Diet determination of wild Pygmy Hippopotamus (*Choeropsis liberiensis*)

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ABSTRACT

Diet determination is an important factor for species conservation. It can give some insights into the physiology, behaviour, ecology and distribution of species that are useful for conservation management. In this study, for such an elusive, endangered and herbivorous species as the pygmy hippopotamus (*Choeropsis liberiensis*), we used a non-invasive faecal analysis method. This method consists of analyzing leave epidermis fragments of plants found in the faeces and compare these fragments with a reference database previously made up by epidermis of local plants. We analysed faecal samples from ten pygmy hippo's collected in an area of 49 km² in the Taï National Park (TNP; Ivory Coast). From these faecal samples, 130 undigested leaves fragments could be described with five variables as well as 56 plants species collected in the TNP. Through Multiple Correspondence Analysis (MCA), we succeeded to target the type of epidermis consumed most frequently by these ten animals. Finally, a deeper analysis by pictures has been carried based on the results of the MCA.

We confirmed the hypothesis that pygmy hippopotamuses eat a wide range of species inside the three main groups of Monocotyledonae, Dicotyledonae and Ferns and hence we strongly support that this animal is an intermediate feeder. Through the detailed picture analysis we found that the hippos in our research area seem to have a favourite preference for *Nephrolepis bisserata*, *Streptogyna crinita*, *Marantaceae species*, *Centhoteca lappaceae* and *Herritiera utilis*.

This study provides an understanding of the food needs of wild pygmy hippopotamuses and this can be translated into advice to improve its conditions in captivity. Furthermore, a tropical plants image database is now available for 60 plants species of the TNP. Some recommendations on the method are given in the discussion part.

Key words: Choeropsis liberiensis, diet, fecal analysis, microscopy, conservation, Africa, Ivory Coast, MCA

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1. INTRODUCTION

The pygmy hippopotamus (*Choeropsis liberiensis*), hereafter referred to as pygmy hippo, is an endemic species to West Africa (Ivory Coast, Guinea, Liberia and Sierra Leone; Prothero *et al*., 2007). Until 1945, pygmy hippos also occurred in Nigeria, but the subspecies (*C. l. heslopi*) is now considered extinct (Robinson, 2013). The International Union for the Conservation of Nature (IUCN) classified the remaining West African pygmy hippopotamus as endangered (Ransom *et al*., 2015). The main threats to their survival are habitat loss, lack of adequate legal protection and poaching for bushmeat (Lewison & Oliver, 2008; Mallon *et al,* 2011). An often-unstable political situation leads to insecurity of protected areas, unregulated logging and hunting and restricted conservation efforts (Mallon *et al*., 2011; Conway, 2013). In the wild, the current population size of pygmy hippos is estimated to be less than 2,500 individuals and the majority of those are believed to reside in the Taï National Park (TNP) in Ivory Coast (Roth *et al.* 2004; Ransom *et al*., 2015).

The TNP has been part of UNESCO's world heritage since 1982 and currently covers an area of 4,450 km². Indeed, it is the largest tropical primary forest of West Africa (UNESCO World Heritage, 2018; OIPR, 2018; Lauginie, 2007). The vegetation of this park is rich with 1,365 documented species (Scouppe, 2011). Regular censuses of the TNP flora have been carried recently throughout the park in the North and East by Scouppe (2011); in the South by Adou Yao *et al*. (2000); in South-West by Menziès (2000) and by Adjanohoun & Guillaumet (1961), Aké Assi & Pfeffer (1975), Aké Assi (1984) and Adou Yao *et al*. (2005) and strong databases exist with the species listed "Flore du Parc National de Taï (Côte d'Ivoire)" from Sattler (2000).

In recent years, many studies have been initiated on pygmy hippos (Robinson, 1970; Eltringham, 1999; Roth *et al*., 2004; Conway, 2013; Bogui, 2016; Hillers *et al*., 2017). However, because of the species' cryptic behaviour, the most informative information gathered about them was obtained by the observation of captive animals (Flacke *et al*., 2015, 2016). Here, health reports of captive individuals showed that many diseases, such as polycystic kidney disease or dental skin and foot problems, could be related to their monotonous captive diet (Steck, 2008; Flacke *et al*., 2017).

In the wild, pygmy hippos are known to eat a wide variety of ferns, roots, grasses, stems and leaves of young trees as well as crops (Robinson, 1970, 1999; Bülow, 1988; Hentschel, 1990), resulting in a list of 17 ferns, 26 dicotyledonae, 16 monocotyledonae and the fruits of 24 tree species (Bülow, 1988; Hentschel, 1990; Robinson *et al*., 2017). This list has been obtained through direct and indirect observations as well as feeding trials (Robinson *et al*., 2017). Robinson (1981) and Eltringham (1999) revealed that this species spends about 6 hours per day feeding. Other observations by camera traps suggest that feeding occurs throughout the night as camera picures show their presence throughout the night (Mallon *et al*., 2011).

The relationship between flora and fauna in the TNP has already been well studied (e.g., Chatelain *et al*., 2000). This helps to understand the spatial distribution of an animal as well as its habitat. Indeed, diet information mainly through the faeces gives (indirect) insight about the physiology, behaviour, ecology (Chame, 2003; Butet, 1985) and distribution (Garthey, 2013) of an animal. The classic method of diet determination in wild animals is by microscopy (Crocker, 1959; Storr, 1961; Chapuis, 1980; Butet, 1985), which generates easily reproducible and accurate qualitative data (Cuartas, 1996). It is based on the microscopic analysis of leaf fragments found in the faeces. This is widely used for elusive animals in the wild (Butet, 1985, 1987) and for knowing the toxicity of plants consumed by captive animals (Rech, 2011).

Plant species identification via microscopy is different from the traditional Linnaean classification system, which is based on the reproductive features of the plants. However, recent botanical studies (Adedeji *et al.*, 2007; Adedeji and Jewoola, 2008; Shah *et al.*, 2018a, 2018b; Ullah *et al*., 2018a, 2018b) show that the microscopic foliar anatomical characters could be a method for plants species identification particularly at the family and group level (Metcalfe and Chalk, 1950, 1957).

In this study, we developed a new identification system for plant species eaten by free ranging pygmy hippos living in the TNP. This identification system is based on five qualitative variables (four microscopic and one macroscopic) used to target a plant epidermis type. Subsequently, a visual analysis of the targeted epidermis is carried out to identify the most common fragments found in the faeces. The main goal of this study is to determine the diet of wild pygmy hippos in our research area. Improving knowledge of the species' diet composition will help in conservation efforts not only in captivity (health problems) but also in the wild (e.g. protecting adequate and specific areas). The larger aim of the study is to assist in developing a determination key for any tropical plant species based on their microscopic features, which could be used for other diet studies.

This study was part of an on-going collaboration between the *Institute for Breeding Rare and Endangered African Mammals* (IBREAM) and the *Centre Suisse de Recherches Scientifiques en Côte d'Ivoire* (CSRS) that started the Pygmy Hippo conservation project « Taï Hippo Projet » (THP) in 2010.

2. MATERIAL AND METHODS

2.1 Study site

This study was conducted in the Taï National Park (TNP), Ivory Coast (West Africa) from July to November 2017. The research area was about 49 km² of forest in the Taï sector (TNP; see **Fig. 1**), centred at Camp Noe research station situated near the Institute of Tropical Ecology (IET; McGraw *et al*. 2007). The entire research area was searched for hippopotamuses tracks and faeces.

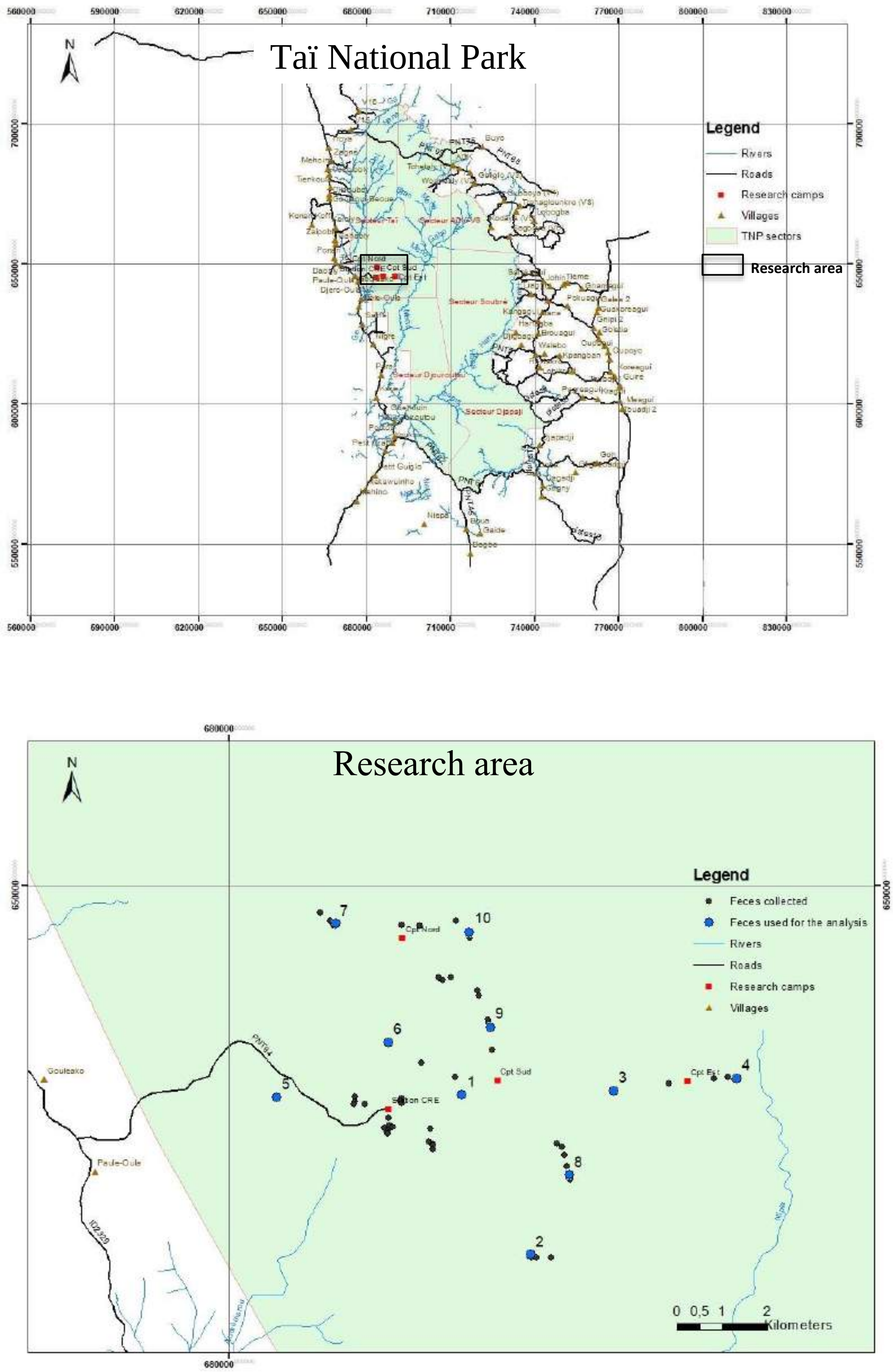


Fig. 1: Taï National Park (TNP), research area. On the top is the map of the TNP. The Park is divided in 5 sectors (Taï, ADK-V6, Djouroutou, Soubré and Djapaji) defined by the Office of Parks and Reserves (OIPR). The black rectangle represents our research area. On the bottom, zoom in into our research area. The black circles represent the faeces collected during the fieldwork and the blue ones represent the ten faeces used for this study.

2.2 Data collection

2.2.1 Food items

In order to build a database for diet identification, we collected sixty plants in the Taï National Park (TNP). The choice of these plants was made on a non-exhaustive list of the favourite plants (twenty-seven in the TNP) eaten by pygmy hippopotamuses. This list is based on direct and indirect observations and by feeding trials of pygmy hippopotamuses in Ivory Coast, Liberia and Sierra Leone (Bülow, 1987; Hentschel, 1990). From this food preferences database, we found only two ferns (*Nephrolepis biserrata, Pteris burtonii*) of the eight favourite, four dicotyledonae (*Desmodium adscendens, Geophila sp., Geophila afzelii, Dissotis rotundifolia*) of the ten favourite, and five Monocotyledonae (*Maschalocephalus dinklagei, Cercestis afzelii, Raphia sp., Streptogyna crinita, Marantochoa sp.*) of the nine favourite in the TNP. In order to refine our research and increase the number of plants references, we collected the plants that seemed most abundant in our research area and that grew between zero and one meter high, as well as the plants on which hippopotamuses's territorial marking had been done (see **Appendix 8.1**).

A voucher of each plant was deposited at the CSRS herbarium as reference in Abidjan, and the assistant curator of the herbarium did the validation of identification. The botanical nomenclature follows the African Plant Database (APD, 2018).

2.2.2 Faeces

Pygmy hippo faeces are dispersive and found in large quantities. Similar to the common hippopotamus, the pygmy hippopotamus makes two types of droppings: territorial droppings and litter droppings (see **Appendix 8.2**; Robinson *et al*., 2017). The consistency of these two droppings is different, one is tough whereas the other one is soft and shapeless but we collected both types for our study. In order to collect a representative sample, we followed the sampling method used by Scotcher *et al.* (1978) and Michez (2006) for the *Hippopotamus amphibius* L. (Common hippopotamus; see **Appendix 8.3**).

We collected N=15 faecal samples during the dry season (August - September 2017) and N=55 samples during the rainy season (October - November 2017). In addition, N=330 GPS data points were recorded when a track (footprint or dropping) was found. These data points were linked with eight ecological data points (i.e. *Date and Time, ID, GPD data (UTM), Canopy, Underwood, McGrew's strata, OIPR code*) to characterize the location in which the track was found as well as additive information for any faeces sample (*level of degradation;* see **Appendix 8.4** and **Appendix 8.5**).

2.3 Data analysis

2.3.1 Food items preparation

We chose two methods of preparation to enhance reliability. For the first method, we used a nailpolish method (Miller *et al*., 1968; Hilu and Randall, 1984), and for the second method we used a discoloration method (Rech, 2011) to remove the epidermis (see **Appendix 8.6.1** and **Appendix 8.6.2)**. The first method consists of applying a thin layer of commercial, transparent nailpolish on the leave. Following drying, we removed the nailpolish layer and placed it on a slide in a water drop. The second method is the same method used for the faeces preparation (Rech protocol, see below). For both methods, we created semi-permanent slides with the two leaves sides and this for our sixty samples of plants.

Finally, the two sides (adaxial and abaxial) of each plant were photographed with inverted microscope *Leica OMI 3000 B* using software LAS V.4.0 with a magnification of 40x, 100x and 200x (see **Appendix 8.6.3**). In total, 720 microscopic pictures were taken for the analysis part. We took also macro photographs of each plant of reference under a binocular magnifying glass (see **TNP PLANT IMAGE DATABASE**).

We did not succeed to remove the two sides of the following species: *Diospyros manii* (species 40), *Parinari excelsa* (species 46), *Massularia acuminata* (species 56) and *Gilbertiodendron preusti* (species 57). This was because the quality of the dried material did not allow us to properly analyse these four plants. For this reason, we did not use these species for the analysis. From the 60 initial plants, we used only 56 for further analysis.

2.3.2 Faeces preparation

We used ten of the 55 pygmy hippopotamuses faeces collected during the rainy season over the entire range to be representative (i.e to avoid analysis of the same individuals). The droppings were selected according to their location after being projected on a map with ArcMap 10.6 programme (see **Fig. 1**). The OIPR gave to us the spatial coordinates for the TNP sectors, villages, research camps, roads and rivers. We then added our spatial coordinates for the faeces collected. Neighbouring samples were separated by a radius of two kilometres for all ten faeces chosen for analysis. This radius has been defined by taking into account the home range of pygmy hippopotamuses, which have been estimated 0.4 – 0.6 km^2 for females and > 1.5 km^2 for males (Bülow, 1988; Hentschel, 1990). It has been observed that sometimes a male's and female's home range can overlap, so it is possible to have different hippos for the same area (Roth *et al.*, 2004). Through this estimation, we can therefore assume that the ten droppings used for the analysis could belong to ten animals.

After the selection of the ten faeces for the analysis, we took a subsample of two grams per faeces and we sorted it into four categories: leaves, roots and stems, seeds and unidentifiable material (see **Appendix 8.6.4**). This sorting allowed quantifying the material available for the analysis and for macroscopic identification (Michez, 2006).

Then, from this sorting, we randomly selected N=48 leaf fragments per faeces. These fragments were placed in two 24-well cell culture clusters (i.e., 48 wells) and photographed under a binocular magnifying glass at 7.5x, 25x and 60x. After photographing, fragments were soaked in ethanol and sodium hypochlorite until they were transparent following the protocol of Rech (2011) for animal faeces studies. Finally, the discoloured fragments were placed between a slide and a lamella in a drop of glycerine (see **Appendix 8.6.4**). In order to keep the slides as long as possible, we added a layer of commercial nail polish around the lamella. This technique allows fixing the lamella and its content for at least few months (semi-permanent fixation) while taking pictures.

Finally, the slides were photographed with the same conditions as the food items references (i.e., in 40x, 100x and 200x; see **Appendix 8.6.3**). In total, 480 fragments with 2,880 pictures (1,440 microscopic and 1,440 macroscopic) were taken for the analysis part (see **FAECES FRAGMENTS IMAGE DATABASE**).

2.3.3 Variable selection for multivariate analysis (food items)

Based on Rech (2011) and other authors (Metcalfe and Chalk, 1950, 1957; Stoddard, 1965; Kok and van der Schijff, 1973; Chapuis 1980; Ullah *et al*., 2018a) we measured 15 qualitative variables (see **Appendix 8.7**). Among them, 14 were microscopic (cell width, cell length, cell layout, cell shape, wall shape, silica, scale, trichome cellularity, trichome insertion, stomata quantity, stomata direction, stomata width, stomata length, stomata type), and one (leaf vein shape) is macroscopic. These variables with their respective categories detailed in the **Table 1** seemed to us to be the most relevant to describe the epidermis of our tropical plants. Thus, the 15 variables were measured first on a reference sampling, i.e., the food item data collection (named hereafter dataset n°1).

Some important variables according to Rech (2011), such as oxalate crystals or the sensor and secretive trichome, were not used because they were not always visible in our fragments of plants. Furthermore, variables or individuals with missing data (i.e. stomata type) or variables that appeared to be non-informative (i.e. silica, scale, trichome) were finally not used in our analysis.

Macroscopic criteria	
1. Leaf vein shape *	macro_veins (3): *pinnate_leaf, reticulate_leaf, parrallel_leaf*
Microscopic criteria	
Epidermal cells	
2. Width	width_epid_cells (2): *ML_25_ep, More_25_ep*
3. Length *	length_epid_cells (3): *small_ep, medium_ep, large_ep*
4. Layout *	layout_epid_cells (2): *aligned, non_aligned*
5. Cell shape	shape_epid_cells (3): *alongated, pentagonal, winding*
6. Wall shape *	shape_wall_cells (5): *straight_wall, angular_wall, wavy_wall, slightly_wavy_wall, round_wall*
7. Silica	silica (3): *absence_silica, concave_parallel, concave_perpendicular*
8. Scale	scale (3): *absence_scale, flat_thiny, flat_thick*
Trichome	
9. Trichome cellularity	trichome (3*)*: *absence_trichome, uni, multi*
10. Insertion	insertion_trichome (3): *absence_insertion, flower, other_insertion*
Stomata	
11. Quantity *	quantity_stomata (4): absence_quantity, large, medium, low
12. Direction	direction_stomata (3): absence_direction, different, same
13. Width	width_stomata (3): absence_width, ML_25_stom, More_25_stom
14. Length	length_stomata (3): absence_length, ML_25_stomata, More_25_stomata
15. Type	stomata_type (8): absence_type, actinocytic, anomocytic, anisocytic, diacytic, gramineous, paracytic, tetracytic

Table 1: List of 15 variables, which describe our reference epidermis with the code used in our dataframe (see Appendix 8.7 & 8.8). In italic are the categories and in brackets is the number of categories used for each variable. The asterix represents the five most relevant variable selected at a later stage in the statistical analysis part.

2.3.4 Statistical analysis

We carried out multivariate analysis in the dataset n°1, in order to explore the spatial structure of the variables and the individuals (Crawley, 2007). Since, we only have qualitative variables with different categories; the most appropriate analysis was the Multiple Correspondence Analysis (MCA) (Benzécri, 1973). This analysis allows representing directly individuals and variables in multidimensional geometric space. The interpretation of results needs the comparison between the individuals and variables projections on axes.

Firstly, a preliminary MCA was performed on the dataset n°1 using the fifteen variables in order to assess the most closely related, which disrupt the interpretation of the MCA, and to get the most informative variables. It allows a selection of five variables highly informative (i.e. looking to the eigenvalues on the axes) for our further analyses and we performed *de novo* a MCA on a new dataset here named dataset n°1.

In order to investigate the best clustering from the dataset n°1, we performed a *k*-means analysis on the individuals coordinates on all the MCA axes. Different values of *k* (from 2 to 7) were used with the Hartigan-Wong algorithm and the followings parameters: 50000 iterations and 50000 random sets. In parallel, we conducted an agglomerative Hierarchical Clustering analysis (HC) and we performed a tree using the ward method and based on the individuals coordinates on all the MCA axes.

Secondly, we added to the first MCA, which was performed on the dataset n°1, the unknown individuals (faeces fragments; dataset n°2) as additional individuals. Thus, the additional individuals were not taken into account into the calculations of the MCA's axes. This allows us to see the position of our faeces fragments in relation to our food items references. In order to interpret the results, we performed a HC tree based on the coordinates of individuals from the dataset n°1 on all the MCA axes and including the additional individuals (dataset n°2). A visual analysis (by pictures) was finally conducted to determine the most common faeces fragments targeted by the MCA analysis.

Finally, we conducted an independent MCA only with the additional individuals (dataset n°2) to see the variability between the 10 droppings and their fragments analysed.

All statistical analyses were performed with the R software (R Development Core Team 2018). We used the package "**ade4"** (**D**ata **A**nalysis functions to analyze **E**cological and **E**nvironmental data in the framework of **E**uclidean **E**xploratory models) with the "dudiacm" function (Dray and Dufour, 2007). The interface "explor" (from explore package) was used to observe the results of MCA and edit the different graphs (https://CRAN.R-project.org/package=explor). The *k*-means analysis has been performed with the package cluster and kmeans function. And, for the HC analysis we used the "hclust" function.

We used Rstudio software version 1.1.463 (R development core team, 2018).

3. RESULTS

3.1 Structure of the food items species

The structure of the 56 food items is shown in **Figures 2** to **5** through the MCA with the *dataset n°1* (five variables).

The individuals projected in the **Figure 2** represent the adaxial and abaxial sides of the 56 plants of reference (112 known individuals). The total inertia is 2.4, with the five main axes that explain 65.7% of the total variation. The first two axes F1 and F2 explain the major variation in our individuals with a cumulative projected inertia of 35.2% (see barplot of the **Fig. 2**). On this individual's projection (*F1xF2* axes), we observe a light Guttman effect (horseshoe shape; see **Fig.2**). The variable *macro veins* and *layout* (in particular the categories aligned (23.11) and parallel leaf (20.27)) contribute a lot on the F1 axis, they can explain this effect. Despite this effect, we can observe three main groups of individual through the categories of our variables (see groups in **Fig. 3).** These groups are also found in the HC tree (see 1, 2, 3 in **Fig. 5**).

The most influential variables for the first axe F1 are the *layout* (contribution of 0.80), *macro veins* (contribution of 0.78), and *length* (contribution of 0.57). For the second axes F2, there are the *wall shape* (contribution of 0.52), *macro veins* (contribution of 0.41) and *stomata quantity* (contribution of 0.38). And, for the third axes F3 there are *wall shape* (contribution of 0.66) and *stomata quantity* (contribution of 0.53) (see **Appendix 8.9.1**).

The *k*-means analysis from two to four factors allows seeing the groups predefined by our knowledge. However, after four factors it is difficult to distinguish any taxonomic rank. With two factors it allows to distinguish very clearly the Monocotyledona group to the Dicotyledonae one. With three factors, we find the three groups of individuals described above. Then, with four factors (see **Fig. 4**), the ferns are distinguished from Monocotyledonae and Dicotyledonae as well as the sides of the leaves (adaxial and abaxial sides). As already said, above four factors, the understanding of the structure is difficult. Indeed, we also made a *k*-means with the 32 families and the 56 species. The *k*-means results do not allow us to regroup the species inside the families and even less at the generic level.

In the HC tree (see **Fig. 5**), a similar structure is found when we cut the tree in four parts. The Monocotyledonae are in red, the two groups of Dicotyledonae in green and sky blue and the ferns between the Dicotyledonae are in dark blue. Here, we can distinguish inside the cutting groups some families as the Rapataceae, Marantaceae, Pteridaceae and Rubiaceae family (see **Fig. 5**; black arrows).

We notice that many species share the same comb of the tree. Indeed, N=34 combs are shared by more than two species (see red circles; **Fig. 5**), N=12 by a single leave side (see green circles; **Fig. 5**), and five by the two leaves sides of species (see yellow circles; **Fig. 5**). So, only twelve of the 112 leave sides described have a singletree branch.

Detailed results can be found in **Appendix 8.9.1.**

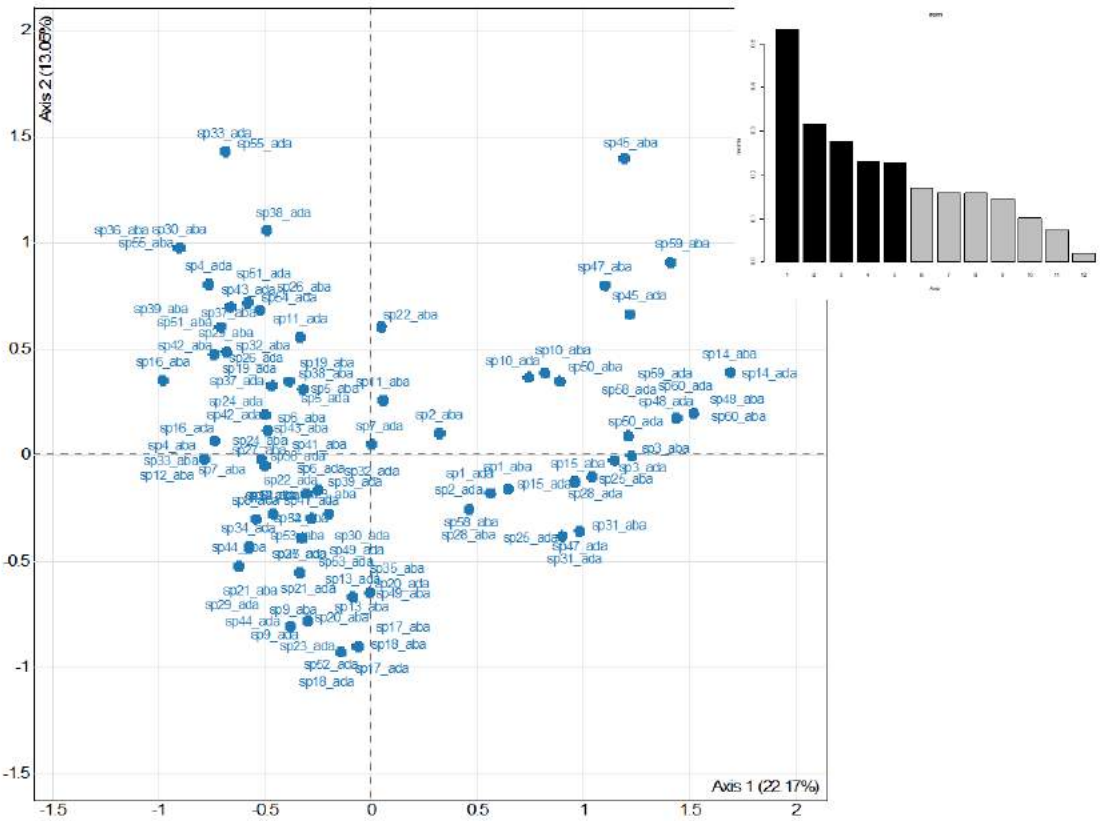


Fig. 2: Projection of the *dataset n°1 (food items individuals)* on *F1xF2* axes. The circle represents the projection of the 112 sides (adaxial and abaxial) of our 56 species after the MCA. With *sp* for species followed by the *number* and the side of the leaf (*ada* for adaxial and *aba* for abaxial).

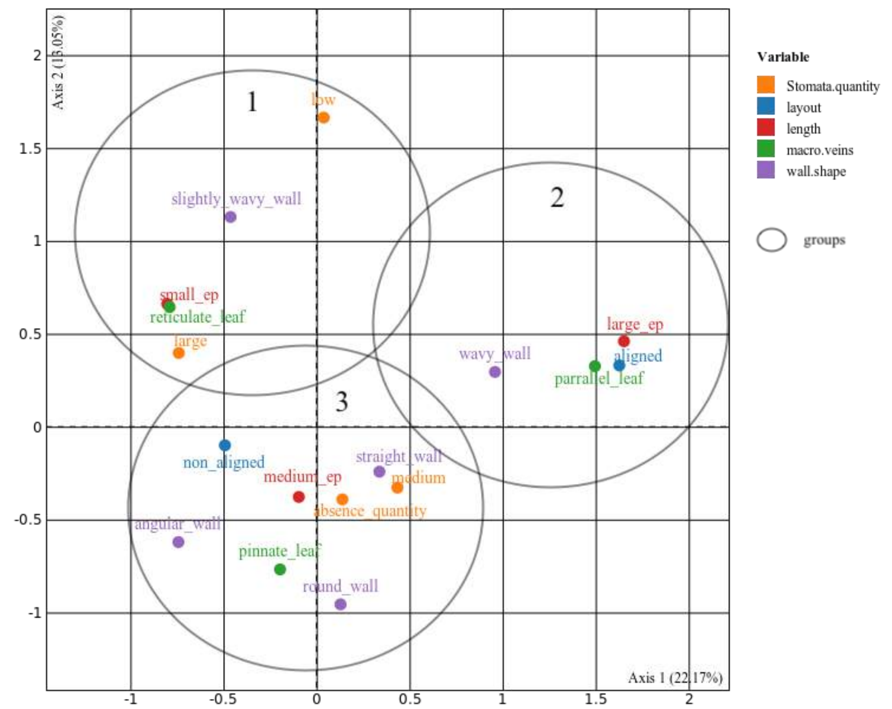


Fig. 3: Projection of the *dataset n°1 (food items variables)* on *F1xF2* axes. The colors represent each variable with their different categories. We added three elliptique circles to highlight three groups of individuals.

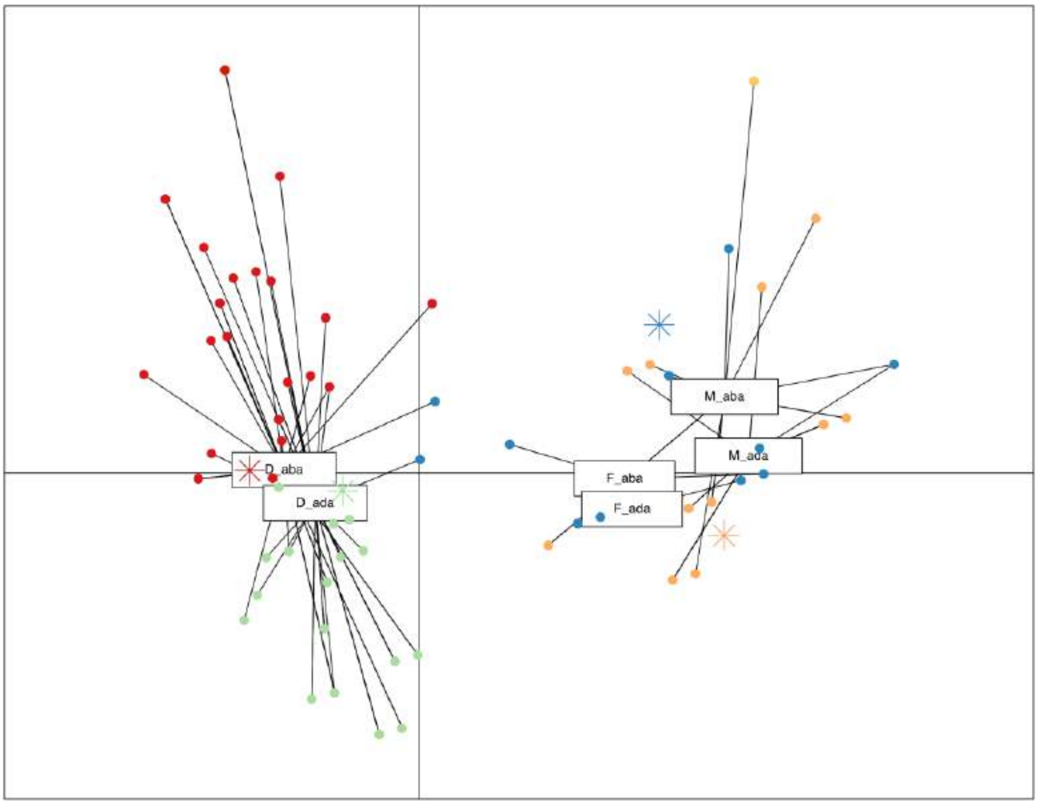
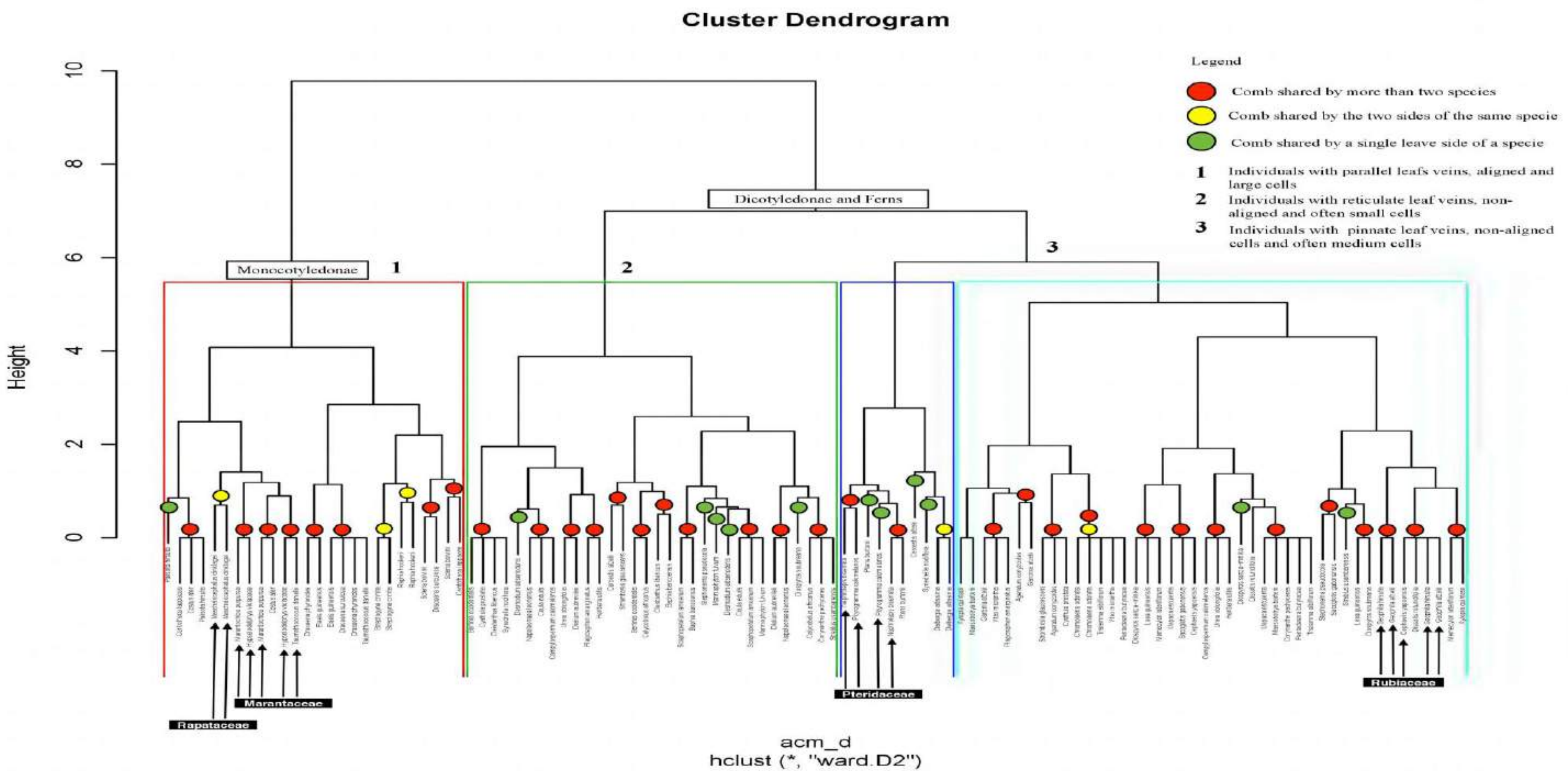


Fig. 4: Projection on MCA *F1xF2* axes with the kmeans results (k=4). The circles represent the individuales position on the MCA, the labels correspond to our *a priori* group: *F* four fern, *D* for Dicotyledonae and *M* for Monocotyledona, *ada* for adaxial and *aba* for abaxial which refer to the side of the leave analysed. The four colors (red, green, blue, orange) were given by the kmeans analysis with four factors and the Hartigan-Wong algorithm. The stars represent the four k-means cluster's barycentre.



