V. H. HEYWOOD: (University of Liverpool)

The Flora of the Sierra de Cazorla, S. E. Spain I.

Introduction

The flora of the Sierra de Cazorla in the province of Jaén, S. E. Spain, is one of the richest of the whole Mediterranean region. The area remained however virtually unexplored until the beginning of the present century. Previously only a few forest botanists had visited the territory, such as Laguna who recorded a few of the shrub and tree species in his *Flora Forestal* (1883, 1890). In WILLKOMM & LANGE's *Prodromus* the Sierra de Cazorla is cited only two or three times.

A summary of the botanists who collected in Cazorla, notably REVERCHON, GANDOGER and LACAITA, is given in HEYWOOD (1954). The investigations of REVERCHON particularly revealed much of the floristic importance of the region but no further detailed work was undertaken until recent years. The need for such work had become urgent since only a portion of the flora had been collected and studied by the early workers and a critical assessment has not been undertaken of the many new taxa and records which they recorded.

Phytogeographically the Sierra de Cazorla, together with the neighbouring Sierra de Segura, is of considerable importance. Apart from the high percentage of endemic species of Mediterranean type (including several "Tertiary relicts" such as the celebrated *Viola cazorlensis* and *Ptilotrichum reverchonii*, etc.) a considerable number of boreal and mesophytic species are found in the mountain zones which have served as refuge habitats during the various migrations and recessions of the Spanish flora that took place as a consequence of the Pleistocene glaciations. Moreover the geographical situation of the Sierra de Cazorla, between the Betic ranges of Sierra Nevada and Sierra de Baza in the south and the Serranía de Cuenca and the mountains of the Maestrazgo in the east-centre, makes it very much a keystone for phytogeographical and distributional studies in the Peninsula.

Topography and Geology

The Sierra de Cazorla lies within the judicial division of Cazorla in the northernmost part of the province of Jaén where it forms a boundary with the province of Granada. It is part of a series of mountain systems linked with the massif of La Sagra, and belongs to the Subpenebetic Zone (Préalpes subbétiques of DOUVILLÉ (1906)) of the Penebetic System. It is intimately connected with the partly contiguous ranges of Sierra de Segura, S. de Castril, S. de Santiago de la Espada and S. de las Villas Mancomunadas, so that it does not have a distinct orographic unity as does, for example, the Macizo de Mágina in the same province.

Topographically the Sierra de Cazorla is, as MACKAY (1917) says, „una verdadera sierra", greatly accidented, with high peaks, deep valleys, gorges

and a wide variety of landscape. The western limits are clearly definable as the mountains rise almost straight up from the adjacent plains of the Betic depression. It should be pointed out that no agreement will be found in maps and geographical texts as to the exact circumscription of the sierra, and I have followed the boundaries laid down by the Patrimonio Forestal del Estado, with one exception which is mentioned below.

Seen from a distance the sierra appears to be divided into two lines of more or less parallel crests — the first forming an outer barrier between the Rio Guadalquivir and the Betic depression, and the second lying almost centrally; these series of peaks are not however continuous, nor are they watersheds of primary or even secondary importance, but the Instituto Geográfico has named them Sierra de Cazorla and Sierra del Pozo respectively, in their topographical map of scale 1 : 50000. According to this map the Sierra de Cazorla extends far into the north, well beyond the limits of the judicial division of Cazorla, while the Sierra del Pozo (Alcón) is contained well within the limits of Cazorla and barely reaches the judicial boundaries of Pozo Alcón, the village from which its name is derived. (The so-called Sierra del Pozo contains the highest peak of the territory, the Pico de Cabañas, 2035 m.) Moreover, the word sierra is employed in many parts of Andalucia, and particularly in this province, to refer to the uncultivated mountainous territory included within a municipal boundary, in contradistinction to *campiña* which refers to flat undulating cultivated terrain. The Sierra de Cazorla is therefore taken to mean the expanse of mountainous land which lies within the township of Cazorla, and this takes in a large part of the area which the Instituto Geográfico refers to as the Sierra del Pozo. It need scarcely be added that the term sierra in this part of Spain does not have its customary academic connotation of a line or chain of high crests (the word *cuerda* is used in this territory for that sense), but is given to mean a complex of heights, escarpments, valleys, gorges, etc. (cf. MACKAY [1917] p. 12, CUATRECASAS [1929] p. 22).

The exception mentioned above is the privately owned Sierra de la Cabrilla (or simply Cabrilla), which consists of the peak of Las Empanadas (2107 m) and a few subsidiary crests, forming, for some distance, the boundary between the provinces of Jaén and Granada. Its eastern slopes are known as the Sierra de Castril, after the village of that name which lies further east. I have included the Cabrilla within the limits of the Sierra de Cazorla as it forms a more or less natural eastern boundary to the territory.

The sierra rises above a countryside constituted by lower strata of Jurassic rocks with a predominance of marls which erode easily; the sierra itself consists almost entirely of hard rocks belonging to the Jurassic and Cretaceous, with a Triassic band of clays and red sands which rises from the margins of the Guadalquivir.

The rocks of the substrata are almost entirely of hard limestone, dolomites and compact marls, forming a series of limestone soils, except in the Triassic zone where they are of quartziferous limestone and red clays, but still giving

rise to soils with a considerable proportion of calcium although often in the form of hard, chemically inert fragments. In the Jurassic zone the soils formed are mainly of calcareous sand, although very limited in extent, and it is here that *Pinus pinaster* grows best. The largely insoluble nature of the hard Jurassic limestone explains the presence of several species normally found on siliceous soils.

In this territory the principal rivers are the Guadalquivir, Guadalentín, and Borosa although none of them develops with any force within the sierra. The Guadalquivir arises officially in these mountains although its permanent sources are in the Sierra de Segura. There are a number of minor streams such as the Rio Cerezo, Rio de Cazorla and Rio Cañamares, but of little importance. An exceptionally rich development of springs is found however.

Climate

Various recording stations, giving pluviothermic data, are maintained by the Patrimonio Forestal del Estado in the Sierra. The data used here are taken from these sources.

In general it may be said that the climate of this territory is harsh: the winters are very cold with absolute minimum temperatures of as low as —12° C in January and February, and often considerable snow fall. After a short spring the temperature rises sharply in May-June reaching extreme maxima of more than 40° C. in the shade. The rainfall is exceptionally heavy and places the territory in one of the highest rainfall zones of Spain. In some stations an annual total of up to 2000 mm. has been recorded; this may be compared with Jaén, the capital of the province, with 706 mm. The rain sweeps up the valley of the Guadalquivir and is of a tormentous character in spring and autumn, showing peaks in these seasons; in winter the precipitation is more or less continuous, while the summers are notably dry but for occasional thunderstorms.

There are few data on wind direction and force but the following table taken from MACKAY (1917) gives some idea of the characteristics of four stations.

Period	*Station*	*Predominant wind direction*
January—March	Fresnedilla	N & W
	Hoyos de Muñoz	WS & W
	Los Collados	W
April—June	Fresnedilla	W
	Hoyos de Muñoz	SW & NW
	Los Collados	W
July—September	Fresnedilla	W & SW
	Hoyos de Muñoz	W & SW
	Los Collados	—
October—December	Fresnedilla	NW
	Hoyos de Muñoz	NW
	Los Collados	W

Also important, and more damaging, is the wind known as "aire solano" which comes from North Africa across the Mediterranean, and after losing considerable humidity by blowing up over the slopes, descends on the countryside like a suffocating gas.

In the adjoining tables (figs. 1—3) I have given the climatic data available for three stations in this territory: Los Collados and Fuente del Oso in the

LOS COLLADOS

Record of observations 1910—1930

	TEMPERATURE				PRECIPITATION			
Month	Mean	Mean of Maxima	Mean of Minima	Mean oscillation	Month	Pptn. mm.	Days Rain	Days Snow
Jan.	3.5	6.5	0.0	6.5	Jan.	125	6	3
Feb.	1.7	3.0	—1.0	4.0	Feb.	190	7	6
March	4.4	5.0	1.6	3.4	March	218	7	5
April	6.2	8.2	3.6	4.6	April	146	9	2
May	11.8	13.4	8.5	4.9	May	78	5	1
June	13.4	15.4	10.5	4.9	June	54	5	0
July	18.7	20.3	14.2	6.1	July	12	1	0
August	20.3	24.2	16.6	7.6	August	18	1	0
Sept.	16.0	19.0	12.2	6.8	Sept.	21	2	0
Oct.	9.8	13.6	5.8	7.8	Oct.	174	7	1
Nov.	4.0	6.2	2.6	3.6	Nov.	234	10	2
Dec.	3.0	4.6	1.3	3.3	Dec.	188	5	3
					Total	1458	65	23

Fig. 1

FUENTE DEL OSO

Record of observations 1910—1930

	TEMPERATURE				PRECIPITATION			
Month	Mean	Mean of Maxima	Mean of Minima	Mean oscillation	Month	Pptn. mm.	Days Rain	Days Snow
Jan.	4.7	9.2	—1.2	10.4	Jan.	140	5	3
Feb.	4.7	7.6	0.2	7.4	Feb.	145	7	2
March	6.2	10.0	2.6	7.4	March	210	8	3
April	8.2	12.4	3.0	9.4	April	115	7	1
May	13.2	19.4	6.5	12.9	May	95	7	0
June	17.1	23.2	10.3	12.9	June	50	4	0
July	20.9	28.2	13.3	14.9	July	5	2	0
August	21.8	29.4	13.7	15.7	August	5	1	0
Sept.	16.2	23.7	10.2	13.5	Sept.	55	4	0
Oct.	12.3	16.4	6.7	9.7	Oct.	130	7	0
Nov.	6.8	11.5	2.2	9.3	Nov.	195	9	2
Dec.	4.5	8.5	0.4	8.1	Dec.	145	4	3
					Total	1290	65	14

Fig. 2

PRADO REDONDO

Record of observations 1910—1930

	TEMPERATURE				PRECIPITATION			
Month	Mean	Mean of Maxima	Mean of Minima	Mean oscillation	Month	Pptn. mm.	Days Rain	Days Snow
Jan.	2.4	5.5	0.8	4.7	Jan.	58	4	3
Feb.	4.0	6.3	1.3	5.0	Feb.	102	7	4
March	7.2	9.6	4.4	5.2	March	163	9	2
April	9.2	12.4	5.4	7.0	April	108	7	2
May	12.8	14.2	9.6	4.6	May	112	11	0
June	17.2	19.2	13.2	6.0	June	72	6	0
July	22.6	26.0	17.8	8.2	July	8	2	0
August	23.0	27.2	18.2	9.0	August	12	2	0
Sept.	16.0	19.2	11.3	7.9	Sept.	56	4	0
Oct.	12.2	14.3	8.7	5.6	Oct.	84	7	0
Nov.	6.8	8.8	3.8	5.0	Nov.	125	8	1
Dec.	4.0	5.8	1.9	3.9	Dec.	93	6	4
					Total	993	73	16

Fig. 3

middle zone, and Prado Redondo in the lower zone, as is shown by its lower rainfall (although still considerably higher than that of Jaén). A curious point to be noted is the low temperature in February recorded at Los Collados.

Vegetation

The vegetation of the Sierra de Cazorla may be divided into three main altitudinal zones or „étages" which correspond to some extent with some of those recognized by EMBERGER in his classification of the Mediterranean climate and vegetation based on the use of a pluviothermic quotient (EMBERGER, 1930, 1933).

A. *The Lower zone* (*Humid-temperate-semiarid „étages"*). From 700 to 1300—1400 m. The olive (*Olea europaea*) is frequently cultivated at low altitudes in this zone. The natural and semi-natural vegetation is characterized by *Pinus halepensis* which has its strongest development in this zone, *Juniperus phoenicea*, *Pinus pinaster*, *Quercus ilex* (usually as scrub), *Pistacia lentiscus*, etc. In a particularly humid enclave there is a marked development of *Quercus ilex* scrub with *Pistacia*, *Phillyrea*, *Arbutus unedo*, etc. known as the „maleza".

B. *The Middle* (*montane*) *zone* (*Humid „étage"*). From 1300—1400 to 1700—1800 m. Characterized by the maximum development of *Pinus nigra* forests with *Quercus faginea*, some *Quercus ilex*, *Pinus pinaster*, *Acer opalus* subsp. *granatense*, *A. monspessulanum*, etc. The rupicolous communities in this zone

are very rich and include the following characteristic species, *Viola cazorlensis*, *Ptilotrichum reverchonii*, *P. longicaule*, *Anthyllis ramburei*, *Teucrium rotundifolium*, *Hypericum ericoides*, *Erinus alpinus*, *Sarcocapnos crassifolia*, etc.

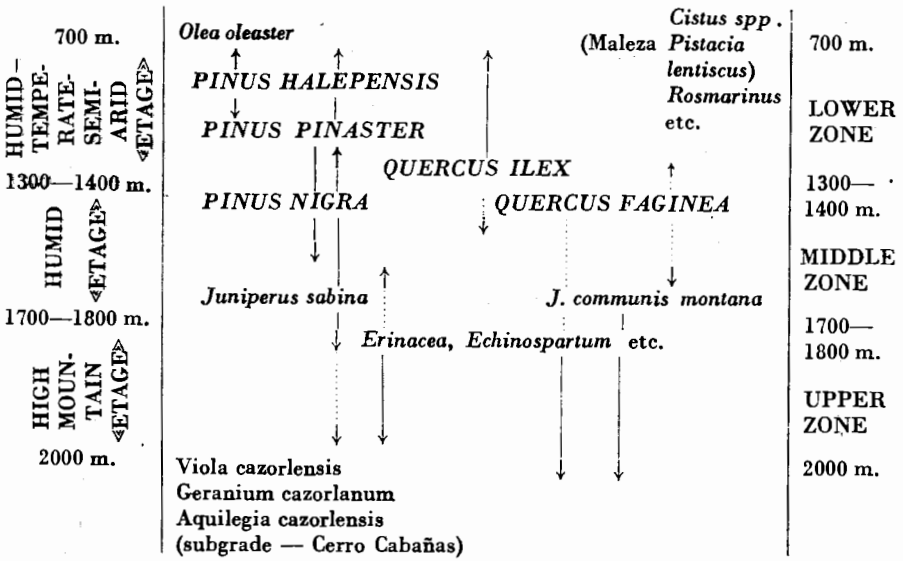
C. *The Upper* (*montane*) *zone* (*Mediterranean High Mountain „étage"*). This zone extends from 1700—1800 to 2100 m. and is characterized by a vegetation of dwarf junipers — *Juniperus sabina* var. *humilis* and *J. communis* subsp. *alpina* — and dwarf spiny chamaephytes such as *Erinacea anthyllis*, *Astragalus sempervirens* subsp., *Ptilotrichum spinosum*, *Echinospartum boissieri*, etc. forming xero-acanthetum communities (CUATRECASAS, 1929). *Pinus nigra* still persists to some extent but with less vigour than in the middle zone, although the shrub layer is better developed.

On the Cerro Cabañas a special subzone is formed at about 2000 m. above the Juniperus-xero-acanthetum communities, marked by saxicolous and scree species such as *Aquilegia cazorlensis*, *Geranium cazorlanum*, etc.

The upper zone of the Sierra de Cazorla agrees well with EMBERGER's Mediterranean High Mountain „étage". It closely resembles also the continental Mediterranean facies of the antealpine grade of vegetation described by RIVAS (1949) from the high limestone mountains of the Macizo Ibérico, Maestrazgo, and Sierra Nevada, characterised by the presence of *Juniperus sabina humilis* and *Astragalus sempervirens*, but without *Erinacea anthyllis*; and with a potential tree climax of *Pinus sylvestris*. In the Sierra de Cazorla this zone has many species in common with this continental Mediterranean facies, as it is developed on Cerro Jabalambre, such as *Ptilotrichum spinosum*, *Erodium trichomanifolium*, *Anemone hepatica*, *Draba hispanica*, *Juniperus sabina humilis* and others, but the corresponding tree climax is *Pinetum nigrae* and *Erinacea* does occur. Peñagolosa in the Maestrazgo, which is lower in altitude than Jabalambre and more continental in character, links up the two types: *Erinacea anthyllis* and *Juniperus communis* are present in the stage in Peñagolosa and the tree climax is *Pinetum nigrae* although at lower levels it is *Pinetum sylvestris*.

