

Effectiveness of selection based on variability uncomplicated by heterotic effects

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Abstract

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Selection for rapid growth is being practiced in progenies of inter- and intra-strain crosses of *Neurospora* to determine the rate of progress based on variability achieved through recombination uncomplicated by

heterotic effects. Additional information, including environmental effects, should make it possible to develop and test mathematical genetic models for quantitative traits in haploid organisms.

Progenies of inter- and intra-strain crosses, including reciprocal crosses between *Neurospora* strains from Honduras and the Philippine Islands and the standard St. Lawrence strains of *N. crassa*, 74A and 77a, are under various stages of selection. Selection is carried out at each of three temperatures (18°C, 25°C, and 35°C) and each cross at each temperature replicated. Twenty progeny (10 of each mating type) from each cross at each temperature are grown in duplicate growth tubes every generation. The fastest growing progeny of opposite mating type are then crossed to obtain the population for the next generation.

Most of the inter-strain crosses have been carried through ten or more cycles of selection. Fewer cycles have been completed in the intra-strain crosses. Intra-strain crosses of Honduras and the controls (74A and 77a), in most cases, have exhibited a marked reduction in fertility with increased selection. This is primarily manifest in fewer perithecia being formed, ascospores failing to mature and an increased

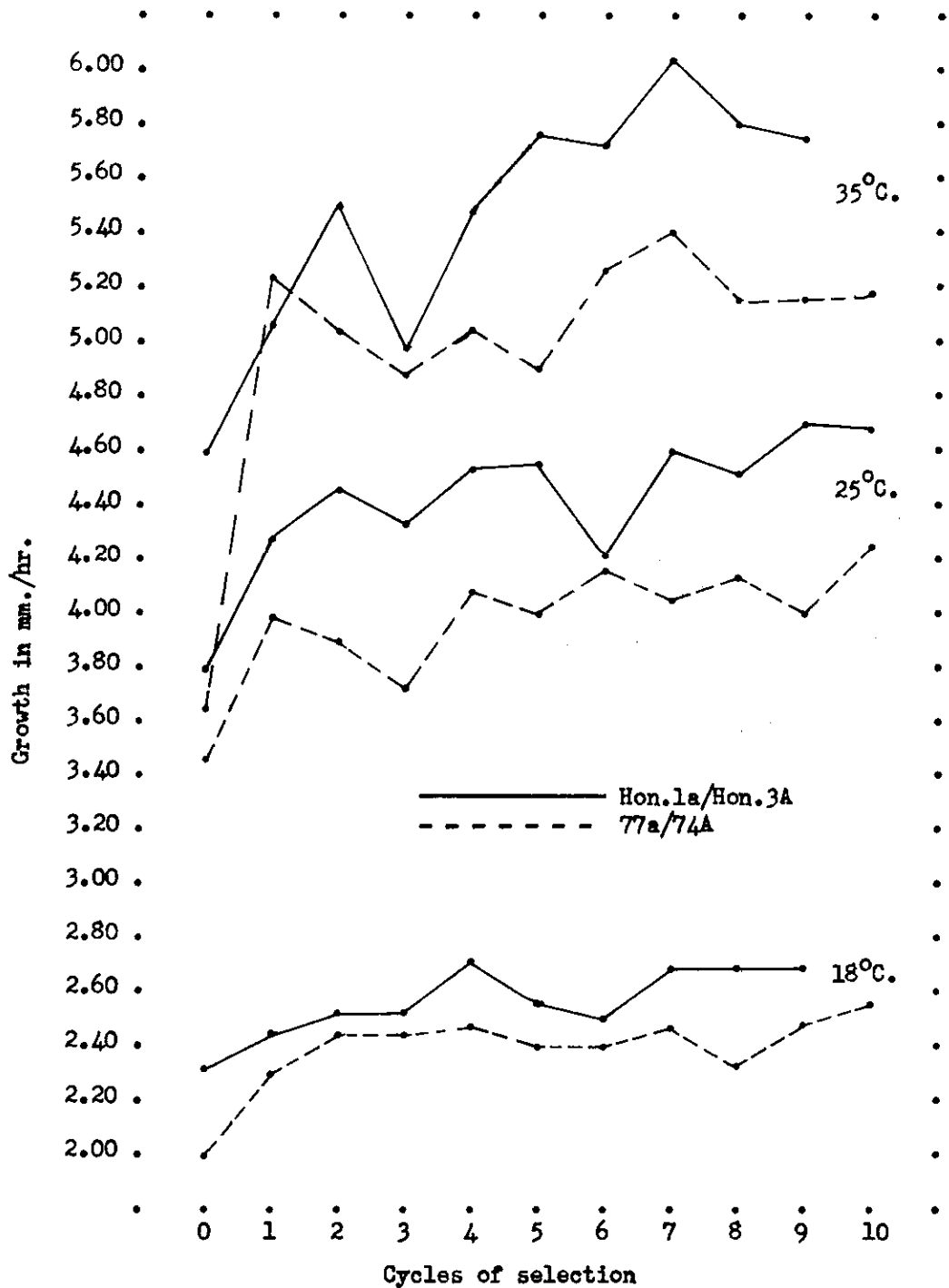


Figure 1. Mean growth rate for two intra-strain crosses of *Neurospora* at three temperatures. Each mean is based on twenty progeny with two observations/progeny.

