



Bryophytes of France: the alpine flora of the eastern Queyras

Andrew Hodgson describes a rich bryoflora, including new occurrences of *Brachythecium tauriscorum*, *Meesia minutissima* and *Oncophorus integerrimus*, and two mysterious *Schistidium* species.

Given its large area and extensive expanses of relative upland wilderness, our nearest neighbour, France, remains bryologically a relatively unexplored and unrecorded country. This situation is slowly changing, with several notable recent regional Floras being published (Chavoutier & Hugonnot, 2013; Hugonnot *et al.*, 2018; Legland & Garraud, 2018). A multi-volume bryophyte flora of France in its entirety is also being produced, but only the first volume has been published to date (Hugonnot & Chavoutier, 2021). The Queyras is the subject of an excellent recent article by Sotiaux *et al.* (2020). The results of my visits to the eastern Queyras mountains, which took

△ Figure 1. View north from Col Vieux. All photographs by A. Hodgson unless stated.

place over roughly two weeks in August 2014 and July 2017, published here, add to the ever-expanding knowledge of bryophytes of alpine habitats in France and will hopefully inspire further exploration and study.

Setting

The Queyras is a rural, relatively isolated region of alpine France, in Hautes-Alpes département, occupying a peninsula of the border region with Italy between the Maritime Alps to the south and the more well-known (to British ski tourists) Savoie region further north (Fig. 2). Its isolated position geographically gives it a quiet, gentle air,



△ Figure 2. Map showing location of the Queyras.
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with a largely agricultural way of life, augmented by winter ski resorts, although on a vastly smaller scale than the famous locations further north. In the eastern Queyras there are few roads or settlements, with only one road crossing the border into Italy, via the Col Agnel. The largest settlement, Abriès, lies along a dead-end road through the beautiful Guil Valley, ending in the lovely Réserve Naturelle National de Ristolas Mont Viso. The Queyras also lays claim to the highest inhabited settlement in Europe: Saint-Véran, a lovely village situated at 2042 m altitude, although this claim is disputed in some sources!

The climate of the region is much drier than the mountains further north, and many of the peaks have an arid feel, with much bare rock and scree at elevations higher than 2750 m.

This is reflected in the bryophyte flora – many of the moisture-loving mosses and liverworts commonly seen further north in Savoie, and in central Europe as a whole, were all but absent in this study.

The eastern Queyras has a complex metamorphic geology, reflecting its position on the ridge-line of the south-western Alps. It is dominated by schists (of different ages) with differing amounts of base-enrichment, with scattered exposures of gabbro and peridotite (an ultramafic mantle-derived igneous rock) amongst these. Exposed basaltic rocks are very uncommon, although two areas of note are east of the Refuge de la Blanche and north of Crête de la Taillante.

Vegetation

Almost without exception, the bryophyte surveying was undertaken above the tree line, which lies at around 2200 m in this area. Below this, depending on aspect and elevation, larch and pine forest intermingle with meadows and pasture (Fig. 3), while at lower elevations a Mediterranean-style maquis of juniper scrub takes over, especially on south-facing slopes.

▽ Figure 3. Pastoral landscape in the Queyras.





△ Figures 4–6. A selection of Queyras alpine flowers.
Figure 4. Top *Campanula alpestris*.
Figure 5. Middle *Gentiana orbicularis*.
Figure 6. Bottom *Saxifraga bryoides*.

Despite the idyllic-looking terrain (in the eyes of a British lowland bryologist!), rich habitats can be hard to come by above the tree line in these



△ Figure 7. Sheltered ridge vegetation on Crête de Gilly.

rather dry mountains but are well worth seeking out. Various important habitats are described in the next section.

Two areas of the eastern Queyras are off-limits to the casual bryologist, and are strictly protected nature reserves: the Réserve naturelle nationale de Ristolas Mont Viso and the Vallon de Bouchouse, which comprises a chain of three high-alpine lakes in a hanging valley below Col Vieux. These areas have superb vascular alpine floras (Figs 4–6) and are rightly protected. In 2014, I requested permission to collect bryophytes in the Viso reserve, but sadly got no response, and hence no bryophytes were searched for there. Given the interesting base-rich marginal habitats in the Vallon de Bouchouse, there would doubtless be some interesting bryophyte discoveries to be made if the authorities were to authorise someone to survey further.

Habitats

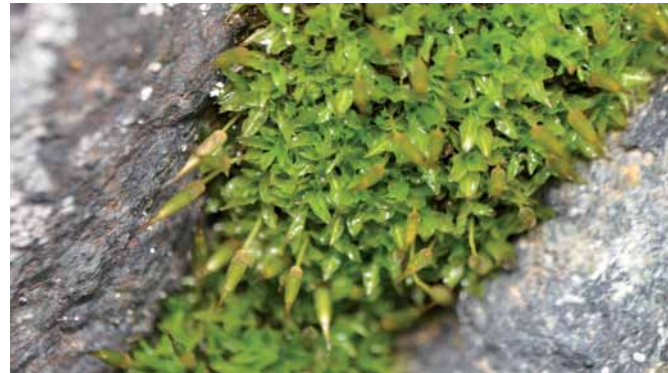
The richest habitats for bryophytes on the Queyras peaks invariably involve sites where desiccation is minimised, in common with much of southern Europe.

Sheltered soil banks on montane slopes

Above the tree line, unspoilt alpine meadows



△ Figure 8. Rock ledges, Col Lacroix.



