Erika Pignatti · Sandro Pignatti

Plant Life of the Dolomites

Atlas of Flora

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Preface

To start with, our botanical investigations in the Dolomites had the purpose of analyzing and describing the plant communities and their special adaptations to the mountain environment on dolomite, a type of basic rock rarely occurring in the Alps. The results of these investigations are set out in the first two volumes of this study, "Plant Life of the Dolomites: Vegetation Structure and Ecology" (cited in the following as "Vol. 1") and "Plant Life of the Dolomites: Vegetation Tables" (cited in the following as "Vol. 2").

During the field work, many data were accumulated, specifically regarding the local distribution of the plant species growing in this territory, and when we were ordering them, we realized that there was enough material to compile a detailed record of the local range of every species growing in this territory. Putting together the data collected during our field work and the lists of species in all plots, complete coverage of the entire area was obtained, from the Puster Valley to the Piave River. This means that there is a flora of the Dolomites, a work up to now lacking in the botanical literature. These data, united in a data bank, are presented here with distribution maps, which allow an immediate perception of the range of each species within the territory.

Over 2400 species are present in the study area. Following the international standards of the specialized literature, the area was divided into about 200 quadrants, and for each of them an almost complete census of the present species (from 400 to over 1000) was obtained. The total of records exceeds 100,000. The evaluation and synopsis (Chorological Atlas) of such a large set of data required a long period of indoor activity, but the adoption of standard methods allows an easy comparison with other areas of the Alps, in Italy and elsewhere.

Nowadays, it is easy, thanks to computerized procedures, to obtain a large number of graphics. But the distribution maps of this volume are not just a standard result produced at the writing desk, because they have been constructed on the basis of a great number of field observations. During the investigation, which was continued for over 40 years, it was impossible to imagine how the distribution map of a single species would have looked like at the end of this survey. This is now possible, and today, comparing the maps, one can often observe patterns which are repeated as if they were made by a stamp, but one has to keep well in mind that this is not the effect of instructions stored in the computer: the patterns derive solely from the observations gained in nature, at different times and places. Therefore, the patterns are true images of the reality, as we have perceived it.

The image which represents the distribution map of each species is a summary of present environmental factors, combined with evolutionary events which occurred in geological times. In fact, in the actual distribution of the plants in the territory, the first fundamental difference is given by the type of substrate, calcareous or siliceous, and in this frame, the distribution patterns are different for species adapted to high altitudes or to lower areas. But in these distribution maps, one can sometimes also individuate traces of facts which happened long ago, like the limit of the glaciers during cold periods of the Quaternary or glacier islands at the southern border of the ice cap which once covered the Alps, with testimony of migrations or extinctions of the local flora. Many of these distribution maps are like fingerprints: species which would normally escape our attention can often give a particular character to the plant cover in the Dolomites and permit us to have a better understanding of the ecological conditions of the alpine environment. In this sense, the present volume "Plant Life of the Dolomites: Atlas of Flora" (Vol. 3) is a necessary complement to the previous volumes dealing with the plant communities.

Rome, Italy

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Contents

History of the Floristic Exploration in the Dolomites

The botanical knowledge of the Dolomites has developed slowly over a long period, and when we started our research there in 1960, a general treatment of this kind was still lacking. It is not possible here to give a detailed historical exposition of the floristic explorations in the Dolomites, which, although of interest, would require a complex analysis of the literature and botanical collections in several scientific institutions in different parts of Europe. In this chapter, we relate only the essential facts and specify the sources that were at our disposal during the decades 1960–1980 when our basic exploration of the plant life in this territory took place.

The Origins

Botanical studies during the Middle Ages were motivated principally by the therapeutic uses of plants but were in general limited to re-publishing the works of classical authors like Dioscorides, Therophrastus, Pliny, Columella and others, with the purpose of identifying in the local flora the medicinal plants described by these authors. Only towards the end of this period was it realised that the publications from the classical period described plants from distant countries that perhaps did not exist elsewhere, and in any case these works had gaps and were often generic or imprecise (also caused by repetitive transcriptions). In this way, interest was directed towards the study of the local flora, which was rich in still under-utilized medicinal resources. The first document we looked at was the *Codex Bellunensis*, which was probably compiled during the first decade of 1400, to which was added the *Codex Guarnerinus*, elaborated not much later in Feltre. The authors of these works remain unknown, but they described plants of the Dolomites which at that time were being used for medicinal purposes (see Argenti 1993).

With the beginning of the Modern Ages, the interest in observation and the direct study of nature began, still by local scientists (medical doctors, pharmacists and friars), who started the first floristic explorations and communicated their results to botanists of their time. Among these, Agostino Alpago from Belluno has to be mentioned, who was corresponding with P.A. Michiel and with Mattioli. Meanwhile, at several universities, the first botanic gardens were being instituted, and among them the one at Padua (founded in 1545) was considered the "Hortus Primigenius", which would soon become the reference point for botanical studies in Central Europe. This was a period of activity by the Italians Mattioli (1500–1577) and Calceolarius (F. Calzolari, 1521–1600), Cortuso, Cesalpino, Casabona and the foreign botanists Clusius (Ch. de l'Ecluse, 1526–1609) and J. Burser (1583–1639), the memory of whom is preserved in the names of many plants. Mattioli, as the personal medical doctor of Ferdinand v. Habsburg, Duke of Tyrol and son of the Emperor Ferdinand I, lived for a long period in Trento, and in 1528 he got married in Cles (Val di Non). Mattioli contributed to the building of the Botanic Garden in Innsbruck and had the opportunity to get to know the alpine flora firsthand. A short time later (1554), Calceolarius made his first excursion to Monte Baldo; this can be considered as the starting point of botanical exploration in the Italian Alps. In

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the following period, Giovanni Pona, another botanist from Verona, published the first descriptions of the plants observed in the Monte Baldo area (1601), followed by other contributions of this kind. The pharmacist of Belluno Nicolò Chiavena (who died in 1617) must also be mentioned here: he described "*Absinthium umbellatum*", successively dedicated by Linnaeus to him as *Achillea clavenae*.

In any case, the research developed very slowly, at least in the Italian portion of the Eastern Alps. In fact, during the sixteenth, seventeenth and eighteenth centuries, studies were concentrated mostly at universities (Padua) and in the most important cities like Venice and Verona. Great interest began to be directed towards the study of oriental countries and of the New World, while the Dolomites, because of their peripheral position, remained excluded. Among the most active botanists of this time, none personally collected plants in the Dolomites. It is difficult to understand that, while plants from far away countries, like the potato, tobacco, papyrus, rice and corn, were adopted in this period and became familiar to the population of Italy, the mountain area which was part of the Venetian Republic remained practically unknown, along with emblematic species like edelweiss (*Leontopodium alpinum*), alpine rose (*Rosa pendulina*) or dwarf pine (*Pinus mugo*). In the valleys of the Dolomites at that time, there was already intense use of the forests and mineral resources, but the mountains were for the most part scarcely settled, while penetrating into their inner valleys would have required difficult and dangerous travel.

In addition, the territory of the Dolomites was divided by an important political boundary: the northern and western part belonged to the Austrian Empire, while the southern and eastern valleys were under Venetian sovereignty. Some border crossings existed, used by travellers and for modest commercial activity, e.g. the so-called Strada d'Alemagna (in reality, a difficult alpine route from Cadore through Podestagno/Peutelstein and Dobbiaco/Toblach), and further on the Vial del Pan near the Marmolada and the Rolle Pass. Regarding the seventeenth century, there is only the memory of the already mentioned Chiavena. For the following century, the first botanical researches in the area of the Dolomites have been documented. In 1712, C. Tura climbed the Vette of Feltre and reported a list of about 100 species. In 1724, G.G. Zannichelli (1662–1729, the author of the first scientific study of the Venice Lagoon) repeated this excursion. His report is a colourful description, giving an idea of the difficulty that naturalists had to face at that time: an uncomfortable and long journey from Venice to Feltre in a primitive coach, then climbing up on mule back and on foot, overnight stays in shepherds' refuges and then the difficulties of descending to the valley bottom with the collected plants. This excursion of Zannichelli was the beginning of the botanical study of the Dolomites. Quite contemporary is Andrea de Petris, born in Sauris in 1692, with a doctoral degree in medicine in Padua gained in July 1722. He left a handwritten book with 352 drawings of plants, most of them collected in the Dolomites (cf. Chiovenda E., *Ann.di Bot*. 7: 215–223, 1902). A short while later, G. Agosti from Belluno (1715–1786) studied the local flora: his herbarium still exists together with the written text *De re botanica*. From that time there were also the visits by P. Arduino (1728–1805) in the Belluno area, but his collections are limited to the most peripheral mountains, probably because they were easier to reach. On June 16, 1817, Contarini arrived on the peak of Mount Cavallo and, following the accurate reconstruction of Lasen C., Cappai A., Velluti C., 1985), one realizes that, although almost two centuries have passed, the environmental conditions today are not much different. One must recall here the name of a great botanist, G.A. Scopoli (1723–1788), born in Cavalese but whose scientific activity regarding the flora of Carniola was developed during his stay as a medical doctor at the mines in Idria (presently in Slovenia); later, he was professor at the University of Pavia, but there is no proof that he studied the flora of the native territory.

The Dolomites as Southern Provinces of the Austrian Empire

With the Napoleon Wars, even inhabitants of alpine areas were to find themselves in conditions of turbulence and general instability: the fall of the Republic of Venice, the following French occupation, the patriotic Tyrolian insurrection and the firm repression. This was certainly not a period in which to develop botanical studies, but the bellicose events brought many foreigners to the territory and among them has to be remembered the French geologist Deodate de

Dolomieu (1750–1801), from whom the Dolomites take their name. With the restoration following the Congress of Vienna, the whole area from the Puster Valley to the Venetian plain became unified within the boundary of the Austrian Empire, and a process of modernisation and of slow development began: roads were constructed, military and administrative requirements brought technicians from the Danube and Lombardo-Venetian areas, and there were also opportunities for young mountain people to get to know the surrounding territories. The government took particular care in the development of education, and within a few decades the whole population had learnt to read and write; in this process, an important role was carried out by religious centres and by priests of nearby valleys.

