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A simple way of finding linked and antagonistic characters by means of table of characters used in the dendrite method

TADEUSZ KOWAL

Department of Pharmaceutical Botany, Medical Academy, Poznań

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Abstract

The author gives a new methodical solution based on the table of characters used in taxonomic examinations by the dendrite method worked out for the species of *Delia* Dum., *Spergula* L. and *Spergularia* Presl. growing in Poland.

This methodical solution shows a simple way to find conjugate and antagonistic characters in the examined species and to determine which characters are related to each other in different organs.

In papers about the adaptation of Wrocław Taxonomy (dendrite method) to solve different problems in taxonomy of plants (Kowal 1961, 1962, 1965; Kowal and Kuźniewski 1958, 1959, 1960; Kuźniewski 1956, 1959; Rostański 1968, 1969; Szweykowski and Koźlicka 1969; Szweykowski and Krzak 1967, 1969) attempts were made to examine the correlation of characters (Kukułczanka 1964, 1965, 1966).

As it is possible to examine correlation of characters by the dendrite method, it is important to widen the application of this method, and form a general methodical basis that would help to work out different taxonomic problems, however it does not solve all problems of plant taxonomy.

The author has investigated for many years the possibility of examining linked and antagonistic characters by the dendrite method; this led to establishing a simple procedure that gives good results.

This problem will be discussed on examples of species of the genera *Delia* Dum., *Spergula L.*, and *Spergularia* Presl. growing in Poland.

The table of characters differentiating "individuals" of the examined set is the basis of taxonomic investigations by means of the dendrite method. In our case such a set will be composed of species belonging

to the genera mentioned above. The characters differentiating the species of this set (Gorshkova 1936, Hegi 1936, Kowal 1966, Kulczyński 1921, Muravieva 1936, Pax and Hoffman 1934, Szafer, Kulczyński and Pawłowski 1959) were compiled in a table of characters.

It must be stressed that the table only contains characters that differentiate species, and therefore it does not include all their characters. Therefore using such a table we shall only be able to determine linked and antagonistic characters from the group of differentiating characters. Each species has all its characters linked together in such a way as to form a set of characters describing the given species.

We can conclude that characters are linked if they are constantly present in the same species. When, characters exclude each other in the same species we may conclude that these are antagonistic characters. All other cases including partial ($x^0/_0$) occurrence of certain characters in the same species indicate a greater or lesser mutual independence of characters that may be examined by correlation. The examination of linked and opposed characters could be done in the same way as the calculation of the magnitude of taxonomic differences, i.e., by means of Czekanowski's table, but modifying it so that characters would be "species" and species "characters". Such a table would give "differences" that could be compared and which would give information about the mutual dependence of characters, but it would not explain the nature of the "differences". This would require additional examination which could be avoided by introducing the modified recording showing the character of "differences" in Czekanowski's table. For example, the difference between characters "a" and "b" is 0 and is the result of the presence of both characters in the same 8 species; this could be written down in the form of a fraction, where the numerator would give the "difference" and the denominator the number of species for each of the two compared characters: $\frac{0}{8:8}$ or, for example, the difference between characters "c" and "d" is 1, and is caused by the presence of character "c" in 7 species, and of "d" in 8 species seven of which are alike, which can be written down in the following way $\frac{1}{7:8}$. Such a recording would make the comparison of various results possible, and define the linkage or antagonism of characters. Though this way gives, without doubt, good results requires a lot of work.

The simplest way to find which characters may be considered on account of their possible linkage with others is to add vertical columns of the table of characters (cf. Table of characters horizontal columns

marked +, ++). The comparison of sums of vertical columns of the table of characters, having the same numerical values, allows to establish which characters do not show differences in the various species, i.e., they occur in the examined set in the same species, and therefore are linked.