△ Figure 9. *Encalypta microstoma* below Col Vieux.

dominate the landscape in the eastern Queyras. At higher elevations, depending on aspect, they are increasingly replaced by scree, bare rock and fell-field habitats (see below). The close turf of alpine meadows has a rich floral diversity, and an equally diverse assemblage of butterflies and other invertebrates, especially on calcareous soils (Fig. 7). The best habitats for bryophytes in these locations are where plant competition and sun exposure is reduced, especially on vertical soil banks with some overhanging vegetation. Here, depending on the soil reaction, mosses such as *Bartramia ithyphylla*, *Brachythecium* spp. (especially *B. collinum*), *Encalypta* spp. (most commonly *E. alpina* and *E. vulgaris*), *Syntrichia norvegica*, *S. ruralis* and *Tortula hoppeana* can be found.

Rock ledges with a north-facing aspect

Rock ledges can be superb places for bryophytes (Fig. 8), as well as offering the chance to see some of the region's floral specialities such as *Androsace helvetica*, *Primula marginata* and *Saxifraga valdensis*. Calcareous rock offers the richest rewards, and is relatively frequent, especially in the south of the region. Further north, the rock becomes more dominated by acidic schists. Ledges where there has been an accumulation of

soil can be especially rich, with *Encalypta* species, including the rare *E. microstoma* (Fig. 9), *Timmia austriaca* and *T. bavarica*, as well as a range of *Grimmia* and *Schistidium* species on the bare rock itself. Even on barren, exposed outcrops, the soil directly beneath them can be rich if it is sheltered from the sun.

Flushed slopes, especially on calcareous soils

Given the dry conditions experienced in the eastern Queyras, flushed habitats are not common, and where they occur, they can be unremittingly acidic, dominated by lush hummocks of *Bryum* spp. and *Philonotis fontana*. That said, the soil surrounding them can be

▽ Figure 10. *Amblyodon dealbatus* near Col de Chamoussière.





△ Figure 11. Fellfield habitat below Col Vieux.

remarkably productive if it is calcareous. In some areas *Oncophorus integerrimus* forms patches covering several square centimetres, associated with *Palustriella* spp. (usually *P. commutata*), and occasionally *Amblyodon dealbatus* (Fig. 10) and *Campylium stellatum*. The southern side of the path up to Col Vieux was especially good

▽ Figure 12. Late-snow hollow with scree, above Lacs Blanchet.



for this habitat in 2014, but on my second visit (July 2017) it had been cordoned off for habitat restoration. This area had some excellent damp areas with localised *Ptychostomum schleicheri* and *P. weigelii*, as well as some superb consolidated block scree habitat.

Consolidated soil and stones in block scree and fell-field

At higher elevations, the habitats for bryophytes become more extreme and demanding (Fig. 11). The dry habitat and increasingly shallow soil can make good ground harder to come across. Here, aspect becomes ever more important. South-facing slopes can be parched wildernesses for bryophytes, although they harbour some beautiful alpine wild flowers. Sheltered areas in these rocky habitats, especially stable, consolidated scree, offer the chance to see interesting calcicoles, which often grow in the humid cavities beneath the stones or, in the case of *Schistidium* species, on the stones themselves.

Damp soil and crags in late-snow areas

These areas are few and far-between, but can have the richest associations of bryophytes. Beneath north-facing crags at high elevations, stony soil retains moisture for much of the year owing to the late snow melt at these sites (Fig. 12). Even in late July or early August, it is common to find remnant snowdrifts. Bryophytes often seen in these sites are *Lescurea plicata*, *Timmia austriaca*, *T. bavarica* and other montane calcicoles, such as *Mnium thomsonii*. On the damp crags themselves grow *Hymenoloma crispulum* and (rarely) *H. compactum* (Fig. 13), as well as *Ptychostomum imbricatulum* and, exceptionally, *P. creberrimum*.

Notable species

A total of six liverwort and 55 moss species were recorded in this study, including one new



△ Figure 13. *Hymenoloma compactum*, with detail of papillose peristome (peristome image: Tom Blockeel)

to the Queyras (*Conostomum tetragonum*) and, remarkably, one new to science (*Schistidium* sp. A). The more notable records are detailed below. Species nomenclature follows the recent checklist of European bryophytes (Hodgetts *et al.* 2020). Locations are specified with decimal co-ordinates. The altitudes given after the habitat of the species are all approximate.

Anthelia juratzkana Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on bare soil in late-snow area, 2700 m, 2 August 2014, Hodgson 06/301.

Barbilophozia hatcheri Abriès: Crête de Gilly, 44.7945°N 6.9625°E, a tiny form on bare soil on mountain ridge, 2350 m, 28 July 2017, Hodgson 09/106 & 107. Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on soil in stable scree, 2700 m, 2 August 2014, Hodgson 06/285.

Barbilophozia sudetica Saint-Véran: slope above Refuge de la Blanche, 44.6631°N 6.9436°E, small, snowbed form with few gemmae and no underleaves on soil ledge in late snow area, with *Conostomum tetragonum*, 2550 m, 25 July 2017, Hodgson 09/035, det. G.P. Rothero.

Blepharostoma trichophyllum Ristolas: ravine above Lac Foréant, 44.7008°N 6.9846°E, flushed

calcareous ground with *Palustriella* and *Oncophorus*, 2700 m, 24 July 2017, Hodgson 09/008, conf. T.L. Blockeel.

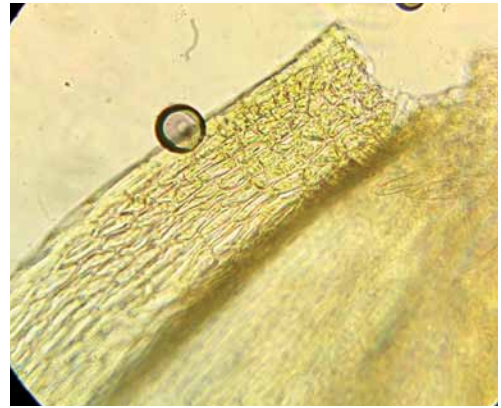
Cephalozia bicuspidata Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on bare soil in late-snow area, 2700 m, 2 August 2014, Hodgson 06/274, det. G.P. Rothero.