During the nineteenth century, the major development in botanical studies in the Eastern Alps came from the Austrian universities, e.g. Innsbruck where A. Kerner (1831–1898) was active and in particular Vienna by R. v. Wettstein (1863–1931). On the other hand, in Padua, R. de Visiani (1800–1878), born in Sebenico, was working on the monumental task of his *Flora Dalmatica* and did not show much interest in the alpine flora. Nevertheless, the general improvement in social and cultural conditions also showed among the resident population of scientists who were carrying out original work. In this way, the publications of two floras of Trento by F. Ambrosi (1854–1857) and by E. Gelmi (1893) occurred. Very important for the knowledge of the flora of the Dolomites was the work of F. Facchini (1788–1852), a physician in Vigo di Fassa, whose *Flora Tiroliae Cisalpinae* (1855) referred to the whole territory, from Belluno to Puster Valley and more, and contained descriptions of numerous endemic species. Also, A. Sandi (1794–1849) from Belluno, G.A. Bérenger (1815–1895) and S. Venzo (1815–1876) have to be remembered. During the second half of the nineteenth century, there was an active trio made up of P. Porta (1832–1923), the parish priest at Cologna near Riva del Garda, R. Huter (1834–1922), born in northern Tyrol, but for a long time parish priest at Sterzing (Vipiteno) and G. Rigo, a pharmacist in the Giudicarie (1841–1922). These three men worked together for several decades, collecting abundant plant material which was distributed as exsiccata from diligent collecting in the alpine area and long excursions to Mediterranean Italy, Spain and the Balkans. In particular, R. Huter has left a rich scientific heritage in his extremely meticulous *Herbarstudien (Oesterreichische Bot. Zeitschrift, 1908)*, from which one can draw some indications concerning the flora of the Dolomites, especially from the mountains around Sexten.

During the nineteenth century, scientific visits to the Dolomites was mostly carried out by geologists who arrived in great numbers from Austrian, German and Italian Universities, maintaining their centre in Predazzo where they elaborated a fundamental theoretical model for the geology of the Alps. But the same did not occur with botanists at that time. The most frequent goal for them were the Mediterranean coasts, the Balkan peninsula or even overseas; instead, botanical studies treating the Eastern Alps were in general without much interest. Besides the activity of local collectors, botanists arriving from northern countries for the alpine flora included D.H. Hoppe (1760–1846), F. v. Hausmann (1810–1878), and Schunk, who published a study in 1878. Also, a kind of scientific tourism was developing, including Englishmen like Ball and Churchill. Gradually, the botanical data entered into publications of geographic content, such as alpine guide books, but always remained episodic and marginal, and it was in this way that the knowledge of the plant world entered Middle-European culture. As successive fruits of this knowledge, we remember the popular *Dolomiten-Wanderbuch* by Delago (1930), the *Schulflora fuer Oesterreich* by A. Heimerl (two editions in 1903 and 1912) and *La nostra flora* by G. Dalla Fior (partly deriving from the *Flora Analitica* by A. Fiori). These were small modest pocket volumes, but from which generations of passionate people (including the authors of the present volume) have learnt the first elements of the *scientia amabili*s.

The synthesis of the most fruitful research period was written by D. Torre and Sarnthein (1900–1913), a monumental work dedicated to the whole region of the Tyrol, but from which it is relatively easy to extrapolate notices regarding the flora of the Dolomites. It is a work of high quality which sets out in detail the floristic knowledge of the time in which it has been written, though by now surpassed regarding the definitions of many critical groups. The data regarding the Dolomites in this work are limited to the territory which at that time was under the Austro-Hungarian Empire; information about the area of Belluno is

completely lacking. Anyway, this work is an important starting point, because it also contains an exhaustive review of all previous literature. We have compiled an extensive list of extracts which has allowed us to identify 1472 species mentioned in these volumes for the Dolomites; this corresponds to about 2/3 of the species observed by us. For each species, the known localities are given, but one has to remember that not all these indications are always really credible, because mostly they refer to important centres at the valley bottom, for instance regarding the general area of the Dolomites, such as Bruneck/Brunico, Bozen/Bolzano, Cavalese, Predazzo, Cortina and Fiera di Primiero, which during the nineteenth century have also been the principal supporting points for visitors. It seems that, for this reason, the placename does not always indicate just that place and the surrounding area, but all potentially accessible places which were reached during the excursions (sometimes lasting over several days) starting from that particular village. This could explain many locations given for plants which, for reasons of altitude, may not seem very credible. When we decided to include the material of D. Torre and Sarnthein in our data bank, we preferred in dubious cases to ignore these records. In fact, our data have been verified directly or are taken from recent bibliographies, with convincing GPS locations and from authors whom we personally know, so we hope that these data constitute a realistic account of the flora of the Dolomites. The addition of further localities which we were not able to verify could have resulted in trivializing some distribution types. Therefore, we preferred to concentrate on the use of personally verified data, although this sometimes may have constrained us to sacrifice the completeness of the information.

It has still to be remembered that the flora is changing with time, and the period of more than a century which separates us from the publication of the work of Dalla Torre and Sarnthein has brought many a change, including in the life style and agricultural activities in the area. In particular, one can observe that, in the flora of Dalla Torre and Sarnthein, much space is given to aliens, probably related to cereal growing in the mountain environment and to sheep grazing pasture, but today these activities have been more or less abandoned and so the corresponding species have also vanished, a sign that they always remained extraneous to the flora of the territory. For instance, for the Bruneck/Brunico, D. Torre and Sarnthein mention *Adonis aestivalis, Bromus secalinus, Conium maculatum. Consolida regalis, Fumaria vaillantii, Hyosciamus niger, Lamium amplexicaule, Nepeta cataria, Puccinellia distans, Sherardia arvensis, Veronica polita* and for Cavalese *Ballota nigra, Caucalis platycapnos, Chondrilla juncea, Crepis pulchra, Hyosciamus niger, Malva alcea, Marrubium vulgare, Melissa officinalis, Onopordon acanthium, Polycnemum majus, Stipa capensis, Microthlaspi perfoliatum* and *Trifolium fragiferum*. As these species have not been confirmed by recent observations, they are left out in our treatment.

The Dolomites as a Northern Province of the Kingdom of Italy

After the third War of Independence (1866), Venetia was united with the Kingdom of Italy, which, in this way, was to take in the entire territory of the ancient Italian Renaissance States, which was an important event that started the recovery of the full national identity. However, for the Dolomites, this could be seen as a setback, because the territory once again became divided by a political boundary. The southern valleys centred on Feltre and Belluno became separated from the German world, but this did not result in a decreasing interest of scientists from Central Europe, France and England for that area. In Italy, there was a different situation. P.A. Saccardo (1845–1920) was professor in Padua and was occupied in the compilation of the general survey of mycology and so less devoted to field research, but he had an important role as a guide to various botanists, among them G. Bizzozero (1852–1885) and Pampanini. The activity of field research received a marked boost in the years around 1900, when A. Fiori (1865–1950) was appointed as an assistant professor in Padua, where, together with Paoletti and Béguinot, he prepared the first edition of his new *Flora Analitica d'Italia*. Fiori himself had considerable experience in the alpine environment, and the plants of the Alps are extensively treated in his publication. Other studies of more local interest were published in this period, including an accurate flora of the Vette di Feltre by Saccardo and Traverso (1905) and the flora of the riverbed of the Piave and other contributions by Minio (1910).; We are pleased to recall that the latter,

a former director of the Museum of Natural History in Venice, has been a guide for one of us (S.P.) in the study of plant collections.

After the first World War, southern Tyrol was to become the provinces of Bolzano and Trento under Italian sovereignty, and thus the Dolomites again became united. During the period between the two World Wars, the activity of botanists belonging to the Germanic culture within the territory of the Dolomites was much reduced, perhaps because of the effect of the frontier, but also surely because of the economic and political crisis in Germany and Austria, and also because of the strengthened nationalism reigning in Italy at that time, when the activity of foreign scientists on Italian territory could have been seen as suspicious. Nevertheless, Murr, resident in Bozen/Bolzano, continued to publish his botanical notes in the German language. The research of Italian scientists showed a remarkable surge which was not only due to an increased Italian presence within the newly gained territory but in particular to individual initiatives of scientists born and living in the territory between Treviso and Belluno, or in any case from the Venetian region. These were scientists most of whom we have personally met, and their most relevant publications are reported in the bibliography for in-depth information. Of those gravitating around Padua and the surrounding territory can be recalled P. Bolzon, C. Cappelletti, M. Minio, S. Tonzig and S. Zenari, and also the Venetian A. Marcello, G. Dalla Fior, palinologist in Trento, A. Chiarugi and above all E. Pampanini (1875–1949), born in Chiapuzza of S. Vito in Cadore, later professor of botany in Florence and Cagliari.

A special comment has to be dedicated to Bolzon, Pampanini and Zenari, three very conscientious and well-documented scientists. During this period in Padua, G. Gola was active and an interest in the phanerogamic flora was again evoked. At the beginning of the century, Gola had published his "osmotic theory of edaphism", interpreting the distribution of plants as depending on osmotic conditions in the soil. Without doubt this theory is true, but, in our opinion catches only part of the reality considering the actual facts and interpretation of the presence of a plant in a determined place as a linear consequence of soil conditions. In fact, the complexity of historical effects which have permitted the species to occur in the present crossing of space/time is not taken into consideration in Gola's theory. In this way, one remains with a deterministic vision which is substantially "fixist". One may doubt whether the three botanists active in Venetia in that period had a clear vision of the whole complex problem or whether they were just in this way interpreting the culture of their time. In fact, they developed a very personal style, publishing a great number of papers with accurate descriptions of biotopes, together with lists as far as possible complete, of the species observed in each of these places. Also, more important publications like Pampanini's *Flora of Cadore* (published posthumously in 1958) and the vegetation of Comelico by Zenari (1942) have the same structure. It is not clear whether these methods were suggested by the ideas of Gola, but in any case it seems that there was a serious initiative to verify the theory of edaphism in the field.

In the publications of these botanical contributions, there is a problem produced by the fact that ,mostly, for each studied biotope, all the species are indicated and, consequently, there are long lists of common and widespread species, and the few really interesting observations are lost in between the continuous repetitions of species like *Poa alpina* or *Picea abies*, the presence of which in most areas of the Dolomites is obvious. In addition, the nomenclature of Fiori's *Flora d'Italia* is followed strictly, consisting of a collection of different varieties and forms often of unclear rank. For these reasons, we had great difficulty in extracting useful information from this material for our floristic inventory. The fact remains that a detailed analysis of the flora of formerly quite unknown areas is presented here and the relative extracted material is carefully conserved in the Herbaria of Padua and Florence and so easily accessible. We had the possibility of studying some critical material, and a complete revision of these collections would probably be fruitful.

