

cellent path leads down through a succession of villages, the first of which is Bonzo, about 25 minutes below the point where the track from the col comes in. 2½ hours farther is Ceres, beautifully situated at the junction of the two arms of the valley. Here we halted at 1.30, and, while a *voiture* was being got ready to take us to Lanzo, partook of a thoroughly Italian dinner at a decent-looking inn. A really fine carriage-road had recently been constructed between Ceres and Lanzo, and down it we rattled in 1½ hour, through the most charming scenery, to Lanzo, situated at the point where the mountains subside into the great plain of Piedmont. We found an omnibus starting at 4, which took us to Turin by 8, and a more amusing ride I have seldom had. The country is like a garden; the harvest was just being got in, picturesque groups gave animation to the scene, and a throng of omnibuses and other vehicles indicated an amount of activity that quite astonished me, whilst the whole was lit up with the rich colouring of the close of a glorious Italian day.

F. F. TUCKETT.

NOTES ON THE BOTANY OF THE DISTRICT OF BORMIO.
By JOHN BALL, F.R.S.

IT is a matter of curious enquiry to ascertain why certain districts of the Alps possess a far more varied vegetation than others. Some of these have long been known to botanists, and acquired a certain celebrity even before modern scientific requirements led to the minute investigation of mountain regions and the careful record of observations. The Mont Cenis, the neighbourhood of the Col di Tenda, the head of the valley of Zermatt, the Monte Baldo and the Monte Sumano are instances which will occur to most Alpine botanists; and since the chain of the Alps has been almost everywhere traversed by naturalists, the number of such districts has been largely increased.

This is not the place to enquire into the causes which may have led to the exceptional richness of certain local floras, beyond the remark that one important, though by no means exclusive agency, must be sought in the varied mineral structure of the district; but it seems not out of place in a periodical devoted to increasing our knowledge of the Alps, to give from time to time such information as may be available respecting the vegetable wealth of districts not yet very com-

pletely known, and as to which scanty details are available even in professedly scientific works. Should the present experiment be received with favour by the members of the Alpine Club and other readers of this journal, I shall be happy to contribute from time to time notes of a similar character having reference to other districts. For the present, I select one with which I am tolerably familiar, and which offers especial attractions from the fact that several species, whose home is situate in widely different regions, find here the extreme limit of their dispersion.

I speak of the district of Bormio, including the four or five short valleys whose torrents unite below that quaint but rather dismal little town to form the main stream of the Adda.

The most considerable of these torrents is the Frodolfo, which originates in the great Forno Glacier, receives close to Santa Catarina another glacier torrent which drains the Val Gavia and the slopes of the Tresero, and lower down, near Bormio, is joined by another tributary which issues from the wild Val del Zebbru.

Next in importance to the Frodolfo is the torrent that flows in the opposite direction, and enters the valley of Bormio from the west, a little above the town, just under the comfortable establishment opened of late years at the Bagni Nuovi. This drains Val Viola, with several short tributary glens, but is not fed by any considerable glacier.

The least considerable of the three streams that unite at Bormio is that which preserves the name Adda, because both its branches lie near to tracks long frequented by travellers passing from Lombardy to Switzerland or Tyrol; while till lately Val Furva and Val Viola were little known, save by name, to Alpine geographers. About three miles above Bormio the traveller following the great road of the Stelvio looks down on the junction of two torrents. That which he is to follow in his ascent to the Stelvio Pass is the Braulio, slender and clear in the morning, but full and turbid in the afternoon, when swollen by the melting of the extensive Vitelli Glacier and the snow-fields that clothe the flanks of the Cristallo. The western stream which joins the Braulio is the Adda, which here descends from the Val di Fraele. The popular fancy has fixed upon a copious flow of water that bursts abruptly from the limestone rock at a great height above the stream as the true source of the river; but recent maps indicate some small swampy pools some five miles farther from the junction as the proper sources.

