4. ISLER O., 1971, "Carotenoids", Birkhäuser Verlag, Basel und Stuttgart, p. 29, 61, 574.
5. NAKAYAMA T.O.M., 1963, in Physiology and Biochemistry of the Algae (J. Myers), Acad. Press, London and New York.
6. NEAMTU G., BODEA C., 1969, Rev. roum. Biochim., 6, 227.
7. NEAMTU G., BODEA C., 197o, St. cerc. biochim., 13, 4o5.
8. NEAMTU G., BODEA C., 1971, Rev. roum. Biochim., 8, 129.
9. NEAMTU G., BODEA C., 1972, St. cerc. biochim., 15, 181.
1o. NEAMTU G., BODEA C., 1969, Rev. roum. Biochim., 6, 157.
11. NEAMTU G., BODEA C., 1974, St. cerc.biochim., 17, 41.
12. NEAMTU G., BODEA C., 1973, St. cerc. biochim., 16, 171.
13. NEAMTU G., TAMAS V., BODEA C., 1966, Rev. roum. Biochim., 3, 3o5.
14. WEEKS O.B., ANDREWS A.G., BROWN B.O., WEEDON B.C.L., 1969, Nature, 244, 879.
15. WINTERSTEIN A., EHRENBERG U., 1932, Hoppe-Seyl. Z., 2o7, 25.
16. ZECHMEISTER L., POLGAR A., 1941, J. Biol. Chem., 139, 193.
17. ZECHEMEISTER L., TURSON P., 1934, Bull. Soc. Chim. biol. Paris, 16.

INSTITUTUM AGRONOMICUM "DR. PETRU GROZA" CLUJ-NAPOCA (ROMANIA)
NOTULAE BOTANICAE HORTI AGROBOTANICI CLUJ-NAPOCA, VIII, (1975/76)

DATA CONCERNING PHENOTYPICAL PLASTICITY (SIZE AND SHAPE OF LEAF) IN RANUNCULUS SECT. AURICOMUS

by A. T. Szabó

The section Auricomus Spach of genus Ranunculus L. have throughly been studied from taxonomic and cytological points of view (4, 5, 6, 8, 1o, 12, 14, 15, 17, 2o), but the problem of morphological modifications determined by ecological conditions it's still not entierely agreed upon (1, 2, 8, 9, 13, 11, 16, 17, 18).

While making the monographic review of the genus Ranunculus for the Romanian Flora (12) A. NYÁRÁDY has noticed microsystematically important morphological modifications within the same plants, during the subsequent years. Relying on these observations, transplant experiments have started with individual plants sampled from natural populations and cultivated on experimental plot under natural environmental conditions.

The observations have been done for the following purposes:

(1) the study of general characteristics of phenotypical plasticity with leaves from the plants belonging to genus Ranunculus sect. Auricomus under natural conditions, over a period of four years;

(2) the examination of microtaxonomic consequences of the modifications under surveillance with individual plants.

This paper is dealing only with the first item of general significance in order to demonstrate, that with this plants, adapted mainly to more humid forest and meadow habitats, certain morphological modifications take place during the individual life which - based probably on autoregulatory dependent morphogenesis (19) - may be correlated with certain climatic differences (temperature, soil humidity) in the subsequent years, with the age of plants and with heteroblastic development. Our observations may be put in connection with the temperature dependent leaf morphogenesis and phenotypical plasticity of the amphibious species of Ranunculus (2, 7).

Material and methods

Seedlings and young plants were selected from spontaneous populations of Ranunculus sect. Auricomus that grew in various ecotopes surrounding the city of Cluj-Napoca (Roumania). The plants were transplanted in the Agrobotanical Garden of "Dr. Petru Groza" Agronomy Institute of Cluj-Napoca situated at 46° 45' N, 23° 36' E; average temperature 8,2°C, average rainfall 613 mm, 375 meters above see level. The individual plants were transplanted in labelled flower pots which were then placed in forest soil in the mentioned garden.