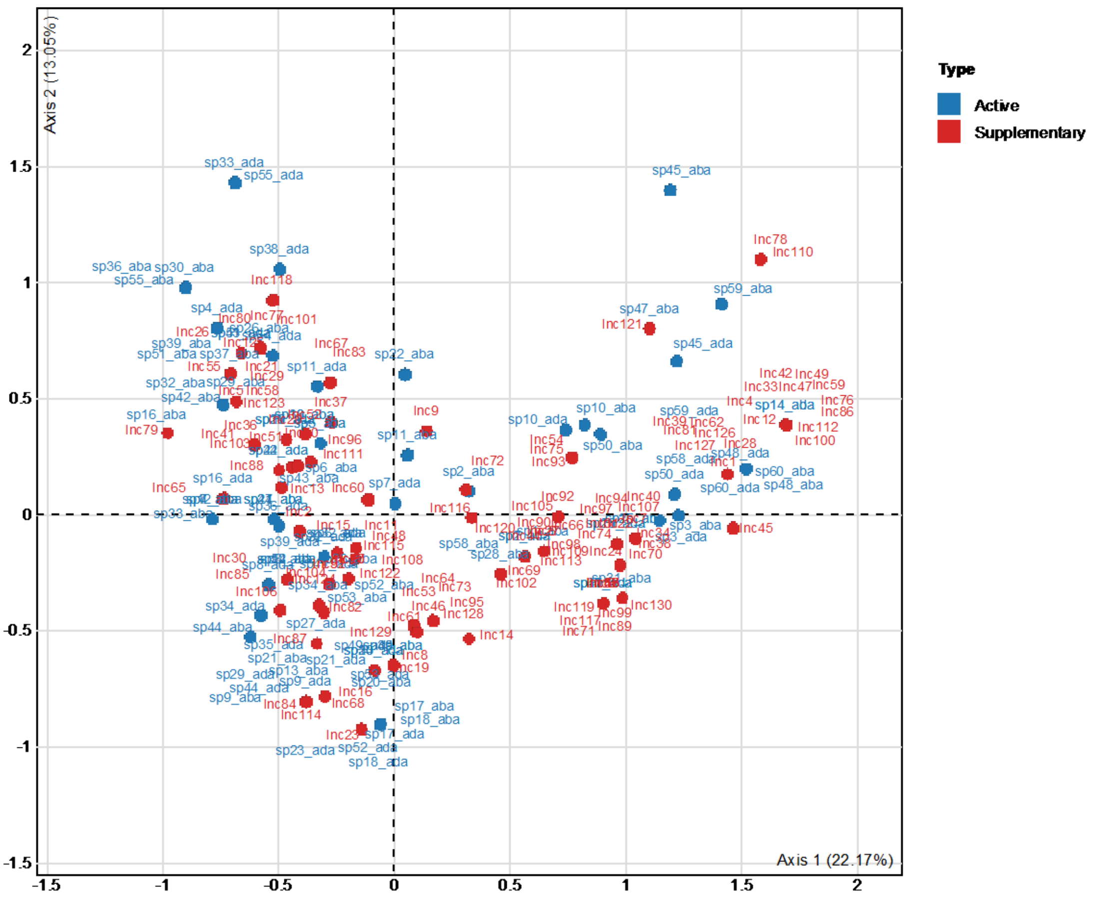
<u>Fig. 5</u>: HC tree (food items) with a cutting of four. The four colors (red, green, blue and sky blue) represent the cutting of the tree in the four main groups. At the bottom of the branches, we have the Latin names of the food items species. In total, 112 individuals are represented (each species is represent twice; for the adaxial side and for the abaxial side). The black arrows show the individuals that share the same families and that are close on the tree. The red, yellow and green circles give an estimate of the species that share the same branches in the tree.

3.2 Identification of the faeces fragments

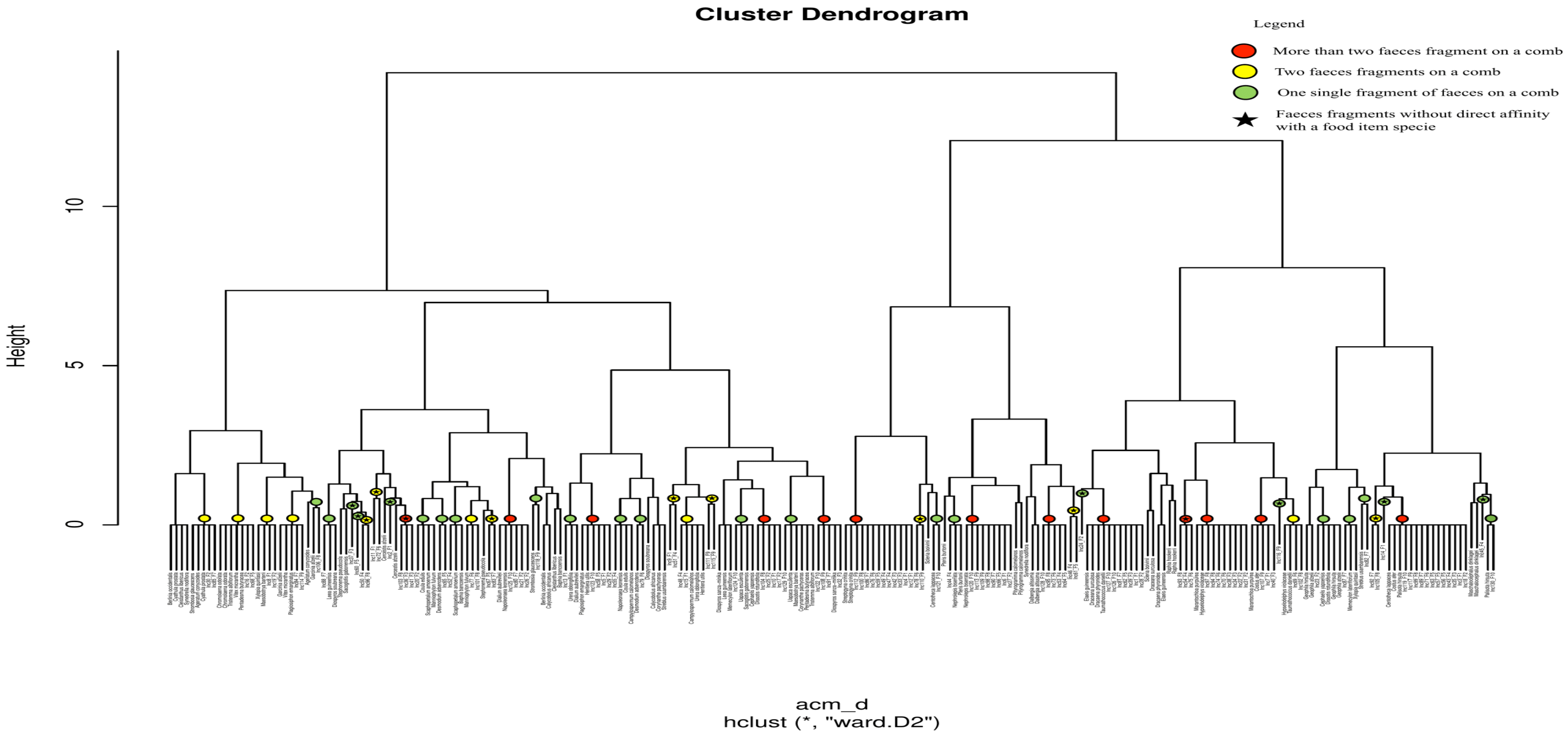
3.2.1 <u>First identification: Target of the epidermis types by MCA analysis</u>

A first identification of the epidermis is done by the MCA; the results are diplayed in **Figures 6** & **7**. In **Figure 6**, we can observe the projection of the food items references (dataset n°1) in blue and the faeces fragments as supplementary individuals (dataset n°2) in red with their respective names on *F1xF2* axes.

We notice that at least twenty-two times, the food items and faeces fragments share the same position on the spatial projection. This position is shared again in the HC tree representation on **Figure 7** through the combs of the tree. We found that thirteen times more than two faeces fragments are shared (see red circles; **Fig. 7**), fifteen times two faeces fragments are shared (see yellow circles; **Fig. 7**) and twenty-four times one single fragment is shared on the combs (see green circles; **Fig. 7**). Finally, seventeen times some of the faeces fragments have no direct affinity with the food items references (see stars; **Fig. 7**).



<u>Fig. 6</u>: Projection of the unknown individuals (faeces fragments) in the food items on MCA *F1xF2* axes. On blue, are represented the food items (112 leaves sides), and on red are the 130 faeces fragments (supplementary individual).



<u>Fig. 7</u>: HC tree for all the individuals (food items and Faeces fragments). On the comb of the tree are written the species names as well as the faeces fragments name (number; from 1 to 130, and faeces number; from 1 to 10). The red circles represent the combs of the tree that are shared by more than two faeces fragments. The yellow circles represents the combs of the tree that are shared by two faeces fragments and the green circles represents a single faece fragment on a comb. Finally, the stars indicate the faeces fragments that have no direct affinity with the food items species.

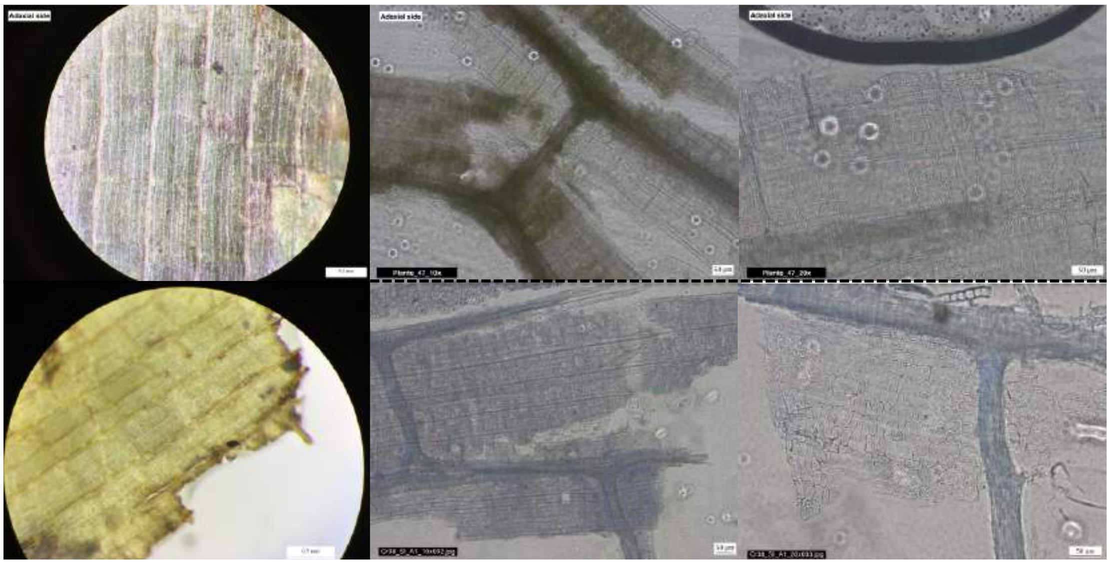
3.2.2 <u>Second identification: Visual analysis of targeted epidermis</u>

A second identification of the faeces fragments is made based on the results of the **Figure 7** and a visual analysis**.** The results are summurize in **Table 2** (see the entire Table in **Appendix 8.9.2).**

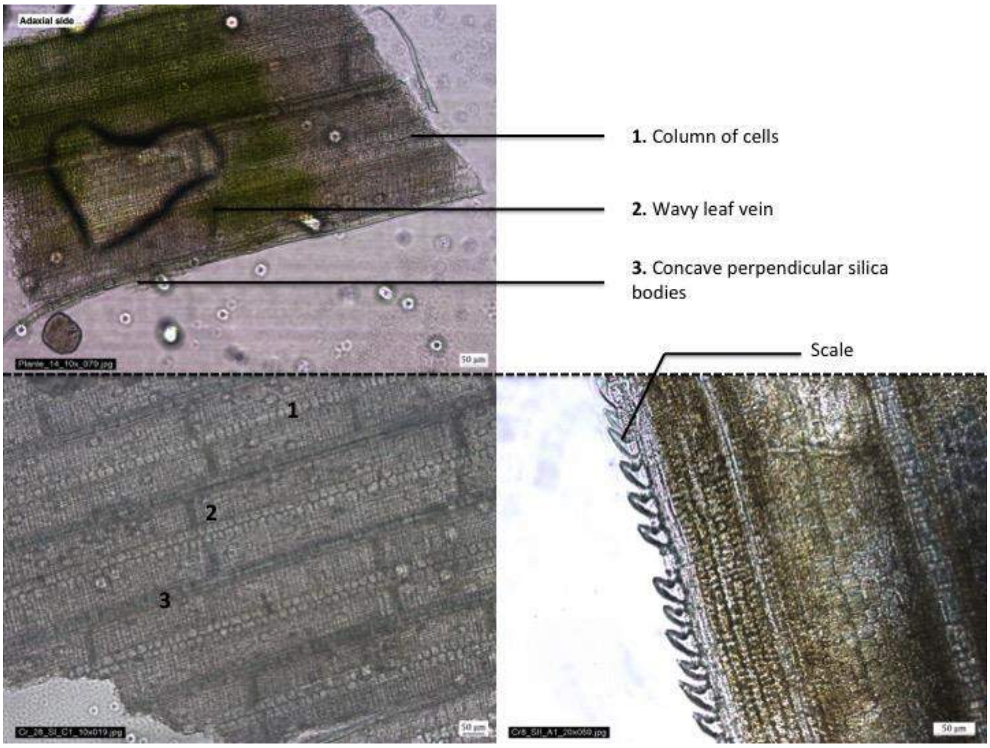
Groups/Families	**Plants species**	**Faeces**									
		1	2	3	4	5	6	7	8	9	10
FERNS		✓	✓		✓	✓		✓	✓	✓	✓
Nephrolepidaceae	*Nephrolepis biserrata*	✓	✓		✓	✓		✓	✓	✓	
Pteridaceae	*Pteris burtonii*				✓						
MONOCOTYLEDONAE		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Marantaceae specie		✓	✓	✓			✓		✓	✓	✓
	Marantocloa purpurea	✓	✓	✓					✓		
	Taumathococcus danielii	✓	✓								
Poaceae species		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Centotheca lappaceae	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Streptogyna crinita	✓		✓	✓	✓	✓	✓	✓	✓	✓
Other families		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
DICOTYLEDONAE		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sterculiaceae	*Heritiera utilis*	✓	✓			✓					✓
Other families		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

<u>Table 2</u>: Summary of the visual anaylsis based on the HC tree in figure 7. The first column represents the plants groups and families, the second one the plants species identified and finally their presence in the ten faeces.

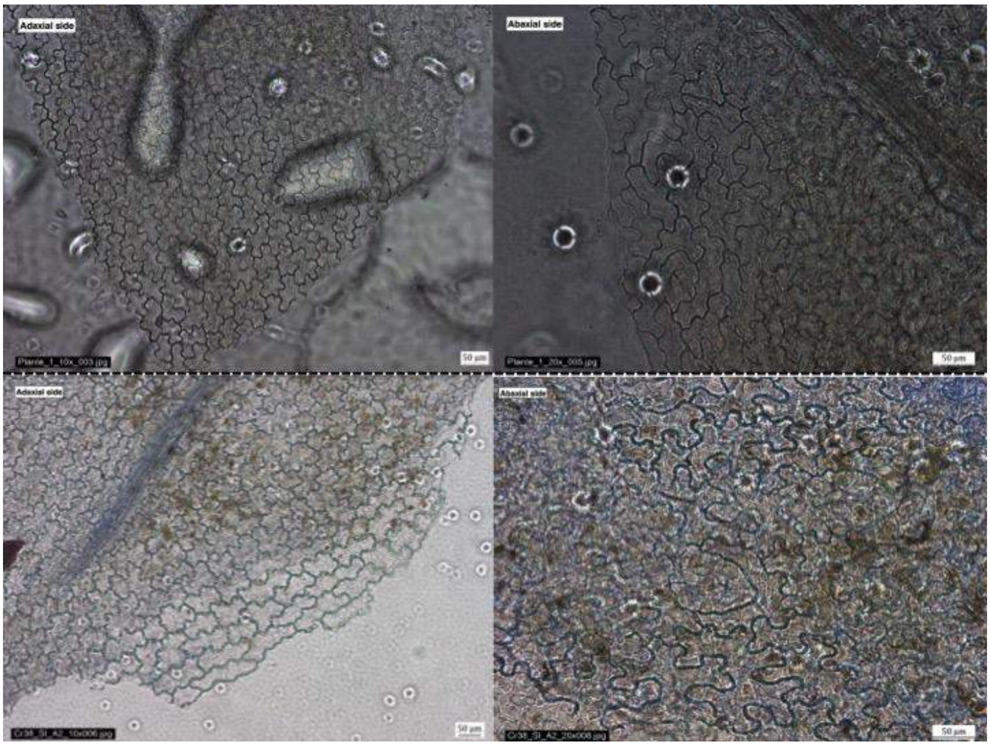
We observe that almost all the faeces contain the three groups of plants species (Monocotyledonae, Dicotyledonae and Fern) except faece, three and six which does not contain any fern. The poaceae family is found in all the faeces, in particular *Centhoteca lappaceae* (see **Fig. 9**) and *Streptogyna crinita* (see **Fig. 10**). The Fern species identified were often *Nephrolepis bisserata* (see **Fig. 11**). And, half of the faeces contain Marantaceae species (see **Fig. 12 & 13**; often *Marantocloa purpurea)* and *Herritiera utilis* (see **Fig. 14**).



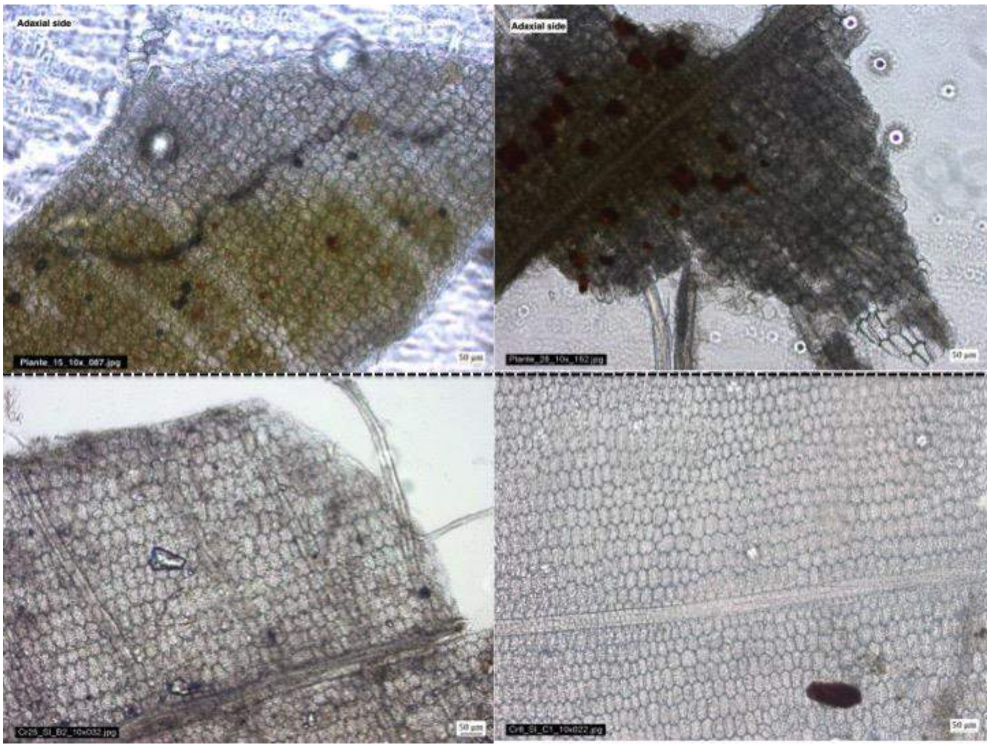
<u>Fig. 9</u>: Comparison between *Centhoteca lappaceae* and a faeces fragment. On the top is represented the adaxial side of *Centhoteca lappaceae* and on the bottom is represented the faeces fragment. The first pictures on the left represent the macroscopic views of each fragment. The other pictures (right) represent the microscopic views with different magnifications (100x for the left and 200x for the right).



<u>Fig. 10</u>: Comparison between *Streptogyna crinita* and a faeces fragment. The picture at the top represented the epidermis adaxial side of *Streptogyna crinita* (species 14). The legend characterizes three specific criteria of this plant. The picture at the bottom, represent the leave fragment (number 120) found in the Faece 9 (Inc120_F9). The numbers represents the three criteria of the legend. The pictures represented have been taken with a 100x magnification. The slides have been prepared with the discoloration method (method 2).



<u>Fig. 11</u>: Comparison between *Nephrolepis bisserata* and a faeces fragment. On the lef (up and down) are the two sides of leaves photographed in the faeces fragment Inc120_10. On the right (up and down) are the two sides of *Nephrolepis bisserata.* The magnification is 100x for the adaxial side and 200x for the abaxial side. The slides have been prepared with the discoloration method (method 2).



<u>Fig. 12</u>: Comparison between Marantaceae species and faeces fragments (adaxial sides). On the top is represented the epidermal cells of the adaxial side of *Marantochloa purpurea* (right) and *Hypselodeplphys violaceae* (left). On the bottom left (Inc97_F8) and right (Inc40_F3) two faeces fragments with similar caracters in the HC tree. The slides have been prepared with the discoloration method (method 2) and were photographed with a magnification of 100x.

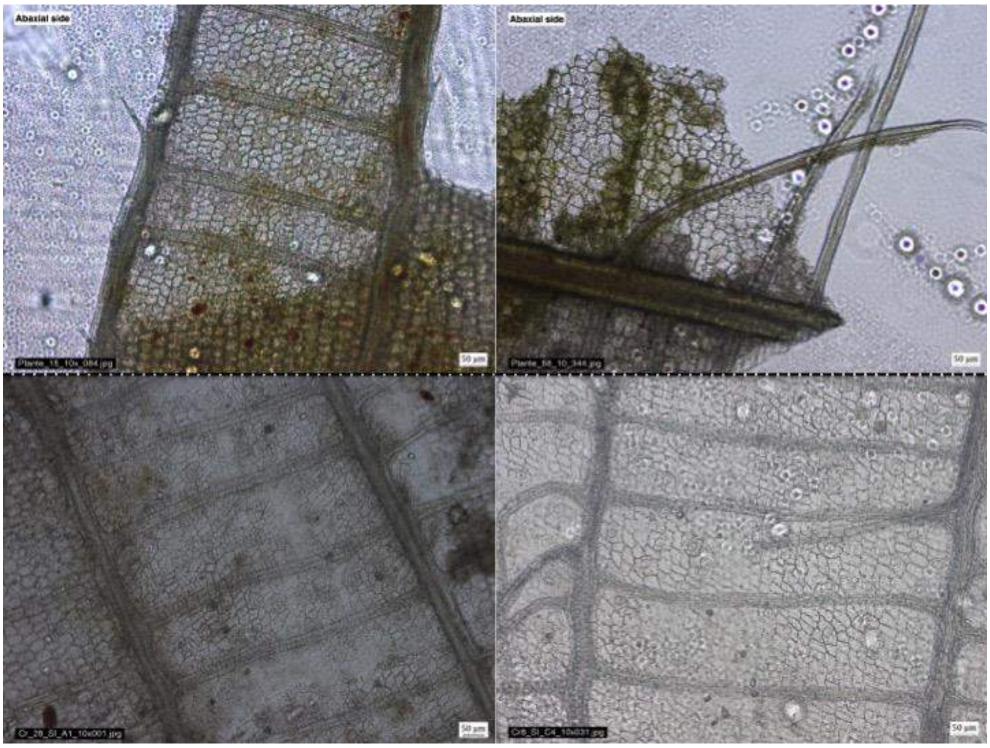


Fig. 13: Comparison between *Marantochloa purpurea, Costus afer* and faeces fragments (abaxial sides). On the top lef is the abaxial side of *Marantochloa purpurea* (Marantaceae) and on the right is the one of *Costus afer* (Zingiberaceae). On the bottom left (Inc107_F9) and right (Inc40_F3) are the faeces fragments. The pictures have been taken in 100x of magnification and the slides prepared with the discoloration method (method 2).

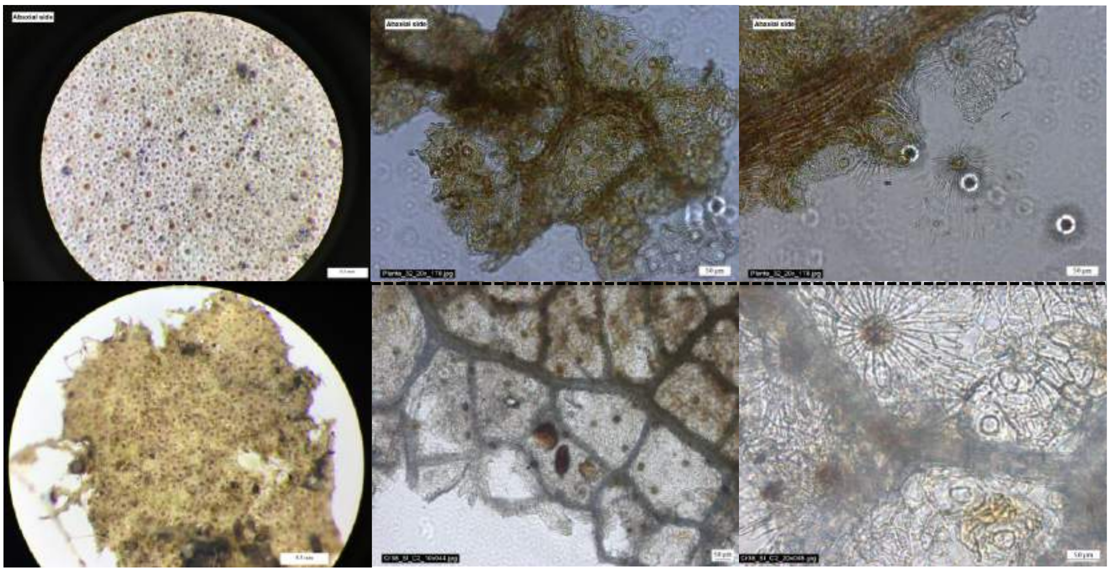


Fig. 14: Comparison between *Herritiera utilis* and an faeces fragment. On the top is represented the abaxial side of *Herritiera utilis* and on the bottom is represented the faeces fragment Inc123_F10. The firsts pictures on the left represent the macroscopic views of each fragment. The other pictures (right) represent the microscopic views with different magnifications (100x and 200x).

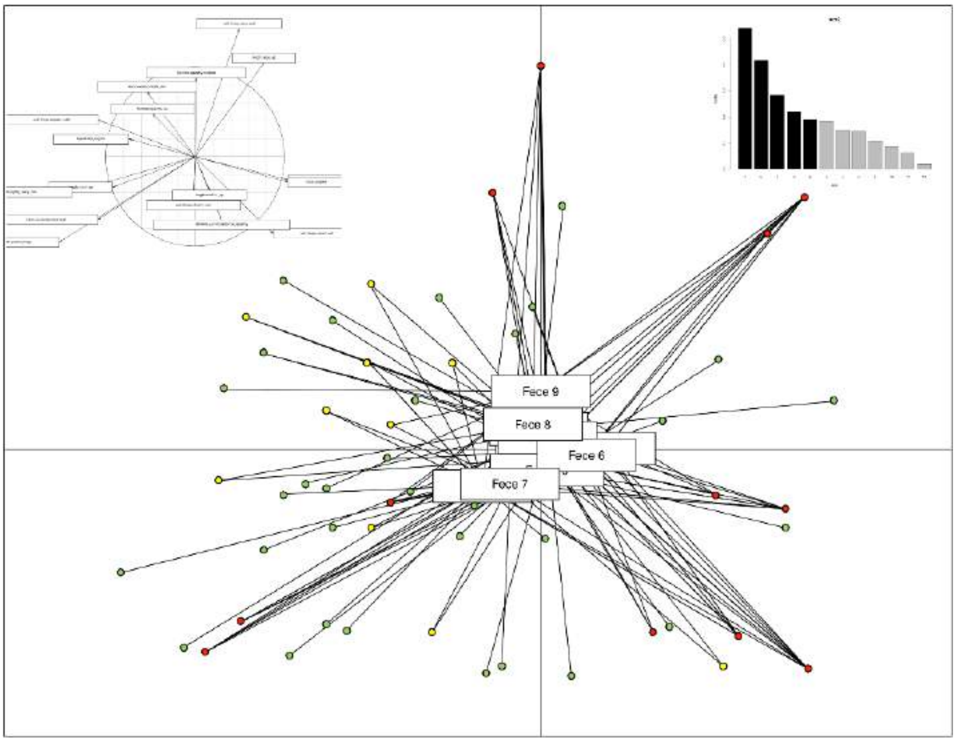
3.3 Variability of the 10 droppings

The variability within the ten droppings is shown in **Figure 15** through the MCA with the faeces fragments (dataset n°2).

The total inertia is 2.4, with the five main axes that explain 68.96% of the total variation. The first two axes F1 and F2 explain the major variation with a cumulative projected inertia of 39.96 % (see **Appendix 8.9.2**). The most contributive variables are close to the ones in the MCA done with the *dataset n°1 (i.e. for the F1 axis macro veins (0.82) and layout (0.77) and for the F2 axis wall shape (0.72) and stomata quantity (0.60)).*

The MCA in **Figure 15** shows that the barycenter of all the faeces are together in the center (junction of the F1 and F2 axes). This is also observable by the direction of the rays. The colours represent the frequency of the rays that share the same fragments. We defined three frequencies: red for high (more than two occurrences), yellow for medium (two occurrence), and green for low (less than two occurrence). We observe that the majority of faeces share at least ten common kinds of fragment (see **Fig. 15**; circles red). Two faeces (see Fig. 15; yellow circles) share nine kinds of fragments and in thirty-four cases; only one faeces has a specific fragment (see **Fig. 15**; green circles).

In the HC tree, we counted N=48 nods for our 130 faeces fragments. Therefore, it means, forty-eight similar fragments independently of the plants side (see **Appendix 8.9.2**; HC tree).



<u>Fig. 15</u>: Projection of the faeces fragments and their correlated faeces on MCA *F1xF2* axes. On the upper right corner is the barplot with the eigenvalues of the MCA (five main axes in black). On the upper left corner is the correlation circle for all the categories of our variables. In the middle stay all the barycenter of the ten faeces. Around the labels are projected the faeces individuals. We added three colors to higlight the different frequencies in wich the fragments occur in the faeces: green for high (more than two occurrence), orange for medium (two occurrence), and red for low (less than two occurrence).

4. DISCUSSION

From the results above three main conclusions can be drawn. Firstly, the pygmy hippopotamus has a very varied diet in the wild. Indeed, all plant groups are found in the faeces analysed. Secondly, among these plants, we were able to identify seven of them, but a certain number of faeces fragments epidermis are still under investigation (see **limits of the study**, below). Thirdly, we observed a low inter-faeces variability in our research area. This means that pygmy hippos in our research area seem to select the same plants to feed.

Hence, these results confirmed the fact that the pygmy hippopotamus has an herbivore generalist function (Hentschel, 1990; Robinson *et al*., 2017). This behaviour is described in the litterature as a feeding strategy (Pyke *et al*, 1977) but for generalists herbivores this strategy has a different basis (Hanley, 1982) and is mostly to acquire enough nutrients in different plants (Westoby, 1974) and at the same time to avoid an overingestion of plants toxins (Freeland and Janzen, 1974). This generalist function does not exclude the fact that herbivorous mammals may have a preference for plants species (Belovsky, 1978). Indeed, we explain the low variability between the different droppings by a food preferencies. The seven species described in our results are frequently found in almost all the faeces samples, particularly the plants from the Poaceae family (grasses).

Bülow (1987) and Hentschel (1990) already proposed a food items database with the favourite plants species eaten by hippos. From this database, we confirm that pygmy hippos in our research area seem to have a favourite preference for *Nephrolepis bisserata, Pteris burtonii,* Marantaceae species and *Streptogyna crinita.* However, we could not certify the presence of the following dicotyledonae in the samples analysed: *Desmodium adscendens, Dissotis rotundifolia, Geophila afzelii, Geophila hirsuta* and *Cercestis afzelii.* As we looked only at large fragments (large particles ingested) present in the faeces, an explanation could be that these dicotyledonae species have a thinner cell wall (Bodmer, 1990; Shipley, 1999) and possibly better absorbed by pygmy hippos, therefore not directly visualizable by our method. Indeed, diet studies on captive hippos explain the low digestibility of some particles by an ineffective mastication (Schwarm *et. al*, 2009). So, in analyzing smaller fragments we should probably find these species.

We would add to this food preferencies database two new species that we discovered very frequently in the droppings: *Centoteca lappaceae* (grass, found in all the samples) and *Herritiera utilis* (tree leaves, found in at least four of the ten samples). This new observation could be explained by the fact that previous studies (based on feeding trials, feeding signs and direct observation; Hentschel, 1990) did not have theses species in their area. In our case, we search all the plants of the initial list and we succeed to find only the half, some plants species classified as favourite were difficult to find or not present in our area as *Staurogyne paludosa, Justicia tenella* and *Floscopa africana*. This confirms again the herbivorous generalist function of this animal (Hentschel, 1990; Robinson *et al*., 2017). Furthermore, as pygmy hippos are very residential (small range), another explanation could be that the species found are very present in our area. Indeed, the species described in our study growth in swampy area and this confirms the hypothesis of the relationship between home range size and nutritional requirement of pygmy hippos (Robinson *et al*., 2017).

All these observations supports that Pygmy hippos are non-ruminant generalist intermediate feeders. An intermediate feeder or mixed feeder is an animal that eats grasses and forbs (containing higher proportions of cellulose; Demment and Van Soest, 1985) as well as shrubs and tree leaves (containing higher proportions of lignin; Bodmer, 1990; Van Soest, 1996). Furthermore, the intermediate feeder is able to adapt its diet according to the availability of resources and the seasons (Hofmann, 1989). The gregarious and territorial pygmy hippos behaviour, dentition (Lang, 1975), and previous diet observations (Bülow, 1987; Hentschel, 1990) demonstrate again this intermediate feeding strategy.

Within zoos, Gabriella Flacke (Thesis, 2017), already highlighted that pygmy hippos would be classified in the wrong category being considered as *non-ruminant generalist browser* by the Nutritional Advisory Group (Lintzenich & Ward, 1997) and reported in the Pygmy Hippo Husbandry Manual (von Houwald *et al*., 2007). Furthermore, when visiting different zoos' websites, it becomes clear that some of them do not always consider the fact that grasses are an integral part of the pygmy hippos' diet. As a result, captive pygmy hippos receive too high-energy intake that leads to obesity and disease related (Flacke *et al*., 2016; Flacke, 2017; Steck 2008). A study carried by the University of Zurich on captive hippos in 2013 showed that by reducing the amount of pellets given, and by increasing the amount of hay (*ad libitum*), pygmy hippos lose weight and have a similar body weight as wild pygmy hippos (Taylor, 2013). This again confirms that Pygmy hippos are not strict browsers but more certainly intermediate feeders and they need to incorporate into their diet slowly digestible plant fibers (Shipley, 1999).

