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Some Remarks on the Synecological and Syntaxonomic Problems of Weed Plant Communities

Poznámky k synekologickým a syntaxonomickým problémům plevelových společenstev

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Abstract — KROPÁČ Z., E. HADAČ et S. HEJNÝ (1971): Some remarks on the synecological and syntaxonomic problems of weed plant communities. — Preslia, Praha, 43 : 139—153. — In order better to explain the intricate complex of conditions for the development of weed plant communities, a short survey of the evolution of anthropogenous communities and their differentiation from the historical point of view is firstly given, then some agro-ecological factors are analysed and a new concept of agro-ecophases, agro-ecostages and agro-ecocycles is presented. Further the relation between agro-ecophases and the development of weed communities is analysed and the conclusion drawn (for the conditions given) that the weed communities of the early spring season are substantially different from those of the summer and autumn season. No significant differences were found between weed communities of cereals and root crops, but weed communities of perennial fodder crops seem to be different. Some new terms are introduced such as association chain and association sequence corresponding to the agro-ecological terms agro-ecostage and agro-ecocycle. Three new associations are established: *Lathyro tuberosi-Adonidetum aestivalis* KROPÁČ et HČ. ass. n., *Veronico-Adonidetum aestivalis* KROPÁČ et HČ. ass. n. (both belonging to the alliance *Caucalion lappulae* TX. 50) and *Valerianello-Thlaspeetum perfoliati* KROPÁČ et HČ. ass. n. (alliance *Veronico politae-Taraxacion* KROPÁČ et HČ. foeder. n.). Both alliances are placed in the order *Secalietalia* BR. BL. 31 em. J. et R. TX. 60 and the class *Secalietea* BR.-BL. 51 em. SOÓ 61.

Introduction

The environment of weed plant communities is extremely variable. The interrelations of individual factors are complicated, due not only to variable natural conditions, but still more to the activity of man — which is "conditio sine qua non" of these communities. This is why weed communities were not held to be real communities at one time (for further see the review by KAMYŠEV 1939). On the other hand, in the course of the last thirty years, an elaborate phytosociological system of weed communities has been established (TÜXEN 1937, KRUSEMAN et VLIEGER 1939, SISSINGH 1950, TÜXEN 1950, OBERDORFER 1957, etc.) which has become a serious part of the whole system of vegetation units in Central and West Europe (e. g. TÜXEN 1961, PASSARGE 1964, OBERDORFER et al. 1967, WESTHOFF et al. 1969 etc.). The distinguishing of two classes (*Secalietea*, *Chenopodietea*) for weed communities on arable land is a present reality in this conception. Another floristic conception of weed phytosociology based on ecologic-sociological groups of species has been developed in the German Democratic Republic (SCHUBERT et MAHN 1959, MÜLLER G. 1963—64, HILBIG 1967); according to these research workers it is hardly possible to find marked differences between *Secalietea* and *Chenopodietea* in Central European weed communities; they have found only facial differences („Ausprägung") in corresponding communities of cereals and root crops. There is no doubt that this conception with its ecological basis is a good advance in ELLENBERG's (1950) ideas. It is worth mentioning that UJVÁROSI (1954) came sooner to a similar conception of one large fundamental unit-association in crop rotation, to some extent influenced by the RADEMACHER's (1948) idea. This is well reflected also in the survey by SOÓ (1961). On the other hand, the concept of association of weed communities, as used by SLAVNIĆ (1951), is very narrow and corresponds approximately to the "aspects" of other authors. This is also in good accord with some results of OBERDORFER (1954) from the Balkan Peninsula.

In our concept of weed communities we consider the sown crops as an integral part of their environment (cf. further our definition of agro-ecophase and cf. also FRIEDERICHS 1966). But in this case what is to be done with weeds sown unwillingly by man simultaneously with cereals? It would be practically impossible to draw a line between plants occurring in the field by their own dissemination and plants sown by man. In communities, the existence of which is entirely due to man, it would be very difficult to discern between „seminatural" and "artificial". On the other hand, we could take wheat or barley etc. as an integral part of the community. If a single species is found to be dominant in a natural community, we are inclined to see some extreme environmental factor behind it; if this dominance is accompanied by the presence or absence of some species indicating certain differences in the environment, the community seems to be a different syntaxon — a variant, subassociation or association. But if we compare field cultures of wheat, barley or oats with respect to their weed flora, the differences are negligible — these cultivated plants as such apparently have a very similar influence on the weed vegetation. It would thus hardly be right to take them as edificators and name the community e.g. *Hordeetum aperetosum*, *Hordeetum caucalidetosum* etc. In our opinion it would be best to take weeds as the fundamental community and express the presence of cultivated plants as "cultifacies" (the term by UJVÁROSI 1954) of the association, e.g. *Aperetum spicae-venti hordeicolum*, *triticicolum*, *avenicolum*.

The ecological basis for the differentiation of weed plant communities must be seen in the changing habitat (including the activity of man) in the course of a year or in different years, which is correctly manifested already in the work of ELLENBERG (1950). To get some clear view on this intricate complex, it seems to be suitable to deal first with the parts of this complex separately and then to try to form a reasonable synthesis of the whole.

The next paragraphs on the history of weed and ruderal communities during the development of agriculture have been written by HEJNÝ, the descriptions of individual agro-ecophases, agro-ecostages and agro-ecocycles and relevés of weed communities have been made by KROPÁČ, and the theoretical evaluation of the material has been made jointly by HADAČ and KROPÁČ.

The ecosystems intensively influenced by man may — from the viewpoint of evolution — be divided into two groups:

a) ruderal communities;
b) weed communities;

both communities became distinctly differentiated one from another during the social development of human society.

An older and therefore primary group represent the ecosystems of settlements. From the primitive settlements, which were at first of a nomadic character and then were successively stabilized, the following types of ecosystems were formed: trodden and dunged habitats, trodden and loosened habitats around the homesteads, waste pits. The annual and perennial species of apophytes and the species transported by man from the previous settlements formed the primordial set of species.

The agricultural ecosystems developed from the forest ecosystems and the primitive pastures. Manure in the form of ash was given to the first fields by fire, deep ploughing was still unknown. The annual and perennial species of apophytes and of species transported with seeds also predominated in these ecosystems. The specific basis of both fundamental types of ecosystems had common roots from the very beginning. However, both types began to differ successively one from another more and more distinctly during the stabilization of communities and their expansion. The field plots were not cultivated continuously every year, but due to the rapid exhaustion of soil fertility they were left fallow. The same plot, from the point of view of viable diaspores, concentrated annual, biennial and perennial species, and the combination of these species in individual agropascuophytocoenoses differed in accordance with the length of the period of using the plot as a field or as a fallow (pasture). The cattle enriched the plot with diaspores from a broader environment both epichorically and endochorically.

On the contrary, the ecosystems of settlements began to change according to the character of community development, where the radius of treading and manuring (waste) was rather spread over larger areas. Thus, the field plot was, at the very beginning of its development, in sign of the temporary existence of phytocoenoses of various ranks, where the weed species were in competition with the crop plants for a short time; annual species influenced by grazing and treading were present more on annual fallows, on perennial ones the soil was successively getting more and more compact, and pascual digression was the main form of development of perennial types of coenoses. The unstabilized pasture-and-field ecosystem caused by the alternation of field and fallow with grazing (with strips of virgin lands) is successively turned into the stabilized system: field-fallow-field, that means the three-field system changing gradually into the more-field one with the successive elimination of fallowing. The profile of the top soil is simultaneously more perfectly ploughed with the introduction of more-field farming and is more intensively manured.

This fact given by the brief historical development signifies, to a certain extent, the function changes in the character of phytocoenoses being formed on the same plot for a long time.

a) Coenoses with the predominance of annual species still occur very diffusely in the period of existence of annual crops and in the course of time certain species differentiate into crops with a certain rhythm of development during the vegetative period (autumn-spring species, spring-summer species, late summer species and so on).

b) Coenoses with predominance of therophyte species begin to concentrate at the end of crop-harvest on the stubble. In full light and without any competition they reach their optimal development.

c) Coenoses with the representation of perennial species demanding a certain degree of soil caking assert themselves more and more in the perennial crops.

Perennial species whose optimum was in the uncultivated soils of fallows, when the soil was still very loose, link up the mentioned groups. It is a group of the following species: *Cirsium vulgare*, *Carduus nutans*, *Sonchus arvensis*, *Polygonum amphibium*, *Mentha arvensis*, *Tussilago farfara*, *Cirsium arvense*, *Agropyrum repens*. These species are shared both by ruderal ecosystems of settlements and by ecosystems of fields.

The possibility of the existence of more coenoses on the level of associations on the same field plot during the rotation is therefore only a shortened and specifically impoverished recapitulation of the ecodynamical development of the plant cover which has its historical roots. On the contrary, the ecosystems of the settlements began to differentiate according to the habitats during the further development of settlement, this means that their number began to increase (ditches, gardens, fences, low walls, terraces) but the same habitat did not pass such changes as a field plot. The change of individual ecotops, in this case, had a different course. The soil cultivation regime and the vertical shift of diaspores from deeper layers of top soil to the higher ones (and vice versa) became a main factor in the fields. This periodical shift resulted in periodical changes of specific populations and of the population complex, as they manifested themselves in stands of individual crops in a certain, but temporary time aspect.