Modern Systematics and Plant Geography

Decisive progress in the meantime has been coming forward primarily from the work of scientists from countries north of the Alps. Already at the end of the nineteenth century the publication of large treatises on the flora of Central Europe had begun, including the whole mountain chain. The first to appear was the monumental work of Ascherson and Graebner

Synopsis der Mitteleuropäischen Flora (1896–1913), still inspired by the nineteenth century concept, the publication of which included less than half of the families of phanerogams, but later (1939) the further volumes of this enormous work were abandoned. Much more modern is the style of the *Illustrierte Flora von Mitteleuropa* by Hegi, the publication of which (first edition 1906–1931) extends into the whole of the twentieth century and is still continuing (edition 3). This is a richly illustrated flora with drawings, photographs and maps, with the space for monographic treatments of the most interesting groups and in particular giving space to the phytogeographic evaluation of the species. When we started studying the alpine environment at the beginning of 1949 in the Lienz Dolomites and some years later at the Stelvio, due to the lack of modern literature in the Italian language, these works became our guide books together with the very accurate *Swiss Flora* by Schinz and Keller (1905). From these works, one can deduce an image of the flora as a living biological unit in continuous interaction with the environment. Some top specialist scientists contributed to the volumes of Hegi and were involved with the definition of the basic principles of geobotany: J. Braun-Blanquet (*Saxifraga, Onosma*), who is also the author of an accurate flora of Grisons, H. Gams (*Papilionaceae*) and W. Luedi (*Primula*). For the following period, the volumes of H. Scharfetter (1938, 1953) and of H. Meusel (1942, 1965–1992) have to be mentioned, containing very personal interpretations of the evolution of the alpine flora and the typology of distribution patterns.

In the meantime, geological, geo-morphological and paleo-climatic knowledge of the cold periods of the Quaternary has increased. The original interpretation by Merxmueller (1952–1954), in his monograph based on the actual distribution of alpine species, introduces the model of the north–south disjunction, caused by the ice cap covering the Alps during the periods of glaciations. The tendency to fragmentation and constitution of localized endemism is described by H. Pitschmann and H. Reisigl, together with the subsequent extensive literature in connection with the results of the rapidly developing cyto-taxonomical investigations on the alpine flora in which the endemic component is emphasized.

Among the Italian botanists, V. Giacomini has moved in this direction with his studies on thermophilous bryophytes of alpine valleys published in 1950. V. Marchesoni in 1959 proposed a phytogeographic articulation of the Trento region and F.M. Gerola and D.U. Gerola presented their ecological investigations on the pastures in that area. All these studies, although not always directly dealing with the flora of the Dolomites, make an important contribution to the knowledge of phytogeographic problems in the Eastern Alps.

New Incentives to Research

Our field investigations in the Dolomites began in summer 1960 (see Vol. 1, Introduction). In the beginning, we dedicated our attention solely to the analysis of the vegetation using the phytosociological method, but towards the year 1970 we were convinced that it was necessary to also extend our investigations to the flora. In fact, the lack of a reference flora presented us with a serious difficulty. The publication of the *Flora Europaea* had begun, in which was proposed completely new formulations of many groups. In addition, one of us (S.P.) was working on the publication of a new *Flora of Italy*, which appeared in 1982. The flora of the Dolomites became a sort of laboratory in order to organize the descriptions and the analytical keys.

In 1967, our colleague and friend F. Ehrendorfer in Vienna proposed a large international collaboration to realize a floristic inventory of the Alps, and in the same year we started a first experiment in Sauris, in a typical dolomite environment (belonging to the Carnic Alps). The first edition of Ehrendorfer's *Liste der Gefaesspflanzen Mitteleuropas* (1967) contains numerous taxonomic novelties, and in particular the concept of the "aggregate", which subsequently became widely applied, was proposed here. During the following years and until now, we have published only a few preliminary papers or short notes dealing with the flora of the Dolomites. In the meantime, others have also conducted qualified research which has allowed the publication of detailed floristic analyses, among which those of Festi and Prosser (2000) on the Nature Park of Paneveggio-Pale of San Martino, and those by Argenti and Lasen (2000) on the National Park of the Belluno Dolomites are particularly relevant, as well as the catalogue of the flora of

Belluno by Argenti and Lasen (2004).We shall come back to this last one later.

A Mountain Flora

From the early investigations by Zannichelli up to now, nearly 300 years have passed, and a great number of scientists have contributed to a deeper knowledge of the plant life of this territory. In this way, one arrives at the concept of a Dolomite Flora as a whole complex of plant species, adapted to this mountain area, surrounded by the deep valleys of Valsugana, Pustertal, Piave and Adige-Isarco rivers, and with the highest mountain peak of the Marmolada (3343 m). The great variety of substrates, from dolomite to volcanic rocks and silicates, and the history of ancient and recent geology, up to the glacial events, have profoundly contributed to the evolution of this flora which today forms a unitary complex, although each species defines its own individual niche, which is different from any other species.

The most significant components are the endemic species which are not as many as in other portions of the Alps (not more than a dozen are strictly limited to the Dolomites). They are accompanied by a much greater number of endemisms, the distribution area of which exceeds by far the area of the Dolomites and extends over areas of the Alps in Carnia, Trentino and Lombardy. This endemic component is concentrated towards the southern elevations, which seems to clearly be the consequence of the fact that they remained outside the area covered by the Quaternary ice cap.

If the most diffuse species of the alpine environment are taken into consideration, this clearly results in the identity of the Dolomite Flora being larger the nearer it approaches to the "hard core" presented by the highest mountain peaks, where the boreal and arctic–alpine components become prevalent. The dolomite and east-alpine components are instead progressively vanishing in peripheral areas due to the bottom valley climate which allows the survival of steppic or sub-mediterranean species, which are to be considered as extraneous elements in the alpine flora. Here also the anthropic influence has favored the arrival of a great number of species related to the human habitat.

The species for which the distribution area is presented in the Atlas are over 2250, but, including the flora of the lower belt, it would be easy to add another 100 or more species (mostly ubiquitous), though their influence on the dolomite environment is negligible. The total obtained by our research is close to 2400 species, but it is not possible to give a precise number, whether because of the exclusion from the total of marginal and synanthropic species, or because an undisputable limit does not exist without an exact geographical or administrative boundary. For this reason, the taking into account and the addition of one or more "marginal" species in the Dolomite Flora has been decided in an arbitrary manner, based above all on their participation in the plant communities which form the native plant cover of the Dolomites.

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Methods and Historical Development

Regional and local floras for centuries consisted of lists in which all the known species for a certain territory were indicated, mostly also accompanied by a description of the species and their distribution within the area, which was obtained by indicating the localities in which they had been collected or observed. The information which can be drawn from these data is in general not uniform. In fact, as one can easily guess when the results are reported on a geographical map, there will be areas which have been intensively visited and studied, whereas others may have only been investigated in a summary fashion because of difficulties of access or for other reasons. A uniform analysis of a flora is obtained by the floristic inventory, carried out for the first time in Europe in the 1930s in the Netherlands and for the first time over a large territory for the *Atlas of the British Flora* (1962). This consists of a grid of defined quadrants (10-km squares) based on geographic coordinates which ensures a uniform level of investigation for each area within the considered territory.

The investigation of the Dolomites flora has been a constant engagement during all our excursions in the Eastern Alps, Venice and Trento areas and, from 1981 onwards, in central Italy, an engagement that at least for the first decade has remained isolated. Today, one can see with satisfaction that the same method is being applied by very active groups in the whole alpine chain and in various areas of the Italian peninsula. The first examples of a published floristic atlas with regional extensions in Italy are in Friuli-Venezia Giulia (Poldini et al. 2002) and in Central and Eastern Lombardy (Martini et al. 2014).

The floristic inventory is carried out in a defined reticulate based on geographic coordinates related to the prime meridian in Greenwich, UK, which is a general reference worldwide. The areas are indicated as quadrants and correspond to a rectangle of 3×3 geographic minutes; at our latitude, these areas have an area of about 35 km^2. All species growing in a given quadrant are identified to obtain a generalized list of the flora and a catalogue of all species occurring in it. This census is repeated for every quadrant, and on this basis it is possible to indicate on a general map of the studied territory the quadrants where a single species occurs. When this procedure is repeated for each species occurring in the studied area, we obtain an Atlas such as the one presented here.

Our inventory of the Dolomite area considered here started in 1970 in the Falcade valley and later continued across the whole territory from the Val Belluna to the Puster Valley. The inventory of the flora was continued during the whole period of research in the Dolomites; the last data added here are from August 2003.

The field survey was carried out on already printed lists, one for each excursion but all following a general scheme; this permits the keeping of a more uniform nomenclature and draws attention to possible gaps. Subsequently, all the data referring to each single quadrant are united in a general list and similarly the indications deriving from the bibliography, which are always added after a critical revision. The recording and informational treatment of the data were initially elaborated by S. Paglia and S. Pietrosanti, while regarding the databank, we are much obliged to E. Bona for statistic elaboration and realisation of the distribution maps in the Chronological Atlas.

E. Pignatti and S. Pignatti, *Plant Life of the Dolomites*,
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The method of the floristic inventory requires a large amount of fieldwork and could seem to be an excess of perfectionism, but this is actually very useful because it compels a generalized analysis of the flora. In this way, the risks of giving emphasis to single taxonomic groups (e.g. the synanthropic flora, endemic species, etc.) can be avoided, and in the same way one is inclined to spread the research over the whole study area in a uniform way. No other method allows one to obtain an equally generalized knowledge of the territory extending from the flora to the ecology of the species, to the communities and to the landscape units. The critical point is realised by the fact that the inventory, even for a single quadrant, can never be considered as truly complete; every new excursion identifies species not previously observed. Even our data cannot be excluded from this criticism, because, even after more than 40 years of observations, the lists of species are still considered incomplete. It has to be remembered that the quadrant information has been written up during the summer and has concentrated on alpine vegetation, so that gaps could exist though mostly for precocious flowering and the flora of the valley bottom. In any case, the data presented here can establish a useful basis for successive investigations.

The data bank of the flora of the Dolomites consists predominantly of direct observations made during field research and has been immediately updated during the following days. A repeated collection of herbarium specimens has not been carried out in all quadrants but an extensive survey, at least for the most critical groups, was carried out. The collection is stored in the herbarium of the Botanic Institute (now Department of Biology) of Trieste University (TSB). The excursions were extended to the whole area of the Dolomites, and also to a larger area than considered here, e.g. in Carnia around Sauris during the whole summer of 1968 (see also Pignatti and Poldini 1969; Pignatti 1973) and also for comparison during excursions over several days in the Dolomites of Brenta, Tremalzo, Recoaro, Grappa Mt., Prealps of Treviso. The first schedules were created and used in 1968, the last ones during summer 2003. As a whole, individual records (species/locality) comprise more than 120,000 of which about 9o% are reported in this study (the others being outside the true Dolomites). To these observations have been added data kindly communicated by C. Lasen (schedules 9837/4, 9838/1, 9838/3, 9936/2, 9936/4, all regarding the Feltre Dolomites and the investigation of the plateau of Foses, together with those from other friends and collaborators (T.& I. Boiti, H. Niklfeld, N. Seraphin). Close and informative relationships have been kept with groups which carried out floristic fieldwork in nearby areas, in Carinthia, Friuli-Venezia Giulia, and Trentino, and regarding the investigation program taking place in Austria (H. Niklfeld). With all these data brought together, one still cannot be certain to have presented here a completely exhaustive inventory, and certainly much remains to be done for a still deeper analysis of the flora.

