ENTOMOLOGY

Procedure for Rearing Houseflies

THE various methods and media used for rearing houseflies[1] each give results considered satisfactory by the individual workers or laboratory, but no rearing procedure is yet accepted as standard. The Chemical Specialties Manufacturers' Association rearing medium and procedure[2] are often accepted in North America but do not appear to be used elsewhere. The rearing procedure evolved in this laboratory[3] has since been modified in the various ways described in *a–d* below, and is now probably simpler and easier than any previously described.

The modifications of the previously described procedure[3] are: (*a*) A 2-in. diameter hole is added to the bottom lid of each cylindrical cage. This accommodates a polythene feeding cup of the same diameter and about 1·5 in. high. These cups are conveniently made by cutting away the upper portion of a 6-oz. polythene bottle. (*b*) The milk-sugar-water food fed previously often sours and requires frequent renewal. As a simpler procedure, each cage, containing up to 1,500 adult flies, is now supplied with approximately 200 ml. of 2·5 per cent sugar solution in the feeding bottles and approximately 25 g dry food in the feeding cups. Cages are charged in this way when pupæ are added for emergence; thereafter the food is changed weekly or when the supply nears exhaustion, except that flies intended for insecticide testing have both sugar solution and solid food renewed two days prior to the insecticide tests. Flies intended for insecticide testing are fed dry white cane sugar in the feeding cups. Those which provide eggs for further rearing are fed a dry mix containing equal parts by weight of cane sugar and dried whole cream milk powder to which are added 10 per cent dried yeast and 0·1 per cent cholesterol. These proportions are arbitrary, and no attempt has yet been made to establish to what extent proportions could be varied or components eliminated. Cholesterol is added as a precaution against inferior egg hatching[4]. A synthetic diet for adult houseflies is available[4]; its adoption could be a further step towards a standardized rearing procedure. (*c*) The breeding medium now used comprises equal parts dry weight of absorbent tissue paper and dried whole cream milk powder to which is added 5 per cent of dried yeast, and 2·1 ml. water/g dried mix. Each rearing jar receives rearing medium from 75 g of dry mix and this is seeded with 0·4 ml. of eggs to produce 1,300–1,500 pupæ in 7 days at 25° C. (*d*) In the earlier procedure[3] the absorbent tissue was soaked for 30 min to facilitate pulping before the dry mix was worked into the wet tissues. It has also been suggested that the tissues be shredded into pieces about an inch long[5]. In the present procedure the dry tissues are disintegrated in a cutting mill run at 3,000 r.p.m., all material passing a 12 mesh to linear in. screen before leaving the mill. The final product is a loose flock, without obvious particles of sheet paper. On mixing the paper flock with the dry components of the medium and adding the water the materials aggregate in large discrete crumbs. This wet material is then easily transferred to the rearing jars, is uniformly distributed by slight shaking and is then lightly tamped prior to addition of eggs.

The last of those modifications has transformed medium preparation from a tiring and time-consuming task to a simple instant mix easily effected with a glass rod. The physical consistency of the wet mix allows excellent penetration by the growing larvæ. The usual fly culture odours are noticeably absent, and there have been no cases of mould or bacterial invasion leading to the revolting 'cheesy' or rotten odour sometimes developed with the mashed paper medium. Pupation occurs in the medium. Pupæ are easily separated by flotation, and, because there is no entanglement, with incompletely macerated paper almost all pupæ are recovered.

Table 1. EFFECTS OF SUBSTITUTING DRIED SKIM MILK FOR DRIED WHOLE CREAM MILK AND OF ADDED CHOLESTEROL ON THE SUITABILITY OF THE STANDARD DIET

Rearing medium	No. of trials	Average values of rearing unit			
		No. of pupæ	Total weight of pupæ (g)	Pupal weight (mg)	Total eggs laid (ml.)
Normal	8	1,374	21·8	16·2	2·6
Skim milk		1,531	16·8	11·1	1·2
S.E. of mean		49·4	0·84	0·52	0·37
Significance		Sign.	H. Sign.	V. H. Sign.	Sign.
Normal	14	—	20·8	15·4	2·9
+ 1·0% cholesterol		—	20·7	15·4	2·8
S.E. of mean			0·70	0·37	0·16
Significance			N.S	N.S.	N.S.

The overall improvement resulting from this simple mechanical preparation of the paper has remarkably simplified rearing procedures, and it is suggested that the medium described here might well serve as a simple and approximately standard rearing medium until fully defined diets and conditions are available. Further, the dry medium could probably be mixed in bulk and stored or the wet mix prepared and deep-frozen until required, an expedient which is frequently used in this laboratory.

Two other variations have failed to effect improvements in the breeding medium. First, substitution of the cheaper dried skim milk for dried whole cream milk increased the number of pupæ per culture but so markedly decreased the average weight of individual pupæ that the biomass per culture unit was decreased. Further, the skim milk-reared flies took longer to come to egg production and the total yield of eggs per rearing unit was less than half that of those reared on the whole milk diet. Information for eight rearings is summarized in Table 1. Secondly, when cholesterol amounting to 1·0 per cent of the dry weight of yeast and milk powder was added to the medium[6] and compared with the normal rearing medium (Table 1) there were no real differences in numbers of pupæ reared, average weight of pupæ, initial egg production or the total egg yield.

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Response to Movement by *Formica polyctena* Forst.

ANTS of the *Formica rufa* group often overlook suitable prey if it does not move[1] and often attack insects not normally preyed upon if they perceive movement[2]. The following experiment was designed to obtain more accurate information on the role of prey movements in the searching behaviour of worker ants.

A small spindle was placed through the centre of the floor of a 1 m² forage area of a colony of 3,000 workers of *Formica polyctena* Forst. A portion of the spindle below the floor was fitted with vanes, allowing the spindle to be rotated by air blown through a rubber tube from a small aspirator bulb. The portion of the spindle above the floor was fitted with either a small white paper flag painted black on one side, or a small drum with black and white vertical stripes. The flag, because it was off-centre, caused a vibration when rotated. When in use these two objects were covered with one of the following: (1) an opaque cover that prevented the