To summarize, although the pygmy hippopotamus has a very varied diet, we can distinguish a preference for certain plants species. We can also notice that these preferences depend on the availability of resources and therefore on its home range. This high diversity of diet in the wild, support that pygmy hippopotamuses are intermediate feeders and therefore that a monotonous diet in captivity can reduce its life expectancy by promoting diseases.

4.1 Limits of the study

The results of this study are limited by the following factors, which would require additional analysis in order to be complete:

1. **The number of food items references**
The main limit of this study is at the level of the food items references. Indeed, less than 4% of the plants species of the TNP documented are represented in this work (only N=56 from the 1356 species documented; Scouppe, 2011). However, among these plants, only shrubs and herbaceous plants could be interesting for the determination of the pygmy hippos' diet, which represents only between 10% and 15% of the 1356 plants species of the TNP.

2. **Variable choice**
The second limit is in the variable choice for the MCA analysis. First, using a macroscopic variable, we are forced to analyze large faeces fragments. This variable is very helpful (contributed strongly; 0.78) in the analysis. However in order to complete the regime of the pygmy hippo, we should look to smaller fragments as well and this variable would therefore not be used. Secondly, many of the food items references share the same characteristics and sometimes it is difficult to distinguish the epidermis of different species. Indeed, the cell structure can be the same in many plants and they are not necessarily taxonomic criteria. This is the reason why we used the macroscopic variable: to have a control on the microscopic descriptions.

3. **Fragments size and seeds**
As already explained, this study analyzed only large plants fragments. In order to have the complete regime of the pygmy hippo, we should look to smaller fragments and to the seeds. Fruits and seeds are also part of the pygmy hippopotamus diet. During the sorting of the faeces we found several times the same seed in many samples of the rainy season (see **Fig. 16**); unfortunately none of the botanist contacted was able to identify it, nor in ivory coast, nor at international level. We did not carry a deep analysis on the seeds because their occurrence in the faeces was low. In one report (van Heukelum, 2010) pygmy hippopotamuses, seem to consume seeds in their entirety, suggesting that wooden remains in the faeces from the seeds or fruits they have eaten. As the majority of the seed and fruit were not preserved in their entirety, DNA barcoding analysis with specific markers would be required for further analyses (Bradley, 2007; Iwanowicz *et al*., 2016).

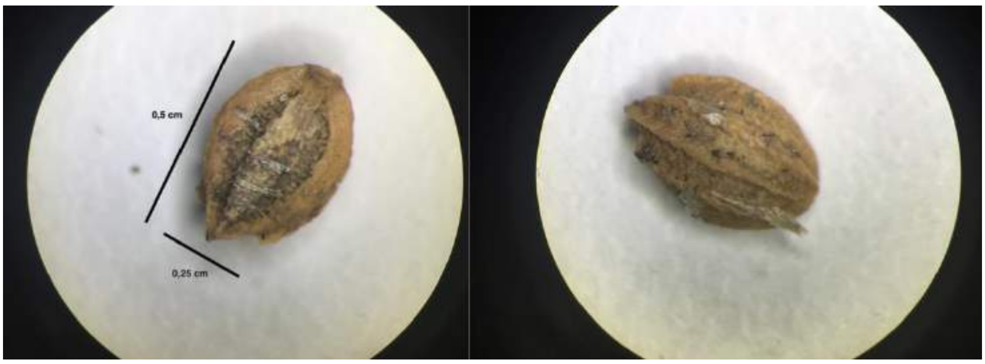


Fig 16: Seed found in many droppings. The pictures represent two different views of the seed in 25x of magnification.

4.2 Recommendations

This study enabled us to build a large tropical plant image database containing 60 plants species (see **TNP PLANT IMAGE DATABASE**). We recommend that this first database will be developped to increase our knowledge of the hippos' diet and other endemic species of the TNP. Furthermore, we recommend to collect faeces in different TNP areas and across the seasons to have another view and comparison to improve our understanding on the flexible pygmy hippos diet and its preferences. Additional methods, as a chemical analysis on the plants eaten could be carried to understand the food needs of wild pygmy hippos (Freeland and Janzen, 1974).

Concerning the microscopic methods used, we worked with dry material (reference plants and droppings) however, it would be better to boil the material such as the preparation of Metcalfe and Chalk (1957). By this method the cells can be rehydrated and regain their shape. This would provide a better comparison and would allow us to look at more digested fragments.

For the variable choice, we recommend to add information on the stomata. Stomata are good indicators, especially the stomata type described by Metcalfe and Chalk (1957). The quality of our reference slides did not allow us to properly distinguish the different stomata. Thus, we had to abandon this variable. Rech (2011) recommends analysing only the abaxial side, because it is more characteristic to the plants species. Indeed, as there are fewer characters visible on the adaxial side, we are limited in the descriptions. We have encountered this several times with the adaxial sides of our reference species. The cells look very similar and it is difficult to distinguish one to another (i.e. adaxial side of *Dialium aubrevillei* and *Napoleona leonensis).* Unforunately, the side of the faeces fragments removed is not always an option.

Finally, we also tried an approach by camera traps to identify the plants eaten by pygmy hippos (182 videos taken over two years by Noémie Capelle from the Max Planck Institute (MPI)). However, it was almost impossible to carry plants identification based on the videos. First because there are not many of them in which it is eaten and second because the videos does not always allow to observe correctly the plants. However, the activity level (Rowcliffe *et al*., 2014) and density (Buckland *et al*., 2000; O'Connell *et al*., 2011; Trolliet *et al*., 2014) of pygmy hippos could be well studied using this material.

To summary, for pygmy hippos diet determination, we recommend to increase the number of references species, to increase sampling (i.e looking faeces across the whole TNP and across seasons) and to improve the MCA identification in describing stomata more accurately.

5. CONCLUSION

The objective of this study was to determine the diet of free ranging pygmy hippopotamuses in the TNP. We confirm by this study that the pygmy hippopotamus is a generalist herbivore with a wide range of plant species consumed: grasses as well as shrubs that leads to suggest that it is an intermediate feeder. Indeed, we observed similar fragments of Monocotyledonae (grasses), Dicotyledonae (shrubs, tree leaves) and Ferns in almost all the faeces analysed (i.e. from ten pygmy hippos). Moreover, refining our analysis with pictures, we suggest that pygmy hippos in our research area have a food preference for *Nephrolepis bisserata* (Fern), *Streptogyna crinita* (Monocotyledonae), Marantaceae species (Monocotyledonae, *Centhoteca lappaceae* (Monocotyledonae) and *Herritiera utilis* (Dicotyledonae). The latter two species were not considered part of the hippo's diet until now. In addition, *Centhoteca lappaceae* (grass) was found in all samples analysed and once again confirms the importance of grasses in the diet of pygmy hippos. Once again, the high diversity of plants in the diet seems to be important for pygmy hippos' survival in the wild and in captivity.

The microscopic method and MCA analysis used in this study helped us to target the type of epidermis consumed by pygmy hippopotamuses and seven species eaten have been identified. However, increasing the number of food items species would give more comparisons to identify more faeces fragments that remain unidentifiable.

This study gives new advices for captive pygmy hippos' conservation (i.e to adapt the food for an intermediate feeder instead of a browser feeder). In addition, this study gathered a huge tropical plants database concerning 60 species that could be useful for other fauna studies in the TNP and West African tropical forests. Further research could be carried on the plants chemical composition of the pygmy hippos' preferred food items database. This would help to improve feeding in the zoo and at a larger scale reduce the risk of contracting a disease due to poor feeding. For wild hippo, this would help to conserve the dynamics of the TNP plants species and provide another reason to protect their habitat from deforestation and plantation.

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8. APPENDIX

8.1 List of plants collected in TNP

Family	Genus	Species	Nb id	Type
Nephrolepidaceae	*Nephrolepis*	*biserrata*	1	ref and mark
Pteridaceae	*Pteris*	*burtonii*	2	ref and mark
Pteridaceae	*Pityrogramma*	*calomelanos*	3	abun
Euphorbiaceae	*Cleistanthus*	*libericus*	4	abun
Fabaceae	*Dalbergia*	*altissima*	5	abun
Urticaceae	*Urera*	*oblongifolia*	6	abun
Asteraceae	*Synedrella*	*nodiflora*	7	abun
Asteraceae	*Ageratum*	*conyzoides*	8	abun
Lamiaceae	*Vitex*	*micrantha*	9	abun
Rapataceae	*Maschalocephalus*	*dinklagei*	10	ref
Araceae	*Cercestis*	*afzelii*	11	ref
Amaranthaceae	*Cyathula*	*prostata*	12	abun
Clusiaceae	*Pentadesma*	*butyracea*	13	abun
Poaceae	*Streptogyna*	*crinita*	14	ref
Marantaceae	*Marantochloa*	*purpurea*	15	ref and mark
Fabaceae	*Desmodium*	*adsencdens*	16	ref
Rubiaceae	*Geophila*	*hirsuta*	17	ref and mark
Rubiaceae	*Geophila*	*afzelii*	18	ref and mark
Sterculiaceae	*Scaphopetalum*	*amoenum*	19	abun
Melastomataceae	*Tristemma*	*albiflorum*	20	abun
Asteraceae	*Chromolaena*	*odorata*	21	abun
Combretaceae	*Strephonema*	*pseudocola*	22	abun
Melastomataceae	*Dissotis*	*rotundifolia*	23	ref
Vitaceae	*Leea*	*guineensis*	24	abun
Zingiberaceae	*Costus*	*afer*	25	abun
Euphorbiaceae	*Manniophyton*	*fulvum*	26	mark
Melastomataceae	*Memecylon*	*lateriflorum*	27	abun
Marantaceae	*Hypselodelphys*	*violaceae*	28	abun
Caesalpiniaceae	*Plagiosiphon*	*emarginatus*	29	mark
Rubiaceae	*Corynanthe*	*pachyceras*	30	abun
Commelinaceae	*Palisota*	*hirsuta*	31	mark
Sterculiaceae	*Heritiera*	*utilis*	32	mark
Caesalpiniaceae	*Berlinia*	*occidentalis*	33	mark
Humiriaceae	*Sacoglottis*	*gabonensis*	34	abun
Annonaceae	*Xylopia*	*quintasii*	35	mark
Moraceae	*Streblus*	*usambarensis*	36	abun
Olacaceae	*Coula*	*eduils*	37	mark
Fabaceae	*Baphia*	*bancoensis*	38	mark
Ochnaceae	*Campylospermum*	*calomelanos*	39	abun
Ebenaceae	*Diospyros*	*manii*	40	mark
Ebenaceae	*Diospyros*	*sanza-minika*	41	mark

Family	Genus	Species	Nb id	Type
Ebenaceae	*Diospyros*	*soubreana*	42	mark
Caesalpiniaceae	*Dialium*	*aubrevileii*	43	mark
Clusiaceae	*Garcinia*	*afzelii*	44	mark
Cyperaceae	*Scleria*	*boivinii*	45	abun
Chrysobalanaceae	*Parinari*	*excelsa*	46	abun
Poaceae	*Centotheca*	*lappacea*	47	mark
Agavaceae	*Dracaena*	*phyronides*	48	abun
Euphorbiaceae	*Maesobotrya*	*barterii*	49	mark
Arecaceae	*Raphia*	*hookerii*	50	mark
Lecythidaceae	*Napoleonaea*	*leonensis*	51	mark
Rubiaceae	*Cephaelis*	*yapoensis*	52	mark
Euphorbiaceae	*Uapaca*	*esculenta*	53	abun
Olacaceae	*Strombosia*	*glaucescens*	54	mark
Convolvulaceae	*Calycobolus*	*africanus*	55	mark
Rubiaceae	*Massularia*	*acuminata*	56	mark
Caesalpiniaceae	*Gilbertiodendron*	*preusti*	57	mark
Marantaceae	*Taumathococcus*	*daniellii*	58	abun
Asparagaceae	*Draceana*	*surculosa*	59	mark
Arecaceae	*Elaeis*	*guineensis*	60	abun

Table 1: Plant species collected in the TNP. The first column represent the Family, the second one the genera, the third one the species and the fourth one the number we gave to simplify the identification. The last column represents the different reasons why these plants were collected. We noted *ref* for reference plants; plants already suggested by other authors to be eaten by hippos. *Abun* for plants that seemed abundant in our research area and *mark* for plants on which we found a hippo's territorial marking. In green are the 10 genera of the preferred food, known to be eaten by pygmy hippos (by feeding signs, feeding trials and direct observation in the TNP; Hentschel, 1990). In red are the four species deleted from the analysis because the two sides of the leaves epidermis removed were not workable. In total, 34 differents plants families have been collected and 60 species of plants.

8.2 Two kinds of faeces

<u>Fig 1</u>: Two Pygmy hippo's faeces. (A) *Territorial faeces* type, the faeces are widespread on the leaves and on the floow. The consistency is more liquid than B; **(B)** *Littery faeces* type, the faeces are lying on the ground. The consistency is tronger and we can distinguish some balls.

8.3 Collection, drying and storage of samples

8.3.1 <u>Collection</u>

To collect a representative sample, we did as Michez (2006, 2013) with the common hippopotamus. We imagined a circle around the whole excrement and we took around this circle small quantities of faeces (see **Fig.2**). All the faeces samples have been collected when the quantity and the level of degradation of the faeces make it possible (see **Appendix 8.2**).

<u>Fig. 2</u>: Collection of a Pygmy Hippo's faeces. *Littery faeces* type, collected on dead wood (TNP).

8.3.2 Drying

We used a method of solar drying. The faeces are spread out on a metal board and exposed to the sun. Depending on the season, we waited three days approximately until the faeces were completely dried. The food items collected have been pressed (Williamson *et al.*, 1990).

Fig. 3: Droppings drying on a metal table.

8.3.2 Storage of the samples

When the droppings samples were dry, we kept them in sterile boxes (see **Fig. 4**). The number of the faece, date of collection and date of conservation is written on it.

During the fieldwork, the dried samples (faeces and food items) were stored in a large box with silicat gel inside to protect them from forest moisture. Back to Switzerland, the faeces were conserved in a fridge at 4 degrees Celsius and the food items were stored in newspaper and in a dry place.

Fig.4: Conservation of the faeces dried in small sterile boxes.

8.4 Table of field data collection

This Table include the eleven information we collected in the field for each pygmy hippos track found.

1	2	3	4	5	6	7
Date and time	ID	GPS (UTM)	Canopy	Underwood	Plants present	MCGrew's strata
8		9		10	11	
OIPR code		Level of degradation		Plants faeces	Comments	

Fig. 5: Table of faeces data collection. 1. Date and Time; **2.** The identity (ID), whether there was a dung (DG), or a footprint (FT); **3**. The GPS data points (Longitud and Latitud in UTM); **4**. The state of the canopy (Open (O), Intermediatee (I), Closed (C)); **5**. The state of the underwood (Open (O), Intermediate (I), Closed (C)); **6.** The presence and absence of the plants and tree fruits known to be eaten by pygmy hippos: *Cephaelis yapoensis, Geophilia sp, Sacoglottis gabonensis, Parinari exelsa* and *Anthonota fragans;* **7.** McGrew's strata (McGraw *et.al*., 1998, 2007). There are four: *ground level* (vegetation of 0 meters), *stratum 1* (vegetation of small trees), *stratum 2* (vegetation between 5 and 15 meters) *stratum 3-* (vegetation between 15 and 25 meters), *stratum 3+ (*vegetation between 24 and 50 metes) and *stratum 4* (vegetation higher than 40 meters); **8.** The code of vegetation of the OIPR. There is several descriptions for the 7 different types of habitats. This method is also used for the monitoring studies in the TNP. Indeed, this methodology distinguish: primary forest (*forêt primaire*), mixed forest underwood open (*forêt mixte Sous-Bois Ouvert*; FMSO), mixed forest underwood closed (*Forêt Mixte Sous-Bois Fermé;* FMSF), forest on hydromorphic soils (*Forêt sur sols hydromorphes*; FSHD), forest of inselbergs or mountain (*Forêt des inselbergs ou de montagne*; FIMT), young secondary forest (*Forêt Secondaire Jeune Fourrés*; *FSJF),* bush or non-woody vegetation (*Brousses ou Végétation non ligneuse (=herbacée)*; *BVNL)* and plantation or farm (*Plantation ou Exploitation agricole*; EXPA). *14.04.29_Guide de formation pour le projet Anti-Brconnage;* **9.** The dungs *level of degradation.* This level has been created with my field assistant to describe the aspect and quantity of the faeces found (see **Appendix 8.5**); **10.** *Plants faeces* column gives the information about the origin of the faece whether there is a territorial dung or litter one. Whenever possible, we recorded the names of the plants on which the hippo had made its territorial marking; **11.** A commentary list of observations.

8.5 Level of degradation of pygmy hippo's faeces

In order to describe the aspect of the faeces, we characterised the faeces from 1 (fresh) to 5+ (very old). Those numbers indicate the level of degradation and give an idea about the whole quantity of it. This method is widely spread in Elephant studies and is based on White and Edwards (2000) protocol. The *Office Ivoirien des Parcs et Réserves (OIPR)* in Ivory Coast also use this method to track the elephants (N'goran *et al*. 2013). Unfortunatly, it do not exist yet a protocol for hippos. We noted the faeces from 1 to 5+ to describe our personal observations.

- **Level 1**: Very fresh, smell, 1 or 2 days ago.
- **Level 2**: Fresh, less smell, 3 to 5 days ago.
- **Level 3**: A bite old, more than 1 week, no mushrooms, sometimes a little bite dry and color yellow, lack of odor.
- **Level 4**: Old, more than 2 weeks, mushrooms, but the quantity can stay high.
- **Level 5**: Very old, black residues and very dry.
- **Level 5+**: Almost disappeared, black/brown dry tracks, no residues anymore.

8.6 Protocols

8.6.1 Polishnail method (method 1)

The method consists to apply a film of clear polish nail on the leaf surface (Miller and Asby, 1968; Hilu and Randall, 1984). As the two sides of the leaves are distinct, the upper and lower side of the leaf are used for the analysis.

For the 60 plants sample, we used the same following treatment:

1. On 0,5 cm of diameter of each side of the leaves, we deposit a film of clear nail polish using the brush of the commercial product.
2. Then, when the product is dry, we removed the film with a lanceolate needle and tweezers.
3. In few drops of water, we put the film on a slide.
4. Finally, the slide content is recovered by a coverslip and ready for the observation under the microscope.

It is important to remaind that the film needs to be dry before the removal. A waiting of minimum fiteen minutes is required but two to four hours is recommended (Hilu and Randall, 1984). In order to conserv the slides, we added polish nail all around the coverslip. This allows to fix it and to have enough time for observation and for taking pictures after a while. With this method, the slides are semi-permanent. On each slide and for each plant specie, the upper (adaxial) and lower (abaxial) epidermis cells are represented.

8.6.2 Discoloration method (method 2)

Based on the book of Rech (2011) we discolored the fragments with some drops of Sodium hypochlorite solution and some drops of Ethanol 70%. The fragments were placed on holes from Polystyrene Square Petri Dish separately and the two solutions were added on it.

When the little fragments become transparent (it can take two days), we washed them with running water.

We handled the discoloration step under the fume hood using appropriate precautions because of the toxicity of the solutions.

8.6.3 Picutres of the slides

The photographs have been taken with an inverted microscope *Leica OMI 3000 B* using the software *LAS V.4.0.* For the food items and the discolored faeces fragments, we took pictures in three different magnification. In 40x to have a general view, then in 100x and 200x.

We took in total, 720 microscopic pictures for the food items references and 1440 pictures for the droppings fragments.

8.6.4 Faeces preparation

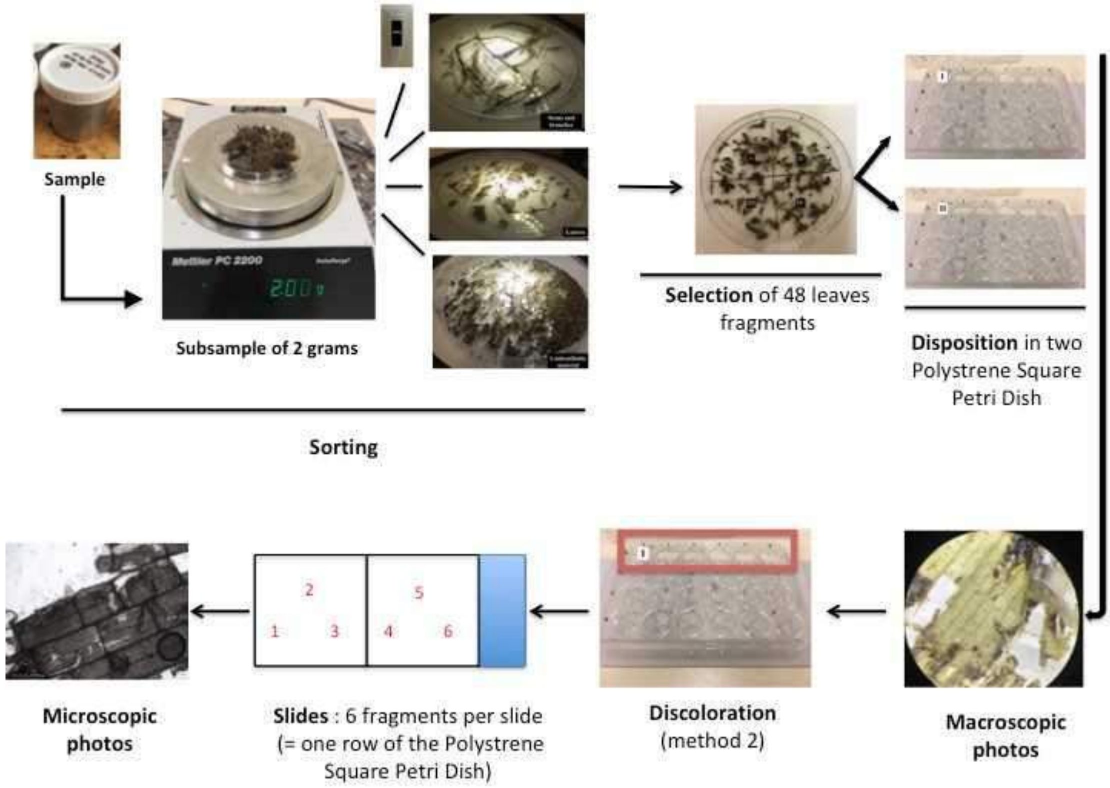


Fig 6: Summary of the faeces preparation. From the sorting to the microscopic pictures.

Sorting: in order to identify the different fragments of plants inside the faeces, a selective sorting is done. We took a subsample of two grammes and we sorted it into four categorises: leaves, roots and stems, seeds and unidentifiable material (Michez, 2006, 2013). Then, we conserved the material sorted in three different petri dishes (for the leaves, roots and stems, and unidentifiable material). The petri dishes are finally closed with a parafilm. The seeds are conserved in a tube of one ml. We stored the sorted material in a cold room (four degrees Celsius) for further analysis.

Selection: we took 48 fragments of plants species coming from the faeces sorting. We selected the fragments in a systematic way. After the sorting, the leaves are laying in a petri dish. We separated the petri dish with a marker in four and we selected the same number of fragments on each section. It means twelf fragments per section (see **Fig. 6**). The fragments of each section are placed in Polystrene Square Petri Dish. A polystrene Square Petri Dish contains 24 holes so we used two of them to put our 48 fragments.

Macroscopic photos: under the binocular magnifer, we photographed each fragment and we name them as for example Faece_1_Section_I_1a.

Discoloration: we proceed with the discoloration of the fragments by following Rech (2011) protocol (see **Appendix 8.6.2**).

Slides: the discoloured fragments are placed finally on slides. We put 6 fragments per slide, which corresponds to a row of the Petri dish (see **Fig 6**). The fragments are kept between the slide and the coverslip with drops of glycerin. After testing water and glycerin, we recommend keeping the discoloured fragments in glycerin. Indeed, it allows to keep the state of the fragment longer.

8.7 Variables we used before the variables selection

Before arriving at a simplified key (with five variables), we defined 15 variables with different categories to describe each fragments. Indeed, some character chosen from the list below cannot be used in our study because their values were not significant enough in the first MCA we conducted. Others, as the stomata type variable, many information was missing and we had to suppress these variables in the final key.

For the macroscopic varibale:

1. **Vein Leaf**: we described how the leaf veins are disposed. We characterized three types: when they are parallel (*parrallel_leaf*), when they are pinnate *(pinnate_leaf)* and when they are reticulate *(reticulate_leaf).*

For the microscopic variables:

2. **Width**: we defined whether the width of the cells is lower or equal to 25 micrometers (*ML_25_ep*), or whether it is bigger than 25 micrometer (*More_25_ep*).
3. **Length**: whether the length of the cells is lower or equal to 25 micrometers (*small_ep*), between 25 and 50 micrometers (*medium_ep*), or bigger than 50 micrometers (*large_ep*).
4. **Layout**: whether the cells are aligned (*aligned*) or non-aligned (*non_aligned*).
5. **Cell shape**: whether the cells are *alongated*, *pentagonal*, or *winding*.
6. **Wall shape**: straight (*straight_wall*), angular (*angular_wall*), wavy (*wavy_wall*), slightly_wavy (*slightly wavy_wall*), round (*round_wall*).
7. **Silica**: whether the silica are concave and perpendicular (*concave_perpendicular*) to the other cells, whether they are concave parallel (*concave_parallel*) to the other cells or whether they are absent (*absence_silica*).
8. **Scale**: some species had visible scales on the veins leaves or edge of the blade. So we created a variable to characterize them.We found two kinds of scales one flat and another one thick, we named three categorises: flat thiny (*flat_thiny*), flat thick (*flat_thick*) and absence of scale (*absence_scale*).
9. **Cellularity**: cellularity of the trichome, whether the trichome are unicellular (*uni*), multicellular (*multi*), or when there is no trichome (*absence_trichome*).
10. **Trichome insertion**: we defined only three types of insertion; a flower insertion «rosette» (*flower*), another insertion (*other_insertion*) or when there is no trichome (*absence_insertion*).
11. **Quantity_stomata**: quantity of the stomata, we qualified four quantities: *low*, *medium*, *large* and *absence_quantity***.**
12. **Direction_stomata**: orientation of the stomata. We defined three categorises: *same* direction, *different* direction, and *absence_direction***.**
13. **Width_stomata**: we estimated the width of the stomata to three categorize : less or equal to 25 micrometer noted as *ML_25_stom*, more than 25 micrometer noted as *More_25_stom* and when there is no stomata present noted as *absence_width*.
14. **Length_stomata**: we estimated the lengh of stomata to three categorise less or equal to 25 micrometer (*ML_25_stomata*), more than 25 micrometers (*More_25_stomata*) and no stomata (*absence_length*).
15. **Type_stomata**: as Metcalfe and Chalk (1950), we used the same descriptions of the seven kinds of stomata. We created eight categorises; *anomocytic*, *diacytic*, *paracytic*, *anisocytic*, *actinocytic*, *gramineous*, *tetracytic*, and *absence_type* when there were none.

When some characters were not possible to identify we wrote NA into the column.

8.8 Datasets

8.8.1 Dataset n°1

A	B	C	D	E	F	G	H	I	J	K
Species_nb	**Family**	**Genus**	**Species**	**Genus_species**	**D_F_M**	**macro veins**	**length**	**layout**	**wall shape**	**Stomata quantity**
sp1_aba	Nephrolepidaceae	Nephrolepis_aba	biserrata_aba	Nephrolepis biserrata	F	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
sp1_ada	Nephrolepidaceae	Nephrolepis_ada	biserrata_ada	Nephrolepis biserrata	F	pinnate_leaf	large_ep	non_aligned	wavy_wall	absence_quantity
sp2_aba	Pteridaceae	Pteris_aba	burtonii_aba	Pteris burtonii	F	pinnate_leaf	large_ep	non_aligned	wavy_wall	large
sp2_ada	Pteridaceae	Pteris_ada	burtonii_ada	Pteris burtonii	F	pinnate_leaf	large_ep	non_aligned	wavy_wall	absence_quantity
sp3_aba	Pteridaceae	Pityrogramma_aba	calomelanos_aba	Pityrogramma calomelanos	F	pinnate_leaf	large_ep	aligned	wavy_wall	medium
sp3_ada	Pteridaceae	Pityrogramma_ada	calomelanos_ada	Pityrogramma calomelanos	F	pinnate_leaf	large_ep	aligned	wavy_wall	absence_quantity
sp4_aba	Euphorbiaceae	Cleistanthus_aba	libericus_aba	Cleistanthus libericus	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	large
sp4_ada	Euphorbiaceae	Cleistanthus_ada	libericus_ada	Cleistanthus libericus	D	reticulate_leaf	small_ep	non_aligned	angular_wall	low
sp5_aba	Fabaceae	Dalbergia_aba	altissima_aba	Dalbergia altissima	D	reticulate_leaf	medium_ep	non_aligned	wavy_wall	large
sp5_ada	Fabaceae	Dalbergia_ada	altissima_ada	Dalbergia altissima	D	reticulate_leaf	medium_ep	non_aligned	wavy_wall	large
sp6_aba	Urticaceae	Urera_aba	oblongifolia_aba	Urera oblongifolia	D	reticulate_leaf	medium_ep	non_aligned	straight_wall	large
sp6_ada	Urticaceae	Urera_ada	oblongifolia_ada	Urera oblongifolia	D	reticulate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp7_aba	Asteraceae	Synedrella_aba	nodiflora_aba	Synedrella nodiflora	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	large
sp7_ada	Asteraceae	Synedrella_ada	nodiflora_ada	Synedrella nodiflora	D	reticulate_leaf	medium_ep	non_aligned	wavy_wall	medium
sp8_aba	Asteraceae	Ageratum_aba	conyzoides_aba	Ageratum conyzoides	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	medium
sp8_ada	Asteraceae	Ageratum_ada	conyzoides_ada	Ageratum conyzoides	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	absence_quantity
sp9_aba	Lamiaceae	Vitex_aba	micrantha_aba	Vitex micrantha	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
sp9_ada	Lamiaceae	Vitex_ada	micrantha_ada	Vitex micrantha	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	absence_quantity
sp10_aba	Rapataceae	Maschalocephalus_aba	dinklagei_aba	Maschalocephalus dinklagei	M	parrallel_leaf	medium_ep	aligned	slightly_wavy_wall	medium
sp10_ada	Rapataceae	Maschalocephalus_ada	dinklagei_ada	Maschalocephalus dinklagei	M	parrallel_leaf	medium_ep	aligned	slightly_wavy_wall	absence_quantity
sp11_aba	Araceae	Cercestis_aba	afzelii_aba	Cercestis afzelii	D	pinnate_leaf	medium_ep	non_aligned	wavy_wall	low
sp11_ada	Araceae	Cercestis_ada	afzelii_ada	Cercestis afzelii	D	pinnate_leaf	medium_ep	non_aligned	slightly_wavy_wall	low

A	B	C	D	E	F	G	H	I	J	K
sp12_aba	Amaranthaceae	Cyathula_aba	prostata_aba	Cyathula prostata	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	large
sp12_ada	Amaranthaceae	Cyathula_ada	prostata_ada	Cyathula prostata	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	medium
sp13_aba	Clusiaceae	Pentadesma_aba	butyracea_aba	Pentadesma butyracea	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
sp13_ada	Clusiaceae	Pentadesma_ada	butyracea_ada	Pentadesma butyracea	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp14_aba	Poaceae	Streptogyna_aba	crinita_aba	Streptogyna crinita	M	parrallel_leaf	large_ep	aligned	wavy_wall	medium
sp14_ada	Poaceae	Streptogyna_ada	crinita_ada	Streptogyna crinita	M	parrallel_leaf	large_ep	aligned	wavy_wall	medium
sp15_aba	Marantaceae	Marantochloa_aba	purpurea_aba	Marantochloa purpurea	M	parrallel_leaf	medium_ep	aligned	straight_wall	medium
sp15_ada	Marantaceae	Marantochloa_ada	purpurea_ada	Marantochloa purpurea	M	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
sp16_aba	Fabaceae	Desmodium_aba	adsencdens_aba	Desmodium adsencdens	D	reticulate_leaf	small_ep	non_aligned	angular_wall	large
sp16_ada	Fabaceae	Desmodium_ada	adsencdens_ada	Desmodium adsencdens	D	reticulate_leaf	small_ep	non_aligned	angular_wall	absence_quantity
sp17_aba	Rubiaceae	Geophila_aba	hirsuta_aba	Geophila hirsuta	D	pinnate_leaf	medium_ep	non_aligned	round_wall	medium
sp17_ada	Rubiaceae	Geophila_ada	hirsuta_ada	Geophila hirsuta	D	pinnate_leaf	medium_ep	non_aligned	round_wall	absence_quantity
sp18_aba	Rubiaceae	Geophila_aba	afzelii_aba	Geophila afzelii	D	pinnate_leaf	medium_ep	non_aligned	round_wall	medium
sp18_ada	Rubiaceae	Geophila_ada	afzelii_ada	Geophila afzelii	D	pinnate_leaf	medium_ep	non_aligned	round_wall	absence_quantity
sp19_aba	Sterculiaceae	Scaphopetalum_aba	amoenum_aba	Scaphopetalum amoenum	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	medium
sp19_ada	Sterculiaceae	Scaphopetalum_ada	amoenum_ada	Scaphopetalum amoenum	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp20_aba	Melastomataceae	Tristemma_aba	albiflorum_aba	Tristemma albiflorum	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
sp20_ada	Melastomataceae	Tristemma_ada	albiflorum_ada	Tristemma albiflorum	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp21_aba	Asteraceae	Chromolaena_aba	odorata_aba	Chromolaena odorata	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
sp21_ada	Asteraceae	Chromolaena_ada	odorata_ada	Chromolaena odorata	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
sp22_aba	Combretaceae	Strephonema_aba	pseudocola_aba	Stephonema pseudocola	D	parrallel_leaf	small_ep	non_aligned	slightly_wavy_wall	medium
sp22_ada	Combretaceae	Strephonema_ada	pseudocola_ada	Stephonema pseudocola	D	pinnate_leaf	medium_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp23_aba	Melastomataceae	Dissotis_aba	rotundifolia_aba	Dissotis rotundifolia	D	pinnate_leaf	small_ep	non_aligned	straight_wall	medium
sp23_ada	Melastomataceae	Dissotis_ada	rotundifolia_ada	Dissotis rotundifolia	D	pinnate_leaf	medium_ep	non_aligned	round_wall	absence_quantity
sp24_aba	Vitaceae	Leea_aba	guineensis_aba	Leea guineensis	D	pinnate_leaf	small_ep	non_aligned	straight_wall	large
sp24_ada	Vitaceae	Leea_ada	guineensis_ada	Leea guineensis	D	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp25_aba	Zingiberaceae	Costus_aba	afer_aba	Costus afer	M	parrallel_leaf	medium_ep	aligned	straight_wall	medium
sp25_ada	Zingiberaceae	Costus_ada	afer_ada	Costus afer	M	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity

