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Biosystematic studies on *Dactylis* L. 2. Original research. 2.1. Morphological differentiation and occurrence of representatives of the genus *Dactylis* in Poland. 2.1.1. Field studies and experimental cultures

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Abstract

The author presents the results of a statistical and populational analysis of the morphological characters of the genus *Dactylis*. Biometric studies of natural populations were carried out simultaneously with observations of samples from experimental cultures. It has been recognized that in Poland the genus *Dactylis* is represented by one species, *D. glomerata* L., within which three subspecies have been distinguished: subsp. *glomerata*, subsp. *aschersoniana* (Graebn.) Thell. and subsp. *slovenica* (Dom.) Dom. The author gives a key to the determination of these subspecies.

Key words: Dactylis, morphological differentiation, systematics, experimental cultures

INTRODUCTION

Previous studies by various authors on morphological differentiation have been reviewed in detail in an earlier paper in this series (Mizianty 1986).

It should be emphasized that the taxa belonging to the genus *Dactylis* exhibit great morphological variation, so that their classification has presented many difficulties to systematists. It seems that only complex studies, i.e. in classic morphological systematics, experimental culture, population investigations by means of numerical methods and detailed cytological analysis may contribute to the elucidation of numerous existing problems. These problems, if left unsolved, render it difficult to gain knowledge of the relations existing within this species, and also impede the construction of a classification showing the evolutionary connections of the systematic units in *Dactylis*.

The aim of the studies now reported was to discover such morphological characters which would enable the taxa of the genus *Dactylis* in Poland to be

identified unambiguously. Special attention has been paid to forms differing in the number of chromosomes (diploids and tetraploids) hitherto not differentiated morphologically. Previous opinions on this subject will be discussed in a forthcoming paper (Mizianty a, in preparation).

The present paper consists of the following 3 parts: A) Variability of characters on the basis of biometric studies, B) Variability of characters not studied statistically, C) Taxonomical problems.

These studies were supplemented by an analysis of specimens in Polish and foreign herbaria. Point maps of the distribution of *D.g.* subsp. *slovenica* and subsp. *aschersoniana* were prepared on the basis of herbarium materials (Mizianty 1988 and Mizianty 1989). No point maps will be given for *D.g.* subsp. *glomerata*, since this plant is very common.

Detailed cytological studies of the genus *Dactylis* in Poland are presented elsewhere (Mizianty 1985 and Mizianty b, in preparation).

MATERIALS AND METHODS

A. VARIABILITY OF CHARACTERS ON THE BASIS OF BIOMETRIC STUDIES

Materials for study were collected from 83 stands in Poland (list on p. 615-619, Fig. 1). The samples of the populations of *Dactylis glomerata* s.l. occupied habitats varying from damp to dry sandy places, from meadow to woodland communities, from plain to mountain stands, from very sunny to very shady sites. The numbering of the stands corresponds to the numbering on the map and on all the presented diagrams and graphs.

Sixty population samples (ten individuals in each) gathered in the field by a simple random method were investigated statistically. Another 23 samples were used only for comparative studies. The numbers of these are shown within brackets in the list of stands. In addition, five specimens gathered and determined by Domin as *D. slovenica* (Domin 1943) were used for comparative studies. In the list of stands (see p. 615) these specimens are marked by the letter D.

The samples collected in the terrain were also represented in a culture (established in the Botanical Garden of the Jagiellonian University of Cracow) with the aim of creating more or less similar conditions for the growing plants so as to lead to the elimination of modification variability.

Some plants were transplanted to a special experimental culture which consisted of thirteen samples representing all the subspecies of *Dactylis glomerata* isolated earlier on the basis of observations in the field. These grew in so-called "random blocks" (Perkal 1967) in three repetitions for five vegetative seasons. Two series of random blocks, identical in arrangement, were planted at the same time. In one series the plants were grown in

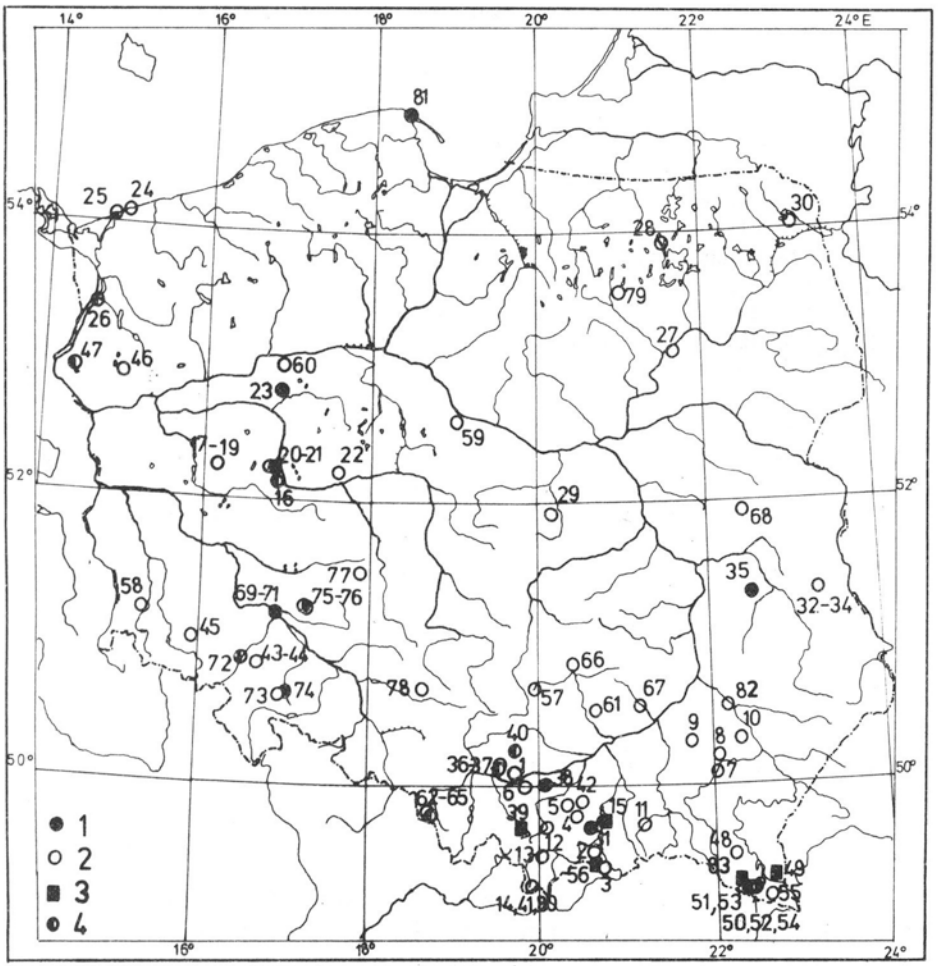

Fig. 1. The distribution of the studied populations of *Dactylis glomerata s.l.* 1 — subsp. *aschersoniana*, 2 — subsp. *glomerata*, 3 — subsp. *slovenica*, 4 — intermediate samples

flower-pots, and in the other directly in the ground. It proved that only plants growing in the ground were suitable for long-lasting culture, so these formed the basis for further considerations. The plants in flower-pots grew very poorly, and some died.

In these studies every sample (60 samples from nature and 13 from experimental culture), each consisting of ten specimens, was studied statistically with regard to thirteen characters (Table 1). The following were calculated for each particular character: the arithmetic mean with standard error ($\bar{x} \pm d$), the standard deviation (s), and the coefficient of variability (V).

The differentiation of the populations was investigated by means of Principal Component Analysis — PCA (Szczotka 1966, Blackith and

Table 1

List of studied characters

No	Feature
	a. biometrically studied
1	Length of the culm (cm), measured from the lowest node to the apex of panicle.
2	Maximum width of the culm (mm)
3	Number of nodes
4	Length of leaf growing in the middle part of the culm (mm)
5	Width of leaf growing in the middle part of the culm (mm)
6	Length of panicle (mm), measured from the lowest panicle node to the apex of the panicle
7	Number of flowers in lowest spikelet of lowest branch
8	Length of lower glume in lowest spikelet of lowest branch (0.1 mm)
9	Width of lower glume in lowest spikelet of lowest branch (0.1 mm)
10	Length of lemma in lowest flower of lowest spikelet (0.1 mm)
11	Width of lemma in lowest flower of lowest spikelet (0.1 mm)
12	Number of spikelets in the basal glomerulus (lowest glomerulus of lowest panicle branch)
13	Ratio of culm length to leaf length
	b. not biometrically studied
14	Colour of leaves – according to Maerz and Paul (1950)
15	Colour of glumes and lemmas
16	Structure of lemma apex
17	Pubescence of glumes and lemmas
18	Phenology

Reyment 1971), Anderson's coefficient of hybridity method (Davidson 1947, Anderson 1949), dendrograms (Sokal and Sneath 1963), and graphs of shape and size (Jentys-Szaferowa 1959). The calculations for the PCA and dendrograms were carried out at the Cracow Regional Computer Centre "Cyfronet".

B. VARIABILITY OF CHARACTERS NOT STUDIED STATISTICALLY

Characters such as the colour of the leaves, glumes and lemmas, the structure of the tip of the lemma, the pubescence of glumes and lemmas and the phenology (Table 1, characters 14-18) were treated only as supplementary observations and have not been studied statistically. Observations of these characters, with the exception of leaf colour (character 14) were made both in the terrain and in the experimental culture. Leaf colour was defined on the basis of a dictionary of colour (Maerz and Paul 1950). It was not possible to make more than an approximate determination of leaf colour in the field, and in a herbarium leaf colour may undergo marked alteration.

In order to observe variations in the colour of the glumes and lemmas (character 15) two experimental cultures were set up, one in full sunshine and the other in shade. Specimens of *Dactylis* from 42 stands were located in these (List of stands, p. 615, samples 1-42).