The direct observations are the principal core of the data to which have been added as many notes as possible from the bibliography, when they were considered relevant. It has to be pointed out that, due to the adopted method, only bibliographic notes could be used which had been localized within the territory, which in many cases was difficult or even impossible, above all for the most ancient records. A great quantity of data from Cadore and Comelico are contained in the *Flora of Pampanini* (1958), but these data also have to be treated with caution, as the work was published posthumously and a last revision by the author is lacking. Although Pampanini's authoritativeness is indisputable (having personally made most of the observations and giving very precise indications of the localities), some data seem to have low credibility, and therefore one can suppose that in some cases his notes had not been correctly interpreted. Our data bank also contains the very accurate data of Zenari (numerous contributions from 1942 to 1951). Among the most recent authors who have to be mentioned are, especially, the contributions of Argenti and Lasen (1985), Boiti (1988), Kiem (1992, 1994, 1996,1997, 2000), Festi and Prosser (2000), Argenti and Lasen (2000), the catalogue of the flora of the province of Belluno by Argenti and Lasen (2004) and the study of exotic Graminaceae by Wilhalm (2001). When the present volume was in an advanced stage of publication, we received the completely new catalogue of the flora of southern Tyrol by Wilhalm et al. (2006), which could only be utilized by us for a few essential new finds. Adding our observations to those of these authors means that some totals obtained are among the highest for the entire area of the Dolomites.

The list deriving from the floristic inventory of the plant species represents a real flora of the Dolomites on its own, published together with the findings of the most recent science and technology. Evidently, many problems concerning the taxonomy of species in the list still remain. For the discussion of some cases and the interpretation which has been given on some notes in the bibliography, see *Floristic Notes* which precedes the Atlas of the species.

Geo-referencing and Graphics

Orientation is an important problem in the Alps and anyone who is familiar with mountains knows that whenever it has been neglected, a high price is often paid. During field excursions, one follows the signs of the paths which in the Dolomites are generally quite accurate, verified continuously on the topographic map, on which the reference is a point (marked with a single dot) or is linear (the itinerary). When our research started in the Dolomites, it was necessary to refer the observations and collections to the data which could be taken from the map. Indeed, in this way it was also possible to give a clear reference for all the collected data. Portable instruments for the Global Positioning System (GPS) became available during the 1990s, and since that time we have largely used this method for identifying the exact points on the terrain.

In consequence, we have used the same method of geo-referencing in the three volumes of *Plant Life of the Dolomites,* and the schedules referring to species and those referring to the plant communities are therefore comparable. For the representation of these data, we used a unified basis, the international grid for the floristic inventory (quadrants), generally recognized in Europe, with cells of 3×5 geographic minutes. In this way, all the collected data have been geo-referenced with completely uniform methods.

Plant Life of the Dolomites is divided into three volumes:

Vol. 1. The cartography for the plant communities (more than 100) is reported in schemes completely corresponding to those dealing with the distribution of the plant species. Similarly, care was taken to insert all the treated information into the corresponding quadrants.

Vol. 2. The phytosociological plots used as permanent surfaces, the quadrant information of vegetation complexes, etc.

Vol. 3. The result of the floristic inventory, in which collections of plants and localities mentioned in literature were incorporated, have all been inserted in the same grid square, the basis for the *Distribution Atlas of the Flora of the Dolomites*, in which maps are given for all the species for which the presence has been proven within the territory.

The maps of the species and those of plant communities are therefore comparable; also, the quantitative evaluations are comparable. With these methods, a new possibility is opened for an interesting field of applications for territorial ecology on a quantitative basis.

In this standardized method for collection of data, a further problem derives from the fact that, in the Dolomites, three different languages are currently spoken (German, Italian and Ladin), and consequently the geographical or topographical nomenclature sometimes results in confusion. The spelling of place-names is often different in the various documents and in excursion guides, but we have tried to keep the form used in the recent IGM cartography at a scale of 1:50,000, even though it is not always convincing from a lexical point of view, while for the German place-names we also refer to the map in the classic *Dolomiten Wanderbuch* by Delago.

In the chapter "Toponyms", an index of place-names of the area used during our investigations is given, with some examples of different names used in the three languages for the same locality. It is certainly not exhaustive, but it can be useful in helping to understand the meaning of some of the place-names used in the description of different localities visited during our research.

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The Flora of the Dolomites

Introduction

The Dolomites are for both of us a well-known environment and have been since our school years, but only during our university studies did we become aware of the richness of the flora in these mountains. The first observations and collections were carried out by Erika in the Lienzer Dolomiten (1949–1952), the subject of her thesis; Sandro at this time was (far away) investigating the vegetation of the lagoon around Venice.

During the summer months of 1953–1955, we carried out some excursions on the dolomite substrate, mostly in the mountain groups surrounding Lienz, and in subsequent years in the Dolomites of Südtirol. Meanwhile, we were both appointed to the research staff of the Institute of Botany and Botanic Garden of Padua University. In 1960, we decided (with agreement from Prof. C. Cappelletti, head of the Institute) to develop a general survey of the flora and vegetation of these mountains. In fact, at that time, an exhaustive analysis of the flora only existed for single areas of the Dolomites, whereas in other parts, recent investigations were completely lacking. A stimulating paper by Pitschmann and Reisigl (1957) on the endemics of this area demonstrated the necessity of an exploration of the plant cover based on modern scientific methods; the whole territory was urgently in need of careful investigation. Our first excursion started on August 1, 1960, with the participation of our friend R. Sutter (Chur, Graubünden, Switzerland).

In September 1960, a larger international group of botanists interested in vegetation science (among them E. Aichinger, J. Braun-Blanquet, E. Oberdorfer, and M. Wraber) was at Brixen for a meeting, with several excursions in the Dolomites (Passo Sella, Karer Forest) guided by us. This was the occasion for a large exchange of information on the progressing investigation of the alpine flora in the Eastern Alps and Dynarids and for the foundation of the Ostalpin-Dinarische Arbeitsgemeinschaft für Vegetationskunde.

Such excursions in the Dolomites were repeated in subsequent years with increasing frequency and continued for almost four decades, often in the framework of our teaching activities or with PhD students, until the end of the twentieth century (in fact, field investigations also continued in subsequent years, but mainly for ecophysiological measurements). The complete series of notebooks with the field records are conserved at the Botanic Garden of Rome and can be readily consulted; the collections are included in the Herbarium of the University of Trieste (TSB).

The generalized survey of the flora, covering the entire area, was carried out through a series of coordinated investigations. Meanwhile, we received a suggestion from F. Ehrendorfer of the opportunity to use the internationally recognized standard grid for the Floristic Inventory (there are approximately 200 quadrants in our Chorological Atlas), and this stimulated our interest to reach a homogenous overview of the patterns of plant distribution. This is a good method to avoid what often occurs during investigations in mountains, that a single valley or a mountain is exhaustively analyzed, whereas other ones remain almost unknown.

At this time, other botanists started parallel investigations in the Dolomites, for example, Boiti, Kiem, Lasen, and, successively, Argenti, Festi, Prosser, Wilhalm; they (in particular Lasen and Argenti) informed us of their new finds. In the same

E. Pignatti and S. Pignatti, *Plant Life of the Dolomites*,
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period, many distinguished scientists from surrounding nations visited this territory for excursions or longer investigations, for example, Gottlich, Gutermann, Landolt, Lorentz, and Niklfeld. We often visited different forests guided by Erwin Aichinger, or we introduced visiting colleagues from overseas, including John Beard, Kinglsey Dixon and Philipp Ladd from West Australia, and Tsukasa Hukusima from Japan.

Meanwhile, much progress in plant science occurred. The most significant was the publication of new modern floras for Switzerland, Germany and Austria, and in particular the *Flora Europaea* (five volumes published in a rapid sequence from 1972 to 1980). Many general concepts of plant systematics and new criteria for nomenclature were developed. As a consequence, in our notebooks with the field observations and in publications, the same species may be listed during the whole period with different names (*Erica carnea*/*E. herbacea*, *Sesleria caerulea*/*S. albicans*, etc.), or with a different taxonomical rank. During the final preparation (ca. 2000–2002), nomenclature and taxonomy were unified based on the concepts considered valid at that time, although, unfortunately, changes in taxonomic nomenclature have continued since.

Despite this, further updating was no longer possible because volumes 1 and 2 of *Plant Life of the Dolomites* were already in publication. We have tried to indicate the most recent nomenclatural changes, at least in synonymy (with thanks to R. Guarino and M. Larosa for help with the solving of many nomenclatural puzzles). Meanwhile, the second edition of the *Flora d'Italia* will soon be published, and in consequence some species will be indicated under different binomials in that work and in *Plant Life of the Dolomites*. These are unavoidable differences but are also a sign of steadily increasing knowledge in plant science.

The Chorological Atlas

The Chorological Atlas in this volume gives the first complete overview published so far on all the plant species living in the territory of the Dolomites. It includes over 2250 species. Since the maps with the distribution of all species in the territory are printed in the following pages of this volume, in alphabetical order, it seems unnecessary to give here a separate checklist with all the species names.

The activity to find the species present in the area of the Dolomites, to distinguish and identify them, was carried out in the period when one of us was preparing the *Flora d'Italia*, published in 1982. Strict relationships exist between the two works: the description of many critical species in the *Flora* is based on collections from our excursions in the Dolomites, and reciprocally the excursions in the Dolomites were planned in the hope of finding significant specimens of some critical groups. In consequence, for a description of the species and eventually occurring synonyms, one should refer to Pignatti's, *Flora d'Italia* (1982).

Indeed, in the subsequent period, much progress was made regarding knowledge of the flora of the Alps, in Italy as well as in Austria and Switzerland, and in particular in the species groups which are more properly located in the Dolomites. To facilitate comparisons with the more recent literature, in the following section, we discuss two important arguments: nomenclatural changes and new finds of rare or critical species.

Updating the Nomenclature of the Species

It is well known to all who are familiar with plant taxonomy that scientific nomenclature is subject to continuous improvement and changes.