Of the valleys here named, that of the Frodolfo (called Val Furva) and Val Viola are almost altogether enclosed by mountains composed of schists and sandstones, often semi-crystalline in structure and containing little lime. These belong apparently to the verrucano and the Trias. The mountain mass rising north of Bormio, which is deeply excavated by the Braulio and the head-waters of the Adda, consists, on the other hand, exclusively of limestone, which exhibits the characteristic features of that rock—lofty mural precipices with steep slopes of débris, dear to botanists, but destructive to the boots of the traveller. The Val del Zebbru, which offers the most striking scenery of this district, is a very deep trench dividing the calcareous rocks of the Cristallo range from the schistose mass of the Monte Confinale.

The botanist who wishes to explore this district, and who is unable to traverse the ground in the expeditious style usual with other Alpine travellers, is fortunate in finding convenient head-quarters within a moderate distance of all the most attractive spots. The new Baths of Bormio offer excellent accommodation, and the courteous and accomplished Swiss gentleman, Dr. Levier, who acts as medical director of the establishment, is also a good botanist, thoroughly acquainted with most of the localities. The establishment open in summer at the mineral spring of Santa Catarina also supplies fair accommodation and good food, when not overcrowded in the height of summer. For the purpose of exploring thoroughly the upper part of the Stelvio Pass and the surrounding heights the botanist may find night quarters and tolerable food at the cantoniera of Santa Maria, on the summit of the Wormserjoch, at the extraordinary height of nearly 8,300 ft. above the sea.

The least conveniently accessible of these valleys is Val Viola; and its tributary glens, Val Elia, Val di Verva, and Val di Dosdé, especially the latter, are too distant from Bormio to be carefully examined in a day's walk. My own acquaintance with the valley is very slight, being confined to a single rapid walk, in which I kept nearly to the main path.

In this paper I merely propose to indicate the localities of the rarer and more interesting species found in this district, for anything like a complete account of the vegetation would be out of place. To save trouble, I may say that I adopt the nomenclature of the third edition of Koch's '*Synopsis Floræ Germanicæ et Helvicæ*,' except where the name of the author is affixed to the species.

I shall commence with Santa Catarina, which may best be

visited during the first half of July, though many plants of the upper region are better gathered in August. Close to the establishment may be seen a few sparse specimens of *Echinospermum deflexum*, a curious plant, less rare in the Alps than is commonly supposed, but never seen in any abundance. The hooked bristles of the fruit cling to men's clothing and the skins of animals, and it is thus carried into unexpected places. It is seen here and there in waste ground about Bormio, and sometimes in stony places up to a height of 7,000 ft. The botanist's first stroll from Santa Catarina will probably be through the woods that clothe the slopes behind the establishment; and when he has ascended some three or four hundred feet he will be sure to perceive, in shaded mossy spots, the delicate lilac bells of the graceful *Linnæa borealis*, often associated with *Pyrola uniflora*, and occasionally with *P. minor* and *P. secunda*. Very rarely the little alpine orchid *Listera cordata* is seen in the tufts of moist moss. The slopes opposite to Santa Catarina, on the N. side of the valley, are more bare, and do not produce much of interest. A *Thalictrum* with much divided glandular leaves is the *T. pubescens* of Schleicher, by some supposed to be a hybrid between *T. fœtidum* and *T. minus*. Many *Umbelliferae*, of which the least common is *Laserpitium hirsutum*, may be collected.

The inevitable excursion for all visitors, botanists or not, is that to the Forno Glacier. It is a charming walk, and the ardent mountaineer, thirsting for snow-fields and ice-fringed mountain ridges, who hurries over the track before daylight in the morning, or at dusk after his hard day's walk, knows little of its attractions. The larch and Siberian pine (*Pinus Cembra*), rooted among huge blocks, or on the verge of overhanging rocks, are not so close together as to shut out the glistening peaks of the Tresero, and allow occasional glimpses into the dark trench in which the Frodolfo roars below. A few plants of interest are seen by the way. The always graceful *Atragene alpina* casts wreaths over the rocks and bushes; *Draba frigida* may be noticed here and there in a cleft; *Senecio abrotanifolius* lights up the slopes of *Arctostaphylos* and *vaccinium* with its flaming orange glow; while the exquisite *Gentiana nivalis*, growing with unaccustomed luxuriance, lifts its starry eyes to the sky, and reflects a tint equally pure and equally intense.