RESULTS

A. VARIABILITY OF CHARACTERS ON THE BASIS OF BIOMETRIC STUDIES

The mutual relationship between the samples of the studied populations was analysed by the PCA method (Fig. 2) with regard to all the presented characters, as well as by dendrograms supplementing the graphs of shape and size (Fig. 3). In the PCA analysis only the first two components (V_1, V_2) were taken into consideration, since together they give 70.38% of the information and are correlated to all the characters, while component V_3 gives only 7.31% of the information, and only character 12 is closely correlated to it. In the dispersion diagram for values V_1 and V_2, two groups emerge. One consists of samples of subsp. *slovenica* and the other of the remaining samples. By introducing various symbols it may be clearly seen that the second group is not homogeneous but consists of clearly outlined subgroups. One of these form the samples belonging to subsp. *glomerata*, the other to subsp. *aschersoniana*. Both subgroups are divided by an evident gap, which gives evidence of the morphological distinction of the two subspecies. The gap between the two subgroups is occupied by samples coming from individuals of which the taxonomic attachment is impossible to establish. They will henceforward be termed "intermediate samples" and "intermediate group" or else "group 4". The other three groups will be defined according to their taxonomic attachment, i.e. subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica*. The division into four groups is also marked in Fig. 3, which presents a dendrogram as well as samples presented by the graphic method of shape and size lines according to Jentys-Szaferowa. As may be seen in Fig. 3, the most uniform in respect to the studied characters is subsp. *aschersoniana*. The lines of shape and size for all samples of the populations entering into the composition of this group more or less resemble one another, but at the same time differ from the rest. The same is so in the group formed by populations belonging to subsp. *slovenica*, except for two populations not belonging to this subspecies (nos. 28 and 63). The shape and size lines of these two populations distinctly deviate from those forming the subsp. *slovenica* group.

In the studied material, subsp. *glomerata* is the most strongly represented. It also exhibits great heterogeneity. In every case, however, the course of the lines of shape and size retain the specific character, of this subspecies, distinct from both subsp. *aschersoniana* and subsp. *slovenica*. The greatest hetero-

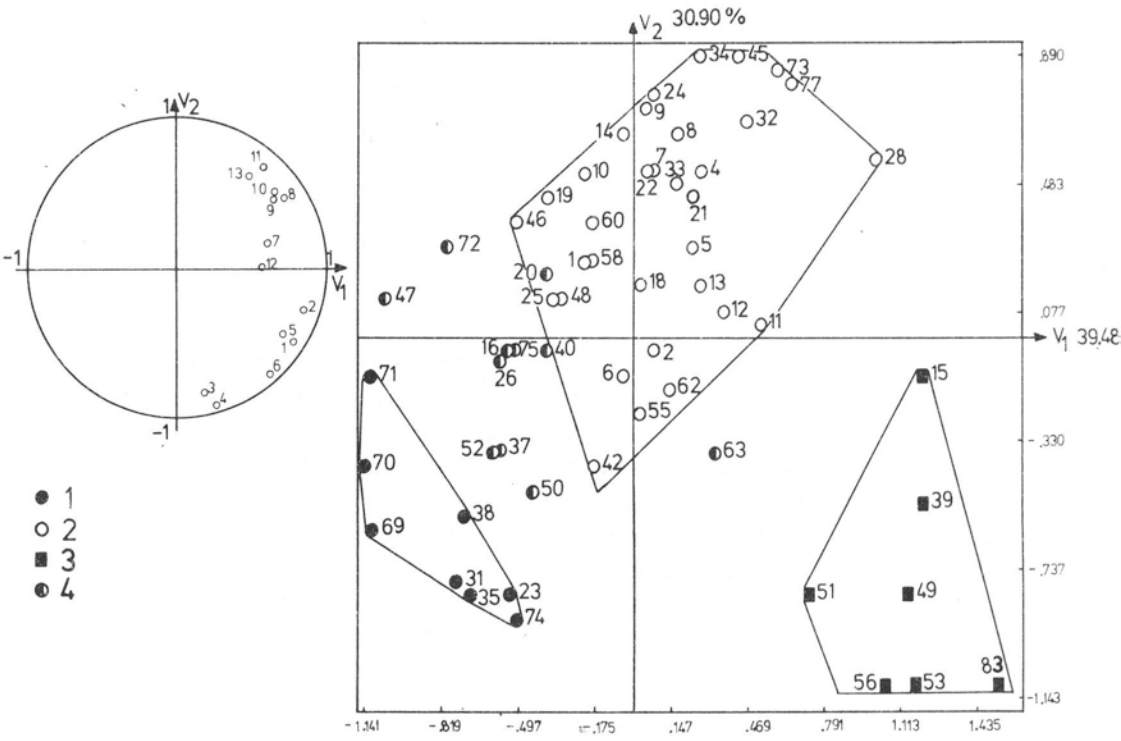

Fig. 2. PCA — dispersion diagram for samples of *D. glomerata* gathered in the field. 1 — subsp. *aschersoniana*, 2 — subsp. *glomerata*, 3 — subsp. *slovenica*, 4 — intermediate samples. The circular diagram shows the correlation of characters (1-13) with components V_1 and V_2

geneity is shown by a group composed of "intermediate samples". The lines of shape and size of these samples partly resemble those of subsp. *glomerata*, partly those of subsp. *aschersoniana*, and partly those of subsp. *slovenica*. A markedly clear distinction of these three subspecies is shown in the experimental cultures, as is illustrated in the dispersion diagram in Fig. 4. The comparison of selected samples representing particular species in the field and in experimental cultures is well illustrated by the dendrograms prepared separately for field and culture samples (Fig. 5). The dendrograms (Fig. 5A) for the selected wild samples (i.e. for those also analysed statistically in experimental cultures) distributed the samples into the following groups: subsp. *glomerata*, subsp. *aschersoniana* and subsp. *slovenica*. Population no. 47 lies between the group of populations belonging to subsp. *glomerata* and that of populations belonging to subsp. *aschersoniana*. A second population, no. 50, is situated in the dendrogram between the group of populations representing subsp. *aschersoniana* and the populations belonging to subsp. *slovenica*. Both samples (47 and 50) are closely linked, and through sample no. 50 are connected with subsp. *slovenica*.

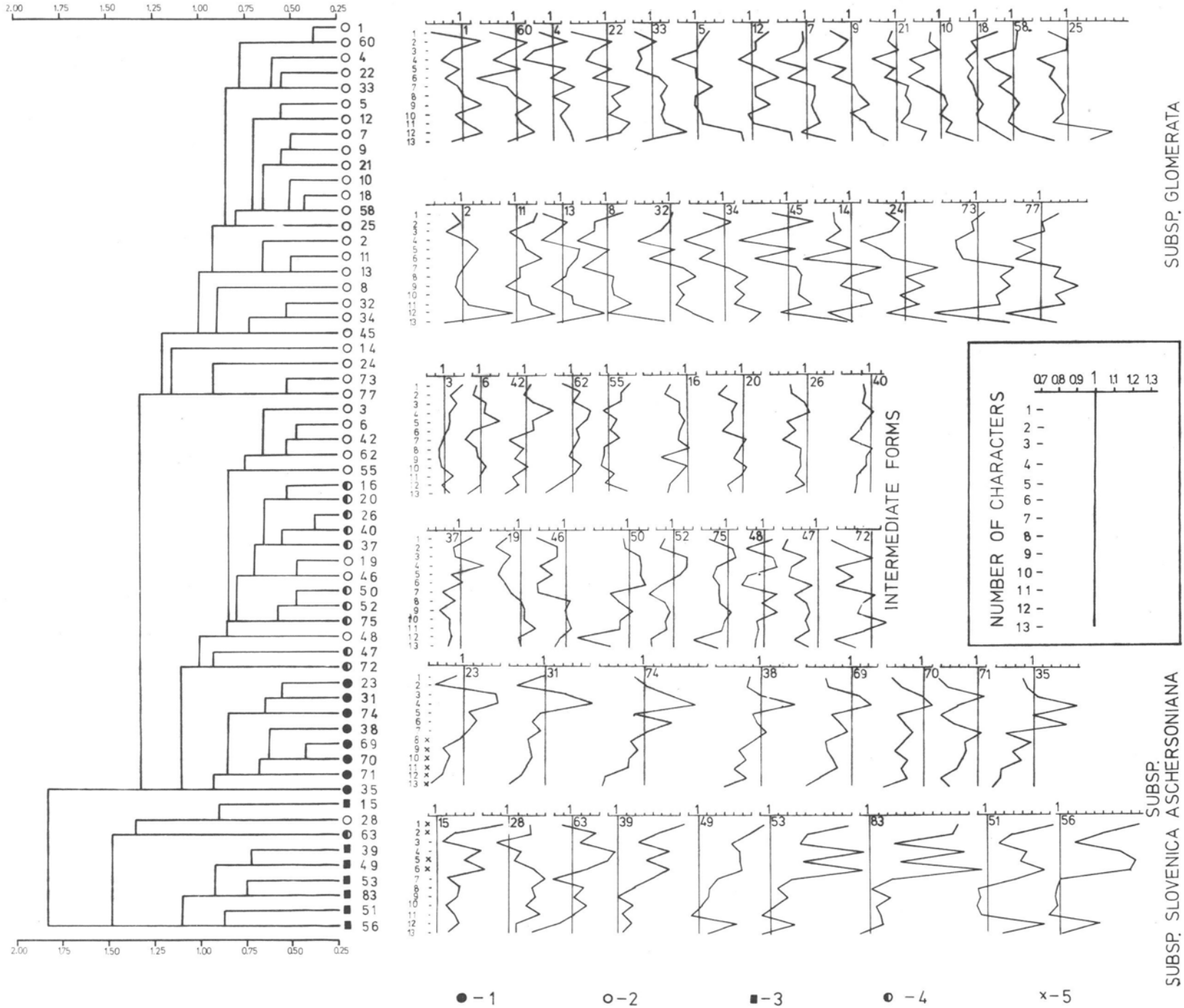

Fig. 3. A dendrogram of taxonomical distances of all samples collected in the field, supplemented by graphs of the lines of shape and size. The comparative unit in the graphs of the shape and size lines is the general mean for each character. 1 — subsp. *aschersoniana*, 2 — subsp. *glomerata*, 3 — subsp. *slovenica*, 4 — intermediate samples, 5 — traits characteristic of the subspecies