The main rule is that the valid denomination of a species is a Latin binomial, consisting of the name of the genus (a substantive) followed by a so-called specific adjective. This adjective may often be a second substantive, sometimes as a genitive name. The binomial is followed by the name (normally shortened) of the author who first described the species (e.g., L. means Linné, the founder of the classical taxonomy). These procedures are overseen by the Nomenclatural Commission.

The nomenclatural rules have the aim of giving names which are as far as possible stable and significant, although it very often happens that a binomial has to be changed, because an older description of the species has been discovered, or (more frequently) because the results of recent taxonomical investigations allow a new interpretation of the species (e.g., splitting into two or more species or lumping together with related ones),. or simply because of changes in the name of the genus.

In the treatment of the flora of the Dolomites, in general the nomenclature used in *Flora d'Italia* (1982) was applied. This was also the case in *Plant Life of the Dolomites* Vols. 1 and 2, with the exception of some well-used names (e.g., *Erica carnea* and *Sesleria caerulea*). In this volume also, we will maintain the same nomenclature. In fact, to update the nomenclature it would be necessary to make changes, both small or substantial, in about 10 % of the binomials. This would become an effective source of errors (and nomenclatural changes will continue also in the future).

In the following list, the correspondence of the synonyms used is given.

Chorological Atlas	Updated scientific name
Achillea clavenae L.	*Achillea clavennae* L.
Achillea roseo-alba Ehrend.	*Achillea roseoalba* Ehrend.
Acinos alpinus (L.) Moench	*Clinopodium alpinum* (L.) Kuntze
Acinos arvensis (Lam.) Dandy	*Clinopodium acinos* (L.) Kuntze
Aconitum lamarckii Rchb.	*Aconitum lycoctonum* L. em. Koelle
Adenostyles glabra (Miller) DC.	*Adenostyles alpina* (L.) Bluff et Fingerh.
Agropyron caninum (L.) Beauv.	*Elymus caninus* (L.) L.
Agropyron intermedium (Host) Beauv.	*Elymus hispidus* (Opiz) Melderis
Agropyron repens (L.) Beauv.	*Elymus repens* (L.) Gould
Agrostis schraderana Becherer	*Agrostis schraderiana* Bech.
Agrostis tenuis Sibth.	*Agrostis capillaris L.*
Aira elegans Willd.	*Aira elegantissima* Schur
Alchemilla acutiloba Opiz	*Alchemilla vulgaris* L. em. S. E. Fröhner
Alchemilla gracilis Opiz	*Alchemilla micans* Buser
Alchemilla plicatula Gand.	*Alchemilla alpigena* Buser ex Hegi
Allium lusitanicum Lam.	*Allium senescens* L. subsp. *montanum* (Fr.) Holub
Anchusa italica Retz.	*Anchusa azurea* Mill.
Antennaria carpathica (Wahlenb.) Bluff et Fingerh.	*Antennaria carpatica* (Wahlenb.) Bluff et Fingerh.
Anthemis altissima L.	*Cota altissima* (L.) J. Gay
Anthemis austriaca Jacq.	*Cota austriaca* (Jacq.) Sch. Bip.
Anthemis tinctoria L.	*Cota tinctoria (L.) J. Gay*
Anthoxanthum alpinum Löve et Löve	*Anthoxanthum nipponicum* Honda
Arabis brassica (Leers) Rauschert	*Arabis pauciflora* (Grimm) Garcke
Arabis pumila Jacq.	*Arabis bellidifolia* Crantz
Arabis vochinensis Sprengel	*Arabis arabiformis* (Hohenw.) Soldano
Aristolochia longa L.	*Aristolochia lutea* Desf.
Aster bellidiastrum (L.) Scop.	*Bellidiastrum michelii* Cass.
Aster linosyris (L.) Bernh.	*Galatella linosyris* (L.) Rchb. fil. subsp. *linosyris*
Aster novi-belgii L.	*Symphyotrichum novi-belgii* (L.) G. L. Nesom
Astragalus purpureus Lam.	*Astragalus hypoglottis* L.
Atriplex latifolia Wahlenb.	*Atriplex prostrata* Boucher ex DC.
Atriplex nitens Schkuhr	*Atriplex sagittata* Borkh.
Avenula praeusta (Rchb.) Holub	*Helictochloa praeusta (*Rchb.) Romero Zarco
Avenula pratensis (L.) Dumort.	*Helictochloa pratensis (L.) Romero Zarco*
Avenula versicolor (Vill.) Lainz	*Helictochloa versicolor* (Vill.) Romero Zarco
Bromus benekenii Lange	*Bromopsis benekenii* (Lange) Holub
Bromus condensatus Hackel	*Bromopsis condensata* (Hack.) Holub
Bromus erectus Hudson	*Bromopsis erecta* (Huds.) Fourr.
Bromus inermis Leyser	*Bromopsis inermis (*Leyss.) Holub
Bromus madritensis L.	*Anisantha madritensis* (L.) Nevski
Bromus pannonicus Kumm. et Sendtner	*Bromopsis pannonica* (Kumm. et Sendtn.) Holub
Bromus ramosus Hudson	*Bromopsis ramosa* (Huds.) Holub
Bromus sterilis L.	*Anisantha sterilis* (L.) Nevski
Bromus tectorum L.	*Anisantha tectorum* (L.) Nevski
Bulbocodium vernum L.	*Colchicum bulbocodium* Ker Gawl.
Calamintha grandiflora (L.) Moench	*Clinopodium grandiflorum* (L.) Kuntze
Calamintha sylvatica Bromf.	*Clinopodium menthifolium* (Host) Stace
Calamintha sylvatica Bromf. subsp. *ascendens* (Jordan) P. W. Ball	*Clinopodium ascendens* Samp.
Cardamine bellidifolia L.	*Cardamine alpina* Willd.
Cardamine hayneana Welw.	*Cardamine matthioli* Moretti
Cardaminopsis arenosa (L.) Hayek	*Arabidopsis arenosa* (L.) Lawalrée
Cardaminopsis halleri (L.) Hayek	*Arabidopsis halleri* (L.) O'Kane et Al-Shehbaz
Cardaria draba (L.) Desv.	*Lepidium draba* L.
Carduus carlinaefolius Lam.	*Carduus carlinifolius* Lam.

(continued)

Chorological Atlas	Updated scientific name
Carex contigua Hoppe	*Carex spicata* Huds.
Carex fusca All.	*Carex nigra* (L.) Reichard
Carex gracilis Curtis	*Carex acuta L.*
Carex juncifolia All.	*Carex maritima* Gunnerus
Carex oederi Retz.	*Carex viridula* Michx.
Carex otrubae Podp.	*Carex cuprina* (Sandor ex Heuffel) Nendtwich ex A. Kern.
Carex pairaei F. Schultz	*Carex muricata* L. subsp. *pairae* (F. W. Schultz) Čelak.
Carex polyphylla Kar. et Kir.	*Carex guestphalica* (Boenn. ex Rchb.) Boenn. ex O. Lang
Carex stellulata Good.	*Carex echinata* Murray
Carex tumidicarpa Anderss.	*Carex demissa* Hornem.
Centaurea cyanus L.	*Cyanus segetum* Hill
Centaurea montana L.	*Cyanus montanus* (L.) Hill
Centaurea triumfetti All.	*Cyanus triumfetti* (All.) Dostál ex Á. Löve et D. Löve
Chamaecytisus hirsutus (L.) Link	*Cytisus hirsutus* L.
Chamaecytisus purpureus (Scop.) Link	*Cytisus purpureus* Scop.
Chenopodium bonus-henricus L.	*Blitum bonus-henricus* (L.) Rchb.
Chenopodium foliosum Asch.	*Blitum virgatum* L.
Chenopodium glaucum L.	*Oxybasis glauca* (L.) S. Fuentes, Uotila et Borsch
Chenopodium polyspermum L.	*Lipandra polysperma* (L.) S. Fuentes, Uotila et Borsch
Chenopodium urbicum L.	*Oxybasis urbica* (L.) S. Fuentes, Uotila et Borsch
Cicerbita alpina (L.) Wallr.	*Lactuca alpina* (L.) A. Gray
Cirsium helenioides (L.) Hill	*Cirsium heterophyllum* (L.) Hill
Cirsium montanum (W. et K.) Sprengel	*Cirsium alsophilum* (Pollini) Soldano
Cnidium silaifolium (Jacq.) Simonkai	*Katapsuxis silaifolia* (Jacq.) Reduron, Charpin et Pimenov
Conyza albida Willd.	*Erigeron sumatrensis* Retz.
Coronilla emerus L.	*Emerus major* Mill.
Coronilla varia L.	*Securigera varia* (L.) Lassen
Crataegus oxyacantha L.	*Crataegus laevigata* (Poir.) DC.
Crepis kerneri Rech. fil.	*Crepis jacquinii* Tausch subsp. *kerneri* (Rech. fil.) Merxm.
Crocus albiflorus Kit.	*Crocus vernus* (L.) Hill
Cystopteris fragilis (L.) Bernh. subsp. *alpina* (Wulfen) Hartman	*Cystopteris alpina* (Lam.) Desv.
Diphasium alpinum (L.) Rothm.	*Diphasiastrum alpinum* (L.) Holub
Diphasium complanatum (L.) Rothm.	*Diphasiastrum complanatum* (L.) Holub

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Chorological Atlas	Updated scientific name
Dorycnium pentaphyllum Scop.	*Lotus dorycnium* L.
Duchesnea indica (Andrews) Focke	*Potentilla indica* (Jacks.) Th. Wolf
Eleocharis austriaca Hayek	*Eleocharis mamillata* H. Lindb. subsp. *mamillata*
Erigeron gaudinii Brügg.	*Erigeron schleicheri* Gremli
Erigeron polymorphus Scop.	*Erigeron glabratus* Hoppe et Hornsch. ex Bluff et Fingerh.
Erophila verna (L.) Chevall. subsp. *obconica* (De Bary) Vollm.	*Draba obconica* (Bary) Fritsch
*Erophila verna (*L.) Chevall. subsp. *praecox* (Steven) D. Fourn.	*Draba praecox* Steven
Erophila verna (L.) Chevall. subsp. *spathulata* (Láng) Walters	*Draba boerhaavii* H. C. Hall
Erophila verna (L.) Chevall. subsp. *verna*	*Draba verna* L. s.s.
Eryngium barrelieri Boiss.	*Eryngium pusillum* L.
Festuca altissima All.	*Drymochloa sylvatica* (Pollich) Holub
Festuca arundinacea Schreber	*Schedonorus arundinaceus* (Schreb.) Dumort.
Festuca gigantea Vill.	*Schedonorus giganteus* (L.) Holub
Festuca laxa Host	*Leucopoa laxa* (Host) H. Scholz et Foggi
Festuca paniculata (L.) Sch. et Th.	*Patzkea paniculata* (L.) G. H. Loos
Festuca pratensis Hudson	*Schedonorus pratensis* (Huds.) P. Beauv.
Festuca pulchella Schrader	*Leucopoa pulchella* (Schrad.) H. Scholz et Foggi
Festuca tenuifolia Sibth.	*Festuca filiformis* Pourr.
Fraxinus oxycarpa Bieb.	*Fraxinus angustifolia* Vahl
Gagea fistulosa (Ramond) Ker Gawl.	*Gagea fragifera* (Vill.) Ehr. Bayer et G. López
Galinsoga ciliata (Rafin.) Blake	*Galinsoga quadriradiata* Ruiz et Pav.
Gentiana kochiana Perr. et Song.	*Gentiana acaulis* L.
Gentianella nana (Wulfen) Pritchard	*Comastoma nanum* (Wulfen) Toyok.
Gentianella tenella (Rottb.) Börner	*Comastoma tenellum* (Rottb.) Toyok.
Globularia punctata Lapeyr.	*Globularia bisnagarica* L.
Glyceria plicata Fries	*Glyceria notata* Chevall.
Helianthemum oelandicum (L.) D. C. subsp. *alpestre* (Jacq.) Breistr.	*Helianthemum alpestre* Jacq.