The stratification of new soil, however, occurred accidentally or periodically on the original one in the same habitat of settlement, so that new soils (neopedon) gradually arose "by apposition". New species previously unknown often appeared in the settlement, and the "old" ones, in buried horizons of soils, lived in the form of diaspores in anabiosis, until they died off. Thus, there are quite different processes in both fundamental types of ecosystems of anthropogenous soils intensively influenced by man. In the fields, under the influence of regular ploughing of the same plot as well as of agricultural measures limited in time, a relatively homogeneous awakening of specific populations within the rank of the same time unit takes place. The heaping-up of new soils in the settlements is irregularly distributed over some parts of used areas and causes the mosaic pattern of stands.

At the beginning of forming the field plots, driving of cattle from the settlement into fields represented a factor of continual mutual exchange of diaspores (annual species of trodden places in settlements and of mellowed ruderal spots penetrated into the fallows, and vice versa field weeds were transported to the settlement habitats). This driving of cattle likewise caused a certain similarity of coenoses (especially of those of perennial fallows) to the ruderal stands of the settlement. Under an intensive development of field cropping (without grazing) the transport of compost and fresh dung from settlement to fields remains the only factor of mutual and direct exchange of diaspores.

This brief review whose purpose was to compare both ecosystem complexes, is not unimportant for the actual solution of agrophytocoenoses.

1. It points to the possibility of application of the concept of temporary enviroments, in accordance with the ecophase-ecostage-ecocycle concept (Hejný 1957), for field plots and their weed complexes.

2. It demonstrates that the historical evolution of coenoses on a field plot, structurally manifested by the existence of a number of associations, can to a certain extent be used in the contemporary analysis and evaluation of agrophytocoenoses.

3. It likewise points to the fundamental difference of the main ecosystems of the field culture and of the settlement under a certain similarity of some ecological groups which are connected with the exchange of diaspores during the whole epoch of the historical evolution of the field complexes and of the corresponding settlement unit.

The concept of the agro-ecophases, agro-ecostages and agro-ecocycles

The agrotechnical activity of man together with cropping rotation and climatic (or meteorological) conditions seem to rule the composition of weed communities in the first place, all other factors (perhaps with the exception

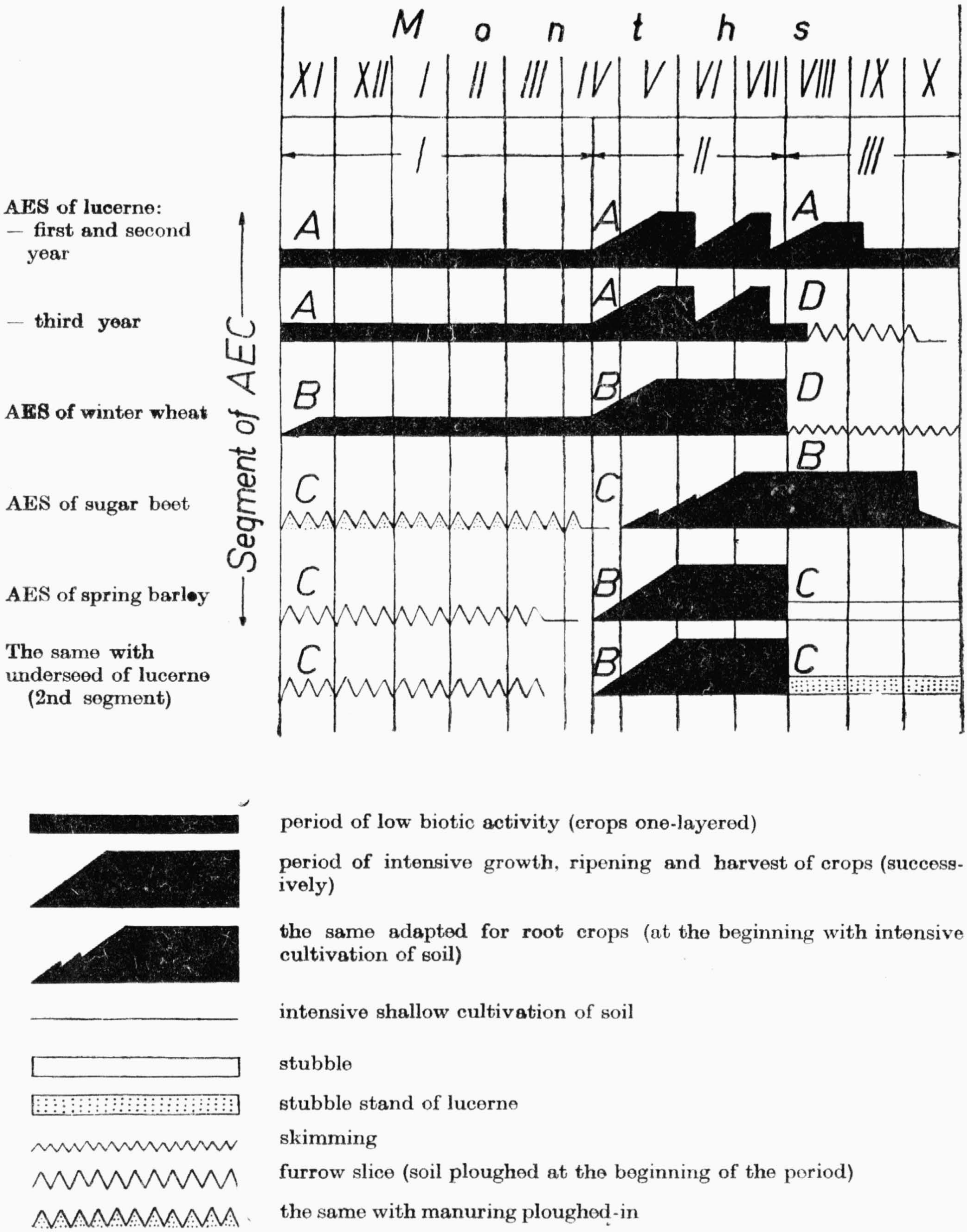

Fig. 1. — Segment of an agro-ecocycle as the example of usual rotational system of cropping in the sugar beet-wheat production zone.

of soil conditions, which may or may not be radically changed by agriculture) seem to be of less importance. The fundamental agrotechnical activity in annual crops is roughly given by ploughing, sowing and harvest at distinct times of year, and by manuring, fertilizing and cultivation of crop stands or applying herbicides or insecticides in different seasons. But for the first three activities, all the others may or may not be applied every year or not at all. A special position in the crop rotation is held by the perennial fodder crops not ploughed for one to three years (rarely more). The meteorological factors specific for spring, summer, autumn and winter, combined with the agricultural operations, thus form specific conditions, not known in other plant communities. These periods may be considered as a kind of ecophases (sensu HEJNÝ 1957), the "agro-ecophases".

The agro-ecophase (further AEP) is understood to be a set of temporary environmental conditions given by the changing ecological factors caused by the agrotechnical treatments and by a definite season of the year as well as by growth phases of the particular crop.

The AEPs are different in different climatic regions and production areas and must first be elaborated; we shall try to demonstrate them on the example of crop rotation in the so-called sugar beet and wheat production area of our country (see Fig. 1). As follows from the definition just mentioned, the AEP is limited, on the one hand, by the set of ecological factors expressed by the specific ecoclimate, and, on the other hand, by the set of ecological factors ruling in a certain type of crop. This is why the terminology of individual AEPs is chosen in the first place with respect to the influence of the first group of eco-factors (Roman numerals), and in the second place with respect to the type of crop including its agrotechnical operations (capitals). The names are symbols only, so that e.g. „autumn" AEP is not identical with the real year's season and practically corresponds to the after-harvest period of cereals.

I. Winter AEP (months XI to IV)

Temperatures mostly about 0° C (with frequent fluctuations in both directions), often freezing and thawing of top soil (especially when without snow); the top soil is generally covered with snow, its layer, however, varies in dependence on climatic region; the biotic activity in this AEP is low. At the end of the AEP, melting of snow takes place and precipitation is predominately in the form of rain, temperature above 0° C predominates but still remains low, the soil moisture content is high enough (sometimes excessing); plants get full light, but days are still short (on the average nearly ten hours).

Special ecological factors ruling individual crops:

I A — Winter AEP with perennial fodder crops

The soil is not loosened by ploughing and tends to become more and more compact. Stands of crops are in the form of one stratum, very low, not fully closed, at the end of this AEP they are fertilized and harrowed.

I B — Winter AEP with winter crops

The top soil is loosened by ploughing at the end of the summer or in early autumn (in accordance with the crop). Stands of winter crops are one-layered, either closed fully (rye) or not fully (wheat), at the end of the AEP they are harrowed or rolled and fertilized.

I C — Winter AEP with bare furrow

Top soil is loosened by ploughing in the autumn and left in the form of bare furrow over to the spring when seed bed preparation is carried into operation (smoothing, harrowing and fertilizing). If root crops are going to be cultivated, farmayrd manure is ploughed-in as early as in the autumn, and also the preparation of the seed bed in spring is prolonged, more intensive, and to some extent deeper.