But the feast for the botanist begins when he reaches the grassy slopes that surround the lower end of the Forno Glacier, especially if he arrive before the hay is cut. Many not common alpine plants here flourish luxuriantly, but the rarest

species are *Sempervivum Wulfeni*—very like the common house-leek, but with yellow flowers—and *Koeleria hirsuta* of Gaudin, more properly known as *Festuca hirsuta*.

The ascent of Monte Confinale, strongly recommended for the sake of its admirable panorama, does not much reward the botanist. The chief object of interest that I noticed was a filled-up tarn, whose level sandy floor was one sheet of *Eriophorum Schenchzeri* waving in the passing breeze.

Of much more interest to the botanist is the excursion to the Gavia Pass. Instead of following the track along the flank of the Tresero, he should ascend rather steeply a few hundred feet towards a small hanging glacier, conspicuous from Santa Catarina. Here, at a height of about 8,200 ft., the crevices of the rock produce a plant of extreme interest. It has as many aliases as a veteran pickpocket, but I follow Koch in calling it *Alsine aretioides*. This is one of the characteristic species of the highest dolomite peaks of the Eastern Alps, nor was it ever seen elsewhere till the Abate Carestia found a variety of it at a height of about 10,000 ft., on the south side of Monte Rosa. The same variety is that which I found on the Tresero.

Returning to the track the traveller crosses the Ponte della Preda, close below the impending tongue of the Gavia Glacier, and then follows the broad upland valley that terminates in the Gavia Pass. On its nearly level floor, the rivulets descending from the snow-fields and smaller glaciers break up into mere trickling runnels, and the entire soil over a large space is soaked with water that can be but one or two degrees above freezing-point. This apparently offers the conditions most conducive to the health of one of the most beautiful plants of the high Alps—*Primula glutinosa*—which here attains its western limit. Nowhere have I seen it grow in such beauty and profusion, and for a distance of several hundred yards its delicate and evanescent, yet penetrating, scent is borne by the breeze. Among the few flowering plants that bear it company are its natural allies, *Androsace glacialis* and *Soldanella minima*.

Another very rough and little-used track leads from Santa Catarina to the Gavia Pass by the west side of the torrent, or that opposite to the Tresero. In following that track and ascending from it to one of the secondary peaks of Monte Gavia, I found some plants of interest, but especially, at a height of about 9,000 ft., *Cardamine gelida* of Schott, intermediate in structure between *C. alpina* and *C. resedifolia*.

I have reserved for the last the most attractive botanical excursion to be made from Santa Catarina. This is directed

to the slopes and the ridge of the Monte Sobretta, which is the massive mountain that encloses on the E. side the upper part of Val Furva. Though patches of snow lie on its flanks, the ridge is bare in summer up to about 10,000 ft. Beyond that height there is no difficulty in following the ridge westward to the rounded almost flat-topped summit of the mountain, about 11,000 ft. in height, which commands a panoramic view not much inferior to that from the Confinale. Immediately above the woods that clothe the slopes behind the Stabilimento is a broad gently-sloping shelf of alpine pasture, some two miles in length, and in many parts marshy. Here may be found *Thalictrum alpinum*, *Saussurea alpina*, *Pedicularis recutita*, *Eriophorum alpinum*, and other uncommon species; but the chief prize is *Willemetia apargiodes*, a Cichoraceous plant not uncommon in the Salzburg and Styrian Alps, rare in Tyrol, and which here finds its only Italian habitat. It has the general appearance of a *Crepis*, but is easily distinguished by its fruit, which much resembles that of the common dandelion. The ridge of the mountain rises in a rather steep range of rock, partly of a pale yellow sandstone, and is most easily ascended by its lower or eastern end. Some of the plants here enumerated seem to be confined to the ledges of sandstone rock, but most of them may be found on the summit of the ridge. The following list includes only a portion of the rare plants of the mountain, but to examine the ground thoroughly more than one day should be devoted to it:—