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Chorological Atlas	Updated scientific name
Hieracium alpicola Schleicher	*Pilosella alpicola* (Schleich. ex Steud. et Hochst.) F. W. Schultz et Sch. Bip.
Hieracium aurantiacum L.	*Pilosella aurantiaca* (L.) F. W. Schultz et Sch. Bip.
Hieracium auricula Lam. et DC.	*Pilosella lactucella* (Wallr.) P. D. Sell et C. West
Hieracium bauhini Besser	*Pilosella bauhini* (Schult.) Arv.-Touv.
Hieracium cymosum L.	*Pilosella cymosa* (L.) F. W. Schultz et Sch. Bip.
Hieracium glaciale Reyner	*Pilosella glacialis* (Reyn. ex Lachen.) F. W. Schultz et Sch. Bip.
Hieracium intybaceum (Wulfen) Jacq.	*Schlagintweitia intybacea* (All.) Griseb.
Hieracium morisianum Rchb.	*Hieracium pilosum* Schleich. ex Froel.
Hieracium pilosella L.	*Pilosella officinarum* Vaill.
Hieracium piloselloides Vill.	*Pilosella piloselloides* (Vill.) Soják
Hieracium staticifolium All.	*Tolpis staticifolia* (All.) Sch. Bip.
Hieracium sylvaticum (L.) L.	*Hieracium murorum L.*
Hierochloë australis (Schrader) R. et S.	*Anthoxanthum australe* (Schrad.) Veldkamp
Hierochloë odorata (L.) Wahlenb.	*Anthoxanthum nitens* (Weber) Y.Schouten et Veldkamp
Hymenolobus pauciflorus (Koch) Sch. et Th.	*Hornungia pauciflora* (W. D. J. Koch) Soldano, F. Conti, Banfi et Galasso
Hymenolobus procumbens (L.) Nutt.	*Hornungia procumbens* (L.) Hayek
Inula conyza DC.	*Inula conyzae* (Griess.) Meikle
Jovibarba hirta (L.) Opiz	*Jovibarba globifera* (L.) J. Parn. subsp. hirta (L.) J. Parn.
Juniperus nana Willd.	*Juniperus sibirica* Burgsd.
Koeleria macrantha (Ledeb.) Sprengel	*Koeleria cristata* (L.) Roem. et Schult.
Lamiastrum galeobdolon flavidum (F. Hermann) Ehrend. et Polatschek	*Galeobdolon flavidum* (F. Herm.) Holub
Lembotropis nigricans (L.) Griseb.	*Cytisus nigricans* L.
Leontodon autumnalis L.	*Scorzoneroides autumnalis* (L.) Moench
Leontodon helveticus Mérat	*Scorzoneroides helvetica* (Mérat emend. Widder) Holub
Leontodon montanus Lam.	*Scorzoneroides montana* (Lam.) Holub
Leopoldia comosa (L.) Parl.	*Muscari comosum* (L.) Mill.
Lepidotis inundata (L.) Beauv.	*Lycopodiella inundata* (L.) Holub
Leucanthemum praecox Horvatic	*Leucanthemum vulgare* (Vaill.) Lam.
Leucorchis albida (L.) E. Meyer	*Pseudorchis albida* (L.) Á. Löve et D. Löve
Ligusticum lucidum Miller subsp. *lucidum*	*Coristospermum cuneifolium* (Guss.) Bertol.
Ligusticum mutellina (L.) Crantz	*Mutellina purpurea* (Poir.) Reduron, Charpin et Pimenov
Ligusticum mutellinoides (Crantz) Vill.	*Pachypleurum mutellinoides* (Crantz) Holub
Loiseleuria procumbens (l.) Desv.	*Kalmia procumbens* (L.) Gift, Kron et Stevens ex Galasso, Banfi et F. Conti
Lonicera coerulea L.	*Lonicera caerulea* L.
Luzula albida (Hoffm.) Lam. et DC.	*Luzula luzuloides* (Lam.) Dandy et Wilmott
Lychnis viscaria L.	*Viscaria vulgaris* Röhl.
Lythrum portula (L.) D. A. Webb	*Peplis portula* L.
Matricaria inodora L.	*Tripleurospermum inodorum* (L.) Sch. Bip.
Medicago sativa L. subsp. *falcata* (L.) Arcang.	*Medicago falcata* L.
Microstylis monophyllos (L.) Lindl.	*Malaxis monophyllos* (L.) Sw.
Minuartia graminifolia (Ardoino) Ják. subsp. *clandestina* (Portenschl.) Mattf.	*Minuartia clandestina* (Port.) Trinajstić
Molinia coerulea (L.) Moench	*Molinia caerulea* (L.) Moench
Moneses uniflora (L.) A. Gray	*Pyrola uniflora* L.
Monotropa hypopitys L.	*Hypopitys monotropa* Crantz
Mycelis muralis (L.) Dumort.	*Lactuca muralis* (L.) Gaertn.
Myosotis caespitosa C. F. Schultz	*Myosotis laxa* Lehm. subsp. *cespitosa* (C. F. Schultz)
Myosoton aquaticum (L.) Moench	*Stellaria aquatica* (L.) Scop.
Odontites lutea (L.) Clairv.	*Odontites luteus* (L.) Clairv.
Odontites rubra (Baumg.) Opiz	*Odontites vulgaris* Moench
Ophrys fuciflora (Crantz) Moench	*Ophrys holosericea* (Burm. fil.) Greuter
Ophrys sphecodes Miller	*Ophrys sphegodes* Mill.
Orchis incarnata L.	*Dactylorhiza incarnata* (L.) Soó
Orchis latifolia L.	*Dactylorhiza majalis* (Rchb.) P. F. Hunt et Summerh.
Orchis maculata L.	*Dactylorhiza maculata* (L.) Soó
Orchis sambucina L.	*Dactylorhiza sambucina* (L.) Soó
Orchis traunsteineri Sauter	*Dactylorhiza traunsteineri* (Saut. ex Rchb.) Soó

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Chorological Atlas	Updated scientific name
Orchis tridentata Scop.	*Neotinea tridentata* (Scop.) R. M. Bateman, Pridgeon et M. W. Chase
Orchis ustulata L.	*Neotinea ustulata* (L.) R. M. Bateman, Pridgeon et M. W. Chase
Ornithogalum pyrenaicum L.	*Loncomelos pyrenaicum* (L.) Hrouda ex Holub
Orobanche loricata Rchb.	*Orobanche artemisiae-campestris* Gaudin
Orthilia secunda (L.) House	*Pyrola secunda* L.
Oryzopsis miliacea (L.) Asch. et Schweinf.	*Oloptum miliaceum* (L.) Röser et Hamasha
Oxytropis jacquinii Bunge	*Oxytropis montana* (L.) DC.
Papaver rhaeticum Leresche	*Papaver aurantiacum* Loisel.
Parietaria diffusa M. et K.	*Parietaria judaica* L.
Peucedanum carvifolia Vill.	*Holandrea carvifolium-chabraei* (Crantz) Soldano, Galasso et Banfi
Peucedanum cervaria (L.) Lapeyr.	*Cervaria rivini* Gaertn.
Peucedanum oreoselinum (L.) Moench	*Oreoselinum nigrum* Delarbre
Peucedanum palustre (L.) Moench	*Thysselinum palustre* (L.) Hoffm.
Peucedanum schottii Besser	*Holandrea schottii* (Besser ex DC.) Reduron, Charpin et Pimenov
Peucedanum venetum (Sprengel) Koch	*Xanthoselinum venetum* (Spreng.) Soldano et Banfi
Peucedanum verticillare (L.) Koch	*Tommasinia verticillaris* (L.) Bertol.
Phegopteris polypodioides Fée	*Phegopteris connectilis* (Michx.) Watt
Phleum alpinum L.	*Phleum rhaeticum (Humphries)* Rauschert
Phleum commutatum Gaudin	*Phleum alpinum* L.
Picea excelsa (Lam.) Link	*Picea abies* (L.) H. Karst.
Picris echioides L.	*Helminthotheca echioides* (L.) Holub
Poa violacea Bellardi	*Bellardiochloa variegata* (Lam.) Kerguélen
Polygonum amphibium L.	*Persicaria amphibia* (L.) Delarbre
Polygonum bistorta L.	*Bistorta officinalis* Delarbre
Polygonum hydropiper L.	*Persicaria hydropiper* (L.) Delarbre
Polygonum lapathifolium L.	*Persicaria lapathifolia* (L.) Delarbre
Polygonum minus Hudson	*Persicaria minor* (Huds.) Opiz
Polygonum mite Schrank	*Persicaria dubia* (Stein) Fourr.
Polygonum nepalense Meisn.	*Persicaria nepalensis* (Meisn.) H. Gross
Polygonum patulum Bieb.	*Polygonum bellardii* All.
Polygonum persicaria L.	*Persicaria maculosa* Gray
Polygonum viviparum L.	*Bistorta vivipara* (L.) Delarbre
Polypodium australe Fée	*Polypodium cambricum* L.
Potamogeton trichoides Cham. et Schl.	*Potamogeton trichoides* Cham. et Schltdl.
Potentilla corsica Sieber	*Drymocallis corsica* (Soleirol) Kurtto
Potentilla rupestris L.	*Drymocallis rupestris* (L.) Soják
Potentilla tabernaemontani Asch.	*Potentilla neumanniana* Rchb.
Pseudolysimachion barrelieri (Schott ex R. et S.) Holub	*Veronica barrelieri* H. Schott ex Roem. et Schult.
Pseudolysimachion longifolium (L.) Opiz	*Veronica maritima* L.
Pseudolysimachion spicatum (L.) Opiz	*Veronica spicata* L.
Ranunculus ficaria L.	*Ficaria verna* Huds.
Ranunculus grenieranus Jordan	*Ranunculus villarsii* DC.
Ranunculus nemorosus DC.	*Ranunculus tuberosus* Lapeyr.
Ranunculus oreophilus Bieb.	*Ranunculus breyninus* Crantz
Ranunculus pyrenaeus L.	*Ranunculus kuepferi* Greuter et Burdet
Rhamnus catharticus L.	*Rhamnus cathartica* L.
Rhamnus pumilus Turra	*Rhamnus pumila* Turra
Rhinanthus aristatus Celak.	*Rhinanthus glacialis* Personnat subsp. *glacialis*
Rosa cinnamomea L.	*Rosa majalis* Herrm.
Rumex alpestris Jacq.	*Rumex arifolius* All.
Saxifraga burserana L.	*Saxifraga burseriana* L.
Scabiosa dubia Vel.	*Scabiosa velenovskyana* Bobrov
Scabiosa graminifolia L.	*Lomelosia graminifolia* (L.) Greuter et Burdet subsp. *graminifolia*
Scabiosa gramuntia L.	*Scabiosa triandra* L.
Scorzonera purpurea L.	*Podospermum purpureum* (L.) W. D. J. Koch et Ziz
Scorzonera rosea W. et K.	*Podospermum roseum* (Waldst. et Kit.) Gemeinholzer et Greuter
Scrophularia juratensis Schleicher	*Scrophularia hoppii* W. D. J. Koch
Sedum anopetalum DC.	*Sedum ochroleucum* Chaix
Sedum maximum (L.) Suter	*Hylotelephium maximum* (L.) Holub subsp. *maximum*
Senecio cordatus Koch	*Jacobaea alpina* (L.) Moench
Senecio erraticus Bertol.	*Jacobaea erratica* (Bertol.) Fourr.