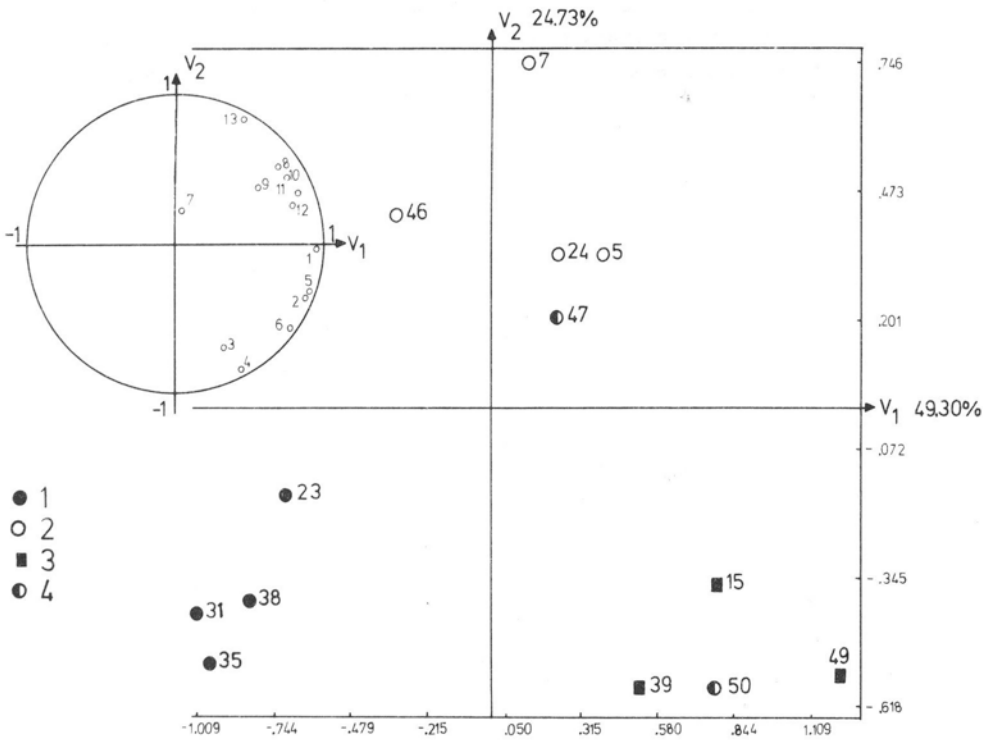

Fig. 4. PCA — dispersion diagram of samples of *D. glomerata* from experimental cultures. 1 — subsp. *aschersoniana*, 2 — subsp. *glomerata*, 3 — subsp. *slovenica*, 4 — intermediate samples. The circular diagram shows the correlation of characters (1-13) with components V_1 and V_2

In the dendrogram for plants from experimental cultures (Fig. 5B), the samples form three separate groups, i.e. subsp. *glomerata, slovenica* and *aschersoniana*. Samples of population 47 and 50 are included in the group subsp. *glomerata*.

It was found, after studying plants taken from the field and from experimental cultures, that these three subspecies could not be determined on the basis of the values of single characters.

Analysing the PCA results and the dendrograms together with the shape and size graphs, and also the values of $\bar{x}$ and s, a set of characters distinguishing a particular subspecies has been established. The values of these characters are listed in Table 2. Analysis of them shows that subsp. *aschersoniana* has the smallest glumes and lemmas (character 8-11) and is distinguished by the fewest spikelets in the glomerulus (character 12), while the cauline leaf is very long in relation to the stem, usually more than half its length (character 13). Another set of morphological characters, however, enables subsp. *slovenica* to be distinguished from the others. This subspecies is

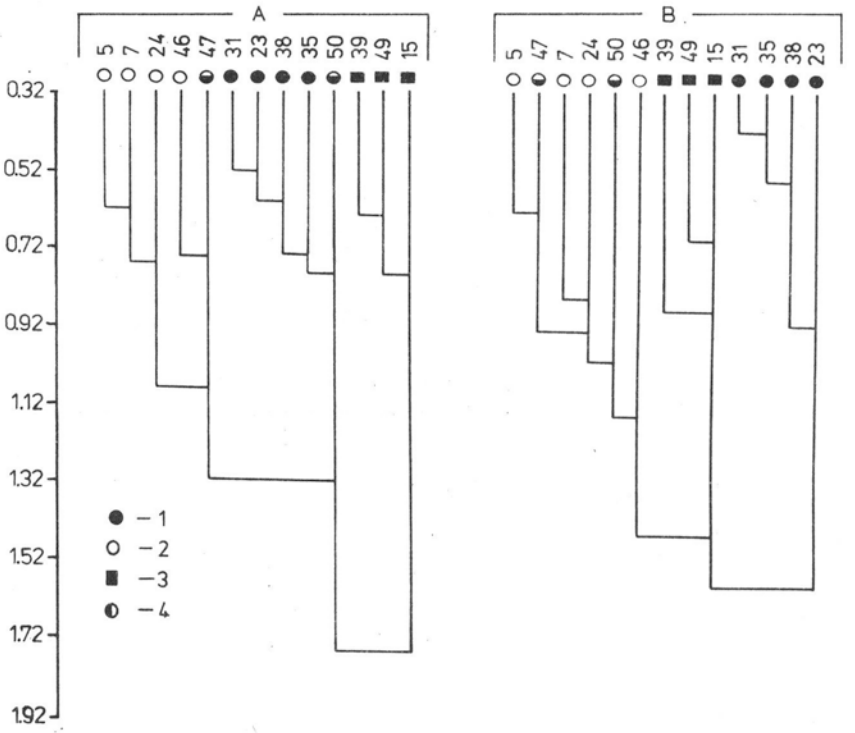

Fig. 5. A dendrogram of taxonomical distances for selected population samples. A – field, B – experimental cultures, 1 – subsp. *aschersoniana*, 2 – subsp. *glomerata*, 3 – subsp. *slovenica* 4 – intermediate samples

characterized by a long stem (character 1), a thickening in the lower part (character 2), very broad leaves (character 5), and a very spreading panicle (character 6).

The differentiation of subspecies of *D. glomerata* as regards the mentioned characters is presented in histograms (Fig. 6) prepared on the basis of the sum of the estimations of selected characters (Tables 3 and 4a, b). In Fig. 6A, with reference to plants from natural habitats, three basic population groups are distinguished, two corresponding to subsp. *aschersoniana* and *slovenica* and a third intermediate between these. This middle group is not uniform, as may be seen in the histogram. Populations belonging to subsp. *glomerata* form one part and samples previously determined as an "intermediate group" a second. The division of the populations into three main groups distinguished by selected characters also persisted in experimental cultures (Fig. 6B). An explanation of the behaviour in experimental cultures of populations nos. 47 and 50 will be given later in this paper (in Part C.).

Table 2

Mean values, minimum and maximum of characters of subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica*

Feature	subsp. *aschersoniana*			subsp. *glomerata*			subsp. *slovenica*		
	$\bar{x}$ min	$\bar{\bar{X}}$	$\bar{x}$ max	$\bar{x}$ min	$\bar{\bar{X}}$	$\bar{x}$ max	$\bar{x}$ min	$\bar{\bar{X}}$	$\bar{x}$ max
1. Length of culm (cm)	45.60	65.49	80.20	48.50	76.61	101.67	141.00	149.20	162.50
2. Maximum width of culm (mm)	2.50	2.92	3.80	2.70	3.68	4.75	4.40	5.56	7.10
5. Width of leaf (mm)	2.70	3.89	4.80	3.40	4.45	5.60	6.00	6.57	8.43
6. Length of panicle (mm)	75.50	101.49	138.60	49.50	90.67	132.10	152.40	182.10	229.50
8. Length of lower glume (0.1 mm)	33.10	39.91	45.70	44.90	49.25	61.10	46.50	52.18	59.10
9. Width of lower glume (0.1 mm)	10.20	11.46	13.40	13.00	15.67	20.70	14.14	16.48	18.20
10. Length of lemma (0.1 mm)	40.10	41.85	43.40	44.90	53.16	62.00	50.30	54.66	59.70
11. Width of lemma (0.1 mm)	12.40	15.02	16.50	16.10	21.46	26.60	17.60	20.08	23.70
12. Number of spikelets in the glomerulus	6.90	8.48	10.20	6.50	13.39	19.60	14.50	16.13	18.00
13. $\frac{\text{Length of culm}}{\text{Length of leaf}}$	1.96	2.30	2.75	2.83	4.63	6.64	3.61	4.11	4.53

$\bar{x}$ – mean value for populations. $\bar{\bar{X}}$ – mean value for total material.

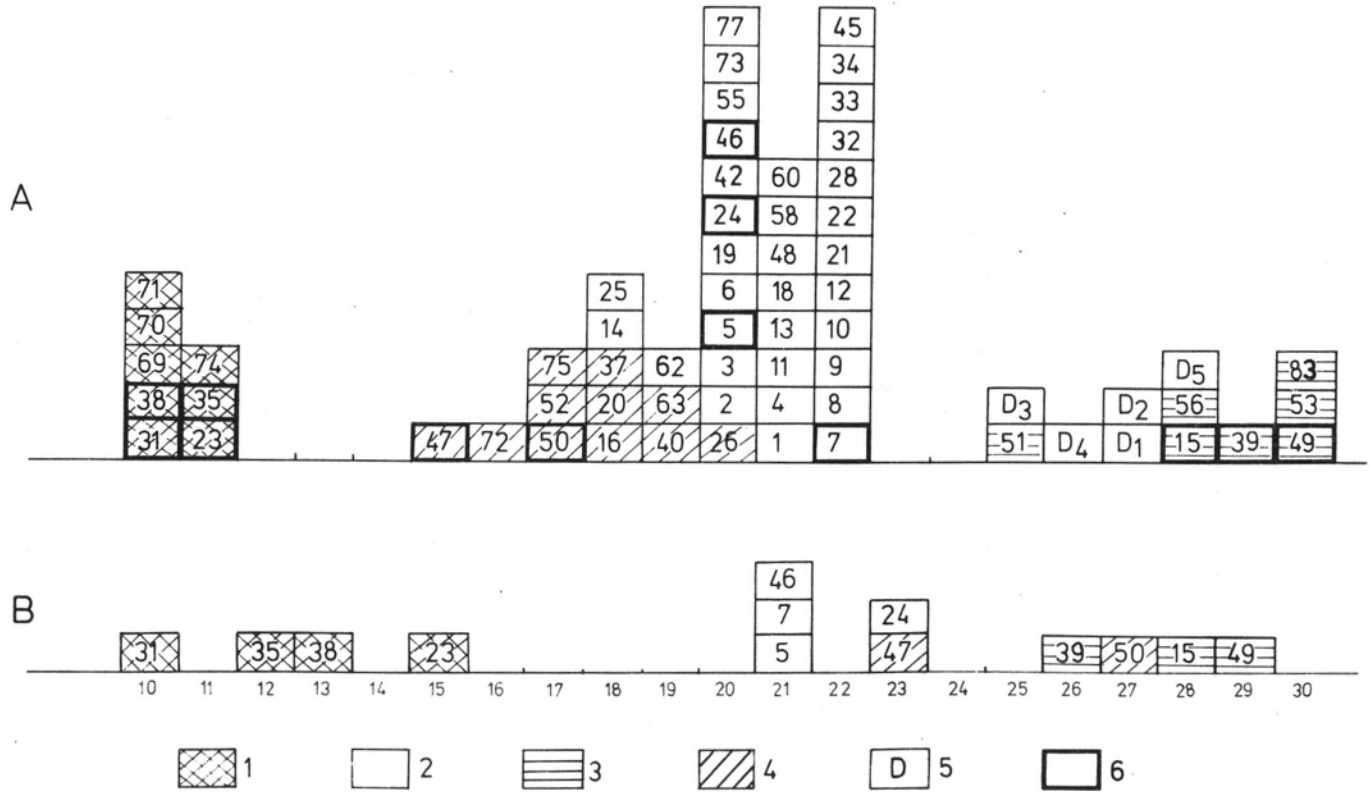

Fig. 6. Histograms of the sum of the estimations. A — population samples collected in nature and studied statistically, B — population samples from experimental cultures, 1 — subsp. *aschersoniana*, 2 — subs. *glomerata* 3 — subsp. *slovenica*, 4 — intermediate samples, 5 — specimens of subsp. *slovenica* collected and designed by Domin, 6 — population samples studied in experimental cultures