There were obtained heliographs of the size and shape of 2-4 typical basal leaves and of 1-2 caulinar leaves for every individual plant during the spring of each year between 197o and 1973. Having used the heliographic replica of the leaves for checking, the plants did not suffer at all and the natural development of stems and leaves remained untroubled.

In 1973 there were done two measurements: the first registred by heliographic impression and, after 3o days, the plants were uprooted, the root-tips sampled for cytological checking and the voucher specimen prepared by pressing. The specimens, together with the original drawings, heliographs and micrographs have been preserved in the Herbarium of "Dr. Petru Groza" Agronomy Institute of Cluj-Napoca (Nr. 13.6o1 - 13.639).

In order to emphasize the connections between the ecological conditions slightly different annually and the morphological modifications (phenotypical plasticity), the plants were grouped in similar phenodemes during the processing of data of the biometrical measurments (Tab. 1.; deme concept according to GILMOUR and HESLOP-HARISSON ap. DAVIS and HEYWOOD 1963, nomenclature based on A. NYÁRÁDY 1953).

There were selected 2-6 plants from each phenodeme for measurements. The leaf diameter (d) and the division of basal leaves were measured and the division coefficient were calculated (DC): $DC = \frac{D}{L}$; where D represents the total number of divisions with the measured leaves, L stands for the number of measured leaves of the same phenodeme.

Other morphological characters such as leaf edge, shape of leaf basis and of upper caulinar leaves (leaflets) are represented here only by means of graphs (fig. 2, 3, 4).

Temperature and rainfall were registred in the course of observations on a spot close to the experimental lot (fig. 1). There were remarcable differences between the springs of 1971 and 1972; these may be taken for lucky coincidence if we think in terms regarding the observations.

Results

The results of measurments are summed up in tab.1. Certain general features of the plastic response of the examined plants can be made evident by using the average values (Md, MDC) calculated for the entire sample examined as a whole.

Tab.1

Annual modifications in the leaf diameter (d) and division coefficient (DC) of the phenodemes under surveillance. The average values for the whole sample (Md, MDC) were calculated on the basis of the data obtained on 373 leaves

Phenodeme / Year	197o		1971		1972		1973	
	d(mm)	DC	d(mm)	DC	d(mm)	DC	d(mm)	DC
FALLAX	46	1.36	51	2.5o	97	1.oo	48	1.o1
AURICOMUS	5o	1.oo	47	1.oo	74	1.oo	55	1.oo
BINATUS	35	3.12	43	5.oo	57	6.66	45	4.6o
VARIIFOLIUS	4o	3.28	5o	5.oo	52	2.3o	46	3.33
SILVICOLUS	33	3.85	49	4.58	85	4.61	61	2.6o
FLABELLOIDES	38	1.oo	42	4.7o	63	3.8o	35	1.oo
STIPITATUS	37	7.oo	5o	8.88	44	6.oo	+	+
Mean per total (Md, MDC)	39.7	2.7o	47.4	4.39	65.o	3.31	41.6	1.86

The heliographic measurments were started in the first spring (197o) mostly with seedlings and young plants similar to R. auricomus L. and R. binatus Kit. The average diameter of leaves was low (Md=39.7 mm) and the mean coefficient of division was of average value(MDC=2.7).

The next year (1971) had a droughty and cold spring. During this year it had been registred a much higher division coefficient (MDC=4,39). The leaf diameter remained low in spite of the fact that the Ranunculus plants of the Auricomus section develops larger leaves in the second and third year of life. The general trend of the phenotypical plasticity was characterized by modifications from auricomus to binatus like plants.

In 1972, there were registred relatively high temperature and rainfall values during the spring. The Md values raised too,(Md=65 mm), but the division coefficient of leaves remained much lower as measured against 1971 (MDC=3.31). The general tendency of plastic modifications could be characterized by emergence of many individuals of R. fallax (Wimm. et Grab.) A.Nyár., that is by alterations between the phenodemes of auricomus (binatus) and cassubicus type.

