage of premeiotic interphase which is disrupted. This phase, in which the mitotic pollen mother cells are synchronised before entering meiosis, only occurs in male gamete formation, and it has been shown to be susceptible to changes in other environmental factors which induce varying degrees of floret sterility[6–8].

No dissections of lateral ears were carried out but it was observed that the general development of these was later than that of main shoot ears, and it is likely, therefore, that the development of pollen in their florets lagged behind that in the main shoot ears. If this occurred, then the reduction in floret fertility in the lateral ears induced by treatment D, but not treatment C, would be consistent with the hypothesis that there is a stage during which pollen development is sensitive to short days and that this is the same for all ears.

The drastic reduction in floret fertility caused by exposure to short days is a new phenomenon. The mechanism of this effect is not clear, but phytohormones may be involved. There is evidence that levels of phytohormones in plant tissues change in response to day length[9,10], and that such substances can affect floret fertility. Thus application of ethrel decreases floret fertility in both barley[11] and wheat[12], whereas gibberellins increase fertility in male sterile lines of tomato[13] and barley[14].

The results described here imply that the use of physiologically induced male sterility may well be feasible in the controlled hybridisation of barley varieties, particularly where a rapid assessment of heterotic combinations is needed in the choosing of parents for the production of hybrid barley varieties.

Table 2 Effects of cross-pollination with pollen from plants grown in long days throughout

	P: Cross-pollinated	Q: Self-pollinated	L.S.D. $P<0.01$
Grain No. (one side of ear)	4.89	0.86	2.28
% floret fertility (one side of ear)	41.82%	7.26%	19.24%

The recipient plants were exposed to 2 weeks of short days at the awn-initial stage. The florets on one side of the ear (P) were cross pollinated using pollen taken from plants kept entirely in long days, while those on the other side (Q) were self-pollinated. Figures are the mean of 25 ears.

We wish to thank Dr M. D. Bennett of the Plant Breeding Institute, Cambridge, for his assistance in the cytogenetic studies reported in this letter.

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Received March 28; revised May 9, 1974.

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Fluidisation as a feeding mechanism in beach flies

We have seen groups of small (4–5 mm long) grey flies belonging to the species *Lipochaeta slossonae* Coquillett, 1896, standing, shaking and apparently feeding, or flying for short distances on stretches of wet sandy beach in La Jolla, California and San Felipe, Mexico. When undisturbed, they walked sideways or stood and shook their bodies, diagonally forward and downward, and backwards and upwards, at an estimated frequency of 5 s^{-1}. We guessed that they were fluidising the wet sand under their feet and thereby loosening some of the interstitial microflora which could then be sucked up as a kind of soup. This was confirmed by laboratory examination of the guts of several specimens, which contained the remains of large numbers of cells of dinoflagellates and diatoms. (The species of dinoflagellates were unfortunately unidentifiable since there were no cell wall remains, but they probably belonged to the genus *Amphidinium*, which comprises some of the commonest unarmoured interstitial dinoflagellates on this beach. The diatom species, however, could be readily identified by their silica walls. There were at least 10 genera, all typical of the marine interstitial community, including various species of *Navicula, Nitzschia, Pinnularia* and *Amphora*.)

The genus *Lipochaeta* has only one known species, *L. slossonae*: it is a poorly known fly, adults having been hitherto recorded only from Florida, Texas and from southern and central California[1,2]. Its larvae and pupae are apparently still undescribed (B. A. Foote, personal communication). Very little is known about its biology

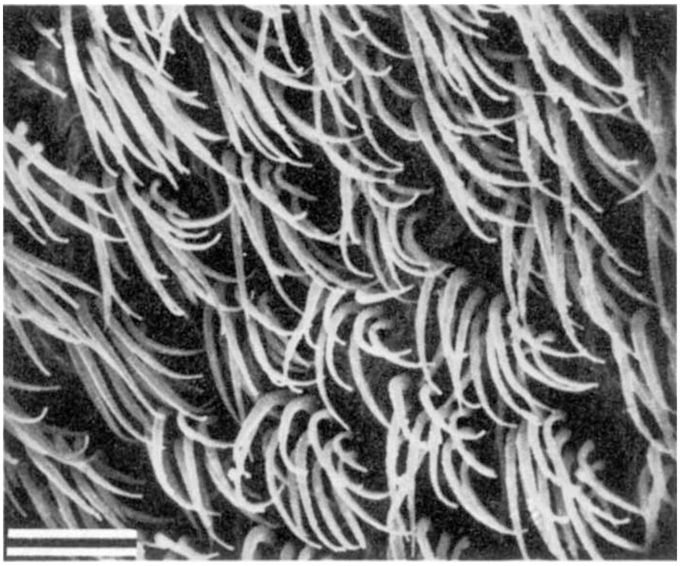

Fig. 1 Stereoscan electron micrograph taken on Cambridge S-4 SEM of portion of surface of clypeus, showing recurved hairs in bundles of 12–15. (Scale bar = 10 μm.)

apart from the fact that adults are commonly found on moist sand of ocean beaches. They are not strong fliers, but they seem to be more wary and less easily caught than the kelp flies present in the same habitat.