Schljakovianthus quadrilobus Ristolas: ravine above Lac Foréant, 44.701°N 6.985°E, flushed calcareous ground with *Palustriella* and *Oncophorus*, 2700 m, 24 July 2017, Hodgson 09/008, conf. T.L. Blockeel.

This is the second record of this rare species for the Queyras, further east and at much higher altitude than the first. Both sites are on flushed calcareous ground by mountain streams. Given its occurrence as scattered stems in a mixed bryophyte patch, this species could be very easily overlooked and is likely to be found more widely in suitable habitat.

Amblyodon dealbatus Molines-en-Queyras: path from Refuge Agnel to Col de Chamoussière, 44.684°N 6.978°E, on flushed bank on W-facing montane slope, 2600 m, 26 July 2017, Hodgson 09/078. Ristolas: path to Col Lacroix, 44.766°N 7.010°E, N-facing flush in meadow, 2150 m, 27 July 2017, Hodgson 09/089.

Bartramia ithyphylla Ristolas: ravine above Lac Foréant, 44.7008°N 6.9846°E, soil ledge on



△ Figure 14. *Brachythecium tauriscorum* below Col Vieux, with (right) detail of the basal leaf margin, showing ascending alar cells.

mountain slope, 2700 m, 24 July 2017, Hodgson 09/015. Saint-Véran: slope above Refuge de la Blanche, 44.6631°N 6.9436°E, on soil ledge, 2550 m, 25 July 2017, Hodgson 09/031.

Brachytheciastrum collinum Saint-Véran: above Lac Blanchet Supérieur, 44.6655°N 6.9546°E, on schist crag, 2850 m, 25 July 2017, Hodgson 09/054, det. T.L. Blockeel.

Brachythecium salebrosum Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on soil in calcareous scree, 2700 m, 2 August 2014, Hodgson 06/291, det. V. Hugonnot.

Brachythecium tauriscorum Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on soil in schist scree, c. 2700 m alt., 2 August 2014, Hodgson 06/296, det. T. Kiebach. Saint-Véran: by Lac Blanchet Inférieur, 44.663°N 6.944°E, on soil bank above alpine lake, c. 2550 m alt., 25 July 2017, Hodgson 09/043 & 044. Abriès: Crête de Gilly, 44.7945°N 6.9625°E, soil bank on mountain ridge, c. 2350 m alt., 28 July 2017, Hodgson 09/103.

Brachythecium tauriscorum (Fig. 14) was described as a valid species by Hedenas (2017a), having been overlooked as a high-altitude variety of *B. glareosum* or *B. albicans* by many previous authors. This chronology is explained further in a note in *Journal of Bryology* (Ellis *et al.*, 2022). These finds represent the first known from the Queyras, from where an

additional specimen was collected in 2021 by T. Kiebach (pers. comm.). *B. tauriscorum* closely resembles *B. glareosum*, a variable, widespread and often common species found across a wide altitudinal range in the Alps. It is distinct in its ovate alar cells, which form an ascending patch some way up the basal margins of the leaves. *B. glareosum* has a more compact, limited group of round/quadrate alar cells which are not ascending. While this record appears to extend the range of *B. tauriscorum* further east in the central French Alps, it is highly likely that some specimens of *B. glareosum* in herbaria will prove to be this species, and all high-altitude vouchers of the latter species should be re-examined. The scattered distribution of these finds and unremarkable habitat almost certainly mean it is currently overlooked.

Bryoerythrophyllum recurvirostrum Abriès: Crête de Gilly, 44.7945°N 6.9625°E, with *Distichium* on soil bank on montane crest, 2350 m, 28 July 2017, Hodgson 09/102. Saint-Véran: above Lac Blanchet Supérieur, 44.6655°N 6.9546°E, crack in schist crag, 2850 m, 25 July 2017, Hodgson 09/057.

Campylium stellatum Ristol: path to Col Lacroix, 44.766°N 7.010°E, flushed slope in meadow, 2150 m, 27 July 2017, Hodgson 09/089 & 203; ravine above Lac Foréant, 44.701°N 6.985°E, on flushed slope, 2700 m, 24 July 2017, Hodgson 09/009.

Catoscopium nigritum Ristol: path to Col Lacroix,

44.766°N 7.010°E, vegetative plants in N-facing flush in meadow, 2150 m, 27 July 2017, Hodgson 09/089, det T.L. Blockeel.

Conostomum tetragonum Saint-Véran: slope above Refuge de la Blanche, 44.6631°N 6.9436°E, on soil ledge in late snow area, with *Barbilophozia sudetica*, 2550 m, 25 July 2017, Hodgson 09/035.

A very distinctive moss of acidic soil in late snow areas (Fig. 15). This record is the first for the Queyras and only the third for Hautes-Alpes, where Villars recorded it in 1789, with no precise locality, and the only previous modern record was made in the western Ecrins in 2019. This is such a distinctive species that it is unlikely to have been overlooked. Its apparent rarity in this part of the Alps is somewhat puzzling, as there appears to be reasonably widespread suitable habitat on leached soils, although large areas of the Queyras massif are too calcareous or too dry to support it. The paucity of records is likely a combination of genuine rarity and lack of recording.

Dichodontium pellucidum Molines-en-Queyras: path from Refuge Agnel to Col de Chamoussière, 44.684°N 6.978°E, damp soil beside flush with *Oncophorus integerrimus*, 2600 m, 26 July 2017, Hodgson 09/082.