In the last year (1973), the vigour of the plants under surveillance had considerably dropped, aging and death of some plants took place, as well. The MDC values were low (MDC=1.7) and the leaf diameter scarcely (Md=41.6 mm). The general direction of the plastic modifications may be characterized by alternations from cassubicus to auricomus type.

This observations prove the fact that individual Ranunculus plants from the Auricomus section display a high phenotypical plasticity regarding the leaf size and shape. There were noticed quantitative and qualitative modifications as well, in the subsequent years with the same individual plant.

It is possible to finde a correlation between temperature, rainfall, the age of plant and leaf morphology. These correlations might have evolutive and taxonomic significance and they are worth being studied where well controlled environment (phytothron) is disposable.

Acknowledgements: Grateful acknowledgement is made to prof. Dr. doc. A. NYÁRÁDY (Dept. of Botany, Inst. Agr. "Dr. Petru Groza", Cluj-Napoca) for his guidance and advice given throughout the cours of this work and to prof, Dr. ARNE ROUSI (Dept. of Botany, University of Turku, Finland) for the critical remarks and sugestions referring to the manuscript.

Figures explanation

Fig.1.: Monthly average temperatures and rainfall calculated on data registred by the Meteorological Station of the Agronomy Institute of Cluj-Napoca in 197o, 1971, 1972, 1973. The arrows point the time of planting and heliographic registration (197o); the time of