Mediterranean High mountain (typical)	Cazorla	Peñagolosa	Jabalambre
	Juniperus sabina humilis J. communis montana	Juniperus communis	Juniperus sabina humilis
Erinacea anthyllis	Erinacea anthyllis	Erinacea anthyllis [Pinus nigra]	[Pinus sylvestris]
[Quercus ilex Pinus nigra	[Pinus nigra]	[Pinus sylvestris]	

The stages which may be delimited in this territory according to the vegetation and climate are shown in the following scheme:



The Principal Tree Communities

1. PINETUM NIGRAE

Pinus nigra is the most important tree species in the territory: it forms dense woods on most types of soil, especially in the Cretaceous zone. Its development is hindered in some areas where there is only a thin and uneven soil layer, especially between 1900 and 2000 m. on the upper slopes of the Cerro de las Empanadas and Cerro Cabañas. The dominance of the black pine in the Sierra, where it forms the climax vegetation in the middle and parts of the upper zone, is explained partly by the peculiar climatic conditions of the region, particularly the high rainfall, which coincide with the ecological characteristics of this essentially sub-Mediterranean species.

2. PINETUM PINASTRI

Today *P. pinaster* is the second in importance of the tree species in the Sierra. It was probably restricted until recent times to calcareous sands or compact limestone in the Jurassic zone but has later extended its area as a result of the regression of *Quercus ilex* and *Q. faginea* in the lower zone and parts of the middle zone. It has great colonizing capabilities once the way has been opened by human intervention (felling, fire, etc.) and its continued presence forming climax communities in the areas corresponding potentially to a climax of *Quercus ilex* is due to more or less permanent anthropogenic action. *P. pinaster* in the Levante region of Spain shows a clear preference for siliceous soils but in Sierra de Cazorla, S. de Segura, S. de Baza, Macizo de Mágina and other southern ranges it is found well developed on calcareous soils. It is less resistent to low temperatures than *P. nigra* and does not grow well in the upper part of the middle zone. The classic zonation of *P. pinaster* at low altitudes replaced by *P. nigra* at higher altitudes is frequently observed in the Sierra de Cazorla.

3. PINETUM HALEPENSIS

Pinus halepensis is of little importance in the vegetation of the region. Its original area, until about a century ago, was at low altitudes in the Triassic zone on dry compact soils of calcareous sand and red clays. Recently its area has been extended and it now grows on chalky and dolomitic soils in the lower zone and in lower parts of the middle zone, although it rarely occurs above 1000 to 1200 m. It is the most xerothermic of the Spanish pine species and is well known for its capacity to invade and replace communities of *Quercus ilex* which have become degraded by anthropogenic factors. Under semi-permanent human influence false climax *Pinus halepensis* communities are maintained; otherwise it is unable to compete with *Quercus ilex*, largely because of its intolerance of the shade given by the oak, *P. halepensis* being extremely heliophilous as well as xerothermic.

4. QUERCETUM ILICIS

In tree form *Quercus ilex* is sparse in the Sierra de Cazorla under present day conditions: the climatic conditions are not suitable for its optimum development and it is largely as a result of felling and fires that it is found in the middle zone. It does however occasionally form mixed communities with *Pinus nigra*, *P. pinaster*, *Quercus faginea*, *Acer monspessulanum*, etc. which remain more or less stable under favourable conditions. On the other hand *Q. ilex* undoubtedly represents the potential climatic climax of the lower zone and it eliminates *Pinus halepensis* and *P. pinaster* under conditions of natural competition. Most of the evergreen oak today is found in subseral communities in a greater or lesser degree of degradation as a result of excessive felling fires, and invasion by the pines. In shrub form it is found in the maleza region as mentioned above and often with *Quercus coccifera*.

5. QUERCUS FAGINEA

Quercus faginea rarely forms distinct communities in the Sierra where its distribution is very limited. Occasional well developed individual trees are to be found scattered throughout the area in other tree communities, particularly in *Pinetum nigrae*, *Quercetum ilicis* and *Quercus-Pinus* associations. It may be considered a relict species in the area today.

The Basis of this study

My first visit to the Sierra de Cazorla was in 1947 in company with Dr. P. L. GIUSEPPI. In 1948 during a collecting expedition to Spain under the aegis of the Royal Horticultural Society of London several weeks were spent in the

area, partly with Dr. P. H. DAVIS. The material collected on these two visits, together with the exsiccata of REVERCHON from the region available in the British national herbaria, formed the basis of a preliminary study.

With many families studied, revealing many problems to be investigated in the field, a further expedition was arranged in 1951 when extensive gatherings were made together with copious notes on the vegetation. Most of the period between September, 1951 and July, 1955 was spent in Spain and further visits were made to the Sierra de Cazorla at all seasons of the year. Many tours were made of the Sierra to study the vegetation. Short additional trips were made in 1956, 1958 and 1959 during expeditions to the neighbouring Sierra de Segura.

Independent investigations were undertaken in the region by Dr. E. FERNÁNDEZ GALIANO in 1956 and 1957 and these are summarized in a joint catalogue published recently (FERNÁNDEZ GALIANO & HEYWOOD, 1960).

Acknowledgments

This work was largely carried out at the Botany School of the University of Cambridge and in the Instituto „Antonio José Cavanilles" of the Consejo Superior de Investigaciones Científicas, Madrid. In addition shorter periods have been spent in the herbaria of the following institutions: — Royal Botanic Gardens, Kew, British Museum (Natural History), London, Royal Botanic Garden, Edinburgh, Facultad de Farmácia, Ciudad Universitaria, Madrid, Instituto Forestal de Investigaciones y Experiencias, Madrid, Instituto Botánico, Barcelona and Facultad de Farmácia, Universidad de Granada. I wish to express my gratitude to the directors of these institutions for the facilities offered me.

I should also like to thank Mr. E. J. H. CORNER (Cambridge), for his stimulating discussion of many problems with me, Professor CHARLES BAEHNI (Geneva) for the loan of BOISSIER types and for help with bibliographical details, Professor E. GUINEA (Madrid), for his enthusiastic support of my investigations and his co-operation in naming the Cistaceae, Professor S. RIVAS GODAY, Director of the Instituto „Cavanilles", Madrid, for his general encouragement, Dr. JOSÉ BORJA (Madrid) for his assistance with some of the basic work and whose knowledge of the flora of Valencia has proved most useful, D. CARLOS VICIOSO for identifying material of *Rosa*, Dra ELENA PAUNERO for assistance with the Gramineae, Mr. J. E. DANDY for the clarification of some points of nomenclature and to Dr. GEORGE TAYLOR for his assistance in many ways. Acknowledgment must be made too of the encouragement and wise advice received from my former teacher, the late Professor Sir W. WRIGHT SMITH.

The following have also assisted me at one time or another with papers or discussion — Drs. J. ARÈNES, B. L. BURTT, P. H. DAVIS, P. FONT QUER, N. Y. SANDWITH, the late A. J. WILMOTT.

I am indebted to the Trustees of the British Museum (Natural History) for the provision of full collecting equipment and a financial grant towards the cost of the field work, the Cory Managers of the University Botanic Garden, Cambridge and the Percy Sladen Memorial Fund for grants; the Carnegie Trust for the Universities of Scotland for a research scholarship for the years 1949—1952; to the Cross Trust for a research grant during the period 1949—1953, and to the Consejo Superior de Investigaciones Cientificas for every assistance during my appointment as Profesor Agregado at the Instituto „Cavanilles" during the period 1952—1955.

I also wish to record the assistance given me by the Spanish Ministry of Agriculture for permission to work in the State Forests of Cazorla and according me Ingeniero's privileges, by the Ingenieros de Montes of the Brigada Forestal de Cazorla who provided me with every facility during my stay, and by the Patrimonio Forestal del Estado for their willing co-operation in my work.

I must add my appreciation of the hospitality afforded me by the State Forest Guards and their families in the sierra, and my gratitude to my guide and inseparable companion in the field, Don JUAN MANUEL GARCÍA.

Critical Systematic Catalogue

In this catalogue I have included all the species of flowering plants and ferns which are known to me to have been found in this territory. It is mainly based on my own collections made in 1948 and 1951—1959, and those of REVERCHON, LACAITA and WILMOTT which I have been able to study.

Each taxon is given with its date of publication. Bibliographic references are given normally for Spanish species only; likewise synonymy and other references are restricted to the Spanish literature unless further details are considered necessary. For each species reference is made to WILLKOMM & LANGE, *Prodromus Florae Hispanicae*, abbreviated as „W. & L." with the volume, page number and date.

The taxonomic categories in this work — species, subspecies, varieties and forms — are employed with essentially the same significance as that given them by ROTHMALER (1944), with the exception that often I have taken a rather wider view of species, preferring the ampler use of subspecies in polymorphic groups.

Full citations of specimens are given as I have found that it frequently detracts from the value of a systematic work if the localities and other data of collection are published in abbreviated form, the exact date of collection or number of a specimen being a valuable aid to checking its authenticity in monographs and similar works.

For most species a short note is given on their general ecology and distribution in the territory, followed by comments on their taxonomy, distribution or nomenclature where pertinent. In the preparation of this study I have had occasion to revise a very large amount of material in the Spanish herbaria, and often, in the case of critical or rare species, I have given a summary of their distribution as worked out from herbarium records. Many critical

studies have been made of the species concerned: these are included in part, others are being published in a separate series of papers (HEYWOOD, 1954, 1960).

The families are arranged, with certain exceptions, according to the system of BENTHAM and HOOKER although the Pteridophyta are placed at the beginning of the sequence. Genera, species and lower units are given in alphabetical order within the families.

A complete set of my 1948 and 1951—1952 collections, including types, is deposited in the Herbarium of the British Museum (Natural History).

The following standard abbreviations of herbaria, as given in Regnum Vegetabile vol. 2 (1952), are employed: —

BC Instituto Botánico de Barcelona
BM British Museum (Natural History)
[BML Strap mounted collection of LACAITA in BM][1])
E Royal Botanic Garden, Edinburgh
K Royal Botanic Gardens, Kew
MA Instituto Antonio José Cavanilles, Jardín Botánico, Madrid
MAF Facultad de Farmácia, Ciudad Universitaria, Madrid.

PTERIDOPHYTA

Equisetaceae

Equisetum ramosissimum DESF. (1799)
Syn. *E. ramosum* SCHL.; W. & L., 1:13 (1861).
Below Casa Forestal Los Rasos, in semi-hydrophytic community at edge of stream, 1180 m., 16 VI 1951, HEYWOOD: 1938; Barranco del Guadalentín, at edge of river, in hydrophytic community, 1200 m., 24 VII 1951, HEYWOOD: 1600; Riogazas, above Cazorla, by stream, 800 m., 17 VI 1955, HEYWOOD: 2020.

Rare, in hydrophytic communities in the lower and middle zones. This species is very polymorphic and the above specimens show a wide range of size and habit.

Pteridaceae

Adiantum capillus-veneris L. (1753); W. & L., 1: 4 (1861).
El Cuevarón, between Garbanzal and Corrasol de la Torre, N-facing 30° inclined limestone cliffs, 1100 m., 13 VII 1951, HEYWOOD: 1246.

Common on moist shaded limestone cliffs and rocks, below overhangs, on walls and floors of caves, in the lower and middle zones.

Pteridium aquilinum (L.) KUHN (1879).
Syn. *Pteris aquilina* L.; WILLK. & LANGE, 1: 4 (1861).
Barranco de Valdeazorillos, in Pinetum nigrae, very frequent, locally dominant in parts, 1100 m., 26 VII 1951, HEYWOOD: 1718.

[1]) This has now been incorporated in the main collections.

Restricted in this territory to a few localities in *Pinetum pinastri* or, very rarely, in *Pinetum nigrae*, in valleys where the soil is largely decalcified or where there is a superficial layer of sandy Triassic soil. It is quite probable that this form which also occurs in the contiguous Sierra de Segura (on frankly calcareous soil) represents a calcium-tolerant ecotype.

Aspidiaceae

Cysopteris fragilis (L.) BERNH. (1806); W. & L., 1: 8 (1861).
Syn. *Cystopteris filix-fragilis* (L.) BORBÁS (1900).
Cerro Cabañas, shady rocks of summit slopes, 1700 m., 1 VII 1948, HEYWOOD: 483 & DAVIS; *ibid.*, shady ledges on limestone boulders, 1900—2000 m., 15 VII 1951, HEYWOOD: 1324, 1325.

Occasional on limestone cliffs and rocks throughout the territory.

Dryopteris villarii (BELL) WOYNAR ex SCHINZ. & THELL.
var. ***nevadensis*** (BOISS.) HEYWOOD
Syn. *Polystichum rigidum* var. *australe* WILLK. in WILLK. & LANGE, 1: 9 (1861), non Ten.
Aspidium nevadense Boiss., Elenchus 93 (1838)
Barranco del Guadalentin, bois humides, 1800 m., rare, Jul., REVERCHON; Sierra de la Cabrilla, REVERCHON (BM).

Previously only known from Sierra Nevada (prov. Granada).

Polystichum lonchitis (L.) ROTH. (1799).
Syn. *Aspidium lonchitis* Sw.; W. & L., 1: 10 (1861).
Cerro Cabañas, summit slopes, in shady hollows and crevices of limestone boulder slopes, rare, 2000 m., 15 VII 1951; HEYWOOD: 1718.

Seen only in the above locality. *P. lonchitis* is widely distributed in north Spain but in the south it has been collected only in Sierra Nevada (prov. Granada) and in this new locality in the province of Jaén.

Aspleniaceae

Asplenium ruta-muraria L. (1753); W. & L., 1: 7 (1861).
Rare, in shady limestone rocks and cliffs.

Asplenium scolopendrium L. (1753).
Syn. *Phyllitis scolopendrium* (L.) NEWM. (1844)
Scolopendrium officinale DC.; W. & L., 1: 5 (1861).

Extremely rare in this territory where it is much prized for its medical properties. The only habitat known to me is the Pena de Jaén but no specimens were collected.

Asplenium trichomanes L., (1753); W. & L., 1: 6 (1861).
Tranco de la Rubia, near Leganillo, 1250 m., 11 VII 1951, HEYWOOD: 1152b; Vertientes de Gilillo, Cueva del Rincon, on shady limestone rocks in cave,

1400 m., 12 VII 1951, HEYWOOD: 1214; Cueva de los Encantados, above La Nava de San Pedro, on walls of cave, 1400 m., 23 VII 1951, HEYWOOD: 1572; Cueva del Filo, near la Nava de San Pedro, on W. exposure shaded limestone cliffs, 1200 m., 1 VIII 1951, HEYWOOD: 1881; Cueva de las Iglesias, Barranco de las Iglesias, on damp shady limestone rocks in centre of N-facing cave with *Aquilegia vulgaris* var. *hispanica*, 1300 m., 7 VIII 1951, HEYWOOD: 1918.

Frequent on damp and shaded limestone rocks and cliffs, often in caves, in the lower and middle zones.

Ceterach officinarum DC.; W. & L., 1: 2 (1861).
La Cimbre, above Nava de San Pedro, in crevices on SW-facing cliffs, 1400 m., 23 VII 1951, HEYWOOD: 1551, 1552.

Occasional on limestone rocks and cliffs.

Polypodiaceae

Polypodium vulgare L. subsp. ***serrulatum*** ARCANG.
Syn. *Polypodium serratum* (WILLD.) SAUT.; *Polypodium australe* FÉE; *P. canariense* WILLD.
On cliffs, very rare.

GYMNOSPERMAE

Gnetaceae

Ephedra nebrodensis TINEO (1844).
Syn. *E. scoparia* LANGE, Pugillus II: 83 (1861) et Descr. Pl. Nov. 19, *t.32* (1864); W. & L., 1: 24 (1861)

Los Choriadores de la Nava del Asno, in lst outcrops, SSE exposure, dominant or with *Prunus prostrata*, 1800 m., 27 VII 1951, HEYWOOD: 1628.

Very rare and localised to a few isolated localities. It is greatly prized for its medicinal properties, this probably explaining its present day semi-extinction.

Pinaceae

Pinus nigra ARN. (1785).
subsp. ***salzmannii*** (DUNAL) NOVAK ex FUKAREK (1958)
Syn. *P. clusiana* CLEMENTE in ARIAS, Adiciones Agric. Gen. Herrera ed. 1818 2 (3): 404 (1818)
P. nigra subsp. *salzmannii* (DUNAL/RICHT.) FONT QUER, Collect. Bot. Barcinon. 1(2): 272 (1947)

var. ***latisquama*** (WILLK.) HEYWOOD.
Syn. *P. laricio* var. *latisquama* WILLK. in W. & L., 1: 18 (1861).
Barranco de las Palomas, below C. F. Fuente del Pino, E. slopes in valley, 1300 m., 14 VII 1951, HEYWOOD: 1307, et loc. plur.

P. nigra subsp. *salzmannii* is the most important tree species in this territory, forming extensive forests in the middle and upper zones, with an altitudinal range of 1200—2000 m.

The taxonomy and nomenclature of this species is discussed by HEYWOOD (1961 in prep.)

Pinus halepensis MILLER, (1768); W. & L., 1: 19 (1861).
El Tranco de la Mahaceituna, W. slopes, nr. Realego, 1100 m., 13 VII 1951, HEYWOOD: 1275 et loc, plur.