The head, somewhat resembling that of a fish, is flattened dorso-ventrally, with an almost flat ventral clypeus covered by small recurved hairs grouped in bundles of 12–15 (Fig. 1). This is probably an adaptation for preventing wetting of the head while the fly is feeding. The antennae, which are extremely small and lack an arista, are inserted in pits spaced far apart (Fig. 2). The mouth parts are of the normal dipteran type except for the labella, which are modified to form a filtering apparatus: it has thickened ridges approximately 8 μm apart and 10 μm long (Fig. 3), leaving pores of a size suitable for the admission of small diatoms and other algae while excluding sand grains. Further feeding adaptations of these otherwise bristle-less flies[2] may be the long, stout spines along their legs and the strong apical tarsal claws which enable them to stand on wet sand without wetting the velvety hair cover of their legs and body.

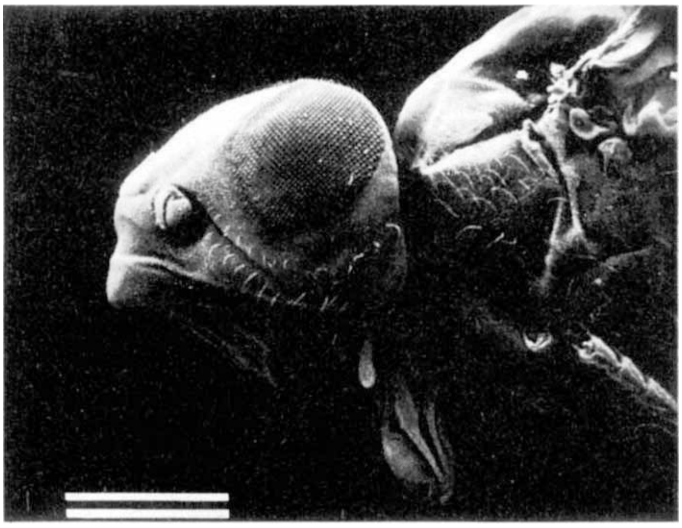

Fig. 2 Lateral view of head of *Lipochaeta slossonae*, showing flattened ventral clypeus, eye, and small antenna in pit. (Scale bar = 500 μm; stereoscan electron micrograph taken on Cambridge S-4 SEM.)

Many adult ephydrids, like their larvae, are known to feed on microscopic algae[3]. Analyses of algae found in the guts of a considerable number of species are presented by Deonier[4], who also reviewed several earlier references on the feeding habits and diets of adult ephydrid flies. A significant observation on the feeding behaviour of adult *Scatella subguttata* (Ephydridae) is that of Brauns[5], who refers to pressure by the anterior, boat-shaped portion of the proboscis as being somehow involved in the "licking" of food organisms from sand grains. But the phenomenon of sand fluidisation, which we observed in the feeding behaviour of *Lipochaeta*, does not seem to have been reported elsewhere. Deonier[6] merely reported that the adults of certain species of *Hydrellia* (Ephydridae) "exhibit peculiar behaviour while feeding, e.g., *H. biloxiae* rhythmically pushes its body up and down", without offering further explanation of this unusual behaviour. Ocypodid crabs are known to feed on interstitial microflora by rolling wet sand into pellets with their maxillipeds and then sucking out the suspension of fine organic detritus, including the microalgae[7]. Apparently some flies can exploit the same dietary niche.

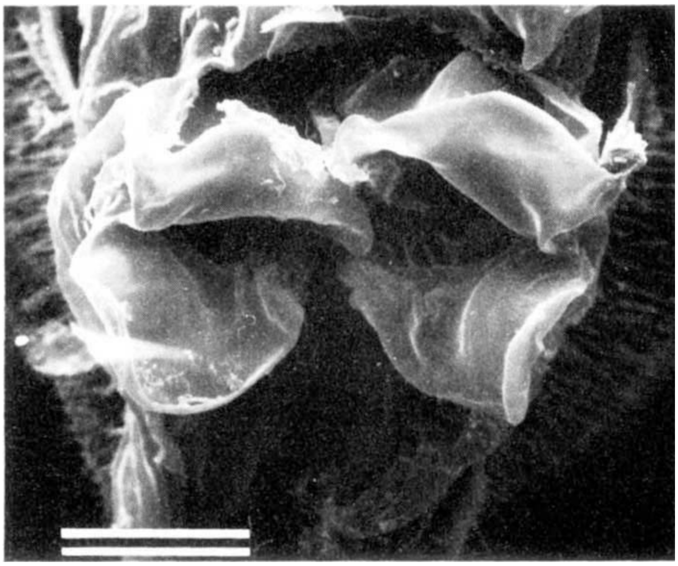

Fig. 3 Ventral view of portion of proboscis showing 'pores' on labella and small internal teeth. (Scale bar = 50 μm; stereoscan electron micrograph taken on Cambridge S-4 SEM.)

We thank Dr W. W. Wirth, USDA, c/o US National Museum, Washington, DC, for identifying the fly species, Ellen Flentye for technical assistance with the scanning electron microscope and the Foundation for Ocean Research for financial support to L.C.

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Received March 4; revised April 26, 1974.

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