Dicranum tauricum Ristolas: Forêt Praroussin, 44.760°N 7.001°E, base of larch tree in forest, 1900 m, 27 July 2017, Hodgson 09/087.

▽ Figure 15. *Conostomum tetragonum* and *Barbilophozia sudetica* below Lacs Blanchet.



Distichium capillaceum Abriès: Crête de Gilly, 44.7945°N 6.9625°E, soil bank on montane crest, 2350 m, 28 July 2017, Hodgson 09/102. Molines-en-Queyras: path above Refuge Agnel, 44.684°N 6.978°E, calcareous schist outcrop in meadow, 2600 m, 26 July 2017, Hodgson 09/074 & 081. Ristolas: ravine above Lac Foréant, 44.701°N 6.985°E, 2700 m, 24 July 2017, Hodgson 09/013; Col Lacroix, 44.7625°N 7.0206°E, crevice in schist crag, 2250 m, 27 July 2017, det. T.L. Blockeel. Saint-Véran: Lac Blanchet Inferieur, 44.6626°N 6.9488°E, soil ledge on schist outcrop, 2750 m, 25 July 2017, Hodgson 09/046.

Encalypta alpina Molines-en-Queyras: path from Refuge Agnel to Col de Chamoussière, 44.684°N 6.978°E, soil bank in meadow, 2600 m, 26 July 2017, Hodgson 09/079. Ristolas: above Col Vieux, 44.6961°N 6.9855°E, on calcareous schist ledge, 2800 m, 24 July 2017, Hodgson 09/003. Saint-Véran: Lac Blanchet Inferieur, 44.6626°N 6.9488°E, E-facing soil bank, 2750 m, 25 July 2017, Hodgson 09/041; above Lac Blanchet Supérieur, 44.6655°N 6.9546°E, small form on soil ledge on schist crag, 2850 m, 25 July 2017, Hodgson 09/061.

Encalypta microstoma Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, calcareous schist outcrop, 2700 m, 2 August 2014, Hodgson 06/268, det. T.L. Blockeel.

Closely related to *E. ciliata*, but easily distinguished by its lack of a peristome and leaves which lack a hair-point. This is the second record for the Queyras, further east and at much higher altitude than the first.

Encalypta rhaptocarpa Ristolas: Col Lacroix, 44.765°N 7.023°E, on schist outcrop, 2300 m, 27 July 2017, Hodgson 09/215.

Eurhynchiastrium diversifolium Ristolas: above Col Vieux, 44.6961°N 6.9855°E, sheltered soil ledge below crag, 2850 m, 24 July 2017, Hodgson 09/214, det. T.L. Blockeel.

Flexitrichum gracile Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, amongst calcareous scree, 2 August 2014, 2700 m, 2 August 2014, Hodgson 06/289; path from Refuge Agnel to



△ Figure 16. *Grimmia reflexidens* below Lacs Blanchet.

Col de Chamoussière, 44.6849°N 6.9752°E, damp N-facing crag, 2650 m, 26 July 2017, Hodgson 09/080.

Grimmia reflexidens Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on schist slab, 2700 m, 2 August 2014, Hodgson 06/297, conf. T.L. Blockeel. Saint-Véran: path to Lac Blanchet Inferieur, 44.6648°N 6.9424°E, crevice in schist outcrop, 2500 m, 25 July 2017, Hodgson 09/033 (Fig. 16); Lacs Blanchet area, 44.662°N 6.950°E, on schist crag, 2750 m, 25 July 2017, Hodgson 09/064.

Hymenoloma compactum Saint-Véran: above Lac Blanchet Supérieur, 44.6655°N 6.9546°E, very small forms on calcareous schist outcrop in late snow area, 2850–2900m, 25 July 2017, Hodgson 09/059 & 060, det. T.L. Blockeel.

This is a rare species in the Queyras, known only from the Lacs Blanchet area east of Saint-Véran and the Guil Valley to the west of Mont Viso. Both areas are adjacent to the Italian frontier. The key features of *H. compactum* are the fully papillose peristome and large (>20 µm) spores and it is always advisable to check potential specimens microscopically. Useful field characters are the distinctive habitat, small size and red-brown colour of mature setae and capsules. Setae are usually short, but are sometimes longer.

Hymenoloma crispulum Ristolas: ravine above Lac

Foréant, 44.701°N 6.985°E, on large schist boulder 2700 m, 24 July 2017, Hodgson 09/020. Saint-Véran: below Lacs Blanchet, 44.664°N 6.943°E, on schist slab on mountain slope, 2550 m, 25 July 2017, Hodgson 09/029; Lacs Blanchet area, 44.664°N 6.951°E, on schist crag, 2750 m, 25 July 2017, Hodgson 09/058.

Lescuraea incurvata Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on soil in stable calcareous scree, 2700 m, 2 August 2014, Hodgson 06/286; c. 1 km SW of Col Vieux, 44.692°N 6.984°E, in crevice in calcareous schist, 2700 m, 2 August 2014, Hodgson 06/298, det. T.L. Blockeel; path from Refuge Agnel to Col de Chamoussière, 44.6854°N 6.9748°E, small form on calcareous outcrop, 2600 m, 26 July 2017, Hodgson 09/083, det. T.L. Blockeel. Ristolas: Col Lacroix, 44.7628°N 7.02378°E, base of schist crag and on schist outcrop, 2350 m, 27 July 2017, Hodgson 09/095 & 218; ravine above Lac Foréant, 44.701°N 6.985°E, 2700 m, 24 July 2017, Hodgson 09/014 & 023. Saint-Véran: below Lac Blanchet Inferieur, 44.664°N 6.943°E, at base of schist crags on mountain slope, 2550 m, 25 July 2017, Hodgson 09/028 & 039, det. T.L. Blockeel.