A	B	C	D	E	F	G	H	I	J	K
sp26_aba	Euphorbiaceae	Manniophyton_aba	fulvum_aba	Manniophyton fulvum	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	medium
sp26_ada	Euphorbiaceae	Manniophyton_ada	fulvum_ada	Manniophyton fulvum	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp27_aba	Melastomataceae	Memecylon_aba	lateriflorum_aba	Memecylon lateriflorum	D	pinnate_leaf	small_ep	non_aligned	straight_wall	large
sp27_ada	Melastomataceae	Memecylon_ada	lateriflorum_ada	Memecylon lateriflorum	D	pinnate_leaf	small_ep	non_aligned	round_wall	absence_quantity
sp28_aba	Marantaceae	Hypselodelphys_aba	violaceae_aba	Hypselodelphys violaceae	M	parrallel_leaf	medium_ep	non_aligned	straight_wall	medium
sp28_ada	Marantaceae	Hypselodelphys_ada	violaceae_ada	Hypselodelphys violaceae	M	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
sp29_aba	Caesalpiniaceae	Plagiosiphon_aba	emarginatus_aba	Plagiosiphon emarginatus	D	reticulate_leaf	small_ep	non_aligned	straight_wall	large
sp29_ada	Caesalpiniaceae	Plagiosiphon_ada	emarginatus_ada	Plagiosiphon emarginatus	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	absence_quantity
sp30_aba	Rubiaceae	Corynanthe_aba	pachyceras_aba	Corynanthe pachyceras	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	large
sp30_ada	Rubiaceae	Corynanthe_ada	pachyceras_ada	Corynanthe pachyceras	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp31_aba	Commelinaceae	Palisota_aba	hirsuta_aba	Palisota hirsuta	M	parrallel_leaf	medium_ep	aligned	round_wall	medium
sp31_ada	Commelinaceae	Palisota_ada	hirsuta_ada	Palisota hirsuta	M	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
sp32_aba	Sterculiaceae	Heritiera_aba	utilis_aba	Heritiera utilis	D	reticulate_leaf	small_ep	non_aligned	straight_wall	large
sp32_ada	Sterculiaceae	Heritiera_ada	utilis_ada	Heritiera utilis	D	reticulate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp33_aba	Caesalpiniaceae	Berlinia_aba	occidentalis_aba	Berlinia occidentalis	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	large
sp33_ada	Caesalpiniaceae	Berlinia_ada	occidentalis_ada	Berlinia occidentalis	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	low
sp34_aba	Humiriaceae	Sacoglottis_aba	gabonensis_aba	Sacoglottis gabonensis	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	large
sp34_ada	Humiriaceae	Sacoglottis_ada	gabonensis_ada	Sacoglottis gabonensis	D	pinnate_leaf	small_ep	non_aligned	angular_wall	absence_quantity
sp35_aba	Annonaceae	Xylopia_aba	quintasii_aba	Xylopia quintasii	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	medium
sp35_ada	Annonaceae	Xylopia_ada	quintasii_ada	Xylopia quintasii	D	pinnate_leaf	small_ep	non_aligned	round_wall	absence_quantity
sp36_aba	Moraceae	Streblus_aba	usambarensis_aba	Streblus usambarensis	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	large
sp36_ada	Moraceae	Streblus_ada	usambarensis_ada	Streblus usambarensis	D	reticulate_leaf	small_ep	non_aligned	round_wall	absence_quantity
sp37_aba	Olacaceae	Coula_aba	eduils_aba	Coula eduils	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	large
sp37_ada	Olacaceae	Coula_ada	eduils_ada	Coula eduils	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp38_aba	Fabaceae	Baphia_aba	bancoensis_aba	Baphia bancoensis	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	medium
sp38_ada	Fabaceae	Baphia_ada	bancoensis_ada	Baphia bancoensis	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	low
sp39_aba	Ochnaceae	Campylospermum_aba	calomelanos_aba	Campylospermum calomelanos	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	large
sp39_ada	Ochnaceae	Campylospermum_ada	calomelanos_ada	Campylospermum calomelanos	D	reticulate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity

A	B	C	D	E	F	G	H	I	J	K
sp41_aba	Ebenaceae	Diospyros_aba	sanza-minika_aba	Diospyros sanza-minika	D	pinnate_leaf	small_ep	non_aligned	straight_wall	large
sp41_ada	Ebenaceae	Diospyros_ada	sanza-minika_ada	Diospyros sanza-minika	D	pinnate_leaf	small_ep	non_aligned	straight_wall	absence_quantity
sp42_aba	Ebenaceae	Diospyros_aba	soubreana_aba	Diospyros soubreana	D	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	large
sp42_ada	Ebenaceae	Diospyros_ada	soubreana_ada	Diospyros soubreana	D	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp43_aba	Caesalpiniaceae	Dialium_aba	aubrevileii_aba	Dialium aubrevileii	D	reticulate_leaf	medium_ep	non_aligned	straight_wall	large
sp43_ada	Caesalpiniaceae	Dialium_ada	aubrevileii_ada	Dialium aubrevileii	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp44_aba	Clusiaceae	Garcinia_aba	afzelii_aba	Garcinia afzelii	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	large
sp44_ada	Clusiaceae	Garcinia_ada	afzelii_ada	Garcinia afzelii	D	pinnate_leaf	medium_ep	non_aligned	angular_wall	absence_quantity
sp45_aba	Cyperaceae	Scleria_aba	boivinii_aba	Scleria boivinii	M	parrallel_leaf	large_ep	aligned	slightly_wavy_wall	low
sp45_ada	Cyperaceae	Scleria_ada	boivinii_ada	Scleria boivinii	M	parrallel_leaf	large_ep	aligned	slightly_wavy_wall	absence_quantity
sp47_aba	Poaceae	Centotheca_aba	lappacea_aba	Centotheca lappacea	M	parrallel_leaf	medium_ep	aligned	wavy_wall	low
sp47_ada	Poaceae	Centotheca_ada	lappacea_ada	Centotheca lappacea	M	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
sp48_aba	Agavaceae	Dracaena_aba	phyronides_aba	Dracaena phyronides	M	parrallel_leaf	large_ep	aligned	straight_wall	medium
sp48_ada	Agavaceae	Dracaena_ada	phyronides_ada	Dracaena phyronides	M	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
sp49_aba	Euphorbiaceae	Maesobotrya_aba	barterii_aba	Maesobotrya barterii	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	medium
sp49_ada	Euphorbiaceae	Maesobotrya_ada	barterii_ada	Maesobotrya barterii	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp50_aba	Arecaceae	Raphia_aba	hookerii_aba	Raphia hookerii	M	parrallel_leaf	medium_ep	aligned	wavy_wall	large
sp50_ada	Arecaceae	Raphia_ada	hookerii_ada	Raphia hookerii	M	parrallel_leaf	medium_ep	aligned	wavy_wall	medium
sp51_aba	Lecythidaceae	Napoleonaea_aba	leonensis_aba	Napoleonaea leonensis	D	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	large
sp51_ada	Lecythidaceae	Napoleonaea_ada	leonensis_ada	Napoleonaea leonensis	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
sp52_aba	Rubiaceae	Cephaelis_aba	yapoensis_aba	Cephaelis yapoensis	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	large
sp52_ada	Rubiaceae	Cephaelis_ada	yapoensis_ada	Cephaelis yapoensis	D	pinnate_leaf	medium_ep	non_aligned	round_wall	absence_quantity
sp53_aba	Euphorbiaceae	Uapaca_aba	esculenta_aba	Uapaca esculenta	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	large
sp53_ada	Euphorbiaceae	Uapaca_ada	esculenta_ada	Uapaca esculenta	D	pinnate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
sp54_aba	Olacaceae	Strombosia_aba	africanus_aba	Strombosia glaucescens	D	reticulate_leaf	medium_ep	non_aligned	angular_wall	medium
sp54_ada	Olacaceae	Strombosia_ada	africanus_ada	Strombosia glaucescens	D	reticulate_leaf	small_ep	non_aligned	round_wall	low
sp55_aba	Convolvulaceae	Calycobolus_aba	africanus_aba	Calycobolus africanus	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	large
sp55_ada	Convolvulaceae	Calycobolus_ada	africanus_ada	Calycobolus africanus	D	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	low

A	B	C	D	E	F	G	H	I	J	K
sp58_aba	Marantaceae	Taumathococcus_aba	daniellii_aba	Taumathococcus daniellii	M	parrallel_leaf	medium_ep	non_aligned	straight_wall	medium
sp58_ada	Marantaceae	Taumathococcus_ada	daniellii_ada	Taumathococcus daniellii	M	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
sp59_aba	Asparagaceae	Draceana_aba	surculosa_aba	Draceana surculosa	M	parrallel_leaf	large_ep	aligned	straight_wall	low
sp59_ada	Asparagaceae	Draceana_ada	surculosa_ada	Draceana surculosa	M	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
sp60_aba	Arecaceae	Elaeis_aba	guineensis_aba	Elaeis guineensis	M	parrallel_leaf	large_ep	aligned	straight_wall	medium
sp60_ada	Arecaceae	Elaeis_ada	guineensis_ada	Elaeis guineensis	M	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity

Table 2: Dataset n°1. *Column A/Number_sp***, number of the plant's species recorded (from 1 to 60) and their respective sides (*ada* for adaxial and *aba* for abaxial); ***Column B/Families***, plant family (32); ***Column C/Genus****, genus of each plant (55); ***Column D /Species ****, species name (57); ***Column E /Genus_species***, This column represents the full name genus and species of each food items species; **Column F/D_F_M**, This column records the differents groups of plants. M for Monocotyledonae, D for dicotyledonae and F for fern; ***Column G*** to ***K*** represents the macroscopic and microscopic variables that we have defined for statistical analyses (see **Appendix 8.7**).

8.8.2 Dataset n°2

A	B	C	D	E	F	G	H
Inc_number	**Faeces_number**	**Fragment_name**	**macro veins**	**length**	**layout**	**wall shape**	**Stomata quantity**
Inc1	Faece 1	Inc1_F1	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc2	Faece 1	Inc2_F1	pinnate_leaf	medium_ep	non_aligned	angular_wall	low
Inc3	Faece 1	Inc3_F1	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc4	Faece 1	Inc4_F1	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc5	Faece 1	Inc5_F1	reticulate_leaf	small_ep	non_aligned	straight_wall	large
Inc6	Faece 1	Inc6_F1	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc7	Faece 1	Inc7_F1	parrallel_leaf	medium_ep	aligned	straight_wall	medium
Inc8	Faece 1	Inc8_F1	pinnate_leaf	medium_ep	non_aligned	straight_wall	medium
Inc9	Faece 1	Inc9_F1	reticulate_leaf	small_ep	aligned	straight_wall	absence_quantity
Inc10	Faece 1	Inc10_F1	pinnate_leaf	small_ep	non_aligned	straight_wall	medium
Inc11	Faece 1	Inc11_F1	pinnate_leaf	medium_ep	non_aligned	round_wall	low
Inc12	Faece 1	Inc12_F1	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc13	Faece 1	Inc13_F1	reticulate_leaf	medium_ep	non_aligned	straight_wall	large
Inc14	Faece 1	Inc14_F1	parrallel_leaf	medium_ep	non_aligned	round_wall	absence_quantity
Inc15	Faece 1	Inc15_F1	reticulate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
Inc16	Faece 2	Inc16_F2	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
Inc17	Faece 2	Inc17_F2	pinnate_leaf	small_ep	non_aligned	straight_wall	medium
Inc18	Faece 2	Inc18_F2	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc19	Faece 2	Inc19_F2	pinnate_leaf	medium_ep	non_aligned	straight_wall	medium
Inc20	Faece 2	Inc20_F2	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	absence_quantity
Inc21	Faece 2	Inc21_F2	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
Inc22	Faece 2	Inc22_F2	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc23	Faece 2	Inc23_F2	pinnate_leaf	medium_ep	non_aligned	round_wall	absence_quantity
Inc24	Faece 2	Inc24_F2	pinnate_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc25	Faece 2	Inc25_F2	pinnate_leaf	small_ep	non_aligned	straight_wall	medium

A	B	C	D	E	F	G	H
Inc26	Faece 2	Inc26_F2	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
Inc27	Faece 2	Inc27_F2	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc28	Faece 2	Inc28_F2	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc29	Faece 2	Inc29_F2	reticulate_leaf	small_ep	non_aligned	straight_wall	large
Inc30	Faece 2	Inc30_F2	reticulate_leaf	medium_ep	non_aligned	angular_wall	medium
Inc31	Faece 2	Inc31_F2	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc32	Faece 3	Inc32_F3	pinnate_leaf	small_ep	non_aligned	straight_wall	absence_quantity
Inc33	Faece 3	Inc33_F3	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc34	Faece 3	Inc34_F3	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc35	Faece 3	Inc35_F3	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc36	Faece 3	Inc36_F3	pinnate_leaf	small_ep	non_aligned	angular_wall	low
Inc37	Faece 3	Inc37_F3	reticulate_leaf	small_ep	non_aligned	wavy_wall	absence_quantity
Inc38	Faece 3	Inc38_F3	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc39	Faece 3	Inc39_F3	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc40	Faece 3	Inc40_F3	parrallel_leaf	medium_ep	aligned	straight_wall	medium
Inc41	Faece 3	Inc41_F3	pinnate_leaf	small_ep	non_aligned	angular_wall	low
Inc42	Faece 3	Inc42_F3	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc43	Faece 4	Inc43_F4	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc44	Faece 4	Inc44_F4	pinnate_leaf	large_ep	non_aligned	wavy_wall	absence_quantity
Inc45	Faece 4	Inc45_F4	parrallel_leaf	large_ep	aligned	round_wall	medium
Inc46	Faece 4	Inc46_F4	pinnate_leaf	medium_ep	non_aligned	wavy_wall	absence_quantity
Inc47	Faece 4	Inc47_F4	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc48	Faece 4	Inc48_F4	reticulate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
Inc49	Faece 4	Inc49_F4	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc50	Faece 4	Inc50_F4	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	medium
Inc51	Faece 4	Inc51_F4	reticulate_leaf	small_ep	non_aligned	straight_wall	absence_quantity
Inc52	Faece 4	Inc52_F4	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	medium
Inc53	Faece 4	Inc53_F4	pinnate_leaf	medium_ep	non_aligned	wavy_wall	medium

A	B	C	D	E	F	G	H
Inc54	Faece 4	Inc54_F4	parrallel_leaf	small_ep	aligned	straight_wall	absence_quantity
Inc55	Faece 4	Inc55_F4	reticulate_leaf	medium_ep	non_aligned	slightly_wavy_wall	large
Inc56	Faece 5	Inc56_F5	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc57	Faece 5	Inc57_F5	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc58	Faece 5	Inc58_F5	reticulate_leaf	small_ep	non_aligned	straight_wall	large
Inc59	Faece 5	Inc59_F5	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc60	Faece 5	Inc60_F5	pinnate_leaf	medium_ep	non_aligned	straight_wall	low
Inc61	Faece 5	Inc61_F5	pinnate_leaf	large_ep	non_aligned	angular_wall	absence_quantity
Inc62	Faece 5	Inc62_F5	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc63	Faece 5	Inc63_F5	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc64	Faece 5	Inc64_F5	pinnate_leaf	medium_ep	non_aligned	wavy_wall	medium
Inc65	Faece 5	Inc65_F5	reticulate_leaf	small_ep	non_aligned	angular_wall	absence_quantity
Inc66	Faece 5	Inc66_F5	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc67	Faece 5	Inc67_F5	reticulate_leaf	medium_ep	non_aligned	straight_wall	low
Inc68	Faece 5	Inc68_F5	pinnate_leaf	medium_ep	non_aligned	angular_wall	medium
Inc69	Faece 6	Inc69_F6	parrallel_leaf	medium_ep	non_aligned	straight_wall	medium
Inc70	Faece 6	Inc70_F6	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc71	Faece 6	Inc71_F6	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc72	Faece 6	Inc72_F6	pinnate_leaf	large_ep	non_aligned	round_wall	low
Inc73	Faece 6	Inc73_F6	pinnate_leaf	medium_ep	non_aligned	wavy_wall	medium
Inc74	Faece 6	Inc74_F6	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc75	Faece 6	Inc75_F6	parrallel_leaf	small_ep	aligned	straight_wall	absence_quantity
Inc76	Faece 6	Inc76_F6	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc77	Faece 6	Inc77_F6	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	medium
Inc78	Faece 6	Inc78_F6	parrallel_leaf	large_ep	aligned	wavy_wall	low
Inc79	Faece 6	Inc79_F6	reticulate_leaf	small_ep	non_aligned	angular_wall	large
Inc80	Faece 7	Inc80_F7	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
Inc81	Faece 7	Inc81_F7	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity

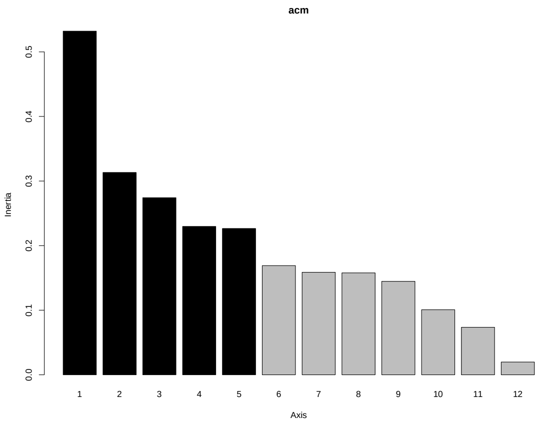
A	B	C	D	E	F	G	H
Inc82	Faece 7	Inc82_F7	reticulate_leaf	medium_ep	non_aligned	round_wall	absence_quantity
Inc83	Faece 7	Inc83_F7	reticulate_leaf	medium_ep	non_aligned	straight_wall	low
Inc84	Faece 7	Inc84_F7	pinnate_leaf	medium_ep	non_aligned	angular_wall	absence_quantity
Inc85	Faece 7	Inc85_F7	reticulate_leaf	medium_ep	non_aligned	angular_wall	medium
Inc86	Faece 7	Inc86_F7	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc87	Faece 7	Inc87_F7	pinnate_leaf	small_ep	non_aligned	round_wall	absence_quantity
Inc88	Faece 7	Inc88_F7	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
Inc89	Faece 7	Inc89_F7	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc90	Faece 7	Inc90_F7	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc91	Faece 7	Inc91_F7	pinnate_leaf	small_ep	non_aligned	straight_wall	absence_quantity
Inc92	Faece 7	Inc92_F7	parrallel_leaf	small_ep	aligned	round_wall	absence_quantity
Inc93	Faece 8	Inc93_F8	parrallel_leaf	small_ep	aligned	straight_wall	absence_quantity
Inc94	Faece 8	Inc94_F8	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc95	Faece 8	Inc95_F8	pinnate_leaf	medium_ep	non_aligned	wavy_wall	medium
Inc96	Faece 8	Inc96_F8	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	medium
Inc97	Faece 8	Inc97_F8	parrallel_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc98	Faece 8	Inc98_F8	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc99	Faece 8	Inc99_F8	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc100	Faece 8	Inc100_F8	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc101	Faece 8	Inc101_F8	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	medium
Inc102	Faece 8	Inc102_F8	parrallel_leaf	medium_ep	non_aligned	straight_wall	medium
Inc103	Faece 8	Inc103_F8	pinnate_leaf	small_ep	non_aligned	angular_wall	low
Inc104	Faece 8	Inc104_F8	pinnate_leaf	small_ep	non_aligned	straight_wall	medium
Inc105	Faece 8	Inc105_F8	parrallel_leaf	small_ep	aligned	round_wall	absence_quantity
Inc106	Faece 8	Inc106_F8	pinnate_leaf	small_ep	non_aligned	angular_wall	medium
Inc107	Faece 9	Inc107_F9	parrallel_leaf	medium_ep	aligned	straight_wall	medium
Inc108	Faece 9	Inc108_F9	pinnate_leaf	small_ep	non_aligned	straight_wall	absence_quantity
Inc109	Faece 9	Inc109_F9	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium

A	B	C	D	E	F	G	H
Inc110	Faece 9	Inc110_F9	parrallel_leaf	large_ep	aligned	wavy_wall	low
Inc111	Faece 9	Inc111_F9	reticulate_leaf	small_ep	non_aligned	straight_wall	medium
Inc112	Faece 9	Inc112_F9	parrallel_leaf	large_ep	aligned	wavy_wall	medium
Inc113	Faece 9	Inc113_F9	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc114	Faece 9	Inc114_F9	pinnate_leaf	medium_ep	non_aligned	angular_wall	absence_quantity
Inc115	Faece 9	Inc115_F9	reticulate_leaf	medium_ep	non_aligned	straight_wall	medium
Inc116	Faece 9	Inc116_F9	reticulate_leaf	medium_ep	aligned	straight_wall	absence_quantity
Inc117	Faece 9	Inc117_F9	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc118	Faece 9	Inc118_F9	pinnate_leaf	small_ep	non_aligned	slightly_wavy_wall	low
Inc119	Faece 10	Inc119_F10	parrallel_leaf	medium_ep	aligned	round_wall	absence_quantity
Inc120	Faece 10	Inc120_F10	pinnate_leaf	large_ep	non_aligned	wavy_wall	medium
Inc121	Faece 10	Inc121_F10	parrallel_leaf	medium_ep	aligned	wavy_wall	low
Inc122	Faece 10	Inc122_F10	pinnate_leaf	small_ep	non_aligned	straight_wall	absence_quantity
Inc123	Faece 10	Inc123_F10	reticulate_leaf	small_ep	non_aligned	straight_wall	large
Inc124	Faece 10	Inc124_F10	pinnate_leaf	medium_ep	non_aligned	straight_wall	large
Inc125	Faece 10	Inc125_F10	reticulate_leaf	small_ep	non_aligned	slightly_wavy_wall	absence_quantity
Inc126	Faece 10	Inc126_F10	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc127	Faece 10	Inc127_F10	parrallel_leaf	large_ep	aligned	straight_wall	absence_quantity
Inc128	Faece 10	Inc128_F10	pinnate_leaf	medium_ep	non_aligned	wavy_wall	medium
Inc129	Faece 10	Inc129_F10	pinnate_leaf	medium_ep	non_aligned	straight_wall	absence_quantity
Inc130	Faece 10	Inc130_F10	parrallel_leaf	medium_ep	aligned	round_wall	medium

Table 3: Dataset n°2. ***Column A/Inc _number***, Number of the faeces fragments from 1 to 130. They are notated as *Inc* followed by their attribute number; ***Column B /Faeces_number***, faeces number in which the fragment was found (faeces number from 1 to 10); ***Column C/Fragment_name***, This column represent the final name of each fragment. It means, the *Inc_number* followed by the *Faeces_number*; ***Columns D*** to ***H***, are the same columns as Dataset°1 (i.e the five variables selected; see **Appendix 8.7**).

8.9 Results

8.9.1 Food items structure



Total inertia: 2.4

Eigenvalues:

Ax1	Ax2	Ax3	Ax4	Ax5
0.5321	0.3133	0.2742	0.2297	0.2265

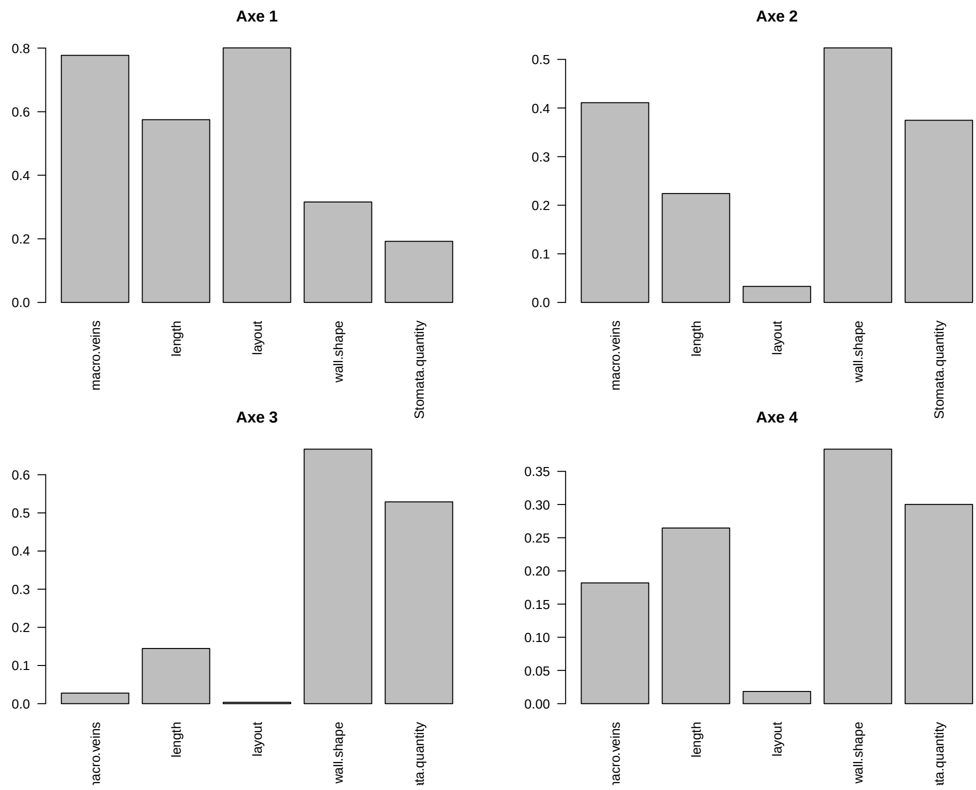
Projected inertia (%):

Ax1	Ax2	Ax3	Ax4	Ax5
22.171	13.054	11.426	9.570	9.439

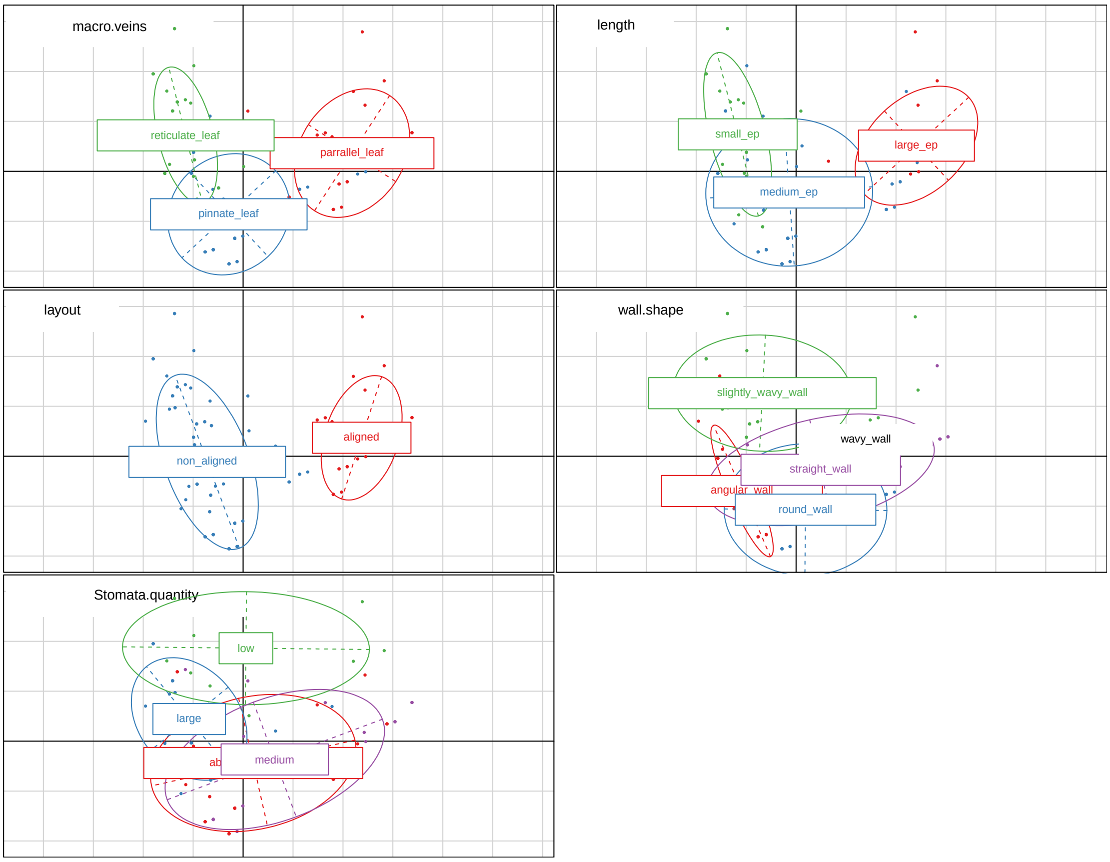
Cumulative projected inertia (%):

Ax1	Ax1:2	Ax1:3	Ax1:4	Ax1:5
22.17	35.22	46.65	56.22	65.66

<u>Fig.7</u>: Barplot of the Eigenvalues and summary of the five main axes. The barplot representation of the eigenvalues according to different axes (1 to 12) is on the left. In black, the five main axes and in grey the other axes. The summary of the five main axes of the barplot is on the right with the percentage of inertia values and the cumulative percentage accross the axes.

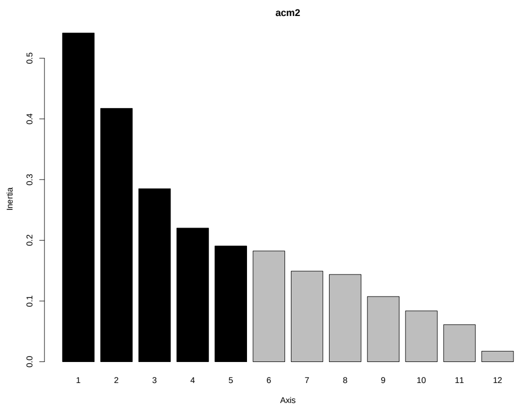


<u>Fig.8</u>: Barplots of the correlation ratios on the four main axes. On the X-axis, are the five variables selected (macro veins, length, layout, wall shape, stomatata quantity) and on the Y-axis their correlation with the mentioned axis. The correlation can vary between 0 and 1, with 0 representing the lowest and 1 the highest correlation.



<u>Fig. 9</u>: Projection of the variables and their categories on F1xF2 axes. This figure presents the five variables with the different categories projected on MCA individuals with the scatter function. The categories are in color and the variables name is written above.

8.9.2 Faeces fragments identification



Total inertia: 2.4

Eigenvalues:

Ax1	Ax2	Ax3	Ax4	Ax5
0.5415	0.4174	0.2851	0.2202	0.1907

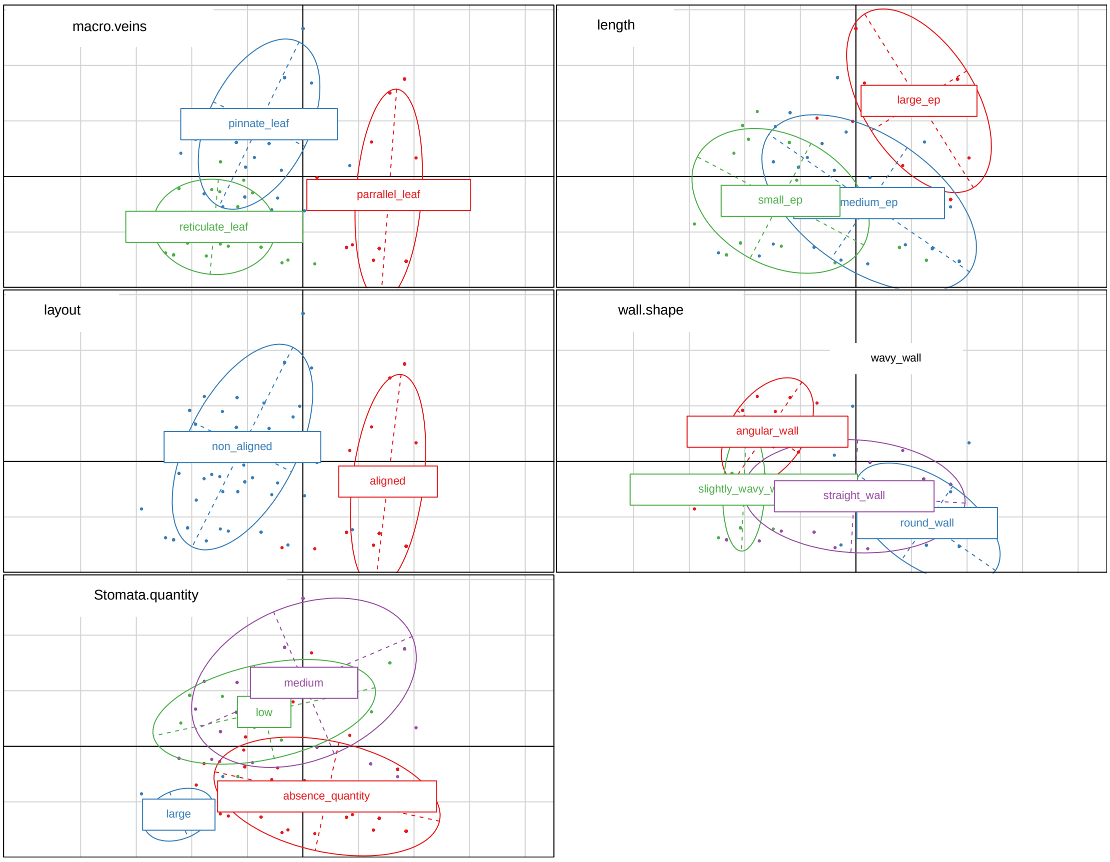
Projected inertia (%):

Ax1	Ax2	Ax3	Ax4	Ax5
22.565	17.393	11.879	9.176	7.947

Cumulative projected inertia (%):

Ax1	Ax1:2	Ax1:3	Ax1:4	Ax1:5
22.56	39.96	51.84	61.01	68.96

<u>Fig.10</u>: Barplot of the Eigenvalues and summary of the five main axes. The barplot representation of the eigenvalues according to different axes (1 to 12) is on the left. In black, the five main axes and in grey the other axes. The summary of the five main axes of the barplot is on the right with the percentage of inertia values and the cumulative percentage accross the axes.



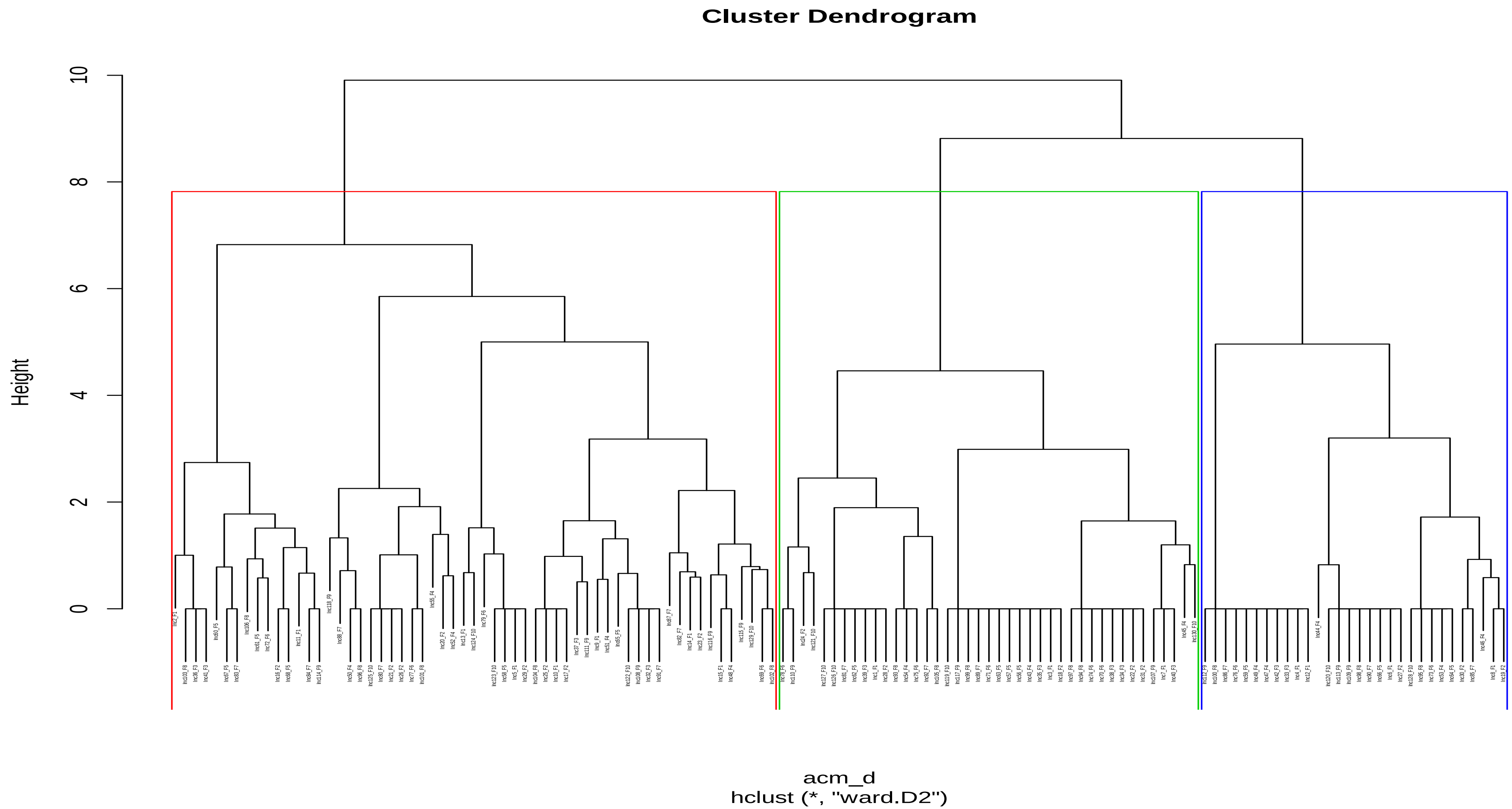
<u>Fig. 11</u>: Projection of the variables and their categories on *F1xF2* axes. This figure presents the five variables with the different categories projected on MCA individuals with the scatter function. The categories are in color and the variables name is written above.