In our example such characters for the whole set (++) are*:

Sum of vertical columns in table of characters	No. of characters that can be linked as they have the same value of characters	No. of linked characters
11	45, 47, 54, 65, 165, 171	65 and 171
10	15, 19, 27, 31, 51, 167, 177	15, 27, 167, and 177
9	63, 69, 160	63 and 160
8	60, 71	60 and 71
7	35, 39, 42, 44, 85, 127, 156, 159, 168	a) 35, 44 and 159 b) 39, 42, 85, 127, 156 and 168
6	81, 89	—
5	11, 12, 13, 24, 25, 36, 40, 41, 43, 75, 78, 80, 84, 122, 128, 157, 158, 173, 179, 181	a) 36, 43, 75, 122, 158, 173 and 179 b) 40, 41, 78, 84, 128, 157 and 181
4	172	—
3	4, 61, 64, 70, 87, 123, 161, 169, 174	64, 87, 161, 169 and 174
2	14, 20, 26, 28, 32, 52, 74, 88, 119, 124, 166, 178, 180	a)20, 88 and 180 b) 28, 52, 74, 166 and 178
1	16, 46, 48, 53, 55, 62, 66, 72, 76, 77, 79, 86, 107, 109, 120, 164, 170	a) 16 and 55 b) 46 and 53 c) 48 and 86 d) 62 and 164 e) 66, 79 and 170

The characters that exclude each other will be antagonistic. In our case two such antagonistic characters, when sums are compared ought to give 12 as result of substraction (as we compare 12 species in the vertical column of the table it is 11). The antagonistic characters should be looked for among those whose sum is 1, for 10 : 2, 9 : 3, etc. These data can easily be found in the list of linked characters.

In our example antagonism is found among the following characters:

* To make the discussed problem clear only such sums of vertical columns in the table of characters that are integers have been set together.

Sum of vertical columns of table (++) giving the sum 12	No of antagonistic characters
11 : 1	a) 45 : 46 and 53; b) 47 : 48 and 86; c) 54 : 55 and 16; d) 65 and 171 : 66, 79 and 170; e) 165 : 164 and 62
10 : 2	a) 15, 27, 167 and 177 : 28, 52, 74, 166 and 178; b) 19 : 20, 88, and 180
9 : 3	63 and 160 : 64, 87, 161, 169, and 174
8 : 4	—
7 : 5	a) 35, 44 and 159 : 36, 43, 75, 122, 158 173 and 179 b) 39, 42, 85, 127, 156 and 168: 40, 41, 78, 84, 128, 157 and 181
6 : 6	—

The linked and antagonistic characters given on the preceding page belong to the whole examined set that consists of species belonging to three genera. In our set we can distinguish three smaller sets corresponding to the various genera. For these small sets linkage and antagonism of characters may be determined in the same way. In our example such a small set are, e.g., *Spergula* species (+). Their numerous linked characters (appearing in all species) do not show any taxonomic difference within the set, and they would not be placed in the table of characters if it only included *Spergula* species. In a larger set these characters are necessary, as they give a taxonomic difference. The greater and the more differentiated the examined set of individuals, i. e., the greater the rank of the small sets included the more linked characters can be found for just these small sets.

As it is possible to examine the linkage and antagonism of characters, it may be established which characters always appear together in the given set, or exclude one another, and which correspond to each other in the case of different organs.

In our table of characters we can find characters differentiating both plants and seeds. On the basis of linkage of characters it can be concluded which of the characters of plants are related with some characters of seeds, and reversely, we may try to determine equivalents of characters for different organs.

Plants	Seeds
65. Sepals with narrow membraneous margin	171. Largest dimensions of epidermal cells of testa seen from above 0,051—0,1 mm
15. Stalks tapering 27. Leaves slightly succulent	167. Outer surface of epidermal cells of testa reticulated 177. Largest dimension of tegmen seen from above, up to 0,035 mm
63. Sepals ovate	160. Sculpture of seed in form of minute delicate prominences (without nodules)
39. In axils of leaves there are thickly leafed short shoots giving the impression of leaves being arranged in many-leafed whorls 42. Leaves shorter than internodes 85. Five carpels	127. Edge of seeds sharp 156. Seeds black 168. Outer surface of epidermal cells of testa with large meshed reticle
35. Leaves without furrow underneath 44. Bracts small (short)	159. Seeds slightly glossy
36. Leaves with furrow underneath 43. Bracts large 75. Corolla petals obovate	122. Lateral sides of seed strongly prominent 158. Seeds lustreless 173. Swell of outer membranes of epidermal cells of testa irregularly stratified 179. Embryo curved in the form of 1,5 to 2 spiral coils
40. Offshoots do not give the impression of whorled arrangement of leaves 41. Leaves equal to, or longer, than, internodes 78. Corolla petals ovate 84. Three carpels	128. Seeds edge ±rounded 157. Seeds (light or dark) brown 181. Embryo bent in a half circle or crescent-shaped way
64. Sepals ovate-lanceolate 87. Capsule slightly longer than calyx	161. Sculpture of seeds in form of minute delicate prominences with nodules 169. Outer surface of epidermal cells of testa with small meshed reticle 174. Swell of outer membranes of epidermal cells of testa with stalactites
20. Stems blue-green 88. Capsule half longer than calyx	180. Embryo shaped like horse-shoe
28. Leaves succulent 52. Bracts widely ovate, topshaped 74. Corolla petals pink	166. Outer surface of epidermal cells smooth 178. Largest dimension of tegmen cells, seen from above 0,036 to 0,05 mm

