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Summer agrestal vegetation of dryland crops in Spain

JOSÉ LUIS CARRETERO

ABSTRACT

CARRETERO, J. L. (1995). Summer agrestal vegetation of dryland crops in Spain. *Candollea* 50: 195-216. In English, English and Spanish abstracts.

A syntaxonomic study of summer-autumn agrestal communities, belonging to the *Diplotaxion erucoidis* alliance, of dryland crops in the Peninsular Spanish Mediterranean Region, is presented. Phytosociological tables of all the syntaxa are given, as well as floristic, chorological, biogeographical and ecological data. One association: *Chenopodio albi-Amaranthetum blitoidis* and two subassociations: *Eragrostio majoris-Chenopodietum botryos amaranthetosum blitoidis* and *Amarantho delilei-Diplotaxietum erucoidis amaranthetosum blitoidis* are described as new. On the basis of the 300 fields surveyed, the frequency, abundance (partial cover percentage) and grade of infestation (global cover percentage) of each important weed are analyzed. The most aggressive agrestals are *Amaranthus blitoides, Amaranthus albus, Diplotaxis erucoides, Chenopodium album, Convolvulus arvensis, Heliotropium europaeum, Salsola kali, Chrozophora tinctoria, Cirsium arvense, Cynodon dactylon, Amaranthus retroflexus, Chondrilla juncea* and *Chenopodium vulvaria,* among many others.

RESUMEN

CARRETERO, J. L. (1995). La vegetación arvense de verano en los cultivos de secano de España. *Candollea* 50: 195-216. En Inglés, resúmenes en Inglés y Español.

Se presenta un estudio sintaxonómico de las comunidades arvenses de verano-otoño, pertenecientes a la alianza *Diplotaxion erucoidis*, en los cultivos de secano de la región mediterránea de la Península Ibérica. Se publican las tablas fitosociológicas de todos los sintáxones, así como datos florísticos, corológicos, biogeográficos y ecológicos. Son descritas como nuevas: una asociación, *Chenopodio albi-Amaranthetum blitoidis,* y dos subasociaciones, *Eragrostio majoris-Chenopodietum botryos amaranthetosum blitoidis* y *Amarantho delilei-Diplotaxietum erucoidis amaranthetosum blitoidis.* Sobre la base de 300 levantamientos de campo, se analizan la frecuencia, la abundancia (porcentaje de cobertura parcial) y grado de infestación (porcentaje de cobertura global) de cada una de las especies más importantes. Las arvenses más agresivas son: *Amaranthus blitoides, Amaranthus albus, Diplotaxis erucoides, Chenopodium album, Convolvulus arvensis, Heliotropium europaeum, Salsola kali, Chrozophora tinctoria, Cirsium arvense, Cynodon dactylon, Amaranthus retroflexus, Chondrilla juncea* y *Chenopodium vulvaria,* entre otras.

KEY-WORDS: Phytosociology — Weed communities — *Diplotaxion erucoidis* — Syntaxonomy — Iberian Peninsula.

Introduction

The area surveyed (Fig. 1) comprises all the Spanish Mediterranean chorological region, except Balearic Islands; that is to say the major part of the Spanish Iberian Peninsula.

The soils may be described as generally siliceous in the western half and calcareous, with some siliceous enclaves, in the eastern half.

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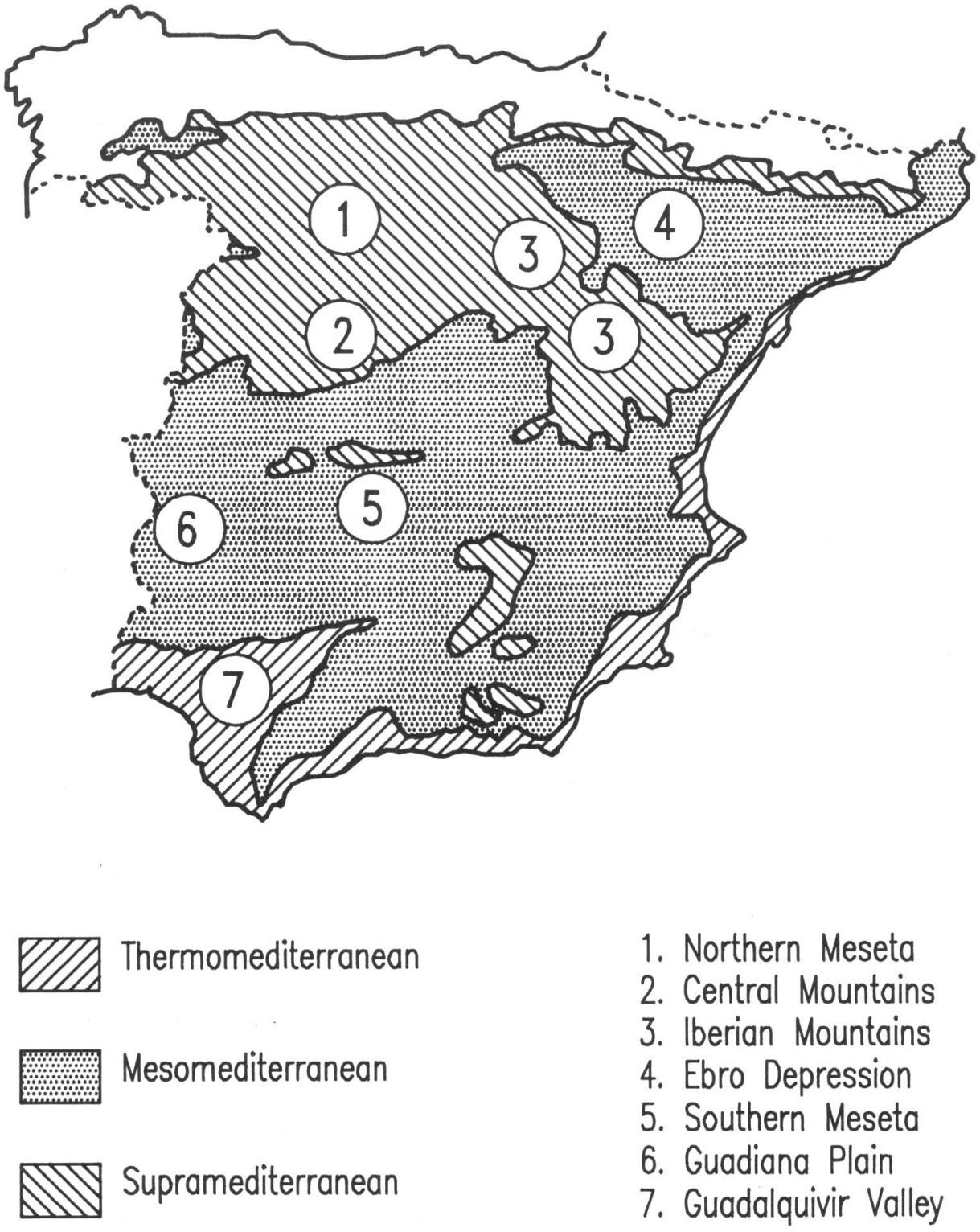

Fig. 1. — Study area with the bioclimatic stages according to RIVAS-MARTÍNEZ (1987a).

Three types of bioclimate may be distinguished (Fig. 1):

1) the Thermomediterranean bioclimate of the coastlands and the Guadalquivir Depression;
2) the Mesomediterranean bioclimate of the Southern Plateau (Southern Meseta), with its neighbouring zones, and the Ebro Depression; and
3) the Supramediterranean bioclimate of the Northern Plateau (Northern Meseta) and the Central and Iberian mountain Systems.

The average temperatures of the year of these bioclimates are, respectively, higher than 17°C, from 13°C to 17°C and lower than 13°C. In the Guadiana (Extremadura), Guadalquivir (Western Andalucia) and Ebro (Aragón) Depressions, and in some points of the Southern Plateau, the average of the maxima of the hottest months (July and August) varies from 32°C to 36°C.

The annual rainfall is variable and scarse throughout our territory. It does not reach 300 mm in the southeastern regions and only exceeds 700 mm in some mountainous zones. In summer, the South has minimum precipitations, not reaching 50 mm in most localities.

Summer-autumn agrestal vegetation of dryland crops (vines, almonds, olives, sunflowers, etc.) and of some irrigated crops (sugar beets, melons, watermelons, fruit trees, etc.) with low soil humidity is widely spread throughout the agricultural areas of the Spanish Mediterranean region. It corresponds to the *Diplotaxion erucoidis* alliance.

When Braun-Blanquet (BRAUN-BLANQUET & al., 1936) describes the *Diplotaxion* alliance, in spite of the fact that its characteristic species are for the most part of summer-autumn phenology, he includes the vegetation developing in the course of over the year (specially in his association *Diplotaxis erucoides-Amaranthus delilei* = *Diplotaxietum erucoidis*). The criterion of considering the winter-spring vegetation as pertaining also to the *Diplotaxion* has been followed by the majority of latter authors (QUANTIN, 1947; BRAUN-BLANQUET & al., 1952; BRAUN-BLANQUET & BOLÒS, 1957; SCHUURMANS STEKHOVEN, 1961; MOUTTE, 1964; BOLÒS, 1967; RIGUAL, 1972; BRULLO & MARCENÒ, 1980; FOLCH, 1981; BOLÒS & VIGO, 1984 and NEZADAL, 1989; among others). Although some authors (RIVAS GODAY, 1956, 1964; RIVAS GODAY & RIVAS-MARTÍNEZ, 1963; IZCO, 1975) already considered the *Diplotaxion* alliance exclusively of summer-autumn phenology, BRULLO & MARCENÒ (1985) are the first that created the *Fumarion wirtgenio-agrariae* alliance for including the winter-spring communities. In our opinion, this last criterion seems to be appropriate, since in our Mediterranean climate there is a clear differentiation between the winter-spring and summer-autumn species (with some rare exceptions, as *Diplotaxis erucoides* that grows during all the year).

BRULLO & MARCENÒ (1980) segregate in the *Chenopodion botryos* alliance all the calciphobe communities, maintaining only the calcicolous ones in the *Diplotaxion.* As the soil characteristics (Table 6) do not play a determinant role in the typification of the most *Diplotaxion* communities, we do not consider adequate (at least in Spain) the separation of the two above mentioned alliance.