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Chorological Atlas	Updated scientific name
Senecio erucifolius L.	*Jacobaea erucifolia* (L.) G. Gaertn., B. Mey et Scherb.
Senecio fuchsii Gmelin	*Senecio ovatus* (G. Gaertn., B. Mey. et Scherb.) Willd.
Senecio gaudinii Gremli	*Tephroseris tenuifolia* (Gaudin) Holub
Senecio incanus L.	*Jacobaea incana* (L.) Veldkamp
Senecio incanus L. subsp. *carniolicus* (Willd.) Br.-Bl.	*Jacobaea carniolica* (Willd.) Schrank
Senecio incanus L. subsp. *insubricus* (Chenevard) Br.-Bl.	*Jacobaea insubrica* (Chenevard) Flatscher, Schneew. et Schönsw.
Senecio jacobaea L.	*Jacobaea vulgaris* Gaertn.
Senecio paludosus L.	*Jacobaea paludosa* (L.) G. Gaertn., B. Mey. et Scherb. subsp. *angustifolia* Holub
Seseli gouanii Koch	*Seseli kochii* Breistr.
Sesleria ovata (Hoppe) Kerner	*Psilathera ovata* (Hoppe) Deyl
Sesleria varia (Jacq.) Wettst.	*Sesleria caerulea* (L.) Ard.
Setaria geniculata (Lam.) Beauv.	*Setaria parviflora* (Poir.) Kerguélen
Setaria glauca (L.) Beauv.	*Setaria pumila* (Poir.) Roem. et Schult.
Silene acaulis (L.) Jacq. subsp. *excapa* (All.) Br.-Bl.	*Silene excapa* All.
Silene alpestris Jacq.	*Heliosperma alpestre (Jacq.) Griseb.*
Silene armeria L.	*Atocion armeria* (L.) Raf.
Silene quadridentata (Murray) Pers.	*Heliosperma pusillum* (Waldst. et Kit.) Hoffmanns.
Silene rupestris L.	*Atocion rupestre* (L.) Raf.
Silene veselskyi (Janka) Bég.	*Heliosperma veselskyi* Janka
Soldanella pusilla Baumg.	*Soldanella alpicola* F. K. Mey.
Sparganium minimum Wallr.	*Sparganium natans* L.
Taraxacum laevigatum (Willd.) DC. (aggregate)	*Taraxacum fulvum* Raunk.
Telekia speciosissima (L.) Less.	*Xerolekia speciosissima* (L.) Anderb.
Tetragonolobus maritimus (L.) Roth	*Lotus maritimus* L.
Thelypteris limbosperma (All.) H. P. Fuchs	*Oreopteris limbosperma* (All.) Holub
Thlaspi alpestre L. subsp. alpestre	*Noccaea caerulescens* (J. Presl et C. Presl.) F. K. Mey.
Thlaspi minimum Ardoino	*Noccaea alpestris* (Jacq.) Kerguélen
Thlaspi perfoliatum L.	*Microthlaspi perfoliatum* (L.) F. K. Mey.
Thlaspi praecox Wulfen	*Noccaea praecox* (Wulfen) F. K. Mey.
Thlaspi rotundifolium (L.) Gaudin subsp. *rotundifolium*	*Noccaea rotundifolia* (L.) Moench
Thymus alpestris Tausch	*Thymus pseudochamaedrys* (Heinr. Braun) Ronniger
Trisetum alpestre (Host) Beauv.	*Trisetaria alpestris* (Host) Baumg.
Trisetum argenteum (Willd.) R. et S.	*Trisetaria argentea* (Vill.) Banfi et Soldano
Trisetum distichophyllum (Vill.) Beauv.	*Trisetaria distichophylla* (Vill.) Paunero
Trisetum flavescens (L.) Beauv.	*Trisetaria flavescens* (L.) Baumg.
Trisetum spicatum (L.) Richter *subsp. ovatipaniculatum* Hultén	*Trisetaria spicata* (L.) Paunero subsp. *ovatipaniculata* (Hultén ex Jonsell) Banfi et Soldano
Valeriana collina Wallroth	*Valeriana wallrothii* Kreyer
Veratrum album L. subsp. *lobelianum* (Bernh.) Arcang.	*Veratrum lobelianum* Bernh.
Vitaliana primulaeflora Bertol.	*Androsace vitaliana* Lapeyr.
x Hieracium sphaerocephalum Froelich	*Pilosella sphaerocephala* (Froel. ex Rchb.) F. W. Schultz et Sch. Bip.

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New Species to be Added

During the long period necessary for the realisation of this volume, research in the territory of the Dolomites was carried out by botanists living in the area, many of them from the younger generation.

The variability of polymorphic groups (*Ranunculus auricomus* and *Alchemilla vulgaris*) was analyzed and several species previously not observed were found, many of them in peripheral areas, or among the synanthropic flora.

We give here a list of new finds, as a demonstration that it is still worthwhile to continue in-depth analysis of the plant life in the Dolomites.

New species described during the last decades are: *Alchemilla lasenii* S. E. Fröhner, *Alchemilla lunaria* S. E. Fröhner, *Helictochloa adsurgens* (Schur ex Simonk.) Romero Zarco subsp. *ausserdorferi* (Asch. et Graebn.) Romero Zarco, *Nigritella rubra* var. *dolomitensis* (Teppner et E. Klein) R. Lorenz et Perazza (= *Gymnadenia dol.* Teppner et E. Klein; *N. dol.* [Teppner et E. Klein] Hedrén, E. Klein et Teppner), *Ranunculus cochlearifer* Dunkel, *Ranunculus melzeri* Hörandl et Gutermann, and *Ranunculus plavensis* Dunkel.

Some of the newly observed species belong to highly polymorphic groups, for example, *Alchemilla*

diversiloba Buser, *Alchemilla niphogeton* Buser in Pampanini, *Centaurea weldeniana* Rchb., *Dryopteris cambrensis* (Fraser-Jenk.) Beitel et W. R. Buck subsp. *insubrica* (Oberh. et Tavel ex Fraser-Jenk.) Fraser-Jenk, *Dryopteris expansa* (C. Presl) Fraser-Jenk. et Jermy, and *Festuca laevigata* Gaudin.

Other species have been recently indicated in general for the Dolomites without mentioning particular localities (or from surrounding areas): *Carex pauciflora* Lightf. (Serla, Zoldano), *Jacobaea disjuncta* Flatscher, Schneew. et Schönsw., *Pteroselinum rablense* (Wulfen) Rchb., *Rubus festii* H. E. Weber (Monte Rovere near Caldonazzo), and *Veronica jacquinii* Baumg. (Ponte nelle Alpi; extinct?)

In addition, several species living under synanthropic conditions, or at low altitudes (and in this sense not belonging to the true mountain environment of the Dolomites), have been observed in marginal areas, for example, *Agrostis vinealis* Schreb., *Allium scorodoprasum* L., *Crepis sancta* (L.) Babc., *Guizotia abyssinica* (L. f.) Cassini, and *Cyperus microiria* Steudel.

Finally, it must be pointed out that, during our excursions, it was impossible to reach the biotope of the Vincheto near Cellarda (Feltre), because of the difficult access in the river-bed of Piave. This is an area of high environmental value, presently managed as a biogenetical reserve (Ramsar Convention), and the list of species growing in the protected area is available. Indeed, this is an aquatic lowland biotope (only 230 m elevation), close (<1 km) to the southern limit of the study area (quadrant 9937.4) where many of the observed plants are specialists of the Eurasiatic streams, and, in contrast, the presence of alpine elements remains relatively scarce; consequently, the species of the Cellarda area have not been included in the data bank.

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Remarks on the Flora of the Dolomites

With Contributions by Carlo Argenti and Cesare Lasen

In this chapter, we comment on various species. The names of species native to the Dolomites are given in bold. The other species are introduced by humans, are synonyms and without recent records.

Abutilon theophrasti Medicus—Sporadic in cultivated fields around Belluno and Sedico.

Acer negundo L.—Cultivated in parks and along roadways and sporadically sub-spontaneous.

Achillea millefolium L.—A polymorphic group, represented in the Dolomites by different species. The true *A. millefolium* L. is quite widespread and dispersed in mountain and subalpine meadows; *A. roseo-alba* Ehrend. is frequent in arid habitats, mostly on foothills in the pre-alpine belt; in the same area, the closely related *A. stricta* Schleicher also occurs sporadically, in regularly mown meadows. We observed some populations (9637/4, 9838/2) with some characters of *A. asplenifolia* Vent., which was formerly indicated by Zenari for 9839/1. It is not certain whether this species really belongs to the flora of the Dolomites.

