

tryptophane (F.A.O., 1968) than the rest of the cereals used. These amino acids are essential for the normal growth and development of *Drosophila* (Lafon, 1939; Hinton et al, 1951). Thus, jowar fulfills all the requirements for boosting up BMR, subsequently yielding healthy pupae as judged from higher pupal weights.

Table 2. Composition of cereals used (Aykroyd, 1966)

| Cereal name | Moisture | Fat | Protein | Carbohydrates | Minerals |
|-------------|----------|-----|---------|---------------|----------|
| Jowar | 11.9 | 1.9 | 10.4 | 72.6 | 1.6 |
| Wheat | 12.8 | 1.5 | 11.8 | 71.2 | 1.5 |
| Barley | 12.5 | 1.3 | 11.5 | 69.6 | 1.2 |
| Bajra | 12.4 | 5.0 | 11.6 | 67.5 | 2.3 |
| Corn | 14.9 | 3.6 | 11.1 | 66.2 | 1.5 |
| Rice | 13.7 | 0.5 | 6.8 | 78.2 | 0.6 |

Although wheat has more protein content than jowar, it is a poor source of tryptophane, methionine, leucine, isoleucine, phenylalanine, threonine, etc. The amount of total hydrolysable starch is also less than that in jowar. Wheat therefore furnishes comparatively less energy for boosting up BMR. Though almost identical to jowar in fat and mineral content, the above-mentioned major deficiencies in wheat have culminated in pupae with lower weights.

Barley and bajra rank third and fourth respectively in order of their nutritional value as judged from pupal weights. Barley is found to be superior to bajra, perhaps due to its high content of total hydrolysable carbohydrates. In protein contents, both barley and bajra are almost identical as far as the quantity is concerned, but the former has more hydrolysable protein than the latter (Aykroyd, 1966). Further, barley is richer in essential amino acids (isoleucine, lysine, phenylalanine, threonine, valine and histidine) than bajra (F.A.O., 1968). Although bajra is richer in fat than barley, it seems that this alone does not become a decisive factor for growth in the early stages of development.

Corn, which is very widely used in the preparation of *Drosophila* medium, ranks fifth in order of its nutritive value, judged from pupal weights, amongst the cereals tested here. It has less minerals and lesser amount of hydrolysable carbohydrates. Although it is quite rich in protein quantitatively, it is inferior in being lysine deficient, poor in tryptophane and other essential amino acids (Block et al, 1951).

Rice comes last in its nutritive value. It is very poor in mineral content and poorest in fat content. Although rice affords appreciably higher carbohydrate content than the rest, its total hydrolysable carbohydrate is comparatively less. Rice is not only low in protein content, but also poor in leucine, isoleucine, histidine, tryptophane, etc. It seems from the lowest pupal weights observed, that due to lack of these essential amino acids, the available energy cannot be channelised for larval growth.

References: Aykroyd, W.R., 1966 in *The Nutritive Value of Indian Foods and the Planning of Satisfactory Diets*, Revised VI Ed. by Gopalan, C. and S.C. Balasubramaniam (Indian Council of Medical Research, New Delhi); Block, R.J. and D. Bolling, 1951 in *The Amino Acid Composition of Proteins and Foods: Analytical Methods and Results*, Charles Thomas Pub., Springfield, Ill.; Bridges, C.B. and H.H. Darby, 1933 *Amer. Nat.* 57: 437; Delcour, J., 1969 *DIS* 44: 133; F.A.O., 1968 *Amino Acid Content of Foods and Biological Data on Proteins by Food Consumption and Planning Branch, Nutrition Division*; Hinton, T., D.T. Noyes and J. Ellis, 1951 *Physiol. Zool.* 24: 335; Lafon, M., 1939 *Ann. Physiol. Physiochem. Biol.* 15: 215; Sahasrabudhe, D.L. 1948 in *Research Papers on Food Problems*, N.W. College, Poona.

Moth, J.J. and J.S.F. Barker. University of Sydney, N.S.W., Australia. Estimation of relative fecundity of two genotypes (or species) in mixed populations.