Lescuraea plicata Ristolas: Col Lacroix, 44.7625°N 7.0206°E, in turf at base of schist outcrop, 2250 m, 27 July 2017, Hodgson 09/199.

Lescuraea radicata Ristolas: ravine above Lac Foréant, 44.701°N 6.985°E, calcareous schist outcrop, 2700 m, 24 July 2017, Hodgson 09/017 & 019, det. T.L. Blockeel; Col Lacroix, 44.7625°N 7.0206°E, at base of schist outcrop, 2250 m, 27 July 2017, Hodgson 09/091, det. T.L. Blockeel. Saint-Véran: track to Lac Blanchet Inferieur, 44.6631°N 6.9436°E, on soil ledge in alpine meadow, 2550 m, 25 July 2017, Hodgson 09/037, det. T.L. Blockeel.

While *L. incurvata* is a common species in the alpine zone, *L. radicata* (Fig. 17) seems rarer in the Queyras. Identification of small specimens can be problematic, however, as extreme forms of *L. radicata* intergrade with *L. incurvata* and *L. saviana*, and different regional floras emphasise different characters for determining these species, some of which are unreliable in specimens from the Alps (especially the shape of the nerve at the

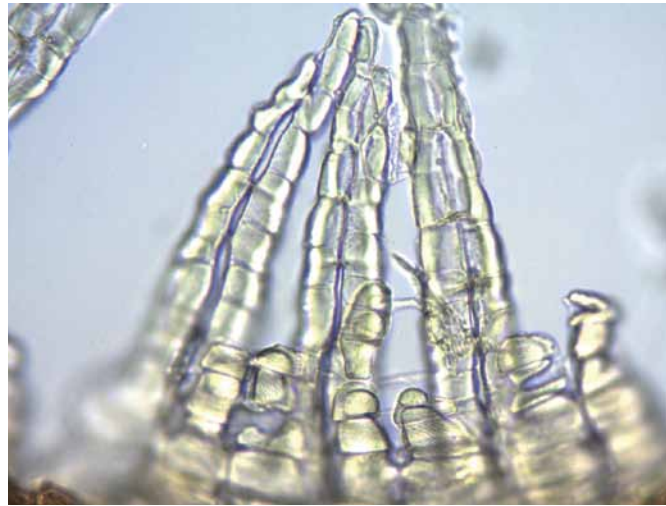


△ Figure 17. *Lescuraea radicata* above Lac Foréant.

leaf apex and presence or not of a central strand in the stem). The identifications above are based on a combination of cell length (presence of many mid-leaf cells longer than 20 µm and with length-width ratio exceeding 2:1) and the nature of the cell-end papillae (prorate laminal cells more prominent and numerous in *L. incurvata*).

Meesia minutissima Molines-en-Queyras: path from Refuge Agnel to Col de Chamoussière, 44.684°N 6.978°E, damp soil beside flush, c. 2600 m alt., 26 July 2017, Hodgson 09/082.

Hedenäs recently (2020) published a morphological and genetic study of *Meesia uliginosa* in Scandinavia, formally describing two new species in addition to defining the widely variable *M. uliginosa* in a strict sense. Both new species, *M. minor* and *M. minutissima*, represent formal descriptions of small, montane forms of *M. uliginosa sens. lat.* which have been known since the 19th century. *M. minutissima* has recently been confirmed in several herbarium samples from the Swiss Alps (Markus Meier, pers. comm., 2021). It was also discovered in a sample from the Refuge Agnel area during the course of this study (Fig. 18). Here, *M. minutissima* occurs as a very small tuft growing in a patch of *Oncophorus integerrimus* on damp, calcareous soil on a flushed, W-facing mountain slope. This record represents the first known occurrence of the species

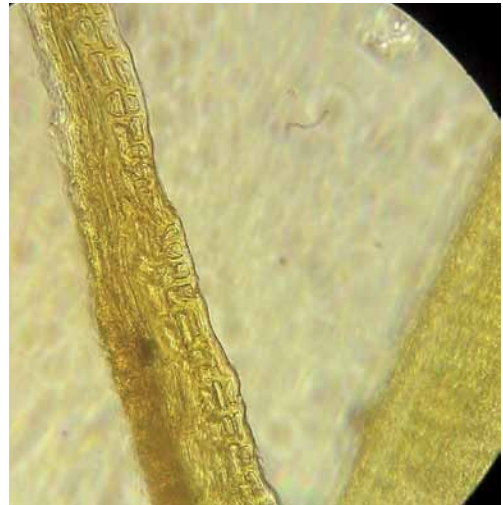


△ Figure 18. Peristome of *Meesia minutissima*.

in Hautes-Alpes département and only the second in the French Alps (T. Legland, pers. comm., 2021), although there seems little doubt that investigation of existing herbarium material from high altitudes will uncover more. *M. minutissima* is distinct from *M. uliginosa* in its consistently much smaller size (setae generally up to 10 mm tall) and mostly acute or acuminate leaf apices, and from *M. minor* in its often smaller size, smaller spores and smooth exostome which bears only faint striations.

Oncophorus integerrimus Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on damp soil in stable scree, c. 2700 m alt., 2 August 2014, Hodgson 06/282, det. T.L. Blockeel; below Col Vieux, track to Lac Foréant, 44.701°N 6.985°E, damp soil on mountain slope, c. 2650 m alt., 24 July 2017, Hodgson 09/007; path from Refuge Agnel to Col de Chamoussière, 44.684°N 6.978°E, damp soil beside flush, c. 2600 m alt., 26 July 2017, Hodgson 09/082. Ristolas: ravine above Lac Foréant, 44.701°N 6.985°E, on flushed slope, c. 2700 m alt., 24 July 2017, Hodgson 09/008 & 009, det. T.L. Blockeel; path to Col Lacroix, 44.766°N 7.010°E, N-facing flush in meadow, c. 2150 m alt., 27 July 2017, Hodgson 09/089.