P. halepensis is the least widespread of the Pine species in this territory. It is confined to low altitudes almost without exception, on dry compact soils derived from the red clays and sandstone of the Triassic zone. Above 1000—1100 m. it is very sparse and of little importance ecologically.

Pinus pinea L., (1753); W. & L., 1: 20 (1861).

Only sporadic individuals have been found near zones of reafforestation. Not native.

Pinus pinaster SOLANDER in AITON (1789); W. & L., 1: 19 (1861).
Syn. *P. maritima* auct. *non* MILLER (1768) — *nom. ambig. et confus.*
Slopes above C. F. Fuente de la Zarza, in sparse community of *P. pinaster* and *Quercus ilex* with regeneration of Pines, young tree, 1250 m., 28 VII 1951, HEYWOOD: 1788.

P. pinaster is much less frequent than *P. clusiana* in this territory but occasionally forms quite extensive forests at lower levels than the other species. It grows in the lower and middle zones but rarely extends beyond 13—1400 m. It is generally confined to superficial sandy soils of the Jurassic zone and its presence in this territory on soils containing Ca, as in other parts of Spain, is probably due to the existence of a special edaphic race.

Cupressaceae

Juniperus communis L. (1753); W. & L., 1: 22 (1861).
subsp. ***alpina*** (GRAY) ČELAK. (1867)
Syn. *J. alpina* S. F. GRAY (1821)
J. communis subsp. *nana* [WILLD.] SYME (1868)

Barranco del Teatino, nr. C. F. Cañada de las Fuentes, NW aspects of valley in *Pinetum clusianae*, 1500 m., 16 VII 1951, HEYWOOD: 1362; slopes of Cerro del Buitre on way to Cerro Cabañas, in xeroacanthetum formation, 1800., 15 VII 1951, HEYWOOD: 1314; S. de Cazorla, Cuerda de las Moras, W. slopes in *Lavanduletum latifoliae*, lst. dry sandy soil and screes, 1500 m., 21 VI I1951, HEYWOOD: 1466.

Characteristic of the upper zone where it reaches its greatest development on the summit slopes of the highest peaks (Cerro Cabañas, Empanadas, etc.) and in xero-acanthetum formations in the numerous navas, between 1700 and 2000 m. It also descends to the middle zone where there are compensating

habitat factors operative, as in the Cuerda de las Moras where it grows with *Buxus sempervirens* on open limestone and chalky slopes, both species obviously relicts of a more humid epoch, and their presence today in such a superficially xeric habitat is probably explained by abundant underground water supply. Another type of habitat of compensation in the middle zone is valley *Pinetum* with abundant humidity and moisture, on N or NW slopes, as in the Barranco del Teatino cited above. *J. communis* subsp. *alpina* is typically a boreal plant of high mountains characterising the subalpine grade of vegetation in more northern Europe. In this territory as in the Macizo de Mágina, it typifies an equivalent high mountain grade of vegetation.

Juniperus oxycedrus L. (1753); W. & L., 1: 22 (1861)
var. ***rufescens*** (LINK) LAGUNA, Fl. Forest. 1 (1): 100 (1883)
Syn. *J. rufescens* LINK, Sitz. Ges. Nat. Berlin (1845) n. v. et in Flora 24: 579 (1846)
J. oxycedrus subsp. *rufescens* (LINK) DEB. (1894)

Cerrado de Palomeque, nr. El Chorro, SSW-facing lst. cliffs of gorge, few bushes at top, 1200 m., 11 VII 1951, HEYWOOD: 1193; above C. F. Realejo, Collado de Terreno, in open parts of *Pinetum halepensis*, 15—20% cover, S exp. 30° slopes, 1100 m., 14 VII 1951, HEYWOOD: 1281; Barranco del Teatino, nr. C. F. Canada de las Fuentes, NW aspects of valley in *Pinetum clusianae*, 1500 m., 16 VII 1951, HEYWOOD: 1364; nr. C. F. La Yedra, Llano de los Molinillos, in maleza formation with *Pinus pinaster*, W exp. 25° slope, 1100 m., 3 VIII 1951, HEYWOOD: 1887; Collado de Roblehermoso, above Barranco de Agracea, in maleza formation of *Quercus ilex*, *Q. lusitanica*, *Arbutus unedo* etc., 1200 m., 7 VIII 1951, HEYWOOD: 1932, 1933, 1934.

This species is widespread in the territory in the lower and middle zones, generally in more or less sunny exposures in *Pinetum halepensis*, *P. pinastris* and to a lesser extent, although by no means uncommon, in *Pinetum clusianae*; it is also very frequent in the maleza formations in the region of Guadahornillos with *Pistacia terebinthus*, *P. lentiscus*, *Juniperus phoenicea*, *Phillyrea* subsp., *Quercus ilex*, *Q. coccifera* etc. It is an excellent indicator of thermophilous vegetation and is ecologically similar in behaviour to *J. phoenicea* although more frost resistant.

Juniperus phoenicea L. (1753); W. & L., 1: 21 (1861)

Nr. C. F. Los Carboneros, Corrasol de la Torre, N slopes of valley with *Echinospartum boissieri*, *Erinacea anthyllis*, *Rosmarinus officinalis* etc., 1200 m., 13 VII 1951, HEYWOOD: 1273; S slopes above Puntal de Balbero, beyond C. F. Fuente del Pino, in *Rosmarinus officinalis* facies of *Pinetum clusianae*, large tree-like bushes, 1600 m., 14 VII 1951, HEYWOOD: 1308; Barranco del Teatino, above C. F. Canada de las Fuentes, NW aspects of valley in *Pinetum clusianae*, 1500 m., 16 VII 1951, HEYWOOD: 1363; between La Fresnedilla and La Torre del Vinagre, Barranco de Cabricuerna, in maleza

of *Quercus ilex*, *Pistacia terebinthus*, *Arbutus unedo*, etc., in fruit, bushes up to 3 m. tall, 900 m., 27 VII 1951, HEYWOOD: 1728.

Widespread in the lower and middle zones but because of its poorer frost resistance than *J. oxycedrus* it is more frequent at low altitudes in sunny exposures, mainly in *Pinetum halepensis*, *P. pinastris*, *Quercetum ilicis*. Its ecological optimum is attained in the maleza formations of *Quercus ilex*, *Pinus halepensis*, *Pistacia terebinthus*, *P. lentiscus*, *Phillyrea media*, etc. in the region of Guadahornillos.

Juniperus sabina L. (1753); W. & L., 1: 21 (1861)
var. ***humilis*** HOOK. (1840); ENDLICHER (1847)
Syn. *J. horizontalis* MOENCH (1794)

La Nava de San Pablo, in *Pinetum clusianae*, spreading bushes, 1600 m., 25 VII 1951, HEYWOOD: 1642; nr. C. F. Gualay, in *Pinetum clusianae*, 1500 m., 16 VII 1951, HEYWOOD: 1365.

Like *J. communis* subsp. *alpina*, a characteristic species of the upper zone of vegetation, found generally above 1600 m. although descending occasionally to lower levels. In the region of Las Empanadas and Cerro Cabañas, both species grow together on the slopes of the highest peaks and in xero-acanthetum-*Juniperus* associes at altitudes of 1700—1900 m. Ecologically the two taxa are distinct: *J. sabina* var. *humilis* shows preferences for a more or less xerothermic continental type of climate, whereas *J. communis* subsp. *alpina* favours a more humid, cooler continental type.

Taxaceae

Taxus baccata L. (1753); W. & L., 1: 23 (1861)

Barranco de las Iglesias, in E-facing exposed lst. cliffs with *Quercus ilex*, *Hedera helix*, *Acer opalus granatense*, small tree, 1300 m., 7 VIII 1951, HEYWOOD: 1908; nr. C. F. Fuente del Pino, Collado de Tabino, 14 VI 1951, SANTIAGO in HEYWOOD: 1309; in valley below Collado de Roblehermoso, Junta del Barranco de Agracea and Arroyo de la Charca, freq., 1300 m., 7 VIII 1951, HEYWOOD *vidit*; lst. slopes nr. Laguna de Valdeazorillos, in *Pinetum clusianae*, v. rare, 26 VII 1951, HEYWOOD *vidit*.

In this territory *Taxus baccata* has a very fragmented distribution, generally rare in any given locality, with the exception of the valley formed by the junction of the Barranco de Agracea and Arroyo de la Charca where it is greatly abdundant, probably due to a combination of factors — low altitude, humidity, microclimate. It is surprisingly rare in cliffs at high altitudes in cool protected situations as in the Macizo de Mágina.

ANGIOSPERMAE

Ranunculaceae

Adonis flammea JACQ. (1776); W. & L., 3: 945 (1880)

S. de la Maleza, dans les moissons, sur le calcaire, 1500 m., Jun. 1904, REVERCHON: 1373 [MA]; Environs of C. F. El Chorro, at edge of *Pinus pinaster*

plantation, fl. scarlet, fl. ?fr., 1400 m., 10 VII 1951, HEYWOOD: 1110; Las Pinareas, in grassy patches, fl. red., rare, 1400 m., 17 VII 1951, HEYWOOD: 1435.

Occasional in damp parts of *Pinetum*, in lower and middle zones.

Adonis baetica Coss., Not. Pl. Crit. 25 (1849); W. & L., 3: 944 (1880)
Le Pozo, moissons sur le calcaire, 1500 m., Jun. 1905, REVERCHON: 1105 [MA]; Barranco del Guadalentin, les moissons calcaires, 1600 m., Jun. 1904, REVERCHON: s. n. [MA].

In the same situations as *A. flammea* but less frequent.

No. 1105 is determined doubtfully but the upper margins of the achenes are 1-toothed not 2-toothed as in *A. annua* which it closely resembles, and the beak is recurved not erect.

Anemone palmata L. (1753); W. & L., 3: 950 (1880)
Sierra de Cazorla, valley of La Hoz, nr. Arroyo de Riogazas, damp. lst. outerop slopes, 950 m., 23 V 1952, HEYWOOD: 1944.

Rare primaveral species in this territory, found in a few localities in the lower zone with abundant moisture.

Aquilegia cazorlensis HEYWOOD, in Bull. Brit. Mus. (Nat. Hist.) Bot. 1 No. 4: 84 (1954)
Pico de Cerro Cabañas, shady lst. slopes by the arch, flowers resembling *A. vulgaris*, 2000 m., 1 VII 1948, HEYWOOD: 432 & DAVIS (*holotypus* in Heb. Mus. Brit.)

Endemic to the Pico de Cabañas where it forms a small colony in the shady limestone slopes nearby the arch at the summit. Details of its relationships are given in Heywood (1954).

Aquilegia vulagaris L., Sp. Pl. ed. 1, 533 (1753)
subsp. ***hispanica*** (WILLK.) HEYWOOD, *comb. nov.*
Syn. *A. vulgaris* var. *hispanica* WILLK. in W. & L., Prodr. Fl. Hisp. 3: 965 (1880)
A. hispanica BORBAS in Magyar Tudom. Akad. 12: 10 (1882)
A. vulgaris auct. hisp. non L.
A. viscosa vel. *A. vulgaris* var. *viscosa* auct. non GOUAN
[*A. lucida* PAU, Cartas No. 2 p.4: 1905]

Barranco del Guadalentin, shady places by stream, very viscid, 1300 m., 26 VI 1948, HEYWOOD: 138 & DAVIS; *ibid.*, REVERCHON: 669 [E]; Cueva de las Iglesias, Barranco de las Iglesias, inclined damp lst. and tufa floors of N-facing cave, on rocks in centre of cave, and in mesophytic community below, associated with *Pinguicula vallisneriifolia*, in fruit, 1300 m., 7 VIII 1951, HEYWOOD: 1919.

Occasional in damp habitats, in ripicolous communities in lower and middle zones. *A viscosa* GOUAN is not a synonym of *A. vulgaris* subsp. *hispanica* as often stated (cf. EMBERGER & MAIRE, 1941 p. 991). EMBERGER & MAIRE replaced „var. *viscosa* (GOUAN) COSS." in North Africa by var. *cossoniana*. It seems that *viscosa* is confined to South France, *hispanica* to Spain, and *cossoniana* to North Africa (and Spain ?), but a fuller study is required. Subsp. *hispanica* contains numerous minor variants, one of which was described by PAU as *A. lucida* with the following description: „Tallos verdes, ligeramente puberulentos, viscosos; hojas máximas, *lúcidas* en el haz, glaucescentes en el envés; foliculos *cortos*, soldados únicamente en su tercio inferior y arqueados hacia fuera", but does not deserve recognition unless as a form with short follicles and shining leaves.

Clematis flammula L. (1753); W. & L., 3: 953 (1880)
Cueva del Polvo, near C. F. Fte. de la Zarza, at edge of *Pinetum pinastri* creeping on banks by pathside, flowers white, 950 m., 28 VII 1951, HEYWOOD: 1763.

Occasional in *Quercus* scrub, at edge of *Pinetum*, pathsides, near streams, etc. in lower and middle zones.

Clematis vitalba L. (1753); W. & L., 3: 953 (1880)
Barranco del Guadalentin, in open parts of *Pinetum*, 30 VI 1948, HEYWOOD: 407 & DAVIS; slopes below Leganillos, in valley community of *Quercus ilex*, *Q. coccifera*, *Crataegus monogyna*, *Berberis vulgaris australis*, *Rubus*, *Thymus*, *Lavandula* etc., in flower, growing through *Crataegus* 1170 m., 11 VII 1951, HEYWOOD: 1170; Barranco del Guadalentin, in *Pinus-Quercus* community with *Berberis vulgaris*, *Rubus* sp., 1100 m., 24 VII 1951, HEYWOOD: 1584; Torcales del Collado de Pedrocerillo, on lst. pinnacles, SE exposure, 1500 m., 1 VIII 1951, HEYWOOD: 1831.

Widespread though not frequent, in *Quercus* scrub, open parts of *Pinetum*, hedgerows, riverbanks etc. in middle and lower zone.

Delphinium halteratum SM. (1809)
subsp. ***gracile*** (DC.) ROTHM. & P. SILVA
Syn. *D. peregrinum* var. *gracile* (DC.) SENNEN & PAU [in SENNEN pl. exs. Nos. 618, 5203] ex PAU, Nuev. Contr. Fl. Granada 81 (1922).
D. peregrinum sensu WILLK. in W. & L. 3: 970 (1880) p. max. pte.
D. cardiopetalum var. *gracile* WILLK., l. c. *quoad nomen tantum.*

Agujeros de San Pedro, lst. rocks, fl. violet-purple, occasional, forming local societies, 1300 m., 11 VIII 1948, HEYWOOD: 959; slopes below Cortada del Haza, on sandy lst. slopes and loose lst. chips, fl. bright blue, 1200 m., 26 VII 1951, HEYWOOD: 1678; Sierra de Cazorla, near La Iruela, dry lst. rocky slopes, 900 m., IV 1952, HEYWOOD: 2001.

Quite rare on limestone rocks and slopes in lower and middle zones.

Ranunculus ficaria L. (1753)
Syn. *Ficaria verna* HUDS.
var. ***degeni*** (HERV.) HEYWOOD

Syn. *Ficaria degeni* HERV. [in litt. 1904] in Bull. Acad. Int. Géogr. Bot. 15: 28 (1905)
Ficaria ranunculoides f. *degeni* (HERV.) CUATR., Estud. Fl. Mágina 281 (1929).
Ranunculus ficaria f. *degeni* PAU, [Cartas No. 3 p. 1: 1906] ex CUATRECASAS l. c. *in syn.*
Ficaria calthaefolia var. *intermedia* DEB. et REV. [in pl. exs. no. 1131 anno 1902] ex HERVIER l. c. *in obs.*

Le Pozo, lieux humides et herbeux, sur le calcaire, 1600 m., rare V 1905, REVERCHON: 1331 [MA]; Barranco del Guadalentin, lieux humides, sur le calcaire, rare, 1800 m., VI 1904, REVERCHON: 1331 [MA]; Le Pozo, lieux humides et herbeux, calc. 2000 m., V. 1905, REVERCHON: s.n. [MA]; Sierra de Cazorls, damp ground in valley of La Hoz, above the town, near a spring, very abundant, 900 m., III 1952, HEYWOOD: 2002.

Occasional in damp habitats throughout the territory, and according to REVERCHON's gatherings ascending to the upper zone.

See Heywood (1961 in prep.) for a discussion of this taxon.

Helleborus foetidus L. (1753); W. & L. 3: 962 (1880)

Barranco de la Garganta, near C. F. N. de San Pedro, in *Pinetum clusianae* in fruit, 1250 m., 25 VI 1948, HEYWOOD: 124 & DAVIS.

Occasional in *Pinetum clusianae*, apparently a relict of a previous more mesophytic climax association in this area.

Hepatica nobilis MILLER (1768)
var. ***hispanica*** (WILLK,) G. BECK (1896)

Syn. *Anemone hepatica* var. *hispanica* WILLK. in W. & L., 3: 947 (1880); Ulbrich in Engl. Bot. Jahrb. 37: 270 (1906)
Anemone hepatica auct. hisp. non L.