For our set, on the basis of linkage of characters, we may establish the following equivalents of characters:

The possibility of establishing equivalents of characters in different plant organs may be very important, not only theoretically, but, above all, practically both in cultivation and in taxonomy. For Wrocław Taxonomy this is a step forward in the possibility of its application.

TABLE OF CHARACTERS

+ Figures in checks showing the "value" of the given character in different species indicate % of individuals of the species, in which the given character occurs, divided by 100 /f.i. 0,05 = 5% ; o,5 = 50% ; 1 = 100% /. Blank checks = "0", and mean that this character is absent in 100% of individuals of this species, while an oblique line in the check / means that the character is lacking in 100% of the individuals, as the organ on which the given character could occur, does not exist.

Fractional numbers in checks mean: numerator the percentage of individuals of this species that possess the given character, the denominator - the percentage of individuals that do not possess the organ in which the given character is met / cf. Kowal 1965 and 1966 /.

No and name of species	No. of character +
I Spergula arvensis L.	
II - linicola Boreau	
III - maxima Weihe	
IV - sativa Boenn	
V - vulgaris Boenn	
VI - pentandra L.	
VII - vernalis Willd	
+ Sum	
VIII Spergularia echinosperma Čel	
IX - marginata /DC/ Kittel	
X - rubra /L./ Presl.	
XI - salina Presl.	
XII Delia segetalis Dum.	
++ Sum	

1 - 3. Hardiness of plants :

1 = annual,

2 = biennial,

3 = perennial,

4 - 8. Height of plants :

4 = up to 10 cm,

5 = 10 - 20 cm,

6 = 20 - 30 cm,

7 = 30 - 40 cm,

8 = 40 - 100 cm,

9 - 10. The characters of stem :

9 = single,

10 = ramose.

	1	2	3	4	5	6	7	8	9	10
I	1				0,2	0,2	0,2	0,4	0,5	
II	1				0,3	0,4	0,3		0,5	
III	1							1	0,5	
IV	1				0,3	0,4	0,3		0,5	
V	1				0,3	0,4	0,3		0,5	
VI		1		0,3	0,7				0,5	0,5
VII		1		0,2	0,5	0,3			0,5	0,5
+	5	2	0	0,5	2,3	1,7	1,1	1,4	3,5	1
VIII	0,3	0,4	0,3	1						
IX			1		0,3	0,7				1
X	0,3	0,4	0,3	0,3	0,5	0,2				
XI	0,3	0,4	0,3	0,2	0,8					0,5
XII	1			1						1
++	6,9	3,2	1,9	3	3,9	2,6	1,1	1,4	3,5	3,5

11 - 20. The characters of stem :

11 = ramose from base,

12 = straight,

13 = rising,

14 = lying,

15 = oval,

16 = angular,

17 = sharp - edged,

18 = bilaterally winged,

19 = green,

20 = blue - green.

	11	12	13	14	15	16	17	18	19	20
I	0,5	0,5	0,5		1				1	
II	0,5	1			1				1	
III	0,5	0,5	0,5		1				1	
IV	0,5	0,5	0,5		1				1	
V	0,5	0,5	0,5		1				1	
VI		0,5	0,5		1					1
VII		0,5	0,5		1					1
+	2,5	4	3	0	7	0	0	0	5	2
VIII	1		0,5	0,5	1				1	
IX			0,5	0,5		1			1	
X	1		0,5	0,5	1				1	
XI	0,5		0,5	0,5			0,8	0,2	1	
XII		1			1				1	
++	5	5	5	2	10	1	0,8	0,2	10	2

21 - 23. The characters of stem :

21 = glabrous,

22 = tomentose / hairy /,

23 = upper part glandular,

24 - 30. Characters of leaves :

24 = linear,

25 = almost filiform,

26 = narrow - lanceolate,

27 = weakly succulent,

28 = succulent,

29 = obtuse on apex,

30 = acuminate.