Table 1

Type of crops		Lucerne		Winter crops		Lucerne		Winter crops		Spring crops		Root crops		Stubble stand	
Season		spring season				summer season						autumn season			
Mean cover of the whole stand (%)		77		56		85.3		84		83.3		85.8		71.8	
Mean cover of weeds (%)		41		30		33		40.5		45.5		51.5		56.5	
Mean number of species		19.8		22.4		29.4		30.3		36		43.3		37.2	
Total number of species		32		42		78		68		70		81		84	
Number of relevés		5		5		10		10		10		10		10	
		C	A	C	A	C	A	C	A	C	A	C	A	C	A
Teph	*Veronica hederifolia* L.	V	0.70	V	3.10	.	.	II	0.20	.	.	.	.	.	.
	Thlaspi perfoliatum L.	V	1.60	I	0.20	.	.	.	.	.	.	.	.	.	.
	Valerianella locusta (L.) LATERRADE	III	0.80	.	.	.	.	.	.	.	.	.	.	.	.
	Veronica triphyllos L.	.	.	II	0.60	.	.	.	.	.	.	.	.	.	.
Tas	*Sonchus asper* (L.) HILL	.	.	.	.	II	0.40	III	0.35	IV	0.75	V	2.05	V	2.65
	Medicago lupulina L.	.	.	.	.	II	0.25	II	0.25	V	0.55	II	0.15	IV	0.65
	Amaranthus retroflexus L.	.	.	.	.	r	0.10	.	.	I	0.10	V	1.50	II	0.45
	Polygonum lapathifolium L.	.	.	.	.	r	0.05	.	.	II	0.35	IV	0.85	III	0.50
	Sonchus oleraceus L.	.	.	.	.	.	.	r	0.05	II	0.35	IV	0.65	III	0.90
	Solanum nigrum L.	.	.	.	.	.	.	.	.	I	0.15	V	0.85	II	0.20
	Aethusa cynapium L.	.	.	.	.	.	.	.	.	II	0.20	r	0.05	II	0.45
	Chenopodium hybridum L.	.	.	.	.	.	.	r	0.05	.	.	III	0.50	.	.
	Setaria viridis (L.) P. B.	.	.	.	.	.	.	.	.	I	0.15	r	0.05	II	0.30
	Erysimum repandum L.	.	.	.	.	.	.	.	.	.	.	I	0.10	.	.
	Bidens tripartitus L.	.	.	.	.	.	.	.	.	.	.	I	0.10	.	.
Tap	*Chenopodium album* L.	.	.	III	0.90	V	1.30	V	2.50	V	3.30	V	4.50	V	3.70
	Sinapis arvensis L.	I	0.10	IV	0.80	III	0.75	IV	1.30	V	2.45	V	1.60	IV	1.50
	Bilderdykia convolvulus (L.) DUM.	I	0.10	II	0.60	V	0.80	V	2.05	V	2.50	V	1.50	V	2.20
	Polygonum heterophyllum LINDMAN emend. H. SCHOLZ	.	.	IV	1.10	V	1.55	V	1.70	V	1.75	V	1.10	V	1.70
	Melandrium noctiflorum (L.) FRIES	.	.	III	1.00	r	0.10	V	1.20	V	1.45	V	1.45	V	1.90
	Avena fatua L.	.	.	III	0.90	IV	2.05	IV	1.65	V	4.20	V	1.75	III	1.20
	Atriplex patula L.	.	.	.	.	II	0.20	IV	0.95	V	0.90	V	1.50	V	1.30
	Euphorbia helioscopia L.	.	.	II	0.20	I	0.15	II	0.25	IV	0.40	V	1.00	III	0.55
	Galium spurium L.	.	.	.	.	r	0.10	III	0.50	IV	0.55	V	0.70	III	0.60
	Anagallis arvensis L.	.	.	.	.	.	.	II	0.20	V	0.75	III	0.55	V	1.30
	Euphorbia exigua L.	.	.	.	.	r	0.05	II	0.25	IV	0.80	III	0.60	IV	1.20
	Atriplex nitens SCHKUHR	.	.	I	0.10	II	0.15	I	0.10	r	0.05	I	0.10	r	0.10
Th	*Descurainia sophia* (L.) WEBB	V	1.10	V	1.60	IV	1.15	V	2.50	IV	0.60	IV	0.45	II	0.25
	Adonis aestivalis L.	I	0.10	V	1.70	III	0.70	V	2.65	V	1.20	II	0.15	III	0.40
	Geranium pusillum BURM. f.	V	2.50	III	0.30	III	0.70	III	0.50	IV	0.40	V	1.55	IV	1.20
	Galium aparine L.	I	0.20	III	0.90	I	0.15	V	1.15	III	0.65	V	0.70	II	0.60
	Myosotis arvensis (L.) HILL	II	0.30	II	0.30	III	0.70	IV	0.65	III	0.30	III	0.35	III	0.90
	Neslia paniculata (L.) DESV.	.	.	III	0.40	II	0.30	IV	1.15	V	0.95	IV	0.85	II	0.40
	Delphinium consolida L.	I	0.10	III	2.00	r	0.05	III	0.95	r	0.40	r	0.10	II	0.50
	Arenaria serpyllifolia L.	I	0.40	.	.	III	0.35	I	0.10	II	0.25	IV	0.75	IV	0.80
	Papaver rhoeas L.	III	0.40	II	0.30	II	0.25	II	0.20	.	.	r	0.05	r	0.05
	Conringia orientalis (L.) DUM.	.	.	II	1.00	I	0.10	II	0.55	II	0.30	I	0.10	.	.
	Erigeron canadensis L.	III	0.70	.	.	II	0.35	.	.	.	.	II	0.50	II	0.20
	Fumaria officinalis L.	.	.	II	0.20	r	0.10	II	0.30	I	0.25	I	0.10	r	0.05
	Lithospermum arvense L.	.	.	II	0.20	.	.	r	0.05	r	0.10	.	.	I	0.10
	Asperugo procumbens L.	.	.	I	0.10	.	.	r	0.10	I	0.10	.	.	I	0.25
	Camelina microcarpa ANDRZ.	.	.	I	0.10	.	.	I	0.10	.	.	.	.	r	0.05
	Agrostemma githago L.	.	.	.	.	.	.	I	0.10	.	.	.	.	.	.
Tepe	*Thlaspi arvense* L.	II	0.20	V	3.20	IV	0.65	V	2.15	V	1.90	V	1.60	IV	1.30
	Stellaria media (L.) VILL.	V	4.00	V	2.10	V	1.25	IV	1.25	IV	0.70	V	2.55	V	2.05
	Viola arvensis MURR.	V	1.10	V	1.60	V	0.70	V	1.05	V	1.10	V	0.80	V	1.65
	Veronica persica POIR.	V	3.00	III	0.90	V	0.85	IV	0.75	III	0.60	V	2.05	V	2.50
	Capsella bursa-pastoris (L.) MED.	V	2.20	IV	1.00	V	0.80	III	0.70	II	0.35	IV	0.70	IV	1.65
	Lamium amplexicaule L.	V	1.20	V	0.90	r	0.10	III	0.55	IV	0.50	IV	0.50	IV	0.50
	Veronica polita FRIES	V	1.60	II	0.30	II	0.40	II	0.25	I	0.10	V	1.15	V	0.95
D	*Malva neglecta* WALLR.	.	.	.	.	r	0.05	r	0.05	II	0.25	III	0.35	III	0.35
	Melilotus officinalis (L.) LAMK.	.	.	.	.	II	0.50	.	.	II	0.25	III	0.30	II	0.55
	Arctium tomentosum MILL.	II	0.30	.	.	III	0.50	I	0.15	r	0.05	.	.	r	0.05
	Daucus carota L.	.	.	.	.	II	0.20	.	.	.	.	r	0.05	II	0.15
	Lactuca serriola L.	.	.	.	.	r	0.05	I	0.15	.	.	r	0.05	r	0.05
	Bromus sterilis L.	.	.	.	.	II	0.20	.	.	.	.	.	.	.	.
H	*Falcaria vulgaris* BERNH.	.	.	III	0.30	IV	0.50	IV	0.90	IV	1.05	V	1.50	IV	0.55
	Taraxacum officinale F. WEBER ex WIGGERS	V	4.00	.	.	V	2.90	I	0.25	III	0.45	V	0.55	IV	0.45
	Melandrium album (MILLER) GARCKE	V	1.60	I	0.10	IV	2.10	r	0.20	r	0.05	II	0.20	III	0.50
	Rumex crispus L.	II	0.30	I	0.10	IV	1.35	II	0.25	IV	0.80	III	0.60	III	0.90
	Knautia arvensis (L.) COULT.	.	.	.	.	II	0.15	.	.	I	0.10	V	0.50	II	0.25
	Artemisia vulgaris L.	.	.	.	.	r	0.20	r	0.05	I	0.10	II	0.15	r	0.05
	Plantago major L.	II	0.20	.	.	II	0.15	.	.	.	.	.	.	II	0.25
	Plantago media L.	III	0.30	.	.	r	0.05	.	.	.	.	.	.	.	.
	Echium vulgare L.	II	0.50	.	.	II	0.15	.	.	r	0.20	.	.	r	0.05
	Ballota nigra L.	I	0.10	.	.	r	0.05	.	.	r	0.05	r	0.05	.	.
	Cichorium intybus L.	.	.	.	.	.	.	r	0.05	r	0.05	r	0.10	.	.
	Plantago lanceolata L.	I	0.20	.	.	r	0.05	.	.	.	.	.	.	.	.
Gp	*Agropyron repens* (L.) P. B.	V	1.90	III	0.50	III	1.00	II	0.90	IV	0.75	IV	1.55	II	0.30
	Sonchus arvensis L.	II	0.30	I	0.10	V	1.30	V	1.10	V	2.85	V	1.55	IV	2.00
	Cirsium arvense (L.) SCOP.	.	.	III	0.50	V	1.55	V	1.70	V	3.00	V	2.30	V	2.40
	Cardaria draba (L.) DESV.	.	.	III	0.70	III	0.75	IV	0.95	II	0.40	III	1.60	II	0.75
Gs	*Convolvulus arvensis* L.	.	.	I	0.10	V	2.30	V	2.90	V	3.40	V	3.30	V	3.00
	Linaria vulgaris MILL.	.	.	I	0.10	III	0.80	II	0.15	II	0.40	IV	0.55	IV	0.90
	Campanula rapunculoides L.	.	.	I	0.10	II	0.45	I	0.30	III	0.45	V	0.95	II	0.50
	Vicia tenuifolia ROTH	.	.	I	0.10	II	0.30	II	0.20	II	0.35	II	0.25	II	0.20
	Lathyrus tuberosus L.	.	.	.	.	II	0.35	II	0.20	III	0.50	IV	1.10	II	0.45
	Euphorbia esula L.	.	.	.	.	II	0.15	I	0.10	III	0.30	III	0.45	II	0.45
	Polygonum amphibium L.	.	.	.	.	I	0.15	.	.	I	0.15	r	0.05	.	.
C	*Rubus caesius* L.	.	.	.	.	II	0.35	r	0.10	II	0.50	II	0.45	II	0.45
Er	*Beta vulgaris* L.	.	.	.	.	.	.	r	0.05	III	0.65	.	.	II	0.50
	Medicago sativa L.	.	.	.	.	.	.	r	0.10	I	0.45	r	0.20	.	.
	Triticum aestivum L.	.	.	.	.	.	.	.	.	.	.	r	0.05	.	.
	Sinapis alba L.	.	.	.	.	.	.	.	.	.	.	I	0.15	r	0.10