Many times, the *Diplotaxion* and *Eragrostion* alliances (originally described in Western and Eastern Europe, respectively) have been confused. TÜXEN (1950) considered the *Diplotaxion* sensu Morariu 1943 non Br.-Bl. 1936 and the *Eragrostion* as synonyms, the *Eragrostion* being subordinated as a thermophile suballiance to the *Panico-Setarion* alliance Sissingh in Westhoff, Dijk, Passchier 1946. Tüxen, however, considered the mediterranean *Diplotaxion* Br.-Bl. 1931 to be separated from the thermophile part of the *Panico-Setarion*. RIVAS GODAY (1956, 1964) included also the *Eragrostion* as a suballiance into the *Panico-Setarion*, but here with the *Diplotaxion* Br.-Bl. 1936 as a synonym of the *Eragrostion*.

TÜXEN & OBERDORFER (1958) place the Spanish association *Setaria glauca-Echinochloa colona* in the *Eragrostidion* suballiance of the *Panico-Setarion,* with no reference to *Diplotaxion.* POLI (1966), MAUGERI & LEONARDI (1974), MAUGERI (1980) and MAUGERI & al. (1980) include both the *Diplotaxion* and *Panico-Setarion* Sicilian communities into the *Eragrostion.* LACOURT (1977) indicated that the *Eragrostion* and *Panico-Setarion* must not be maintained as independent alliances and he places them, without any syntaxonomic rank, in *Diplotaxion.* IZCO (1975) and RIVAS-MARTÍNEZ (1987b) consider the *Eragrostion* partially contained in *Diplo-*

taxion. RIVAS-MARTÍNEZ (1977) and BRULLO & MARCENÒ (1980) subordinates the *Eragrostion* to the *Panico-Setarion;* these authors and also OBERDORFER (1954), KOJIČ (1975) and NEZADAL (1989) maintain the independence between the *Eragrostion* and *Diplotaxion* alliances. NEZADAL (1989), in his study about the Iberian spring weed vegetation, includes the autumn-winter-spring communities on loamy soil in *Diplotaxion* and the summer-autumn-winter ones on sandy soil in *Eragrostion.*

As a result of the reading of all this bibliographical information, and also of some of the most significant papers referring to Central and Eastern Europe (TÜXEN, 1950; OBERDORFER, 1954, 1983; KOVAČEVIĆ, 1970; BRULLO & MARCENÒ, 1980; ELIÁŠ. 1983; KRIPPELOVÁ, 1984; KRIPPELOVÁ & MUCINA, 1988, KOROTKOV & al., 1991), in addition to our own field observations, we consider the inclusion of the greatest part of the *Eragrostion* vegetation (in spite of the presence of more thermophile taxa) in the *Panico-Setarion* alliance as the most convenient, without stablishing any lower syntaxonomic status, as generally the position of the summer agrestal communities of the irrigated crops, at least in Spain, in one or another alliance would be very difficult. On the other hand, according to the rather xerophile characteristic taxa (*Heliotropium europaeum, Amaranthus albus, Salsola kali, Amaranthus blitoides, Tragus racemosus, Tribulus terrestris,* etc.) of those indicated in the Eastern European *Eragrostion,* the inclusion of part of this alliance in the *Diplotaxion* would not be incorrect.

As conclusion of all above observations, we believe that the Spanish Mediterranean summer-autumn agrestal weed communities, on any soil type (sandy, loamy, clayey, limy or siliceous), must be distributed between the *Diplotaxion* in dryland crops and the *Panico-Setario* in irrigated crops.

The *Diplotaxion* communities are agrestal pioneers of summer-autumn phenology, formed mainly by therophytes, and some other geophytes and hemicryptophytes, that grow in dry or subhumid, ploughed, sunny, and generally slightly nitrogenous soils. In our territory, their characteristic species are: *Amaranthus albus, Amaranthus blitoides, Chrozophora tinctoria, Diplotaxis erucoides, Heliotropium europaeum, Salsola kali, Tribulus terrestris, Setaria viridis, Eragrostis barrelieri, Sorghum halepense, Chenopodium botrys, Erucastrum nasturtiifolium, Xanthium orientale,* etc. This type of vegetation has been object of many scientific publications in Spain (ALCOBER, 1983; BEDIN & ZARAGOZA, 1981; BOLÒS, 1962, 1967; BOLÒS & BOLÒS, 1950; BURGAZ & SAIZ, 1989; CARRETERO, 1989; DÍAZ & PENAS, 1984; HIDALGO & al., 1990; IZCO, 1975; LADERO & al., 1983; MASALLES, 1983; MENDIOLA & OLMEDO, 1987; NAVARRO & VALLE, 1984; PEINADO & al., 1985; PUJADAS & HERNÁNDEZ-BERMEJO, 1988; RIVAS GODAY, 1956, 1964; SAAVEDRA & al., 1989; among others), but the studies have almost always been incomplete or refer to limited areas. The aim of the present survey is to analyze the agrestal syntaxa found by personal investigation of the author in the Spanish Iberian Peninsula.

Material and methods

Over the last twelve years 300 phytosociological relevés of 100 m^2 have been carried out in the Spanish agrestal *Diplotaxion* vegetation, according to the Braun-Blanquet method (BRAUN-BLANQUET, 1965; GEHU & RIVAS-MARTÍNEZ, 1981). Sixty two of them were chosen for tables 1 to 4, defining the respective communities.

In order to evaluate the importance of the different weeds in the established syntaxa (Table 5) and in the whole of the 300 relevés (Table 7), the following has been determined for each species: the frequency (percentage of relevés where the species is present), the partial cover percentage (relationship between the sum of the average cover percentages and the number of relevés where the species is found), and the global or total cover percentage (relationship between the aforementioned sum and the total number of relevés, always of the corresponding syntaxa). The abundance-dominance signs have been transformed into average cover percentage in the following way: + = 0.5%, 1 = 2.5%, 2 = 15%, 3 = 37.5%, 4 = 62.5%, 5 = 87.5%.

Nr. order	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*
Cover %	*30*	*40*	*35*	*50*	*25*	*30*	*65*	*30*	*20*	*30*	*40*	*35*	*40*	*40*	*35*	*30*	*35*	*50*
Characteristics of association and alliance																		
Amaranthus albus	2.1	2.1	2.1	2.1	2.1	2.1	3.1	1.1	.	2.1	3.1	1.1	2.1	2.1	2.1	2.1	2.1	2.1
Heliotropium europaeum	.	+	1.1	1.1	1.1	.	1.1	1.1	.	1.1	.	+	1.1	.	.	+	1.1	2.1
Chenopodium botrys	.	.	.	1.1	.	.	2.1	.	1.1	.	1.1	.	.	.	.	.	.	1.1
Tribulus terrestris	1.1	.	.	.	.	1.1	.	.	.	.	.	.	.	.	1.1	.	.	.
Salsola kali	.	.	1.1	.	.	.	.	.	.	.	.	.	.	1.1	.	.	.	2.1
Eragrostis barrelieri	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	1.1	.	.
Diplotaxis erucoides	.	.	.	.	.	.	.	.	.	.	.	1.1	1.1	.	.	.	.	.
Setaria viridis	.	.	.	.	.	.	.	.	.	.	1.1	.	.	.	.	.	.	.
Diff. subassociation																		
Amaranthus blitoides	.	.	.	.	.	.	.	.	.	1.1	1.2	1.1	2.1	1.1	1.1	1.1	1.1	1.2
Chrozophora tinctoria	.	.	.	.	.	.	.	.	.	1.1	.	.	.	+	.	.	.	.
Cyperus rotundus	.	.	.	.	.	.	.	.	.	1.1	.	.	1.1	.	.	.	.	.
Panico-Setarion																		
Solanum nigrum	.	.	1.1	1.1	1.1	.	1.1	1.1	.	.	.	.	.	.	.	1.1	+	.
Amaranthus retroflexus	1.1	.	1.1	.	.	.	1.1	.	.	.	.	.	1.1	2.1	.	.	.	.
Portulaca oleracea	.	+	.	.	.	.	.	.	.	.	.	1.1	+	.	.	.	.	.
Ruderali-Secalietea																		
Chenopodium album	.	2.1	.	1.1	.	.	.	1.1	1.1	1.1	1.1	2.1	1.1	2.1	2.1	+	1.1	1.1
Convolvulus arvensis	.	1.2	1.2	1.1	.	1.2	1.1	.	1.2	1.2	1.2	.	.	.	.	+	1.2	.
Cynodon dactylon	.	.	1.2	.	.	1.2	.	2.2	1.2	.	.	1.2	.	.	1.2	1.2	.	1.2
Chondrilla juncea	.	1.1	+	1.1	.	.	1.1	.	1.1	.	+	.	.	.	.	.	.	.
Xanthium spinosum	.	1.1	+	1.1	1.1	.	1.1	.	.	.	.	.	.	.	.	.	1.1	.
Chenopodium vulvaria	.	1.1	.	1.1	.	.	.	.	.	1.1	.	1.1	.	.	.	1.1	.	.
Lolium rigidum	1.1	1.1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Cirsium arvense	.	.	.	1.1	1.1	.	1.1.	.	.	.	.	.	.	.	.	.	.	.
Sonchus oleraceus	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.1	.	.	1.1	.
Lactuca serriola	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.
Anacyclus clavatus	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Fallopia convolvulus	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Euphorbia chamaesyce	.	.	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.	1.1	.
Conyza canadensis	.	.	.	.	.	.	.	+	.	.	.	.	.	1.1	.	.	.	.

Other species — Panico-Setarion: In 2: *Amaranthus graecizans* subsp. *silvestris* 1.1; 5: *Datura stramonium* +; 11: *Amaranthus hybridus* +; 13: *Digitaria sanguinalis* 1.1; 16: *Eragrostis cilianensis* 1.1; 17: *Setaria verticillata* +. Ruderali-Secalietea — 1: *Chamaemelum mixtum* +; *Malva sylvestris* +; *Senecio vulgaris* +; 4: *Malva neglecta* +; *Polygonum rurivagum* 1.1; 5: *Vicia benghalensis* 1.1; 7: *Linaria spartea* +; 9: *Rumex bucephalophorus* subsp. *gallicus* +; 10: *Avena sterilis* 1.1; *Diplotaxis virgata* 1.1; *Papaver rhoeas* 1.1; 11: *Euphorbia serrata* +; 15: *Chenopodium murale* +; 17: *Kickxia lanigera* +; *Sonchus asper* 1.1; 18: *Vaccaria hispanica* 1.1.

