INTERNODE LENGTH IN PISUM. THE INTERACTION OF GENES lv AND lk

Reid, J.B. Department of Plant Science, University of Tasmania
Hobart, Tasmania 7001, Australia

Gene lk is a recessive mutation which, when homozygous, results in the very short, stout erectoides phenotype (2). Such plants show a very much reduced response to the application of GA_1, the endogenous active gibberellin in peas, compared with Lk plants (4). In contrast, gene lv results in an increase in internode length in plants grown in white light and an increased response to applied GA_1 (5). This gene is thought to partially block the transduction chain from physiologically light stable phytochrome, leading to an enhanced GA_1 response and consequently increased elongation (1). Therefore it is of interest to determine the interaction of the lk and lv genes and to identify the phenotype of homozygous lk lv plants. The selection of genotype lk lv may also be of use in future physiological studies examining the control of the GA response.

These questions were examined by crossing lines NEU3 (genotype le La cry^C Na Lm Lh Ls Lk Lw Lka Lkb lv, 5) and JI1420 (le La cry^C Na Lm Ls Lh lk Lw Lka Lkb Lv, 2). The F_1 was dwarf (5) and the F_2 segregated to yield 16 erectoides and 61 non-erectoides plants (Fig. 1). The non-erectoides group may be further divided into 44 dwarf and 17 taller plants (Fig. 1). This separation was not pronounced. The taller plants showed considerable variation and with two exceptions were substantially shorter than the NEU3 parent. Likewise the dwarf progenitor of NEU3, cv Sparkle, was substantially longer than the majority of the dwarf segregates. This appears to have occurred because the Sn-sn pair of alleles were probably also segregating in this cross (JI1420 appears to carry Sn while NEU3 carries sn) (see 3). This would also explain the variability within these groups and the poor separation between the dwarf (Lk Lv le) and taller (Lk lv le) plants (see 3). The overall F_2 segregation of 16 erectoides, 44 dwarf and 17 taller plants (Fig. 1) is in agreement with both a 3:9:4 and 4:9:3 segregation ratio (χ^2_2 = 0.4 and 1.0, respectively). In the F_3, the erectoides class bred true (6 progeny from each of 6 F_2 plants) while of the 4 "tall" F_2 plants tested in F_3 (12 progeny per F_2 plant), one segregated to give 3 erectoides and 9 "tall" plants. Consequently it appears that gene lk is epistatic to the gene lv and genotype lk lv (on a le background) possesses an erectoides phenotype. The mean length between nodes 4 and 6 was 1.40 ± 0.15 cm (n=3) for the lk lv F_3 segregates. This was slightly longer than the overall mean for F_3 progeny from a selection of erectoides (lk) F_2 segregates (1.03 ± 0.06 cm, n=12).

The results suggest that the GA-non-responsive character conferred by lk over-rides the GA-hyper-responsive character conferred by lv to cause genotype lk lv to possess an erectoides phenotype. However, lv may still exert some small quantitative effect within this erectoides group comparable with that caused by the slender gene combination (la cry^S) (see 2).

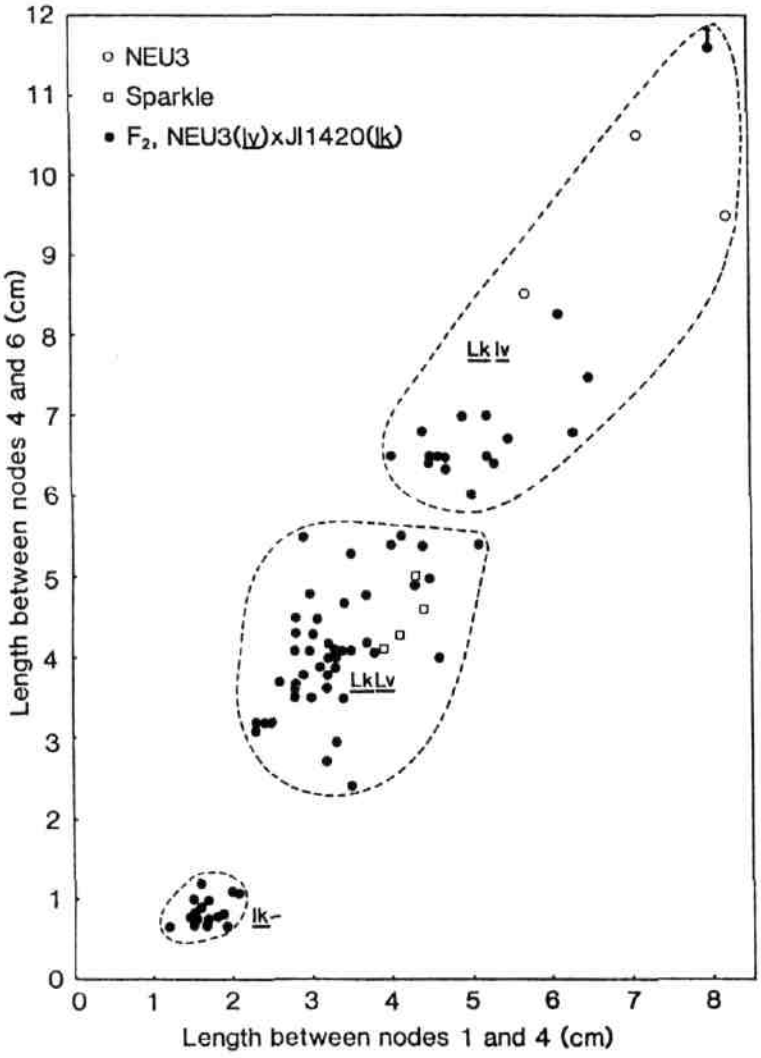

Fig. 1. Stem length between nodes 1 and 4 versus stem length between nodes 4 and 6 for F_2 plants from cross NEU3 (lv) x JI1420 (lk) (●). NEU3 (○) and Sparkle (□) controls are shown. The photoperiod was 18 h.

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