Table 3

Estimates of characters for cyclograms and histograms

Culm		Leaf	Panicle
1. Length (cm)	2. Maximum width (mm)	5. Width (mm)	6. Length (mm)
up to 110. . . . . .1 110.1-140.0. . . . . 2 above 140.0. 3	up to 5. . . . . .1 above 5. 3	up to 5.9. . . . . .1 above 5.9. 3	up to 150. . . . . .1 above 150. 3
Lower glume		Lemma	
8. Length (0.1 mm)	9. Width (0.1 mm)	10. Length (0.1 mm)	11. Width (0.1 mm)
up to 44.0. . . . . 1 44.1-48.0. . . . . 2 above 48.0. 3	up to 12.5. . . . . 1 12.51-15.0. . . . . .2 above 15.0. 3	up to 43.5. . . . . 1 above 43.5. 3	up to 16.5. . . . . 1 above 16.5. 3
12. Number of spikelets in the glomerulus		13. $\frac{\text{Length of culm}}{\text{Length of leaf}}$	
up to 11. . . . . .1 above 11. 3		up to 2.75. . . . . .1 above 2.75. 3	

Table 4a

Sums of estimates of characters — natural localities

Number of feature	subsp. *aschersoniana*								subsp. *slovenica*												4*										
	23	31	35	38	69	70	71	74	15	39	49	51	53	56	83	D_1	D_2	D_3	D_4	D_5	16	20	26	37	40	47	50	52	63	72	75
1	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	1	2	1	2	2	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	3	3	1	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	3	1	1
6	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3
11	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
12	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3
8	2	1	2	1	1	1	1	1	3	3	3	1	3	2	3	3	3	3	3	3	3	2	2	1	3	1	1	1	3	1	1
9	1	1	1	1	1	1	1	2	3	2	3	2	3	2	3	2	3	2	2	2	1	2	2	1	2	2	2	2	2	1	2
Sum of estimates	11	10	11	10	10	10	10	11	28	29	30	25	30	28	30	27	27	25	26	28	18	18	20	18	19	15	17	17	19	16	17

Number of feature	subsp. *glomerata*																															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	18	19	21	22	24	25	28	32	33	34	42	45	46	48	55	58	60	62	73	77
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
11	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
12	3	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	1	1	1	
13	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8	2	2	2	2	2	2	3	3	3	3	3	3	3	2	2	2	3	3	3	2	3	3	3	3	2	3	2	2	2	2	2	3	3	3
9	3	2	2	3	2	2	3	3	3	3	22	3	2	2	3	2	3	3	3	2	3	3	3	3	2	3	2	3	2	3	3	2	3	3
Sum of estimates	21	20	20	21	20	20	22	22	22	22	21	22	21	18	21	20	22	22	20	18	22	22	22	22	20	22	20	21	20	21	21	19	20	20

* This group imtermediate populations.

Table 4b

Sums of estimates of characters – experimental cultures

Number of feature	subsp. *aschersoniana* 23 31 35 38	subsp. *glomerata* 5 7 24 46 47	subsp. *slovenica* 15 39 49 50
1	1 1 1 1	1 1 2 1 1	2 1 3 2
2	1 1 1 1	1 1 3 1 1	3 3 3 3
5	1 1 1 1	1 1 1 1 1	3 3 3 3
6	1 1 1 1	1 1 1 1 3	3 3 3 3
10	3 1 3 3	3 3 3 3 3	3 3 3 3
11	3 1 1 1	3 3 3 3 3	3 3 3 3
12	1 1 1 1	3 3 3 3 3	3 3 3 3
13	1 1 1 1	3 3 3 3 3	3 3 3 3
8	1 1 1 1	2 3 2 2 2	3 1 2 2
9	2 1 1 2	3 2 2 3 3	2 3 3 2
Sum of estimates	15 10 12 13	21 21 23 21 23	28 26 29 27

The results of these biometric studies on the taxa of *Dactylis* occurring in Poland may be compared with the studies of the same type carried out by Borrill (1961a and b) on taxa occurring in Northern Europe and in the Mediterranean region, Cenci (1982) in Italy, Wetschnig (1984) in Carinthia (Austria) and Doroszewska (1961) in Czechoslovakia and Poland. Unfortunately the values of all the characters studied cannot be compared, since not all these authors investigated the same characters. Comparative lists of character value are given in Table 5 and Fig. 7. It should be remarked that this is only a general and not a statistical comparison. From this it appears that the specimens recognized by Cenci l.c. as typical of the subspecies *glomerata* (coming only from Northern Italy) have a very long blade and panicle and a long broad leaf. The values of some of these features are in part greater than in the specimens recognized by the present author as subsp. *glomerata*. Cenci recognizes specimens with lower values of the characters as intermediate between subsp. *glomerata* and subsp. *hispanica*. On the other hand, the *D. glomerata* studied by Borrill (1961a) in Denmark, Norway, Scotland and Finland had a leaf the length of which had a narrower range than that established for the populations in Poland. The present author's results most nearly approximate those obtained by Wetschnig (1984) when investigating subsp. *glomerata* and subsp. *aschersoniana* in Carinthia. The range of character variability in the material from Carinthia is slightly greater than in the material from Poland, but only when the mean values of the characters are taken into consideration. If the minimum and maximum of the Polish mean values of measurements of single specimens is compared (as Wetschnig probably did in 1984) then the range of character values is very similar.

Table 5

Comparison of character values of subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica*

Author	Length of culm (cm)	Length of panicle (mm)	Length of leaf (mm)	Width of leaf (mm)
	aschersoniana			
Mizianty*	(38)46-80(107)	(35)76-139(175)	(130)170-350(430)	(2)2.7-4.8(6)
Wetschnig (1984)	40-121	30-170	160-360	3.0-7.0
Borrill (1961a)	–	10.6	117	–
	glomerata			
Mizianty*	(30)43-102/182	(25)50-132(210)	(60)100-330(370)	(2)3.0-6.4(9)
Cenci (1982)	91-118	110-190	250-310	9.0-10.0
Wetschnig (1984)	43-135	40-200	130-350	3.0-8.0
Doroszewska (1961)	up to 100	93-230	–	–
Borrill (1961a)	–	–	140-200	–
	slovenica			
Mizianty*	(101)142-163(199)	(103)152-230(265)	(170)320-460(670)	(4)6.0-8.4(9.0)
Doroszewska (1961)	about 150(191)	148-364	–	up to 15.0

* In brackets – values for specimens, without brackets – mean values for populations.