Localities, crops and dates: 1. Jaén: La Carolina, olives, 4.7.82; 2. Zamora: Villamayor de Campos, sugar beets, 19.8.82; 3. Valladolid: Vega Sicilia, vines, 19.8.82; 4. Soria: Noviercas, sunflowers, 19.8.82; 5. Guadalajara: El Pobo de Dueñas, sunflowers, 21.8.82; 6. Segovia: Zarzuela del Monte, potatos, 8.10.82; 7. Palancia: Ledigos, vines, 15.8.83; 8. Cáceres: Almoharín, watermelons, 10.8.83; 9. Avila: El Tiemblo, vines, 31.7.86; 10. Sevilla: Dos Hermanas, safflower, 5.6.82; 11. Teruel: Báguena, vines, 17.8.82; 12. Navarra: Milagro, sugar beets, 18.8.82; 13: Albacete: Almansa, corn, 21.9.82; 14. Ciudad Real: Manzanares, vines, 3.10.82; 15. Huelva: Cartaya, corn, 20.6.83; 16. Valencia: Baldovar, vines, 28.9.85; 17. Málaga: Antequera, onions, 19.8.89; 18. Cuenca: Sisante-Rubielos Bajos, sunflowers, 20.8.89.

Table 1. — *Eragrostio majoris-Chenopodietum botryos* Br.-Bl. 1936 *amaranthetosum blitoidis* subass. nov. (Holotypus: rel. 11).

Nr. order	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Cover %	*40*	*35*	*30*	*40*	*30*	*35*	*40*	*30*	*45*	*25*
Characteristics of association and alliance										
Chrozophora tinctoria	2.1	2.1	2.1	3.2	2.1	1.1	1.1	1.1	2.1	2.1
Amaranthus albus	1.1	.	2.1	2.2	.	1.1	1.1	+	2.1	1.1
Heliotropium europaeum	1.1	1.1	1.1	1.1	1.1	1.1	.	.	1.1	.
Amaranthus blitoides	1.1	.	1.1	.	.	1.1	1.1	.	.	+
Kickxia lanigera	.	.	.	.	.	.	+	.	1.1	.
Physalis philadelphica	.	.	.	.	.	.	.	1.1	.	.
Salsola kali	.	.	1.1	.	.	.	.	.	.	.
Solanum villosum	.	.	.	.	.	1.1	.	.	.	.
Tribulus terrestris	1.1	.	.	.	.	.	.	.	.	.
Panico-Setarion										
Datura stramonium	+	.	.	.	+	.	.	.	.	+
Amaranthus hybridus	.	.	+	.	.	1.1	.	.	.	.
Amaranthus retroflexus	.	.	+	.	.	.	.	.	.	+
Solanum nigrum	.	.	.	.	.	2.2	1.1	.	.	.
Ruderali-Secalietea										
Chenopodium album	1.1	.	1.1	1.1	.	1.1	1.1	.	2.1	1.1
Convolvulus arvensis	.	1.1	1.2	.	.	.	1.2	.	1.1	1.2
Chenopodium vulvaria	.	1.1	1.1	.	1.1	.	1.1	.	.	.
Cirsium arvense	.	.	1.1	.	.	.	2.2	2.1	.	.
Diplotaxis virgata	.	1.1	.	.	.	1.1	.	.	1.1	.
Sonchus oleraceus	.	.	+	.	.	1.1	1.1	.	.	.
Cynodon dactylon	1.2	1.2	.	.	.	.	.	.	.	.
Euphorbia chamaesyce	1.1	.	.	.	.	.	.	+	.	.
Hirschfeldia incana	+	1.1	.	.	.	.	.	.	.	.
Lactuca serriola	1.1	.	.	.	.	.	.	+	.	.
Chondrilla juncea	.	.	.	.	+	.	.	1.1	.	.
Xanthium spinosum	.	.	.	.	+	.	.	.	.	+

Other species — Panico-Setarion: 6. *Digitaria sanguinalis* +; *Echinochloa eolonum* +; *Setaria verticillata* 1.1; 9: *Portulaca oleracea* 1.1; Ruderali-Secalietea — 1: *Anacyclus radiatus* 1.1; *Anchusa azurea* 1.1; *Chenopodium murale* 1.1; *Polygonum murivagum* +; *Pulicaria paludosa* +; 2: *Papaver rhoeas* +; *Vaccaria hispanica* +; 3: *Euphorbia serrata* +; 6: *Polygonum aviculare* 1.1; 9: *Anagallis faemina* 1.1; *Capsella rubella* 1.1; *Phalaris minor* 1.1.
Localities, crops and dates: 1. Badajoz: Olivenza, chickpeas, 6.6.82; 2. Sevilla: El Arahal, sunflowers, 5.7.82; 3. Albacete: Albacete-Baylazote, sunflowers, 14.8.82; 4. Córdoba: Posadas-La Carlota, sunflowers, 18.8.82; 5. Zaragoza: La Almolda, sunflowers, 20.8.83; 6. Jaén: Solana de Torralba, sugarbeets, 2.10.82; 7. Ciudad Real: Santa Cruz de Mudela-Valdepeñas, sugar beets, 30.10.82; 8. Guadalajara: Armuña de Tajuña, sunflowers, 9.10.82; 9. Cádiz: Venta del Cuervo-Jerez de la Frontera, cotton, 21.6.83; 10. Toledo: Villasequilla de Yepes, vines, 30.7.86.

Table 2. — *Kickxio lanigerae-Chrozophoretum tinctoriae* Rivas Goday ex Izco 1975.

Nr. order	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*
Cover %	*30*	*40*	*40*	*50*	*65*	*85*	*50*	*40*	*45*	*60*	*25*	*75*	*50*	*50*	*60*	*60*	*40*	*50*
Characteristics of association and alliance																		
Amaranthus blitoides	2.1	2.1	2.1	2.1	3.3	4.4	2.1	2.1	3.3	3.1	2.2	3.3	2.1	2.1	3.1	3.1	2.1	3.1
Heliotropium europaeum	.	1.1	1.1	+	.	.	.	.	.	.	.	+	1.1	1.1	.	1.1	+	1.1
Diplotaxis erucoides	+	.	1.1	+	1.1	1.1	.	.	.	1.1	.	1.1	.	.	.	.	.	1.1
Tribulus terrestris	.	.	.	.	.	1.2	1.1	1.1	.	.	1.1	+	+	.	.	.	.	.
Salsola kali	2.1	.	.	.	.	.	.	.	1.1	2.1	.	2.1	.	.	.	.	.	.
Sorghum halepense	.	.	.	1.1	.	.	.	.	.	.	.	1.2	.	1.1	.	.	1.2.	.
Setaria viridis	1.1	2.1	.	2.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Chrozophora tinctoria	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	+	1.1.
Amaranthus albus	+	.	.	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.
Eragrostis barrelieri	.	.	.	.	.	1.2	.	.	.	1.1	.	.	.	.	.	.	.	.
Erucastrum nasturtiifolium	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.•	+
Solanum villosum	.	.	.	.	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.
Tagetes minuta	.	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Panico-Setarion																		
Portulaca oleracea	.	.	.	.	1.2	1.1	1.1	+	.	+	.	.	.	.	2.1	.	.	.
Cyperus rotundus	.	.	.	.	1.1	.	.	.	.	.	1.1	.	.	1.1	1.1	.	.	.
Amaranthus retroflexus	.	.	.	2.1	2.1	.	.	.	.	1.1	.	.	.	.	.	.	.	.
Amaranthus hybridus	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	1.1	.	.	.
Ruderali-Secalietea																		
Chenopodium album	1.1	2.1	1.1	2.1	1.1	+	1.1	1.1	1.1	1.1	.	1.1	1.1	1.1	1.1	2.1	1.1	1.1
Convolvulus arvensis	+	1.2	2.2	2.2	1.1	+	1.2	1.2	.	.	1.2	1.1	1.2	1.2	.	1.2	1.2	.
Cynodon dactylon	1.2	.	1.2	2.2	.	.	.	.	.	.	.	2.2	1.2	1.2	.	1.2	.	.
Chondrilla juncea	.	1.1	.	.	.	.	+	1.1	.	.	+	1.1	+	.	.	.	.	.
Cirsium arvense	+	.	2.1	1.1	.	.	1.1	1.1	.	.	.	.	.	.	.	.	.	.
Lolium rigidum	.	1.1	1.1	.	.	.	.	1.1	.	+	.	.	.	.	.	.	.	.
Sonchus leraceus	.	1.1	1.1	.	.	.	.	.	.	.	.	.	.	.	1.1	.	.	1.1
Xanthium spinosum	.	.	.	.	.	.	1.1	.	1.1	.	.	.	.	.	1.1	.	+	.
Lactuca serriola	+	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	1.1	.
Chenopodium vulvaria	.	2.1	.	.	.	.	.	2.2	.	.	.	.	.	.	.	1.2	.	.
Euphorbia serrata	.	+	.	.	.	.	.	.	.	.	1.2	.	1.1	.	.	.	.	.
Beta maritima	.	.	1.1	.	.	.	.	.	.	.	.	.	1.1	1.1	.	.	.	.
Atriplex patula	.	1.2	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Other species — Panico-Setarion, 4: *Digitaria sanguinalis* 1.2; 5: *Setaria adhaerens* 1.2; 6: *Amaranthus graecizans* subsp. *silvestris* 1.1; 10: *Setaria verticillata* 1.1; 18: *Datura stramonium* 1.1. Ruderali-Secalietea, 1: *Foeniculum vulgare* subsp. *piperitum* +; 2: *Cichorium intybus* +; *Eruca sativa* +; *Glaucium corniculatum* +; *Polygonum rurivagum* 1.1; *Rapistrum rugosum* 1.1; *Reseda lutea* +; 3: *Polygonum bellardii* 1.1; 4: *Bidens subalternans* 1.1; 5: *Diplotaxis muralis* 1.1; *Mercurialis annua* +; 6: *Conyza bonariensis* +; 7: *Sonchus tenerrimus* 1.1; 10: *Bassia scoparia* +; 12: *Anacyclus clavatus* 1.1; *Senecio vulgaris* 1.1; *Sisymbrium irio* 1.1; 13: *Amaranthus viridis* 1.1; *Moricandia arvensis* 1.1; *Zygophyllum fabago* 1.1; 14: *Cardaria draba* 1.2; *Chenopodium murale* +; 15: *Aster aquamatus* +; *Conyza sumatrensis* 1.1; 16: *Diplotaxis virgata* 1.1; *Hirschfeldia incana* 1.1; *Papaver rhoeas* +; *Vaccaria hispanica* +.

