FRUIT VARIATION IN *POLYGONUM PERSICARIA* L.

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ABSTRACT

The variation found in the fruits of *Polygonum persicaria* L. is described and analysed. A possible explanation of the variation is discussed. A new fruit type (tetragonal), believed to be previously unrecorded, is described.

INTRODUCTION

The 'seeds' of *Polygonum persicaria* are in fact the fruits (nuts) which fall from the parent plant with the dead perianth still attached. Styles (1962) found the relationship between the length of the nut and the length of the persistent perianth a useful character in section *Polygonum*, but it would appear to be of no value in section *Persicaria*.

The phenomenon of polymorphism of fruits or seeds is not common. The best-known example outside the *Polygonaceae* is *Rhynchospora*, which has fruits which are usually biconvex and rarely trigonous. In other members of the *Cyperaceae*, e.g. *Carex*, *Eleocharis* and *Schoenoplectus* the number of stigmas and hence the shape of the fruit is used as a species-separating character. Within the *Polygonaceae* only the genus *Polygonum* is recorded as having polymorphic nuts and within this genus polymorphy occurs only in sections *Persicaria* and *Echinocaulon*.

In *P. persicaria* the two fruit shapes found are:

(i) lenticular or biconvex to planoconvex which arise from flowers with two styles and lenticular ovaries;

(ii) angular or trigonous with three concave faces which arise from flowers with three styles and trigonous ovaries.

There is no apparent correlation between the position of the flower in the inflorescence and the type of nut produced. Both fruit shapes may be found on the same plant, and although considerable variation has been found in the relative numbers of each type, no plants have been found which have nuts of only one type. This situation may be compared with that found in *P. lapathifolium* in which the percentage of trigonous nuts is always very low and where plants may readily be found on which there are only biconcave nuts (Timson 1963).

METHODS

The length and maximum breadth of the nuts (without perianth) were measured in millimetres to the nearest 0·1 mm, each set of measurements being on a sample of mature nuts usually 50 or more in number. An index was obtained by dividing the length by the breadth. The arithmetic mean, standard deviation, and the range of these measurements were calculated. The average nut weight in mg of a sample was obtained by weighing a known number of nuts, usually 100 and never less than 30.

RESULTS

The averages of the data for all the nuts of *P. persicaria* measured are given in Table 1. From this it is clear that the British and foreign material are essentially similar. The comparative column for *P. lapathifolium* shows that the two species are significantly different in index and in percentage of trigonous nuts (see also Timson 1963). Styles (1962) found that fruit length was a useful character in section *Polygonum* for the separation

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of the species, but the data presented here suggest that it is of little value in section *Persicaria*. In this section the nuts not only show a considerable range of size on a given plant, but also the average lengths for the different species are very similar.

Using nuts collected in 1958 near Ryston, Norfolk, plants were grown from nuts of known shape in similar conditions and the percentages of trigonous nuts determined. This was repeated over three seasons and the results are given in Table 2. From these results it seems that the shape of the nut from which the parent plant has been grown can affect the relative proportions of trigonous and biconvex nuts. The age of the parent plants also seems to affect the relative abundance of trigonous nuts. This was discovered when the nuts of a number of plants which had been allowed to grow old (i.e. leaves dried up, stem very dry and red), in the greenhouse were examined. They were found to be 73 per cent trigonous and 26 per cent biconvex. A third shape, not previously recorded, was present in small numbers (1 per cent)—four-sided with four concave faces (tetragonal).

There are few records in the literature of the weight of nuts of *P. persicaria*. Simmonds (1945) gives 2·3 mg; Korsmo (1934), 2·7 mg; and Pammel (1910), 1·41 mg. It is difficult to compare these figures with those given here because the authors do not say

TABLE 1. Combined data for all fruits measured of *P. persicaria*.

		P. persicaria			P. lapathifolium
		British	*Foreign*	*Total*	
Length	*mean*	2·61	2·05	2·33	2·64
	s.d.	0·11	0·14	0·12	0·13
	range	2·0–3·2	1·7–3·0	1·7–3·2	2·0–3·3
Breadth	*mean*	2·01	1·99	2·00	2·27
	s.d.	0·12	0·12	0·12	0·13
	range	1·4–2·7	1·5–2·4	1·4–2·7	1·7–2·9
Index	*mean*	1·31	1·28	1·30	1·17
	s.d.	0·07	0·06	0·07	0·045
	range	1·1–1·6	1·1–1·6	1·1–1·6	1·0–1·5
Shape (%)	*biconvex*	76	80	78	99·2 (*biconcave*)
	trigonous	24	20	22	0·8
Average weight	(mg)	2·32	1·93	2·13	2·57

TABLE 2. Changes in the proportions of trigonous nuts in plants grown from nuts of known shape.

Year	% *Trigonous*			
	From trigonous	*From biconvex*	*From total*	% *of total from plants grown from trigonous nuts*
1958	—	—	24	—
1959	44	26	35	63
1960	60	34	43	64
1961	45	8	26·5	78

whether or not the persistent perianth was removed before weighing. If, as is probable, it was not removed, it is difficult to be sure that only mature nuts have been weighed. For this reason the results given in Table 3 are for mature nuts without perianth.

TABLE 3. Weights of fruits of *P. persicaria.*

Year of growth	*Grown in*	*Shape*	*Average weight (mg)*
Origin: BUDE, CORNWALL			
1959	Nature	Total	2·57
1960	Garden	Biconvex	2·64
,,	,,	Trigonous	3·22
,,	,,	Total	2·93
1961	Greenhouse	Biconvex	2·36
,,	,,	Trigonous	2·61
,,	,,	Total	2·49
Origin: KEELE			
1959	Nature	Total	1·69
1960	Garden	Biconvex	2·26
,,	,,	Trigonous	2·74
,,	,,	Total	2·50
1961	Greenhouse	Biconvex	1·67
,,	,,	Trigonous	2·96
,,	,,	Total	2·31

There is considerable variation in the results obtained and it seems probable that the environment of the parent plant is the main factor. Thus nuts harvested in nature where the parent plant is in competition with other plants were usually lighter than those grown in cultivation where the plants were spaced out and competitors removed. Those produced in the garden were usually heavier than those produced in the greenhouse, probably because more space per plant was available in the former. It is clear that the trigonous nuts are normally heavier than the biconvex nuts produced on the same plant.

DISCUSSION

In *P. persicaria* the control of nut shape appears to be complex. The main conclusions emerging from the results are that:

1. It is possible to select to some extent for nut shape;
2. The nuclear genes do not completely control the nut shape, since the three kinds of nut may occur together on one plant.
3. More trigonous nuts are produced as the plant becomes senescent.

From this it seems that the production of trigonous nuts is caused by some interaction between genetic and other factors; possibly their production is favoured by a breakdown of some metabolic mechanism which occurs more frequently during senescence.

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