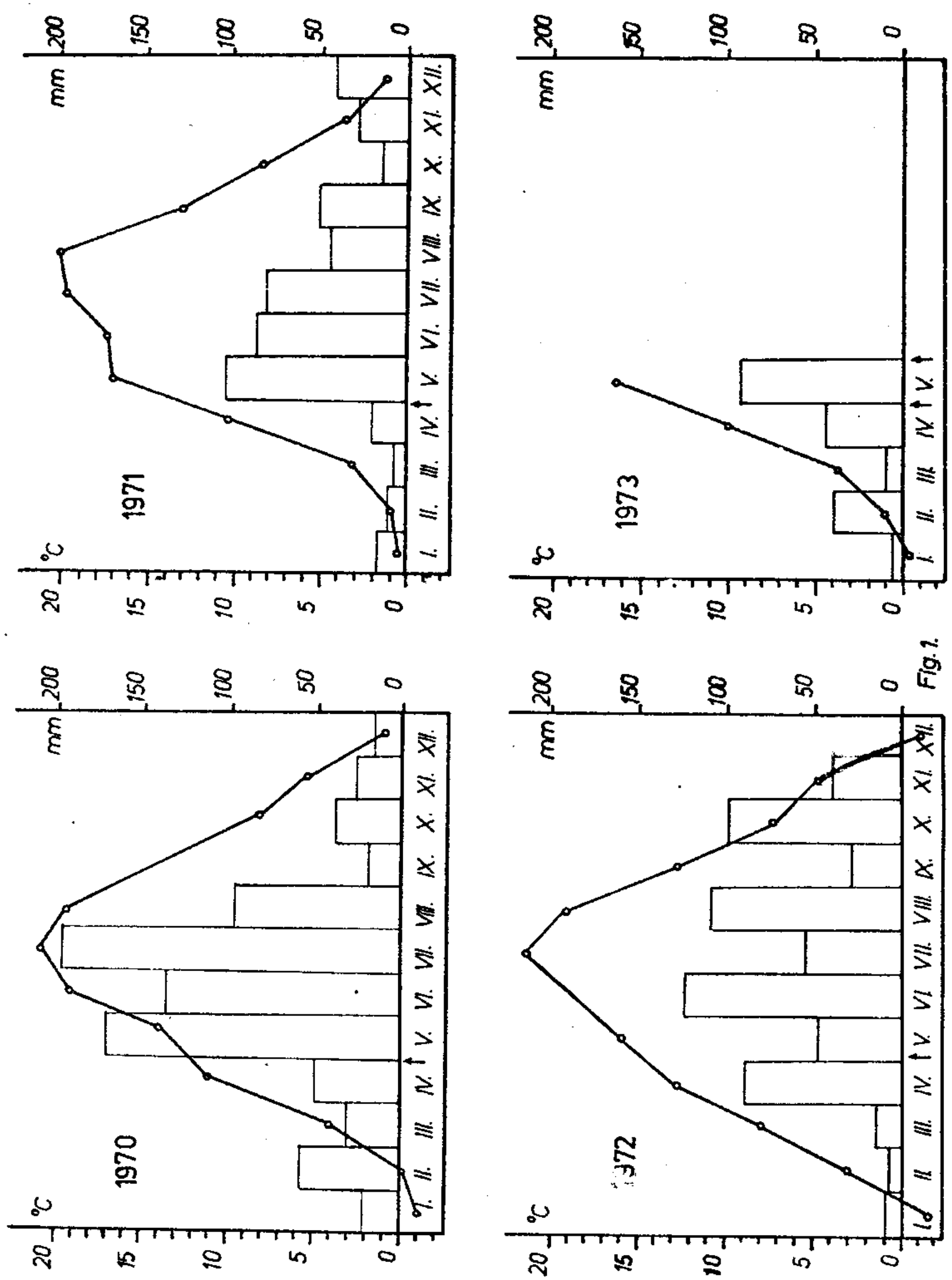
