SHOOT TIP ABORTION IN PEA SEEDLINGS (PI 356980) AS AFFECTED BY GERMINATION TEMPERATURE

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Seeds of Pisum sativum ecotype arvense L. (PI 356980) normally germinate to produce monopodial seedlings having a dominant apical meristem. Secondary branches may develop when the young plant has produced several nodes, but usually do not, at least not under greenhouse conditions. Some seedlings are atypical, however, in that the stem tip dies at an early stage of development, usually before the third internode is fully elongated, and one or more branches then arise from the cotyledon axes, or from the axis of the first or second cataphyll. It had been noted previously that the numbers of such branched seedlings seemed to vary with germination temperature. To test whether this was indeed the case and not simply a chance selection of disparate seed lots, the F2 generations of each of six crosses made by G. A. Marx (PNL 11:25-26, 1979) were divided into two parts, one to germinate at a low temperature of 10°C or 13°C, the other at the higher temperature of 20°C.

Seeds were soaked for 24 hours after surface sterilization with sodium hypochlorite, scarified if not swollen by that time, and placed on a thin layer of moist vermiculite in a 9 cm Petri plate. Germination, including the soaking period, proceeded under a 16-hr photoperiod provided by fluorescent lamps. Seedlings were removed from the Petri plates as the epicotyls emerged and planted into vermiculite, 5 per 4 in pot, for continued growth in the same environment. The numbers of abnormal seedlings were counted only when extension growth of the fifth internodes had been completed, by which time an unequivocal distinction between normal and abnormal could be made.

As Table 1 clearly shows, the tip death rate at 10°C or at 13°C ranged from 0 to 9%, while at 20°C the range was from 10% to 32% and thus invariably higher. The difference in response to temperature was not the same among all the six familes and involvement of a genetic factor is suggested. Causes of the premature death of the stem tip remain to be discovered. The fact that only the primary apex is affected while the apical tips of secondary branches develop normally indicates that it results from abnormal differentiation of the epicotyl during seed development.

Table 1. A comparison of apical death rates when six F_2 families of pea seeds of PI 356980 were each divided into two comparable groups for germination at different temperatures.

Parentage* of F_2 family	Temperature (°C)	No. seeds germinated	Apical death (%)	Increase in apical death at 20°C (%)
2-8-2 x 2-4-6	10	46	0	
	20	152	14	+ 14
2-4-6 x 5-18-4	10	48	4	
	20	98	15	+ 11
10-5-3 x 2-8-5	13	152	1	
	20	151	18	+ 17
10-5-7 x 2-4-3	13	70	7	
	20	112	26	+ 19
10-5-5 x 5-18-2	13	82	8	
	20	96	10	+ 2
2-8-1 x 10-5-7	13	103	9	
	20	103	32	+ 23

*Notations as used in PNL 11:25-26, 1979, modified to indicate which of the second generation offspring was used as parent