Besides with constancy lower than 10% (r) and low abundance number (mostly 0.05–0.10):
Anthemis cotula L. (winter cr., spring cr. and stubble), *Avena sativa* L. (root cr. and stubble), *Brassica napus* L. (winter and spring cr.), *Bromus mollis* L. (lucerne), *Caucalis platycarpos* L. (winter and spring cr.), *Centaurea cyanus* L. (stubble), *Centaurea scabiosa* L. (root cr. and stubble), *Chelidonium majus* L. — juv. (root cr.), *Crepis tectorum* L. (lucerne), *Dactylis glomerata* L. (root cr.), *Galeopsis tetrahit* L. (winter cr.), *Geranium dissectum* L. (stubble), *Hordeum distichon* L. (winter cr. and stubble), *Lapsana communis* L. (lucerne and stubble), *Nonea pulla* (L.) DC. (root cr. and stubble), *Onopordum acanthium* L. — juv. (winter cr. and stubble), *Pastinaca sativa* L. (lucerne), *Phacelia tanacetifolia* BENTH. (lucerne and stubble), *Poa pratensis* L. (lucerne), *Polygonum persicaria* L. (spring cr., root cr. and stubble), *Potentilla reptans* L. (lucerne), *Secale cereale* L. (lucerne), *Senecio vulgaris* L. (root cr. and stubble), *Sherardia arvensis* L. (lucerne, root cr. and stubble), *Stachys palustris* L. (lucerne), *Symphytum officinale* L. (root cr.), *Trifolium pratense* L. (lucerne), *Tussilago farfara* L. (lucerne, spring cr. and stubble), *Urtica urens* L. (winter and root cr.), *Veronica arvensis* L. (lucerne), *Vicia angustifolia* (L.) REICHARD (root cr. and stubble), *Vicia tetrasperma* (L.) SCHREB. (stubble), *Vicia villosa* ROTH (root cr.).

Note. Winter crops and lucerne — summer season only.