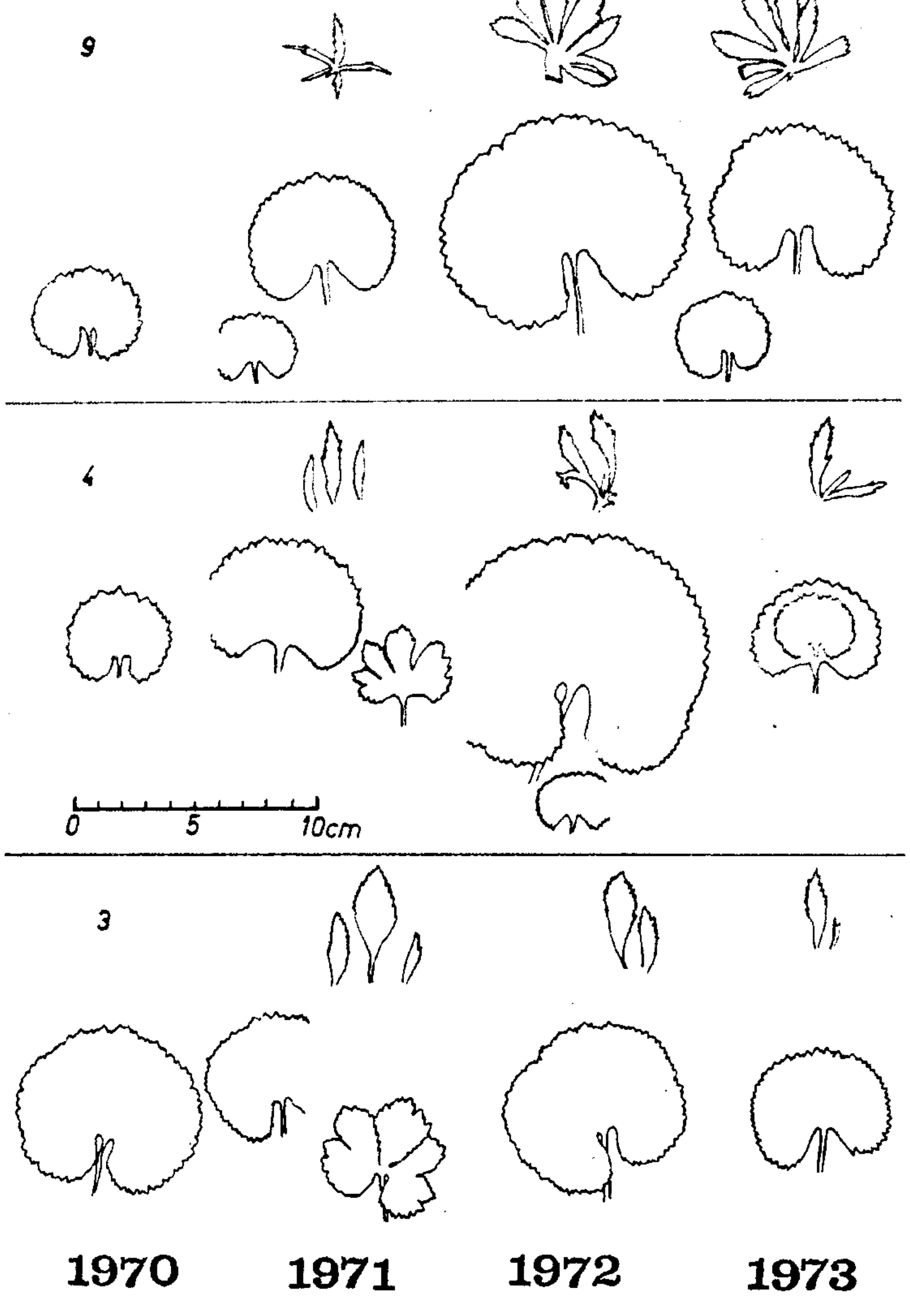
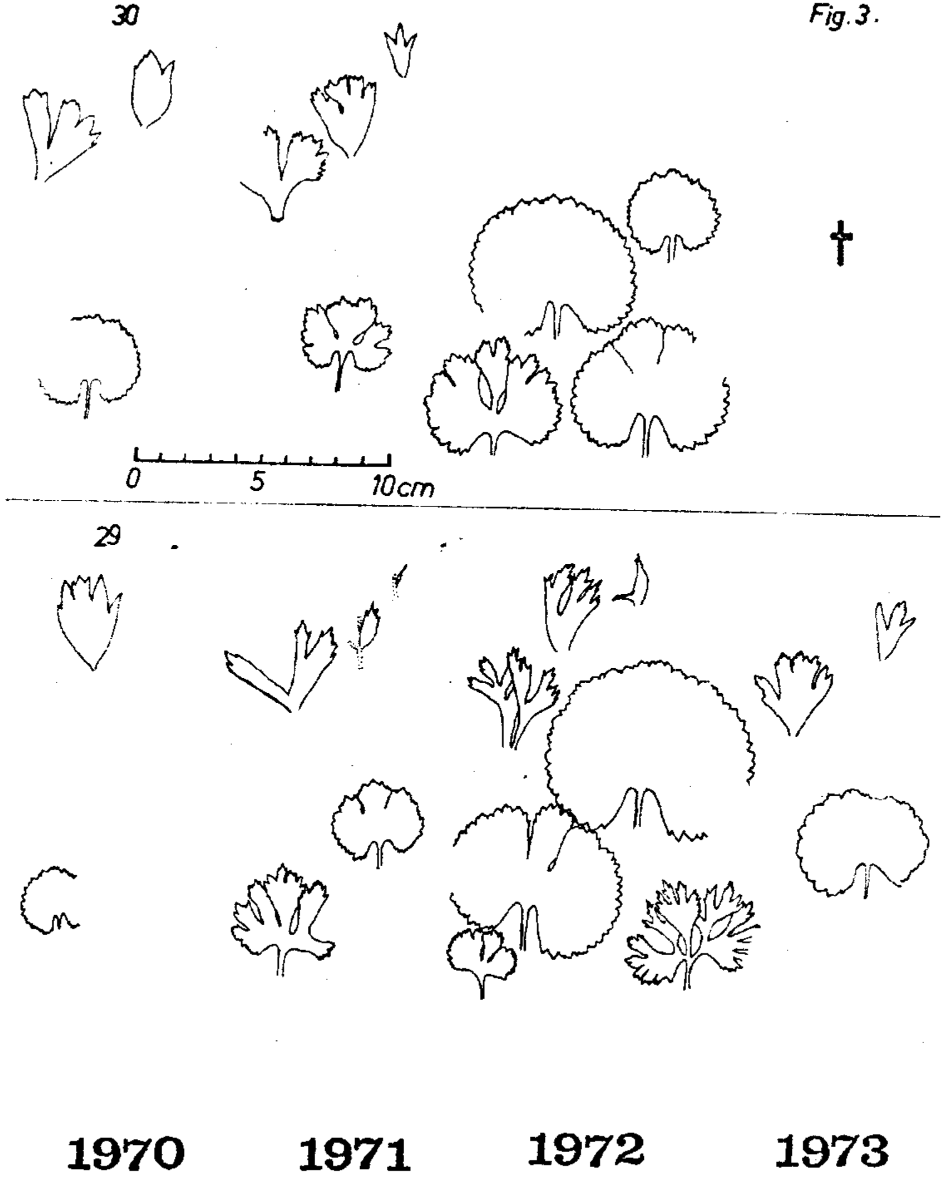