Limestone rocks opposite the pinnacles of Los Organos, 27 VI 1948, HEYWOOD: 257 & DAVIS; Sierra de Cazorla in rupibus umbrosis, al Poyo Cerezo, 15 VI 1928, LACAITA: 452 [BML]; Barranco de Poyo Cerezo, 1st. N. cliffs, 1550 m., 26 VII 1951, HEYWOOD: 1688.

Confined to shady limestone cliffs in the region of Los Organos-Poyo Cerezo. These specimens, although they do not possess mature fruits, agree well with WILLKOMM's description. They are, I believe, new records for the province of Jaén.

Paeonia broteroi BOISS. & REUT., Diagn. Pl. Hisp. 4 (1842); W. & L., 3: 975 (1880); ROTHMALER in Feddes Repert. 49: 176 (1940); STERN, *Study*, p. 86 (1946).

Syn. *Paeonia lusitanica* auct. non MILLER sive *P. lusitanica* MILL. (1768) *nomen dubium*
P. mascula var. *lusitanica* PAU Cartas no. 3 p. 1: 1906 ex CUATREC. Estud. Fl. Mágina 276 (1929) *in syn.*

Below and near N. de S. Pablo, in *Pinetum clusianae*, stems reddish, leaves, more or less glossey, in fruit, 26 VI 1948, HEYWOOD: 164 & DAVIS; Nr. N. de San Pablo, below Poyos de la Carilarga, open aspects of *Pinetum clusianae*, 1500 m., 28 VI 1948, HEYWOOD: 334 & DAVIS; Le Pozo lieux arides, sur le calcaire, 1500 m., VI 1905, REVERCHON: 539 [MA]; Near Cortada de El Chorro, on way to Leganillos, edge of *Pinetum*, frequent but localised, in fruit, 1250 m., 11 VII 1951, HEYWOOD: 1135; Poyo Bajo, in *Pinetum clusianae* repopulation with *Quercus ilex*, 1200 m., 11 VII 1951, HEYWOOD: 1175; S. de Cazorla, vertientes de Gilillo, NNW slopes in *Lavandula latifolia* and *Thymus mastychina-T. hiemalis* communities, 1500 m., 12 VII 1951, HEYWOOD: 1197; *ibid.*, at base of NNE rocks, slopes, sandy soil, 1st. substrate, 1400 m., 12 VII 1951, HEYWOOD: 1202; Cuerda de las Moras, Cueva de los Zamoros, on 1st. rocky slopes, 1500 m., 21 VII 1951, HEYWOOD: 1485; Sollana del Arroyo Mallar, in *Pinetum pinastri*, infrequent, 1400 m., 22 VII 1951, HEYWOOD: 1503; slopers above Cerrado de Tejo near N. de San Pedro, in dense aspects of *Pinetum clusianae*, vegetative, 1250 m., 23 VII 1951, HEYWOOD: 1537; Barranco de Valdeazorillos, in *Pinetum clusianae*, sandy 1st. slopes, vegetative, rare, 1200 m., 26 VII 1951, HEYWOOD: 1696; Rastrillo de los Covarones, 1st rocky slopes in *Pinetum pinastri*, 1400 m., 28 VII 1951, HEYWOOD: 1801.

Widespread in the middle zone in forests of *Pinus clusiana* and *P. pinaster*, or rarely in mixed *Quercus-Pinus* communities.

Paeonia humilis RETZ. (1783); ROTHMALER l. c., STERN, *op. cit.* p. 104

Syn. *Paeonia microcarpa* BOISS. & REUT., Pugillus 3 (1852).
Paeonia paradoxa var. *leiocarpa* DC., Prodr. 1: 66 (1824)
Paeonia peregrina var. *leiocarpa* COSS., Not. Pl. Crit. II: 93 (1851); W. & L., 3: 975 (1880)

High pastures of Las Empanadas, S. de la Cabrilla, 16 VI 1928, LACAITA: 463 [BML]; S. de Cazorla, by infant Guadalquivir, c. 1500 m., growing with *P. lusitanica* [*P. broteri*], 31 V 1928, LACAITA: 326 [BML]; S. de la Gabriella, CUATRECASAS [BC]; S. de la Maleza REVERCHON, n. v.

Rare, in the middle and upper zones.

Ranunculus aleae WILLK., Pugillus Pl. Nov. in Linnea 30: 84 (1859); FREYN in W. & L., 3: 931 (1880)

Cazorla, pelouses fraiches, sur le calcaire, 1200 m., mai, 1901, REVERCHON: 674 [BM]; Cerro Gilillo, environs de la Fte. del Tejo, GANDOGER n. v.

Although the plants collected by REVERCHON agree in some respects more with *R. broteri* Freyn (receptacle intermediate in shape between elliptical and ovate-conical, peduncles slightly sulcate from the base) and the leaves are not quite typical of any examples of *R. aleae* which I have seen but approach the *broteri* type, on the whole they seem to fit better into *R. aleae*. The plants are low growing with thick fleshy roots coming from the more or less bulbous base of the stems, many-stemmed, peduncles 1—2 flowered, thick, leaves

variable, orbicular-ovate or orbicular-pentagonal, trisect, each segment being obtusely or acutely dentate. *Carpels c. 50 terminated by a recurved beak.*

Ranunculus escurialensis BOISS. & REUT. ex FREYN in W. & L., 3: 922 (1880)

forma „an species propia? Folia glabra crassa, 3-lobata, caulis petiolique sparse pilosi, spica fructifera globosa parva tuberi sphaerici carnosi" GANDOGER in Bull. Soc. Bot. France 52: 453 (1905)

Sierra de Cazorla, Cerro Jilio [Gilillo] environs de la Fte. del Tejo et de la vallée alpine que va de ce point au sud vers le Cerro Jilio [Gilillo]. Versus cacumen. GANDOGER, n. v.

I have not seen this collection but it possibly treats of *R. malessanus* DEG. & HERV., q. v.

Ranunculus paludosus POIR.

Syn. ***R. flabellatus*** DESF. (1798) FREYN in W. & L., 3: 923 (1880)

var. **aff. *mollis*** (FREYN) et ***nevadensis*** (FREYN)

Le Poso, lieux arides et calcaires, 1500 m., mai 1905, REVERCHON: 1339 ut var. *ovatus* [BML].

See HEYWOOD (1954).

Ranunculus gramineus L. (1753); FREYN in W. & L., 3: 917 (1880).

Sierra de Cazorla, above Cazorla, rocks near Puerto de Jilillo, 15 VI 1927, WILMOTT, s. n. [BM]; Sierra de Cazorla, Solleno de Prado Redondo, damp hollows, 950 m., 2 V 1952, GARCIA in HEYWOOD: 1967.

Rare. Typical specimens.

Ranunculus granatensis BOISS., Diagn. Ser. 2 (1): 8 (1853)

Syn. *R. acris* auct. hisp. maj. part. teste FREYN; non L.
R. steveni sensu FREYN in W. & L., 3: 938 (1880), et auct. hisp. non ANDRZ. (1822)

Barranco del Guadalentin, creeping horizontal rootstock, perennial, 26 VI 1948. HEYWOOD: 237 & DAVIS; Sierra de Cazorla, banks of Aguas Negras, 15 VI 1928, LACAITA: 458 [BML].

Occasional in damp habitats, near streams etc.

Ranunculus malessanus DEGEN & HERVIER apud HERVIER in Bull. Acad. Int. Géogr. Bot. 16: 222 (1906); HEYWOOD in Brit. Mus. Bull. (Nat. Hist.) Bot. 1, 4: 87 (1954).

Sierra de la Cabrilla. lieux fraiches ombragés, et forets de pin, 1700—2000 m., mai-juin, REVERCHON: 1317 (cotypus); S. de Cazorla, rocks near headwaters of Guadalquivir, 31 V 1929, LACAITA: 327 [BM, BML].

Occasional in damp ground and rocks.

Ranunculus repens L. (1753); FREYN in W. & L., 3: 933 (1880).

Common in damp meadows, ripicolous communities and, less frequently, in damp forests.

Thalictrum minus L. (1753) *sensu lato*; W. & L., 3: 956 (1880).

Slopes of La Verezera, above Cazorla, in dampish graminetum, in fruit, 1200 m., 17 VII 1951, HEYWOOD: 1410.

Very rare in this area is in the Macizo de Mágina. The Spanish races of *T. minus* have not been studied.

Thalictrum flavum L.

subsp. ***glaucum*** (DESF.) BATTAND., Fl. Algérie, Dicot. 4 (1888)

Syn. *T. speciosissimum* L. ex LOEFL., Iter. Hisp. 303 (1758).
T. flavum [var.]. *speciosum* L. (1753)
T. glaucum DESF., [123 (1804), nom. nud.] ed. 2: 146 (1815)

Barranco del Guadalentin, lieux humides sur le calcaire, 1500 m., VII 1904, REVERCHON: 471 [MA]; *ibid.*, by the river, 26 VI 1948, HEYWOOD: 190 & DAVIS; Spring at Cueva del Puerco, Sierra de Cazorla, inclined slopes of slimy tufa flowing with water, 1070 m., 6 VII 1951, HEYWOOD: 1038.

Widespread and common in ripicolous communities in lower and middle zones. *T. speciosissimum* is currently regarded as a distinct species from *T. flavum* which it replaces in Portugal, Spain and North Africa (Algeria).

Berberidaceae

Berberis vulgaris L. (1753); W. & L. 3: 901

Barranco del Guadalentin, in *Pinus clusiana*, *Acer opalus*, *Quercus ilex-lusitanica* community, 1150 m., 24 VII 1951, HEYWOOD: 1590.

Occasional in *Pinus* and *Quercus* communities in more or less dampish situations. It appears to be much less common than subsp. *australis* (but see below).

subsp. ***australis*** (BOISS.) HEYWOOD

Syn. *Berberis vulgaris* var. *australis* BOISS., Voy. Bot. Esp. 2: 15 (1839)
Berberis hispanica BOISS. & REUT., Pugillus 3 (1852); W. & L., 3: 901 (1880) Distribution: Spain, mainly Centre and South; North Africa.

See Heywood (1961 in prep.)

In this territory I have noted only typical *B. vulgaris* and an intermediate form (see below) which is more widespread.

Forma racemis multifloris longius stipitatis fasiculos foliorum excedentibus (ut in subsp. *vulgare*), foliis spinis longioribus, stigmatibus stipitatis. A subsp. *vulgare* differt stigmatibus stipitatis, foliis minoribus. Forsan *B. vulgaris* subsp. *vulgaris* × subsp. *australis*.

? *Berberis hispanica* f. latifolia dentata GANDOGER in Bull. Soc. Bot. France 453 (1905).

Slopes above Gualay, in *Pinetum clusianae*, in fruit, frequent, large bushes, 1300 m., 16 VII 1951, HEYWOOD: 1382; between N. de San Pedro and Puntal de Ana Mario, pathside, in fruit, 30 VI 1948, HEYWOOD: 383 & DAVIS: Near C. F. N. de San Pablo, on way to Los Organos, in *Quercetum ilicis* scrub, 24 VI 1948, HEYWOOD: 247 & Davis.

The above gatherings are intermediate between subsp. *vulgaris* and subsp. *australis*, and probably are of hybrid origin. The stigmas are stipitate as in subsp. *australis* and the leaves also agree in size with that subspecies, but the racemes are longly stalked and many-flowered, longer than the fascicules of leaves, as in subsp. *vulgaris*.

Papaveraceae

Papaver dubium L. (1753); W. & L., 3: 872 (1880); Fedde, *Papaveraceae-Papaveroideae* in Engler, Pflanzenr. *VI. 104*: 313 (1909)
var. ***subbipinnatifidum*** (O. KTZE.) FEDDE, *op. cit.* P. 316
Syn. *P. rhoeas* var. *dubium* 4. *subbipinnatifidum* O. KTZE. (1887)
P. tenue BALL (1873)

Sierra de Cazorla, W slopes on approaches to Santuario de la Virgen de la Cabeza above Cazorla, 1st. rocky slopes, 950 m., 21 V. 1952, HEYWOOD: 1990.

P. dubium, in various forms, is quite frequent on the lower slopes of the outer eastern zone. It is also common as a weed.

Papaver rhoeas L. (1753); W. & L., 3: 872 (1880); FEDDE, *op. cit.* p. 293
Sierra de Cazorla, path between La Iruela-Cazorla road and Cuerda de las Moras, fl. light red, 1000 m., 4 VII 1948, HEYWOOD: 573 & DAVIS: Barranco de Valdeazorillos, slopes of *Pinetum clusianae* on damp ground, fl. large carmine, 1300 m., 26 VII 1951, HEYWOOD: 1705.

Occasional in the lower and middle zones in waste places, pathsides or, more rarely, in Pine woods.

? ***Papaver rhoeas*** × ***dubium*** var. ***minus***, *hybr. nov.*
Sierra de Cazorla, path between La Iruela-Cazorla road and Cuerda de las Moras, fl. light red, more hispid than No. 573 [*P. rhoeas*], 1000 m., 4 VII 1948, HEYWOOD: 576 & DAVIS.

The above collection contains four indumentum types:

(a) the setae all spreading
(b) the setae spreading at the base, those of the peduncles adpressed
(c) the setae spreading at the base, those of the peduncles spreading at the base, subadpressed higher up
(d) the setae spreading at the base, those of the peduncles more or less adpressed

(a) is very similar to *P. rhoeas*; (b), (c) and (d) resemble *P. roubiaei* VIG. from the south of France although they are by no means identical. Other affinities suggested are *P. subadpressiusculosetosum* FEDDE, *P. schweinfurthii* FEDDE and *P. exspectatum* FEDDE (*P. dubium*×*rhoeas* ?). (b) in addition agrees to some with *P. dubium* var. *minus* LANGE but I have not been able to see material of it. If this assumption is correct, however, the population would be the result of hybridization between *P. rhoeas* and *P. dubium* var. *minus*.

Fumariaceae

Fumaria macrosepala BOISS., Elenchus 8 (1838); W. & L., 3: 880 (1880)
Syn. *F. megasepala* PAU in Mem. R. Soc. Esp. Hist. Nat. 12: 275 (1924)
var. ***obscura*** PUGSLEY in Journ. Linn. Soc. Botany 47: 439 (1927); *op. cit.* 49: 520 (1934) — FONT QUER in Cavanillesia, 6: 23 (1933).
Barranco de la Garganta, nr. C. F. La Nava de San Pedro, in *Pinetum clusianae*, fl. white with maroon tips, 1300 m., 25 VI 1948, HEYWOOD: 160 & DAVIS.

Rare in this territory, in Pine woods.

A discussion of this variety which is confined in Spain to the Betic Provinces is given in HEYWOOD (1954).

Fumaria parviflora LAM. (1788); W. & L., 3: 884 (1880); PUGSLEY, A revision of the genera *Fumaria* and *Rupicapnos* in Journ. Linn. Soc. Botany 44; 322 (1919)
Sierra de la Maleza, dans les moissons, sur le calcaire, rare, Jun. 1904, REVERCHON: 1378 ut *P. densiflora* DC. [MA]

Platycapnos spicatus (L.) BERNH.
subsp. ***echiandiae*** (PAU) HEYWOOD, *comb. et stat. nov.*
Syn. *Platycapnos echeandiae* PAU, Not. Bot. Fl. Esp. II: 6 (1889); IV: 14 (1891); Willk., Suppl. 312 (1893)
Sierra de la Cabrilla, REVERCHON, s. n.; Cazorla, lieux incultes, sur le calcaire, 1200 m., rare, mai 1901, REVERCHON: 950 [BM]

Extremely rare in this territory.

Platycapnos saxicola WILLK. in Bot. Zeitschr. 367 (1848); W. & L. 3: 885 (1880)
Sierra de la Cabrilla, les débris mouvants et calcaires, 2000 m., très rare, Jun. 1906, REVERCHON: 1207 [MA]

Rare in screes in the upper zone.