A	B	C	D
Faeces	**M_D_F**	**Identification**	**Comments**
Inc1_F1	M	Marantaceae specie	Thaumatococcus danielli
Inc2_F1	D	no identification	
Inc3_F1	M	Centotheca lappaceae	
Inc4_F1	M	Streptogyna crinita	
Inc5_F1	D	Herritiera utilis	
Inc6_F1	F	Nephrolepidaceae	Nephrolepis bisserata
Inc7_F1	M	Marantaceae specie	Marantochloa purpurea
Inc8_F1	D	no identification	
Inc9_F1	D	no identification	
Inc10_F1	D	no identification	
Inc11_F1	D	no identification	
Inc12_F1	M	Streptogyna crinita	
Inc13_F1	D	no identification	Similar to Dialium aubrevillei but bad quality
Inc14_F1	D	no identification	
Inc15_F1	D	no identification	
Inc16_F2	D	no identification	Fragments too similar
Inc17_F2	D	no identification	
Inc18_F2	M	Centotheca lappaceae	
Inc19_F2	D	no identification	
Inc20_F2	D	no identification	
Inc21_F2	D	no identification	Adaxial sides, too similar to each other
Inc22_F2	M	no identification	
Inc23_F2	D	no identification	Probably Rubiaceae
Inc24_F2	D	no identification	
Inc25_F2	D	no identification	Not Dissotis rotundifolia
Inc26_F2	D	no identification	Adaxial sides, too similar to each other
Inc27_F2	F	Nephrolepis bisserata	
Inc28_F2	M	Marantaceae specie	Thaumatococcus danielli
Inc29_F2	D	Herritiera utilis	
Inc30_F2	D	no identification	Similar to Strombosia
Inc31_F2	M	Marantaceae specie	Marantochloa purpurea
Inc32_F3	D	no identification	Adaxial sides, too similar to each other
Inc33_F3	M	Streptogyna crinita	
Inc34_F3	M	no identification	
Inc35_F3	M	Centotheca lappaceae	
Inc36_F3	D	no identification	
Inc37_F3	D	no identification	Adaxial sides
Inc38_F3	M	Marantochloa purpurea	Marantaceae sp
Inc39_F3	M	no identification	
Inc40_F3	M	Marantochloa purpurea	
Inc41_F3	D	no identification	
Inc42_F3	M	Streptogyna crinita	
Inc43_F4	M	Centotheca lappaceae	
Inc44_F4	F	Nephrolepidaceae	
Inc45_F4	M	no identification	

Inc46_F4	F	no identification	Nephrolepidaceae
Inc47_F4	M	Streptogyna crinita	
Inc48_F4	D	no identification	Similar to Campylo. or Urera.
Inc49_F4	M	Streptogyna crinita	
Inc50_F4	D	no identification	
Inc51_F4	D	no identification	Adaxial side
Inc52_F4	D	no identification	
Inc53_F4	D	no identification	
Inc54_F4	M	no identification	
Inc55_F4	D	no identification	Campylospermum amoenum
Inc56_F5	M	Palisota hirsuta	Very similar to Palisota hirsuta
Inc57_F5	M	Centotheca lappaceae	
Inc58_F5	D	Herritiera utilis	
Inc59_F5	M	Streptogyna crinita	
Inc60_F5	D	no identification	
Inc61_F5	D	no identification	
Inc62_F5	M	no identification	
Inc63_F5	M	no identification	
Inc64_F5	D	no identification	
Inc65_F5	D	no identification	
Inc66_F5	F	Nephrolepidaceae	Nephrolepis bisserata
Inc67_F5	D	no identification	
Inc68_F5	D	no identification	
Inc69_F6	M	Marantaceae specie	
Inc70_F6	M	no identification	
Inc71_F6	M	Poaceae	Centotheca lappaceae
Inc72_F6	D	no identification	
Inc73_F6	D	no identification	
Inc74_F6	M	no identification	Similar to Palisota hirsuta
Inc75_F6	M	no identification	
Inc76_F6	M	Poaceae	Streptogyna crinita
Inc77_F6	D	no identification	Similar to Manniophyton fulvum
Inc78_F6	M	Poaceae	Streptogyna crinita
Inc79_F6	D	no identification	
Inc80_F7	D	no identification	Similar to Napoleona leonasis or Dialium aubrevileii
Inc81_F7	M	no identification	
Inc82_F7	D	no identification	Similar to Strebulus (adaxial side)
Inc83_F7	D	no identification	
Inc84_F7	D	no identification	Adaxial side, similar to Garcinia afzelii
Inc85_F7	D	no identification	
Inc86_F7	M	Poaceae	Streptogyna crinita
Inc87_F7	D	no identification	Adaxial side
Inc88_F7	D	no identification	Smilar to Leea guineensis (adaxial side)
Inc89_F7	M	Poaceae	Centotheca lappaceae
Inc90_F7	F	Nephrolepidaceae	Nephrolepis bisserata
Inc91_F7	D	no identification	Similar to Diospyros sanza-minika (see trichoma in macro)
Inc92_F7	M	no identification	
Inc93_F8	M	no identification	
Inc94_F8	M	no identification	

Inc95_F8	D	no identification	
Inc96_F8	D	no identification	
Inc97_F8	M	Marantaceae specie	
Inc98_F8	F	Nephrolepidaceae	Nephrolepis bisserata
Inc99_F8	M	Poaceae	Centotheca lappaceae
Inc100_F8	M	Poaceae	Streptogyna crinita
Inc101_F8	D	no identification	
Inc102_F8	M	Marantaceae specie	
Inc103_F8	D	no identification	
Inc104_F8	D	no identification	
Inc105_F8	M	no identification	
Inc106_F8	D	no identification	
Inc107_F9	M	Marantaceae specie	
Inc108_F9	D	no identification	Diospyros sanza-minika
Inc109_F9	F	Nephrolepidaceae	Nephrolepis bisserata
Inc110_F9	M	Poaceae	Streptogyna crinita
Inc111_F9	D	no identification	
Inc112_F9	M	Poaceae	Streptogyna crinita
Inc113_F9	F	Nephrolepidaceae	Nephrolepidaceae
Inc114_F9	D	no identification	
Inc115_F9	D	no identification	
Inc116_F9	M	no identification	
Inc117_F9	M	Poaceae	Centotheca lappaceae
Inc118_F9	D	no identification	
Inc119_F10	M	Poaceae	Centotheca lappaceae
Inc120_F10	F	Nephrolepidaceae	
Inc121_F10	M	Poaceae	Streptogyna crinita
Inc122_F10	D	Diospyros sanza-minika	Diospyros sanza-minika (adaxial side)
Inc123_F10	D	Herritiera utilis	
Inc124_F10	D	no identification	Sacoglottis gabonensis
Inc125_F10	D	no identification	Dialium aubrevileii (adaxial side)
Inc126_F10	M	no identification	
Inc127_F10	M	Marantaceae specie	
Inc128_F10	D	no identification	
Inc129_F10	D	no identification	
Inc130_F10	M	no identification	Palisota hirsuta

Fig.12: Table of results of the visual analysis (second fragments identification). ***Column A/Faeces***, it represents the name of the faeces fragments, followed by the number of the faeces (F_ from 1 to 10); ***Column B/M_D_F***, it represents an *a priori* identification M for Monocotyledonae, D for dicotyledonae and F for ferns; ***Column C/ Identification***, it represents the names of the species identified from the fragments with certainty; ***Column D/ Comments***, it represents comments on the identification and some plants suggestions.



<u>Fig. 13</u>: HC tree for the unknown individuals (faeces fragments) with a cutting of four.

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TNP Plant Image Database

Created for a diet determination study (Msc Thesis)
Alba Hendier
2019

CONTENT

This database gathers 60 plants collected in the Taï National Park as part of a Conservation study project to determine the diet of wild Pygmy Hippopotamus (*Choeropsis liberiensis)*.

For a large majority of plants species collected, a herbarium plate, a macroscopic view (60x) and a microscopic view of both sides of the leaves is available. In addition, microscopic photos of both sides prepared with two different methods (transparent nailpolish method and discoloration method) are in this document.

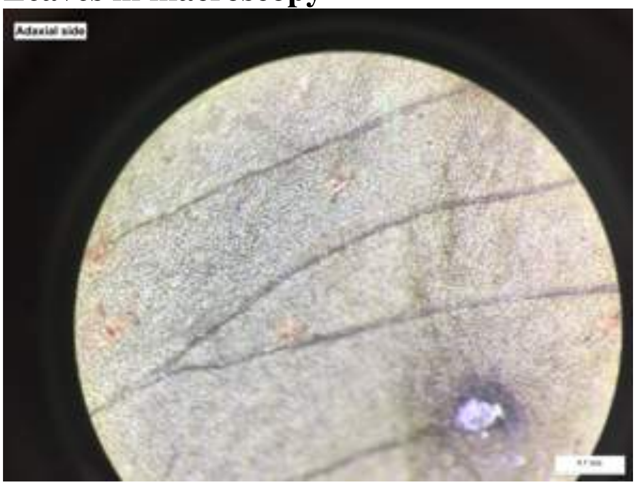
The microscopic pictures were taken with an inverted microscope *Leica OMI 3000 B* using the software LAS V.4.0.

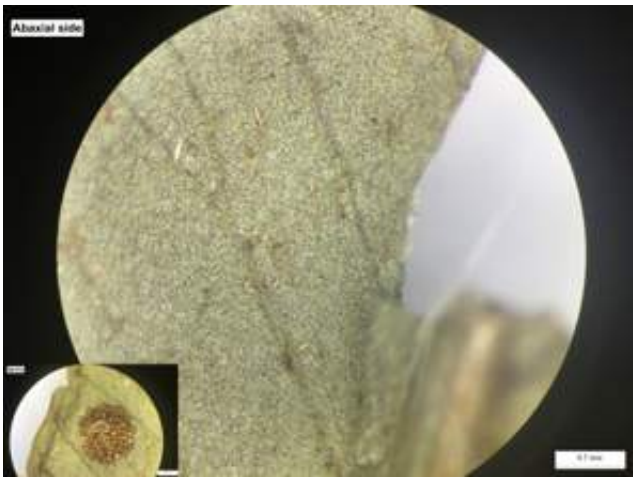
FERNS

Nephrolepis bisserata (Plant 1), *Pteris burtonii* (Plant 2), *Pityrogramma calomelanos* (Plant 3)

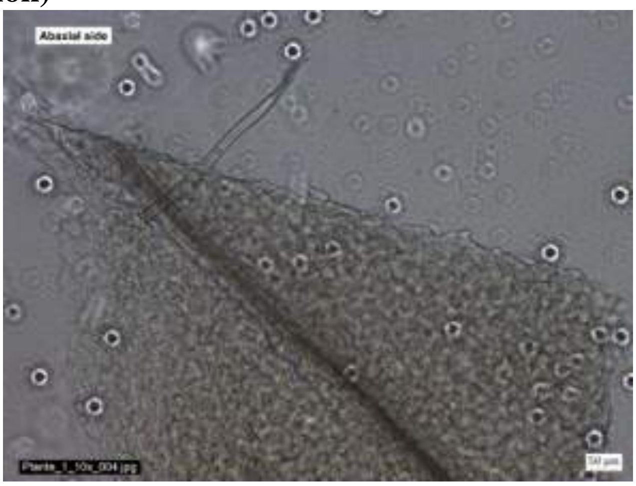
Herbarium plant

Leaves in macroscopy

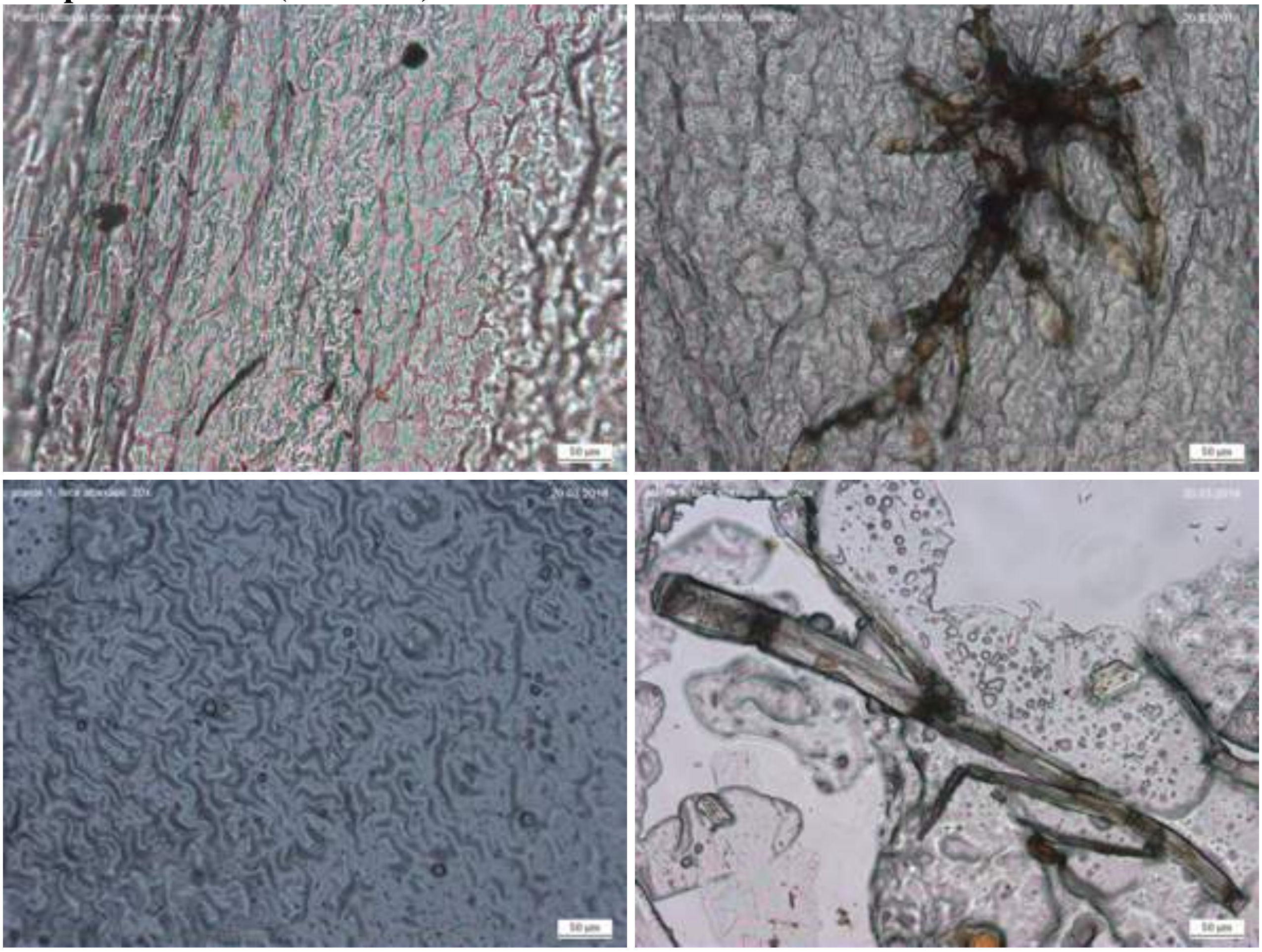




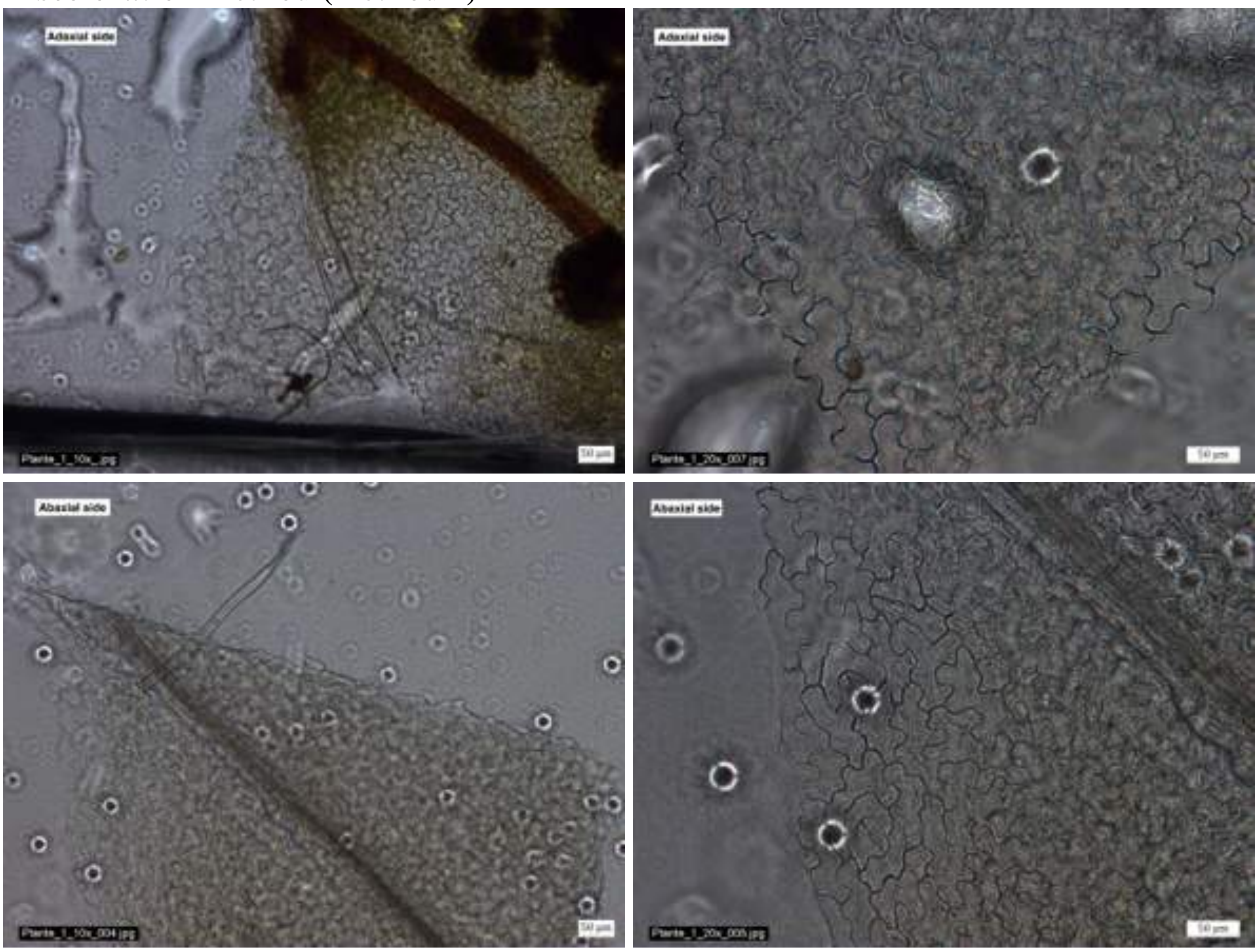
Leaves in microscopy (method 2, discoloration)



Nailpolish method (method 1)



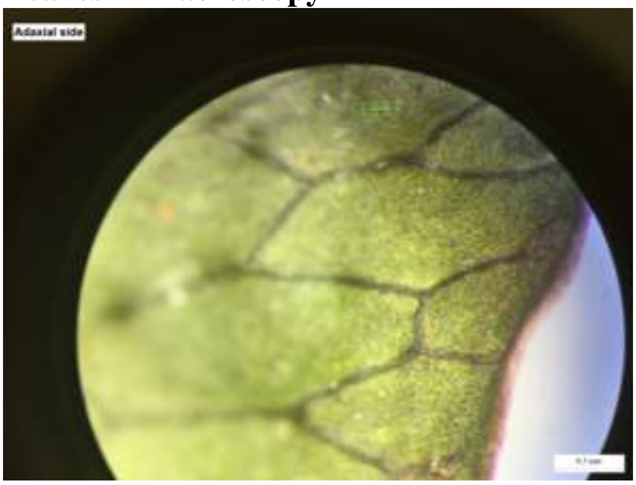
Discoloration method (method 2)

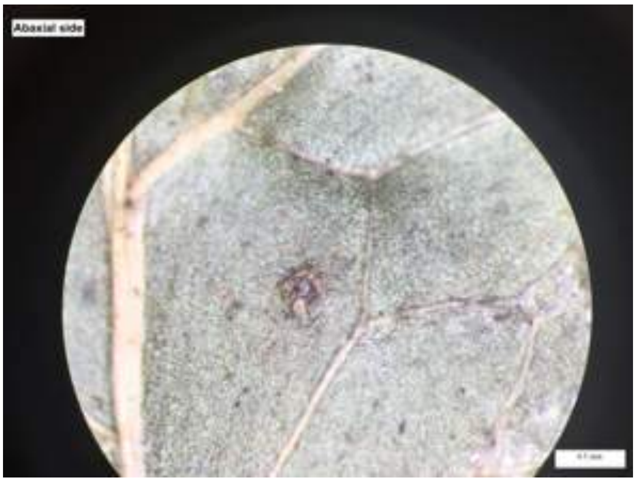


Herbarium plant

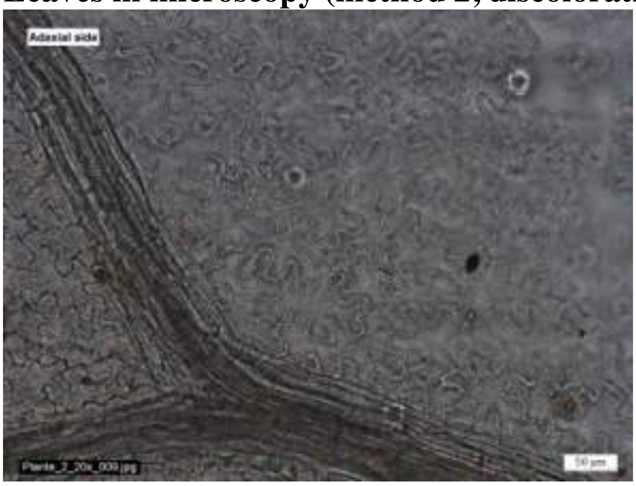
Collection in Taï National Park by Alba Hendier and Donatien Bété, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

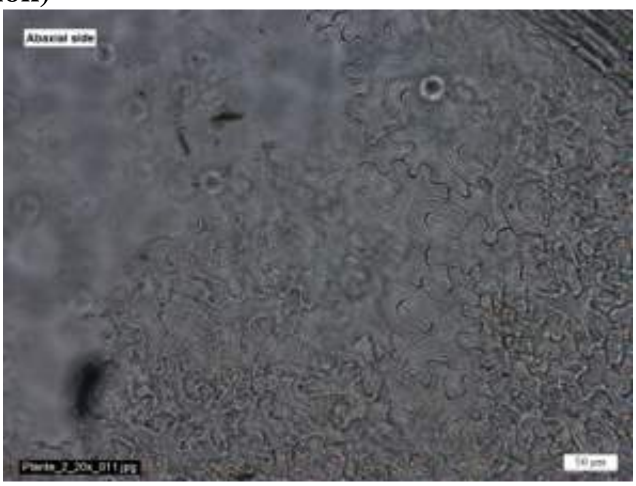
Leaves in macroscopy



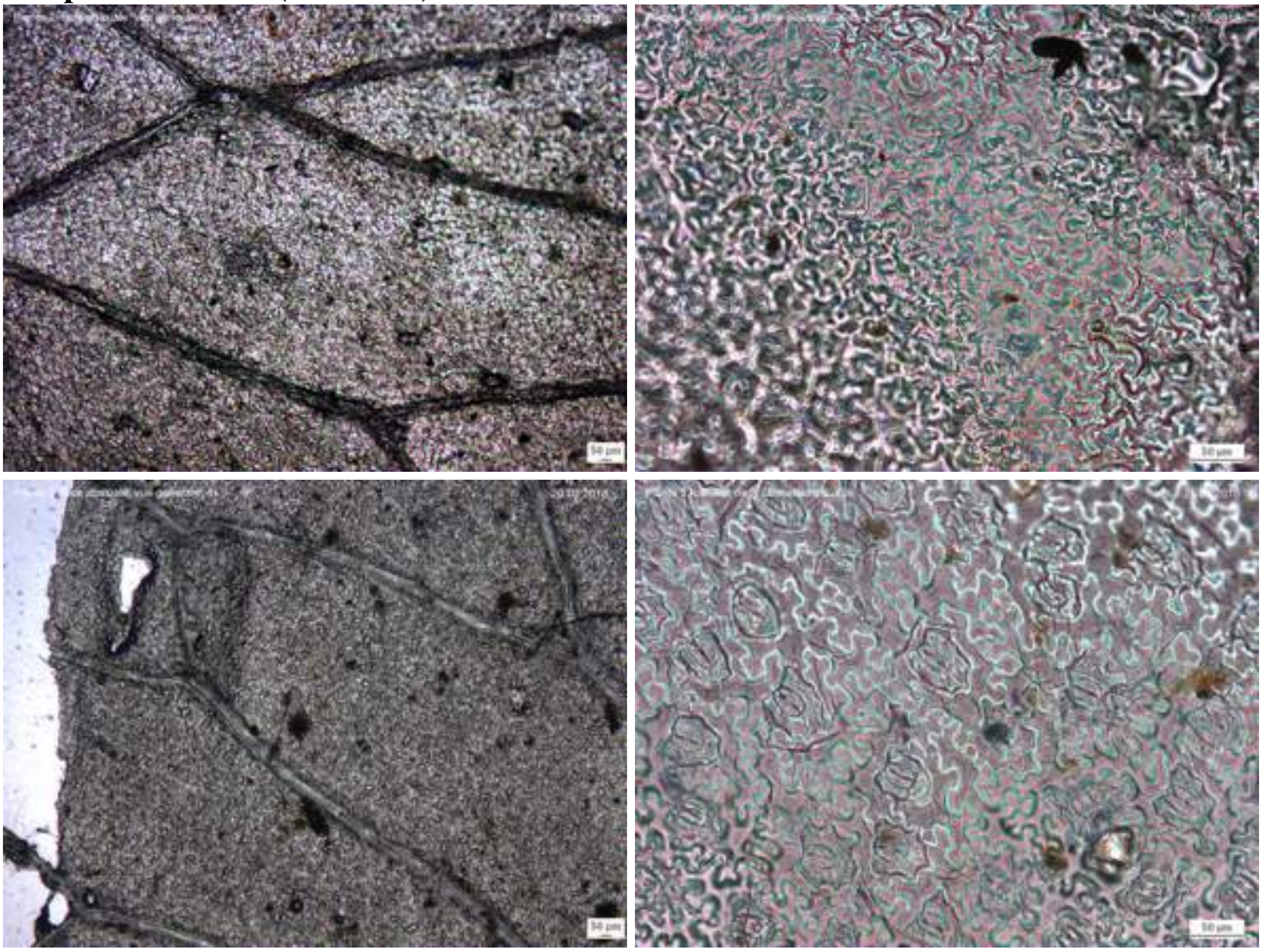


Leaves in microscopy (method 2, discoloration)

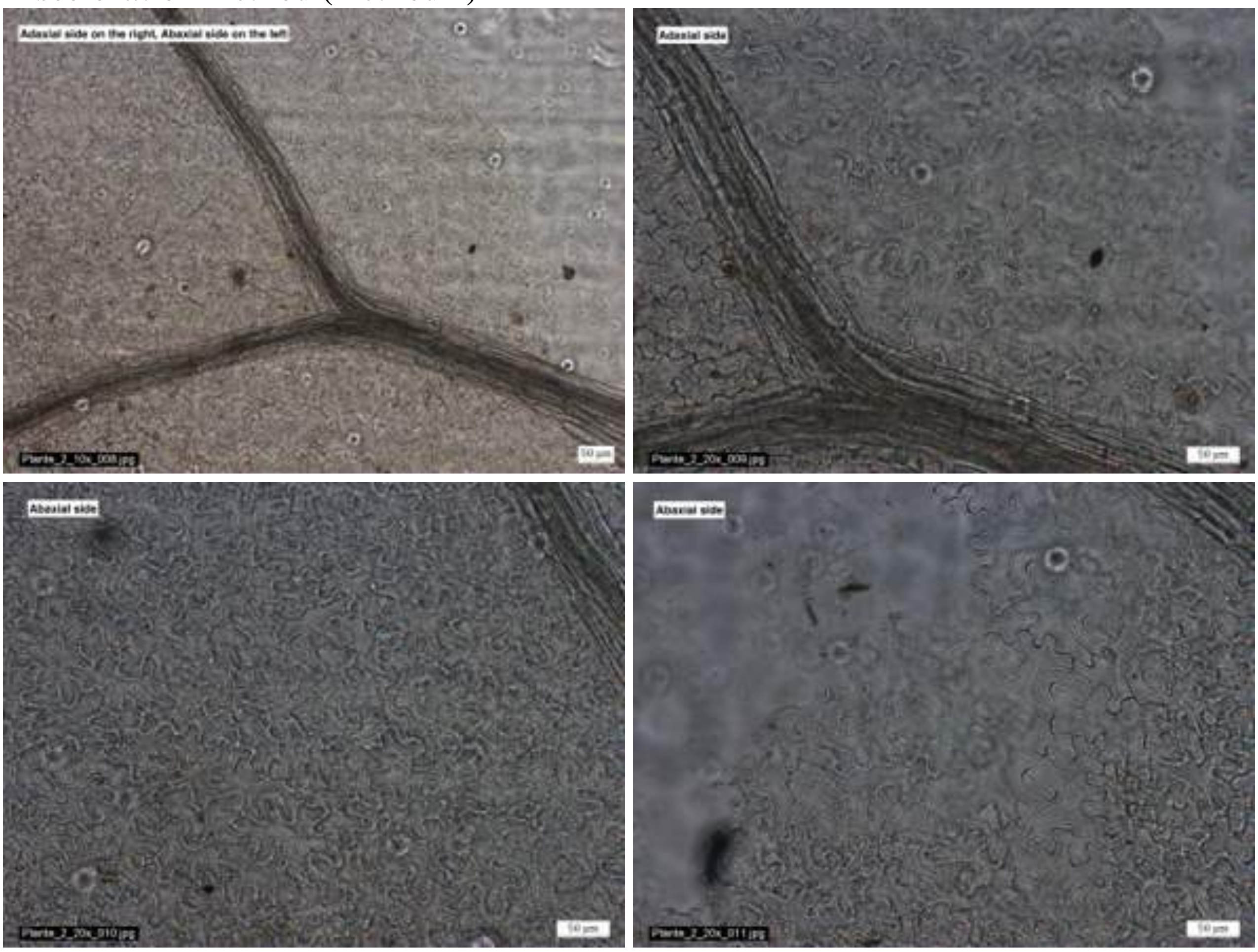




Nailpolish method (method 1)



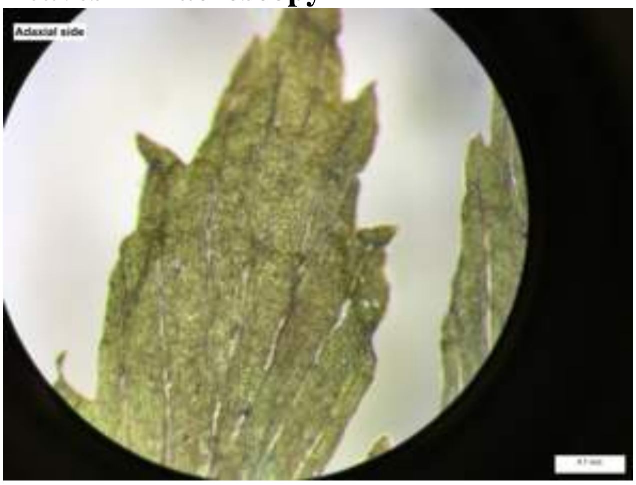
Discoloration method (method 2)

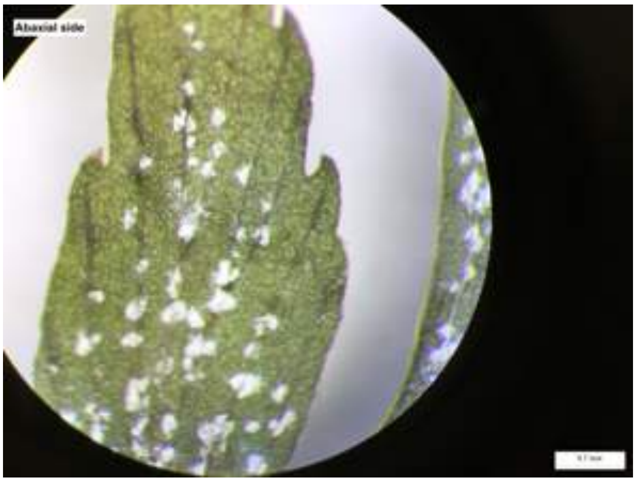


Herbarium plant

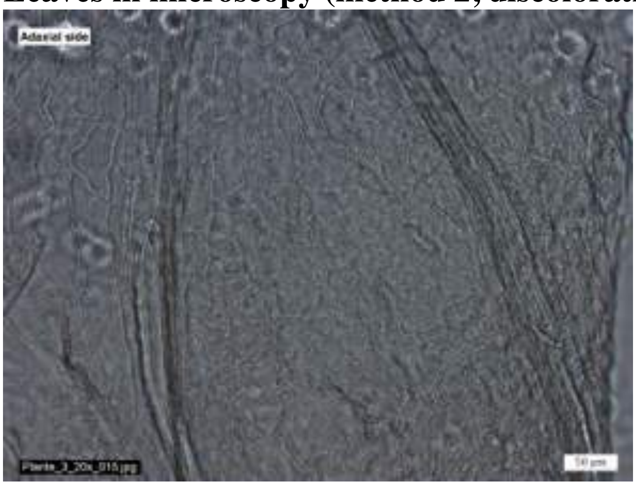
Collection in Tai National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougounein the Centre Suisse des Recherches Scientifiques en Côte d'Ivoire (CSRS)

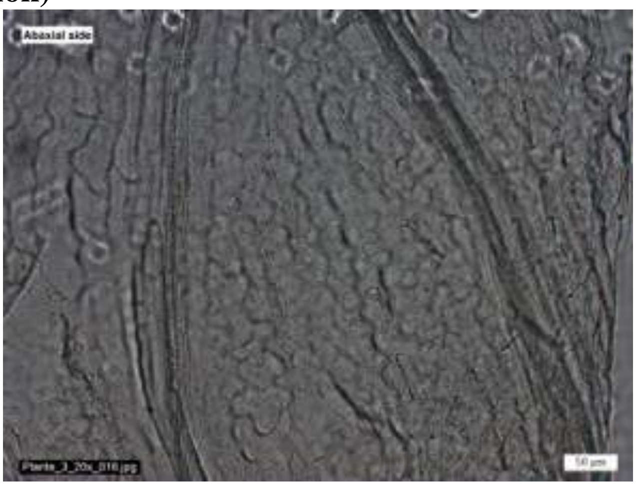
Leaves in macroscopy





Leaves in microscopy (method 2, discoloration)