Table 3

Alliance	*Caucalion lappulae*												*Veronico-politae-Taraxacion*	
Association sequence	*Cardaria draba*												—	
Association	*Lathyro tuberosi-Adonidetum aestivalis*										*Veronico-Adonidetum aestivalis*		*Valerianello-Thlaspeetum perfoliatae*	
Subassociation	*anagallidetosum*				*typicum*		*taraxacetosum*		—		—		—	
Facies	*normale*		*amaranthosum*		—		—		—		—		—	
Number of species (total)	89		81		68		78		112		42		32	
Number of relevés	20		10		10		10		50		5		5	
Symbols of syntaxa	A 1a		A 1b		A 2		A 3		A		B		C	
Characteristic combination of assoc. species														
a) Diagnostic important species:														
Lathyrus tuberosus L.	II	0.48	IV	1.10	II	0.20	II	0.35	III	0.52	.	.	.	.
Adonis aestivalis L.	IV	0.80	II	0.15	V	2.65	III	0.70	IV	1.02	V	1.70	I	0.10
Conringia orientalis (L.) DUM.	I	0.15	I	0.10	II	0.55	I	0.10	II	0.21	II	1.00	.	.
Veronica hederifolia L.	.	.	.	.	II	0.20	.	.	r	0.04	V	3.10	V	0.70
Veronica triphyllos L.	.	.	.	.	.	.	.	.	.	.	II	0.60	.	.
Thlaspi perfoliatum L.	.	.	.	.	.	.	.	.	.	.	I	0.20	V	1.60
Valerianella locusta (L.) LATERRADE	.	.	.	.	.	.	.	.	.	.	.	.	III	0.80
Plantago media L.	.	.	.	.	.	.	r	0.05	r	0.01	.	.	III	0.30
b) Species with constancy higher than 60%:														
A, B, C *Stellaria media* (L.) VILL.	V	1.38	V	2.55	IV	1.25	V	1.25	V	1.56	V	2.10	V	4.00
A, B, C *Viola arvensis* MURR.	V	1.38	V	0.80	V	1.05	V	0.70	V	1.06	V	1.60	V	1.10
A, B, C *Descurainia sophia* (L.) WEBB	III	0.43	IV	0.45	V	2.50	IV	1.15	IV	0.99	V	1.60	V	1.10
A, B *Thlaspi arvense* L.	V	1.60	V	1.60	V	2.15	IV	0.65	V	1.52	V	3.20	II	0.20
A, B *Sinapis arvensis* L.	V	1.93	V	1.60	IV	1.30	III	0.75	V	1.52	IV	0.80	I	0.10
A, B *Polygonum heterophyllum* LINDM. em. H. SCHOLZ	V	1.73	V	1.10	V	1.70	V	1.55	V	1.56	IV	1.10	.	.
A, C *Veronica persica* POIR.	IV	1.55	V	2.05	IV	0.75	V	0.85	V	1.35	III	0.90	V	3.00
A, C *Geranium pusillum* BURM. f.	IV	0.80	V	1.55	III	0.50	III	0.70	IV	0.87	III	0.30	V	2.50
B, C *Lamium amplexicaule* L.	IV	0.50	IV	0.50	III	0.55	r	0.10	III	0.43	V	0.90	V	1.20
A *Bilderdykia convolvulus* (L.) DUM.	V	2.30	V	1.50	V	2.05	V	0.80	V	1.81	II	0.60	I	0.10
A *Sonchus arvensis* L.	V	2.43	V	1.55	V	1.10	V	1.30	V	1.76	I	0.10	II	0.30
A *Cirsium arvense* (L.) SCOP.	V	2.70	V	2.30	V	1.70	V	1.55	V	2.19	III	0.50	.	.
A *Chenopodium album* L.	V	3.50	V	4.50	V	2.50	V	1.30	V	3.06	III	0.90	.	.
A *Convolvulus arvensis* L.	V	3.20	V	3.30	V	2.90	V	2.30	V	2.98	I	0.10	.	.
A *Avena fatua* L.	IV	2.70	V	1.75	IV	1.65	IV	2.05	IV	1.97	III	0.90	.	.
A *Falcaria vulgaris* BERNH.	IV	0.80	V	1.50	IV	0.90	IV	0.50	IV	0.90	III	0.30	.	.
A *Sonchus asper* (L.) HILL.	V	1.70	V	2.05	III	0.35	II	0.40	IV	1.24	.	.	.	.
A *Atriplex patula* L.	V	1.10	V	1.50	IV	0.95	II	0.20	IV	0.97	.	.	.	.
C *Agropyron repens* (L.) P. B.	III	0.53	IV	1.55	II	0.90	III	1.00	III	0.90	III	0.50	V	1.90
Differential species of subassociation:														
Anagallis arvensis L.	V	1.03	III	0.55	II	0.20	.	.	III	0.56	.	.	.	.
Euphorbia helioscopia L.	IV	0.48	V	1.00	II	0.25	I	0.15	III	0.47	II	0.20	.	.
Aethusa cynapium L.	II	0.33	r	0.05	.	.	.	.	I	0.14	.	.	.	.
Setaria viridis (L.) P. B.	II	0.23	r	0.05	.	.	.	.	I	0.10	.	.	.	.
Amaranthus retroflexus L.	II	0.28	V	1.50	.	.	r	0.10	II	0.43	.	.	.	.
Polygonum lapathifolium L.	III	0.43	IV	0.85	.	.	r	0.05	II	0.55	.	.	.	.
Solanum nigrum L.	II	0.18	V	0.85	.	.	.	.	II	0.24	.	.	.	.
Sonchus oleraceus L.	II	0.63	IV	0.65	r	0.05	.	.	II	0.39	.	.	.	.
Chenopodium hybridum L.	.	.	III	0.50	r	0.05	.	.	.	.	.	.	.	.
Characteristic species of assoc. sequence:														
Cardaria draba (L.) DESV.	II	0.58	III	1.60	IV	0.95	III	0.75	III	0.89	III	0.70	.	.
Caucalion species:														
Melandrium noctiflorum (L.) FRIES	V	1.68	V	1.45	V	1.20	r	0.10	IV	1.22	III	1.00	.	.
Delphinium consolida L.	II	0.45	r	0.10	III	0.95	r	0.05	II	0.40	III	2.00	I	0.10
Neslia paniculata (L.) DESV.	III	0.68	IV	0.85	IV	1.15	II	0.30	III	0.73	III	0.40	.	.
Euphorbia exigua L.	IV	1.00	III	0.60	II	0.25	r	0.05	III	0.58	.	.	.	.
Galium spurium L.	IV	0.58	V	0.70	III	0.50	r	0.10	III	0.49	.	.	.	.
Lithospermum arvense L.	I	0.10	.	.	r	0.05	.	.	r	0.05	II	0.20	.	.
Camelina microcarpa ANDRZ.	r	0.03	.	.	I	0.10	.	.	r	0.03	I	0.10	.	.
Caucalis platycarpos L.	r	0.10	.	.	r	0.05	.	.	r	0.05	.	.	.	.
Veronico-politae-Taraxacion species as well as differential species of subassociation:														
Taraxacum officinale F. WEBB. ex WIG.	IV	0.45	V	0.55	I	0.25	V	2.90	IV	0.92	.	.	V	4.00
Capsella bursa-pastoris (L.) MED.	III	1.00	IV	0.70	III	0.70	V	0.80	IV	0.84	IV	1.00	V	2.20
Veronica polita FRIES	IV	0.53	V	1.15	II	0.25	II	0.40	III	0.57	II	0.30	V	1.60
Melandrium album (MILLER) GARCKE	II	0.28	II	0.20	r	0.20	IV	2.10	II	0.61	I	0.10	V	1.60
Echium vulgare L.	r	0.13	.	.	.	.	II	0.15	r	0.08	.	.	II	0.50
Plantago lanceolata L.	.	.	.	.	.	.	r	0.05	r	0.01	.	.	I	0.20
Other species of higher syntaxa (a) and companions (b–f):														
a) *Myosotis arvensis* (L.) HILL.	III	0.60	III	0.35	IV	0.65	III	0.70	III	0.58	II	0.30	II	0.30
Papaver rhoeas L.	r	0.03	r	0.05	II	0.20	II	0.25	I	0.11	II	0.30	II	0.40
Fumaria officinalis L.	I	0.15	I	0.10	II	0.30	r	0.10	I	0.16	II	0.20	.	.
b) *Erigeron canadensis* L.	I	0.10	II	0.50	.	.	II	0.35	I	0.21	.	.	III	0.70
Atriplex nitens SCHKUHR	r	0.08	I	0.10	I	0.10	II	0.15	I	0.10	I	0.10	.	.
Asperugo procumbens L.	I	0.18	.	.	r	0.10	.	.	r	0.09	I	0.10	.	.
Malva neglecta WALLR.	III	0.30	III	0.35	r	0.05	r	0.05	II	0.21	.	.	.	.
Lactuca serriola L.	r	0.03	r	0.05	I	0.15	r	0.05	r	0.06	.	.	.	.
Bromus sterilis L.	.	.	.	.	.	.	II	0.20	r	0.04	.	.	.	.
c) *Galium aparine* L.	III	0.63	V	0.70	V	1.15	I	0.15	III	0.65	III	0.90	I	0.20
Arctium tomentosum MILL.	r	0.05	.	.	I	0.15	III	0.50	I	0.15	.	.	II	0.30
Ballota nigra L.	r	0.03	r	0.05	.	.	r	0.05	r	0.03	.	.	I	0.10
Artemisia vulgaris L.	I	0.08	II	0.15	r	0.05	r	0.20	I	0.11	.	.	.	.
Melilotus officinalis (L.) LAMK.	II	0.40	III	0.30	.	.	II	0.50	II	0.32	.	.	.	.
Daucus carota L.	II	0.08	r	0.05	.	.	II	0.20	I	0.08	.	.	.	.
d) *Rumex crispus* L.	IV	0.85	III	0.60	II	0.25	IV	1.35	III	0.78	I	0.10	II	0.30
Plantago maior L.	I	0.13	.	.	.	.	II	0.15	I	0.08	.	.	II	0.20
e) *Arenaria serpyllifolia* L.	III	0.53	IV	0.75	I	0.10	III	0.35	III	0.45	.	.	I	0.40
Medicago lupulina L.	IV	0.60	II	0.15	II	0.25	II	0.25	III	0.37	.	.	.	.
Vicia tenuifolia ROTH	II	0.28	II	0.25	II	0.20	II	0.30	II	0.26	I	0.10	.	.
f) *Campanula rapunculoides* L.	II	0.48	V	0.95	I	0.30	II	0.45	III	0.53	I	0.10	.	.
Linaria vulgaris MILL.	III	0.65	IV	0.55	II	0.15	III	0.80	III	0.56	I	0.10	.	.
Euphorbia esula L.	III	0.38	III	0.45	I	0.10	II	0.15	II	0.29	.	.	.	.
Knautia arvensis (L.) COULT.	II	0.18	V	0.50	.	.	II	0.15	II	0.20	.	.	.	.
Rubus caesius L.	II	0.48	II	0.45	r	0.10	II	0.35	II	0.37	.	.	.	.

Other species with constancy mostly lower than 10% (r):

A 1a: *Anthemis cotula* L., *Centaurea cyanus* L., *Centaurea scabiosa* L., *Cichorium intybus* L., *Erodium cicutarium* (L.) L'HÉR., *Geranium dissectum* L., *Lapsana communis* L., *Nonea pulla* (L.) DC., *Onopordum acanthium* L. – juv., *Polygonum amphibium* L., *Polygonum persicaria* L., *Senecio vulgaris* L., *Sherardia arvensis* L., *Tussilago farfara* L., *Vicia angustifolia* (L.) REICHARD, *Vicia tetrasperma* (L.) SCHREB.

A 1b: *Bidens tripartitus* L., *Centaurea scabiosa* L., *Chelidonium majus* L. – juv., *Cichorium intybus* L., *Erysimum repandum* L., *Euphorbia peplus* L., *Nonea pulla* (L.) DC., *Polygonum amphibium* L., *Polygonum persicaria* L., *Senecio vulgaris* L., *Sherardia arvensis* L., *Symphytum officinale* L., *Urtica urens* L., *Vicia angustifolia* (L.) REICHARD, *Vicia villosa* ROTH.

A 2: *Agrostemma githago* L., *Anthemis cotula* L., *Cichorium intybus* L., *Galeopsis tetrahit* L., *Onopordum acanthium* L. – juv., *Urtica urens* L.

A 3: *Bromus mollis* L., *Crepis tectorum* L., *Dactylis glomerata* L., *Erigeron acris* L., *Lapsana communis* L., *Pastinaca sativa* L., *Poa pratensis* L., *Polygonum amphibium* L., *Potentilla reptans* L., *Sherardia arvensis* L., *Stachys palustris* L., *Trifolium pratense* L., *Tussilago farfara* L., *Veronica arvensis* L.

Rests of preceding crops:

A 1a: *Beta vulgaris* L., *Brassica napus* L., *Medicago sativa* L., *Phacelia tanacetifolia* BENTH., *Sinapis alba* L.

A 1b: *Avena sativa* L., *Medicago sativa* L., *Sinapis alba* L., *Triticum aestivum* L.

A 2: *Beta vulgaris* L., *Hordeum distichon* L., *Medicago sativa* L.

A 3: *Phacelia tanacetifolia* BENTH., *Secale cereale* L.

II. Spring-summer AEP (months IV to VII)

A period of intensive growth and ripening of some crops. In the conditions of our territory the soil is covered with crops practically all the time, exceptions may occur with root crops only. The air gradually grows warmer and warmer, and so does the top soil. At the beginning of this AEP the soil moisture content is still high enough, however, the drying-up of the soil (in the dry regions of territory) gradually occurs. In general, this period is the richest in rainfall. In this AEP the day length gradually grows longer (on the average more than fifteen hours), but weeds get full sunlight only in the beginning of the AEP (when the stands of crops are small). The closeness of stand and biomass of crops gradually increase, and the shade they cast gets deeper; only at the end of the vegetation period of cereals (ripening period) do the light conditions become more favourable again. Marked differences may often occur in the light absorption curves in different crops (cf. RADEMACHER 1950).

II A — Spring-summer AEP with perennial fodder crops

The top soil becomes more and more compact with subsequent production years. Good stands grow very luxuriantly and their yield is usually high (if the soil moisture is sufficient), and the cover values can often reach 100%. Two mowings of stands take place; after them full sunlight for weeds occurs temporarily, as well as warming-up and drying-up of the top soil.