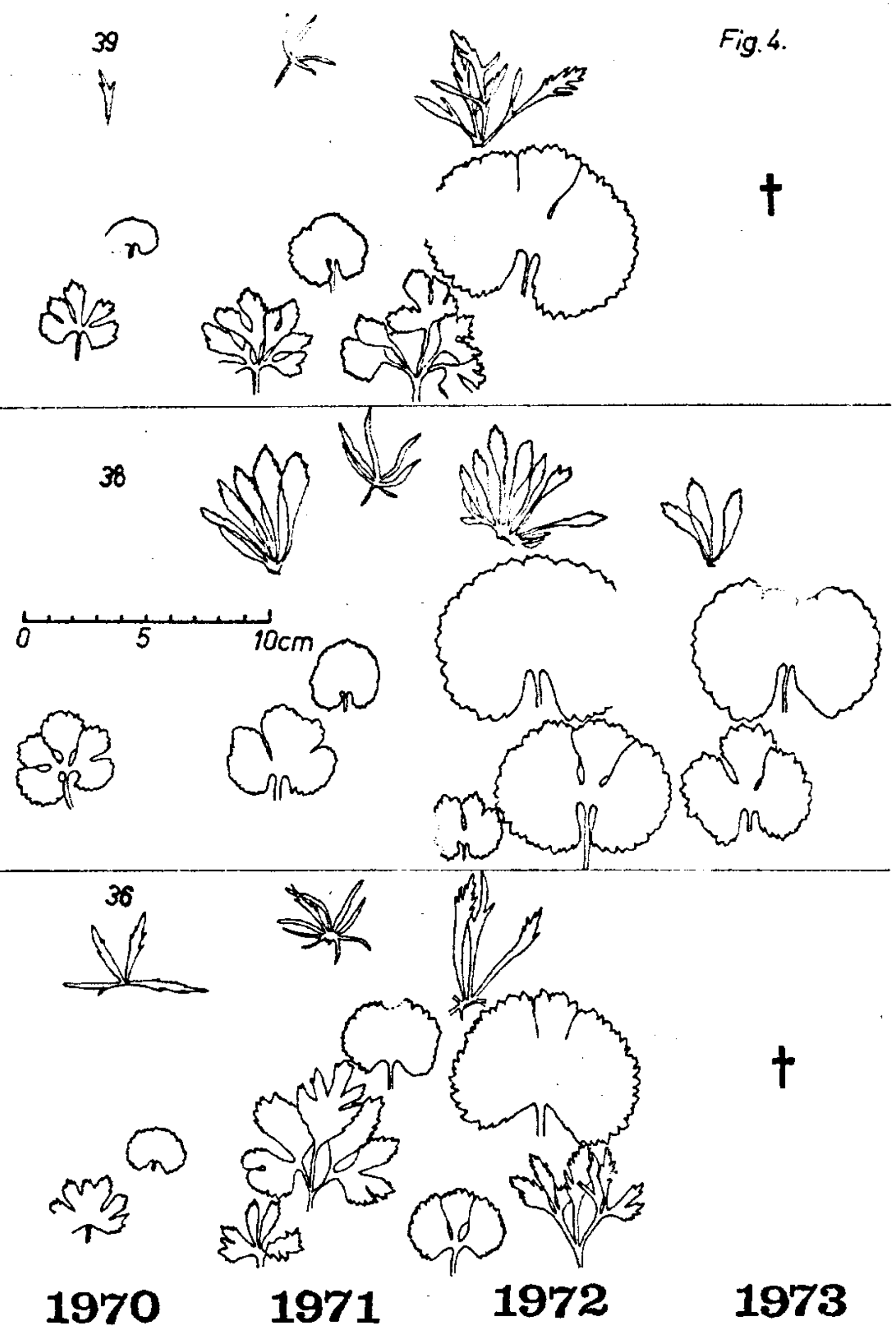