Hedenäs (2017b) recently revised the genus *Oncophorus* in Scandinavia, formally describing two new species, one segregated from *O. wahlenbergii*,



△ Figure 19. *Oncophorus integerrimus* above Lac Foréant, with (right) detail of upper leaf margin showing obscure, distant teeth.

and one segregated from *O. virens*. The second of these, *O. integerrimus*, is apparently widely-distributed in the western Alps (Chavoutier, 2019) and has recently been confirmed from Scotland (Rothero, 2020). It is distinct in its sparsely, irregularly and obtusely toothed upper leaf margins, and leaves which are less strongly twisted when dry.

All material of the genus collected in the studies published here corresponds to *O. integerrimus* (Fig. 19), as does material I have collected nearby on the Italian side of the border and further north in Savoie. It remains to be seen if true *O. virens* actually occurs in the mountainous regions of France, and all herbarium material warrants reassessment.

Orthothecium intricatum Saint-Véran: above Lac Blanchet Supérieur, 44.6655°N 6.9546°E, damp crevice in calcareous schist crag, 2850 m, 25 July 2017, Hodgson 09/063.

Palustriella decipiens Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, damp crack in schist on montane slope, 2700 m, 2 August 2014, Hodgson 06/270, det. T.L. Blockeel.

Palustriella falcata Molines-en-Queyras: path from Refuge Agnel to Col de Chamoussière, 44.684°N 6.978°E, on flushed bank on W-facing montane

slope, 2600 m, 26 July 2017, Hodgson 09/084, conf. T.L. Blockeel. Ristolas: ravine above Lac Foréant, 44.701°N 6.985°E, flushed calcareous ground, 2700 m, 24 July 2017, Hodgson 09/008, det. T.L. Blockeel.

This species appears unaccountably rare in the Queyras, with all but one of the six known sites (including those published here) on flushed mountain slopes very close to the Italian border. However, *Palustriella* species are common in many flushes and *P. falcata* may have been under-recorded or overlooked as *P. commutata*.

Philonotis tomentella Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, amongst calcareous scree, 2700 m, 2 August 2014, Hodgson 06/283, det. T.L. Blockeel.

Poblia cruda Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, amongst calcareous schist scree, 2700 m, 2 August 2014, Hodgson 06/266 & 06/292, det. T.L. Blockeel.

Poblia elongata* var. *greenii Ristolas: Forêt Praroussin, 44.765°N 7.002°E, dry schist outcrop in open larch forest, 2000 m, 27 July 2017, Hodgson 09/088, conf. T.L. Blockeel. Guerra (2021) argues that this taxon is better treated as a species.

Polytrichastrum alpinum Ristolas: NW crags above Col Vieux, 44.6961°N 6.9855°E, sheltered soil ledge, 2850 m, 24 July 2017, Hodgson 09/016; ravine above Lac Foréant, 44.701°N 6.985°E, on schist outcrop, 2700 m, 24 July 2017, Hodgson 09/021.

Pseudostereodon procerrimus Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, in calcareous scree, 2700 m, 2 August 2014, Hodgson 06/281, 284 & 326, all conf. T.L. Blockeel.

Pterigynandrum filiforme Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.69°N 6.98°E, on schist outcrop on mountain slope, 2600 m, 2 August 2014, Hodgson 06/279.

Ptychostomum creberrimum Saint-Véran: above Lac Blanchet Supérieur, 44.6626°N 6.9488°E, soil ledge on schist outcrop, 2750 m, 25 July 2017, Hodgson 09/048 & 050, det. T.L. Blockeel.

Only the second record for the Queyras (Fig. 20). This site is on the southern side of the same mountain ridge as the original find.

Ptychostomum elegans Ristolas: Col Lacroix, 44.7625°N 7.0206°E, form with short hair-point on soil below calcareous schist crag, 2400 m, 27 July 2017, Hodgson 09/100, det. T.L. Blockeel.

Ptychostomum imbricatum Ristolas: above Col Vieux, 44.6961°N 6.9855°E, calcareous schist ledge, 2850 m, 24 July 2017, Hodgson 09/006.

▽ Figure 20. *Ptychostomum creberrimum*, Lac Blanchet Supérieur.



Ptychostomum schleicheri Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, damp mountain slope in late snow area, 2700 m, 2 August 2014, Hodgson 06/276.

Ptychostomum weigelii Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on damp soil in late snow area, 2700 m, 2 August 2014, Hodgson 06/302, conf. T.L. Blockeel.

Ptychostomum zieri Abriès: Crête de Gilly, 44.793°N 6.964°E, crevice in calcareous schist, 2450 m, 28 July 2017, Hodgson 09/109.

This is only the second record for the Queyras, the other being further south, above Lac Egorgéou. Both occurrences are very similar in aspect and altitude.

Roaldia revoluta sens. lat. Abriès: Crête de Gilly, 44.793°N 6.964°E, crevice in calcareous schist, 2450 m, 28 July 2017, Hodgson 09/109. Molines-en-Queyras: crags above Col Vieux, 44.6961°N 6.9855°E, on calcareous soil, 24 July 2017, Hodgson 09/200, conf. T.L. Blockeel. Ristolas: ravine above Lac Foréant, 44.701°N 6.985°E, calcareous schist outcrop, 2700 m, Hodgson 24 July 2017, 09/018; Col Lacroix, 44.7625°N 7.0206°E, on schist outcrop, 2250 m, 27 July 2017, Hodgson 09/216. Saint-Véran: Lac Blanchet Inférieur, 44.6625°N 6.9486°E, schist outcrop by lake, 2750 m, 25 July 2017, Hodgson 09/042 & 045.