Localities, crops and dates — 1, Navarra: Castejón, vines, 18.8.82; 2, Huesca: Almudévar, sunflowers, 12.8.84; 3, Lérida: Tárrega, sunflowers, 17.8.82; 4, Barcelona: Villafranca del Penedés, vines, 17.8.82; 5, Tarragona: Altafulla, hazelnuts, 8.11.82; 6, Castellón: La Pelechana, almonds, 4.10.83; 7, Valencia: Higueruelas, almonds, 27.8.89; 8, Cuenca: El Provencio, sugar beets, 1.8.82; 9, Madrid: Fuentidueña del Tajo, corn, 29.7.85; 10, Alicante: Villena, vines, 28.7.89; 11, Albacete: Cancarix, vines, 3.8.85; 12, Alicante: La Mata, vines, 23.6.90; 13, Murcia: La Unión, oranges, 3.7.84; 14, Almería: Vera, lemons, 23.6.83; 15, Jaén: Andújar, plums, 4.7.88; 16, Sevilla: Alcalá de Guadaira, olives, 5.7.82; 17, Ciudad Real: Daimiel, vines, 5.10.82; 18, Zaragoza: Alfajarín, sunflowers, 27.8.83.

Table 3. — *Chenopodio albi-Amaranthetum blitoidis* assoc. nov. (Holotypus: rel. 12).

Nr. order	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
Cover %	*50*	*55*	*55*	*70*	*35*	*70*	*45*	*50*	*45*	*60*	*65*	*60*	*70*	*80*	*55*	*70*
Characteristics of association and alliance																
Diplotaxis erucoides	2.1	3.1	2.1	2.1	2.1	2.1	2.1	3.1	+	3.1	3.1	3.1	2.1	3.3	2.1	4.4
Erucastrum nasturtiifolium	.	1.1	.	3.1	.	.	.	.	2.1	.	.	.	.	+	.	
Setaria viridis	.	.	1.1	1.1	.	.	.	.	1.1	.	.	.	1.1	.	.	.
Sorghum halepense	.	1.2	.	1.2	.	.	.	.	.	1.2	.	.	.	.	.	.
Tribulus terrestris	.	.	.	+	.	1.1	.	.	.	.	.	.	.	.	2.1	
Amaranthus albus	.	.	.	.	.	1.1	.	.	.	.	.	+	.	+	.	.
Heliotropium europaeum	1.1	.	.	.	.	.	.	.	.	.	.	.	1.1	.	.	.
Eragrostis barrelieri	.	.	.	.	.	.	.	.	.	.	2.2	.	.	.	1.1	.
Salsola kali	.	.	.	.	.	1.1	.	.	.	.	.	.	.	.	+	.
Xanthium orientale	.	.	.	.	.	1.1	.	.	.	.	.	+	.	.	.	.
Diff. subassociation																
Amaranthus blitoides	.	.	.	.	.	.	.	.	1.1	1.1	1.1	2.1	1.1	2.1	1.1	1.1
Panico-Setarion																
Amaranthus retroflexus	2.1	1.1	.	.	1.1	1.1	1.1	.	.	1.1	+	.	.	.	1.1	1.1
Portulaca oleracea	.	.	.	.	.	.	.	1.1	+	.	1.1	.	.	+	1.1	.
Ruderali-Secalietea																
Chenopodium album	2.1	.	1.1	.	1.1	2.1	1.1	1.1	1.1	1.1	.	.	.	+	1.1	.
Convolvulus arvensis	1.1	1.2	1.2	.	.	2.2	2.2	.	1.2	1.1	.	.	2.2	1.2	.	1.2
Chondrilla juncea	1.1	.	1.1	.	.	1.1	1.1	.	1.1	.	.	.	2.2	1.1	+	.
Cirsium arvense	.	.	1.1	.	.	1.1	1.1	.	1.1	.	.	.	2.2	.	.	.
Cynodon dactylon	.	.	1.2	.	.	.	.	.	.	1.2	1.2	.	.	2.2	.	.
Lobularia maritima	+	.	.	1.1	.	.	.	.	.	.	.	.	.	.	+	.
Daucus carota	.	1.1	.	+	.	.	.	.	1.1	.	.	.	.	.	.	.
Sonchus tenerrimus	.	+	.	+	.	.	.	.	.	.	.	+	.	.	.	.
Chenopodium vulvaria	.	.	.	.	1.2	.	.	.	.	.	.	+	+	.	.	.
Reseda phyteuma	.	+	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.
Euphorbia serrata	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.	+	.
Medicago sativa	.	.	1.1	.	.	.	.	.	.	.	.	.	.	+	.	.
Xanthium spinosum	.	.	.	.	.	.	.	1.1	.	.	.	.	.	.	+	.

Other species — Panico-Setarion, 8: *Amaranthus hybridus* 1.1; *Amaranthus powellii* 1.1; 11: *Amaranthus graecizans* subsp. *silvestris* 1.1; 16: *Cyperus rotundus* 1.1. Ruderali-Secalietea, 1: *Picris hieracioides* +; 2: *Anagallis arvensis* 1.1; 3: *Poa compressa* +; 5: *Polygonum aviculare* 1.1; *Sinapis arvensis* +; 6: *Malva sylvestris* +; 7: *Erodium cicutarium* 1.1; *Lamium amplexicaule* 1.1; *Rumex crispus* +; *Sonchus oleraceus* +; 8: *Silybum marianum* 1.1; 9: *Conyza canadensis* +; *Foeniculum vulgare* subsp. *piperitum* +; 12: *Eruca vesicaria* +; 13: *Trigonella polyceratia* +; 14: *Diplotaxis viminea* +.

Localities, crops and dates — 1, Gerona: Figueras, vines, 13.9.86; 2, Barcelona: Rubí, almonds, 30.8.85; 3, Zaragoza: Murillo de Gállego, olives, 12.8.87; 4, Tarragona: Cambrils, olives, 8.9.82; 5, Teruel: Villafranca del Campo, sugar beets, 19.8.88; 6, Zaragoza: Cariñena, vines, 14.8.88; 7, Castellón: Villafranca del Cid, potatos, 4.10.83; 8, Valencia: Utiel, alfalfa, 17.10.83; 9, Navarra: Castejón, vines, 12.8.88; 10, Lérida: Borjas Blancas, vines, 27.8.89; 11, Castellón: Pobla Tornesa, almonds, 4.10.83; 12, Madrid: Castillejo, vines, 9.6.82; 13, Cuenca: La Pobleta, almonds, 12.10.91; 14, Valencia: Higueruelas, almonds, 30.9.89; 15, Valencia: Paterna, vines, 2.9.82; 16, Alicante: Villena, garlics, 28.7.89.

Table 4. — *Amarantho delilei-Diplotaxietum erucoidis* Br.-Bl. ex Br.-Bl. 1936 *amaranthetosum blitoidis* subassoc. nov. (Holotypus: rel. 14).

Table 5. — Frequencies (F), and partial (PC) and global (GC) cover percentages of the most important species of the Spanish *Diplotaxion* communities (see explanations in the text). **Aa:** *Eragrostio-Chenopodietum botryos chenopodietosum botryos;* **Ab:** *E.-Ch. b. amaranthetosum blitoidis;* **B:** *Kickxio-Chrozophoretum tinctoriae;* **C:** *Chenopodio-Amaranthetum blitoidis;* **D:** *Amarantho-Diplotaxietum erucoidis;* **n:** number of relevés.