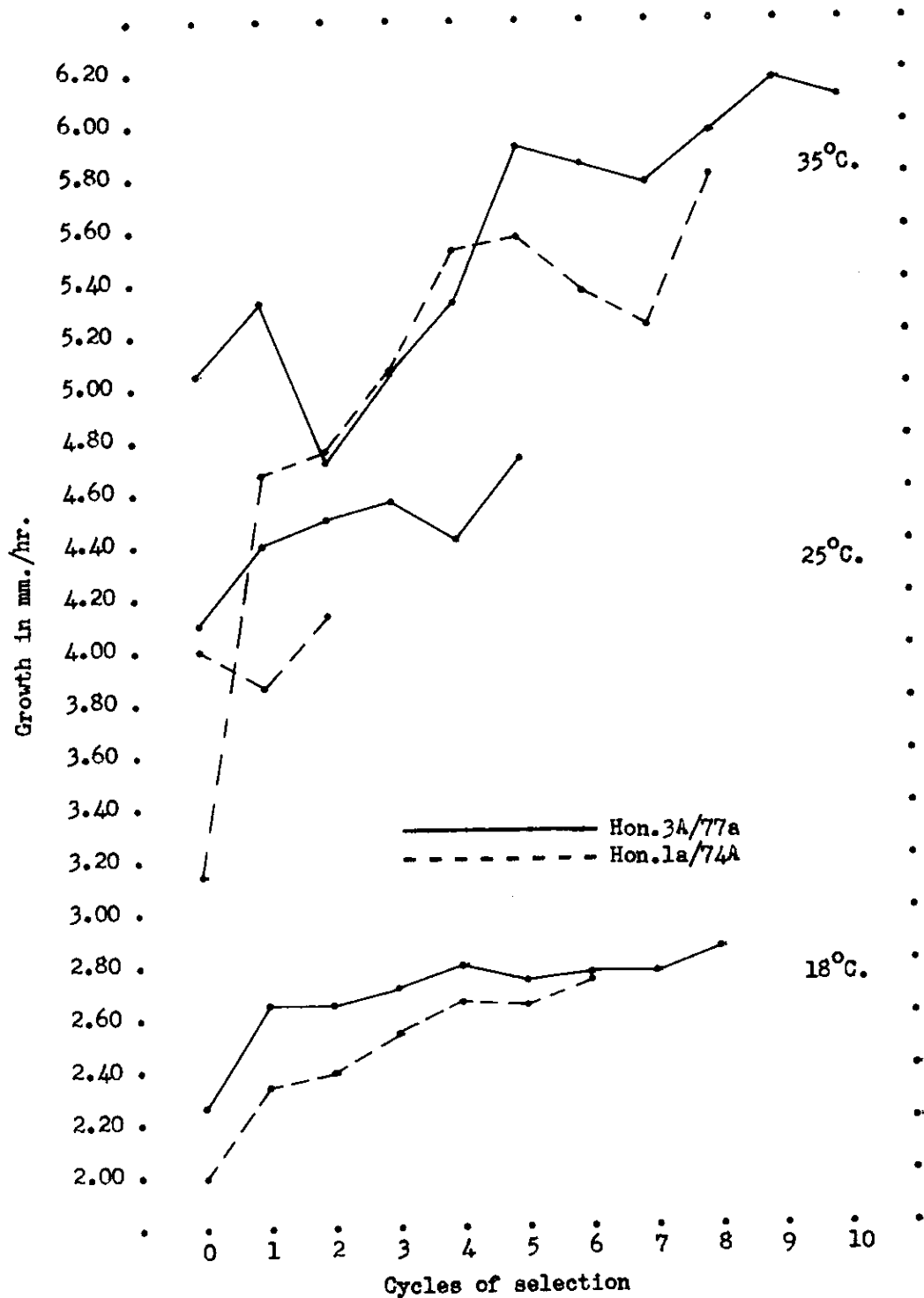


Figure 2. Mean growth rate for two inter-strain crosses of *Neurospora* at three temperatures. Each mean is based on twenty progeny with two observations/progeny.

frequency of mature ascospores failing to germinate.

The data obtained thus far indicate that selection has been effective in increasing growth rate. Figures 1 and 2 show the progress attained through selection in two intra- and two inter-strain crosses. As can be seen from figure 1 (two inter-strain crosses), considerably more progress was made in the cross Hon. 1a/Hon. 3A than in 77a/74A. This is not surprising, since 74A and 77a are highly inbred and improvement in growth rate in these lines in contrast to the other cross would seem more dependent on favorable mutation and less dependent on favorable recombination.

Slightly more progress was attained in the inter-strain crosses as shown in fig. 2. In most of the inter-strain crosses studied thus far, the unselected progeny means of the original crosses are greater than those of the intra-strain crosses. This is not entirely true, however, in the four crosses included in figure 1 and 2 at 18°C. In addition, lower progeny means for the unselected original crosses were obtained at 35°C in each case where 74A was used as either parent due to one or more temperature sensitive genes evidently present in this strain. These genes appear to be eliminated following one cycle of selection at 35°C.

Statistical analyses of the data indicate a lower genetic component of variance among the progeny as the number of cycles of selection increases. The rate at which the variance is reduced appears to be directly correlated with the type of cross involved (inter- or intra-) as well as with the strains used in the original crosses. A reduced variation among progeny accompanied by no significant increase in mean growth rate for several consecutive cycles should offer some indication of the extent to which selection, in the manner outlined, can be continued. Although all of the data have not yet been statistically analyzed, there appear to be no real differences between reciprocal crosses. Therefore, extra-chromosomal effects on growth rate in this study are either absent or too minor to detect. ---Department of Plant Breeding, Cornell University, Ithaca, New York.