II B — Spring-summer AEP with cereals

The top soil is relatively still loosened, however, it gradually becomes compact; especially with the winter crops. Cereals are usually not treated mechanically, but herbicides have been intensively applied in our country during the last decennium. Stands become gradually dense and only in the course of ± the last month before harvesting does more light reach the ground layer, which provides better conditions for the further development of weeds. In general, there is no essential difference in the phytoclimate of the winter and spring cereals, but there are some differences in the light absorption curves, the maxima of them may at different time be reached; the difference often depends rather on the quality of stand than on the species of cereal, and often the variety is more decisive (cf. RADEMACHER 1950, HODÁŇOVÁ 1967). This AEP is finished by the harvesting of cereals.

II C — Spring-summer AEP with root crops

AEP differing very substantially from the others in the corresponding period. Above all, the top soil is properly loosened by cultivation operations, at first by seed bed preparations, later on by inter-row cultivation, as long as the stands are not closed. At that time there is plenty of light for weeds, the top soil warms-up to a considerable extent, and a higher content of nitrates is also characteristic (ploughing-in of manure in the preceding autumn). Lately special herbicides of high selectivity have also been applied.

III. Autumn AEP

The start of the AEP is generally characterized by the harvesting of cereals. The specific eco-factors in common are as follows: at first still higher temperatures (as in the summer), the top soil warmed-up in the whole profile and only to the end of the period temperatures decreasing (but exceptionally below 0° C); the rainfall is mostly limited (regionally variable factor), the top soil dries-up and only later on does precipitation increase and the soil moisture content get again high. For this period the shortening of days is typical (from nearly fifteen hours to ten), whereas the light conditions for weeds are different (in the AEP III A + B not full light, in AEP C + D full sunlight).

III A — Autumn AEP with perennial fodder crops

Stands usually lower (as for the lucerne, the third mowing is possible), top soil very compact and often very dry (cracks occur in heavy soils).

III B — Autumn AEP with root crops

Stands usually closed (depending on the crop) and in no case in cultivation continued; top soil relatively loosened (in comparison with other corresponding AEP). At the end of this AEP root crops are gathered in.

III C — Autumn AEP with stubble

This AEP develops after the harvesting of cereals so long as the following AEP (III D) is not produced. From the agronomical point of view, this AEP is fully justified only if a stubble stand of perennial fodder crops occurs (after undersowing into preceding cereal), however, in farming practice this AEP exists for various working reasons. The top soil is relatively more compact, and being exposed to full sunlight, it warms-up markedly and dries-up (cracks are possible in heavy soils).

III D — Autumn AEP with skimming

This AEP starts after harvesting of cereals if the stubble is shallowly (about 10 cm) ploughed or cultivated; the same effect is reached after deeper ploughing (e.g. for early sown winter crops). The top soil is loosened in this AEP (at least its upper layer), which prevents the wastage of soil moisture from deeper soil layers and secures higher temperatures in the upper ones; on the other hand the reception of heavier rainfall is thus facilitated better than in the case of stubble stands. Here also the full sunlight occurs.

General characterization of the agro-ecostages (AES)

The agro-ecostage is considered to be a temporary environment delimited by the sequence of individual agro-ecophases in a particular type of crop including its agricultural treatments.

From Fig. 1 it is evident that the sequence of AEPs is practically given by the type of crop with its appropriate agrotechnical operations. This is why we must find the differences of AESs in special agro-ecological factors ruling the individual crop type; here we can give a short account of them:

1. Perennial fodder crops

The decisive agro-ecological factors are as follows:

a) lacking of the yearly-repeated ploughing and no soil cultivation (except for harrowing) during the vegetation period, which results in the compactness of top soil and causes changes in soil physical properties;
b) the repeated mowing of stands is very effective (with red clover two and with lucerne usually three mowings, except for seed production stands).

2. Winter crops

The decisive agro-ecological factors can be shown in the following:

a) ploughing early in the autumn (terms differing in accordance with the crop) with subsequent seed bed preparation and sowing of winter crop;
b) the winter stand of crops always covers the top soil (the canopies being dependent on the type of crop) and in spring only minimum cultivation of soil takes place (exceptions with winter rape).

3. Root crops

are characterized by very specific agro-ecological factors that may be grouped as follows:

a) ploughing in autumn and at that time incorporation of high doses of farmyard manure (about 300 q/ha);
b) long-lying furrow during the autumn-winter-spring period;

c) intensive spring seed bed preparation, ± prolonged and differently deep (depending on the type of crop), which is in correlation with terms of sowing or planting;
d) inter-row cultivation at least during the early growth stages of root crops; for potatoes creating of a specific nanorelief in the form of hilling is typical.

4. Spring crops (cereals or pulses and mixtures of both)

Here the following decisive agro-ecological factors may be noted:
a) deep ploughing in the autumn and bare furrow lying during autumn and winter;
b) moderately intensive and shallow seed bed preparation in early spring;
c) early sowing which is in accordance with the preceding point (b), today without inter-row cultivation, but the application of herbicides has become an integral part of cultural treatments.

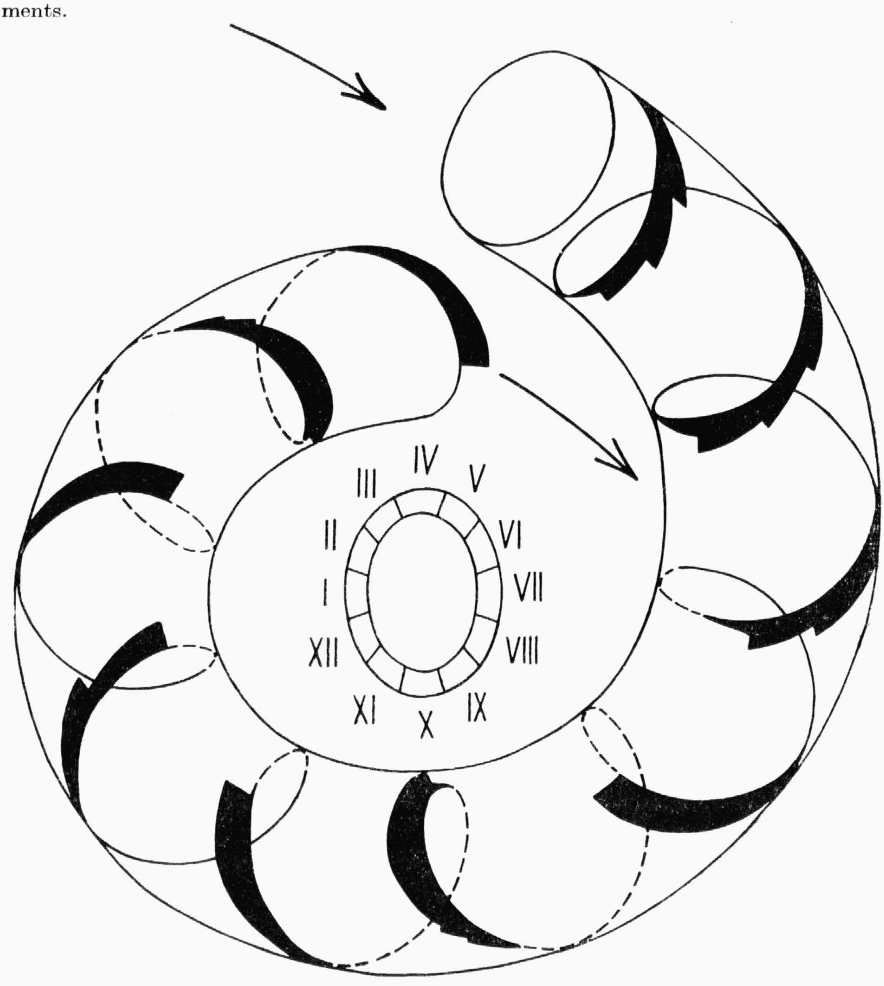

Fig. 2. — Model of one agro-ecocycle with individual spirals of the agro-ecostages; — — — soil without crops; ——— crops in the phase of retard growth or reduced after harvest; ▬ crops in the phase of intensive growth.

Agro-ecocycle (AEC) is a cycle of individual agro-ecostages (see the small spirals on the Fig. 2) and is generally conditioned by the agronomical system from the historical and economic point of view and by the corresponding crop rotation from the viewpoint of the production zone. For example, the AEC usual in the sugar beet-wheat production zone is as follows:

lucerne (two or three years) → winter crops → root crops → spring crops → mixtures → winter crops → root crops → spring crops (with underseed of lucerne).

AEC is thus composed of two segments of crop sequence (see also Fig. 1), in the middle of which root crops are situated and on the both sides usually winter or spring cereals (or mixtures with them) are placed. The whole AEC starts or ends with perennial fodder crops, so that after some years (according to the number of crops included) the whole AEC comes to the end and starts anew in the ± similar form as far as the agronomical system does not change. This development can be illustrated as one cycle of the big spiral (see Fig. 2).

The concept of the syntaxonomic units in weed communities

Let us consider the relation of the agro-ecophases to weeds and weed communities. Some results about the duration of individual life of weed plants have been published (Gams 1918, Oplištilová 1953, Sychowa 1959). The results of Kropáč (1959) from the years 1954—1957 can also provide a good basis for this consideration. The advantage of Kropáč's investigations lies in that they were performed continuously in the course of four years on permanent sites in the crop rotation of sugar beet-wheat production zone as illustrated above.