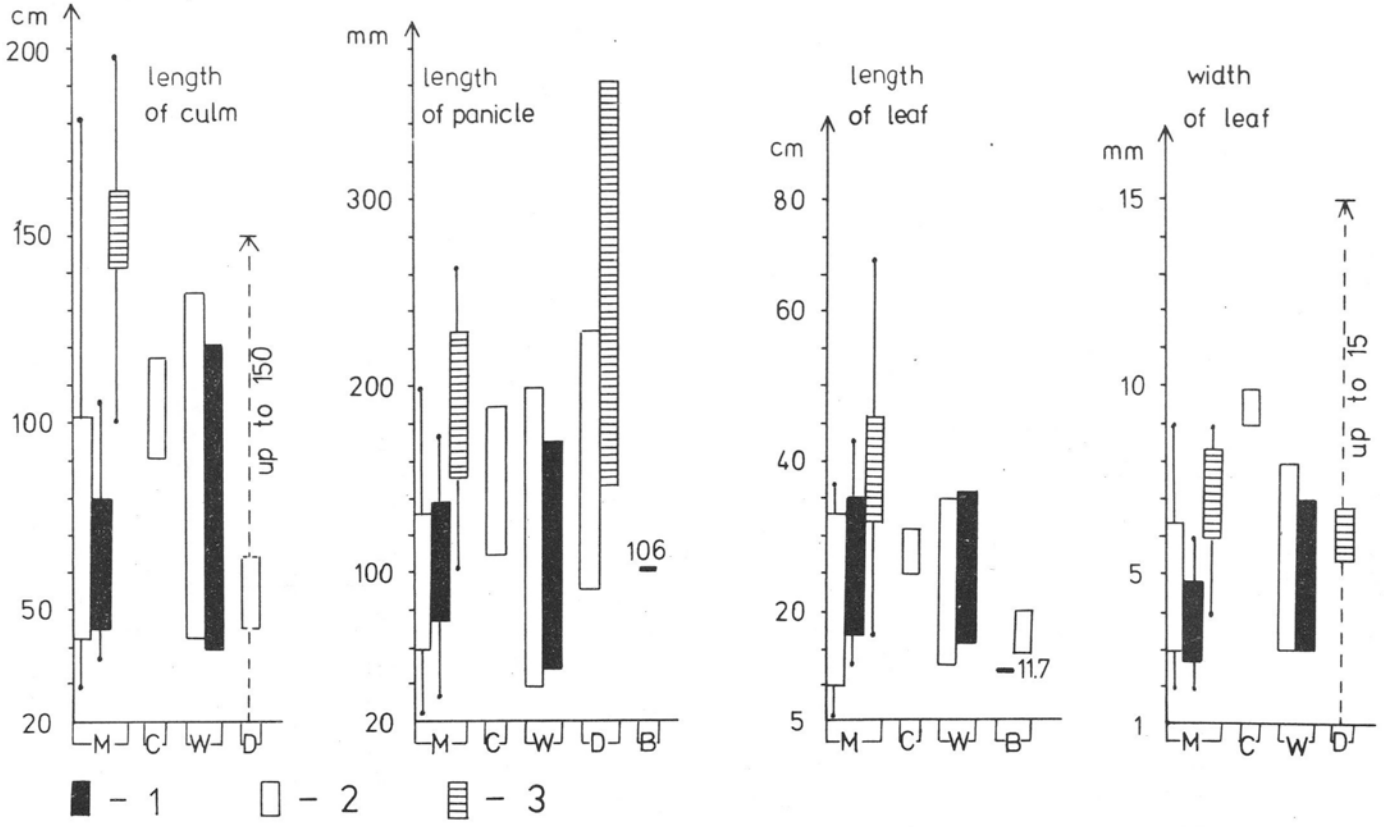

Fig. 7. Comparison of results of studies. 1 – subsp. *aschersoniana*, 2 – subsp. *glomerata*, 3 – subsp. *slovenica*, M – Mizianty, C – Cenci (1982), W – Wetschnig (1984), B – Borrill (1961a), D – Doroszewska (1961). For M are given the minimum and maximum mean values and the minimum and maximum for individual specimens, for W the probable minimum and maximum for individual specimens, for C, D and B (in part) the minimum and maximum values of the means. The numerical values are given in Table 5

B. VARIABILITY OF CHARACTERS NOT STUDIED STATISTICALLY

Leaf colour (character 14)

A comparison of the colours of the leaves of selected plants in experimental cultures growing in a sunny situation is shown in Fig. 8. The populations of subsp. *aschersoniana* had yellowish-green leaves, subsp. *glomerata* had greyish-green leaves, and subsp. *slovenica* had something between the two. Differentiation in leaf colour was maintained during the whole duration of the experiment. Subsp. *aschersoniana* differed very considerably in leaf colour from the other population samples, although it was quite different from that in its shady natural habitat, where this subspecies is characterized by bright-green leaves. On the other hand, leaf colour in representatives of subsp. *glomerata* and subsp. *slovenica* remained unchanged and was the same whether the plants grew in the shade or in the sun. Whether in sun or in shade, however, subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica* differed from another in leaf colour. Many workers have written on the subject of difference in leaf colour between individual taxa in the genus *Dactylis*, as is shown by the list in Table 6. The author's own field observations agree with those of the authors who report leaf colour in subsp. *aschersoniana* as dark green to bright green. No subsp. *aschersoniana* in nature was found to have yellowish-green leaves. While, as already mentioned, populations of subsp. *aschersoniana* transferred to experimental cultures in full sunlight assumed a leaf colour from light green to yellowish green. The fact that there were differences in leaf colour between subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica* which persisted in experimental cultures gives evidence of the individuality of these taxa.

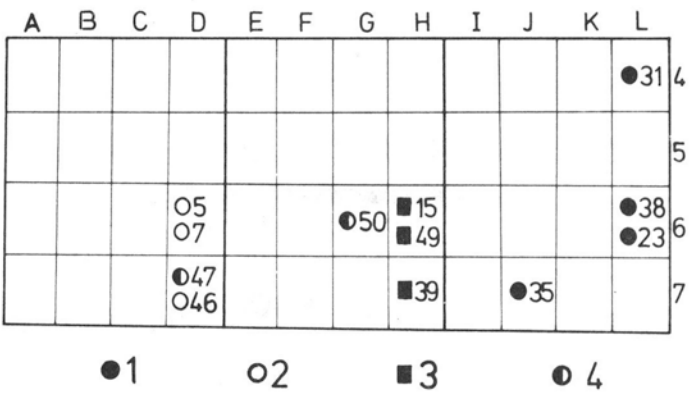

Fig. 8. Comparison of leaf colours in experimental cultures according to an atlas of colour (Maerz and Paul 1950, Table 21). 1 — subsp. *aschersoniana*, 2—2 subsp. *glomerata*, 3 — subsp. *slovenica*, 4 — intermediate samples

Table 6

Leaf colours of subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica* according to various authors

Author	subsp. *aschersoniana*	subsp. *glomerata*	subsp. *slovenica*
Domin (1943)	green	bluish-green	green
Tzvelev (1976)	intensely green	bluish-green	green
Prokudin et al. (1977)	light-green	bluish-green	green
Doroszewska (1961)	–	pale-green	pale-green
		bright-green	bright-green
		bluish-green	bluish-green
		grayish-green	
Stebbins and Zohary (1959)	yellow-green to bright-green	bluish-green	–
Rothmaler (1963)	fresh-green	grayish-green	–
Hegi (1965)	yellow-green	grayish-green	–
Wetschnig (1984)	dark-green	–	–
Szafran (1933)	–	grayish-green	–

Variability of leaf colour of tetraploids belonging to "group 4" will be presented in part C of this paper.

Colour of glumes and lemmas (character 15)

The colour of glumes and lemmas was observed to change in two experimental cultures planted at the same time, one in sun and the second in shade (see Methods B). The hue of the glumes and lemmas depends on the intensity of illumination. All the plants belonging to the subspecies *aschersoniana, glomerata* and *slovenica* growing in cultures in the sun had glumes and lemmas more or less violet or tinged with purple, while those growing in the shade were greenish or yellowish, so that the classification on the basis of this character used by Domin (1943) does not seem satisfactory.

Structure of the lemma tip (character 16)

This character was studied in all the populations observed. On the whole, the lemma was drawn out more or less into a point and provided with a shorter or longer awn. Such a structure of the lemma was characteristic of *D.g.* subsp. *aschersoniana*, *glomerata* and *slovenica*, unlike *D. hispanica* Roth., of which the lemma has lobate auricles at the base of the awn, and the awn is often shortened. In the material from Poland, one population (no. 24) was found in which some specimens had a rounded or slightly lobate lemma tip, and so was linked to *D. hispanica* by this character (Fig. 9). According to Borrill (1961a)

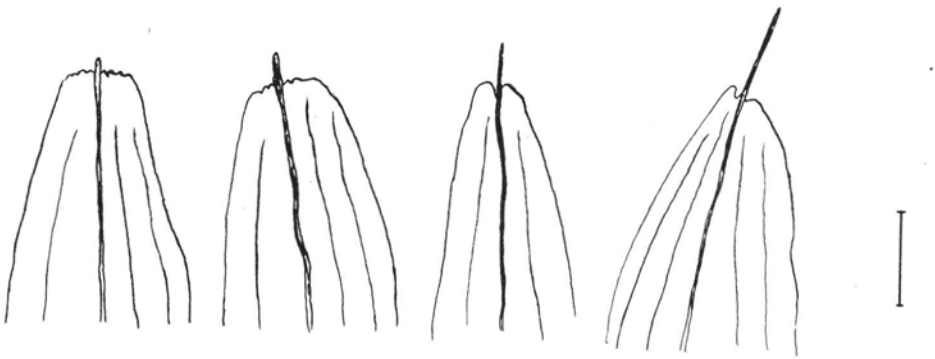

Fig. 9. Examples of tip structure of lemma in specimens of population no. 24. Scale 1 mm

the structure of the lemma tip is very important systematic character in the genus *Dactylis*. It follows from his investigations that the degree of division of the tip of the lemma is negatively correlated with the length of the panicle. The length of the panicle in population no. 24 was 8.70 cm, and comes within the range reported by the present author for *D.g.* subsp. *glomerata* (4.95-13.21 cm); so does the value of this character given by Borrill (1961a) for *D.*

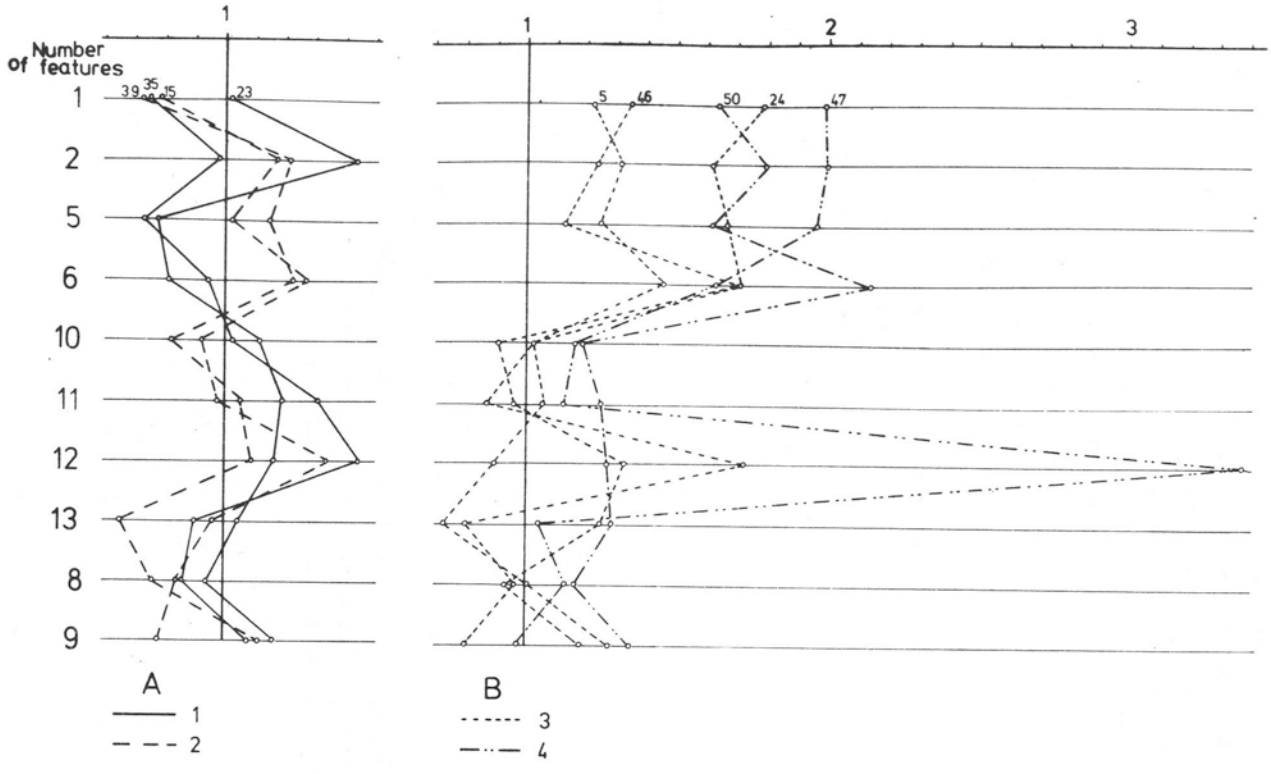

Fig. 10. Comparison of character values in nature and in experimental cultures. 1 – subsp. *aschersoniana*, 2 – subsp. *slovenica*, 3 – subsp. *glomerata*, 4 – intermediate samples. The comparative unit was taken as the mean values of particular characters for the corresponding population samples collected in the field. Character numbers according to Table 1