Achillea nobilis L.—Not without a certain perplexity, we attributed a few populations of an *Achillea* with capillar and laciniate leaves to this species, which appear sporadically in arid calcareous areas of the Piave Valley and the Prealps. The general aspect is that of *A. setacea* W. et K., but it occurs on siliceous substrates and is limited to areas with a rather continental climate.

Achillea tomentosa L.—The indications given by D. Torre and Sarnthein (1900–1913) for Brunico and the Schlern seem to be doubtful; it has not been recently observed, and on the whole this is a species of low altitudes.

Aconitum lycoctonum L (*Aconitum lamarckii Rchb.*, a polymorphic group)—Quite widespread together with species of the following (group). The recognition of whether a plant belongs to this group is generally almost immediate, but there are big problems regarding its components, whether classified as a subspecies or a species; therefore, the indications on the map refer to the whole group in its totality. In the literature, the most frequent subspecies has been indicated as subsp. *ranunculifolium* (Rchb.) Sch. et K., probably corresponding to *A. lamarckii* Auct.; in Argenti and Lasen (2000), the populations at low altitudes of the Dolomites near Belluno and Feltre are attributed to the subsp. *vulparia* (Rchb.) Nyman, which we have not distinguished. Following the text of W. Starmuehler (Graz), for the second edition of *Flora d'Italia* (in publication), the populations present in the Dolomites will be referred to three species: *A. lupicida* Rchb., *A. lycoctonum* L. with subsp. *lycoctonum* and subsp. *vulparia* (Rchb.) Nyman, and *A. ranunculifolium* Rchb.

Aconitum napellus L. (a polymorphic group)—This group is also quite widespread and variable on the higher mountains. The populations in the Dolomites generally belong to *A. tauricum* Wulfen, with glabrous tepals, which on limestone are mostly represented by the subsp. *latemarense* (Degen et Gayer) Starmuehler; individuals with hairy tepals, perhaps referable to the real *A. napellus* L., have seldom been observed; on the maps, only the group to which they belong is indicated.

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Aconitum variegatum L. (a polymorphic group)—Generally represented by populations having flowers with a "helmet" about as high as wide, and in general also with the axes and ramifications of inflorescences provided with glandular hairs; they correspond to the concept of *A. degenii* Gayer (i.e., to *A. paniculatum* Lam.). *A. variegatum* are understood to be types with helmets markedly higher than wider and generally with axes and branches glabrous or without glandular hairs. In effect, Pampanini (1958) indicates for Cadore only *A. paniculatum*; Argenti and Lasen (2000) are also of the same opinion and, for the Parco delle Dolomiti Bellunesi, indicate only *A. degenii* Gayer (synonymized to *A. paniculatum*) and explicitly exclude the presence of populations referable to *A. variegatum* s. str. (which also corresponds to our experience). Anyway, we observed in the years around 1970 some populations without glandular hairs, near S. Vito in Cadore, with annotations made during our surveys, and also found the same characteristics in plants collected above Borca and later as far as Val d'Oten; such observations were also repeated in the Prealps, in the area of Col Faverghera, Nevegal, and Col Visentin. Glandular populations have been observed in both areas, as well as largely prevail in Cadore. It is possible that they are of hybridogenous origin.

Adenostyles leucophylla (Willd.) Rchb.—Forcella Juribrutto, Cima Bocche and Busa d'Orso (Festi and Prosser 2000); not observed by us.

Aesculus hippocastanum L.—A cultivated species, sporadically spreading in semi-natural habitats, for example, in Pieve di Cadore.

Aethusa cynapium L.—Along the valley of Belluno, in many localities (C. Lasen, personal communication).

Agropyrum intermedium Beauv. (see under ***Elytrigia intermedia*** [Host] Nevski).

Agrostis gigantea Roth—Indicated for 9536/3 after Dalla Torre and Sarnthein (1900–1913). Quite widespread and also along the riverbed of the Piave, starting at Comelico (C. Lasen, in litt.).

Alchemilla L. Reproduction by apomixy. Hundreds of species are recognized in the Alps, mostly based on minimal morphological differences, and in consequence the analysis of the species occurring in the Dolomites is certainly still incomplete.

During our investigations in the field, and in the following critical revision of the collections in the herbarium of Trieste University (TSB), the determinations have been made based on the treatment in *Flora d'Italia* (1982), a text written mainly under the influence of the Austrian, German and Swiss floras. It has to be pointed out that the recognized species correspond only approximately to more modern and rigorous criteria, and therefore these identifications should be considered mainly as tentative, just giving an idea of the high variability of this genus. Indeed, the presence in the Dolomites has been confirmed for the large majority of these species in the still unpublished text for the second edition of *Flora d'Italia* (courtesy of F. Festi). The collections from the Dolomites are conserved in the herbarium of the University of Trieste and have been revised by S. E. Fröhner and subsequently by F. Festi.

From the species of *Alchemilla* previously indicated for the Dolomites, the following need to be confirmed: *A. cinerea* Buser, *A. demissa* Buser, *A. fissimima* Buser, *A. glacialis* Buser, *A. incisa* Buser, *A. trunciloba* Buser, *A. longana* Buser, and *A. transiens* (Buser) Buser.

Meanwhile, a new species has been described from the Dolomites: *Alchemilla lasenii* S. E. Frohner, as a rare endemism of this area.

A. niphogeton Buser and *A. pampaniniana* Buser also belong to this genus, both being of special interest because the locus classicus of the two species is Casera Mondeval above S. Vito di Cadore (9538/2). This is an area we visited several times, and it is very rich in *Alchemilla* species, but among these it has not been possible for us to identify the two above-mentioned species. According to Festi (in litt.), the second one is synonymous with *A. decumbens* Buser, while the first one is also considered as a critical species.

For these reasons, in the present treatment of *Alchemilla*, only localities supported by herbarium specimens revised by specialists are taken into account. The much larger number of observations in the field and during the surveys are not indicated. Consequently, the individual maps are to be considered a first approximation of the real distribution of the *Alchemilla* species in the Dolomites.

Allium ampeloprasum L.—An alien species, observed near Fonzaso (9936/4), Feltre and near Lamen.

Allium angulosum L.—Observed within the quadrants Sagron and Feruch, but difficult to

distinguish from the closely related *A. lusitanicum Lam.* (*Allium senescens* L. subsp. *montanum* [Fr.] Holub), known from some localities close by. Argenti C. (in litt.) considers *A. angulosum* as a species of the humid meadows in the lowlands.

Allium saxatile Bieb.—Mentioned by Bolzon (1914) for the Marmolada, but this is not an alpine species, so maybe there has been confusion with *A. ericetorum* Thore, though this species is also unknown in this area.

Allium schoenoprasum L.—Populations growing under natural conditions in general belong to the subsp. *sibiricum* (e.g., in 94373).

Alnus cordata (Loisel.) Desf.—A species widespread in southern Italy, sometimes used for reforestation purposes, which might grow permanently in local spontaneous vegetation (e.g. near Agordo).

Alopecurus geniculatus L.—Riverbeds of the Boite near Borca at about 800-m altitude and in a humid meadow near Limana (9938/2; Lasen C., in litt.).

Alopecurus utriculatus (L.) Pers.—Indicated for Comelico by Pampanini (1958), but rather doubtful, maybe referring to *A. geniculatus* L.

Alyssum alyssoides (L.) L.—Indicated by D. Torre and Sarnthein (1900–1913) for quadrant 9238/4 (Innerprags), but should be verified.

Amaranthus hybridus L.—Alien in foothills; observed at Fiera di Primiero (9836/2). A polymorphic group that also includes *A. chlorostachys*, *A. cruentus*, etc.

Ampelopsis tricuspidata Sieb. et Zucc.—Cultivated along roadside slopes, with a tendency to become sub-spontaneous.

Androsace alpina (L.) Lam. and ***A. vandellii*** (Turra) Chiov.—The indications for quadrant 9736/2 are from I. and T. Boiti, referring to *A. alpina* on 4.8.1983, along the itinerary Passo Colbricon (1900 m)—Forc. Colbricon (2480 m)—Forc. Caremana (2428 m), whereas *A. vandellii* was observed on 27.8.1983 during an excursion to Punta Ces (2227 m)—Forc. Caremana (2428 m)—Forcella Colbricon (2480 m). In addition, I. Boiti writes: "*Androsace alpina* at the Forc. Colbricon (on pebbles) here in cushion form, all lengthened and low (presence of more or less coloured stipitate glands), while the same species on porphyritic rocks at Passo Manghen 2190 m and at Forc. Giuribrutto (2300 m) have higher growth and only a few glands." Festi and Prosser (2000) also indicate *A. wulfeniana* W. D. J. Koch for the same area (see below); therefore, the three species grow in the vicinity of each other.

Androsace chamaejasme Wulfen—The indication for the Latemar (9635/1) due to Werner seems doubtful for phytogeographical reasons and probably should be referred to *A. obtusifolia* All.

Androsace villosa L.—An indication by Zardini for the Cortina area which should be verified.

Androsace wulfeniana W. D. J. Koch—Localized in the Lagorai group; the only localities known for the study area are on Colbricon and Cavallazza (Festi and Prosser 2000) and Col Margherita–Cima di Bocche (see Rasetti).

Angelica archangelica L.—Once cultivated as an aromatic species and has become sub-spontaneous in orchards and waste places, for example, at Pozza di Fassa and close to Feltre.

Anthemis montana L.—The indication for quadrant 9342/3 in Pampanini (1958) is most likely an error, as this is a species of the Apennines.

Anthyllis vulneraria L.—Present as different subspecies, sometimes with intermediates, probably hybridogenous forms, but which could not always be taken into account. The species, sensu lato, is present in the whole territory of the Dolomites. When indications on infraspecific taxa are lacking, the records can be mainly referred to the subsp. *carpatica* (Pant.) Nyman.

On calcareous alpine grasslands (*Seslerio-Caricetum sempervirentis* and others), the subsp. *alpestris* (Kit.). Asch. et Gr. with a characteristic swollen calyx is frequent; the indication of subsp. *baldensis* (Kerner) Becker in 9535/2 (Dalla Torre and Sarnthein 1900–1913) seems doubtful; indeed, some populations on M. Serva have convergent characters.

Populations in steppe meadows in the prealpine belt may often be referred to the subsp. *polyphylla* (DC) Kit (= subsp. *macrocephala* Wender); area of the Seslerio-Brometum and in the lower Boite-Valley.

Reported by Landolt and Müller (1990) in the subalpine belt; populations can be observed with intermediate forms between *alpestris* × *carpatica*.