The locality of observation is called Kaštice near Podbořany, situated in West Bohemia; it lies in the driest region of Czechoslovakia with rather high temperature (mean annual rainfall 441 mm and mean annual temperature +8.6° C as given by the meteorological station at Žatec), the soil is chernozem (slightly degraded, middle deep), rather heavy (about 40% of top soil particles are smaller than 0.001 mm), developed on the parent material made up of pleistocenean greyish-yellow aeolian soil material and partly of delluvial origin where basic minerals prevail (basalts, basaltic tuffs), the pH being neutral or slightly alkaline, top soil without carbonate of lime, but with high saturation percentage (more than 95%), total humus of the top soil about 3.5%.

All permanent sites were located on the same soil type in the plain, so that the soil conditions were ± equal. Relevés were taken in practically all the above defined AEPs by means of the Domin-Hadač scale (for further see Hadač et Váňa 1967). Detailed phenospectra are in preparation for another publication, here only the names of individual distinguished life forms are used (see Tab. 1). The synthesis of the relevés from seven most important AEPs is presented, whereas some not well developed weed communities (e.g. on the autumn AEP with skimming) are not yet considered here. Each column contains constancy classes as well as values of mean abundance (for further see Hadač et Váňa 1967).

From the results of phenological observation it can be stated only very briefly that there are some perennials, like *Agropyron repens*, living through all the AEPs, but the bulk of weeds shows full life activity during some or only one of them. We get "aspects", usually named the "spring aspect", "summer aspect", and "autumn aspect"; these aspects are interpreted as normal aspects of one and the same fundamental community — association. Is it right? Does *Veronica hederifolia*, *V. triphyllos* or *Thlaspi perfoliatum* meet in competition with *Amaranthus retroflexus*, *Polygonum lapathifolium*, or with *Solanum nigrum*? We can see a similar situation from the phenospectra published by Sychova (1959). It is true that the seeds of named weeds can meet in the soil side by side (for further see e.g. Kropáč 1966) — but their mutual influence in this state of latent life is none. A fundamental

Tab. 2. — Floristic affinity of sets of relevés from different agro-ecophases (Jaccard indices with respect to mean abundance values)

	Lucerne	Winter crops	Lucerne	Winter crops	Spring crops	Root crops	Stubble stand
	— spring season —		— summer season —			autumn season —	
Lucerne — spring season (58.1)	—	20.5	26.2	15.1	10.1	19.7	18.6
Winter crops — spring season (51.7)	20.5	—	28.4	46.0	27.6	25.0	26.8
Lucerne — summer season (49.8)	26.2	28.4	—	44.6	39.6	38.6	39.9
Winter crops — summer season (70.2)	15.1	46.0	44.6	—	56.5	46.7	47.2
Spring crops — summer season (59.2)	10.1	27.6	39.6	56.5	—	54.6	56.2
Root crops — autumn season (71.4)	19.7	25.0	38.6	46.7	54.6	—	63.2
Stubble stands (64.5)	18.6	26.8	39.9	47.2	56.2	63.2	—

Note: Floristic similarity within sets of relevés is quoted in brackets.

community, an association, consists in our opinion of members influencing each other negatively or/and positively as commensals and as organisms living together simultaneously in the same environment. Considered from this point of view, not all the "agroaspects" need belong to one integrate fundamental community — association. Each syntaxon should be considered also as something existing in time. The existence of forest communities must be measured by hundreds of years, of meadow or mire communities at least by tens of years as their respective edificators are hundreds or tens of years old. But the weed communities must be measured by the length of life of individual plants — and this means by a quarter of a year in many cases, or by half a year in others. Thus it seems not unnatural to establish plant associations, limited by their duration or at least by their life optimum to one agro-ecophase.

And now, how to establish in our case syntaxa of different rank from the material given (Tab. 1)? What is here the association? In order that the floristic similarity of weed communities from individual AEPs could be considered more objectively, we have used the Jaccard index of affinity with respect to mean abundance value (for further see Hadač et Váňa 1967). The results are contained in the Tab. 2, from which it is evident that weed communities from spring-summer and autumn AEP are the most similar, among them the weed communities of lucerne are at the border, but floristically belong still to the basic syntaxon — association. As different associations should be considered weed communities of winter AEP and as to the weeds from lucerne they must be differentiated on the level of different alliances. The synthetic survey is presented in the Tab. 3, to which the following short explanation is necessary. This contribution was not intended to be a syntaxonomic study, however, in evaluating the appropriate relevés a need for establishing some new syntaxa arose. This is why we can publish here only the synthetic table and one typical relevé from each new association described. The establishing of a new association *Lathyro tuberosi-Adonidetum aestivalis* KROPÁČ et HČ. ass. n. hoc loco proved to be unavoidable; it can be identified neither with association *Galio* (*tricornis*)-*Adonidetum* (*aestivalis*) R. SCHUBERT et KÖHLER 1964 nor with *Caucalo-Scandicetum* TX. 50 and *Caucalo-Adonidetum* TX. 50 (the last name is derived from *Caucalis latifolia* L. and *Adonis flammea* JACQ.).

Typical relevé of our new association is as follows: Kaštice, ca. 350 m E. of the village, alt. ca. 270 m, slope — 0, 18. 6. 1957, area of relevé — 100 m², winter wheat, cover of the whole stand — 80%, cover of the weeds — 50%. *Delphinium consolida* L. 6, *Adonis aestivalis* L. 3, *Convolvulus arvensis* L. 3, *Bilderdykia convolvulus* (L.) DUM. 3, *Descurainia sophia* (L.)WEBB 3, *Conringia orientalis* (L.) DUM. 2, *Sinapis arvensis* L. 2, *Thlaspi arvense* L. 2, *Lathyrus tuberosus* L. 1, *Avena fatua* L. 1, *Chenopodium album* L. 1, *Falcaria vulgaris* BERNH. 1, *Lamium amplexicaule* L. 1, *Melandrium noctiflorum* (L.) FRIES 1, *Neslia paniculata* (L.) DESV., *Polygonum heterophyllum* LINDMAN emend. H. SCHOLZ 1, *Veronica persica* POIR. 1, *Viola arvensis* MURR. 1, *Agropyron repens* (L.) P. B. +, *Cirsium arvense* (L.) Scop. +, *Euphorbia exigua* L. +, *E. helioscopia* L. +, *Fumaria officinalis* L. +, *Galium spurium* L. +, *Geranium pusillum* BURM. f. +, *Sonchus arvensis* L. +, *Veronica polita* FRIES +, *Vicia tenuifolia* ROTH +.

The following relevé can be given as typical for the *Veronico-Adonidetum aestivalis* KROPÁČ et HČ. ass. n. hoc loco which can be characterized in some regions of Czechoslovakia by the *Veronica triloba* OPIZ, but in this case only *V. hederifolia* L. (cf. also FISCHER 1967) was present.

Kaštice, ca. 300 m E. of the village, alt. ca. 270 m, slope — 0, 12. 4. 1957, area of relevé — 100 m², winter wheat, cover of the whole stand — 60%, cover of the weeds — 40%. *Delphinium consolida* L. 5, *Veronica hederifolia* L. 4, *Adonis aestivalis* L. 4, *Conringia orientalis* (L.) DUM. 3, *Thlaspi arvense* L. 3, *Bilderdykia convolvulus* (L.) DUM. 2, *Descurainia sophia* (L.) WEBB 2, *Melandrium noctiflorum* (L.) FRIES 2, *Polygonum heterophyllum* LINDMAN emend. H. SCHOLZ 2, *Sinapis arvensis* L. 2, *Viola arvensis* MURR. 2, *Chenopodium album* L. 1, *Veronica triphyllos* L. 1, *Agropyron repens* (L.) P. B. +, *Avena fatua* L. +, *Cirsium arvense* (L.) SCOP. +, *Euphorbia helioscopia* L. +, *Falcaria vulgaris* BERNH. +, *Geranium pusillum* BURM. f. +, *Lamium amplexicaule* L. +, *Neslia paniculata* (L.) DESV. +, *Sonchus arvensis* L. +, *Stellaria media* (L.) VILL. +, *Veronica persica* POIR. +.

The third new association *Valerianello-Thlaspeetum perfoliati* KROPÁČ et HČ. ass. n. hoc loco with the typical relevé is also presented here.

Kaštice, ca. 700 m SW. of the village, alt. ca. 290 m, slope — 5°, aspect N., 6. 4. 1955, area o relevé — 100 m², lucerne, cover of the whole stand — 90%, cover of the weeds — 65%. *Taraxacum officinale* F. WEBER ex WIGGERS 6, *Geranium pusillum* BURM. f. 4, *Stellaria media* (L.) VILL. 4, *Capsella bursa-pastoris* (L.) MED. 4, *Thlaspi perfoliatum* L. 3, *Veronica persica* POIR. 3, *Valerianella locusta* (L.) LATERRADE 2, *Agropyron repens* (L.) P. B. 2, *Arenaria serpyllifolia* L. 2, *Echium vulgare* L. 2, *Erigeron canadensis* L. 2, *Descurainia sophia* (L.) WEBB 1, *Lamium amplexicaule* L. 1, *Melandrium album* (MILLER) GARCKE 1, *Plantago lanceolata* L. 1, *Veronica polita* FRIES 1, *Viola arvensis* MURR. 1, *Bilderdykia convolvulus* (L.) DUM. +, *Delphinium consolida* L. +, *Plantago media* L. +, *Sinapis arvensis* L. +, *Veronica hederifolia* L. +.