glomerata (8.21-15.92 cm). On the other hand, the leaf length (11.1 cm) corresponds to that given by Borrill l.c. for *D. hispanica* (3.10-18.20 cm). In spite of a certain resemblance to *D. hispanica*, population no. 24 in the present stage of investigations has been assigned to *D.g.* subsp. *glomerata*. It should, however, be remarked that still another character differentiates specimens of population no. 24 from the typical subsp. *glomerata*. In the natural habitat, the number of spikelets in the inflorescence was very small (character 12). Subsp. *aschersoniana* and the populations in "group 4" also had a small number. The changes undergone by the characters studied in population no. 24, growing in experimental cultures are shown by the Jentys-Szaferowa method (Fig. 10). The nature of these changes is similar to those taking place in populations 47 and 50, which also belong to "group 4". The lobate tip of the lemma was also preserved in experimental cultures. Borrill (1961a) reported earlier that this is a hereditary character. *D. hispanica* is not such an outstanding taxon as Boissier (1855) considered it to be. Information on the variability of *D. hispanica* and its intermediate forms may be found in the publications of Borrill (1961a and b), Vierhapper (1915), and Stebbins and Zohary (1959). The area of natural occurrence of *D. hispanica* lies in the Mediterranean region, although Scannell and Synnott (1972) report this species in Ireland. The current map of distribution of *D. hispanica* was given in an earlier paper of the present series (Mizianty 1986). Sample no. 24 was subjected to detailed cytological studies. It may be a hybrid between *D.g.* subsp. *glomerata* and *D. hispanica*. The situation of its stands may also favour this supposition (see list of stands, p. 615).

Pubescence of glumes and lemmas (character 17)

It is advisable to examine the glumes on the exterior of a spikelet, since glumes covered by other spikelets may be less pubescent. On the whole, subsp. *aschersoniana* and subsp. *slovenica* had glumes and lemmas without hairs. Single hairs up to 0.05 mm in length were sometimes found on the keel. Subsp. *glomerata*, however, usually had hairs up to 1 mm long on the glumes and lemmas and often the whole surface of the glumes and lemmas was pubescent. These observations on pubescence in the particular taxa of *Dactylis* agree with those of Domin (1943), Doroszewska (1961) and others. Pubescence of the glumes and lemmas did not change in experimental culture.

Phenology (character 18)

In the period 1982-1984 observations were made on the phenological development of samples in experimental cultures grown in a very sunny site. The studies were preliminary in nature. The main subject of observation was

the differences in florescence between subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica*.

The earliest to flower, about the middle of May, were some samples belonging to subsp. *glomerata* (nos. 29, 30, 45, 46, 48), and some in "group 4" (nos. 37, 40, 47). A few days later, between May 20 and 25, subsp. *aschersoniana* and subsp. *slovenica* flowered almost at the same time. The remaining samples of populations belonging to subsp. *glomerata* or to "group 4" flowered successively until all had flowered by July 15.

Recapitulating, in experimental cultures the florescence of populations of subsp. *glomerata* was differentiated, that of subsp. *aschersoniana* and subsp. *slovenica* was a little later than the earliest flowering representatives of subsp. *glomerata*.

Attention has been called by Tomov (1973), to the different florescence of subsp. *glomerata* in his studies on Bulgarian and other (chiefly English and Australian) populations. For *D.g.* subsp. *glomerata* he established six periods of panicle formation, from very early (second half of April) to late (second half of May). Differentiation of florescence in subsp. *glomerata* in Poland requires further detailed field and experimental studies, especially since transfer of those populations from natural to experimental conditions might influence florescence. For example, subsp. *slovenica* in experimental cultures flowered earlier than in natural conditions. According to this author's own observations, as well as those of Doroszewska (1961) in the field, specimens belonging to this subspecies flower only at the end of June or the beginning of July, i.e. about a month later than in experimental cultures.

All observations of characters nos. 14-18 have been included in Table 7.

C. TAXONOMICAL PROBLEMS

The results of the studies now reported inclined the author to assign the rank of subspecies to the distinguished taxa i.e. *glomerata, aschersoniana* and *slovenica*. This is supported by the fact that they are not clearly divided from one another morphologically, and there are no morphological characters which would define the attachment to any subspecies unambiguosly. The subspecies may be distinguished by applying appropriate sets of characters.

Studies of other authors on biological and genetic criteria (Mizianty a, in preparation) also indicate the close relationship of subsps. *glomerata*, subsp. *aschersoniana* and subsp. *slovenica*. It should be emphasized that numerous workers on this genus have given the units distinguished within it a varied range, from varieties "*glomerata*" (Speranza and Cristofolini 1986) to species "*glomerata*" (Mizianty 1986).

As far as the level of ploidy is concerned, subsp. *glomerata* and subsp. *slovenica* are tetraploids and subsp. *aschersoniana* is solely diploid. Subsp.

Table 7

Comparison of subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica* in respect to characters not studied biometrically

No	Feature	subsp. *aschersoniana*	subsp. *slovenica*	subsp. *glomerata*
14	colour of leaves in experimental cultures, according to Maerz and Paul (1950)	Table 21, L4, L6	Table 21, G6, H6, H7	Table 21, D6, D7
17	pubescence of glumes and lemmas	generally hairless or with single hairs on the kil and margin		generally hairy kil and margin as well as the whole surface; rarely hairless
18	phenology in experimental cultures	starts blooming about 20-25 May		starts blooming from 15 May to 15 July
15	colour of glumes and lemmas	from yellow to purple-violet, in all subspecies it depends on insolation		
16	structure of lemma apex	in all subspecies the lemma has a more or less elongated apex, with long or short seta		

aschersoniana preserves morphological individuality in experimental culture, as do the other two subspecies (*glomerata* and *slovenica*).

In the studies now reported, a separate problem is posed by the analysis of populations denoted by the PCA method as "group 4", or the "intermediate group". This includes populations which in the field appear to be morphologically intermediate between subsp. *glomerata* and subsp. *aschersoniania*. In the wild they grew in a habitat approximating that of subsp. *aschersoniana* with respect to moisture and illumination. Cytological tests showed unquestionably that these populations were not diploid, as distinguished from the typical subsp. *aschersoniana*, which is diploid ($2n = 14$). The populations in the "intermediate group" were tetraploids ($2n = 28$), like typical subsp. *glomerata* and subsp. *slovenica*. Previous cytological investigations have also permitted the assumption that in this group there are populations in which individuals may have different chromosome numbers. Studies are in progress.

Two populations from the "intermediate group" (nos. 47 and 50) were introduced into the experimental cultures, treating them as tetraploidal subsp. *aschersoniana*. This was done because it resulted from earlier investigations (Doroszewska 1961 and Rurka 1974) that in Poland, both diploidal and tetraploidal subsp. *aschersoniana* occur. These two cytotypes are indistinguishable morphologically according to the cited authors. Many other authors (see Mizianty a, in preparation) have also reported that in the genus *Dactylis* there are specimens morphologically similar but differing in the level of ploidy. In the particular biometric studies now reported, close attention was paid to finding such morphological characters which would differentiate apparently indistinguishable diploids from tetraploids. While the characters were being analysed, it proved that the difference between these two cytotypes is particularly marked in character 13. In diploids the cauline leaf is about half the length of the stem, but in tetraploids it is markedly shorter and constitutes about one-third of the stem or even less.

Experimental cultures confirmed the genetic nature of character 13. By means of this character, subsp. *aschersoniana* may be distinguished from the other subspecies occurring in Poland. It was found, when taking this character into consideration, that the populations forming "group 4" do not belong to subsp. *aschersoniana*, although at first glance they greatly resemble it. Bearing in mind the value of character 13, they may belong to subsp. *glomerata* or subsp. *slovenica*. Two samples (nos. 47 and 50) belonging to "group 4" behaved differently in experimental cultures. Population no. 47 was approximate to subsp. *glomerata*, but population no. 50 to subsp. *slovenica* (Figs. 4 and 6B). At the same time, the populations belonging to subsp. *aschersoniana*, subsp. *glomerata* and subsp. *slovenica* kept their individuality in experimental cultures. Proceding further along this line of argument it may be assumed that the populations belonging to "group 4" represented in experimental cultures by samples 47 and 50 undergo marked modifying changes.

In nature, growing in a habitat approaching that of the diploidal *aschersoniana*, were morphologically linked with this subspecies (with the exception of character 13), while in experimental cultures with a habitat very near that of subsp. *glomerata*, they undergo further modification.