Sarcocapnos baetica (BOISS. & REUT.) NYMAN, Consp. Fl. Europ. 26 (1878); W. & L., 3: 886 (1880) excl. var.
Syn. *Aplectrocapnos baetica* BOISS. & REUT. in Boiss. Diagn. Pl. Or. (5): 79 (1844)
S. enneaphylla var. *baetica* (BSS. & RT.) PAU, Pl. Almería 7 (1925)
S. integrifolia var. *baetica* CUATREC., Estud. Fl. Mágina 287 (1929)
S. enneaphylla sensu BOISS., Voy. Bot. Esp. 2: 18 (1839); *non* DC.
Sierra de Cazorla, nr. Cueva de la Magdalena, Pena de los Alcones, shady vert. 1st. rocks, fl. white yellowish centre, 950 m., 24 VI 1948, HEYWOOD: 60 & DAVIS; *ibid.*, rocks at Cueva de la Magdalena, 31 V 1928, LACAITA: 318 [BM]; Agujeros de San Pedro above La Nava de S. P., shady vertical 1st. rocks, 29 VI 1948, HEYWOOD: 362 & DAVIS; nr. El Cuevarón, above C. F. Garbanzal, 30° N-facing inclined 1st. rocks, hanging vertically from the inclines, leaves

generally 3-foliate, 1100 m., 13 VII 1951, HEYWOOD: 1243; Los Choradillos de la Magdalena, in damp crevices on lst. faces, 950 m., 7 VII 1951, HEYWOOD: 1055; Cueva de las Encantadas, above La Nava de San Pedro, on walls of cave, 1400 m., 23 VII 1951, HEYWOOD: 1571; La Cimbre above La Nava de San Pedro, on WSW-facing lst. rocks, on inclined faces or dominant on 30° overhangs, leaves 3—5-foliate, biternate, 1400 m., 23 VII 1951, HEYWOOD: 1529; Los Poyos de la Carilarga, in lst. crevices below slight overhangs, 1700 m., 25 VII 1951, HEYWOOD: 1620; La Cueva del Filo, nr. La Nava de San Pedro, on vert. faces or slight inclines shaded by overhang, N exp., leaves constantly 3-foliate, 1300 m., 1 VIII 1951, HEYWOOD: 1879

Common throughout the territory on shaded limestone cliffs and rocks. It is much more frequent than the following species.

The taxonomy and relationships of this species are considered in HEYWOOD: (1954).

Sarcocapnos crassifolia (DESF.) DC. (1821); W. & L., 3: 887 (1880)

Syn. *Fumaria crassifolia* DESF., Fl. Atl. 2: 126, *t. 173* (1798)

var. ***speciosa*** (BOISS.) LANGE in W. & L., 3: 887 (1880)

Syn. *S. speciosa* BOISS. Diagn. Pl. Or. ser. 2, (1): 14 (1853)
S. crassifolia sensu BOISS., Voy. Bot. Esp. 2: 18 (1839)

Los Organos, dry overhanging lst. cliffs, fl. white with yellow centre fading pink, spectabilis, 1300 m., 27 VI 1948, HEYWOOD: 254 & DAVIS; Cortada del Haza, Los Organos, in very unstable lst. N cliffs, in crevices of vert. faces, spurred flowers, 1250 m., 26 VII 1951, HEYWOOD: 1685; cliffs of Aguilones de la Fuente de Umbria, 1360 m., 15 VI 1928, LACAITA: 447 [BML]; Cueva de las Iglesias, vert. lst. N. cliffs, fl. large and long spurred, strikingly handsome plants, 1300 m., 7 VIII 1951, HEYWOOD: 1921

S. crassifolia var. *speciosa* is rare in this territory and is apparently confined to the localities noted above; it shows a microhabitat preference for dry overhanging limestone rock.

Cruciferae

Aethionema monospermum R. BR. (1812)

Syn. *A. ovalifolium* BOISS. (1867); W. & L., 3: 781 (1880) p. p.
A. saxatile γ ovalifolium DC. (1821)

var. ***monospermum***

Syn. *A. monospermum* var. *ovalifolium* (DC.) ROTHM. in Cavanillesia 7: 113 (1935)

Sierra del Pozo Alcón, Cerro Cabañas on lst. rocks of summit slopes, 2000 m., 1 VII 1948, HEYWOOD: 435 & DAVIS.

In cliffs and rocks of the upper zone.

ROTHMALER (loc. cit.) maintains this species separate from *A. saxatile*, replacing *A. ovalifolium* (DC.) BOISS. by the earlier name *A. monospermum* R. BR.

Alyssum alyssoides (L.) L. (1759).

Syn. *Alyssum calycinum* L. (1763); W. & L., 3: 833 (1880)

Barranco del Guadalentin, lieux arides sur le calcaire, 1500 m., Jun. 1904, REVERCHON: 706 [MA].

Alyssum granatense BOISS. & REUT. Pugillus 9 (1838); W. & L., 3: 833 (1880)

Syn. *A. alyssoides* var. *granatense* (BOISS. & REUT.) Pau in Bol. Soc. Arag. Cienc. Nat. 237 (1915)
A. calycinum var. *β granatense* PAU [Cartas No 3 p. 2: 1906] ex CUATREC. 304 (1929)
A. hispidum var. *β granatense* WILLK., Illustr. 1: 86 t. 56b (1882)

Le Pozo, lieux arides sur le calcaire, 1500 m., Jun. 1906, REVERCHON: 706 [MA].

Alyssum serpyllifolium DESF. (1798)

Syn. *A. alpestre* sensu BOISS., Voy. Bot. Esp. 2: 43 (1839) *non* L.

f. ***serpyllifolium*** (= *A. alpestre* var. *incanum* Boiss., l. c.)

Sierra de Cazorla, above Cazorla, Peñon Morondo, 14 VI 1927, WILMOTT, s. n., [BM]; *ibid.*, above Cazorla towards Fte. de la Magdalena, 13 VI 1927, WILMOTT s. n. [BM]; above C. F. Prado Redondo, on more or less dry lst. slopes, 1010 m., 9 VII 1951, HEYWOOD: 1104

f. ***alpinum*** (BOISS.) HEYWOOD, comb. et stat. nov.

A. alpestre var. *β. alpinum* BOISS., l. c.
A. serpyllifolium var. *β alpinum* WILLK., l. c.

Sierra del Pozo Alcón, Cerro Cabañas, slopes near summit, lst. rocks and screes 1 VII 1948, 1900—2000 m., HEYWOOD: 444 & DAVIS; Sierra de la Cabrilla, Barranco de Ginez to Las Empanadas, fl. yellow, 1500—2000 m., 28 VI 1948, HEYWOOD: 308 & DAVIS.

Occasional in rocks, cliffs and rocky slopes ranging from 900 to 2000 m. These plants are greatly susceptible to habitat conditions and there are many transitional forms between BOISSIER's vars. *incanum* and *alpinum*, the latter replacing the former at higher altitudes. The degree of indumentum, habit and siliqua size and shape are variable.

A. alpestre is a wide-ranging polymorphic species which has been divided into numerous races (cf. NYARADY, 1928, 1929, 1931, 1932; BRIQUET, 1913 p. 57), but it does not grow south of the Pyrenees where it is replaced by *A. serpyllifolium*. The alpine form is known only from Betica.

Alyssum fastigiatum HEYWOOD in Bull. Brit. Mus. (Nat. Hist.) Bot. 1, 4: (1954)

Pico de la Garganta above N. de San Pedro, rocky places, 1400 m., 28 VII 1948, HEYWOOD: 153 & DAVIS [holotypus! BM]; S. de Cazorla, Cuerda de las Moras, W. slopes, at base of NW rocks, 1500 m., 21 VII 1951, HEYWOOD: 1447

Extremely rare, in lst. rocks and cliffs.

Since its original discovery in 1948 with Davis I have only been able to find this species in a single additional locality. It is most closely related to *A. montanum* differing principally in its erect-fastigiate habit with all the stems more or lass of the same height, elongate racemes, smaller flowers, the petals 1½ times as long as the calyx, whitish flowers which do not change colour *in sicco*, and emarginate capsules. As the later collection is in fruit it has not yet been possible to evaluate the significance of the winged stamens observed in some flowers in 1948.

A. linifolium Steph. in Willd. (1800)

Syn. *Alyssum minimum* sensu Pau in Bol. Soc. Arag. Cienc. Nat. 237 (1915) non L.

f. *hispanica* Pau in Deb., Pl. Rar. Arag. 87

Cazorla, lieux arides, 1200 m., rare, Reverchon: n. v.

"Bien distinte de la var. α *genuinum*, répandue en Algérie, par ses tiges très rameuses, suffrutescentes à la base, par ses feuilles plus larges et plus courtes à la fois, par ses calices plus grands, ses silicules plus larges, et par l'aspect argenté de toute la plante", Hervier (1905 p. 30).

Alyssum minus (L.) Rothm. in Fedde, Repert. 50: 77 (1941)

Syn. *Clypeola minor* L., Fl. Monspel. 21 (1756)
Alyssum campestre L. (1763) p. p. non L., (1759)
A. parviflorum Fisch. ex M. B., (1819)

Sierra de Cazorla, above Cazorla, rocks near Puerto de Gilillo, 15 VI 1927, Wilmott s. n. [BM]; *ibid.*, towards Pte de Rechitas, 14 VI 1927, Wilmott, s. n. [BM]; *ibid.*, near Arroyo Mallar, 14 VI 1927, Wilmott s. n. (BM); Le Pozo lieux incultes, sur le calcaire, 1500 m., Jun. 1906, Reverchon: 706 [BML] ut *A. hispidum.*

Occasional in lower and middle zone in cliffs, rocks and slopes, etc.

The Cazorlan plants represent a variant of *A. parviflorum* with densely stellate capsules which are slightly emarginate; probably they can be included in var. *simplex* (DC.) Breistr. = *A. collinum* Brotero.

Alyssum montanum L. (1753); W. & L., 3: 832 (1880)

Sierra de Cazorla, above Cazorla, Puerto de la Calabaza, 15 VI 1927, Wilmott s. n. [BM]; *ibid.*, above Cazorla, rocks near Puerto de Gilillo. 15 VI 1927, Wilmott s. n. [BM]; *ibid.*, above Cazorla, Peñon Morondo 14 VI 1927, Wilmott s. n. [BM]; above Cazorla, Cañada de la Sabina, 15 VI 1927, Wilmott s. n. [BM]; Cerro Gilillo rocky lst. slopes, with numerous earth pockets and loose rocks, 50° slopes, 1450 m., 17 VII 1951, Heywood: 1406; *ibid.*, on WNW-exposed lst. cliffs, fl. & fr. 1500 m., 17 VII 1951, Heywood: 1432.

Quite common on cliffs, rocks and rocky slopes of the lower and middle zones.

Arabis auriculata Lam. (1784?); W. & L., 3: 818 (1880)

Sierra de Cazorla, valley of La Hoz above the town, damp sandy banks, 850 m., March 1952, Heywood: 2022.

Occasional in damp places in the lower zone and probably also at higher altitudes.

Arabis hirsuta (L.) Scop. (1772)

Above Casa Forestal Prado Redondo, in plantation of *Pinus pinaster*, in fruit, single spikes, 950 m., 9 VII 1951, Heywood: 1103.

Biscutella stenophylla Duf. (1820); W. & L., 3: 764 (1820) var. ***stenophylla***

Sierra de Cazorla, towards Penon Morondo, 14 VI 1927, Lacaita: 286 partim [BML]; *ibid.*, above Cazorla, Puerto de la Calabaza, 15 VI 1927, Wilmott s. n. [BM]; *ibid.*, above Cazorla towards Puente de Rechitas, 15 VI 1927, Wilmott s. n. [BM]; *ibid.*, towards Cañada de la Sabina, 15 VI 1927, Wilmott s. n. [BM]; *ibid.*, nr. Fte. de la Magdalena, 15 VI 1927, Wilmott s. n. [BM].

forma

Sierra de Cazorla, towards Peñón Morondo, 14 VI 1927, Lacaita: 286 partim [BML].

Biscutella variegata Boiss. & Reut. (1852)

Sierra de Cazorla, above the Cueva de la Magdalena, in saxosis, 31 V 1928 Lacaita: 315 BML.

The above collections of Biscutella have been determined by Machatschki Laurich. My own collections have had to be omitted as it was not possible to identify them in Madrid due to a lack of genuine material.

Camelina sativa (L.) Crantz (1762) p. p. emend Fries (1842)

Syn. *Myagyrum sativum* L. (1753) p. p.

var. ***silvestris*** Fries (1819)

Syn. *C. microcarpa* Andrz in DC. (1821)
C. silvestris Wallr. (1823)

Sierra de Cazorla Reverchon, n. v.

For a summary of the nomenclature of this species see Hylander (1945 p. 189).

Capsella bursa-pastoris (L.) Mch. (1794); W. & L., 3: 779 (1880).

S. de Cazorla, Cuerda de las Moras, Cueva de los Marranos, in semi-shade below NW-facing lst. cliffs of save, in mesophytic community, in fruit, 1500 m. 21 VII 1951, Heywood: 1435

Very rare in the territory, occurring sparsely in cool more or less shaded habitats, in or near rocks. The above gathering is a teratological form.

Cardamine hirsuta L. (1753); W. & L., 3: 825 (1880)

Sierra de Cazorla, valley of La Hoz, slopes above the town, damp sandy banks, 850 m., March, 1952, HEYWOOD: 2020

Clypeola eriocarpa CAV. (1802); W. & L., 3: 758 (1880).
Syn. *Vesicaria lanuginosa* POIR. in LAM. (1808).
Clypeola eriophora DC. (1821)

Le Pozo, lieux incultes et calcaires, 1500 m., rare, Jun. 1905, REVERCHON: 1232 [MA].

The distribution of this specis according to material in Madrid is prov. *Jaén*: Cazorla, Segura, Calar del Mundo; prov. *Granada*: Baza, Alfacar; *Castille*: Aranjuez.

[v. CHAYTOR, D. A. & TURRILL, W. B. The genus *Clypeola* and its intraspecific variation. *Kew Bull.* 1935 (1): 1 (1936)].

Crambe filiformis JACQ., Ic. Pl. Rar. 3, fasc. 14, t. 504 (1793—4); p. 8 (1795); W. & L., 754 (1880)

Syn. *C. reniformis* DESF., Fl. Atl. 2: 78, t. 151 (1798)
var. *β* ***hispanica*** LANGE, Pugillus 275 (1861); W. &. L., l. c.

Sierra de Cazorla, Cabeza del Tejo, in crevices of NW-facing 1st. cliffs, fl. white tinged lilac, globular fruits, rare, 1450 m., 23 VII 1951, HEYWOOD: 1538.

In rocks and cliffs of middle and upper zone; rare. The specimens agree well with North African material of this species and do not seem separable, so that var. *hispanica* may be the common form there as well as in Spain.

Draba hispanica BOISS., Elenchus No 13 (1838); et Voy. Bot. Esp. 2: 48 (1839); W. & L., 3: 839 (1880); O. E. SCHULZ in Engler, Pflanzenr. *IV.105*: 53 (1927).

Syn. *D. alpina* ASSO, Syn. stirp. Arag. 83 (1779) *non* L.
D. aizoides CAV., Descr. 421 No 948 (1802) *non* L.
D. cuspidata DC. (1821) et (1824) p. p. quoad pl. Hisp. *non* MB.

var. ***hispanica***

Sierra de la Cabrilla, 2000 m., 1905, REVERCHON: 495 *fide* Schulz; S. del Pozo, REVERCHON: 495 *fide* Schulz.

f. ***exscapa*** PAU in Bol. Soc. Arag. Cienc. Nat. 7: 112 (1909)
Sierra del Pozo, GANDOGER s. n. *fide* O. E. SCHULZ.
A dwarf form with short scapes, siliquas and styles.

var. ***segurensis*** O. E. SCHULZ, *op. cit.* p. 54 (1927)

Pico de Garganta, Cabeza del Tejo, above N. de San Pedro, N-facing 1st. rocks, in fruit, 25 VI 1948, HEYWOOD: 109 & DAVIS: S. de Cazorla, above Cazorla, rocks near Puerto de Gilillo, 15 VI 1927, WILMOTT s. n. [BM]: Puerto de Gilillo in rupestribus calcareis, 15 VI 1927, LACAITA: 309 [BML]: S. de la Cabrilla, Pico de Cabañas, at base of 1st. boulders or in crevices of

1st. rocks, in fruit, 2000 m., 15 VII 1951, HEYWOOD: 1340 S. de Cazorla, Cerro Gilillo on NW-facing 1st. cliffs, in fruit, 1500 m., 17 VII 1951, HEYWOOD: 1425; *ibid.*, Cuerda de las Moras, Cueva de los Marranos, on NW-facing cliffs shaded from morning sun with *Potentilla caulescens villosa* and *Viola cazorlensis*: 1500 m., 21 VII 1951, HEYWOOD: 1472; Rastrillo de los Covarones, above C. F. Fte. de la Zarza, in 1st. rocks and rocky slopes above *Pinetum pinastri*, in fruit, 1400 m., 28 VII 1951, HEYWOOD: 1803

Frequent and widespread in communities on dry limestone cliffs and rocks in the lower and middle zones.

The commonest form in this territory of this polymorphic species is var. *segurensis* which has a characteristic facies due largely to its narrow elongate fruits which do not tend to be ovate-elliptical as in most forms but oblong-elliptical (7—9 mm. long, 2.5—3 mm. broad). The style may be as long as 5 mm. in some examples. LACAITA's collection is of a form with short capsules although typical in shape. Other forms of the species, as listed above, have been recorded from this area by Schulz (l. c.) but their taxonomic status is doubtful: a gathering of *D. hispanica* collected in 1837 by BOISSIER in Granada (in Herb. Cantabr.) shows some of the attributes of var. *brevistyla*, f. *exscapa* and var. *brachycarpa*!