This association also is the type of the new alliance *Veronico politae-Taraxacion* KROPÁČ et HČ. foeder. n. hoc loco, the establishing of which proved to be necessary, because the conception of *Trifolio-Medicaginion* by SOÓ (1961 : 427) is too broad. We place both alliances, i.e. *Caucalion* and *Veronico politae-Taraxacion*, in the order *Secalietalia* BR.-BL. 31 em. J. et R. TX. 60 and in the class *Secalietea* BR.-BL. 51 (cf. also R. SCHUBERT et MAHN 1968). Besides, the association *Lathyro tuberosi-Adonidetum aestivalis* can further be divided into the subassociations, the composition of which may be seen from the table 3. The results just presented show that the placing of the weed communities of cereals and root crops of one and the same crop rotation into different classes (see agreeing results of ELLENBERG 1950,

R. SCHUBERT et MAHN 1968 etc.) or into different alliances (cf. KORNAŚ 1964) cannot be justified. Of course we cannot make generalizations here, because, for example, in another phytogeographical region with different agronomical conditions (cf. OBERDORFER 1954) there can be distinct differences not only on the level of alliances, but also on the level of orders or classes. On the other hand, the rotation of different associations during a year proved to be justified in our conditions, so that they thus form "association chain" corresponding to relevant agro-ecostage and "association sequence" corresponding to the agro-ecocycle (see Fig. 2).

As demonstrated by our results of the period past (1954—57), the association sequence had been characterized by the occurrence of some ruderals and for field conditions *Cardaria draba* (L.) DESV. can be named as especially typical. All these circumstances can be explained by the temporary lower agrotechnic treatments and for today's agro-ecocycle they are no longer important (KROPÁČ, in preparation). This is in a good accordance with the knowledge that weed communities have also their secular development as stated e.g. by RADEMACHER (1968) who distinguishes five historical phases of weed communities from the beginning of agriculture.

Souhrn

Autoři podávají úvodem stručný přehled různých fytocenologických koncepcí u plevelových společenstev, především ve střední a západní Evropě. Konstatují, že prostředí plevelových společenstev je velmi proměnlivé, při čemž rozhodující úloha připadá člověku, který agrotechnikou a osevními postupy podstatně ovlivňuje, ovšem spolu s faktory podnebnými a půdními, složení plevelových společenstev. Tyto skutečnosti jsou mnohem srozumitelnější, promítne-li se stručně historie vzniku, vývoje a diferenciace antropogenních společenstev, jak je učiněno rovněž v úvodní části. Dále jsou definovány tzv. agro-ekofáze, agro-ekoetapy (angl. agro-ecostages) a agro-ekocykly; v tomto ohledu je použita teoretická koncepce HEJNÉHO (1957).

Agro-ekofází (AEP) rozumějí autoři soubor dočasných podmínek prostředí, daný proměnlivými ekologickými faktory, podmíněnými agrotechnickými zásahy a určitým ročním obdobím, jakož i růstovými fázemi příslušné plodiny. Názvosloví AEP je voleno kombinovaně jednak s ohledem na specifické ekoklima (názvy symbolicky podle ročních období, s nimiž se jednotlivé AEP ale nekryjí — viz římská čísla) a jednak s ohledem na typ plodiny, která zahrnuje též její agrotechniku (viz velká písmena). Je rozlišeno celkem 10 AEP. Dále podávají autoři všeobecnou charakteristiku agro-ekoetap, kterou rozumějí dočasné prostředí, vymezené sledem jednotlivých agro-ekofází v příslušném typu plodiny včetně její agrotechniky (viz obr. 1). Dále uvádějí stručný přehled určujících agroekologických faktorů v příslušných agro-ekoetapách pro čtyři hlavní typy plodin. Agro-ekocyklem (AEC) rozumějí autoři víceletý cyklus jednotlivých agro-ekoetap (viz malé spirály na obr. 2), při čemž AEC je z obecného hlediska podmíněn agronomickou soustavou, jež vyplývá z historicko-ekonomických podmínek a prakticky se projevuje na poli příslušným sledem plodin z hlediska výrobního typu. Jedna rotace celého osevního postupu odpovídá jednomu agro-ekocyklu (viz jedna otočka velké spirály na obr. 2).

Dále řeší autoři vztah agro-ekofází k vytváření plevelových společenstev na příkladu snímkového materiálu z osevního postupu v Kašticích u Podbořan. Trvalé pozorovací plochy zde byly umístěny v ± stejnocenných podmínkách půdně-klimatických a byly sledovány po dobu čtyř let. K vzájemnému porovnání snímků ze sedmi různých AEP (viz tab. 1) byl použit Jaccardův index příbuznosti (viz tab. 2) a vlastní výsledky (viz tab. 3) ukazují, že v daných podmínkách a v témže osevním postupu není možno oddělovat plevelová společenstva obilnin a okopanin do různých asociací či svazů, nebo dokonce řádů a tříd, což je u řady autorů běžné. Zato byla zjištěna výraznější odlišnost mezi plevelovými společenstvy AEP časně jarní sezóny a letně-podzimní. V té souvislosti je diskutován pojem „aspekt" u plevelových společenstev a jsou uváděna některá zásadní kritéria chápání asociace, která by měla být podle autorů složena z rostlin, jež vstupují do vzájemných vztahů. V daném případě se ukázalo nezbytným oddělit plevelová společenstva zimních AEP (tj. časně na jaře) od ostatních AEP do různých asociací, ba i svazů (pokud jde o víceleté pícniny). Tím se zavádí nový pojem „řetěz asociací", pod nímž se rozumí časově souslédný soubor asociací, odpovídající příslušné agro-ekoetapě, a dále pojem „sled asociací", představující časově posloupný soubor příslušných řetězů a odpovídající jednomu agro-ekocyklu.

„Sled asociací" může být charakterizován i floristicky a je částí sekulárního vývoje plevelových společenstev.

V práci jsou popsány tři nové asociace: *Lathyro tuberosi-Adonidetum aestivalis* Kropáč et Hč. ass. n., *Veronico -Adonidetum aestivalis* Kropáč et Hč. ass. n. (obě v rámci svazu *Caucalion lappulae* Tx. 50) a *Valerianello-Thlaspeetum perfoliati* Kropáč et Hč. ass. n. v rámci nového svazu *Veronico politae-Taraxacion* Kropáč et Hč. foeder. n. Oba svazy se řadí do řádu *Secalietalia* Br.-Bl. 31 em. J. et R. Tx. 60 a třídy *Secalietea* Br.-Bl. 51 em. Soó 61.

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Soupis československých herbářů

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Soupis je prvním pokusem o registraci všech dokladových botanických sbírek v Československu, veřejných i soukromých. Za vzor pro zpracování si autoři zvolili známou a obecně užívanou příručku LANJOUW et STAFLEU: Index herbariorum. Seznam rozdělili do dvou částí, na sbírky veřejných institucí (jichž zařadili celkem 80) a na sbírky v soukromém majetku (104). Údaje o jednotlivých sbírkách uvádějí — kromě jména instituce (resp. soukromého majitele) a zkratky herbáře — rok založení a počet položek, charakteristiku obsahu sbírky (materiál československý — cizí, užší oblast sběrů apod.), významné kolekce nebo sběry známých botaniků, které byly do herbáře včleněny (zejména u veřejných sbírek), jiné sbírky, které instituce uchovává nebo tvoří (sbírku semen, plodů, vzorků dřev aj.), jméno současného ředitele ústavu, kustoda botanické sbírky a ostatních odborných zaměstnanců, možnost a podmínky při vypůjčování ze sbírky, název periodika, které instituce vydává, název exsikátové sbírky, kterou vydává apod. Všechny tyto údaje jsou stručně a přehledně uspořádané a publikace má úplný rejstřík jmen sběratelů, takže orientace je v ní snadná a rychlá.

U osmi největších institucionárních herbářů jsou uvedeny mezinárodně registrované a obecně užívané zkratky, u dalších dvacetičtyř sbírek takové zkratky autoři navrhli; bylo by ovšem žádoucí, aby se také postarali o jejich mezinárodní uznání a registraci, aby nedocházelo při citacích k nemilým zmatkům. Jinak budeme těchto zkratek, které znamenají často značnou úsporu místa v tisku, s radostí užívat.

O významu a ceně herbářového dokladu není třeba se zmiňovat, toho jsou si dnes už taxonomové a floristé dokonale vědomi. Proto lze Ujčíkův a Houfkův soupis jen uvítat jako důležitý přínos k organizaci naší botanické práce. Je, myslím, samozřejmé, že tento první pokus není bez vad, bez drobných omylů, nepřesností a nedůsledností; při první verzi práce tohoto druhu to snad ani jinak nemůže být. Žádná z těchto vad není však taková, aby nějak podstatně snižovala cenu a použitelnost této práce, a proto se jimi ani nechci zabývat.

Jednu vadu však pokládám za tak významnou, že ji zde pominout nemohu. Je to spíš nepatrná než malá publicita této příručky, která má sloužit rozsáhlému okruhu institucí a pracovníků u nás i v cizině. Vyšla v rotaprintově rozmnožovaném, téměř neznámém Metodickém listu, v nákladu tak malém (500 ks), že ani nestačí zásobit naše floristy. Není to ovšem vina autorů a není to, bohužel, ani ojedinělý případ u nás. A to je škoda.

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