Fig.1.


9
4
0 5 10cm
3
1970
1971
1972
1973
Fig. 2.


30
†
0 5 10cm
29
1970
1971
1972
1973
Fig. 3.



heliographic registration (1971, 1972); the time of heliographic registration (first arrow), cytological examination and preparation of voucher specimens (second arrow, 1973).

Fig.2.: Phenotypical plasticity of shape and size of leaves of Ranunculus, fallax phenodeme, exemplified by plants belonging to R. fallax (Wimm. et Grab.) A. Nyár. The leaves of the same plant are disposed in the horizontal rows (left hand pot labels), shape and size registred in the same year, in vertical columns (thick figures at bottom). The graphical reduction is shown by means of cm scale. Size and shape of first basal leaf (bottom), of entirely developed basal leaves (middle) and of upper caulinar leaves or leaflets (top) have been obtained through heliographs and drawn in outline. Defects from heliograph registrations were not completed; other shape defficiencies (gnawings) are marked by dot lines. Superposed outlines (nr.4) indicate the size and shape of the same leaf at two different registration data in 1973.

Nr.2.: R. fallax, 2n = 44; Nr.4.: R. fallax var. incisifolius (Rchb.) A. Nyár. (no mitosis in root tips in 1973); Nr.9: R. fallax, 2n = 32.

Fig.3.: Phenotypical plasticity of shape and size of leaves of Ranunculus, phenodeme flabelloides exemplified by plants nr.29: R. auricomoides A.Nyár. et L. Alex. var. flabelloides A. Nyár., 2n = 32; nr.3o: R.auricomoides var. flabelloides (extinct in 1973). Other details same as in fig.2.

Fig.4.: Phenotypical plasticity of shape and size of leaves of Ranunculus, phenodeme silvicolus exemplified by plants nr.36: Ranunculus silvicolus (Wimm. et Grab.) A. Nyár. var. diversifolius (Schur) A. Nyár. f. stipitatus (Nyár), extinct in 1973; nr.38.: R. silvicolus var. diversifolius, 2n = 32; nr.39: R. silvicolus var. diversifolius extinct in 1973. Other details same as in Fig.2.

References

1. BARA I.I., GHIORGHIȚĂ G.I., TOTH E.G., 1973, Lucr. Stat "Stejarul" Ecol. Terest. Genet., 1972-1973, 83-1o1.
2. COOK C.D.K., 1968, Phenotypic Plasticity with Particular Reference to Three Amphibious Plant Species, in: V.H. HEYWOOD (Ed.), Modern Methods in Plant Taxonomy, Acad. Press London and New York.