On one hand it may be assumed that tetraploidal specimens morphologically very close to the diploidal subsp. *aschersoniana* found in habitats similar in respect to humidity and illumination to those of subsp. *aschersoniana*, are merely the result of a modification variability in subsp. *glomerata* or subsp. *slovenica*. Szafran (1933) reported variability of this type. On the other hand, this problem cannot be explained so simply. The populations in "group 4" may also be of hybrid character, or else the result of introgression. Such an eventuality has been confirmed by studies giving evidence of a possible exchange of genes between diploids and tetraploids as well as among various tetraploidal taxa in the genus *Dactylis*. Other experimental studies carried out by numerous researchers have also pointed to this (Mizianty a, in preparation). Studying populations from this point of view, cyclograms were prepared for some wild populations. These cyclograms (Fig. 11) illustrate the values of the characters analysed for the typical subsp. *aschersoniana* (pop. 31), subsp. *glomerata* (pop. 45) and subsp. *slovenica* (pop. 49) as well as for some populations in "group 4" (pops. 40, 47, 50, 63). In the last group the populations are not similar in regard to the characters studied. In particular samples some characters correspond to subsp. *glomerata* and others to subsp. *aschersoniana*, and still others to subsp. *slovenica*. On the basis of the character values, it may be supposed that sample 50 is composed of specimens of hybrid origin between subsp. *slovenica* and subsp. *aschersoniana*, sample 63 between subsp. *slovenica* and subsp. *glomerata*, and samples 40 and 47 between subsp. *aschersoniana* and subsp. *glomerata*. It should be remarked that sample no. 63 was the only one in "group 4" whose character 13 corresponded to subsp. *aschersoniana*. It had, however, very broad leaves, which clearly differentiated it from subsp. *aschersoniana* and linked it with subsp. *slovenica*. The great phenotype plasticity may also be evidence of the hybrid origin of the samples of populations in "group 4". The changes undergone by the characters studied in the experimental cultures of selected diploids and tetraploids are presented in a graph (Fig. 10) plotted according to the method of Jentys-Szaferowa (1959). In this graph the values in the field constitute the comparative unit. Each sample from the experimental cultures has been compared with the corresponding sample from the field. The values of characters 1, 2, 5 and 6 in populations 47 and 50 changed in experimental cultures to a much greater degree than in the diploids, i.e. subsp. *aschersoniana* (pops. 23, 35) as well as in the tetraploids representing the typical subsp. *glomerata* (pops. 5, 46) and subsp. *slovenica* (pops. 15, 39). In population 50 the value of character 12 also increased considerably. The populations in "group 4" thus underwent the greatest changes in experimental culture.

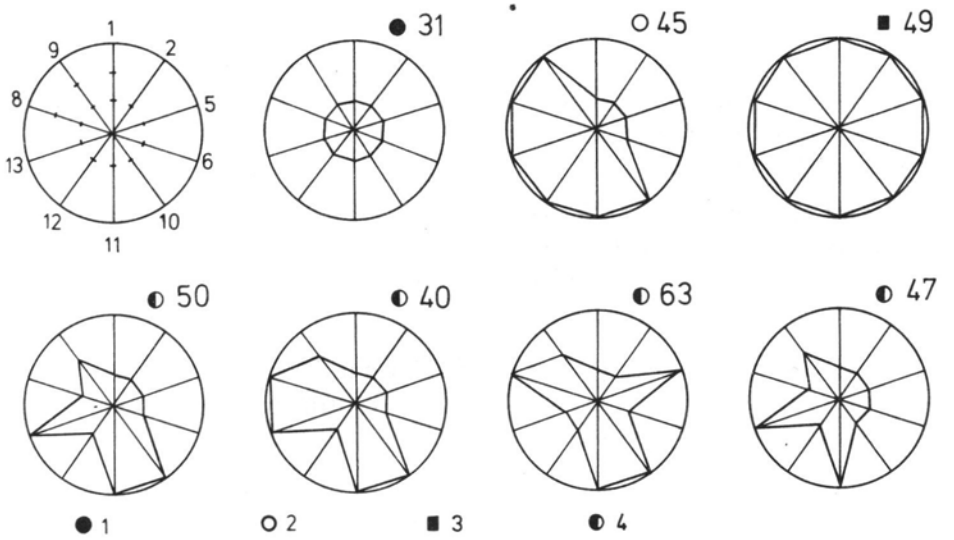

Fig. 11. Cyclograms of selected population samples from nature. 1 — subsp. *aschersoniana*, 2 — subsp. *glomerata* 3 — subsp. *slovenica*, 4 — intermediate samples. Character numbers used in the cyclograms and their estimations according to Table 3

The changes in leaf colour of the representatives of populations from "group 4" in relation to illumination are presented below. Tetraploids belonging to "group 4" in natural shady stands had bright green leaves i.e. characteristic of the subsp. *aschersoniana*, but in experimental cultures planted in a sunny location the leaf colour changed even in the second year of experiment. The leaves, however, did not become yellowish green, as in the diploidal representatives of subsp. *aschersoniana* in this culture. In leaf colour, populations 50 and 63 resembled subsp. *slovenica*, and the rest of the populations were like subsp. *glomerata*. Summing up, leaf colour in representatives of subsp. *glomerata* and subsp. *slovenica* does not change and is similar whether the plants grow in shade or sun, while representatives of subsp. *aschersoniana* and plants belonging to "group 4" change leaf colour, depending on the intensity of illumination. The changes in leaf colour in populations belonging to "group 4" may be evidence of their hybrid origin.

CONCLUSIONS

It may be concluded on the basis of the presented studies that in Poland the genus Dactylis is represented by one species *D. glomerata* L., within which three subspecies have been distinguished: subsp. *glomerata*, subsp. *aschersoniana* (Graebn.) Thell., Thellung 1911, Notizbl. Kgl. Gart. Muz. Berlin 17:

274 and subsp. *slovenica* (Dom.) Dom., Domin and Podpera, 1928, Klíč Úplné Květeně Rep. Česk: 903.

The key to the determination of subspecies in Poland is based on the morphological characters investigated statistically, both in nature and in experimental cultures.

1. Height of plant over 1 m, base of culm thickened to a diameter of c. 5 mm or more, cauline leaf (growing in the central part of the stem) 6 mm or more in breadth, panicle more than 15 cm in length . . . . . subsp. *slovenica*

1+. Height of plant up to 1 m, base of culm unthickened, less than 5 mm in diameter, cauline leaf (growing from the central part of the stem) up to 6 mm broad, panicle up to 15 cm long . . . . . 2.

2. Cauline leaf (growing from the central part of the stem) equal to about half the length of the culm or somewhat longer . . . . . .subsp. *aschersoniana*

2+. Cauline leaf (growing from the central part of the stem) about onethird the length of the culm or shorter . . . . . .subsp. *glomerata*

As far as the level of ploidy is concerned, subsp. *glomerata* and subsp. *slovenica* are tetraploids and subsp. *aschersoniana* is solely diploid.

Tetraploidal specimens in nature resembling subsp. *aschersoniana* and changing in experimental culture, may with great probability be recognized as a modifications of subsp. *glomerata* or subsp. *slovenica*, though it is not ruled out that they are hybrids between the three mentioned subspecies. Accurate elucidation of the nature of populations belonging to this group (group 4) requires detailed cytological and experimental studies.

In one stand (population no. 24) specimens occurred which might be suspected of being hybrids between subsp. *glomerata* and *D. hispanica*, which does not occur in Poland.

Subsp. *slovenica* has not hitherto been described at all in the numerous local floras, prepared for various regions of Poland. This may be because it does not occur in these regions, or else that it has not been distinguished by the authors of the detailed elaborations. Only Jasiewicz (1965) mentions it as occurring in the Bieszczady Mts. Studies on the distribution of this taxon in Poland are being continued by the present author; so far the occurrence of subsp. *slovenica* has been ascertained in seven stands in the Polish Carpathians (list of stands, p. 615).

A separate problem is posed by the study of intraspecific variation in subsp. *glomerata*. This subspecies seems to be very variable. The investigations of this by Turesson (1929), Domin (1943), Doroszewska (1961) as well as the present author's own studies give evidence of this. This problem constitutes a separate field of study requiring additional experiments.

In general, studies on the morphological variability of taxa in the genus *Dactylis* are difficult on account of continuous variability, and since characters vary to such a degree, conclusions on the appurtenance of a taxon should be drawn on the basis of investigations of samples of populations and not single specimens.

LIST OF STANDS

Explanations: ( ) – sample not studied statistically
D – specimens from Belanské Tatry Mts. (Czechoslovakia) determined by Domin (PRC)
The collector's name is given when the sample was not collected by the author.

DACTYLIS GLOMERATA L. SUBSP. *GLOMERATA*

1. Rudawa, Province of Kraków, grassland near the railway; dry sunny site, 29.05.1977,
2. Cyganowice near Stary Sącz, Province of Nowy Sącz, shady site near a highway, 05.06.1977.
3. Kosarzyska near Piwniczna, Province of Nowy Sącz, around a monument to the partisans, extremely shady site, 05.06.1977,
4. Kanina near Limanowa, Province of Nowy Sącz, by the roadside, 05.06.1977,
5. Sowliny near Limanowa, Province of Nowy Sącz, by the roadside, 05.06.1977,
6. Kraków-Kozłówek, in an orchard, very shady rather damp site, L. Frey, 07.06.1977,
7. Rzeszów-Pobitno, opposite the cemetery, sunny site, by the roadside, 20.06.1977,
8. Nienadówka near Rzeszów, Province of Rzeszów, orchard, fairly shady site, 20.06.1977,
9. Kolbuszowa, Province of Rzeszów, dry grassland by roadside, 20.06.1977,
10. Leżajsk, Province of Rzeszów, grassland near a wall, under trees, 21.06.1977,
11. Gorlice, Province of Nowy Sącz, grassland near railway station, 23.06.1977,
12. Mszana Dolna, Province of Nowy Sącz, pebbles on the river Mszanka, 24.06.1977,
13. Nowy Targ – Równia Szaflarska, Province of Nowy Sącz, grassland, 24.06.1977,
14. Zakopane-Lipki, Province of Nowy Sącz, damp meadow, 24.06.1977,