	21	22	23	24	25	26	27	28	29	30
I	0,5	0,5	1	0,5	0,5		1		1	
II	0,5	0,5	1	0,5	0,5		1		1	
III	0,5	0,5	1	0,5	0,5		1		1	
IV	0,5	0,5	1	0,5	0,5		1		1	
V	0,5	0,5	1	0,5	0,5		1		1	
VI	0,5		0,5		0,5	0,5	1		1	
VII	1				0,5	0,5	1		1	
+	4	2,5	5,5	2,5	3,5	1	7	0	7	0
VIII	0,1	0,9	0,7		1		1			
IX	0,1		0,9	1				1		
X	0,1	0,9	0,7	1			1			1
XI	0,5		0,5			1		1		1
XII	1			0,5	0,5		1		0,5	0,5
++	5,8	4,3	8,3	5	5	2	10	2	7,5	2,5

31 - 40. Characters of leaves :

31 = without prickle on apex,

32 = apex prickled,

33 = prickle short,

34 = prickle distinct,

35 = without furrow underneath,

36 = with furrow underneath,

37 = flat,

38 = semicylindrical,

39 = in axils of leaves there are richly leafed short shoots, causing that leaves seem to be arranged in multifoliate verticilis,

40 = offshoots never so shortened to give the impresion of being arranged verticillate.

	31	32	33	34	35	36	37	38	39	40
I	1		/	/		1		1	1	
II	1		/	/		1		1	1	
III	1		/	/		1		1	1	
IV	1		/	/		1		1.	1	
V	1		/	/		1		1	1	
VI	1		/	/	1		1		1	
VII	1		/	/	1		1		1	
+	7	0	/7	/7	2	5	2	5	7	0
VIII	0,5	0,5	0,5/0,5	/0,5	1		1			1
IX	1		/	/	1			1		1
X		1		1	1		1			1
XI	1		/	/	1			1		1
XII	0,5	0,5	1		1		0,5	0,5		1
++	10	2	1,5/9,5	1/9,5	7	5	4,5	7,5	7	5

41 - 42. Characters of leaves :

41 = equal to, or longer than, internodes,

42 = shorter than internodes.

43 - 50. Characters of stipules :

43 = large,

44 = small,

45 = permanently present,

46 = falling off quickly,

47 = dull,

48 = silvery,

49 = accrete at basal part,

50 = free.

	41	42	43	44	45	46	47	48	49	50
I		1	1		1		1			1
II		1	1		1		1			1
III		1	1		1		1			1
IV		1	1		1		1			1
V		1	1		1		1			1
VI		1		1	1		1			1
VII		1		1	1		1			1
+	0	7	5	2	7	0	7	0	0	7
VIII	1			1		1	1			1
IX	1			1	1		1		0,8	0,2
X	1			1	1			1	0,5	0,5
XI	1			1	1		1		0,5	0,5
XII	1			1	1		1		1	
++	5	7	5	7	11	1	11	1	2,8	9,2

51 - 57. Characters of stipules :

51 = ovate - lanceolate,

52 = wide - ovate, sharpened,

53 = wide - triangular,

54 = similar on the whole plant,

55 = lower and upper ones various,

56 = entire,

57 = broken.

58 - 60. Characters of petioles :

58 = naked,

59 = covered with glandules,

60 = 3 to 7 times longer than capsule.

	51	52	53	54	55	56	57	58	59	60
I	1			1		1			1	1
II	1			1		1			1	1
III	1			1		1			1	1
IV	1			1		1			1	1
V	1			1		1			1	1
VI	1			1		1		0,8	0,2	1
VII	1			1		1		0,8	0,2	1
+	7	0	0	7	0	7	0	1,6	5,4	7
VIII			1	1		1		1		
IX	1	1			1	1		1		
X	1			1		0,2	0,8	1		
XI		1		1		1			1	
XII	1			1			1	1		1
++	10	2	1	11	1	10,2	1,8	5,6	6,4	8

61 - 62. Characters of petioles :

61 = to 3 times longer than capsule,

62 = ± equalling length of capsule.

63 - 70. Characters of sepals :

63 = ovate,

64 = ovate - lanceolate,

65 = with high membraneous margin,

66 = with wide membraneous margin,

67 = naked,

68 = glandular - hairy,

69 = obtuse,

70 = acuminate.