3. DAVIS P.H., HEYWOOD V.H., 1963, Principles of Angiosperm Taxonomy, Van Nostrand Co, Princeton, N,Y.
4. FAGESTROM L., 1963, 1967, Acta Soc. Faun. Flor. Fenn., 78, 1-15; 79, 1-63.
5. IZMAILOW R., 197o, Acta Biol. Cracow., Ser. Bot., 13, 37-5o.
6. JASIEWICZ A., 1965, Fragm. Flor. et Geobot. Krakow, 2, 1, 62-11o.
7. JOHHNSON M.P., 1967, Nature, London, 214, 5o95, 1354-1355.
8. KOCH W., 1933, Ber. der Schw. Bot. Ges., 42, 2.
9. KURBS S., 1973, Bot. Jahrb. für Syst. und Pflgeogr., 93, 1, 13o.
1o. MARKLUND G., 1961, 1965, Flora Fennica, 3, 3-128; 4, 3-1o3.
11. MARKLUND G., ROUSI A., 1961, Evolution, USA, 15, 4, 51o-522.
12. NYÁRÁDY A., 1953, Ranunculus, in Flora R.P.Română, II, 577-591.
13. NYÁRÁDY E.I., 1933, Bul. Grăd. Bot. şi al Mus. Bot. Univ. Cluj, 13, 4, 85-1o1.
14. OLAFSON P., 1961, Acta Soc. Faun. Flor. Fenn., 76, 3, 1-37.
15. ROUSI A., 1956, Ann. Bot. Soc. Zool. Bot. Fenn. "Vanamo", 29, 2, 1-65.
16. ROZANOVA M.A., 1922, Zeitschr. Russ. Bot. Ges., 7, 31-45.
17. ROZANOVA M.A., 1932, Trudi Petrogr. Biol., 8, 19-148.
18. SCHILLER ZS., 1917, Math. Termtud. Ért., 23, 3-4, 361-447.
19. SCHMALHAUSEN I.I., 1949, Factors od Evolution, McGrow Hill, N.Y.
2o. SOÓ R., 1965, Acta Bot. Hung., 1,395-4o4.

INSTITUTUM AGRONOMICUM "DR. PETRU GROZA" CLUJ-NAPOCA (ROMANIA)
NOTULAE BOTANICAE HORTI AGROBOTANICI CLUJ-NAPOCA, VIII (1975/76)

DETERMINING PEDO-ECOLOGICAL FACTORS OF A PHYTOCENOSIS COMPLEX (SINTEREAG, THE VALLEY OF ŞIEU)

by I. Puia, P. Guş

As an aftermath to the studies performed along the pedological and vegetational charting (scale 1: 2ooo) in the district of Bistriţa-Năsăud, namely at Sintereag, on the field called "Patachiuz," there have been investigated an inlay of phytocenosis comprising twelve local variants of lawns named after the predominating species:

1. Festuca pratensis - Trifolium pratense;
2. Festuca pratensis;
3. Agrostis stolonifera;
4. Puccinellia distans;
5. Carex distans, Carex vulpina;
6. Puccinellia distans + Triglochin maritima;
7. Agropyron repens;
8. Phragmites communis;
9. Triglochin maritima + Agrostis stolonifera + Phragmites communis;
1o. Bolboschoenus maritimus;
11. Schoenoplectus tabernaemontani;
12. Heleocharis palustris.

The distribution of the variants is shown in Fig.1.

The vegetation mosaic is surrounded by variants of Festuca pratensis, and respective Festuca pratensis - Trifolium pratense. The number of species that enters the floral composition of the two variants is close (22-24), but esentially differs the abundance and domination of the same species within the variants and the participation percentage of groups of species, as well. (Tab.1).

By analysing the pedo-ecological characteristics (Tab.2) of profils 1 and 7, one can see marked trophic differences in the two soils. Thus, the soil on which appears the variant with Festuca pratensis - Trifolium pratense (profil 7), is excessively supplied with mobile P_2O_5 and very well with mobile K_2O, very rich in humus(o-1o cm) and total nitrogen. The soil of the variant with Festuca pratensis