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The Pgm locus in Baetis harrisoni (Insecta: Ephemeroptera)

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ABSTRACT

A population of Baetis harrisoni is polymorphic for phosphoglucomutase allozymes, coded for by a locus (probably autosomally inherited) with three alleles segregating; heterozygosity is 0,66 $\pm$ 0,08; there is no hybrid isozyme band; distribution of genotypes follows the expected pattern and the population studied forms a single gene pool.

Nymphs of Baetidae the family to which the animal studied belongs, form an essential component of the fresh water biota in most parts of the world. Ecologically they are primary consumers and thus a link between production and many sepcies of fish. Their study has a practical application in that they are useful as indicators of water quality.

Nothing is known concerning the genetic structure of populations in this order, living members of which are generally regarded as the remnants of the most ancient order of winged insects and yet form just over 2000 in number of species (compare genus Drosophila with approximately the same number of species). It is clear that aspects such as speciation, the possibility of sibling species, levels of gene diversity and many others are worthy of study in this group. The development over the last two decades of newer techniques, e.g. the isozyme concept makes such studies feasible.

Reported here is the occurrence of multiple variants (electromorphs) of Pgm (phosphoglucomutase, EC 2.7.5.1) in a single population of B. harrisoni, a widespread species in southern Africa. Pgm catalyzes the transfer of glucose-1-phosphate to glucose-6-phosphate in carbohydrate metabolism.

Material and Methods

Mature nymphs, that is, in one of the last few instars, of B. harrisoni were collected from a local stream in the Johannesburg area. In the laboratory, nymphs were individually ground in wells in 0,01 ml buffer and each homogenate absorbed by a 3 x 9 mm strip of Whatman No. 1 paper. Strips were inserted in 8 percent starch gels; gel slabs underwent horizontal electrophoresis at 50 mA constant current for 5 hours using a tris-citric acid-EDTA buffer system for both gel and bridge. After running, 2 mm thick gel slices were incubated in 100 ml of 0,1 M tris-HCl buffer (pH 7,1) containing 20 mg NBT, 10 mg NADP, 200 mg $MgCl_2$, 600 mg glucose-1-phosphate and 80 units G6PD; after 1 hour, 5 mg of PMS was added to visualize the isozyme bands.

Results

A single zone of activity was noted in all 46 genomes tested, suggesting control by one locus for the Pgm isozymes in this species. Three alleles Pgm^{100}, Pgm^{102} and Pgm^{98} with approximate frequencies 0,80, 0,11 and 0,09 were found to be segregating in the population. The six possible combinations were as follows:

PHENOTYPES	FOUND	EXPECTED	
100/100	16	15	
100/102	2	4	
100/98	3	3	
102/102	1	< 1	1
102/98	1	< 1	
98/98	0	< 1	
	23	23	

The found numbers did not deviate significantly from those expected under Hardy-Weinberg equilibrium so the population forms a single gene pool, random-mating at least in respect to this locus.

Heterozygotes did not show a hybrid band, and this is in accord with the situation described for phosophoglucomutase in man (Spencer et al. 1964), and Drosophila (Hjorth 1970; Trippa et al. 1970), and Anopheles (Bullini et al. 1971).

The heterozygosity (h) of the B. harrisoni population in respect of this locus was $0,66 \pm 0,08$.

Discussion

The zymogram suggests that the Pgm locus in the species studied is autosomally inherited, as in Drosophila melanogaster (Hjorth 1970; Tripp et al. 1970) whereas it is sex-linked in D. pseudoobscura (Dobzhansky et al. 1971). Further studies would be needed to obtain certainty on this point.

The biological significance of this particular polymorphism is unknown,

but it is interesting to note that the situation is similar to that found in various stains of Anopheles studied by Bullini et al. (1971), where three alleles at varying frequencies were found segregating. It may be noted though, that from studies on widely separated animals, phosphoglucomutase is one of the most polymorphic enzymes known (Ayala 1976).

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