Sanionia uncinata Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, on damp soil in late snow area, 2700 m, 2 August 2014, Hodgson 06/277. Ristolas: Col Lacroix, 44.7641°N 7.0241°E, base of schist crag, 2350 m, 27 July 2017, Hodgson 09/095.

Schistidium

The genus *Schistidium* is notoriously difficult, and even more so in mountainous regions of central Europe, where species as currently defined do not encompass all the specimens encountered in the field. This is especially seen in the widespread variation in *Schistidium confertum*, one of the most commonly encountered species in alpine and subalpine rocky habitats. Three closely related species, *S. echinatum*, *S. spinosum* and *S. marginale*, have recently been



△ Figure 21. *Schistidium* cf. *confertum*, Lacs d'Eychassier.

described (Ignatova *et al.*, 2010), but even these cannot be matched to some of the specimens seen. A full-scale account of the genus in the central Europe is much-needed, and new species no doubt remain to be described formally. It is hoped that by publishing the two mysterious specimens here, others will discover additional material and better understand species variation and distribution.

Schistidium confertum Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, crevice in schist outcrop, 2600 m, 2 August 2014, Hodgson 06/280, det. T.L. Blockeel. Ristolas: Col Lacroix, 44.7646°N 7.0229°E, dry S-facing schist outcrop, 2300 m, 27 July 2017, Hodgson 09/093 & 09/098, conf. T. Kiebacher.

Part of a very difficult complex of species (see above), but it is generally easy to recognise in its typical form. This species is regarded by Sotiaux *et al.* (2020) as very rare – there seems to be only one previous record of this species from the Queyras, in the Mont Viso area. However, it appears relatively widespread in the eastern Queyras on exposed, dry, sunny crags at high altitude, especially in the Col Vieux/Agnel area.

Schistidium* cf. *confertum Abriès: Crête de Gilly, 44.793°N 6.960°E, loose schist fragment on mountain ridge, 2400 m, 28 July 2017, Hodgson 09/111, det. T. Kiebacher. Ristolas: outcrops above Lacs d'Eychassier, 44.702°N 6.974°E, S-facing schist outcrop, 2900 m, 24 July 2017, Hodgson

09/022, det. T. Kiebacher.

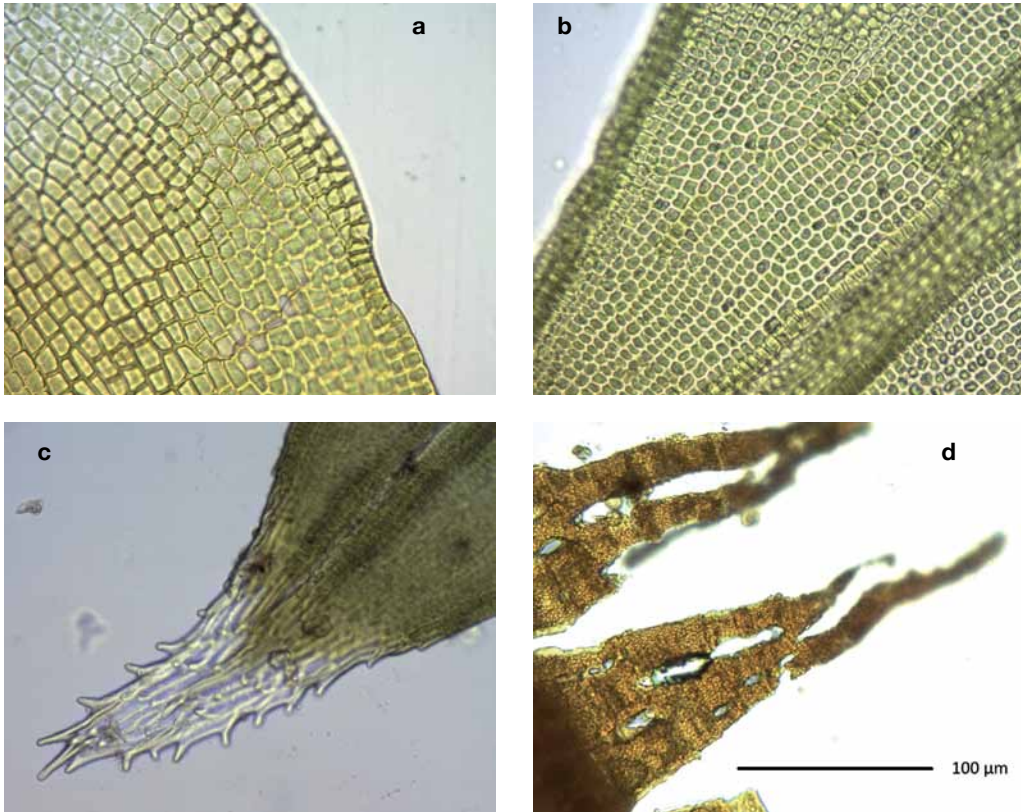
These specimens (Fig. 21) are recorded as cf. *confertum* due to overlap of some characters with *S. echinatum*, which has recently been confirmed from the Queyras (T. Kiebacher, pers. comm. 2021). Further studies are ongoing to more clearly differentiate the key morphological characters of these two similar species. *S. echinatum* seems to occur exclusively on calcareous rocks.

Schistidium* cf. *flaccidum Saint-Véran: track SE of Refuge de la Blanche, 44.6648°N 6.9424°E, in crevice in very large schist boulder on mountain slope, c. 2500 m alt., 25 July 2017, Hodgson 09/032, det. H. Köckinger.