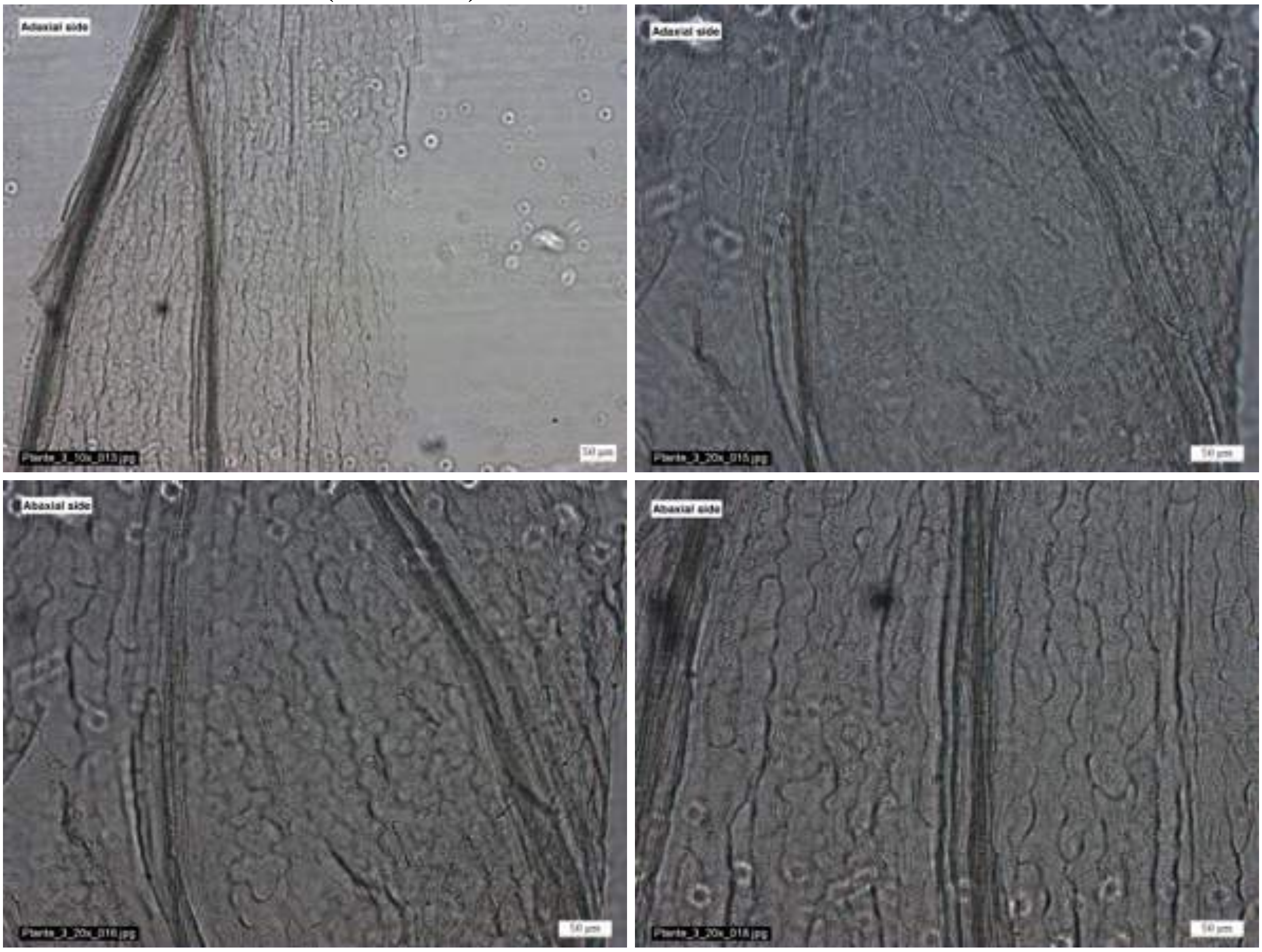




Nailpolish method (method 1)

No references available

Discoloration method (method 2)



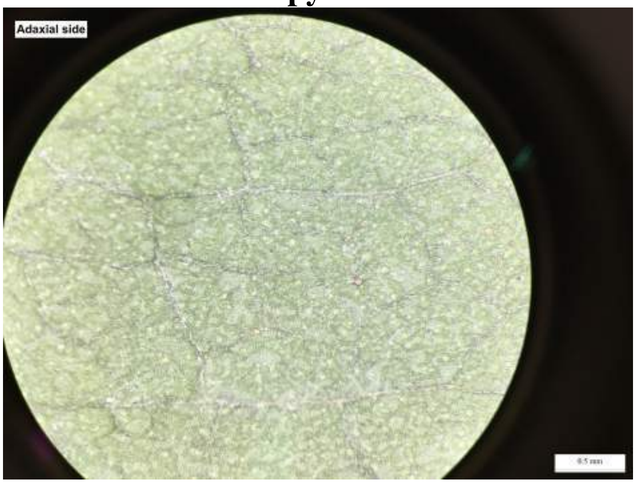
DICOTYLEDONAE

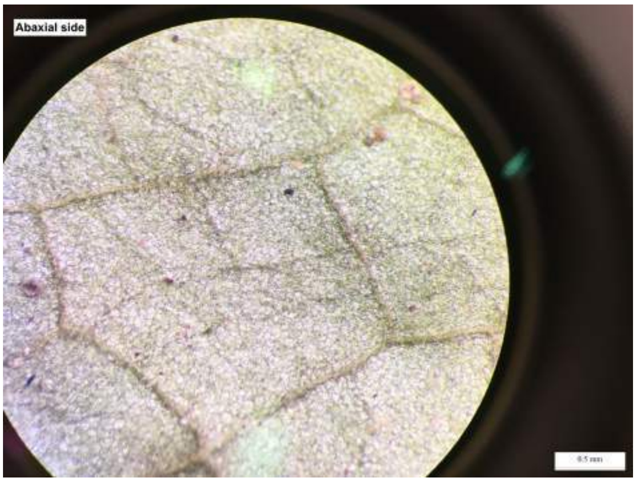
Cleistanthus libericus (Plant 4), *Dalbergia altissima* (Plant 5), *Urera oblongifolia* (Plant 6), *Synedrella nodiflora* (Plant 7), *Ageratum conyzoides* (Plant 8), *Vitex micrantha* (Plant 9), *Cercestis afzelii* (Plant 11), *Cyathula prostata* (Plant 12), *Pentadesma butyracea* (Plant 13), *Desmodium adsencdens* (Plant 16), *Geophila hirsuta* (Plant 17), *Geophila afzelii* (Plant 18), *Scaphopetalum amoenum* (Plant 19), *Tristemma albiflorum* (Plant 20), *Chromolaena odorata* (Plant 21), *Stephonema pseudocola* (Plant 22), *Dissotis rotundifolia* (Plant 23), *Leea guineensis* (Plant 24), *Manniophyton fulvum* (Plant 26), *Memecylon lateriflorum* (Plant 27), *Plagiosiphon emarginatus* (Plant 29), *Corynanthe pachyceras* (Plant 30), *Heritiera utilis* (Plant 32), *Berlinia occidentalis* (Plant 33), *Sacoglotis gabonensis* (Plant 34), *Xylopia quintasii* (Plant 35), S*treblus usambarensis* (Plant 36), *Coula eduils* (Plant 37), *Baphia bancoensis* (Plant 38), *Campylospermum calomelanos* (Plant 39), *Diospyros manii* (Plant 40), *Diospyros sanza-minika* (Plant 41), *Diospyros soubreana* (Plant 42), *Dialium aubrevileii* (Plant 43), *Garcinia afzelii* (Plant 44), *Parinari excelsa* (Plant 46), *Maesobotrya barterii* (Plant 49), *Napoleonaea leonensis* (Plant 51), *Cephaelis yapoensis* (Plant 52), *Uapaca esculenta* (Plant 53), *Strombosia glaucescens* (Plant 54), *Calycobolus africanus* (Plant 55), *Massularia acuminata* (Plant 56), *Gilbertiodendron preussii* (Plant 57)

Herbarium plant

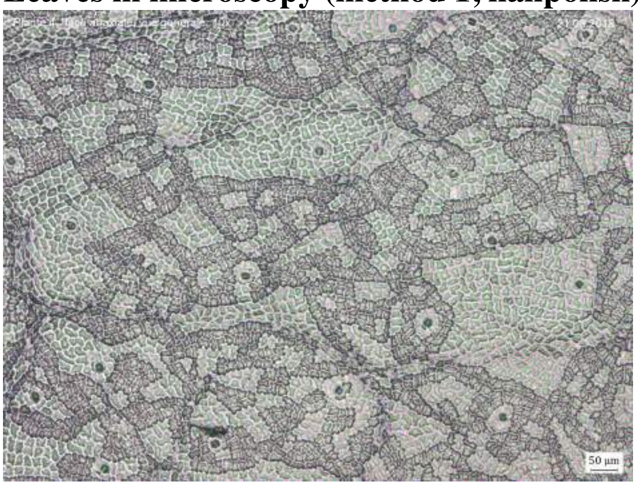
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

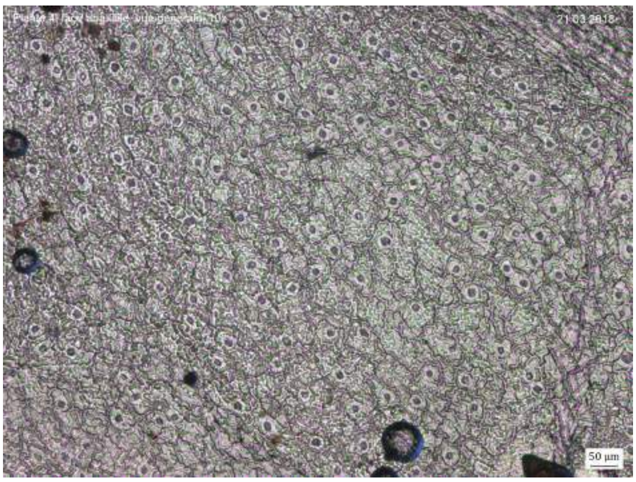
Leaves in macroscopy



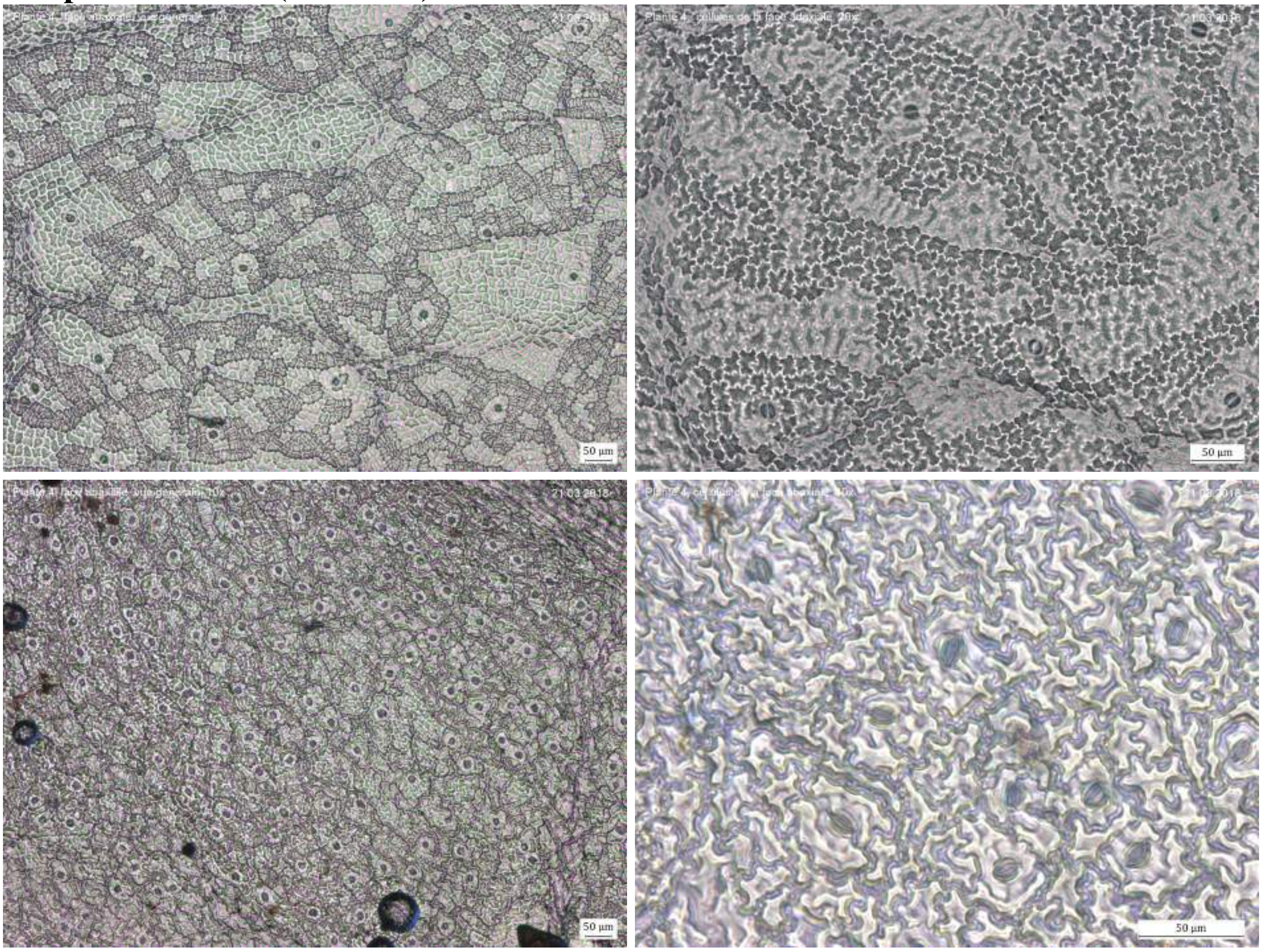


Leaves in microscopy (method 1, nailpolish)

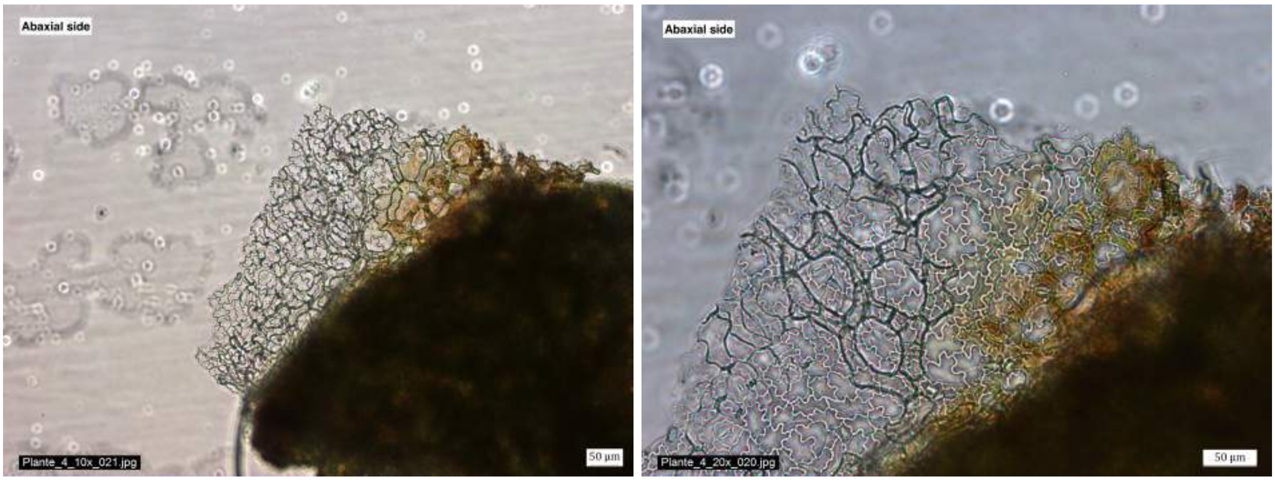




Nailpolish method (method 1)

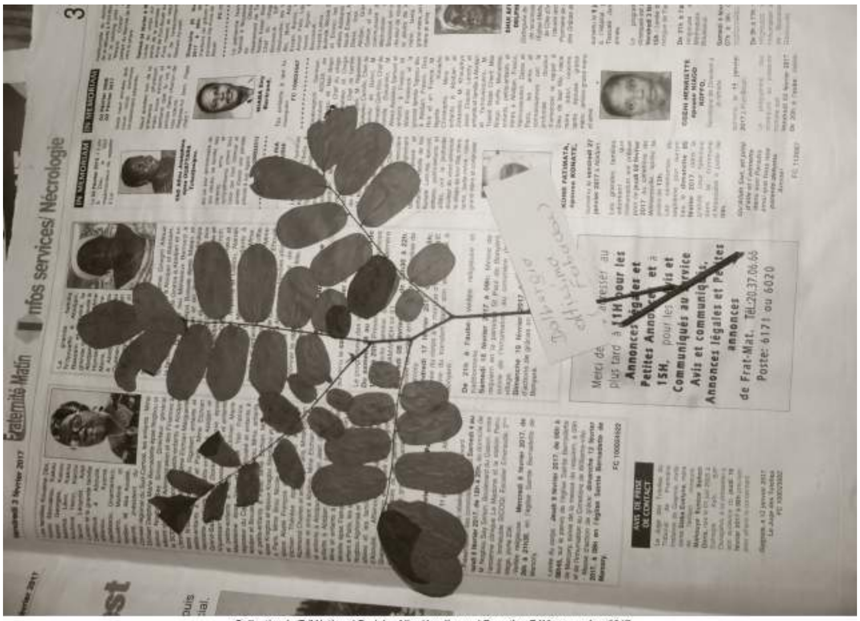


Discoloration method (method 2)



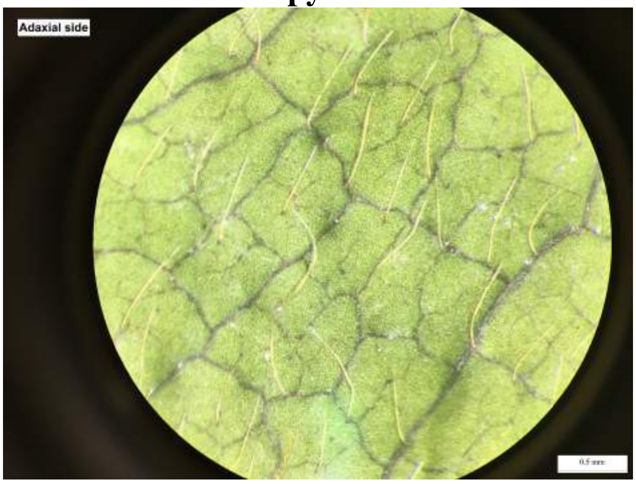
Dalbergia altissima (Plant 5) FABACEAE

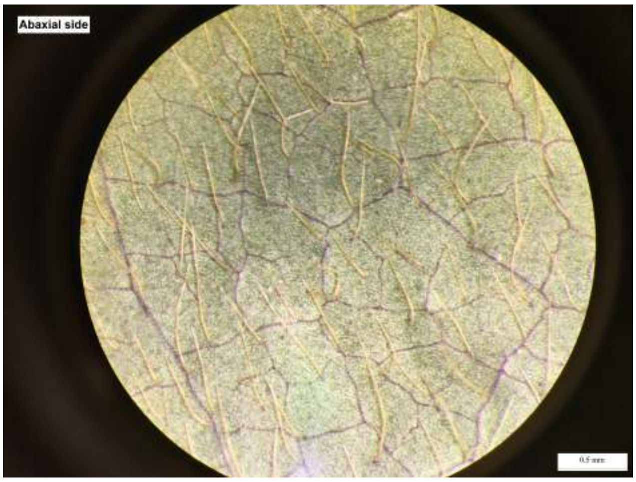
Herbarium plant



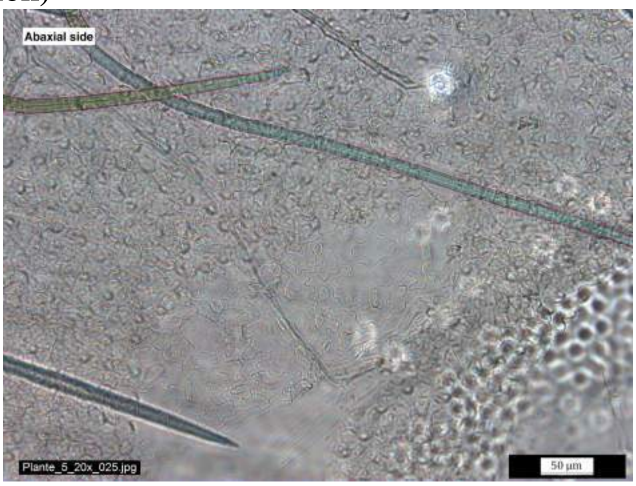
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

Leaves in macroscopy

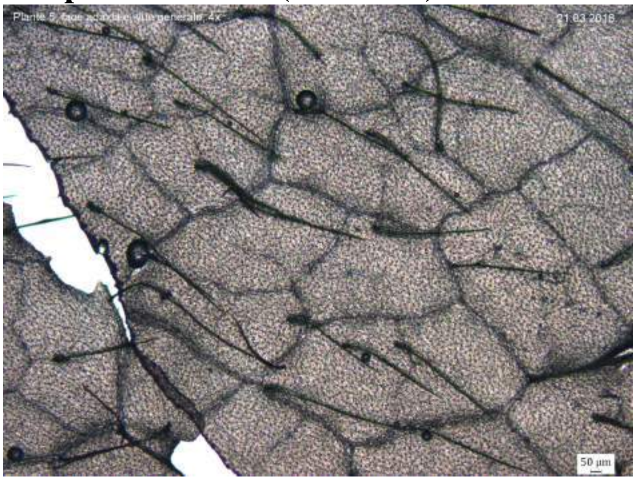


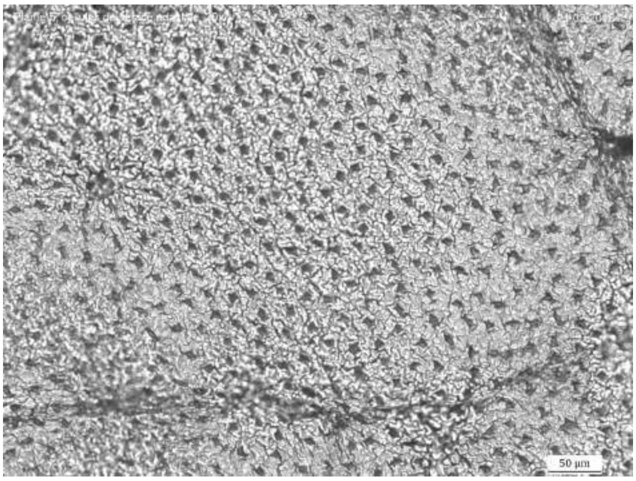


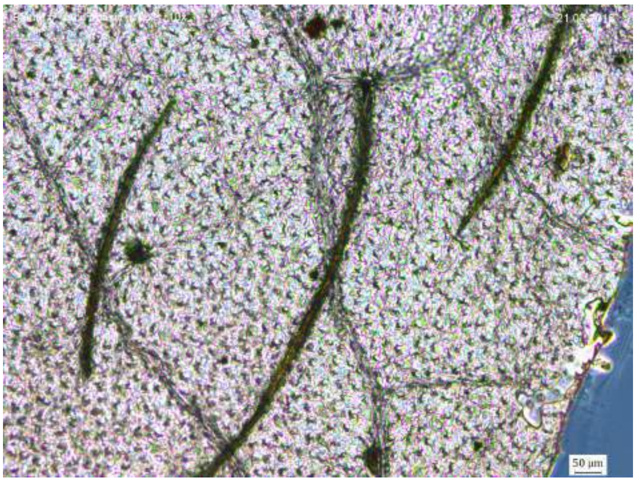
Leaves in microscopy (method 2, discoloration)

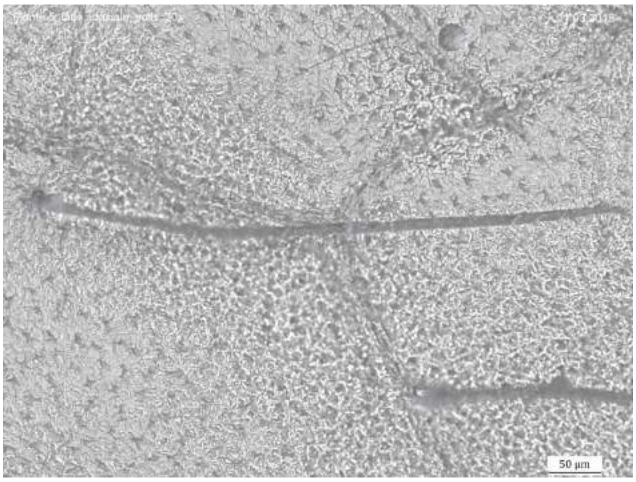


Nailpolish method (method 1)

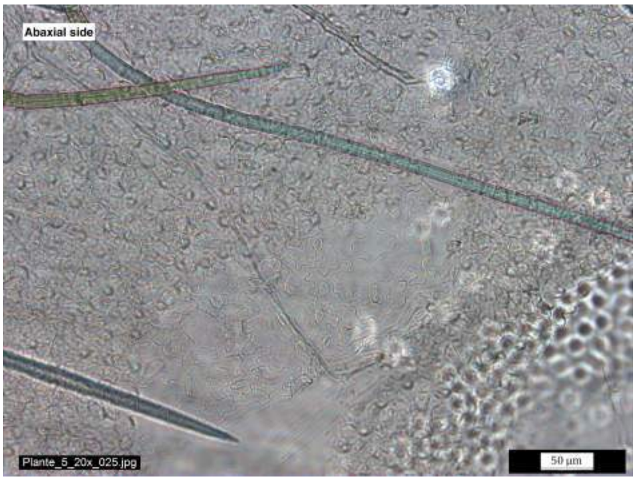


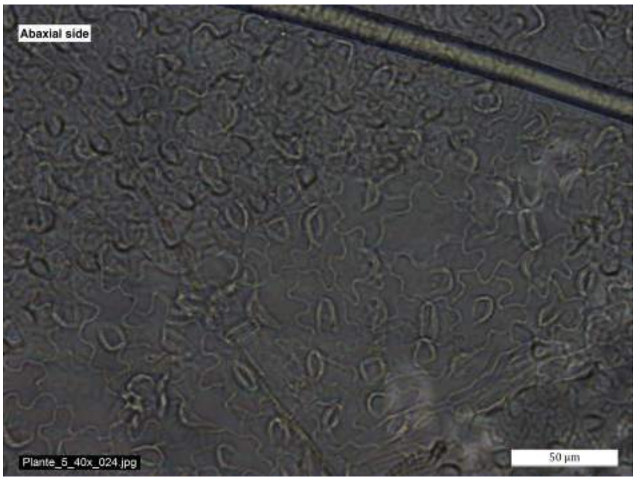






Discoloration method (method 2)

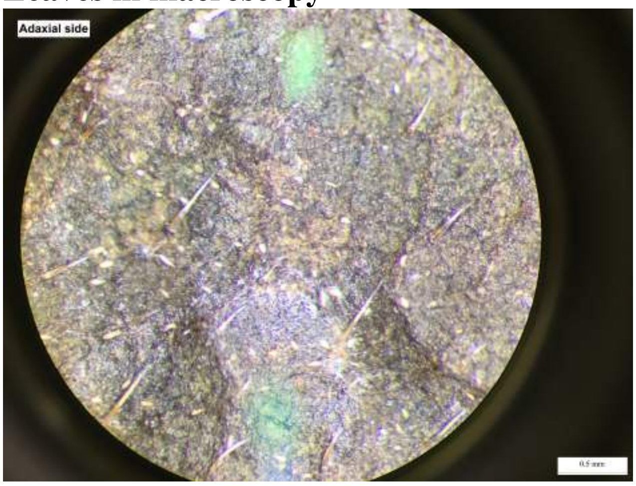


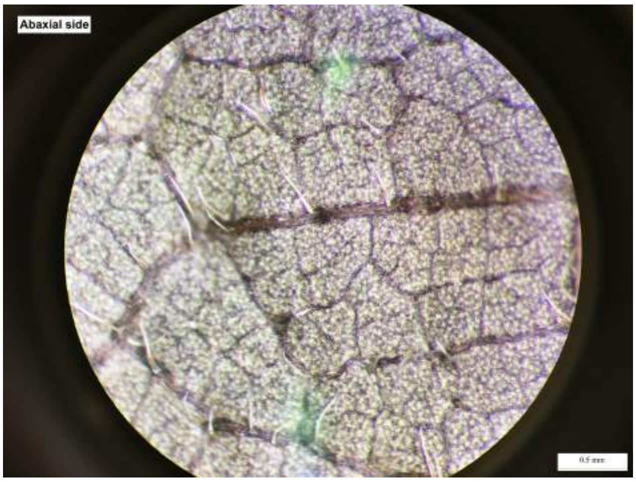


Herbarium plant

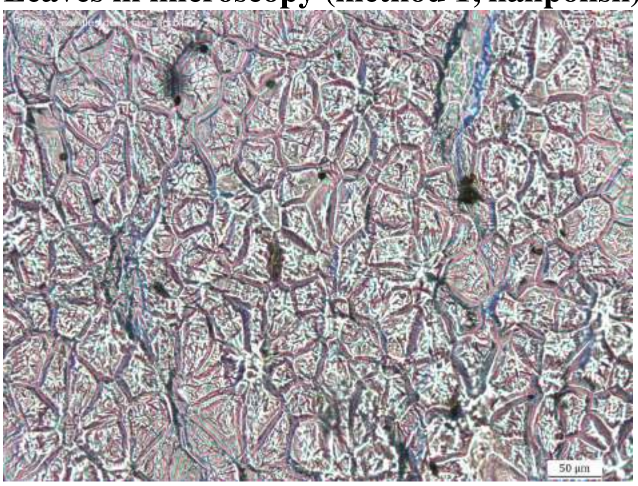
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

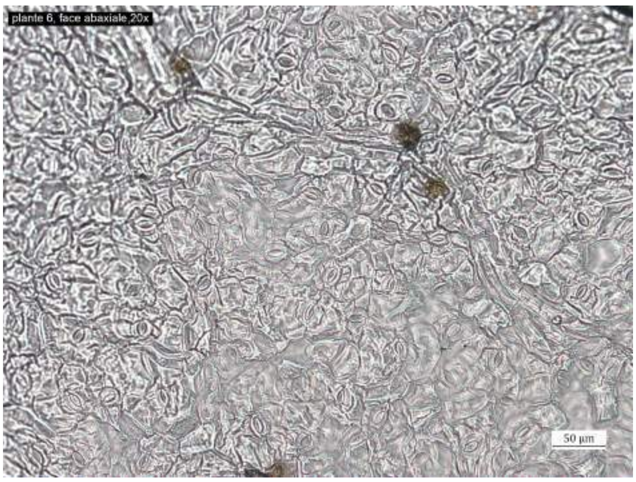
Leaves in macroscopy



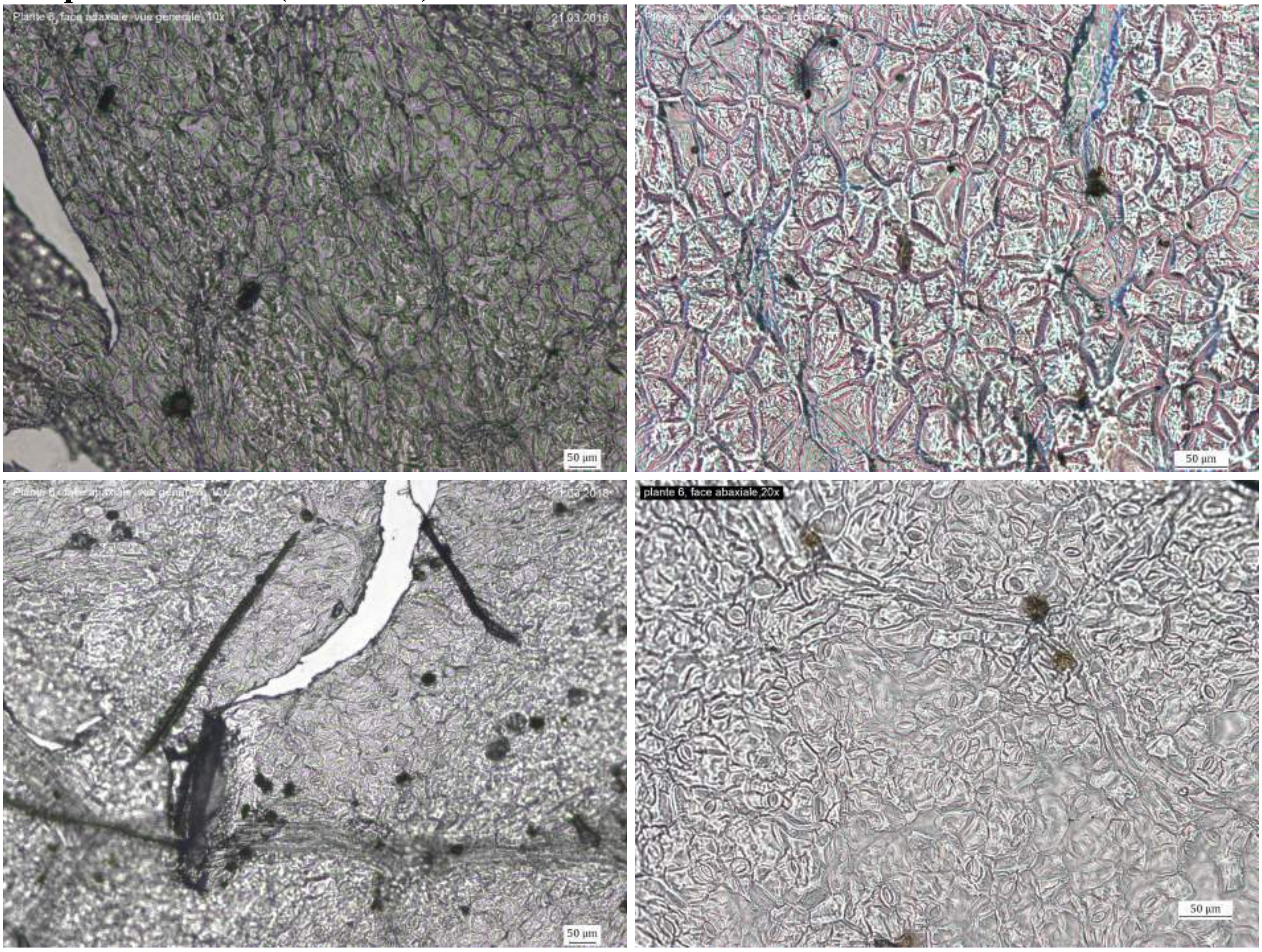


Leaves in microscopy (method 1, nailpolish)

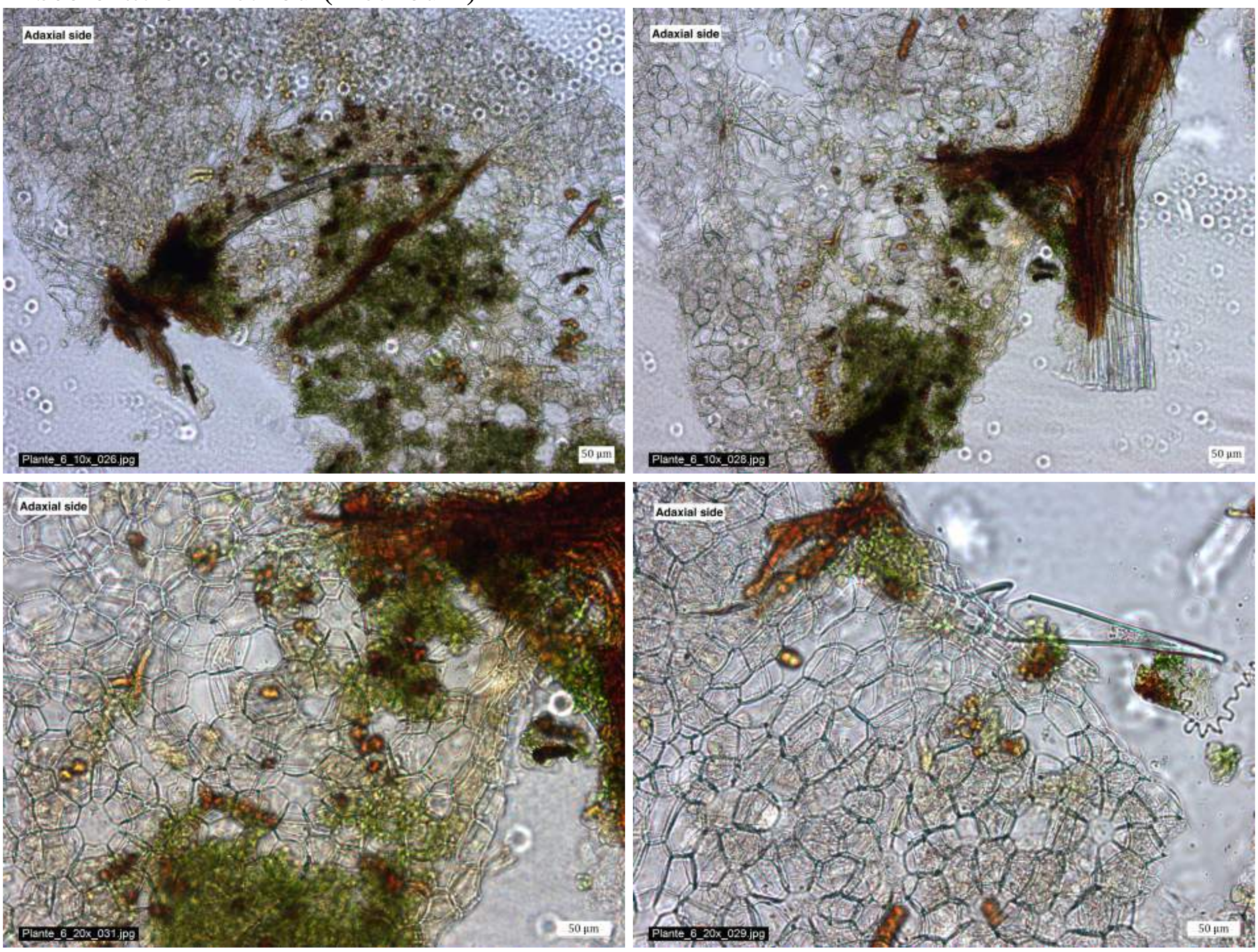




Nailpolish method (method 1)