Erophila praecox (STEV.) DC. (1821); W. & L., 3: 841 (1880); O. E. SCHULZ in Engler, Pflanzenr. IV.105: 365 (1927)

Sierra de Cazorla, valley of La Hoz, above the town, on damp sandy banks, 850 m., March, 1952, HEYWOOD: 2017.

The Spanish species of *Erophila* have not been critically studied but according to the characters given by CLAPHAM (1952 p. 200 seq.) this gathering belongs to *E. praecox*, agreeing in leaf and fruit characters although the seeds are not markedly reticulate.

Erophila verna (L.) CHEVALL. (1836); W. & L., 3: 840 (1880); O. E. SCHULZ in Engler, Pflanzenr. *IV. 105*: 345 (1927)

Syn. *Draba verna* L., Sp. Pl. 642 (1753)
Sierra de Cazorla, in valley of La Hoz above the town, on damp sandy banks, 850 m., March, 1952, HEYWOOD: 2016.

Eruca vesicaria (L.) CAV. in DC. (1821); W. & L., 3: 849 (1880)
Cazorla, REVERCHON, n. v.

Erysimum linifolium (PERS.) GAY (1842); W. & L., 3: 807 (1880)
Syn. *Cheiranthus linifolius* PERS. (1806)

subsp. ***cazorlense*** HEYWOOD, in Bull. Brit. Mus. (Nat. Hist.) Bot. 1, 4: 100 (1954)

Syn. *E. popovii* ROTHMALER in Fedde, Repert. 49: 180 (1940), p. p. quoad pl. e Cazorla, Cabrilla, Castril, Maleza cit.

Barranco del Guadalentin, above the river, chalky slopes, fl. violet, 1300 m., 26 VI 1948, HEYWOOD: 182 & DAVIS [holotypus in BM]; Barranco de Ginez to La Empanadas, S. de la Cabrilla, 1st. slopes, rocks, 1300—1800., 28 VI 1948, HEYWOOD: 314 & DAVIS; S. de la Cabrilla, shoulder of Las Empanadas, c. 1900 m., 16 V 1928, LACAITA: 465 [BML]; above Cazorla, nr. Puerto de Gilillo, 15 VI 1927, WILMOTT s. n. [BM]; S. de la Maleza, lieux arides sur le calcaire, 1800 m., Jun. 1904, REVERCHON: 1103 [MA]; S. de la Cabrilla, lieux arides et calcaires, 1700 m., rare, Jun. 1905, REVERCHON: 1103 [MA]; Barranco de Ginez, nr. Cerro de las Empanadas, on loose 1st. scree slopes with rocks, with sparse *Pinus clusiana*, 1750 m., 25 VII 1951, HEYWOOD: 1673.

Occasional on more or less exposed limestone or chalky slopes in all three zones.

A critical study of the taxonomy and variation of *E. linifolium* s. l. is given in HEYWOOD (1954). Since describing subsp. *cazorlense* in 1949 I have seen the material of *E. linifolium* in Madrid Herbarium which confirms the distinctness of the new taxon. Its range has been widened by a collection of CUATRECASAS from the Calar del Mundo (Albacete — MA) which has a close floristic relationship with the Sagra-Cazorla mountain complex.

Subsp. *cazorlense* differs from subsp. *baeticum* (the southern Spanish race of the species) by its one-stemmed habit, persistent basal rosettes of entire, flat or conduplicate, repand leaves, the stem leaves conferted extending to the base of the inflorescence which is a dense raceme producing in the fruiting stage an elongate "spike" of numerous conferted siliquas which are adpressed to the axis or erect. It thus shows a remarkable superficial resemblance to *E. myriophyllum*.

Erysimum grandiflorum DESF., Fl. Atlant. 2: 85 (1798)

Syn. *Erysimum longifolium* DC. (1821), *nom. illegit.*

E. australe GAY, Erys. Nov. Diag. 6 No. 11 (1842) *nom. illegit.*, p. p. quoad pl. occid.; W. & L., 3: 806 (1880) excl. specim. nonnull. qua ad *E. myriophyllum* pertinent

E. bocconi auct. hisp. *non* PERS.

E. canescens sensu BOISS., Voy. Bot. Esp. 2: 31 (1839) pro parte; *non* ROTH.

E. pallens sensu BOISS. op. cit. 2: 716 (1845) p. p.; *non* PERS.

Sierra de Cazorla on way to Gilillo, on the same hillside as 328 but quite distinct, 31 V 1928, LACAITA: 329 [BML]; S. de Cazorla, above C. F. Prado Redondo in *Buxus* facies of *Pinus clusiana* plantation, fl. & fr. 1010 m., 9 VII 1951, HEYWOOD: 1084; Tranco de la Rubia, nr. Leganillos, by roadside at edge of plantation of *Pinus pinaster*, rare, in fruit, 1400 m., 11 VII 1951, HEYWOOD: 1159; S. de Cazorla, Cerro Gilillo, rocky 1st. slopes with pockets of terra rossa, 1500 m., 17 VII 1951, HEYWOOD: 1412; lower slopes of Cabeza del Tejo, above Nava de San Pedro, on 1st. rocky slopes in open aspects of sparse *Pinetum clusianae*, 1550 m., 23 VII 1951, HEYWOOD: 1555.

forma foliis basalibus plusminusve dense confertis *E. myriophyllum* simulans. Barranco de Valdeazorillos, near Los Organos, in herbetum of *Pinetum clusianae*, sandy 1st. slopes, flowers yellow, c. lm. tall, 1200 m., 26 VII 1951, HEYWOOD: 1695.

The species is occasional in more or less open aspects of Pinetum, and on exposed limestone slopes in the lower and middle zones.

A full discussion of this species is given in a study of the *E. longifolium-myriophyllum* species pair in HEYWOOD (1954). Later observations in the field have confirmed the specific distinctness of these taxa. No. 1695 is a „pseudomyriophyllous" form with the basal leaves, more or less densely conferted almost forming rosettes as in *E. myriophyllum* but distinguished from that species by its shorter less crowded racemes, naked stems subtending the inflorescences and the position of the siliquas (cf. HEYWOOD 1954).

Erysimum myriophyllum LANGE in Vidensk. Medd. Naturhist. Foren. Kjøbenhavn 1881: 102; Diag. Pl. Iber. Nov. 2: 16 (1882); Wk., Suppl. 300 (1893)

Syn. *E. simplex* (WILLK.) Pau, Nuev. Contr. Fl. Granada 20 (1922) *quoad syn.*

E. australe var. alpinum WILLK. et var. simplex WILLK. in W. & L., 3: 807 (1880) p. p.

E. canescens sensu BOISS., Voy. Bot. Esp. 2: 31 (1839) p. p. *non* ROTH.

E. pallens sensu BOISS. op. cit. 716 (1845) p. p.; *non* PERS.

E. nevadense REUT. var. *stenophyllum* REUT. herb.

Cerro Cabañas, 1st. slopes, fl. canary yellow, 1 VII 1948, HEYWOOD: 461 & DAVIS; S. de Cazorla on way to Gilillo, 31 V 1928, LACAITA: 328 [BML]; S. de Cazorla, pinewoods above Arroyo Mallar, 14 VI 1927, LACAITA: 291 [BML]; *ibid.*, near Arroyo Mallar, 14 VI 1927, WILMOTT s. n. [BM]; above Cazorla, Penon Morondo, 14 VI 1927, WILMOTT s. n. [BM]; S. de Cazorla, Los Tranquillos, SW slopes, moist sandy soil, 1070 m., 6 VII 1951, HEYWOOD: 1026; Yano de la Cuerda, on W and NW slopes of loose 1st. in xero-acanthetum and in *Pterocephalus spathulatus — Convolvulus nitidus* assn., 1800 m., 12 VII 1951, HEYWOOD: 1229; Cerro Gilillo, on WNW rocky 1st. slopes, in crevices and pockets of terra rossa, 1500 m., 17 VII 1951, HEYWOOD: 1428; Cue da de las Moras, Canada de la Magdalena and W slopes of the Cuerda, in loose grey 1st. scree between ledges of outcropping rock, 1500—1600 m., 21 VII 1951, HEYWOOD: 1443.

forma foliis caulinis deciduis, caule igitur nudo.

Rastrillo de los Covarones, above C. F. Fte. de la Zarza, 1st. rocky slopes above *Pinetum pinastri*, in fruit, 1400 m., 28 VII 1951, HEYWOOD: 1808.

Occasional on more or less exposed 1st. slopes or more rarely in *Pinetum*, in all three zones, unlike *E. longifolium* which I have not seen above 1500—1600 m. in this territory.

This elegant species has an unmistakable facies given by its rosettes of grey canaliculate leaves, those of the previous years forming "nodes" on the stem-base, and its dense infructescences of crowded siliquas which are subtended by more or less erect pedicels which curve in at the apex so that the siliquas are closely adpressed to the axis (v. HEYWOOD 1954).

Hirschfeldia incana (L.) LAGREZE-FOSSAT (1847); O. E. SCHULZ in ENGL., Pflanzenr. *IV.105*: 137 (1919)

Syn. *Sinapis heterophylla* LAG., Gen et Sp. 20. No 265 (1816)
Brassica adpressa BOISS., Voy. Bot. Esp. 2: 38 (1839)
Erucastrum incanum KOCH (1835); W. & L., 3: 961 (1880)
Erucastrum heterophyllum WILLK. in W. & L., l.c.

var. ***hirta*** (BAB.) O. E. SCHULZ op. cit. p. 141

Sierra de Cazorla, Cerro de los Covatillos above La Iruela, pathsides and dry sandy 1st. slopes, in sparsely developed *Thymetum mastychinae*, fl. yellow, 850 m., 9 VII 1951, HEYWOOD: 1074; Tranco de la Rubia, above Leganillos, in sandy hollow on 1st. substrate, in fruit, 1400 m., 11 VII 1951, HEYWOOD: 1158.

Common as a weed in the lower zone, on pathsides or dry sandy 1st. slopes in degraded subseral communities resulting from the destruction of *Quercetum ilicis*.

LAGASCA's *Sinapis heterophylla* is often cited as a synonym of var. *hirta* but the type (Casa del Campo, Madrid 1815, LAGASCA, MA) has glabrous siliquas!

Hornungia petraea (L.) RCHB. (1837)

Syn. *Hutchinsia petraea* (L.) R. BR. (1812); W. & L., 3: 774 (1880)

var. ***granatensis*** (AMO) HEYWOOD, *comb. nov.*

Syn. *Hutchinsia petraea β granatensis* AMO, Fl. Iber. 6: 622 (1873); W. & L., l. c.

Sierra de Cazorla, valley of La Hoz, damp sandy banks, 850 m., March 1952, HEYWOOD: 2018.

Occasional on rocks and cliffs in the middle and upper zones, and in damp habitats in the lower zone.

Hutchinsia prostii GAY ex JORD., Diagn. 1: 388 (1846)

Barranco del Guadalentín, très rare, dans les rochers humides, à 1800 m., REVERCHON, n. v.

I have not collected this rare species and REVERCHON's collection was so limited that it was not distributed. Also known from the S. de Albarracín.

Iberis crenata LAM. (1789)

Syn. *I. pectinata* BOISS. (1842)
I. bourgaei BOISS. & REUT. (1854)

Sierra de Cazorla, beyond the Fte. del Santuario de la Virgen de la Cabeza, 1st. rocky slopes, 1000 m., 21 V 1952, HEYWOOD: 1957.

Occasional in the lower zone on chalky or clayey soil.

Iberis lagascana DC. (1821); WILLK., Suppl. 296 (1893)

var. ***granatensis*** (B. & R.) PAU, Not. Bot. No 5, 13 (1892)

Syn. *I. granatensis* BOISS. & REUT., Pugillus 11 (1852)
I. spathulata WEBB., Iter. Hisp. 77 (1838)
I. nana sensu BOISS., Voy. Bot. Esp. 2: 77 (1839) *non* ALL.

Sierra del Pozo Alcón, Cerro Cabañas, near the summit, 1st. screes and rocks, 2000 m., 1 VII 1948, HEYWOOD: 439 & DAVIS; between Barranco de Ginez and Las Empanadas, S. de la Cabrilla, 1st. slopes, rocks, in fruit, 1700 m., 28 VI 1948, HEYWOOD: 319 & DAVIS; S de la Cabrilla, Las Empanadas, crevices of rocks, 1st. slopes, calyx purple, petals white 1900 m., 28 VI 1948, HEYWOOD: 310 & DAVIS; S. de Cazorla, at Puerto de las Palomas, c. 1100 m., copiosissime, flores variant lilacini et albescentes, 14 VI 1928, LACAITA: 434 [BML].

var. ***lagascana***

Sierra de Cazorla, above Cazorla, Rincontro del Avellano, 14 VI 1927, WILMOTT s. n. [BM].

Most common in the rocks and screes of the upper zone, but also occurring sparsely at lower levels.

The genus *Iberis* in Spain urgently requires revision. As early as 1892 PAU suggested that *I. lagascana*, *I. granatensis* and several related taxa should be reduced to a single species because of the inconstancy of the criteria used to delimit them. It is difficult to say just how many species should be submerged (cf. CAMARA-NIÑO, 1935—40, 1946 p. 380) but it is widely admitted that *lagascana* and *granatensis* are conspecific, perhaps not even varietally distinct (cf. CUATRECASAS 1929 p. 292; CABALLERO, 1944 p. 415; PAU 1892 p. 13, 1906 p. 2, 1922 p. 21 etc.). The differences given by WILLKOMM (1893 p. 296) to separate *granatensis* from *lagascana* „... corollis lilacinis, stylo longiore et lobis silicularum rotundatis" are of little value, and other characters such as the depth of the sinus of the siliculas, degree of divergence of the lobes, their shape and length, indumentum of leaves etc. are likewise inconstant. Frequently these characters are mixed in a single gathering.

These plants are very susceptible to different ecological conditions and show considerable variation: height of stems, their number and length, the shape and thickness of the leaves vary greatly in different habitats. Other characters whilst not apparently affected by ecological conditions show variation within the same locality, such as petal colour, shape of fruits etc.

No 319 is a glabrous form with only the edges of the leaves ciliate, and the stems papillose-pubescent; the siliculas are elliptical, completely glabrous, rounded at the base, the wings more or less acute, the sinus variable in depth and the style three times as long as the sinus with the stigmas well

marked. No 439 shows more variation: the leaves in some specimens are more or less hairy, the siliculas narrower, ovate or broadly ovate rather than elliptical, the sinus narrower, the lobes less acute and the stigmas less evident. WILMOTT's gathering is a single specimen in fruit with the lobes of the wings very acute, deeply separated, the sinus slightly shorter than the style. The fruits are superficially very distinct from var. *granatensis*.

Iberis hegelmaieri WILLK. in W. & L., 3: 770 (1880)

var. ***glabrescens*** PORTA & RIGO in Atti. Acad. Reveretana (R. Accad. Agiata) [Vegetabilia 9] 9: (1891); WILLK., Suppl., 296 (1893).

Sierra de la Maleza, bois arides sur le calcaire, 1500 m., très rare, Jun. 1904, REVERCHON: 1355 [MA].

According to PAU (Carta No 2, p. 5: 1905) this gathering is *I. linifolia* Loefl. var. *contracta* (Pers.) PAU, but it is probably better accommodated, like *I. hegelmaieri*, in *I. lagascana* DC.

Iberis saxatilis L. [TORNER], Cent. Pl. II: 23 (1756)

subsp. ***cinerea*** (POIR.) P. W. BALL & HEYWOOD, *stat. nov.*

Syn. *I. cinerea* POIR., Encycl. Suppl. 3: 133 (1813)
I. subvelutina DC., Syst. Nat. 2: 397 (1821)
I. saxatilis var. ***cinerea*** (POIR.) PAU, Bol. Soc. Iber. Ci. Nat. 82 (1919); Nuev. Contr. Fl. Granada p. 22 (1922)
[*I. saxatilis* var. *β subvelutina* PAU, Cartas No 3 p. 3: 1906]

Sierra de Cazorla, below Gililo, in rupestribus Puntada de la Losilla, 1700 m., LACAITA: 316 [BML].

A broader-leaved form than usual with denser indumentum.

Lepidium hirtum (L.) DC. (1821); THELLUNG, Monogr. 101 (1906); W. & L., 3: 783 (1880)

subsp. *hirtum* var. ***psilopterum*** WILLK. ap. J. HERVIER in Rev. Gén. Bot. 4: 152 (1892) et Suppl. 297 (1893)

Near C. F. Nava de San Pedro, rocks in *Pinetum clusianae* in N-facing ravine in fruit, 29 VI 1918, 1300 m., HEYWOOD: 350 & DAVIS.