<i>Arabis cœrulea</i>	<i>Senecio carniolicus</i>
<i>Draba fladnizensis</i> of Wulfen	<i>Phyteuma pauciflorum</i>
<i>Hutchinsia brevicaulis</i>	<i>Androsace glacialis</i>
<i>Alsine recurva</i>	„ <i>obtusifolia</i>
<i>Potentilla frigida</i>	<i>Statice alpina</i>
<i>Saxifraga controversa</i>	<i>Lloydia serotina</i>
<i>Gaya simplex</i>	<i>Allium sibiricum</i> of Willdenow
<i>Gnaphalium carpaticum</i>	<i>Elyna spicata</i>
<i>Artemisia spicata</i> , var. with stem leaves deeply cut	<i>Avena subspicata</i>
<i>Achillea nana</i> , together with an almost glabrous variety	<i>Sesleria disticha</i>
	<i>Festuca Halleri</i> and <i>F. pumila</i>

I reserve for separate notice three plants of especial interest. A single specimen of *Potentilla nivea*, a pretty arctic species, hitherto seen in Europe only in the Valais Alps, where it is very rare, in three localities in Tyrol, at one spot in the Apennines and in the north-western corner of Piedmont, was found by Dr. Levier, and must be exceedingly scarce, as I have never since lit upon a specimen. *Dianthus glacialis*, a

species of the Carpathians and Eastern Alps, here reaches its western limit, unless it has been found by Rota a few miles farther in that direction, somewhere near the Tonale Pass. *Sesleria microcephala*, still more exclusively a native of the Eastern Alps, here also attains its western limit, and, save one station in Friuli, on the dividing ridge of the Carnic Alps, this is its only Italian habitat.

Of the genus *Hieracium*, so ubiquitous in the Alps, and so protean in its forms, there are not many noteworthy examples about Santa Catarina. The most remarkable is a form approaching to, but not identical with, *H. furcatum*.

Of ferns the most interesting is *Woodsia hyperborea*. The diligent searcher will certainly find a few specimens, usually rooted in the crevices of rather dry overhanging rocks, but I decline to mention the precise spot where it most abounds, lest these pages should fall into the hands of some one of the tribe of rapacious collectors.

The Val del Zebbru has been very imperfectly examined. It, doubtless, offers an interesting vegetation, and in itself the circuit of the Monte Confinale, which is effected by crossing the ridge at its head and descending by the Val di Cedeu and Val Forno to Santa Catarina, is a delightful walk; but it would be necessary to start very early in order to find time for a careful examination of the rocks and slopes on its N. side, which promise an ample harvest. *Aconitum paniculatum*, rare elsewhere in this district, is abundant in the lower part of the valley.

To become fully acquainted with the Flora of Bormio, one should devote several days in the month of June to the lower slopes and exposed rocks, and return in the second half of July to visit the upper part of the Stelvio Pass and the surrounding ridges. Many rare species are seen close to the Baths, and others may be found by anyone who will ascend the overhanging steep slopes of limestone débris up to the rocks that will probably bar his further progress.

Of the plants of the lower region near the town, and extending thence to the Baths, the following deserve notice:—*Aquilegia atrata*, *Papaver dubium* (in cornfields), *Nasturtium pyrenaicum*, *Sisymbrium strictissimum*, *S. Sophia*, *Cochlearia saxatilis*, *Æthionema saxatile*, *Neslia paniculata*, *Helianthemum fumana*, *Viola pinnata*, *Saponaria ocymoides*, *Silene noctiflora*, *Alsine rhatica* of Brügger—apparently a singular variety of *A. verna*, very common—*Alsine rostrata*, *Geranium divaricatum* (not seen by me), *Astragalus Cicer* and *A. Onobrychis*, *Pencedanum rablense*, *Aster Garibaldi* of Brügger—a poly-