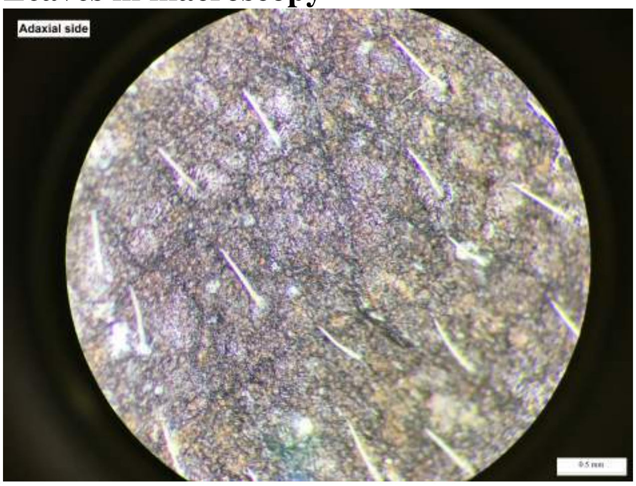
Discoloration method (method 2)

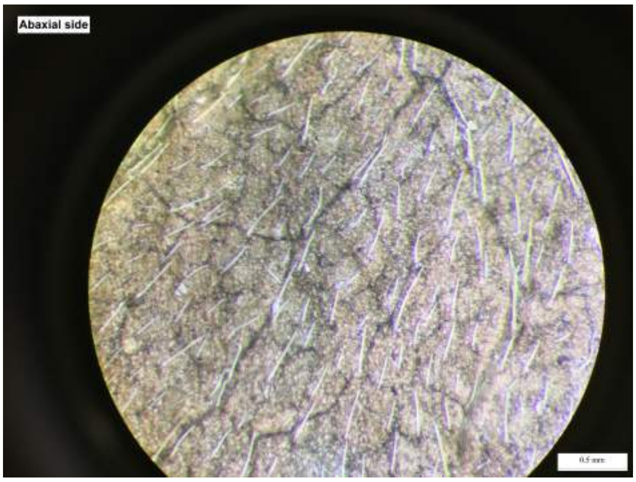


Herbarium plant

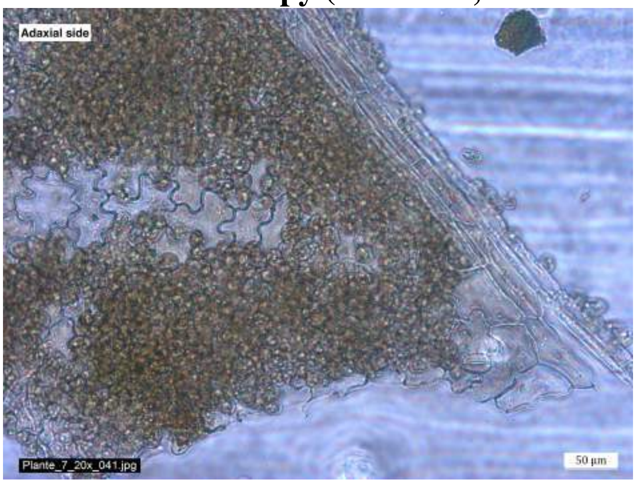
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

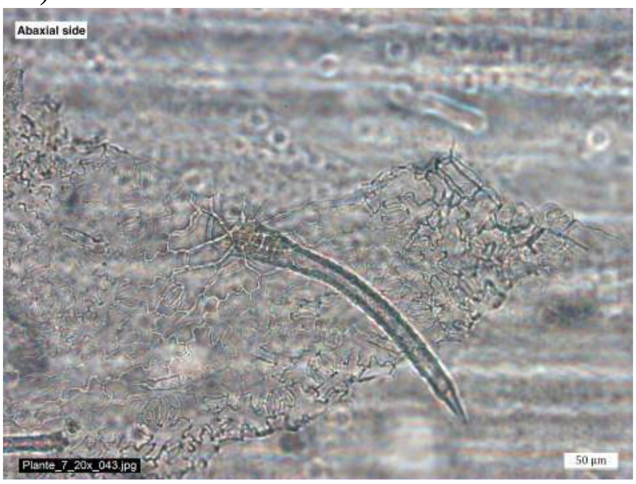
Leaves in macroscopy



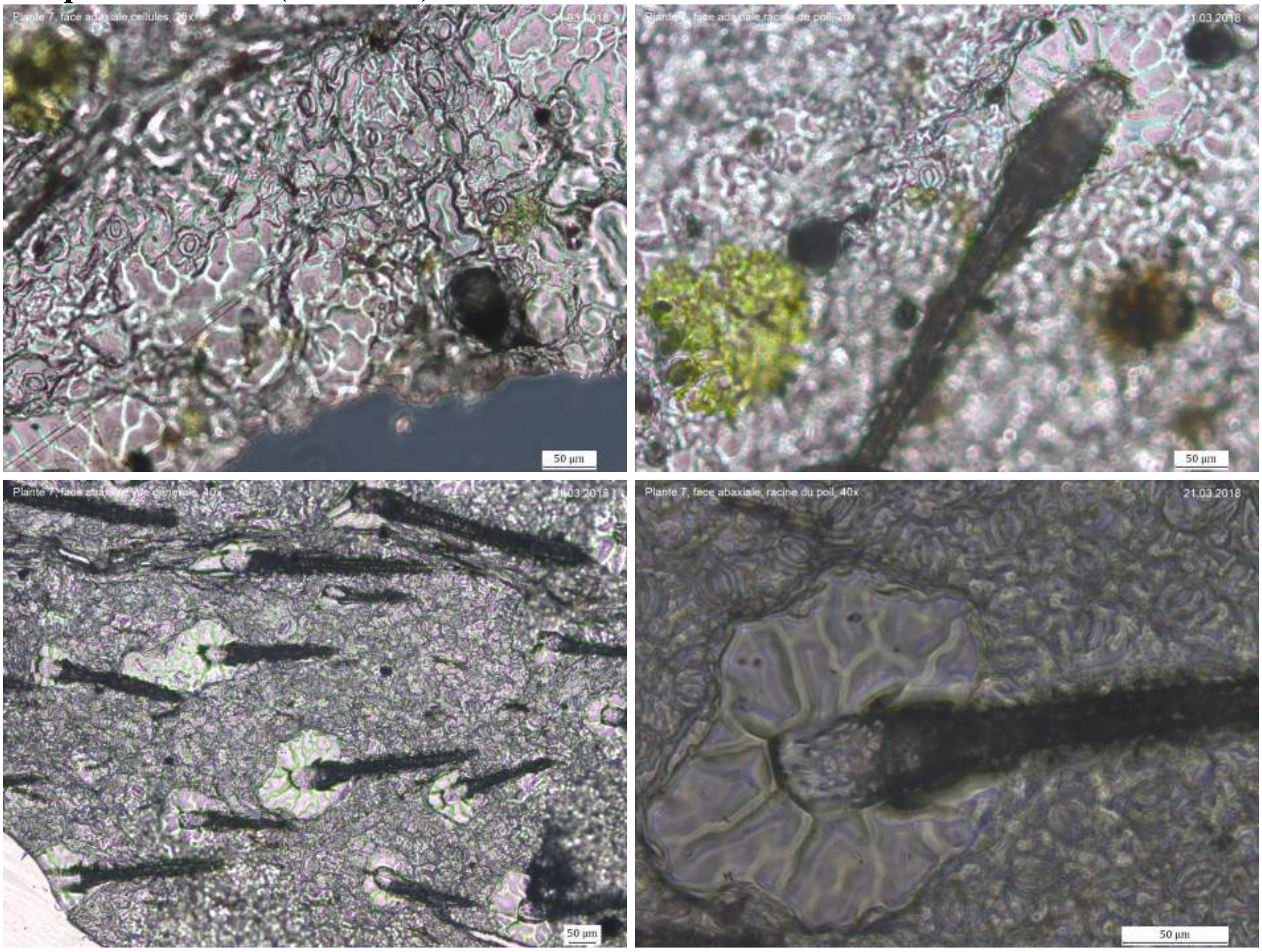


Leaves in microscopy (method 2, discoloration)

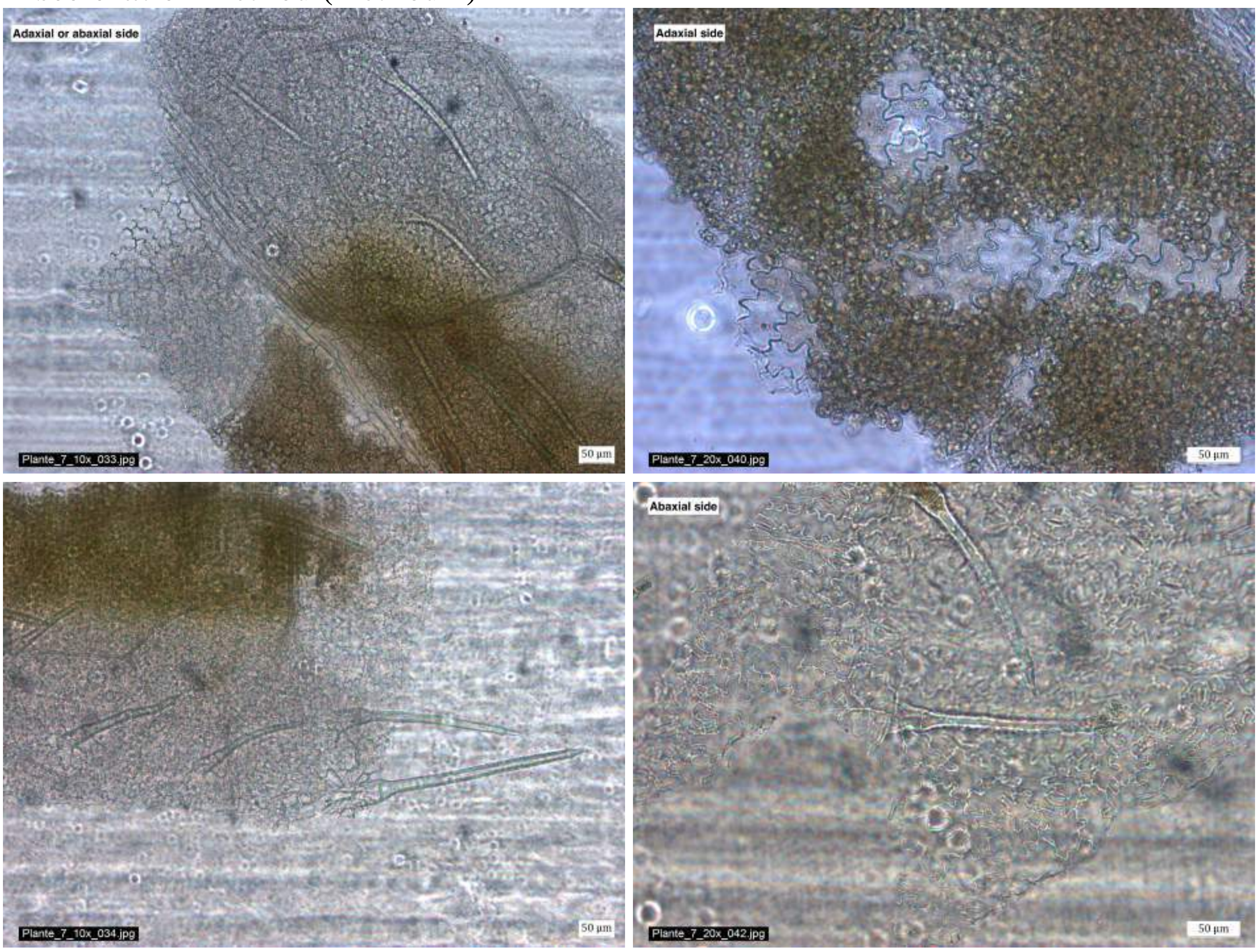




Nailpolish method (method 1)



Discoloration method (method 2)

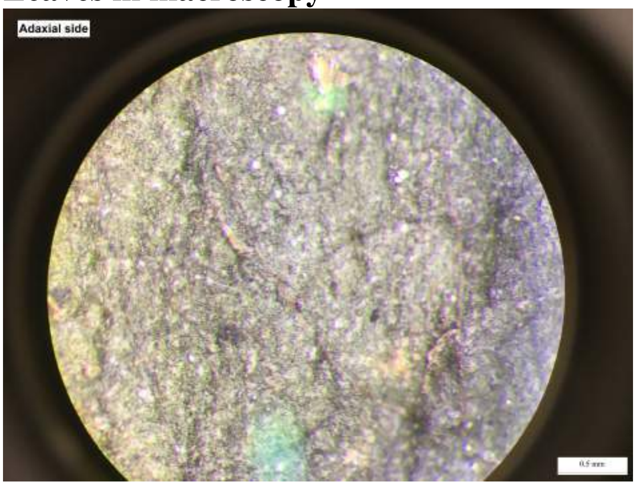


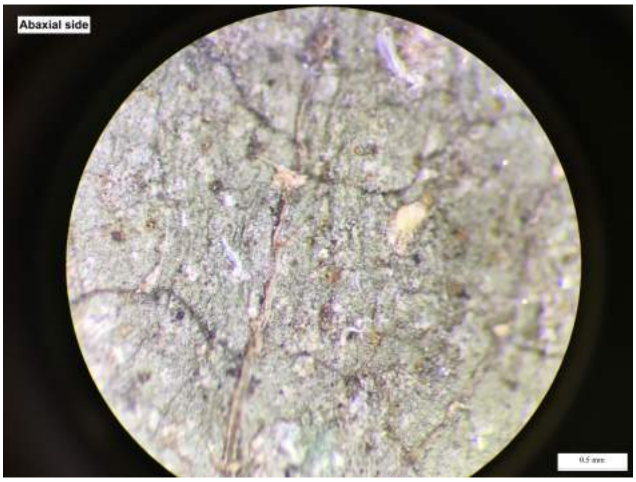
Ageratum conyzoides (Plant 8) ASTERACEAE

Herbarium plant

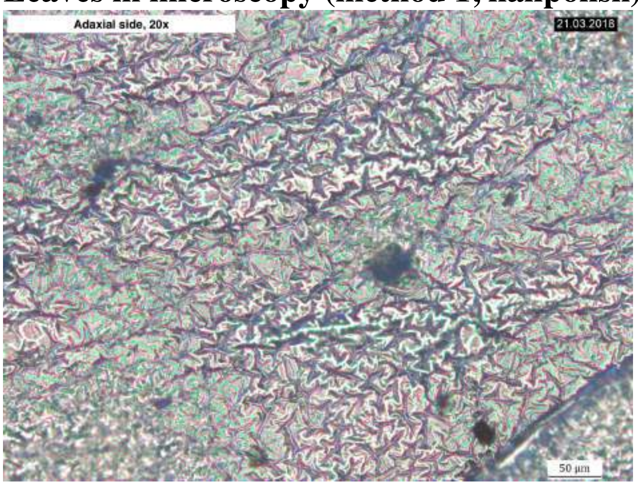
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

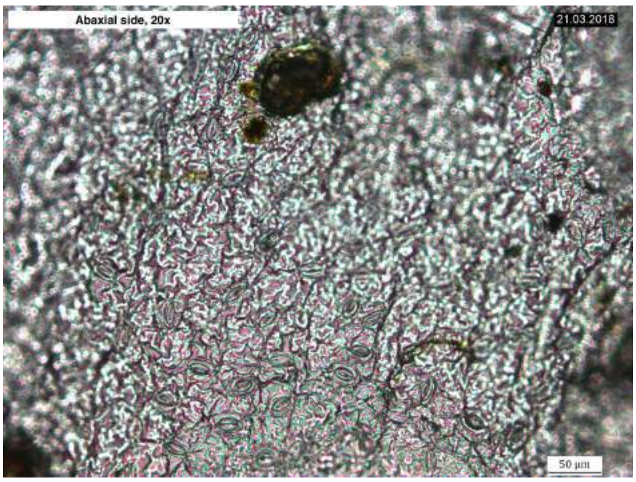
Leaves in macroscopy



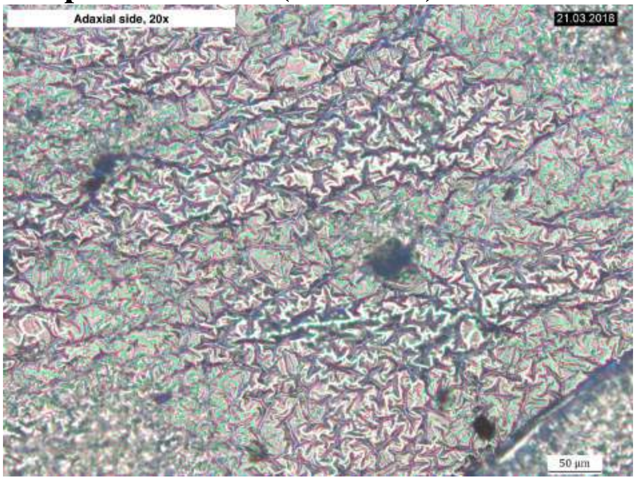


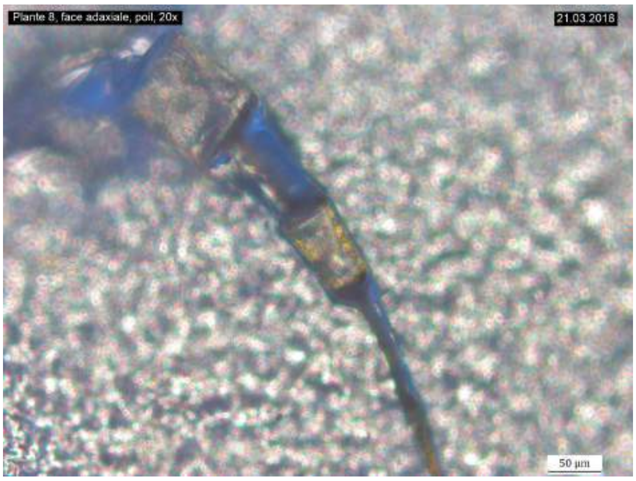
Leaves in microscopy (method 1, nailpolish)

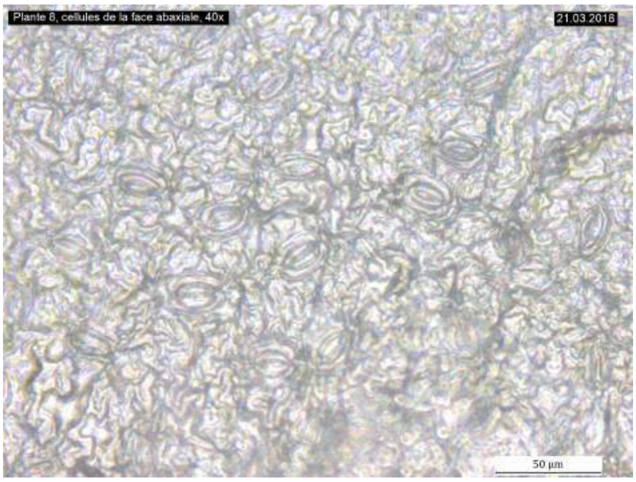


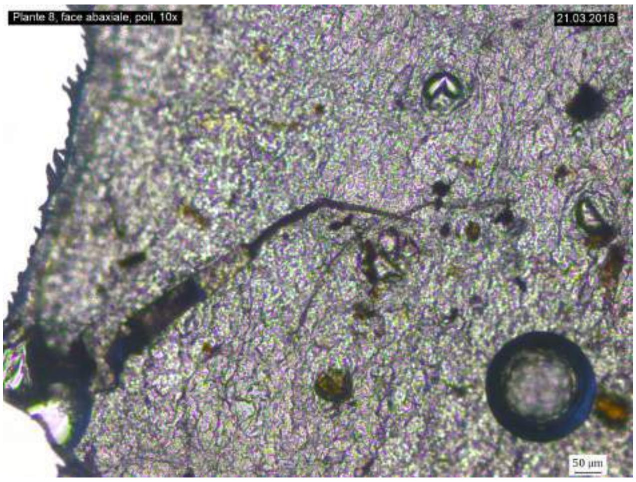


Nailpolish method (method 1)

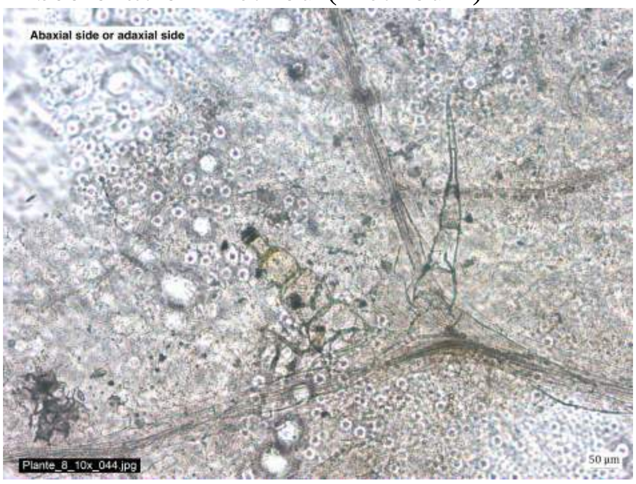


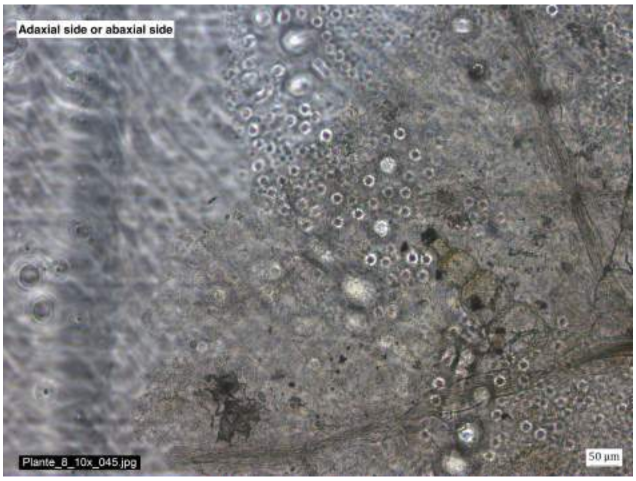


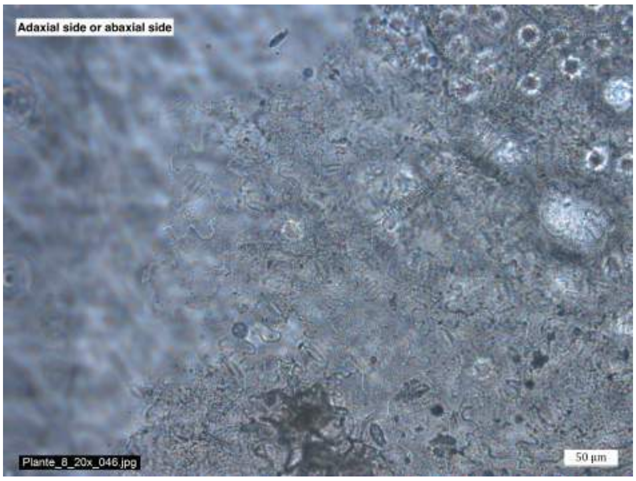




Discoloration method (method 2)



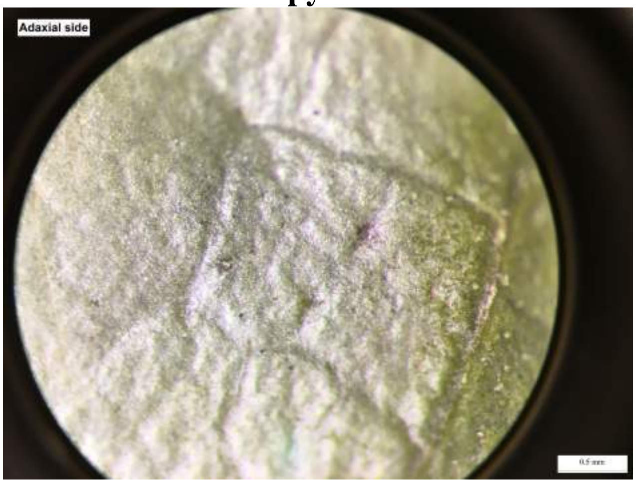




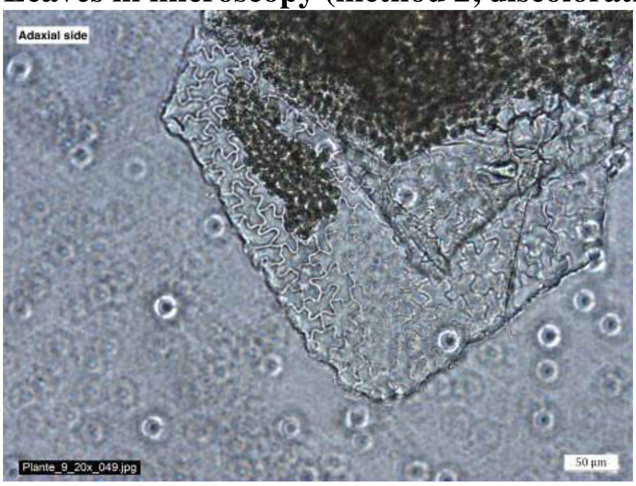
Herbarium plant

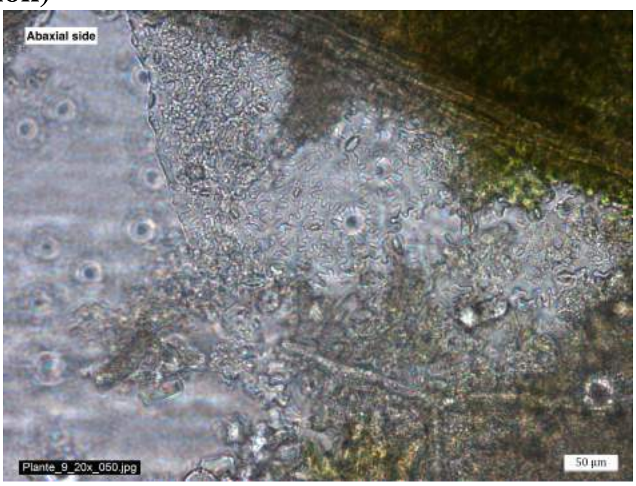
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

Leaves in macroscopy

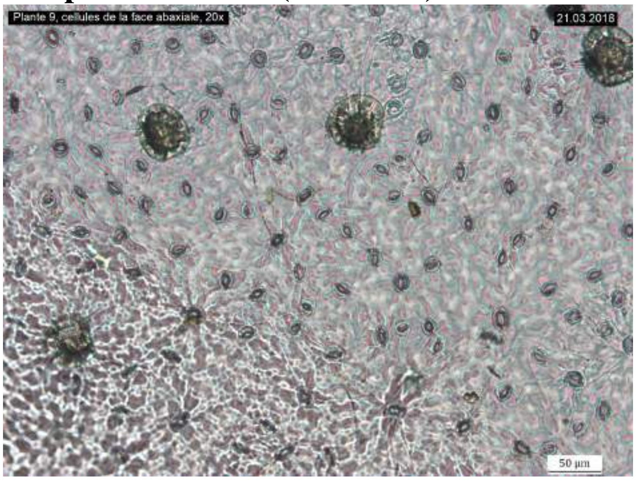


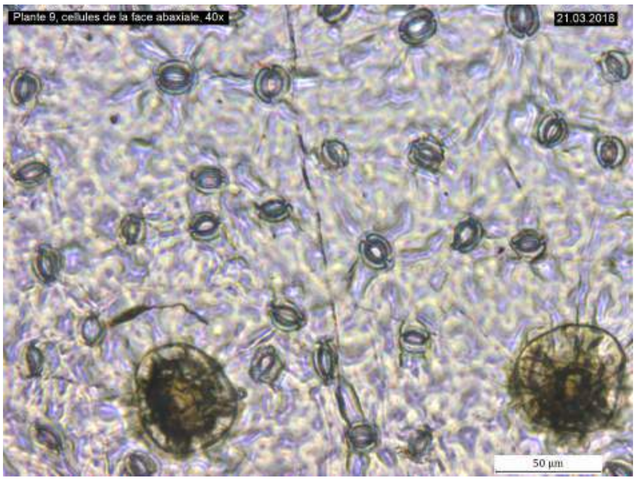
Leaves in microscopy (method 2, discoloration)



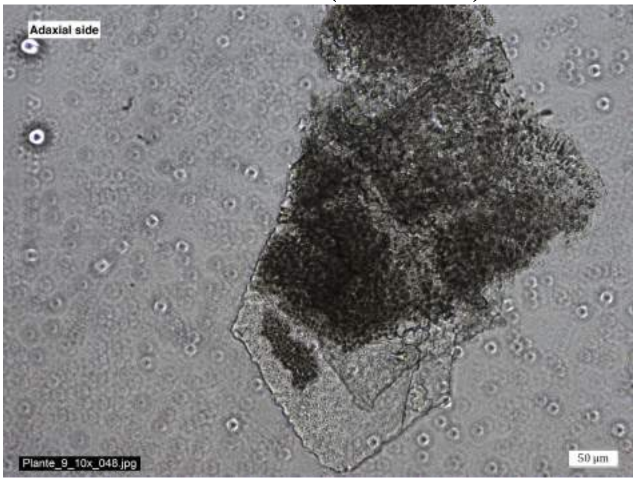


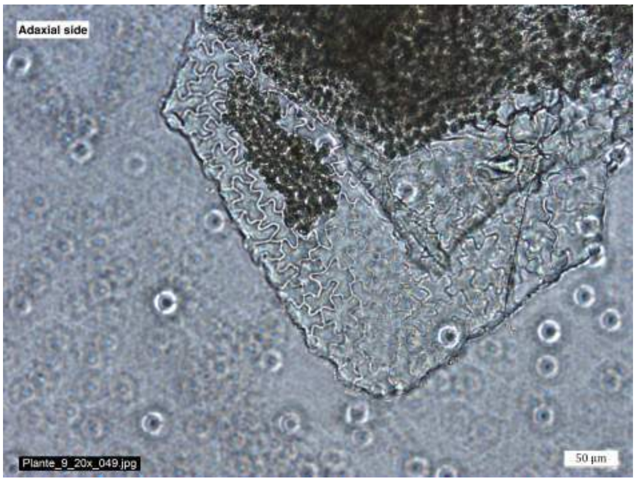
Nailpolish method (method 1)

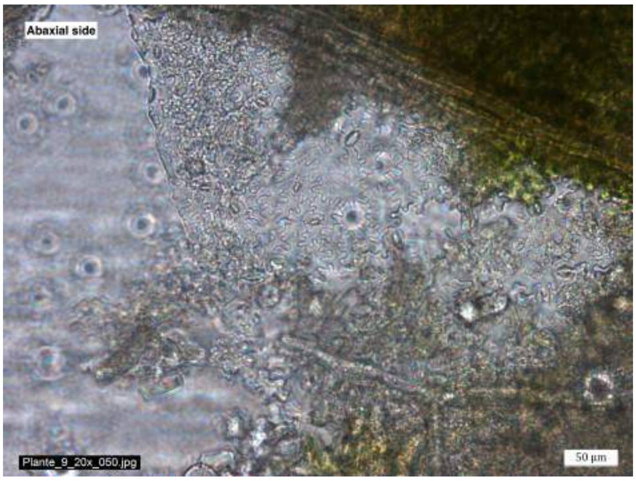




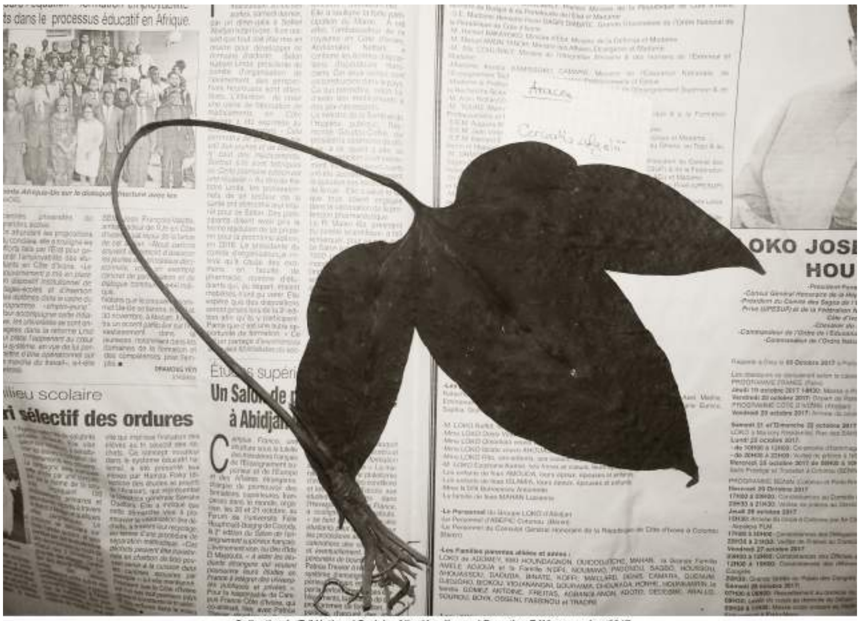
Discoloration method (method 2)







Herbarium plant



Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
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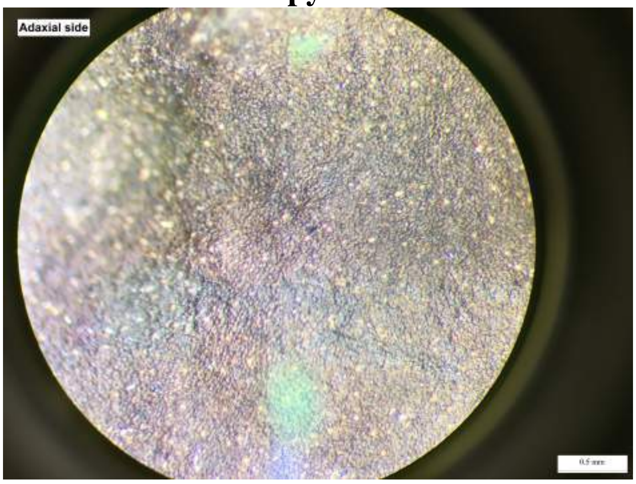
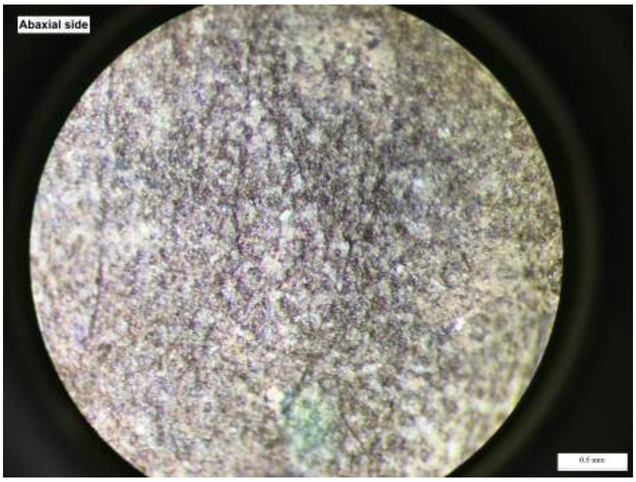
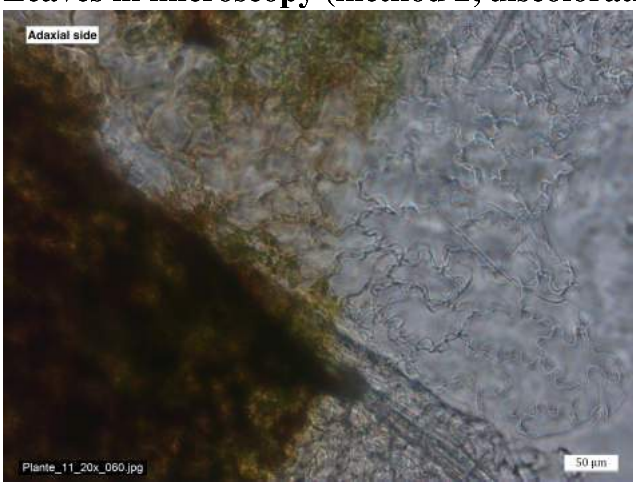
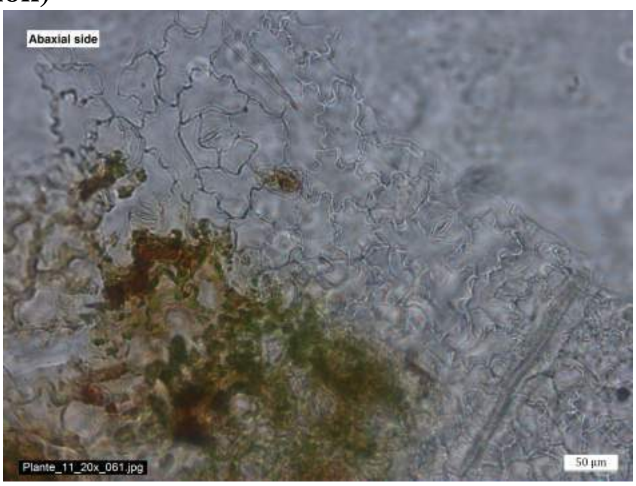
Leaves in macroscopy