Form with oblong siliculas, rounded attenuate at the base, more or less as long as the pedicels, the style longly exserted, the wings as long as the seminiferous part, very hirsute pubescent except at the margins which are subglabrous, ciliate.

formae

Sierra de Cazorla, above Cazorla near Fte. de la Magdalena, 15 VI 1927, WILMOTT s. n. [BM]; *ibid.*, above Cazorla, towards Cañada de la Sabina, 15 VI 1927, WILMOTT s. n. [BM].

Forms with the cauline leaves dentate, siliculas oblong-attenuate towards the apex, with the wings slightly pubescent.

Lepidium hirtum is best interpreted as a polymorphic species embracing principally *L. petrophilum*, *L. calycotrichum*, *L. nebrodense*, *L. humifusum*, *L. stylatum*, distributed in West Europe and North Africa. The centre of variation appears to be in the mountains of the Betic Cordillera. Typical *L. hirtum* is not known with certainty from Spain where it is represented by subsp. *stylatum* (LAG. & RODR.) THELL., subsp. *calycotrichum* (KZE.) THELL., subsp. *petrophilum* (COSS.) THELL. and the vars. *psilopterum* and *willkommii* of the typical subspecies. The infraspecific variation of the Spanish races requires further study.

Lepidium villarsii GREN. & GODR. (1847)

Syn. *L. pratense* SERRES in F. SCHULTZ (1840) *pro syn.*, ex GREN. & GODR. (1848); THELLUNG, Monogr. 95 (1906).

subsp. ***reverchonii*** (DEB.) BREISTROFFER (1947)

Syn. *L. reverchonii* DEBAUX in WILLK., Suppl. 332 (1893)

Barranco del Guadalentin, lieux frais et herbeux, sur le calcaire, 1700 m., Jun. et Jul. 1904, REVERCHON: 867 [BM].

Rare.

Lepidium subulatum L. (1753); W. & L., 3: 786 (1880)

La Pozo, lieux incultes, sur le calcaire, 1500 m., Jun. 1905, REVERCHON: 829 [BM].

Form covered with a fine indumentum of very short hairs.

Pseudocytisus spinosus (BOISS.) REHDER (1927)

Syn. *Vella spinosa* BOISS., Elenchus No. 20 (1838) et Voy. Bot. Esp. 2: 41 (1839); W. & L., 3: 847 (1880).

Sierra de la Cabrilla, lieux arides sur le calcaire, 1800 m., Jun. 1905, REVERCHON: 1086 [BM].

A rare constituent of the xero-acanthetum formations at high altitudes. It is rare in the territory and is confined apparently to the Sierra de la Cabrilla.

Ptilotrichum longicaule BOISS., Elenchus, No 17 (1838) et Voy. Bot. Esp. 2: 47 (1839); W. & L., 3: 834 (1880).

Syn. *Alyssum longicaule* BOISS., Bibl. Univ. Genève 407 (1838)
Koniga halimifolia WEBB, Iter Hisp. 75 (1838) *non* RCHB.

Calar de Juana, lst. rocks, often growing with *Viola cazorlensis*, rare, in bud, 2 VII 1948, HEYWOOD: 525 & DAVIS; Cueva del Orno, shady lst. rocks, flowers white, minute, stems very brittle, 2 VII 1948, HEYWOOD: 539 & DAVIS; Cerro de los Carboneros, NW-facing vertical lst. rocks, in flower, in *Hedera helix*, *Draba hispanica*, *Globularia hispanica* community, 1230 m., 13 VII 1951, HEYWOOD: 1257; Los Rastrillos de la Fuente de la Umbria, NNW-facing vertical cliffs, occasional, in young flower, 1700 m., 2 VIII 1951, HEYWOOD: 1849.

Rare, occurring sporadically in a few localities in the territory, on more or less cool lst. cliffs, generally on vertical aspects. Late flowering — July—August. New for the territory.

Ptilotrichum reverchonii DEGEN & HERVIER ap. DEGEN in Mag. Bot. Lapok, 5: 2 (1906) et in Bull. Acad. Int. Géogr. Bot. 16: 224 (1906).

In saxosis calcareis vallem Barranco del Guadalentín imminentibus, fruct. alt. 1800 m., Jun. 1904, REVERCHON: 1365; Sierra de la Cabrilla, rochers escarpés et calcaires, rarissime, 1800 m., Jun. 1906, REVERCHON: 1365 [MA]; S. de Cazorla, loco Los Organos dicto in rupibus praeruptis, 15 VI 1928, LACAITA: 456/28 [K, BM, BML, MA]; in gorge of Rio Borosa below Los Organos, on sheer vertical lst. faces, 1200 m., Jul. 1947, HEYWOOD: s. n. [E]; Los Organos, on vertical faces of lst. pinnacles, 1270 m., in fruit, 1700 m., 27 VI 1948, HEYWOOD: 256 & DAVIS; Poyos de la Carilarga, vertical lst. rocks, 1700 m., 28 VI 1948, HEYWOOD: 327 & DAVIS; *ibid.*, 12 VIII 1948, HEYWOOD: 967; Cortada del Haza, Los Organos, on vertical lst. cliffs, W. slopes, in fruit, 1300 m., 26 VII 1951, HEYWOOD: 1679.

Extremely rare chasmophyte, known only from a few localities in this territory to which it is endemic. It almost invariably grows on vertical limestone cliffs.

P. reverchonii was discovered by REVERCHON in 1904 in the rocks overlooking the Barranco del rio Guadalentín and later found by him in a few additional localities. I have myself only found it in two distinct localities and have been able to determine its centre of distribution as Los Organos, the limestone pinnacles at Aguas Negras dominating the gorge where the waters cascade to form the Rio Borosa in the valley below. The remaining habitats are not far distant from the centre (i. e. S. de la Cabrilla, Poyos de la Carilarga). The altitude given by REVERCHON for his record from the S. de la Cabrilla, c. 2500 m., is greatly exaggerated and should probably be 1800 m., for the peak of the sierra, Las Empanadas, barely exceeds 2000 m.

The closest ally of this species is *P. pyrenaicum* which is localised at the shady rocks of La Font de Comp in the East Pyrenees where it seems destined to disappear, but BRAUN-BLANQUET (1948 p. 29 footnote) says that it is much less rare than previously although the crosion of the rock will however lead to its eventual elimination. *P. reverchonii* has likewise been placed in peril by the excavations at the rocks of Los Organos in connection with hydro-electric operations. The losses so far have not been great and the remaining habitats, where the plant is admittedly less frequent, remain untouched.

PAU (Cartas No 3) characteristically dismisses *P. reverchonii* as a variety of *Alyssum pyrenaicum* saying "it seems to me nothing but a leiocarpous form". The two taxa are however sufficiently distinct as can be seen from the lengthy comparison given by HERVIER who sent his material to GAUTIER for comparison. *P. reverchonii* shows a surprising amount of variation in leaf and capsule shape given its relict nature: in some of my gatherings the leaves are obtuse-rounded, in others more or less acute apiculate, the dimensions also varying (an extreme form No 967 having leaves 6.5 cm. long, 2.2 cm. broad); the capsules may be entire at the apex or markedly retuse, even subcordate, and HERVIER describes a form with large capsules. This variation is of little taxonomic significance but it is a notable fact that many Tertiary relict species such as *P. reverchonii*, although presumably genetically depauperate show a considerable amount of minor variation.

Ptilotrichum spinosum (L.) BOISS., Voy. Bot. Esp. 2: 46 1839); W. & L., 3: 835 (1880).

Calar de Juana, rocks in fruit, 2 VII 1948, HEYWOOD: 948
f. floribus purpureis.

Sierra de la Cabrilla, Pico de las Empanadas, upper slopes, screes, rocks, fl. purple, growing with the typical form, 2000 m., 28 VI 1948, HEYWOOD: 289 & DAVIS.

Occasional in the upper zone in xero-acantheta with *Echinospartum boissieri* and *Erinacea pungens* but of much less importance ecologically than these other two species.

The purple coloration of the flowers of this species at high altitudes is not uncommon: I have observed the phenomenon in several other Andalucian mountains, and JAHANDIEZ & MAIRE (Cat. Pl. Maroc. (1931) p. 305) note its frequent occurrence in North Africa.

Ptilotrichum purpureum (LAG. & RODR.) BOISS., VOY. Bot. Midi Esp. 2: 46 (1839); W. & L., 3: 835 (1880).

Sierra de la Cabrilla, E. F. GALIANO (MAF)
Extremely rare in limestone screes.

Rapistrum rugosum (L.) ALL.
Weed in the area of cultivation in the lower zone.

Rorippa nasturtium-aquaticum (L.) HAYEK (1905)
Laguna de Valdeazorillos, near Los Organos, at edge of lake, 1200 m., 25 VI 1948, HEYWOOD: 270 & DAVIS.
Very rare, at edge of rivers, lakes, etc.
A low-growing form with a poorly differentiated style, otherwise typical.

Sisymbrella aspera (L.) SPACH (1838)
subsp. ***pseudoboissieri*** (DEGEN) HEYWOOD in Brit. Bull. Mus. (Nat. Hist.) Botany 1, 4: (1954)

Syn. *Sisymbrium pseudoboissieri* DEGEN [in litt. ad REVERCHON] apud HERVIER in Bull. Acad. Int. Géogr. Bot. 15: 94, 170 (1905); op. cit. 16: 223 (1906).

Le Pozo, lieux humides et calcaires, 1500 m., Jun. 1905, REVERCHON: 1370 [*cotypus* E]; Barranco del Guadalentin, lieux frais et humides, sur le calcaire, 1700 m., Jun. 1904, REVERCHON: 1379 [*cotypus* — E]; La Nava de San Pablo,

in turf, flowers yellow, 1600 m., 26 VI 1948, HEYWOOD: 312 & DAVIS; *ibid.*, Fte. Pajarero, in damp herbetum of *Pinetum clusianae*, 1600 m., 25 VII 1951, HEYWOOD: 1656.

In damp meadows, in *Pinetum* at high altitudes in the middle to upper zones.

A critical revision and analysis of the variation of the genus *Sisymbrella* in Spain is given in HEYWOOD (1954). Subsp. *pseudoboissieri* which is endemic to the Sierras de Cazorla is differentiated from subsp. *boissieri* principally by its siliquas which have the seeds uniseriate in each loculus (not biseriate) and suspended on long funicles.

Sisymbrium orientale L. [TORNER] (1756)

Syn. *S. columnae* JACQ. (1776); W. & L., 3: 800 (1880)
var. ***subhastatum*** (WILLD.) THELL. in ZIMMERMAN
Syn. *S. longesiliquosum* WILLK., Suppl. 332 (1893)

Cerro de los Carboneros, in cornfields, 1st. substrate, in fruit, 1170 m., 13 VII 1951, HEYWOOD: 1267.

In lower parts of the territory, pathsides, as weed in zones of cultivation.

Sisymbrium crassifolium CAV., Descr. 437 No. 977 (1802); W. & L., 3: 799 (1880) *sensu amplo*

Sierra de la Cabrilla in Barranco de Ginez, 1750 m., 16 VI 1928, LACAITA: 461 [BML]; Sierra del Pozo Alcón, Sierra de Cazorla, GANDOGER fide Schulz l.c. (n.v.)

In rocks, cliffs and slopes in all three zones.

LACAITA's specimens are rather undeveloped suggesting a lax-flowered depauperate *S. crassifolium*. There are no ripe fruits and the plants are so pressed that the direction of the siliquas is doubtful, but I see no reason for calling them *S. laxiflorum* as does PAU. (in herb.)

Sisymbrium laxiflorum BOISS., Elenchus 9 (1838) et Voy. Bot. Esp. 2: 29 (1839); W. & L., 3: 800 (1880)
Syn. *S. crassifolium* var. *laxiflorum* (BSS.) PAU, Not. Bot. V: 10 (1892)
Sierra de Cazorla, above Cazorla, near Puerto de Gilillo, 15 VI 1927, WILMOTT: s. n. [BM].

It is debatable whether *S. laxiflorum* is specifically distinct from *S. crassifolium* (cf. PAU, WILLKOMM, l.c.); but the loose-flowered habit, long fruiting spike, rather longer pedicels, thicker siliquas with very pronounced veins on the valves and more acutely divided leaves serve to distinguish the former in "good" examples. The Cazorlan plants branch from the base (and not from above as WILLKOMM says in his key to separate *laxiflorum* from *arundanum*) but have oblong seeds unlike *S. arundanum* in which they are cylindrical.

Sisymbrium arundanum BOISS., Voy. Bot. Esp. 2: 30 (1839); W. & L., 3: 800 (1880)
Sierra de Cazorla, REVERCHON, n. v.

Sisymbrium hispanicum JACQ., Ic. Pl. Rar. 1: 12, t.124 (1781—86) et Collect. 1: 69 (1786); W. & L., 3: 799 (1890); O. E. SCHULZ l.c. p. 112.
Syn. *S. pyrenaicum* subsp. *hispanicum* THELL in HEGI, Ill. Fl. Mitteleur. 4 (1): 172 (1916) *in obs.*

Le Pozo, moissons, sur le calcaire, 1500 m., Jun. 1905, REVERCHON: 1252 [BML]; S. de Cazorla, REVERCHON: 1252, n. v.

Sisymbrium irio L. (1753); W. & L., 3: 801 (1880)
Frequent weed in cultivations, pathsides, in lower zone especially.

Thlaspi perforliatum L.
Above Cazorla, Puerto de Gilillo, WILMOTT, 15 Jan. 1927 (BM).

Ionopsodium prolongoi (BOISS.) BATTAND. (1896)
Syn. *Thlaspi prolongi* Boiss., Voy. Bot. Esp. 2: 53 (1839); W. & L., 3: 776 (1880)

S. de Cazorla, nr. Puntada de la Losilla, 1680 m., 31 V 1928, LACAITA: 320 [BML].

Addendum

Hutera rupestris PORTA in Atti Accad. Roveretana (R. Accad. Agiati) 9: 6 (10 Oct. 1891); WILLK., Suppl. 283 (1893)
Syn. *Coincya rupestris* ROUY in Le Naturaliste ser. 2, **13**: 248 (15 Oct. 1891)
Raphanus rupestris PORTA & RIGO [Pl. exs. 1890 no. 194] ex PORTA, l.c. *in syn.*

Recorded by GANDOGER from this territory *sine loco.*

Resedaceae

Reseda fruticulosa L. (1759)

Syn. *R. suffruticulosa* L., (1762)
R. gayana BOISS., Voy. Bot. Esp. *1*: *t.21*, *2*: 76 (1839); W. & L., 3: 892 (1880)

Path running above Barranco de la Cueva de Ladrones, on slopes of N-facing cutting on dry yellowish lst. soil, 1100 m., 13 VII 1951, HEYWOOD: 1248; Arroyo de los Cierzos, above C. F. Sacejo, in *Pinetrum pinastri*, 1250 m., 22 VII 1951, HEYWOOD: 1525
forma capsulis magnis, plusminusve cylindrico-tetragonis ad *R. baeticam* GAY (e descript.) vergens.
La Cimbre, above La Nava de San Pedro, on rocky lst. outcrop slopes, in fruit, 1400 m., 23 VII 1951, HEYWOOD: 1563.

Reseda baetica GAY [in herb. Boiss.] ex MÜLLER (1857); W. & L., 3: 891 (1880)
Syn. *R. barrelieri* BERT. (1842)
R. fruticulosa f. *γ barrelieri* PAU, Not. Suelt. No. 7 in Bol. Soc. Iber. Cienc. Nat. 85 (1919)

Barranco del Guadalentin, S-facing dry 1st. slopes, in fruit, 26 VI 1948, HEYWOOD: 199 & DAVIS.

In its various forms *R. fruticulosa* is found in several parts of the territory in the lower and middle zones; in general it prefers more or less sunny exposed habitats but I have also noted it in the shade, N. exposures and in Pine forests.

R. fruticulosa is an aggregate species which is in dire need of revision. The microspecies *R. baetica* is very imperfectly known and in Madrid Herbarium the few sheets reputed to be this refer to other species. My gatherings from the Barranco del Guadalentin agree with the description of *R. baetica* but until genuine material can be traced the determination should be regarded as provisional.

Reseda lanceolata LAGASCA, Gen. et Sp. 17 No. 220 (1816); W. & L., 3: 892 (1880)

Between Fte. del Pino and Barranco de Palomares, pathsides, 1500 m., 14 VII 1951, HEYWOOD: 1294.

Infrequent in the middle zone in clearings, pathsides. Probably more common in the lower zone as a weed.