There is ample evidence that the fitness of genotypes or species in mixed populations cannot generally be predicted from estimation of fitness (or fitness components) in pure populations (e.g. Barker and Podger 1970). We are interested in analytical analyses of competitive outcome between various strains of *D. melanogaster* and *D. simulans*, and particularly in the effects of variation in population density and relative frequency of the two species on components of fitness. As the eggs of these species are indistinguishable, analyses of

fecundity in mixed populations would be simplified if those laid by one species were marked in some way. A suitable technique is presented here. By rearing *Drosophila* on media containing the isotope ^{32}P it is possible to obtain adult females which lay 100% labelled eggs. This technique could be readily used for identifying eggs to species (or genotypes) in any competitive situation where eggs are otherwise indistinguishable.

Table 1. Exposure times for eggs tested immediately.

| Time after eclosion of egg laying (hrs) | Exposure time in days | Film type |
|---|-----------------------|-----------|
| 0 - 18 | 1.5 | AA* |
| 19 - 30 | 2.5 | AA |
| 31 - 42 | 2.5 | AA |
| 43 - 54 | 2.5 | AA |
| 55 - 66 | 8.5 | AA |
| 67 - 78 | 8.5 | AA |
| 79 - 90 | 9.5 | AA |
| 91 - 102 | 9.5 | AA |
| 103 - 114 | 4.5 | IND** |
| 115 - 126 | 4.5 | IND |
| 127 - 138 | 6.5 | IND |
| 139 - 150 | 6.5 | IND |
| 151 - 162 | 8.5 | IND |
| 163 - 174 | 8.5 | IND |

* Kodak industrial X-ray film type AA.

** Kodak industrial X-ray film.

previously) are allowed to lay eggs in each bottle for twenty four hours. Each bottle will produce between 1,000 and 2,000 labelled, optimally reared adults from these eggs. For at least the first seven days after eclosion 100% of eggs laid by females so reared will be labelled.

Table 2. Exposure times for eggs held four days after laying before testing.

| Time after eclosion of egg laying (hrs) | Exposure time in days | Film type |
|---|-----------------------|-----------|
| 31 - 42 | 2.5 | IND |
| 43 - 54 | 3.5 | IND |
| 55 - 66 | 6 | IND |
| 67 - 78 | 6.5 | IND |
| 79 - 90 | 7 | IND |
| 91 - 102 | 7 | IND |
| 103 - 114 | 9 | IND |
| 115 - 126 | 9 | IND |
| 127 - 138 | 9 | IND |
| 139 - 150 | 10.5 | IND |
| 151 - 162 | 10.5 | IND |
| 163 - 174 | 10.5 | IND |

turer.

In our experiments, cohorts of labelled *D. simulans* and unlabelled *D. melanogaster* adults (and vice versa) were allowed to lay eggs on agar slabs coated with a thin suspension of dead yeast. Every 12 hours this agar slab was removed and all eggs and yeast thoroughly dispersed in a 14.5 g sucrose/100 ml water solution at 20°C. After a few seconds the yeast settles and the eggs remain suspended in the sucrose solution. A sample of approximately 250 eggs was taken, and with the aid of a Buchner funnel the sucrose solution removed and eggs collected on a 7 cm dark green filter paper. (Note: No more than 300 eggs should be spread on a 7 cm paper or the individual egg exposures will merge and be indistinguishable.) Each filter

The isotope ^{32}P is obtained as orthophosphate in a dilute HCl solution with high specific activity. A known activity is diluted with water so that 1 ml of solution has approximately 35 microCuries of activity. 1 ml of this diluted solution (i.e. 35 μCi) is thoroughly mixed into 30 ml of Medium F (Claringbold and Barker 1961) in a quarter pint cream bottle before solidification. (Note: No more than 1 ml should be added to the medium or it will become too watery.)

After the medium has cooled, twenty five pairs of adults (which have been fed yeast for two days

Labelled eggs are detected by their ability to expose X-ray film plates. Exposure times and types of film plate used are given in Table 1 for eggs tested immediately after collection.