	61	62	63	64	65	66	67	68	69	70
I			1		1		0,5	0,5	1	
II			1		1		0,5	0,5	1	
III			1		1		0,5	0,5	1	
IV			1		1		0,5	0,5	1	
V			1		1		0,5	0,5		
VI			1		1		1			1
VII			1		1		1			1
+	0	0	7	0	7	0	4,5	2,5	5	2
VIII	1			1	1			1	1	
IX	1		1		1			1		1
X	1			1	1			1	1	
XI		1	1		1		0,2	0,8	1	
XII				1		1	1		1	
++	3	1	9	3	11	1	5,7	6,3	9	3

71 - 80. Characters of petals :

71 = white,

72 = red - pink,

73 = lilac - blue,

74 = pink,

75 = obovate,

76 = obtuse,

77 = lanceolate,

78 = ovate,

79 = half the length of calyx,

80 = somewhat shorter than calyx.

	71	72	73	74	75	76	77	78	79	80
I	1				1					
II	1				1					
III	1				1					
IV	1				1					
V	1				1					
VI	1						1			
VII	1					1				1
+	7	0	0	0	5	1	1	0	0	1
VIII		0,5	0,5					1		1
IX				1				1		1
X		0,5	0,5					1		1
XI				1				1		1
XII	1							1	1	
++	8	1	1	2	5	1	1	5	1	5

81. Characters of petals :

81 = longer than, or equal to, calyx.

82 - 83. Number of stamens :

82 = five,

83 = ten,

84 - 85. Number of carpels :

84 = three,

85 = ten,

86 - 89. Length of capsules in realation to length of calyx:

86 = ± as long as calyx,

87 = a little longer than calyx,

88 = half a long as calyx,

89 = twice longer than calyx.

90. Length of seeds :

90 = 0,21 - 0,4 mm.

	81	82	83	84	85	86	87	88	89	90
I	1				1				1	
II	1				1				1	
III	1				1				1	
IV	1				1				1	
V	1				1				1	
VI	1	1			1			1		
VII		0,1	0,9		1			1		
+	6	1,1	0,9	0	7	0	0	2	5	0
VIII			1	1			1			0,3
IX		0,1	0,9	1					1	
X			1	1		1				
XI		1		1			1			
XII		1		1			1			
++	6	3,2	2,9	5	7	1	3	2	6	0,3

91 - 98. Length of seeds :

91 = 0,41 - 0,6 mm,

92 = 0,61 - 0,8 mm,

93 = 0,81 - 1 mm,

94 = 1,01 - 1,2 mm,

95 = 1,21 - 1,4 mm,

96 = 1,41 - 1,6 mm,

97 = 1,61 - 1,8 mm,

98 = 1,81 - 2 mm,

99 - 100. Width of seeds :

99 = 0,21 - 0,4 mm,

100 = 0,41 - 0,8 mm.

	91	92	93	94	95	96	97	98	99	100
I			0,1	0,2	0,1	0,2	0,2	0,2		
II						0,2	0,6	0,2		
III						0,3	0,5	0,2		
IV				0,7	0,3					
V			0,6	0,4						
VI				0,6	0,4					
VII			0,7	0,3						
+	0	0	1,4	2,2	0,8	0,7	1,3	0,6	0	0
VIII	0,7								0,6	0,4
IX		0,6	0,4							0,4
X		1								1
XI		0,6	0,4							0,3
XII	1								1	
++	1,7	2,2	2,2	2,2	0,8	0,7	1,3	0,6	1,6	2,1

101 - 106. Width of seeds :

101 = 0,61 - 0,8 mm,

102 = 0,81 - 1mmm,

103 = 1,01 - 1,2 mm,

104 = 1,21 - 1,4 mm,

105 = 1,41 - 1,6 mm,

106 = 1,61 - 1,8 mm.

107 - 110. Thickness of seeds :

107 = to 0,2 mm,

108 = 0,21 - 0,4 mm,

109 = 0,41 - 0,6 mm,

110 = 0,61 - 0,8 mm.

