29. THE SPIRALITY OF MAIN STEM AND ITS RELATIONSHIP TO THAT OF OFF-SHOOTS IN EUPHORBIA ANTIQUORUM LINN.

(With a text-figure)

The stem of some euphorbiaceous species twists either clockwisely (left-handed) or counter-clockwisely. This twisting is easily perceivable in stems bearing one or more wings, grooves, rows of leaves or spines. This brief report shows how the twisting of the main stem and that of the first order of off-shoots in Euphorbia antiquorum are related. In this species, the stem is a succulent cladode which bears three or four wings, each wing possessing pairs of spines at intervals and small caducous jeaves. In many varieties of E. antiquorum the stem does not show any twisting, but in one variety, very common in south India, twisting of the stem is clearly noticeable (Fig. 1). Data were collected in January 1965 from a population of this variety in a village near Coimbatore, south India.

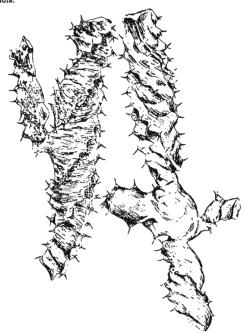


Fig. 1. Right- and left-twisting stems of Euphorbia antiquorum

1,500 main stems were examined of which two per cent showed a reversal of the twisting from one type to the other. A fraction of these showed double reversals as seen in Table 1.

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phorbia antiquorum : NATURE	OF M	AIN STE
Left-handeds		748
Right-handeds		722
Left turning right		20
Right turning left		7
Left to right to left		3
Right to left to right	••	0
1		1.600

50-88 per cent of the regularly twisting stems were left-handers. A further 200 main stems were cut randomly from a further lot of plants. As mentioned, the stem has either three or four wings at the 'internodal' region. Out of the 200 plants, 58 had four wings each and the rest three. The stem may produce one branch each from a wing, and so a fourwinged stem may have four off-shoots although in many they may be reduced to 3, 2, 1 or nil. Similarly, a three-winged stem may have less than four or no off-shoots. The few stems producing no off-shoot were excluded. Very rarely a wing produced more than one off-shoot. In Table 2 details of the off-shoots produced from the 200 main stems are given.

TABLE 2 Euphorbia antiquorum: No. of off-shoots per 'internode' (ALL WINGS) OF 200 MAIN STEMS

		Number of off-shoots									
Main	stem		4-wir	ged s	tems		i I	3-v	vinged	stem	s
Spiral	No.	4	3	2	1	Total	4	3	2	ı	Total
Left Right	117 83	22 12	01 8	5	-	37 21	1	51 43	24 15	4	80 62
Total	200	34	18	5	1	58	1	94	39	8	142

Like the main stems, the off-shoots also showed asymmetry by twisting either clockwisely or conversely. A smaller percentage of these offshoots, however, did not show any twisting and they were recorded as neutrals. From the 200 plants, 572 off-shoots were examined for their spirality and the data are given in Table 3.

Fundarbin antiquarum . DIRECTION OF OFE-SHOOTS OF 700 SHAND

			C	OFF - \$H001	13			
Main stem	1	Left:		Right:	N	outr	al:	
	observed	%	observed	%	observed	%	Total	%
Left Right	243 66	71·26 28·57	72 145	21·11 62·77	26 20	7·62 8·67	341 231	100-00
L+R	309	54·02	217	37-94	46	8:04	572	100.00

To find out whether there is a correlation between the kinds of twisting of the off-shoots and of the main stem, the observations were split up for the 4-winged shoots and 3-winged shoots and are presented in Table 4.

Table 4

Euphorbia antiquorum: Asymmetry of off-shoots in relation to main stem

Spiral of	off-shoots	Nature of off-shoots					
main stem	011-800015	Left	Right	Neutral	Total		
	4-winged	off-sl	hoots (To	tal 198)		-	
Left	observed percentage percentage on all	::	100 78·12	16 12·50	12 9.38	128 100:00	
	shoots		29.32	4.69	3-52	37-54	
Right	observed percentage percentage on all	::	13 18·57	47 67·14	l0 14·28	70 100 [.] 00	
	shoots	٠.	5.63	20.35	4.33	30-30	
	3-winge	i off-	shoots (T	otal 374)		_	
	observed , percentage		143 67·14	56 26·29	14 6·57	213 100:00	
Left	percentage on all shoots		41.94	16:42	4-11	62:46	
Right	observed percentage	::	53 32·92	98 60:87	10 6·21	100·00 161	
	percentage on all shoots		22-94	42.42	4.33	69-70	

The expected values for all the groups have been calculated and given below:

		- [Off-shoots						
	Main stem	-	L	R	N	Total			
Lest	{ observed expected	::	243 183·212	72 129·365	26 27·423	341			
Right	observed expected	::	66 124·788	145 87-634	20 19·783	231			
Total			309	217	46	572			

The value of X^a is highly significant both at the 5% and 1% levels, which clearly demonstrates the positive dependence of the off-shoots on the main stems with regard to the type of twisting. Similar values for the data relating to the 4-winged stems and 3-winged stems as given in Table 4 were calculated and in each case, the X^a value turns out to be highly significant even at the 1% level.

4-winged off-shoots— $\chi^2 = 71.314$ 3-winged off-shoots— $\chi^2 = 147.984$

There is an interesting analogy to the above situation. In Cordyline rubra of Agavaceae, the leaves are arranged in two spirals, both of them running either clockwise or counter-clockwise in a shoot. The lamina is convolute in bud, rolling either clockwise or converse. In a shoot with right-handed foliar spiral, about 81 per cent of the leaves have right-handed convolution. In a left-spiralled shoot, on the other hand, the convolution in about a similar percentage is left-handed (Davis & Ghosh, in press). However, in Dieffenbachia sp., the foliar spiral and convolution of the lamina in a plant move oppositely. In Pothos scandens, a leaf of left convolution is generally followed by a leaf of right convolution, and rarely by one with involute rolling (Davis, in press).

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