The Size of *Nicotiana rustica* × *Nicotiana tabacum* Hybrid Embryos and Hybrids in Respect to their Parents.

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ASHBY (1930, 1932) in studying the problem of hybrid vigour in maize, found a dependence between the size of the hybrid embryos and the hybrid vigour. According to Ashby (1936) "the final size of a plant is the resultant of the initial size of its primordia and the relative growth-rate. Since in relative growth-rate the hybrid had no advantage over its parents, size-heterosis must have been due to an initially bigger primordium. In other words, if the rate of compound interest in the hybrid is no bigger, its capital of dividing cells must be higher. The simplest way to measure this capital is to dissect the primordia (plumule and radicle) from the embryo and weigh them. When this was done it was found that the hybrid embryos were bigger than those of either parent, and the size heterosis observed in these experiments was due solely to the maintenance of this initial advantage in primordial size" (Ashby, 1936). He recorded that he has obtained the same results in experimenting with beans and six strains of tomatoes. Ashby's (1930–37) statements were recently supported by Luckwill (1937).

In studying the cell size in vigorous and dwarf hybrids, Kostoff and Arutiunova (1935, 1936) found that the vigorous hybrids have not larger cells than their parents, consequently their vigour is attained by more rapid cell division.

What concerns the relation between embryo sizes and "vigour" I found some data in *Nicotiana* species crosses which show that hybrid embryos might be very small, much smaller than the embryos in either parent, nevertheless, the hybrids that develop from them are very vigorous. This phenomenon can be observed in a series of interspecific hybrids in *Nicotiana*. I shall give here, however, as an example, the cross *Nicotiana rustica* × *N. tabacum*.

Hybrid embryos in mature seeds produced by crossing *N. rustica* with *N. tabacum* are very small. A large number of them do not germinate but even those that do germinate are much smaller than the embryos of either parents. I have crossed flowers of *N. rustica* with pollen of *tabacum* and at the same time I selfed flowers from the parental species. The capsules became yellowish, thirty days after the crossing and selfing and the seeds dark-brown, which means that they were mature. Such capsules were fixed and from them paraffin sections were made. Then the embryos were measured and the data obtained are given in Table I.

TABLE I.

The Length and the Breadth of the Embryos 30 days after Pollination (i.e., when it is Completely Mature).

No.	Embryos from species and hybrids	Somatic chromosomes	Length in microns			Breadth in microns		
			n	M	σ	n	M	σ
1	*N. rustica* selfed ..	48	150	998·5	12·1	150	764·3	9·6
2	*N. tabacum* selfed ..	48	150	684·2	10·5	150	503·7	8·4
3	The cross F_1 *N. rustica* × *N. tabacum*	48	150	181·7	18·1	150	126·3	15·3
4	Amphidiploid *N. rustica—tabacum* ..	96	20	936·3	15·6	20	718·2	11·7

I raised plants from hybrid seeds *N. rustica* × *tabacum* as well as from the pure parental species under equal environmental conditions and the plants were measured at the end of their florescence period (October 8th). It was found that from exceedingly small embryos, very vigorous F_1 hybrids have developed.

I also included in the experiment the amphidiploid *N. rustica — tabacum* plants (2n = 96). They also were much larger in size than the parental forms, but smaller than the F_1 hybrids (Table II). It should

TABLE II.

The Size of the Parental Plants and the Hybrids in cm.

No.	Species and hybrids	Somatic chromosomes	n	M	σ
1	*Nicotiana rustica* ..	48	30	82·8	2·9
2	*Nicotiana tabacum*..	48	30	96·2	3·0
3	F_1 hybrid *N. rustica* × *tabacum* ..	48	9	148·5	2·9
4	Amphidiploid *N. rustica—tabacum*	96	20	128·9	3·7

be mentioned here that amphidiploid *N. rustica – tabacum* is not constant (Kostoff, 1937) because it forms quadrivalents, trivalents and univalents during the meiosis which accounts for its greater variability ($\sigma = 3 \cdot 7$) no matter that for the experiment uniform seedlings were selected, which were morphologically like F_1 hybrids.

Hybrid embryos in our case are smaller than those of either parents, because their physiology in general and the physiology of development in particular, is different from that of the maternal plant. The hybrid embryos *N. rustica* × *tabacum* are somewhat foreign for the maternal plant *N. rustica* having 50 per cent. of its genetic nature from *N. tabacum*. If the hybrid embryos were not grown on maternal plant they probably would not be as small as they really were. The reactivity of the maternal organism might also suppress somewhat the hybrid embryos in some respects, the latter being somewhat foreign for the mother (*cf.* Kostoff, 1930).

These ideas were inferred on the basis of the relative size of the normal embryos, hybrid embryos grown in *N. rustica* organism, and the hybrid embryos that develop in the amphidiploids, the latter being considerably larger than those grown in *N. rustica* organism, no matter that they have about the same genetic constitution. It seems that the differences in size of amphidiploid embryos and F_1 embryos are not exclusively due to the polyploid nature of the former.

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The Hayes Radiometer as a Fog Signal.

FOG, shipping's deadliest enemy, appears one step nearer defeat with the announcement of successful heavy weather signalling by means of the Hayes Radiometer, originally invented as an extremely sensitive device for measuring heat radiation. Its inventor, Hammond V. Hayes of Boston, reports in the September, 1937, *Review of Scientific Instruments*. The instrument makes practical the long hoped-for means of signalling by use of heat radiation instead of light. Heat rays penetrate foggy and thick atmosphere much more strongly than does light. Boston harbour during the last winter was the trial ground for the radiometer, which is being improved as a result of the first experiments. Signals were sent successfully a distance of more than a mile and a half on days when visibility was so poor that objects situated much nearer than the heat source could not be picked out.

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