	Aa n: 50			Ab n: 50			B n: 50			C n: 100			D n: 50		
Diplotaxion erucoidis	F	PC	GC	F	PC	GC	F	PC	GC	F	PC	GC	F	PC	GC
Amaranthus albus	86	14.66	12.61	96	11.72	11.25	56	9.34	5.23	20	1.20	0.24	18	4.83	0.87
Amarantus blitoides	–	–	–	84	9.43	7.92	44	8.16	3.59	95	19.69	18.70	28	8.46	2.37
Heliotropium europaeum	50	5.74	2.87	42	6.69	2.81	76	7.20	5.47	23	1.98	0.45	12	1.83	0.22
Diplotaxis erucoides	–	–	–	14	1.93	0.27	6	1.83	0.11	31	2.52	0.78	96	22.56	21.66
Chrozophora tinctoria	–	–	–	10	1.70	0.17	96	10.39	9.98	7	2.21	0.15	2	2.50	0.05
Salsola kali	14	4.29	0.60	24	6.33	1.52	16	1.50	0.24	41	11.06	4.53	6	1.83	0.11
Tribulus terrestris	34	3.12	1.06	18	3.67	0.66	8	5.12	0.41	15	3.07	0.46	6	6.00	0.36
Setaria viridis	12	1.33	0.16	8	2.00	0.16	–	–	–	12	5.46	0.65	22	4.59	1.01
Eragrostis barrelieri	6	1.83	0.11	10	1.70	0.17	2	2.50	0.05	16	3.03	0.48	16	3.31	0.53
Sorghum halepense	–	–	–	2	2.50	0.05	4	8.75	0.35	14	5.04	0.70	18	4.83	0.87
Chenopodium botrys	28	4.00	1.12	6	1.83	0.11	–	–	–	–	–	–	–	–	–
Erucastrum nasturtiifolium	–	–	–	2	0.50	0.01	2	2.50	0.05	6	1.83	0.11	24	11.50	2.76
Xanthium orientale	4	8.75	0.35	4	2.50	0.10	6	1.83	0.11	6	2.50	0.15	4	2.50	0.10
Kickxia lanigera	–	–	–	2	2.50	0.05	18	3.22	0.58	2	1.50	0.03	–	–	–
Solanum villosum	6	2.50	0.15	4	1.50	0.06	4	1.50	0.06	4	2.00	0.08	2	0.50	0.01
Tragus racemosus	–	–	–	–	–	–	–	–	–	4	5.12	0.20	2	0.50	0.01
Chrozophora obliqua	–	–	–	–	–	–	6	1.83	0.11	–	–	–	–	–	–
Tagetes minuta	–	–	–	–	–	–	–	–	–	3	6.00	0.18	2	0.50	0.01
Panico-Setarion															
Amaranthus retroflexus	26	4.27	1.11	26	3.46	0.90	8	5.12	0.41	29	4.79	1.39	36	3.78	1.36
Portulaca oleracea	18	2.28	0.41	24	3.37	0.81	6	1.83	0.11	24	2.69	0.64	28	2.82	0.79
Solanum nigrum	32	2.37	0.76	16	2.00	0.32	10	4.60	0.46	7	2.21	0.15	4	2.50	0.10
Cyperus rotundus	–	–	–	20	2.30	0.46	4	2.50	0.10	14	4.00	0.56	6	2.50	0.15
Amaranthus hybridus	6	6.00	0.36	6	1.17	0.07	12	1.83	0.02	9	2.28	0.20	10	2.10	0.21
Datura stramonium	12	1.33	0.16	4	1.50	0.06	4	1.50	0.06	5	4.60	0.23	4	2.50	0.10
Amaranthus graecizans silvestris	6	1.83	0.11	6	1.17	0.07	–	–	–	8	2.25	0.18	6	1.83	0.11
Digitaria sanguinalis	6	1.17	0.07	4	0.50	0.02	6	1.83	0.11	6	1.83	0.11	4	1.50	0.06
Setaria verticillata	2	2.50	0.05	8	2.00	0.16	4	1.50	0.06	8	5.37	0.43	2	2.50	0.05
Setaria adhaerens	–	–	–	6	1.83	0.11	4	1.50	0.06	7	2.21	0.15	6	6.67	0.40
Amaranthus powellii	10	1.70	0.17	6	6.00	0.36	–	–	–	3	2.50	0.07	2	0.50	0.01
Echinochloa colonum	–	–	–	2	0.50	0.01	2	0.50	0.01	3	1.83	0.05	2	0.50	0.01
Eragrostis cilianensis	4	1.50	0.06	2	2.50	0.05	–	–	–	–	–	–	–	–	–
Ruderali-Secalietea															
Chenopodium album	74	5.43	4.02	72	7.87	5.67	62	7.50	4.65	66	4.18	2.76	60	4.80	2.88
Convolvulus arvensis	50	4.50	2.25	38	7.92	3.01	52	4.19	2.18	57	5.72	3.26	56	5.39	3.02
Chondrilla juncea	60	2.80	1.68	20	3.35	0.67	18	2.05	0.37	35	1.93	0.67	36	4.47	1.61
Cynodon dactylon	28	5.89	1.65	38	3.82	1.45	30	4.03	1.21	27	4.67	1.26	24	4.42	1.06
Cirsium arvense	38	2.84	1.08	14	9.00	1.27	22	5.36	1.18	28	4.52	1.26	40	8.52	3.41
Chenopodium vulvaria	26	3.31	0.86	24	4.42	1.06	28	4.29	1.20	12	5.46	0.65	12	6.67	0.80
Xanthium spinosum	32	2.37	0.76	8	1.50	0.12	26	2.04	0.53	21	2.90	0.61	14	3.43	0.48
Sonchus oleraceus	14	2.21	0.31	18	2.28	0.41	12	3.67	0.44	20	2.00	0.40	16	3.56	0.57
Euphorbia serrata	6	1.17	0.07	6	1.17	0.07	18	0.94	0.17	12	1.50	0.18	10	1.70	0.17
Lactuca serriola	12	4.25	0.51	10	2.10	0.21	18	2.67	0.48	8	2.25	0.18	4	1.50	0.06
Lolium rigidum	16	3.81	0.61	10	2.50	0.25	10	2.10	0.21	9	2.06	0.18	4	1.50	0.06
Polygonum rurivagum	16	2.00	0.32	6	1.17	0.07	6	1.83	0.11	5	2.10	0.10	8	2.00	0.16
Anacyclus clavatus	14	2.21	0.31	6	0.50	0.03	8	1.50	0.12	8	1.75	0.14	4	2.50	0.10
Diplotaxis virgata	4	2.50	0.10	14	1.93	0.27	16	3.81	0.61	4	5.12	0.20	2	2.50	0.05
Medicago sativa	8	2.00	0.16	12	1.83	0.22	6	0.50	0.03	8	2.00	0.16	6	2.50	0.15
Papaver rhoeas	12	1.83	0.22	14	1.64	0.23	6	1.17	0.07	1	2.50	0.02	4	1.50	0.06
Sonchus tenerrimus	4	1.50	0.06	4	1.50	0.06	4	1.50	0.06	15	1.70	0.25	10	1.70	0.17
Euphorbia chamaesyce	10	2.10	0.21	4	1.50	0.06	16	3.56	0.57	3	1.17	0.03	2	2.50	0.05
Chenopodium murale	4	1.50	0.06	12	3.92	0.47	6	1.83	0.11	5	0.90	0.04	4	2.50	0.10
Polygonum aviculare	10	1.70	0.17	4	1.50	0.06	6	1.83	0.11	2	1.50	0.03	8	2.00	0.16
Hirschfeldia incana	2	0.50	0.01	6	1.83	0.11	10	2.10	0.21	6	1.50	0.09	2	2.50	0.05
Daucus carota	2	0.50	0.01	4	1.50	0.06	4	1.50	0.06	6	1.83	0.11	6	1.17	0.07

Table 5 (continuation).

	Aa n: 50			Ab n: 50			B n: 50			C n: 100			D n: 50		
Polygonum bellardii ...	2	2.50	0.05	6	1.17	0.07	4	0.50	0.02	6	1.50	0.09	2	0.50	0.01
Amaranthus viridis	–	–	–	6	1.83	0.11	2	2.50	0.05	9	3.67	0.33	2	2.50	0.05
Conyza canadensis	10	1.70	0.17	4	1.50	0.06	–	–	–	3	6.00	0.18	2	0.50	0.01
Equisetum ramosissimum	–	–	–	4	2.50	0.10	–	–	–	5	4.10	0.20	8	2.00	0.16
Chrysanthemum coronarium	–	–	–	10	2.10	0.21	6	2.50	0.15	–	–	–	–	–	–
Cichorium intybus	2	2.50	0.05	–	–	–	6	1.17	0.07	6	1.17	0.07	2	2.50	0.05
Rumex bucephalophorus	6	1.83	0.11	6	6.00	0.36	4	1.50	0.06	–	–	–	–	–	–
Anacyclus radiatus	–	–	–	10	1.70	0.17	4	1.50	0.06	–	–	–	–	–	–
Beta maritima	–	–	–	–	–	–	4	1.50	0.06	7	2.21	0.15	2	2.50	0.05
Chrysanthemum segetum	6	1.17	0.07	4	1.50	0.06	2	2.50	0.05	–	–	–	–	–	–

The bioclimatic terminology used follows the criteria of RIVAS-MARTÍNEZ (1987a). For soil analysis (Table 6), the official methods, approved by the Spanish Ministry of Agriculture, Fishing and Food (VALLEJO, 1986), were followed for pH, texture, total and active calcium carbonate, organic matter (O.M.), total nitrogen (N) and salinity expressed in conductivity of the saturation extract (Sat. ext. conduct.) and in sodium adsorption relation (SAR) of the saturation extract. Inorganic nitrogen (Inorg. N: nitrates, nitrites and ammonium) as well as sulphates ($SO_4^=$) were extracted and later analysed by colorimetry (WALTERS, 1989).

The taxa names are given according to CASTROVIEJO & al. (1986-1993), GREUTER & al. (1984-1989) or TUTIN & al. (1964-1980), except *Conyza sumatrensis* (Retz.) E. Walker (*C. albida* Willd. ex Spreng.). For the syntaxa we have followed the rules of the Code of Phytosociological Nomenclature (BARKMAN & al., 1986).

Description of the communities

Eragrostio majoris-Chenopodietum botryos Br.-Bl. in Br.-Bl. & al. 1936.

Our relevés could be assigned to three syntaxa: *Eragrostio majoris-Chenopodietum botryos* (BRAUN-BLANQUET & al., 1936, 1952), *Tribulo terrestris-Heliotropietum europaei* (RIVAS GODAY, 1956) and *Heliotropio europaei-Amaranthetum albi* (RIVAS GODAY, 1964). After the analysis of the phytosociological tables presented by the aforementioned authors, it seems imposible to consider these associations as different, as is indicated by POLI (1966) and BRULLO & MARCENÒ (1980) in some measure. Although the first name is somewhat unfortunate, it is the one that should prevail according to the Phytosociological Nomenclature Code (BARKMAN & al., 1986). Given that BRAUN-BLANQUET (BRAUN-BLANQUET & al., 1936) bases his description on a presence synthetic table without indicating type relevé, rel. 7 (Table 1) is proposed as neotype, considering that it is a perfect representation of the *Eragrostio majoris-Chenopodietum botryos* meaning.

It is characterized (Tables 1 and 5) by a great presence of *Amaranthus albus* and *Heliotropium europaeum,* frequently accompanied by other *Diplotaxion* (*Tribulus terrestris, Salsola kali, Chenopodium botrys,* etc.) and *Panico-Setarion* (*Amaranthus retroflexus, Salanum nigrum, Portulaca oleracea,* etc.) taxa. There is also a high incidence of a more general ecology species such as *Chenopodium album, Convolvulus arvensis, Chondrilla juncea, Cynodon dactylon, Cirsium arvense, Chenopodium vulvaria* and *Xanthium spinosum,* among many others.

In the warmer regions, more thermophilous elements occur, especially *Amaranthus blitoides,* which make it possible to differentiate a subassociation: *amaranthetosum blitoidis* (Table 1, relevés 10-18, holotype: rel. 11), which is proposed as new. The presence of *Chrozophora tinctoria* in the

warmest summer areas permits the identification of a variant of an even more thermic nature. They represent a transit towards the *Chenopodio albi-Amaranthetum blitoidis* and *Kickxio lanigerae-Chrozophoretum tinctoriae,* respectively.

Overall cover tends to be low, rarely exceeding 50%. The most important species (Table 5), with highest frequency and cover percentages, is *Amaranthus albus.* Then follow *Chenopodium album, Heliotropium europaeum, Convolvulus arvensis, Chondrilla juncea* and *Cynodon dactylon,* among many others, but with much lower values. *Amaranthus blitoides* is of great relevance within the *Amaranthetosum blitoidis* subassociation.

This association is distributed through Mediterranean Spain (Fig. 2), being scarcer in the eastern regions. The greatest representation of the typical subassociation is found on the Northern Meseta and the Central and Iberian mountain systems, which have a Supramediterranean thermoclimate. *Amaranthetosum blitoidis* subassociation occurs in the Thermo and Mesomediterranean bioclimatic stages.

Both subassociations grow in dryland fields (vines, sunflowers, fallow lands, etc.) as well as in irrigated crops (melons, watermelons, sugar beets, etc.) with low soil moisture. In the soil samples analyzed (Table 6), coarse particles are predominant, pH is acid or slightly basic and the calcium carbonate percentage nil or low. Organic matter, nitrogen, sulphates and salinity tend to be of low proportions.

Kickxio lanigerae-Chrozophoretum tinctoriae Rivas Goday ex Izco 1975.