	101	102	103	104	105	106	107	108	109	110
I		0,2	0,2	0,2	0,2	0,2				0,3
II				0,2	0,6	0,2				
III				0,2	0,6	0,2				
IV			1							1
V		1								1
VI			1					0,2	0,8	
VII		1						0,8	0,2	
+	0	2,2	2,2	0,6	1,4	0,6	0	1	1	2,3
VIII							0,5	0,5		
IX	0,6							1		
X								0,4		
XI	0,7							1		
XII							0,5	0,5		
++	1,3	2,2	2,2	0,6	1,4	0,6	1	4,4	1	2,3

111 - 113. Thickness of seeds :

111 = 0,81 - 1 mm,

112 = 1,01 - 1,2 mm,

113 = 1,21 - 1,4 mm.

114 - 117. Ratio of width to length of seeds :

114 = from 0,61 - 0,70,

115 = from 0,71 - 0,80,

116 = from o,81 - 0,90,

117 = from 0,91 - 1.

118 - 120. Outline of seeds :

118 = circular,

119 = triangularly reniform,

120 = obovate.

	111	112	113	114	115	116	117	118	119	120
I	0,2	0,3	0,2			0,4	0,4	0,6		
II	0,1	0,6	0,3			0,5	0,5	0,5		
III	0,2	0,6	0,2			0,4	0,6	0,6		
IV						0,3	0,7	0,7		
V						0,4	0,6	0,7		
VI						0,3	0,7	0,6		
VII						0,55	0,45	0,4		
+	0,5	1,5	0,7	0	0	2,85	4,15	4,1	0	0
VIII					0,1	0,6	0,3		0,3	
IX					0,2	0,5	0,3	0,2	0,2	0,3
X				0,2	0,5	0,3			0,7	0,2
XI						0,3	0,7	0,4	0,3	
XII				0,6	0,4				0,5	0,5
++	0,5	1,5	0,7	0,8	1,2	4,55	5,45	4,7	2	1

121. Outline of seeds :

121 = broadly obovate.

122 - 126. Formation of lateral sides of seed :

122 = strongly convex,

123 = slightly convex,

124 = flat,

125 = slightly concave,

126 = one ± convex, the other ± slightly concave.

127 - 128. Formation of edges of seed :

127 = ± sharp,

128 = ± rounded.

129 - 130. Wing of seed :

129 = seed unwinged,

130 = seeds winged.

	121	122	123	124	125	126	127	128	129	130
I	0,4	1					1			1
II	0,5	1					1			1
III	0,4	1					1			1
IV	0,3	1					1			1
V	0,3	1					1			1
VI	0,4		1				1			1
VII	0,6		1				1			1
+	2,9	5	2	0	0	0	7	0	0	7
VIII	0,7			1				1	1	
IX	0,3				1			1		1
X	0,1			1				1	1	
XI	0,3				0,3	0,7		1	0,3	0,7
XII			1					1	1	
++	4,3	5	3	2	1,3	0,7	7	5	3,3	8,7

131 - 135. Wing of seed

131 = wing stiff and hard,

132 = wing membraneous and soft,

133 = edge of wing entire,

134 = edge of wing lacerate,

135 = wing white.

	131	132	133	134	135
I	1				
II	1				
III	1				
IV	1				
V	1				
VI		1			1
VII		1			
+	5	2	0	0	1
VIII	/	/	/	/	/
IX		1		1	1
X	/	/	/	/	/
XI	/0,3	0,7/0,3	/0,3	0,7/0,3	0,7/0,3
XII	/	/	/	/	/
++	5/3,3	3,7/3,3	/3,3	1,7/3,3	2,7/3,3

136. Wing of seed :

136 = wing becoming brown.

137 - 140. Width of wing of seed :

137 = to 0,5 mm,

138 = 0,51 - 1 mm,

139 = 1,1 - 3,1 mm,

140 = 3,1 - 4 mm.

	136	137	138	139	140
I	1	0,5	0,5		
II	1		1		
III	1	1			
IV	1		1		
V	1	1			
VI					
VII	1				0,3
+	6	2,5	2,5	0	0,3
VIII	/	/	/	/	/
IX				0,3	0,6
X	/	/	/	/	/
XI	/0,3	/0,3	/0,3	0,3/0,3	0,4/0,3
XII	/	/	/	/	/
++	6/3,3	2,5/3,3	2,5/3,3	0,6/3,3	1,3/3,3

141 - 142. Width of wing of seed :

141 = 4,1 - 5 mm,

142 = 5,1 - 6 mm.

143 - 145. Indumentum of seeds :

143 = without hairs,

144 = downy,

145 =hairs on the whole surface.