S. flaccidum, as currently understood, encompasses a broad range of variable leaf and peristome characters in the European Alps and is in need of further study (H. Köckinger, pers. comm., 2017). A new species, *S. succulentum*, closely related to *S. flaccidum* has been described in an account of the genus in Russia, and it has recently been reported from the Italian Alps (Kiebacher, 2020). This specimen from the Saint-Véran area corresponds closely to *S. flaccidum* in its mammillate operculum, steeply keeled leaf section and basal marginal cells with thickened transverse walls, but differs from 'typical' *S. flaccidum* having a well-developed peristome (to 230 µm long) and hair-points with coarse, finger-like teeth (Figs 22, 23).

▽ Figure 22. *Schistidium* cf. *flaccidum* above Refuge de la Blanche.





△ Figure 23. *Schistidium* cf. *flaccidum*: **a** basal cells; **b** mid-leaf cells; **c** hair-point, **d** peristome.

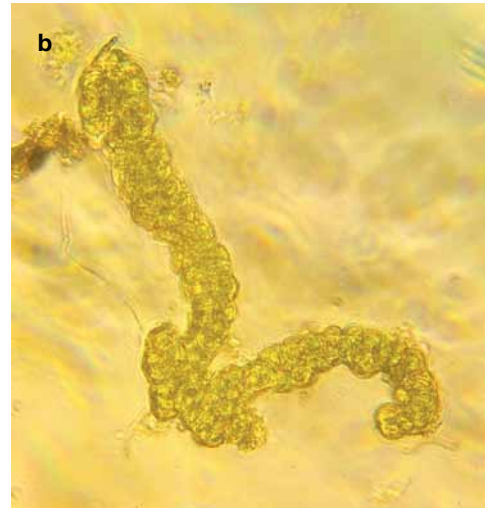
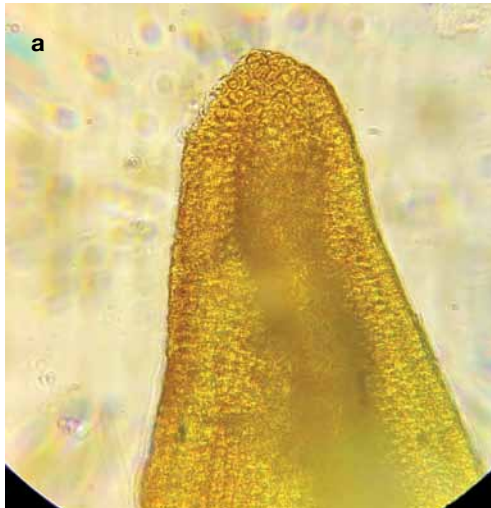
This *Schistidium* (whatever its identity) is certainly uncommon in the area – of all my *Schistidium* samples collected across different localities in the Queyras (and further north in Savoie), only this one small patch corresponds to it.

***Schistidium* species A** Saint-Véran: below Lac Blanchet Inferieur, 44.664°N 6.943°E, at base of complex crags on mountain slope, c. 2550 m alt., 25 July 2017, Hodgson 09/027.

The specimen was collected from the base of a W-facing crag with varied geology (Figs 24, 25). It is immediately distinctive in its mucous leaves with mammillose cells. The site was recently visited by Thomas Kiebach and additional material found. A formal description of this taxon as a new



▷ Figure 24. *Schistidium* species A above Refuge de la Blanche.



△ Figure 25. *Schistidium* species A: **a** leaf apex, showing obtusely rounded shape; **b** upper leaf section, showing mostly bistratose lamina with bulging cells on both surfaces; ◁ **c** short capsule with almost entire peristome teeth.

species is being prepared for publication in the near future, and so the details here have been kept brief. It appears to be very rare and is currently only known from the Lacs Blanchet area, where it has proved to be locally frequent over an area of around 1 km². A single specimen has also recently been confirmed from the Swiss Alps (T. Kiebach, personal communication, 2021).

Syntrichia norvegica Abriès: Crête de Gilly, 44.7945°N 6.9625°E, on bare soil on E side of mountain ridge, 2350 m, 28 July 2017, Hodgson 09/105. Molines-en-Queyras: c. 1 km SW of Col Vieux, 44.692°N 6.984°E, amongst calcareous schist scree, 2700 m, 2 August 2014, Hodgson 06/265 & 294. Ristolas: crag by N end of Lacs d'Eychassier, 44.7069°N 6.9730°E, schist outcrop, 2850 m, 24 July 2017, Hodgson 09/025. Saint-Véran: by Lac Blanchet Inferieur, 44.6626°N 6.9488°E, on gravelly soil, 2750 m, 25 July 2017, Hodgson 09/038.

Timmia austriaca Ristolas: Col Lacroix, 44.7641°N 7.0241°E, fruiting on sheltered ledge below calcareous schist crag, 2350 m, 27 July 2017, Hodgson 09/094, det. T.L. Blockeel.

Timmia bavarica Ristolas: above Col Vieux, 44.6961°N 6.9855°E, fruiting on sheltered soil ledge below calcareous schist crag, 2800 m, 24 July 2017, Hodgson 09/011, det. T.L. Blockeel; Col Lacroix, 44.7625°N 7.0206°E, base of schist outcrop, 2250 m, 27 July 2017, Hodgson 09/100.

Saint-Véran: by Lac Blanchet Inferieur, 44.6626°N 6.9488°E, fruiting on soil ledge on schist outcrop, 2750 m, 25 July 2017, Hodgson 09/047, det. T.L. Blockeel, & 09/049.

Tortula hoppeana Ristolás: Col Lacroix, 44.7649°N 7.0232°E, dry, calcareous schist crag, 2350 m, 27 July 2017, Hodgson 09/097, det. T.L. Blockeel; Forêt Praroussin, 44.765°N 7.002°E, dry schist outcrop in open larch forest, 2000 m, 27 July 2017, Hodgson 09/099.

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