This association was perfectly studied by IZCO (1975) in Central Spain. It is characterized (Tables 2 and 5) by the almost constant presence of *Chrozophora tinctoria,* accompanied or substituted on rare occasions by *Kickxia lanigera* and/or *Chrozophora obliqua,* together with other *Diplotaxion* therophytes (fundamentally *Heliotropium europaeum, Amaranthus albus* and *Amaranthus blitoides*). Some *Ruderali-Secalietea* therophytes (*Chenopodium album, Chenopodium vulvaria, Xanthium spinosum,* etc.) and geophytes (*Convolvulus arvensis, Cynodon dactylon* and *Cirsium arvense*) are also frequent.

In the 50 relevés carried out, all within the crops, no appreciable variability was found, none of them corresponded to the *sonchetosum crassifoliae* and *kickxietosum spuriae* subassociations indicated by IZCO (1975).

Overall cover in cultivated fields tends to be rather low, similar to that corresponding to the *Eragrostio-Chenopodietum botryos.* The species with highest frequency and cover percentages (Table 5) is *Chrozophora tinctoria. Heliotropium europaeum, Chenopodium album, Amaranthus albus, Convolvulus arvensis* and *Amaranthus blitoides* follow with a certain importance. Other taxa are *Cynodon dactylon, Chenopodium vulvaria, Cirsium arvense, Xanthium spinosum, Kickxia lanigera, Lactuca serriola,* etc.

The association is distributed (Fig. 3) in the areas with the highest summer temperatures (Southern Meseta, Guadiana extremaduran Basin, Western Andalucia and the Ebro Depression, radiating towards the SE of the Iberian Peninsula), where a Thermo to Mesomediterranean thermoclimate is found.

It grows in dryland fields (vines, sunflowers, legumes, almonds, fallow lands, etc.) and in irrigated crops (sugar beets, melons, watermelons, etc.) with low soil humidity. In the soil samples analised (Table 6), the texture varies from sandy loamy to clayey and the pH ranges from practically neutral to relatively high. Calcium carbonate content oscillates from low to high. Organic matter and nitrogen tend to be in low proportions. Sulphate concentration and salinity show values from between nil or very low to moderately high. IZCO (1975) indicates very gypseous and very saline soils in some of his relevés.

	Texture	*Sand %*	*pH*	*Total CO_3Ca%*	*Active CO_3Ca%*	*O.M.%*	*Total N.%*	*Inorg. N. ppm.*	*SO_4= ppm*	*Sat. ext. conduct.*	*SAR*
Aa n: 10	sand to sandy loam	60.50-88.15 76.18	5.80-7.95 6.85	0.00-25.68 5.41	0.00-2.30 0.45	0.17-1.93 0.58	0.01-0.10 0.03	3.25-15.00 8.92	0-1500 205	0.30-2.05 0.75	0.15-0.80 0.34
Ab n: 10	sand to sandy clay loam	50.50-96.00 70.33	6.70-8.25 7.83	0.00-28.10 6.85	0.00-4.20 1.05	0.15-2.12 0.88	0.01-0.14 0.05	5.25-21.25 13.20	0-1600 210	0.58-1.63 1.12	0.26-1.70 0.88
B n: 10	sandy loam to clay	30.80-78.40 58.61	7.25-8.30 7.78	0.00-42.68 8.92	0.00-5.55 1.26	0.20-2.44 1.02	0.01-0.15 0.07	7.40-17.50 11.32	0-5500 650	0.54-3.66 1.37	0.25-2.65 1.04
C n: 25	sand to clay	10.55-93.65 56.64	7.27-8.90 8.27	0.00-75.45 29.75	0.00-18.50 7.55	0.15-6.56 1.27	0.01-0.21 0.07	6.35-45.50 17.20	0-7000 1200	0.38-12.35 1.85	0.25-15.26 1.65
D n: 11	sandy loam to clay	9.05-74.34 43.30	8.00-8.75 8.38	9.20-59.52 27.80	1.10-10.65 4.97	0.15-3.04 1.45	0.01-0.19 0.10	6.25-32.50 15.96	0-4000 550	0.49-2.83 1.16	0.32-6.96 1.37

Table 6. — Extreme and mean values of major physical-chemical factors of soils (see explanations in the text). **Aa:** *Eragrostio-Chenopodietum botryos chenopodietosum botryos;* **Ab:** *Eragrostio-Chenopodietum botryos amaranthetosum blitoidis;* **B:** *Kickxio-Chrozophoretum tinctoriae;* **C:** *Chenopodio-Amaranthetum bliitoidis;* **D:** *Amarantho-Diplotaxietum erucoidis;* **n:** number of samples.

Fig. 2. — Distribution of the studied localities of *Eragrostio majoris-Chenopodietum botryos:* • *chenopodietosum botryos;* ★ *amaranthetosum blitoidis.*

Fig. 3. — Distribution of the studied localities of *Kickxio lanigerae-Chrozophoretum tinctoriae*.

Chenopodio albi-Amaranthetum blitoidis assoc. nov.

It is characterized (Tables 3 and 5) by the almost constancy of *Amaranthus blitoides* and the notable presence of other annual taxa belonging to *Diplotaxion* (*Salsola kali, Diplotaxis erucoides* and *Heliotropium europaeum,* among others) and to *Panico-Setarion* (*Amaranthus retroflexus* and *Portulaca oleracea*). Species of *Ruderali-Secalietea* (*Chenopodium album, Convolvulus arvensis, Chondrilla juncea, Cirsium arvense, Cynodon dactylon, Xanthium spinosum,* etc.) are also frequent. Holotype: rel. 12, Table 3.

The surface covered by the association is variable, the higher cover being frequent, greater than 60%. The most important taxa, with highest frequency and global cover percentage, are (Table 5): *Amaranthus blitoides, Salsola kali, Chenopodium album, Convolvulus arvensis, Amaranthus retroflexus, Cirsium arvense, Cynodon dactylon, Diplotaxis erucoisdes* and *Chondrilla juncea,* among many others.

In spite of being a relatively homogeneous association (a division into subassociations would not seem to be convenient) as one could consider some variants according to the variation of environmental factors. As, for instance, the presence of *Chrozophora tinctoria* as a transit to the *Kickxio lanigerae-Chrozophoretum tinctoriae* in the hottest summer regions, *Panico-Setarion* species in more humid soils and halophytes such as *Beta maritima* in saline soils.

It is relatively similar to the association *Atriplici rosae-Salsoletum ruthenicae* (RIVAS-MARTÍNEZ, 1978) of the alliance *Chenopodion muralis.* The existance of taxa which are common to both associations, especially *Salsola kali* and *Amaranthus blitoides,* have lead to the fact that relevés carried out until now on the *Chenopodio albi-Amaranthetum blitoidis* have been included in the *Atriplici rosae-Salsoletum ruthenicae* (ALCARAZ, 1984; ALCOBER, 1983). In our association, of agrestal and no ruderal character, as well as the great dominance of *Amaranthus blitoides,* a lower frequency of *Salsola kali* and an almost complete absence of *Atriplex rosea,* it gathers together a rich variety of predominantly agrestal taxa. Moreover, *Chenopodio albi-Amaranthetum blitoidis* does not spread into the Supramediterranean bioclimatic stage, as opposed to *Atriplici rosae-Salsoletum ruthenicae,* which is quite at home there (LADERO & al., 1983; BURGAZ & SAIZ, 1989).

Our association reaches its optimum development (Fig. 4) in the eastern half of Spain (very probably including the Balearic Islands), radiating towards the SW of the Iberian Peninsula, where *Eragrostio majoris-Chenopodietum botryos amaranthetosum blitoidis* and *Kickxio lanigerae-Chrozophoretum tinctoriae* predominate. It grows on the Thermo and Mesomediterranean bioclimatic stages.

It occurs chiefly among dryland crops (almonds, vines, olives, sunflowers, etc.), and can also be found on irrigated land with low soil moisture. In the soil samples analysed (Table 6) texture ranges from sandy to clayey and pH varies from between almost neutral to highly alkaline. Lime content tends to be high, although in some cases it is nil. The proportion of organic matter and nitrogen are variable, but soils are predominantly poor in these elements. Sulphates and salinity oscillate between nil or low quantitites to quite high ones, as happened with the samples taken in the SE of the Iberian Peninsula.

Amarantho delilei-Diplotaxietum erucoidis Br.-Bl. ex Br.-Bl. in Br.-Bl. & al. 1936 nom. inv.

The association described by BRAUN-BLANQUET (BRAUN-BLANQUET & al., 1936) is a mixture of winter-spring and summer-autumn species. Although the original diagnosis corresponds to a synthetic table with no individual relevés, we consider that the vegetation we have studied corresponds to this association, reserving the winter-spring taxa for other communities. Relevé 1 (Table 4) is put forward as the neotype, being the closest, of those available, to the region where the association was originally described.

It is characterized (Tables 4 and 5) by the abundance and almost constant presence of *Diplotaxis erucoides,* sometimes accompanied, or on rare occasions substituted, by *Erucastrum nasturtiifolium,* together with summer-autumn species of *Solano nigri-Polygonetalia convolvuli*

Fig. 4. — Distribution of the studied localities localities of *Chenopodio albi-Amaranthetum blitoidis.*

(*Amaranthus retroflexus, Portulaca oleracea, Amaranthus blitoides, Setaria viridis, Sorghum halepense,* etc.). The *Ruderali-Secalietea* taxa are also frequent, such as *Chenopodium album, Convolvulus arvensis, Cirsium arvense* and *Chondrilla juncea,* among many others.

In the biotopes where the association reaches maximum development, generally in spaciously planted woody crops, cover is high, easily passing 60%. *Diplotaxis erucoides* is the species with by far the highest global cover percentage (Table 5). Followed, with much smaller values, by *Cirsium arvense, Convolvulus arvensis, Chenopodium album, Erucastrum nasturtiifolium, Amaranthus blitoides, Chondrilla juncea, Amaranthus retroflexus, Cynodon dactylon, Setaria viridis, Sorghum halepense,* etc.

This association is distributed (Fig. 5) throughout the eastern half of Spain, including the Balearic Islands, being most abundant in areas with the highest summer rainfall (NE of the Iberian Peninsula). Bioclimatically, it presents a wide ecological spectrum, establishing itself in the Thermo, Meso and Supramediterranean stages. In the warmer (Thermo and Mesomediterranean bioclimates) and less humid biotopes, *Amaranthus blitoides* appears as a differential species, permiting the identification of a subassociation: *amaranthetosum blitoidis* which is proposed as new (Table 4, relevés 9-16, holotype: rel. 14), establishing the transit towards the *Chenopodio albi-Amaranthetum blitoidis.*

The association grows principally among dryland woody crops (almonds, vines, olives, etc.), although it is also frequent among herbaceous ones. In dryland areas, soil humidity corresponds to that found in a subhumid or not particularly dry ombroclimate. In more arid regions a moderate irrigation is necessary for its development.