	141	142	143	144	145
I			0,4	0,6	0,6/0,4
II			1		/
III				1	1
IV			0,8	0,2	0,2/0,8
V				1	1
VI	0,5	0,5		1	
VII	0,6	0,1		1	
-	1,1	0,6	2,2	4,8	2,8/2,2
VIII	/	/	1		/
IX	0,1		1		/
X	/	/	0,2	0,8	/0,2
XI	/0,3	/0,3	1		/
XII	/	/	0,2	0,8	/0,2
++	1,2/3,3	0,6/3,3	5,4	5,4	2,8/5,6

146 - 150. Indumentum of seeds :

146 = hairs only on the peripheral part of lateral sides,

147 = hairs on edge,

148 = hairs in regular rows,

149 = hairs irregularly distributed,

150 = few hairs.

	146	147	148	149	150
I	/0,4	/0,4	/0,4	0,6/0,4	0,2/0,4
II	/	/	/	/	/
III				1	
IV	/0,8	/0,8	/0,8	0,2/0,8	0,2/0,8
V				1	
VI	1		1		
VII	1		1		
+	2/2,2	/2,2	2/2,2	2,8/2,2	0,4/2,2
VIII	/	/	/	/	/
IX	/	/	/	/	/
X	/0,2	0,8/0,2	0,8/0,2	/0,2	/0,2
XI	/	/	/	/	/
XII	/0,2	0,8/0,2	0,8/0,2	/0,2	/0,2
++	2/5,6	1,6/5,6	3,6/5,6	2,8/5,6	0,4/5,6

151 - 155. Indumentum of seeds

151 - numerous, densely distributed hairs,

152 - hairs white,

153 - hairs becoming brown,

154 - hairs long,

155 - hairs short.

	151	152	153	154	155
I	0,4/0,4	0,6/0,4	/0,4	0,6/0,4	/0,4
II	/	/	/	/	/
III	1	1		1	
IV	/0,8	0,2/0,8	/0,8	0,2/0,8	/0,8
V	1	1		1	
VI	1	1			1
VII	1	1			1
+	4,4/2,2	4,8/2,2	/2,2	2,8/2,2	2/2,2
VIII	/	/	/	/	/
IX	/	/	/	/	/
X	0,8/0,2	/0,2	0,8/0,2	/0,2	0,8/0,2
XI	/	/	/	/	/
XII	0,8/0,2	/0,2	0,8/0,2	/0,2	0,8/0,2
++	6/5,6	4,8/5,6	1,6/5,6	2,8/5,6	3,6/5,6

156 - 157. Colour of seeds :

156 = black,

157 = light or dark brown.

158 - 159. Lustre of seeds :

158 = opaque,

159 = with slight lustre.

160 - 163. Relief of seed surface :

160 = minute delicate prominence without nodules,

161 = minute delicate prominences with nodules,

162 = nodules occurring on all cells,

163 = nodules only on cells of the peripheral part of the lateral sides of seed, and on the edge.

	156	157	158	159	160	161	162	163
I	1		1		1		/	/
II	1		1		1		/	/
III	1		1		1		/	/
IV	1		1		1		/	/
V	1		1		1		/	/
VI	1			1	1		/	/
VII	1			1	1		/	/
+	7	0	5	2	7	0	7	7
VIII		1		1		1	1	
IX		1		1	1		/	/
X		1		1		1		1
XI		1		1	1		/	/
XII		1		1		1	1	
++	7	5	5	7	9	3	2/9	1/9

164 - 165. Outline of epidermal cells of testa seen from above :

164 = two - winged,

165 = ± irregularly stellate.

166 - 169. Formation of outer surface of epidermal cells of testa :

165 = smooth,

167 = reticulate,

168 = reticle with large meshes,

169 = reticle with small meshes / punctate /.

170 - 171. Largest dimensions of epidermal cells of testa seen from above :

170 = 0,01 - 0,05 mm,

171 = 0,05 - 0,1 mm.

	164	165	166	167	168	169	170	171
I		1		1	1			1
II		1		1	1			1
III		1		1	1			1
IV		1		1	1			1
V		1		1	1			1
VI		1		1	1			1
VII		1		1	1			1
+	0	7	0	7	7	0	0	7
VIII		1		1		1		1
IX		1	1					1
X		1		1		1		1
XI	1		1					1
XII		1		1		1	1	
++	1	11	2	10	7	3	1	11

172 - 174. Formation of thickness of outer walls of epidermal cells of testa :
172 = with regular horizontal stratification,
173 = with irregular stratification,
174 = with ,, stalactites ".