If eggs are not tested immediately but held for a period of time, the length of exposure must be increased because of a rapid loss of activity. (The half-life of ^{32}P is 14.3 days.) Table 2 gives exposure times and film plate type for eggs held four days. This delay before testing is necessary when one wishes to identify dead and infertile eggs (Stalker 1954).

Development, for these two types of plate, is according to standard procedures outlined by the manufacturer.

paper has attached a 2 cm by 2 cm label of thin white paper. Onto this label is written, in heavy black (e.g. with a Pentel pen), the treatment number. This filter paper was then put against a film plate but separated from it by a thin plastic sheet (0.01 mm) to prevent eggs sticking to it. The film plate, with filter papers held firmly against it by a sheet of clear glass, was then exposed to a 15 watt incandescent light source 120 cm above for 7-9 seconds. This blackens the part of the film plate not covered by a filter paper, making a clear outline around each paper, and permanently marks onto the plate the treatment number of the filter paper. (Light penetrates the white paper label but not the black writing on it, thereby forming an image of clear writing on a grey background.) Resultant exposures according to Tables 1 or 2 indicate eggs laid by *D. simulans* and by subtraction from the total, the number laid by *D. melanogaster* was determined. (Work supported by Australian Research Grants Committee.)

References: Barker, J.S.F. and R.N. Podger, 1970 *Ecology* 51: 170-189; Claringbold, P.J. and J.S.F. Barker, 1961 *J. Theoret. Biol.* 1: 190-203; Stalker, H.D., 1954 *Genetics* 39: 4-34.

Rushton, J. and J.A. Metcalfe. University of York, England. A behavioural mutant of *Drosophila melanogaster*: "Amiel".

The mutant to be described here was found in a dumpy-oblique (dp^0) stock during a comparative analysis of the courtship behaviour of this stock with a wild type strain. This mutant apparently affects the behaviour of the males

only (irrespective of whether he courts dp^0 or wild type females) since dp^0 females show normal courtship behaviour with wild type males.

Observations were made on 4 day old flies in perspex mating chambers of 2 cm. diameter. The behavioural sequence was recorded up to the time of copulation or for the first hour. The pairs of flies which did not mate within this time were classed as non-mating.

A continuous and permanent record of the mating behaviour was made using a kymograph and 5 pointers which were manipulated through a battery by a 5-way switch. Each pointer corresponded to a particular element of mating behaviour viz., orientation, scissoring, vibration, licking and attempted or successful copulation.

The mutant males differ from wild type males in the following features:

1. The mutant males are less successful at stimulating females as indicated by the facts that the duration of courtship is significantly longer for dp^0 than wild type males, and that the percentage of unsuccessful matings is also much higher (dp^0 24/41 = 59%; + 6/46 = 13%).

2. Mutant males always initiate courtship upon entry into the mating chamber by wing vibration and not, unlike wild type males, by orientation although orientation after this initial bout does not seem to be affected.

3. Mutant males have fewer rest periods (percentage of time inactive being significantly lower) despite the fact that the total courtship time is longer.

4. The amount of scissoring is significantly reduced but both vibration and attempted copulations are much increased (percentage of time spent and the number of bouts per minute being significantly different for all 3 behavioural elements).

Thus, although the mutant males are more active than wild type males they are in fact less successful. The reduced amount of scissoring, which normally plays an important part in the stimulation of the female, is not compensated by an intensification of other elements of mating behaviour such as vibration and attempted copulation. Or, possibly, the female regards the high activity of the mutant males, in combination with the different pattern, as aggressive rather than courtship behaviour. Outcrossing, reciprocally, the dp^0 stock to wild type, showed that the mutant is recessive and not sex linked since both types of heterozygotes behaved as wild type. However, of the 17 progeny of heterozygotes tested 2 showed the same abnormal behaviour.

That the abnormal behaviour does not result from the oblique wing is indicated by the fact that both dp^0 males which manifest an oblique wing and those which manifest a normal wing behave abnormally. Furthermore, although the courtship time of dumpy (dp^{02}) is significantly longer than that of wild type their behaviour pattern is normal.

Behavioural mutants such as described here may prove to be useful in analyzing which elements or pattern thereof of the male's mating behaviour produce the greatest response in the female.