In the samples analysed (Table 6) the soils that predominated were those with a higher proportion of fine particles, although some of them proved to be of a sandy loamy texture. Calcium carbonate content and pH tend to be quite high. Organic matter and nitrogen, the total as much as the inorganic, are variable, depending on whether the sample was taken from dry or irrigated land. This association can establish itself, perfectly well, in gypseous and saline soils, as in the case of the relevé 16 (Table 4) from Villena (Alicante).

Conclusions

This paper describes the summer-autumn vegetation found in 300 dryland or scantily irrigated cultivated fields (*Diplotaxion erucoidis* alliance) of the Spanish Mediterranean region, excluding Balearic Islands. This type of vegetation falls within the following syntaxa:

Ruderali-Secalietea cerealis Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 (Syn. *Stellarietea mediae* R. Tx., Lohmeyer & Presing in R. Tx. 1950. Incl. *Secalietea* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952; *Chenopodietea* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952).

Chenopodietalia albi R. Tx. & Lohmeyer in R. Tx. 1950 [Syn. *Solano nigri-Polygonetalia convolvuli* (Sissingh in Westhoff, Dijk & Passchier 1946) O. Bolòs 1962; *Chenopodietalia muralis* Br.-Bl. ex Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 p.p. Incl. *Polygono convolvuli-Chenopodietalia albi* J. Tx. in Lohmeyer & al. 1962; *Eragrostietalia* J. Tx. in Lohmeyer & al. 1962].

Diplotaxion erucoidis Br.-Bl. ex Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 (Syn. *Eragrostion* R. Tx. in Slavnic 1944 p.p.).

- *Eragrostio majoris-Chenopodietum botryos* Br.-Bl. in Br.-Bl. Gajewski, Wraber & Walas 1936 (Syn. *Tribulo terrestris-Heliotropietum europaei* Rivas Goday 1956; *Panico sanguinalis-Eragrostietum barrelieri* Rivas Goday 1956 com. prov. p.p.; *Heliotropio europaei-Amaranthetum albi* Rivas-Goday 1964 prov. p.p.). Preferably silicicolous.
  - — *chenopodietosum botryos.* Mainly Supramediterranean.
  - — *amaranthetosum blitoidis* subassoc. nov. Thermo-Mesomediterranean.

Fig. 5. — Distribution of the studied localities of *Amarantho delilei-Diplotaxietum erucoidis:* • *diplotaxietosum erucoidis;* ★ *amaranthetosum blitoidis.*

	F	PC	GC
Amaranthus bilitoides	57.67	14.82	8.55
Amaranthus albus	49.33	10.28	5.07
Diplotaxis erucoides	29.67	13.26	3.93
Chenopodium album	66.67	5.68	3.79
Convolvulus arvensis	51.67	5.48	2.83
Heliotropium europaeum	37.67	5.42	2.04
Salsola kali	23.67	8.11	1.92
Chrozophora tinctoria	20.33	8.61	1.75
Cirsium arvense	28.33	5.58	1.58
Cynodon dactylon	29.00	4.52	1.31
Amaranthus retroflexus	25.67	4.25	1.09
Chondrilla juncea	34.00	2.78	0.94
Chenopodium vulvaria	19.00	9.84	0.87
Tribulus terrestris	16.00	3.56	0.57
Portulaca oleracxea	20.67	2.76	0.57
Xanthium spinosum	20.33	2.56	0.52
Erucastrum nasturtiifolium	6.67	7.65	0.51
Setaria viridis	11.33	3.97	0.45
Sorghum halepense	8.67	5.07	0.44
Sonchus oleraceus	16.67	2.52	0.42
Solanum nigrum	12.67	2.53	0.32
Cyperus rotundus	9.67	3.10	0.30
Eragrostis barrelieri	11.00	2.73	0.30
Lactuca serriola	10.00	2.70	0.27
Lolium rigidum	9.67	2.58	0.25

Table 7. — Frenquencies (F), and partial (PC) and global (GC) cover percentages (see explanations in the text) of the 25 most harmful weeds in the whole of the 300 relevés.

- *Kickxio lanigerae-Chrozophoretum tinctoriae* Rivas Goday ex Izco 1975 (Syn. *Heliotropio europaei-Amaranthetum albi chrozophoretosum tinctoriae* Rivas Goday 1964 prov.; *Chrozophora tinctoriae-Heliotropietum europaei* Rivas Goday 1964 nom. nud.). Thermo-Mesomediterranean. Hottest summer regions. Indifferent to soil types.
- *Chenopodio albi-Amaranthetum blitoidis* assoc. nov. (Syn. *Atriplici rosae-Salsoletum ruthenicae* auct., non Rivas-Martínez 1978). Thermo-Mesomediteraanean. Preferably Iberian-Levantine. Mainly calcicolous.
- *Amarantho delilei-Diplotaxietum erucoidis* Br.-Bl. ex Br.-Br. in Br.-Bl., Gajewski, Wraber & Walas 1936 nom. inv. (Syn. *Diplotaxietum erucoidis* Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936 pro syn.; *Erucastro nasturtiifolii-Diplotaxietum erucoidis* Brullo & Marcenò 1980). Iberian-Levantine. Calcicolous.
  - — *diplotaxietosum erucoidis.* Thermo to Supramediterranean. Less xerophile.
  - — *amaranthetosum blitoidis* subassoc. nov. Thermo-Mesomediterranean. More xerophile.

The most phytosociologically significant species of the spanish *Diplotaxion* agrestal communities are (Table 5): *Amaranthus albus, Amaranthus blitoides, Chrozophora tinctoria* and *Diplotaxis erucoides.* Other alliance characteristic taxa are: *Heliotropium europaeum, Salsola kali, Tribulus terrestris, Setaria viridis, Eragrostis barrelieri, Sorghum halepense, Chenopodium botrys, Erucastrum nasturtiifolium, Xanthium orientale,* etc.

In all the studied communities some species of *Panico-Setarion* are frequent (*Amaranthus retroflexus, Portulaca oleracea* and *Solanum nigrum* being the most important) and there is a high incidence of the agrestal taxa of a more general ecological character, belonging to *Ruderali-Secalietea,* such as *Chenopodium album, Convolvulus arvensis, Chondrilla juncea, Cynodon dactylon, Cirsium arvense, Chenopodium vulvaria, Xanthium spinosum, Sonchus oleraceus* and many others.

Floristically, a total of 180 taxa was recorded, considering that the floristic diversity of summer-autumn agrestal vegetation is much lower than that of winter-spring one. Considering only the 63 most important taxa shown in Table 5, the families with the highest number of species were *Compositae* (22%), *Gramineae* (17%), *Amaranthaceae* (11%) and *Chenopodiaceae* (10%); 84% of the weeds were therophytes, 11% geophytes and 5% hemicryptophytes; a significant number (17%) were of American origin, e.g. *Amaranthus albus, A. blitoides, A. retroflexus* and *Xanthium spinosum.*

The 25 most aggressive weeds surveyed in the whole of the 300 relevés without grouping in communities (Table 7) were *Amaranthus blitoides, A. albus, Diplotaxis erucoides, Chenopodium album, Convolvulus arvensis, Heliotropium europaeum, Salsola kali,* etc.

Chenopodium album, Convolvulus arvensis, Cirsium arvense, Cynodon dactylon, Chondrilla juncea and *Chenopodium vulvaria,* among others, are species with a broad ecological and sociological amplitude, forming a high percentage of the weed floras of all the communities (Table 5) and therefore they are very widely distributed in all the studied territory. *Amaranthus retroflexus, Portulaca oleracea* and *Solanum nigrum* are summer weeds characteristic of irrigated fields, but they penetrate into dryland crops where soil retains a certain humidity.

Amaranthus albus and *Heliotropium europaeum* shown a certain preference for siliceous soils, being much more frequent and abundant in the *Eragrostio majoris-Chenopodietum botryos* and *Kickxio lanigerae-Chrozophoretum tinctoriae* associations, that is to say in the western half of the Spanish mediterranean region and in some localities for the rest of the Mediterranean Spain. *Amaranthus blitoides* occurs only on the Thermo and Mesomediterranean bioclimatic stages and it is indifferent to soil types; it is one of the most important weeds of all the surveyed territory, except of the Supramediterranean *Eragrostio-Chenopodietum botryos chenopodietosum botryos* subassociation (Northern Meseta, Central and Iberian mountain systems, as principal areas) and of the Supramediterranean zones of the *Amarantho delilei-Diplotaxietum erucoidis* association (prepyrenean regions and upper Eastern Iberian mountains).

Diplotaxis erucoides is a weed commonly occurring on calcareous soils with a moderate humidity; it is distributed mainly throughout the eastern half of Spain, being most abundant in the highest summer rainfall areas, e.g. NE of the Iberian Peninsula. *Chrozophora tinctoria* is distributed in the highest summer temperature areas (Southern Meseta, Guadiana Extremaduran Basin, Western Andalucia and the Ebro Depression), where a Thermo-Mesomediterranean bioclimate is found. *Salsola kali* prefers xeric habitats; that is why it is much less frequent in the *Amarantho delilei-Diplotaxietum erucoidis* association, where the soil moisture is slightly higher than in other communities.

REFERENCES

ALCARAZ, F. (1984). *Flora y vegetación del NE. de Murcia.* Universidad de Murcia.

ALCOBER, J. (1983). *La vegetación arvense del secano valenciano.* Unpublished Ph. D. thesis, Universidad Politécnica de Valencia.

BARKMAN, J. J., J. MORAVEC & S. RAUSCHERT (1986). Code of Phytosociological Nomenclature. *Vegetatio* 67: 145-195.

BEDIN, P. & C. ZARAGOZA (1981). Flora adventicia de las zonas vitícolas de Cariñena y Borja (Zaragoza). *Anales INIA, ser. Agric.* 15: 111-122.

BOLÒS, A. DE & O. DE BOLÒS (1950). *Vegetación de las comarcas barcelonesas.* Inst. Esp. de Estudios Mediterranáneos. Barcelona.

BOLÒS, O. DE (1962). *El paisaje vegetal barcelonés.* Fac. Fil. Letr. Univ. Barcelona.

