A novel allele at the *Afila* (*Af*) locus and new alleles at the *Tendril-less* (*Tl*) locus

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The *aflila* (*af*) mutation in pea has been widely used since the early 1970s following the suggestion that the additional tendrils may assist with standing ability of the combined crop (1). The fully 'leafless' pea (*af*,st) was one of the initial ideotypes for a dried pea breeding program at the John Innes Institute and later was widely taken up by private breeders. The first 'leafless' variety was released in the UK in 1978 as the cultivar Filby (JI 1768). The tendrils, leaf rachis, reduced stipules (st) and stem of the 'leafless' ideotype were able to produce sufficient photosynthate not to limit the development of the sink, i.e. seeds (2) at normal agronomic densities. The ideotype was found to be limited when grown at low planting densities (where plants were in larger spaces), thus there was a limitation to the total biomass of plants and hence the crop with this genetic constitution (3). The solution was to retain the *afila* (*af*) allele but revert to the use of wild type stipules (St). The increase in laminar tissue overcame the problem of the fully leafless form and the 'semi-leafless' (*af*,St) model has adopted by most pea growing countries of the world for the past 30 years. The ability to manipulate leaf form in the pea crop is therefore of considerable interest, and novel alleles of known mutants with new phenotypes are of potential commercial interest.

A paper by Vassileva (4) included an image of a novel foliar mutation described as *afila* (11/47 *AFILA*) induced in the cultivar Raman by a combination of gamma rays and fast neutrons While crosses between the mutants were reported no reference to allelism tests were included. Seed of the mutant and two new acacia (*tl-w*) mutants generated within the same program, were tracked down to the Nordic Gene Bank (Table 1). The acacia or tendril-less mutants were crossed to each other and to an F9 recombinant inbred line (JI15 X JI 73/128 tl) homozygous for the tendril-less type allele *tl-w*. All F_1 plants were classic *tl-w* phenotype indicating the two new mutants to be new alleles at the *Tl* locus.

The F_1 plants from the cross between JI 3129 and JI 3111 (*af*) were all classic *afila* phenotype. Segregation in the F_2 of crosses with wild type (*Af*) lines showed the mutation to behave as a single recessive allele and the novel phenotype (*Fig. 1*) was consistent for all crosses and not a consequence of the genetic background of the initial line. The mutation in 11/47 (JI 3129) is confirmed as a new allele at the *af* locus which is weaker than existing alleles.

Table 1. Germplasm accessions

JI Number	Name	Nordic Genebank No.	Initial line
3128	1/101 ACACIA	WL 6026	RAMONSKII 77
3129	11/47 *AFILA*	WL 6033	RAMAN
3130	V/234 ACACIA	WL 6047	IREGI-5
2225	RAMONSKII-77	WL 2100	-
3131	IREGI-5	WL 2166	-
3133	RAMAN	WL 2168	-

The *afila* mutation of line JI 3129 is characterized by a pair of leaflets of normal size and morphology or a single leaflet at or just after the ramification of the central rachis (figs. 1a and 1b). The majority of leaflets are borne on the leaf rachis as they are normally but some at high nodes were observed on the outside edge of a rachide. Occasionally leaflets were observed borne on short petiolules. Leaflets are seen as early as node 4 and increase in size on consecutive vegetative nodes. The size and frequency of leaflets decreases after flowering which, coincides with the usual reduction in the overall size of the structures at the top of the plant. The number of ramifications of the central rachis is consistently 3 as opposed to the usual 5 in other *afila* mutations, thus there is a reduction in the total number of tendrils within each compound leaf.

Fig. 1. Compound leaves of the novel afila *mutation in 11/47-AFILA (JI 3129: a). from lower nodes (4-6), b) from higher nodes (10-12).*

Fig. 2. Plants of JI 3129 growing outside

The novel *afila* allele offers a number of useful features that warrant further investigation. It is possible that the presence of a pair of leaflets at each node may increase the photosynthetic capacity of the plant and enable further increases in biomass at lower densites. The presence of additional leaflets may result in an increase in the leaf area index of a crop early enough in crop development to cut light levels penetrating the crop and thus help suppress emerging weeds (*Fig. 2*). Despite a reduction in the total number of tendrils, there appear to be sufficient to help lock the canopy together.

The allele clearly offers the possibility of a distinct and stable character for use under plant variety rights, which alone should make it of interest to breeders. For these reasons I propose that this novel allele in an *St* background might usefully be referred to as 'semi-leafless+'.

Seeds of all lines are available from the John Innes Pisum collection.

1. Snoad, B. 1974. Euphytica 23: 257-265.
2. Hedley, C. L. and Ambrose, M. J. 1979. Ann. Bot. 44: 469-478.
3. Hedley, C. L. and Ambrose, M. J. 1981. Adv. Agron. 34: 225-277.
4. Vassiliva, M. M. 1979. Dokl. Bulg. Akad. Nauk. 32: 1425-1428.