175 - 176. Height of thickness of outer walls of epidermal cells of testa :
175 = up to 0,01 mm,
176 = 0,011 - 0,02 mm.

177 - 178. Largest dimensions of tegmen cells seen from above :
177 = up to 0,035 mm,
178 = 0,036 - 0,05 mm.

179 - 181. Formation of embryo in seeds :
179 = curled in the form of 1,5 - 2 spiral coils,
180 = bent like horse - shoe,
181 = bent in a semicircular or falcate way.

	172	173	174	175	176	177	178	179	180	181
I		1		0,2	0,8	1		1		
II		1			1	1		1		
III		1			1	1		1		
IV		1		0,5	0,5	1		1		
V		1		0,5	0,5	1		1		
VI	1			0,5	0,5	1			1	
VII	1			0,5	0,5	1			1	
+	2	5	0	2,2	4,8	7	0	5	2	0
VIII			1	1		1				1
IX	1			1			1			1
X			1	1		1				1
XI	1			1			1			1
XII			1	1		1				1
++	4	5	3	7,2	4,8	10	2	5	2	5

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Prosty sposób wyszukiwania cech sprzężonych i przeciwstawnych przy pomocy tabeli cech stosowanej w metodzie dendrytowej

Streszczenie

Na przykładzie krajowych gatunków rodzajów *Delia* Dum., *Spergula* L. i *Spergularia* Presl, autor przedstawia prosty sposób znajdowania cech sprzężonych i przeciwstawnych w badaniach systematycznych prowadzonych metodą dendrytową.

Podstawę do badań tą metodą stanowi tabela cech różniących osobniki badanego zbioru.

W naszym przykładzie ta tabela obejmuje zbiór 12 gatunków (osobników) różniących się 181 cechami przedstawionymi na tabeli cech (str. 78—98).

W takim zbiorze cechy sprzężone są obecne zawsze u tych samych gatunków. Cechy przeciwstawne natomiast wykluczają się wzajemnie u tych samych gatunków.

Najprostszym sposobem zorientowania się, które cechy mogą być sprzężone lub przeciwstawne, jest podsumowanie kolumn pionowych tabeli cech (patrz tabela cech: kolumny poziome oznaczone + i ++).

Porównanie ze sobą kolumn pionowych tabeli cech o tych samych wartościach liczbowych, pozwala ustalić, które cechy nie wykazują różnic w obecności ich u poszczególnych gatunków, czyli występują w badanym zbiorze u tych samych gatunków, a zatem są ze sobą sprzężone. W naszym przykładzie cechami takimi dla całego zbioru (++) są np.:

Suma kolumny pionowej tabeli cech	Nr cech, które mogą wykazać sprzężenie, gdyż posiadają taką samą wartość sumy	Nr cech sprzężonych
11	45, 47, 54, 65, 165, 171	65 i 171

itd. patrz str. 75.

Przeciwstawność będą wykazywać te cechy, które wzajemnie się wykluczają, czyli sumy dwu cech przeciwstawnych winny dać sumę osobników badanego zbioru. W naszym przykładzie sumę 12, zaś dla całego zbioru przedstawiają się następująco:

Sumy dwu kolumn pionowych tabeli (++), dające sumę 12	Nr cech przeciwstawnych
11 : 1	a) 45 : 46 i 53

itd. patrz str. 76

Na podstawie znalezionego sprzężenia cech można określić, które cechy odpowiadają sobie wzajemnie na różnych organach. Nasza tabela cech obejmuje cechy różniące rośliny i nasiona krajowych gatunków *Delia, Spergula* i *Spergularia*. A zatem na podstawie sprzężenia cech możemy ustalić, które cechy roślin odpowiadają jakimś cechom nasion i na odwrót. W naszym przykładzie są one zestawione na str. 77.

Możliwość ustalania odpowiedników cech na różnorodnych organach roślin wydaje się mieć duże znaczenie nie tylko teoretyczne, ale przede wszystkim praktyczne zarówno w uprawie jak i systematyce. Dla metody Taksonomii Wrocławskiej jest to dalsze rozszerzenie możliwości jej stosowania

Zakład Botaniki Farmaceutycznej
Instytutu Biologiczno-Farmaceutycznego
Akademii Medycznej w Poznaniu