BOLÒS, O. DE (1967). Comunidades vegetales de las comarcas próximas al litoral situadas entre los ríos Llobregat y Segura. *Mem. R. Acad. Cienc. Art. Barcelona* 38: 1-280.

BOLÒS, O. DE & J. VIGO (1984). *Flora dels Països Catalans.* Vol. 1. Ed. Barcino, Barcelona.

BRAUN-BLANQUET, J. (1965). *Plant Sociology. The study of plant communities.* Hafner Publ. Co., New York.

BRAUN-BLANQUET, J. & O. DE BOLÒS (1957). Les groupements végétaux du bassin moyen de l'Ebre et leur dynamisme. *Anales Est. Exp. Aula Dei* 5(1-4): 1-266.

BRAUN-BLANQUET, J., W. GAJEWSKI, M. WRABER & J. WALAS (1936). *Prodrome des groupements végétaux 3. Classe des Rudereto-Secalinetales. Groupements messicoles, culturaux et nitrophiles-rudéraux du cercle de végétation méditerranéen.* Montpellier.

BRAUN-BLANQUET, J., N. ROUSSINE & R. NÈGRE (1952). *Les groupements végétaux de la France Méditerranéenne.* C.N.R.S., Montpellier.

BRULLO, S. & C. MARCENÒ (1980). Il Diplotaxion erucoidis in Sicilia, con considerazioni sulla sintassonomia e distribuzione. *Notiziario Soc. Ital. Fitosociol.* 15: 27-44.

BRULLO, S. & C. MARCENÒ (1985). Contributo alla conoscenza della vegetazione nitrofila della Sicilia. *Colloques Phytosociol.* 12: 23-148.

BURGAZ, A. R. & F. SAIZ (1989). Estudio fenológico de las comunidades arvenses cerealistas de Tierra de Pinares (Valladolid, España). *Bot. Complutensis* 15: 127-147.

CABRETERO, J. L. (1969). Las malas hierbas de los cultivos de la Comunidad Valenciana (España). *Proc. 4º EWRS Mediterranean Symp.* 2: 99-112.

CASTROVIEJO, S., M. LAINZ, G. LÓPEZ-GONZÁLEZ, P. MONTSERRAT, F. MUÑOZ-GARMENDIA, J. PAIVA & L. VILLAR (eds.) (1986-1993). *Flora Iberica.* Vols. 1-4, Real Jardín Botánico, CSIC., Madrid.

DÍAZ, T. E. & A. PENAS (1984). Datos sobre la vegetación terofítica y nitrófila leonesa. *Acta Bot. Malacitana* 9: 233-254.

ELIÁŠ, P. (1983). Flora and vegetation of the Slovak vineyards. *Verh. Ges. Ökol.* 10: 127-142.

FOLCH, R. (1981). *La vegetació dels Països Catalans.* Inst. Catalana Hist. Nat. Barcelona.

GÉHU, J. M. & S. RIVAS-MARTÍNEZ (1981). Notions fondamentales de phytosociologie. *In:* DIERSCHKE, H. (ed.), *Ber. Int. Symp. Int. Vereinigung Vegetationskunde. Syntaxonomie:* 5-33. J. Cramer, Vaduz.

GREUTER, W., H. M. BURDET & G. LONG (eds.) (1984, 1986, 1989). *Med-Checklist 1, 3, 4.* Conservatoire et Jardin botaniques de la Ville de Genève.

HIDALGO, B., M. SAAVEDRA & L. GARCÍA-TORRES (1990). Weed flora of dryland crops in the Córdoba province (Spain). *Weed Res.* 30: 309-318.

IZCO, J. (1975). Las comunidades vegetales del Diplotaxion erucoidis del Centro de España. *Doc. Phytosociol. N.S.* 9-14: 139-144 + 3 tabs.

KOJIČ, M. (1975). Pflanzengeographische und taxonomische Gliederung der Untrautgesellschaften in Jugoslawien. *Probl. Agrogeobot.* 65: 38-42; *Herbol. Croatica* 11: 1-6.

KOROTKOV, K. O., O. V. MOROZOVA & E. A. BELONOVSKAJA (1991). *The USSR vegetation syntaxa Prodromus.* Publ. by G. E. Vilchek, Moscow.

KOVAČEVIĆ, J. (1970). A survey of the weed associations of Yugoslavia. *Bull. Sci. Yugosl., sect. A,* 15(9-10): 325.

KRIPPELOVÁ, T. (1984). Prehlad výskumu burinových spoločenstiev na Slovensku do roku 1983 (triedy Secalietea a Chenopodietea). *Preslia* 56: 229-240.

KRIPPELOVÁ, Z. & L. MUCINA (1988). Charakteristika vyšších syntaxónov triedy Stellaritea mediae na Slovensku. *Preslia* 60: 41-58.

LACOURT, J. (1977). *Essai de synthèse sur les syntaxons commensaux des cultures d'Europe.* Unpublished Ph. D. thesis. Univ. Paris-Sud, Orsay.

LADERO, M., F. NAVARRO & C. J. VALLE (1983). Comunidades nitrófilas salmantinas. *Stud. Bot.* 2: 7-67.

MASALLES, F. (1983). *Flora i vegetació de la conca de Barberá.* Inst. d'Estudis Catalans, Barcelona.

MAUGERI, G. (1980). La vegetazione infestante gli agrumeti dell'Etna. *Notiziario Soc. Ital. Fitosociol.* 15: 45-54.

MAUGERI, G. & S. LEONARDI (1974). La vegetazione infestante de colture di mandorlo nel siracusano. *Arch. Bot. Biogeogr. Ital., ser. 4,* 19(1-2): 1-26.

MAUGERI, G., T. TINÉ & L. DI BENEDETTO (1980). Aggrupamenti dell'Eragrostion nelle colture siciliane. *Notiziario Soc. Bot. Ital. Fitosociol.* 15: 57-62.

MENDIOLA, M. A. & M. J. OLMEDO (1987). Estudio fenológico de la flora arvense en viñedos de Madrid. *ITEA Madrid* 71: 32-40.

MOUTTE, P. (1964). Etude phytosociologique et écologique de la végétation naturelle du vignoble d'Hyères (Var). *Ann. Soc. Sci. Arch. Toulon et Var:* 82-106.

NAVARRO, F. & C. J. VALLE (1984). Vegetación herbácea del Centro-Occidente Zamorano. *Stud. Bot.* 3: 63-177.

NEZADAL, W. (1989). Unkrautgesellschaften der Getreide — und Frühjahrshackfruchtkulturen (Stellarietea mediae) im mediterranen Iberien. *Diss. Bot.* 143, 205 pp. + tab.

OBERDORFER, E. (1954). Über Unkrautgesellschaften der Balkanhalbinsel. *Vegetatio* 4: 379-411.

OBERDORFER, E. (1983). *Süddeutsche Pflanzengesellschaften Teil III.* 2. Aufl. G. F. Verlag, Stuttgart.

PEINADO, M., C. BARTOLOMÉ & J. M. MARTÍNEZ PARRAS (1985). Notas sobre vegetación nitrófila, I. *Stud. Bot.* 4: 27-33.

POLI, E. (1966). Eine neue Eragrostidion-Gesellschaft der Citrus-Kulturen in Sizilien. *In:* TÜXEN, R. (ed.), *Anthropogene Vegetation. Ber. Int. Symp. Int. Vereinigung Vegetationskunde:* 60-74. Den Haag.

PUJADAS, A. & J. E. HERNÁNDEZ-BERMEJO (1988). Floristic composition and agricultural importance of weeds in southern Spain. *Weed Res.* 28: 175-180.

QUANTIN, A. (1947). Les associations végétales des cultures sarclées en bourgogne méridionale. *Bull. Soc. Bot. Fr.* 94(7-8): 320-323.

RIGUAL, A. (1972). *Flora y Vegetación de la provincia de Alicante.* Diputación Provincial de Alicante.

RIVAS GODAY, S. (1956). Aportaciones a la Fitosociología hispánica, I. *Anales Inst. Bot. Cavanilles* 13: 337-422.

RIVAS GODAY, S. (1964). *Vegetación y flórula de la cuenca extremeña del Guadiana.* Excma. Diputación de Badajoz.

RIVAS GODAY, S. & S. RIVAS-MARTÍNEZ (1963). *Estudio y clasificación de los pastizales españoles.* Min. Agric. Madrid.

RIVAS-MARTÍNEZ, S. (1977). Datos sobre la vegetación nitrófila española. *Acta Bot. Malacitana* 3: 159-167.

RIVAS-MARTÍNEZ, S. (1978). Sobre la vegetación nitrófila del Chenopodion muralis. *Acta Bot. Malacitana* 4: 71-75.

RIVAS-MARTÍNEZ, S. (1987a). *Memoria del mapa de series de vegetación de España, 1:4000.000.* ICONA, Madrid.

RIVAS-MARTÍNEZ, S. (1987b). *Ensayo taxonómico de la vegetación nitrófila de Europa Occidental.* (Ined.). Universidad Complutense, Madrid.

SAAVEDRA, M., L. GARCÍA-TORRES, E. HERNÁNDEZ-BERMEJO & B. HIDALGO (1989). Weed flora in the Middle Valley of the Guadalquivir, Spain. *Weed Res.* 29: 167-179.

SCHUURMANS STEKHOVEN, J. H. (1961). Das Frühlingsbild des Diplotaxietum erucoidis Br.-Bl. 1931. *Acta Bot. Neerland.* 10: 327-334.

TUTIN, T. G., V. H. HEYWOOD, N. A. BURGES, D. M. MOORE, D. H. VALENTINE, S. M. WALTERS & D. A. WEBB (eds.) (1964-1980). *Flora Europaea:* 1-5. Cambridge University Press.

TÜXEN, R. (1950). Grundriss einer Systematik der nitrophilen Unkraurtgesellschaften in der Eurosibirischen Region Europas. *Mitt. flor.-soz. Arbeitsgem. N.F.* 2: 94-176. Stolzenau.

TÜXEN, R. & E. OBERDORFER, E. (1958). Die Pflanzenwelt Spaniens II Teil. Eurosibirische Phanerogamen Pflanzengesellschaften Spaniens. *Veröff. Geobot. Inst. Rübel Zürich* 32: 1-328. Bern.

VALLEJO, J. M. (ed.) (1986). *Métodos oficiales de análisis. III: Suelos y aguas.* MAPA, Madrid.

WALTERS, G. L. (ed.) (1989). *Water analysis Handbook.* Hach Co., Loveland, USA.

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