cephalous variety of *A. alpinus*—*Hieracium glaucum*, *Veronica Teucrium* and *V. anagallis*, the latter rare in the Alps, *Ophrys muscifera*, *Bromus racemosus* and *Adiantum Capillus-Veneris*—a few small fronds about the so-called Fountain of Pliny, which should not be disturbed. The following occur on slopes of débris, or on rocks, on most of the mountains near Bormio up to a height of about 7,000 ft.:—*Arabis ciliata*, *Draba Thomasii* (I agree with Hausmann in considering this a variety of *D. incana*), *Silene saxifraga*, *Arenaria Marschlinii*, *Phaca australis*, *Sorbus chamæmespilus*, *Saxifraga Vandellii* (flowers early in June), *Athamanta cretensis* var. *mutellinoides*, *Heraclium asperum*, *Laserpitium Gaudinii* and *L. Siler*, *Leontodon incanus*, *Crepis alpestris* and *C. Jacquini*, *Hieracium pulmonarioides*, *Gentiana asclepiadea*, *Pedicularis Jacquini*, *Carex mucronata*, *C. firma* and *C. alba* and *Poa cenisia*. *Crepis pygmæa*, a curious Pyrenean species, found very rarely in the Apennines and Western Alps, here reaches its eastern limit at a point far removed from its natural home. It is found in débris about 2,000 ft. above the Baths, and more abundantly near the entrance to the Val dei Vitelli. An interesting excursion may be made by ascending the Monte Fraele, or Monte delle Scale of the Swiss Federal map, which rises W. of the Baths, and descending thence to the Lago delle Scale, a rather large alpine lake scarcely indicated on that map. The shortest way back to Bormio is by the Scala, a steep track leading down to Pedenosso in Val di Dentro; but a more interesting way is by Val Fraele and the gorge connecting it with the Stelvio road. Besides other species already mentioned, I found on the mountain *Ononis rotundifolia*, *Phaca alpina*, a curious rose, probably *R. glandulosu* of Bellardi, a stunted downy-leaved form of *Dryas octopetala*, and *Valeriana supina*, which here probably reaches its south-easternmost limit. In the lake M. Brügger has found *Ranunculus paucistamineus*.

The upper part of the Stelvio road will afford occupation to the botanist for at least two or three days. The steep slope of Spondalunga, which the high road ascends in zigzags, the short glen called Val dei Vitelli, extending thence to the glacier of the same name, the slopes of Piz Umbrail and Monte Braulio, and even the immediate neighbourhood of the Cantoniera of Santa Maria, are unusually rich in rare plants. A good many of these mentioned by German botanists as having been collected on the Stelvio or the Wormserjoch may, however, have been found at some distance, as those terms have been vaguely applied to the entire tract between the Münsterthal, the

Stilfsersthal, and the town of Bormio. In the following list special localities are mentioned for the rarer species :—

- Thalictrum alpinum*, Spondalunga.
Ranunculus parnassifolius, Braulio and Val dei Vitelli.
 „ *pyrenæus*.
 „ *alpestris*.
 „ *glacialis*, unusually large below the Stelvio Pass.
 „ *hybridus*, Braulio and Val dei Vitelli.
Aquilegia Haenkeana, Wormserjoch.
Papaver pyrenaicum.
Arabis pumila.
Cardamine gelida of Schott.
Braya pinnatifida, Braulio, its extreme eastern limit.
Draba frigida.
 „ *fladnizensis* of Wulfen.
Dianthus superbus, Braulio.
 „ *alpinus*, Wormserjoch, somewhat doubtful.
 „ *glacialis*, Piz Umbrail.
Alsine biflora, a very rare plant found near the summit of Wormserjoch.
Mæhringia polygonoides.
Stellaria Frieseana, said to have been found once on the Stelvio.
Oxytropis Halleri.
 „ *montana*.
Saxifraga elatior, Spondalunga.
Achillea atrata.
Leontodon Taraxaci.
Rhododendron intermedium, here and there, probably a hybrid.
Gentiana tenella.
Primula œnensis of Thomas.
Salix arbuscula.
Carex ornithopoda, up to above 8,000 ft.
Kœleria hirsuta, near the Wormserjoch.
Cistopteris regia.

A few plants of *Polemonium cæruleum*, which has no other Italian habitat, still exist between Bormio and the top of the Stelvio, but should be spared by any true botanist. The plant is found abundantly on the other side of the pass in open places in the woods above Trafoi. Some curious forms of *Hieracium*, being links in the chain connecting *H. glaucum* with *H. villosum*, may be found in the alpine region above Bormio.

As already mentioned, the Val del Zebru and the lateral glens of Val Viola, have been little or not at all examined by botanists; and any traveller who will explore them carefully is pretty sure to make additions to the rich flora of this district.