Reseda ramosissima POURR. in WILLD. (1809)

Syn. *R. lutea* var. *ramosissima* (POURR.) PAU, in Bol. Soc. Iber. Cienc. Nat. 93 (1923)

Le Pozo, lieux incultes sur le calcaire, 1500 m., Jun. 1905, REVERCHON: 1267 ut *R. lutea* var. *gracilis* [BML, MA]; between Fte. del Pino and Barranco de Palomares, pathsides, 1500 m., 16 Jul. 1951, HEYWOOD: 1296.

Occasional in waste places in lower and middle zones of territory.

Reseda luteola L. (1753); W. & L., 3: 897 (1880)

Between N. de S. Pedro and Puntal de Ana María, in cornfields near a stream, 30 VI 1948, HEYWOOD: 387 & DAVIS; near El Cortado del Chorro, pathsides, 1250 m., 11 VII 1951, HEYWOOD: 1134; S. de Cazorla, slopes of La Cerezera above Cazorla, in dampish graminetum on dry red sandy 1st. slopes, 1300 m., 17 VII 1951, HEYWOOD: 1413.

Common in lower zone of the territory as a weed; less frequent in the lower zone on deforested slopes. Nos. 1134 and 1413 approach var. *gussonei* (BOISS.) MÜLL. by their longly cuspidate capsules but the leaves are not crispate or wavy.

Violaceae

[illegible] *cazorlensis* GANDOGER in Bull. Soc. Bot. France, 5: 226 (1902), emend, DEGEN & HERVIER in HERVIER in Bull. Acad. Int. Géogr. Bot. 15: 60 (1905); MELCHIOR & CUATRECASAS in Cavanillesia 7: 134 (1936)

Cerro Cabañas, summit screes or shady rocks at low altitudes, fl. variable in size and shape, crimson-carmine to pale pink, blotched with vivid carmine or immaculate, in full flower, tiny plants or large clumps, 1800—2000 m., 1 VII 1948, HEYWOOD: 474 & DAVIS; *ibid.*, in 1st. screes, on ledges, fl. often immaculate and of rich pink-purple, 2000 m., 15 VII 1951, HEYWOOD: 1326; Barranco del Guadalentin, between San Pedro and San Pablo, shady rocks by stream, 1300 m., 26 VI 1948, HEYWOOD: 193 & DAVIS; Los Organos, shady 1st. cliffs, on vertical faces, in young fruit, 1300 m., 27 VI 1948, HEYWOOD: 250 & DAVIS; Sierra de Cazorla, Cuerda de las Moras, Prado Redondo, on 1st. rocks and in crevices, 1300—1400 m., Jul. 1948, HEYWOOD, *vid.*; Sierra de Cazorla *sine loco*, 14 VI 1927, LACAITA: s. n. [MA]; Sources du Guadalquivir, au Barranco del Guadalentin, fissures des rochers escarpés, sur le calcaire, rare, 1700 m., Jun. 1904, REVERCHON: 1313 [MA]; Sierra de la Maleza, rochers ombragés et calcaires, 1700 m., Jun. 1906, REVERCHON: 1313 [MA]; Sierra de la Cabrilla, les rochers ombragés et calcaires, 1700 m., rare, Jun. 1906, REVERCHON: 1313 [MA].

This extremely beautiful chasmophyte is widely distributed in the territory, generally on more or less shaded limestone cliffs but occasionally in screes at high altitudes. Phytosociologically it occurs in various „associations" of the order *Potentilletalia caulescentis* BR.-BL. including those of the order *Saxifragion camposii* [„campoi"] CUATREC. described from the Sierras de Cazorla and Magina (*l. c. sup.*). Its altitudinal range is 1000—2000 m.

Reference should be made to the monographic study by MELCHIOR and CUATRECASAS (l. c.) where an excellent survey is given of its taxonomy, ecology and distribution. Some ecological observations are given below.

Viola cazorlensis is an excellent example of a Tertiary relict: it is confined in distribution to the Sierras de Cazorla, Magina (prov. Jaén) and Castril (prov. Granada) in Spain, but two closely related species, *V. delphinantha* and *V. kosaninii* occur in the Balkan Peninsula. These three species constitute the section *Delphinopsis* Becker of the genus *Viola* which thus has a relict and disjunct area of a familiar pattern in the Mediterranean flora. The differentiation of the ancestral species of the section almost certainly followed as a result of geographical isolation during the Tertiary. There is sufficient morphological evidence to support this hypothesis of the antiquity of this species.

The ecology of relict chasmophytes such as *Viola cazorlensis* has received little attention and as I have discussed elsewhere the concepts employed in the classification of rupicolous communities in general require reassessment (HEYWOOD, 1953). Rupicolous species, especially chasmophytes, have a greater "social" independence than is frequently acknowledged, and their occurrence in various communities is to a large extent independent of the "social" structure of these groupings and finds an explanation in the occurrence of suitable microhabitats in a given locality. The microhabitat is the determinant of the rupicolous community, i. e. the communities comprise those species which inhabit the same or related microhabitats and not those which populate the rock surface in general. Thus a large number of the rupicolous communities described are artificial units: their apparent homogeneity in many cases is due to the fact similar combinations of microhabitats occur

together in distinct localities (what I have termed elsewhere macrohabitats). When similar combinations do not occur in different habitats, the "accompanying" species differ.

V. cazorlensis **is found generally in crevices on sloping or subvertical rock faces and is accompanied naturally by species which have similar microhabitat preferences;** as the *Viola* has an apparently wide tolerance it grows in a large altitudinal range and is therefore accompanied by species with similarly wide tolerance *in general*, and *locally* by those species which prefer the same type of microhabitat but are restricted for various reasons to certain altitudinal zones. As a result of this, CUATRECASAS's "associations" with *Viola cazorlensis* give a very misleading picture of the ecology of the species if taken at face value: **he says that *Viola* is found in the more xerophytic facies of the communities of his *Saxifragion* alliance** characterised by *Sarcocapnos crassifolia*, *Galium erythrorrhizum* etc. whereas **it is my own experience that *V. cazorlensis* is generally found in distinctly mesophytic habitats.** The explanation of this apparent paradox is that CUATRECASAS considers only the macrohabitat which in the cases he selects has a larger proportion of xerophilous species than others, while *Viola cazorlensis*, as well as other species, has its own *independent* mesophytic cool microhabitat *within* the artificial community which corresponds to the macrohabitat (CUATRECASAS's "associations"). Further details on this point are given in HEYWOOD (l. c.).

Viola sepincola JORD. (1849); LAZARO, Rev. *Viola* 261 (1919)
subsp. ***glabrescens*** BECKER (1910)
Syn. *V. segorbiciensis* PAU, Not. Bot. 2: 9 (1888)
V. cochleata COINCY in Journ. Bot. No. 1 (1894)
V. torresii MARCET in Butl. Inst. Catal. Hist. Nat. 75 (1905)
V. sepincola var. *perennis* (MIEG.) PAU in Bol. Soc. Arag. Cienc. Nat. 206 (1915)
[*Viola reverchonii* WILLK. nomen in schaed. et in litt (1894)]
Sierra de Cazorla, Cueva del Puerco, in ripicolous assn. veg. only, 1100 m., 6 VII 1951, HEYWOOD: 1051; Cerro Cabanas, summit slopes, in crevices of 1st. boulder rocks, fl. just withered, 2000 m., 15 VII 1951, HEYWOOD: 1327; Cuerda de las Moras, on 1st. NW facing boulder rocks and at base, rosettes only, 1500 m., 21 VII 1951, HEYWOOD: 1477; Fte. Pajarero, below La Ladera de la Ventana, nr. La Nava de San Pedro, in damp herbetum of *Pinetum clusianae*, fl. cleistogamous, 1600 m., 25 VII 1951, HEYWOOD: 1638; Barranco del Guadalentín, near the river, on wet 1st. rocks, 1300 m., 26 VI 1948, HEYWOOD: 169 & DAVIS; Cortijo de Cabrereza, by the edge of irrigation channels, under *Ficus carica*, vegetative, 850 m., 27 VII 1951, HEYWOOD: 1741.

Frequent in damp shady habitats throughout the territory, ranging in altitude from 850—2000 m. The distribution of this subspecies which is closely related to *V. odorata* and *V. alba* is interesting: it has two centres of concentration — in the Magina-Cazorla region in Jaén, and, after a great

hiatus, in Valencia and Aragón; it also occurs sporadically in Old and New Castille and in Cataluna. No. 1327 has more rounded leaf apices and appears to be intermediate to *V. odorata* which is rare in Spain.

Viola kitabeliana ROEM. & SCH. (1819)
La Nava de San Pablo, Fte. Pajarero, in damp herbetum of *Pinetum clusianae*, in fruit, 1600 m., 25 VII 1951, HEYWOOD: 1649.

Rare in the territory in *Pinetum* and infrequent as a weed in the lower zone. The above collection is in fruit so that a more precise determination is not possible but it appears to be *V. kitabeliana*.

Polygalaceae

Polygala boissieri COSS., Not. Pl. Crit. 100 (1851); W. & L. 3: 559 (1878) CHODAT, Monogr. Polygal. in Mém. Soc. Phys. Hist. Nat. Genève 31: 438 (1893)
Syn. *P. rosea* BOISS. Voy. Bot. Esp. 2: 81 (1839) *non* DESF. (1800)
Between La Nava de San Pablo and Los Organos, mauve pink flowers, perennial, 1500 m., 27 VI 1948, HEYWOOD: 242 & DAVIS.

Rare, in sparse aspects of *Pinetum*, clearings, grassy places in middle and upper zone.

P. boissieri **is a relect species probably dating from Tertiary times, distributed in a few mountains of the provinces of Jaén, Granada and Albacete.**

Polygala rupestris POURR. (1788); W. & L., 3: 554 (1878; CHODAT, *op. cit.*
forma floribus pallide lilacino-albicantibus
Sierra de Cazorla, La Pena de Alcones, nr. Cueva de la Magdalena, rocks, vert. 1st. cliffs, fl. very pale lilac-white, 24 VI 1948, 950 m., HEYWOOD: 57 & DAVIS; Nr. Puntal de Ana Maria, vertical SW-facing 1st. cliffs, perennial, 1300 m., 30 VI 1948, HEYWOOD: 380 & DAVIS; Rastrillo de los Covarones, above C. F. Fuente de la Zarza, 1st. slopes above *Pinetum pinastri*, in fruit, 1400 m., 28 VII 1951, HEYWOOD: 1809.

Distinctly uncommon in this territory, on limestone cliffs and rocky slopes. The winged sepals are rather broader in these collections than is usual and the flowers very pale lilac-white.

Hypericaceae

Hypericum caprifolium BOISS., Voy. Bot. Esp. 2: 115 (1839); W. & L., 3: 591 (1880)
Sierra de Cazorla, spring at Cueva del Puerco, in ripicolous community and on inclined slopes of slimy tufa flowing with water, 1070 m., 6 VII 1951, HEYWOOD: 1040; *ibid.*, Cerro de los Cobatillos, in ripicolous community at small spring, fl. yellow tinged red, 900 m., 9 VII 1951, HEYWOOD: 1073; between La Nava de San Pedro and Puntal de Ana Maria, in *Pinetum*, buds reddish, 1200 m., 30 VI 1948, HEYWOOD: 408 & DAVIS; Cuerda de las Moras,

del Fte Tejo, streamside and damp ground, 1300 m., 4 VII 1948, Heywood: 578 & Davis.

Characteristic species of ripicolous communities in the lower zone of the territory.

Hypericum ericoides L. (1753); W. & L., 3: 595 (1878); Turrill in Bot. Mag. 165: *t. 36* (1948)
Cueva del Romeral, La Cimbre above La Nava de San Pedro, on WSW-facing lst. cliffs, on more or less vertical faces, 1450 m., 23 VII 1951, Heywood: 1559; Los Rastrillos de la Fuente de Umbría, on NW-facing vert. lst, cliffs, freq. in fl., 1700 m., 2 VIII 1951, Heywood: 1855; Barranco de la Garganta, nr. La Nava de San Pedro, on dry lst. rocks opposite the Fte. de la Garganta, 1200 m., 25 VI 1948, Heywood: 136 & Davis; Los Agujeros de San Pedro, on shady rocks in bud, 1450 m., 29 VI 1948, Heywood: 363 & Davis; *ibid.*, El Peñón de los Agujeros, v. freq. on shady rocks, fl. and young fr., 11 VIII 1948, Heywood: 957.

A chasmophyte of very limited distribution in this territory; it characterises the more or less shaded cool limestone rocks in the area of La Nava de San Pedro, where its distribution is centred.

H. ericoides appears to be fragmented into a number of local races: the plants of the Cazorla-Sagra complex of mountains comprise one, those of the mountains of Valencia another, and those from Porta-Coeli (prov. Valencia) yet another, but a detailed study is needed to decide if these variants deserve recognition and description. The differences found in the field suggest that there is ecotypic differentiation.

The locality „below las Cabanas" reproduced by Turrill (l. c.) refers to the Cerro de las Cabañas in this territory.

Hypericum perforatum L. (1753); W. & L., 3: 590 (1878).
Sierra de Cazorla, above C. F. Prado Redondo, in plantation of *Pinus pinaster*, and on open slopes, 1010 m., 9 VII 1951, Heywood: 1086; *ibid.*, between Tobazo de Nace el Rio and Cueva de la Magdalena, at edge of potato plots, by small spring, 900 m., 7 VII 1951, Heywood: 1058; Los Tranquillos, SW st. rocky slopes, 1010 m., 6 VII 1951, Heywood: 1029; below C. F. Los Rasos, in mesophytic community in damp meadows, 1200 m., 16 VII 1951, Heywood: 1401b; Sollana del Arroyo Millar, in dampish facies of *Pteridium aquilinum* in *Pinetum pinastri*, 1150 m., 22 VII 1951, Heywood: 1516; between La Nava de San Pedro and Barranco del Guadalentín, in stream, 1200 m., 30 VI 1948, Heywood: 402 & Davis.

Common in more or less mesophytic habitats in the lower and middle zones of the territory.

Hypericum tomentosum L. (1753); W. & L., 3: 590 (1878).
Slopes below la Cueva del Polvo, nr. La Fresnedilla, in open parts of a maleza formation with *Quercus coccifera*, *Q. ilex*, *Q. lusitanica*, *Pistacia terebinthus*, *P. lentiscus*, *Halimium atriplicifolium*, more or less creeping stems, 800 m., 28 VII 1951, Heywood: 1772.

forma pumila cymis congestis
Corrasol de la Torre, Los Carboneros, on N slopes and paths on hot dry lst. soil, 1170 m., 13 VII 1951, Heywood: 1258.

H. tomentosum is found in this territory in more or less mesophytic communities, near streams, caves etc. on damp calcareous soil. Both the above gatherings are extremely white-tomentose, apparently in response to their atypical habitats; No. 1258 is so greatly modified — dwarf stems, congested leaves and cymes — that it does not appear at first glance to be the same species as No. 1772, and is consequently even further removed from typical *H. tomentosum*.

(to be continued)

A. K. Skvortsov:[1])

Sieben neue *Salix*-Arten aus der Sowjetunion

Im Laufe der von mir unternommenen taxonomischen Revision der Gattung *Salix* im Rahmen der Flora der UdSSR hat es sich erwiesen, daß 7 neue Weiden-Arten aufgestellt werden müssen, deren Diagnosen hierauf folgen. Ausführlichere morphologische, taxonomische und geographische Kommentare werden in Publikationen des Verf. in russischer Sprache gegeben (diejenige über *Salix nasarovii* und *S. recurvigemmis* sind erschienen, weitere sind in Vorbereitung).

1. Salix pentandroides A. Skvortsov sp. nova

(*S. pentandra* auctt. fl. causas., non L.). Arbor parvus v. altitudinis mediocris. Rami 3—4 — ennes grisei glabri opaci, 2-ennes griseo- v. stramineo-mellei v. olivacei, lucidi. Ramuli annotini fine autumni et hieme 2—2,5 mm (inter gemmas ab apice 3-am et 4-am) crassi, olivacei, olivaceo-mellei, brunneo-olivacei v. brunneo-fulvescentes glaberrimi lucidi. Gemmae vegetativae genetativis habitu externo simillimae, utrae ramulis adpressae, ovatae v. triangulari-ovatae, facie adaxiali ± applanatae, 5—8 mm longae, 3—4,5 mm latae, ca. 2 mm crassae, apice obtusato rarius subacuto, ramulum versus ± inclinato; perula autumno marcescens (cingulo vivo angusto ima basi tantum persistente) glaberrima lucida ramulis concolor v. magis lutescens v. fulvescens; foliorum primordia 5—8, margine sericeo-villosa, facie interna glabra, externa glabra v. breviter sericea, primordium primum latum (suborbiculatum v. fere reniforme), cetera amplectens, amenti primordio fere duplo longius. Stipulae

[1]) Der Verf. bittet, die richtige Transkription seines Familiennamens zu beachten; die in einigen Veröffentlichungen erschienenen Transkriptionen wie Skvortzov oder Skvorzov sind als Druckfehler zu betrachten.