(17.) Sątopy near Nowy Tomyśl, Province of Poznań, edge of woods, 29.06.1977,
18. Sątopy near Nowy Tomyśl, Province of Poznań, edge of woods, 29.06.1977,
19. Sątopy near Nowy Tomyśl, Province of Poznań, edge of woods, 29.06.1977,
21. Poznań-Dębina, near a pond, damp sunny site, 29.06.1977,
22. Września, Province of Poznań, grassland in a street, 30.06.1977,
24. Trzęsacz, Province of Szczecin, on a sea-cliff, 20.07.1977,
25. Dziwnów on Lake Wrzosowskie, grassland under trees, 25.07.1977
(27). Ostrołęka, Province of Ostrołęka, damp meadow by a country road, on the edge of a willow coppice, 19.08.1977,
28. Mikołajki, Province of Suwałki, by a country road on the edge of a potato field, dry sandy soil, L. Frey, 23.08.1977,
(29). Międzyborów near Skierniewice, Province of Skierniewice, woodland road, L. Frey, 29.08.1977,
(30). Leszczewek on Lake Wigry, Province of Suwałki, M. Tyszkiewicz, 11.09.1977,
32. "Stawska Góra" Reserve, Province of Chełm, Łęczyńsko-Włodawskie Lake District, J. Mesjasz, 08.06.1978,
33. On Zienki Lake, Province of Chełm, Łęczyńsko-Włodawskie Lake District, J. Mesjasz, 08.06.1978,
34. Wytyczno, Province of Chełm, Łęczyńsko-Włodawskie Lake District, canal embankment, J. Mesjasz, 08.06.1978,
(36). Dulowska Forest, district of Dulowa, Province of Katowice, along a flow of water, 28.06.1978,
(41). Zakopane, Province of Nowy Sącz, on the slopes of Ciągłówka, above Harenda, edge of woods, 18.10.1978,
42. Żmiąca, Province of Nowy Sącz, Jaworze range (Beskid Wyspowy), in a meadow, M. Szewczyk, 10.06.1979,
(43). Radunia Hill, Province o Wrocław, Ślęża Massif, 12.06.1979,
(44). "Sulistrowickie Meadows" near Sulistrowiczki, Province of Wrocław, damp meadow, 12.06.1979,
45. Wilków near Złotoryja, Province of Legnica, residual pond of the mining concern "Lena", 13.06.1979,
46. Tchórzyno, Province of Szczecin, borders of peat bog on chalk bed, 14.06.1979,
48. District of Zagórz, Province of Krosno, deciduous woods, 08.07.1979,
(54). Bereżki, Province of Krosno, Bieszczady Mts., on the edge of an alder thicket on the stream Wołosaty, 08.07.1979,
55. Ustrzyki Górne, Province of Krosno, Bieszczady Mts., near the shelter, 10.04.1979,
(57). Dierzgów near Moskorzewo, Province of Częstochowa, edge of pine woods, 12.06.1980,

58. Stary Węgliniec, Province of Jelenia Góra, on the edge of a country road, L. Frey, 12.08.1980,
(59). Rózinowo near Włocławek, Province of Włocławek, by a road through pine-oak woods with an admixture of birch, L. Frey, 26.06.1981,
60. Chodzież, Province of Piła, by woodland on the Gontyniec hill, L. Frey, 15.07.1981,
(61). "Grabowiec" Reserve near Bogucice, Province of Kielce, xerotermic grassland with thickets of steppe cherry, M. Gostyńska-Jakuszewska, 08.06.1982,
62. Tuł Mts., Province of Bielsko, beech woods at the foot of hill, near the bus stop "Cisownica-Hławiczka", 10.06.1982,
(64). On the black tourist track on Mt. Tuł, Province of Bielsko, not far from the shelter-home, on the edge of a wood, 10.06.1983,
(65). On the black tourist track on Mt. Tuł, Province of Bielsko, not far from the shelter-home, on the edge of a wood, 10.06.1983,
(66). Grzywy Mt. near Korzecko, Province of Kielce, Świętokrzyskie Mts., *Tilio-Carpinetum*, L. Frey, 15.06.1982,
(67). Potok (a village) near Staszów, Province of Kielce, pine woods, L. Frey, 16.06.1982,
(68). Wólka Świątkowa near Łuków, Province of Siedlce, by a country road, L. Frey, 23.06.1982,
73. Between Henryków and Muszkowice near Ząbkowice Śląskie, Province of Wałbrzych, edge of thicket in pastureland, 07.07.1982,
(76). Oleśnica district, Province of Wrocław, deciduous woods, 08.07.1982.
77. Szklarska Myślniewska near Ostrzeszów, Province of Kalisz, boundary strip, 08.07.1982,
(78). Between Łomnica and Sieraków near Lubliniec, Province of Częstochowa, by the highway, 08.07.1982,
(79). Zyzdrój Nowy near Szczytno, Province of Olsztyn, pine woods, L. Frey, 02.07.1982,
(80). Zakopane, Province of Nowy Sącz, by the road "Pod Reglami" between Mraźnica and Buńdówki, Z. Mirek, 11.06.1983,
(82). Racławice near Nisko, Province of Tarnobrzeg, shady place, J. Wójcicki, 18.06.1984,

DACTYLIS GLOMERATA SUBSP. *ASCHERSONIANA* (GRAEBN.) THELL.

23. "Dębina" Reserve, near Wiatrowiec, Province of Poznań, 01.08.1977,
31. Klęczany, Province of Nowy Sącz, beech wood not far from quarries, 19.09.1977,
35. Dys, Province of Lublin, wooded ravine near a bus stop, L. Frey, 16.06.1978,
38. Niepołomice Forest, between Chobot and Ispina, Province of Kraków, by a runnel, 01.07.1978,

69. Wrocław-Zacisze, on the right bank of the Old Odra River, in a deciduous wood, 05.07.1982,
70. Wrocław, park by Młodej Gwardii Street, 05.07.1982,
71. Wrocław-Leśnica, Park Zamkowy, 06.07.1982,
74. Muszkowice near Ząbkowice Śląskie, Province of Wałbrzych, deciduous wood, 07.07,1982,
(81). "Buczyna" Cliff Reserve, Rozewie Peninsula, Province of Gdańsk, M. Jagiełło, 24.06.1983.

DACTYLIS GLOMERATA SUBSP. *SLOVENICA* (DOM.) DOM.

15. District of Gródek-on-the-Dunajec, Province of Nowy Sącz, between Koszarka and Lipie, damp place, thicket on edge of a wood, 26.06.1977,
39. Jordanów, Province of Nowy Sącz, thicket on the river Skawa, 07.07.1978,
49. Bus stop "Polana Ostre" on the Czarna-Lutowiska track, Province of Krosno, in thickets by the highway, 08.07.1979,
51. Bereżki, Province of Krosno, Bieszczady Mts., patch of burdocks on the mountain stream Wołosaty, 08.07.1979,
53. Brzegi Górne, Province of Krosno, Bieszczady Mts., thicket on the mountain stream Prowcza, 09.07.1979,
56. Roztoka Wielka near Rytro, Province of Nowy Sącz, patch of burdocks on a stream, 14.08.1979,
83. "Sine Wiry" on the river Wetlina, Province of Krosno, Bieszczady Mts., 10.07.1984,

D_1. Drabina, lg. K. Domin, 27.08.1937,
D_2. Čierna voda, lg. K. Domin et V. Krajina, 09.08.1937,
D_3. Rigel'ský Stream, lg. K. Domin, 23.07.1929,
D_4. V. Podkošar 1600m, lg. K. Domin, 20.08.1935,
D_5. Kobyli vrch 1120m, lg. K. Domin, 24.07.1937.

[x]*DACTYLIS GLOMERATA* – GROUP 4

16. Puszczykówko near Poznań, Province of Poznań, edge of woods on the river Warta, sandy, damp site, 28.06.1977,
20. Poznań-Dębina, beside woodland road, sandy, dry, shady place, 29.06.1977,
26. Szczecin-Wały Chrobrego, park, moderately shady site, 30.07.1977,
37. District of Wola Filipowska, Province of Kraków, Dulowska Forest, by a woodland road, 28.06.1978,
40. Grodzisko near Skała, Province of Kraków, thicket, 12.07.1978,

[x] Samples which may have been changed by modification, as well as samples of hybrid origin belong to this group.

47. Krzymowski Wood near Chojna, Province of Szczecin, 15.06.1979,
50. Bereżki, Province of Krosno, Bieszczady Mts., alder thicket on the stream Wołosaty, 08.07.1979,
52. On the tourist track from Bereżki to Połonina Caryńska, Province of Krosno, in shade under trees, 09.07.1979,
63. Beech wood at the foot of Mt. Tuł, Province of Bielsko, near the bus stop "Cisownica-Hławiczka", 10.06.1982,
72. Świdnica, Province of Wałbrzych, park by 1 Maja Street, 07.07.1982,
75. Vicinity of Oleśnica, Province of Wrocław, deciduous wood, 08.07. 1982.

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Biosystematyczne studia Dactylis L. 2. Badania własne. 2.1. Zróżnicowanie morfologiczne i występowanie przedstawicieli rodzaju Dactylis w Polsce. 2.1.1. Badania terenowe i kultury eksperymentalne

Streszczenie

Celem tej części badań było znalezienie takich cech morfologicznych, które jednoznacznie pozwoliłyby określić taksony rodzaju *Dactylis*, występujące w Polsce. Szczególną uwagę zwrócono na formy różniące się liczbą chromosomów (diploidy i tetraploidy), dotychczas morfologicznie

nieodróżniane. Badania oparto na 63 próbach populacji *Dactylis*, zebranych z całej Polski. Do szczegółowych badań statystycznych założono specjalną kulturę eksperymentalną, składającą się z 13 prób, reprezentujących wszystkie podgatunki *Dactylis glomerata*, wyodrębnione wcześniej na podstawie badań terenowych.

Na podstawie przeprowadzonych badań biometrycznych uznano iż na obszarze Polski rodzaj *Dactylis* reprezentowany jest przez jeden gatunek *D. glomerata* L., w ramach którego wyodrębniono trzy podgatunki: subsp. *glomerata*, subsp. *aschersoniana* (Graebn.) Thell. oraz subsp. *slovenica* (Dom.) Dom. Za nadaniem wyróżnionym taksonom rangi podgatunku przemawia fakt, że pod względem badanych cech nie są one od siebie wyraźnie oddzielone. Jakkolwiek należy podkreślić, że podział populacji na trzy główne grupy przy użyciu wybranych cech, zachował się również w kulturach eksperymentalnych.

Autorka zamieszcza klucz do oznaczania podgatunków, który jest oparty na cechach morfologicznych, przebadanych statystycznie, zarówno w terenie, jak i w kulturach eksperymentalnych. Badania statystyczne uzupełniono obserwacjami takich cech, jak: kolor liści, plew i plewek, struktura szczytu plewki dolnej, owłosienie plew i plewek oraz fenologia kwitnienia. Wyżej wymienionych cech nie badano statystycznie, przeprowadzono jedynie ich obserwacje w terenie i w kulturach eksperymentalnych.

Ustalono, że *D.g.* subsp. *aschersoniana* jest wyłącznie diploidem. Okazy tetraploidalne, morfologicznie przypominające subsp. *aschersoniana*, z dużym prawdopodobieństwem można uznać za modyfikację subsp. *glomerata* lub subsp. *slovenica*, nie można jednak wykluczyć, że są mieszańcami między trzema wyróżnionymi podgatunkami. Na jednym stanowisku stwierdzono występowanie osobników, które można podejrzewać o to, że są mieszańcami między subsp. *glomerata* a nie występującą w Polsce *D. hispanica*.