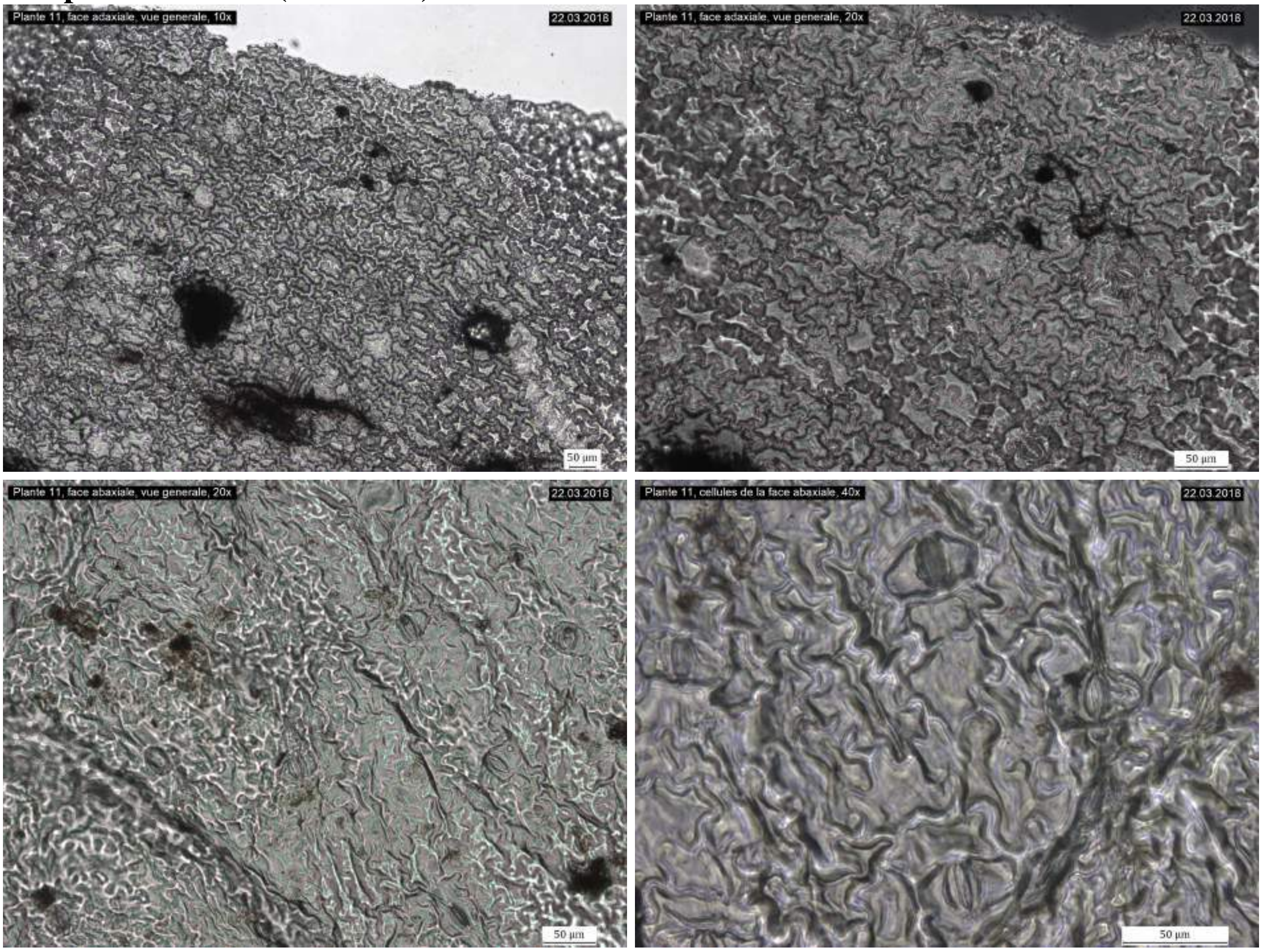


Leaves in microscopy (method 2, discoloration)

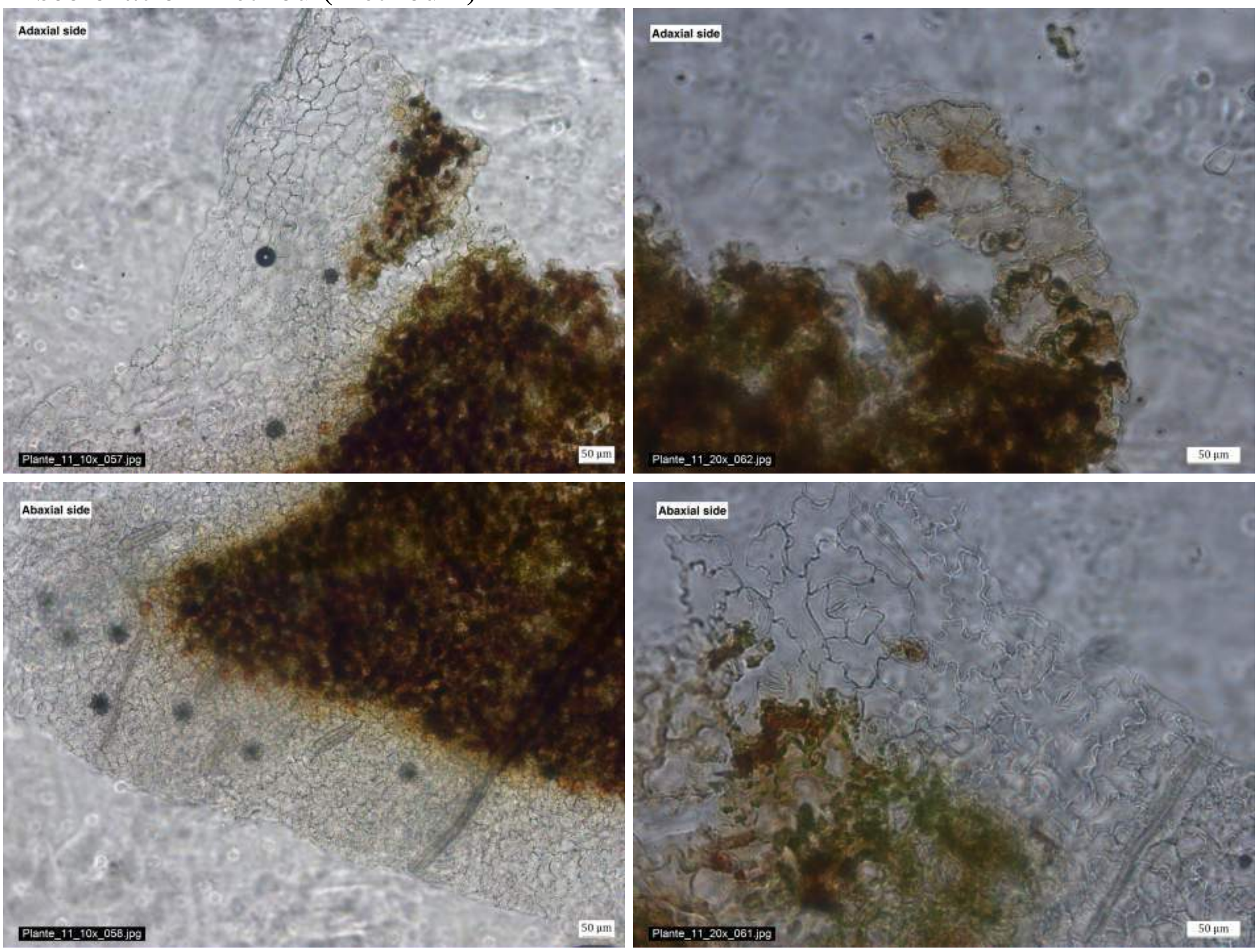




Nailpolish method (method 1)

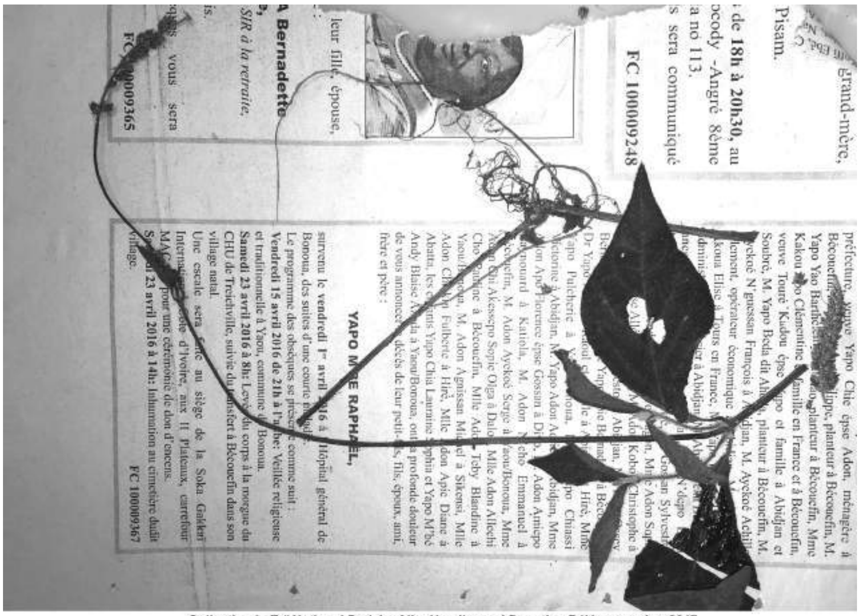


Discoloration method (method 2)



Cyathula prostata (Plant 12) AMARANTHACEAE

Herbarium plant



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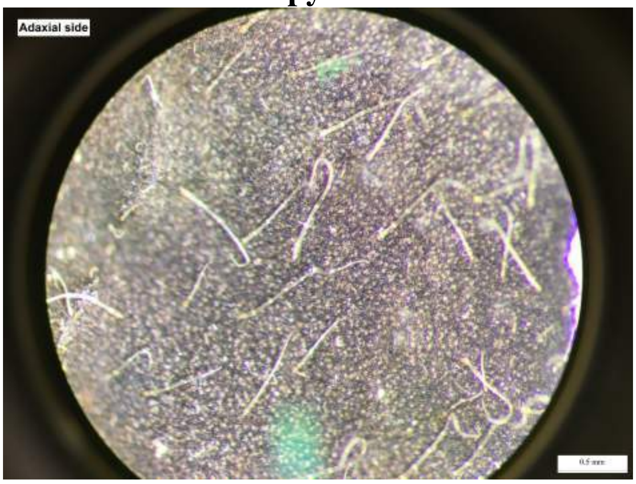
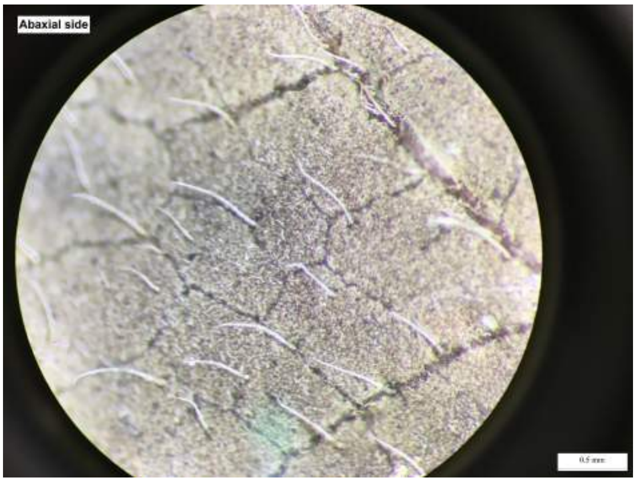
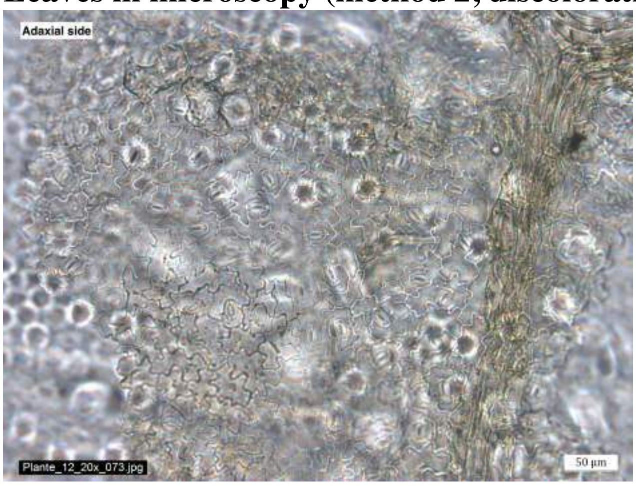
Confirmation of the determination by Saturnin Dougounein the Centre Suisse des Recherches Scientifiques en Côte d'Ivoire (CSRS)

Leaves in macroscopy





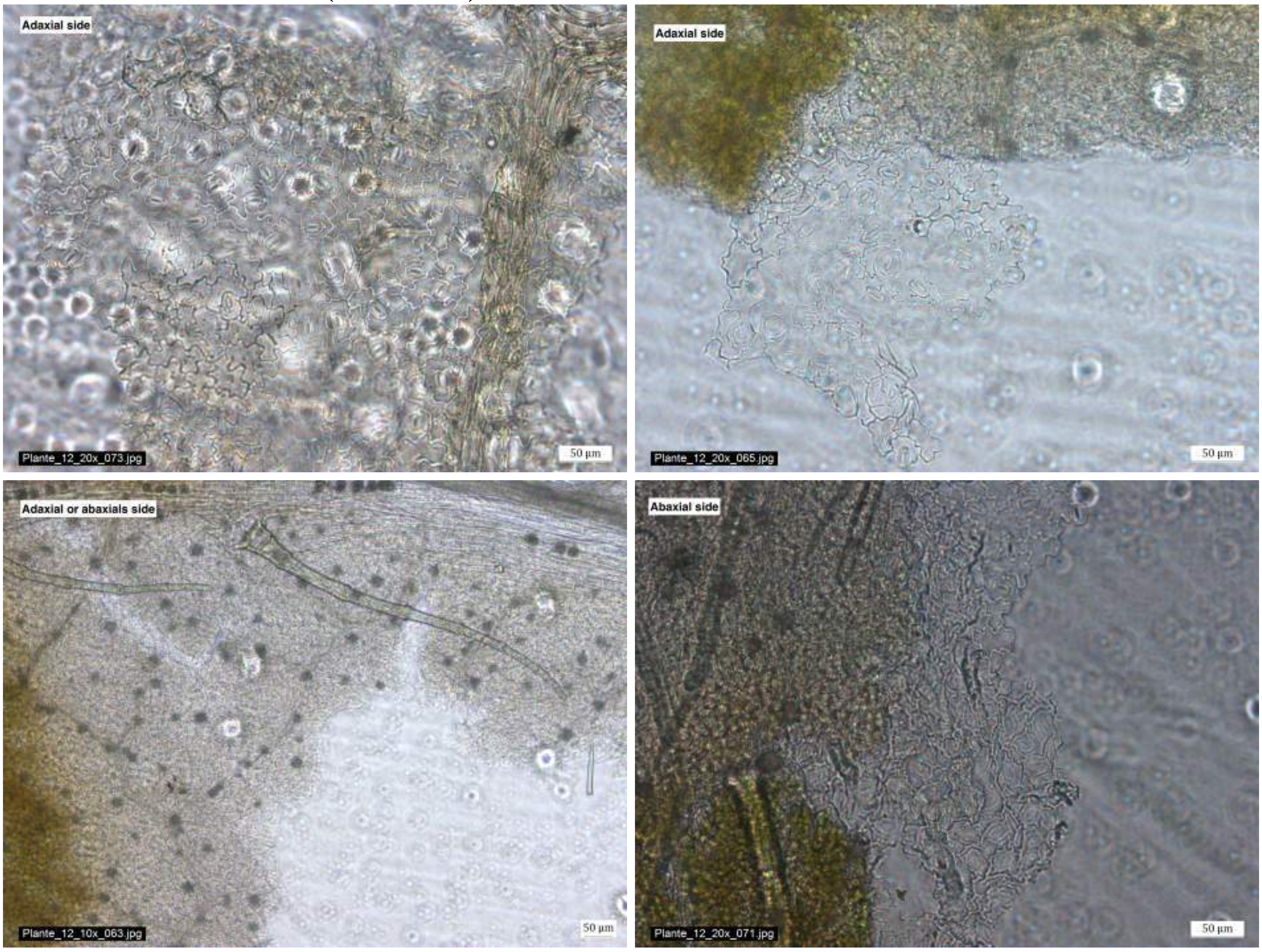
Leaves in microscopy (method 2, discoloration)



Nailpolish method (method 1)

No references available

Discoloration method (method 2)



Herbarium plant

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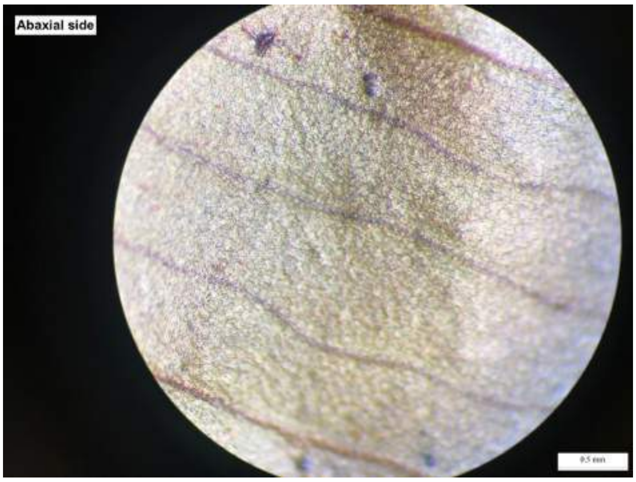
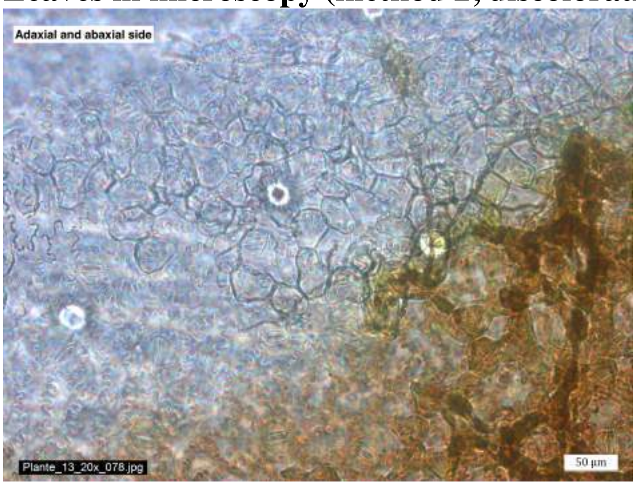
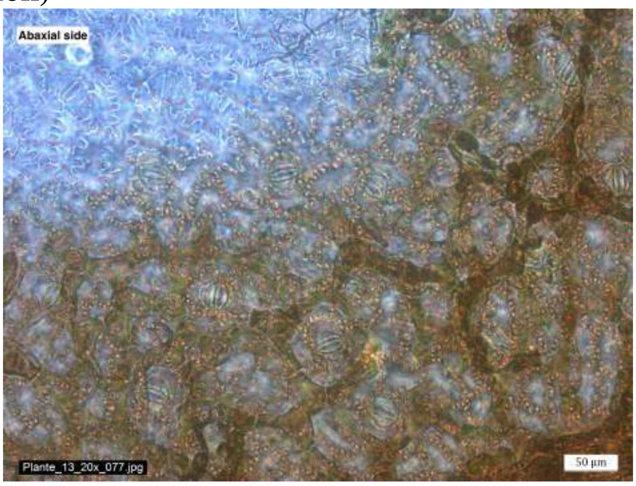
Leaves in macroscopy

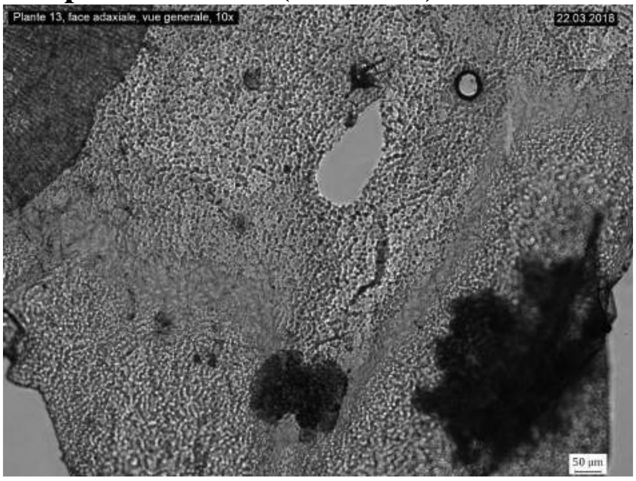


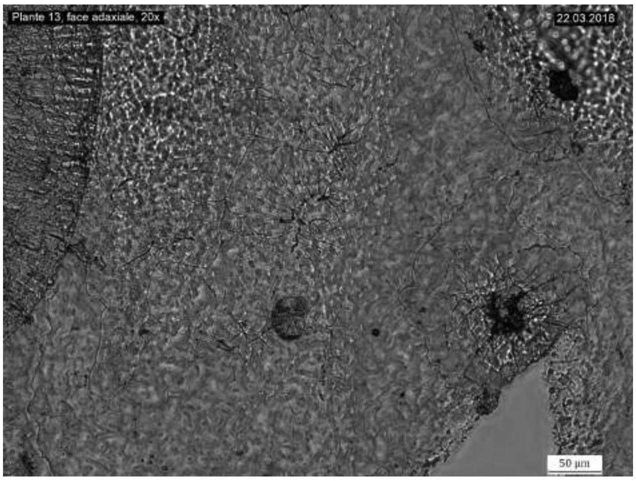
Leaves in microscopy (method 2, discoloration)

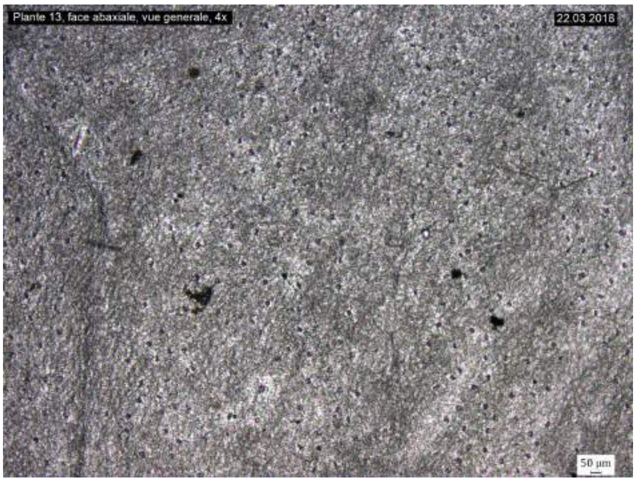


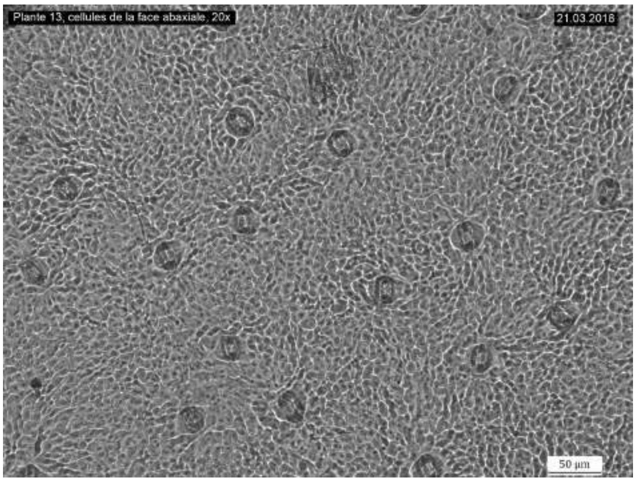


Nailpolish method (method 1)

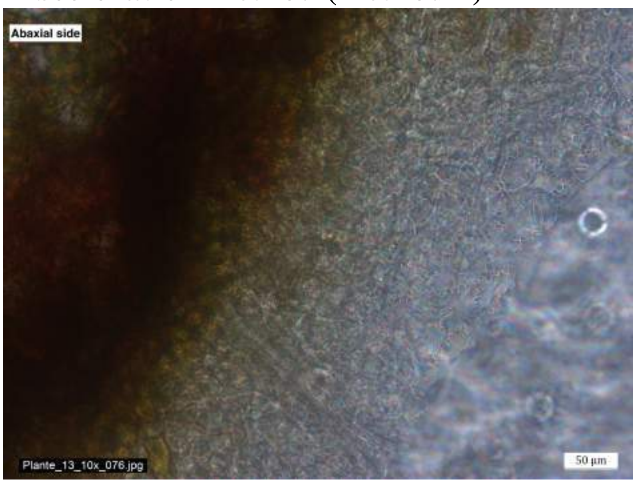


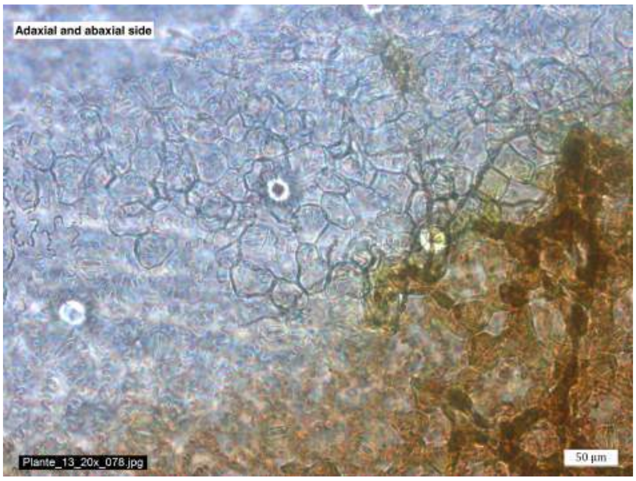


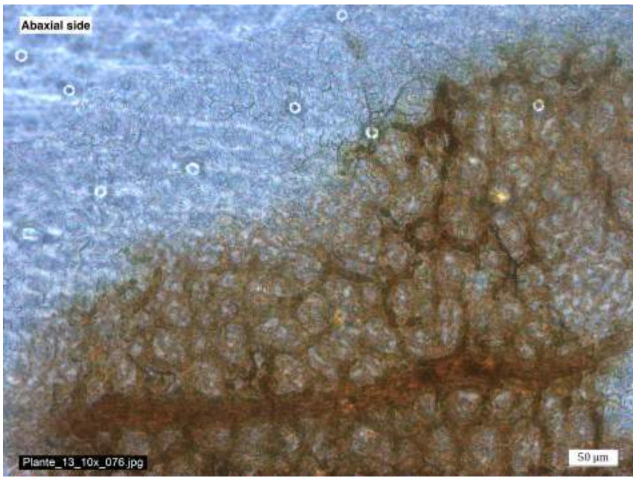


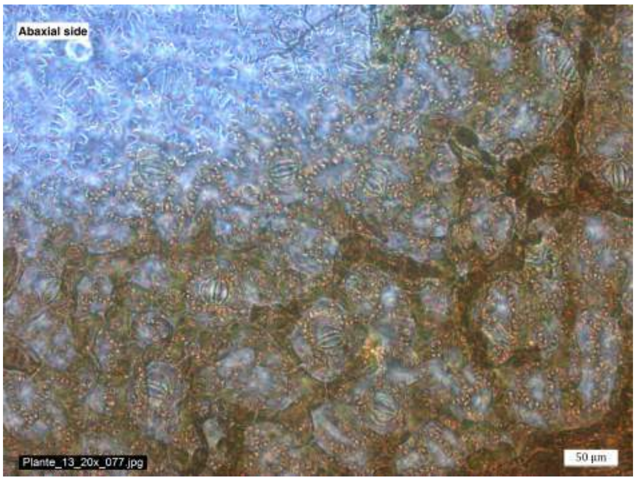


Discoloration method (method 2)

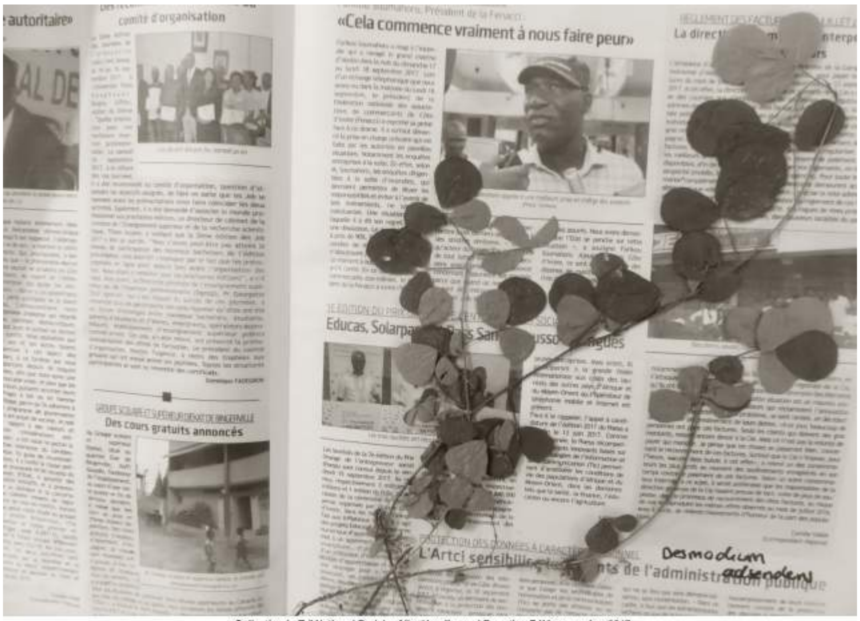








Herbarium plant



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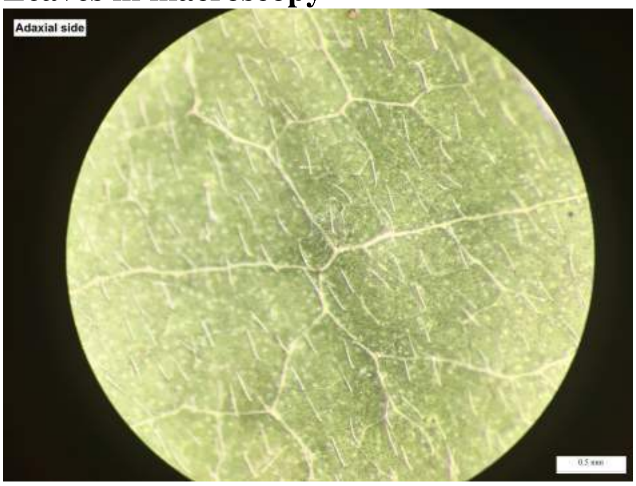
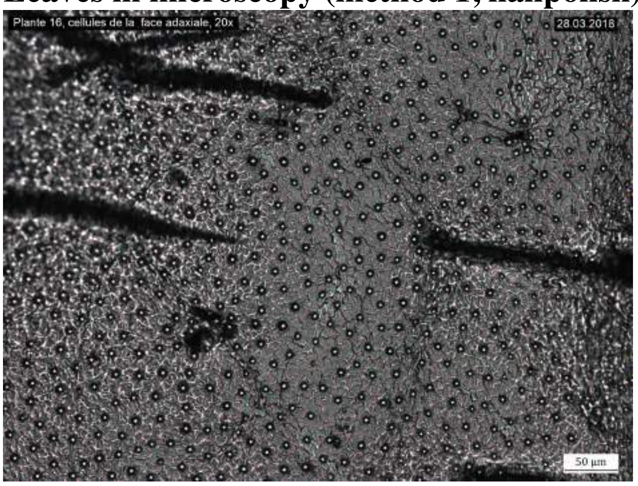
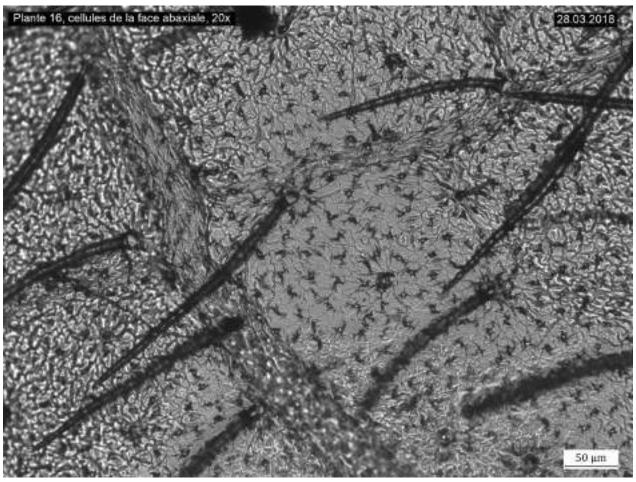
Leaves in macroscopy

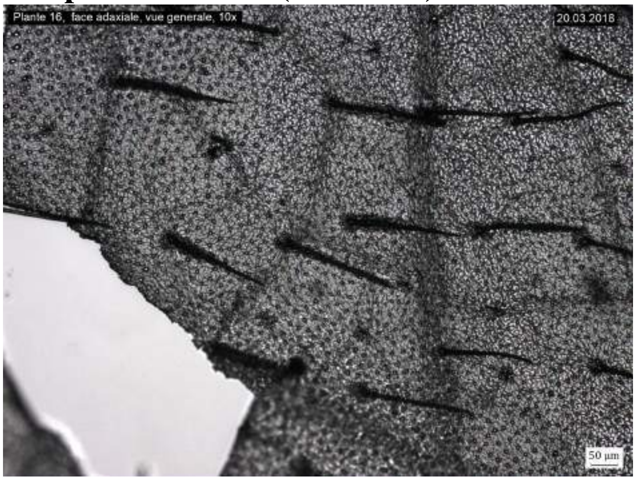


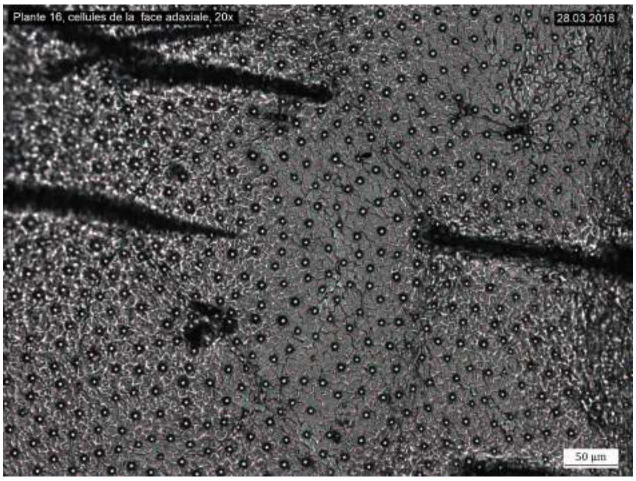
Leaves in microscopy (method 1, nailpolish)

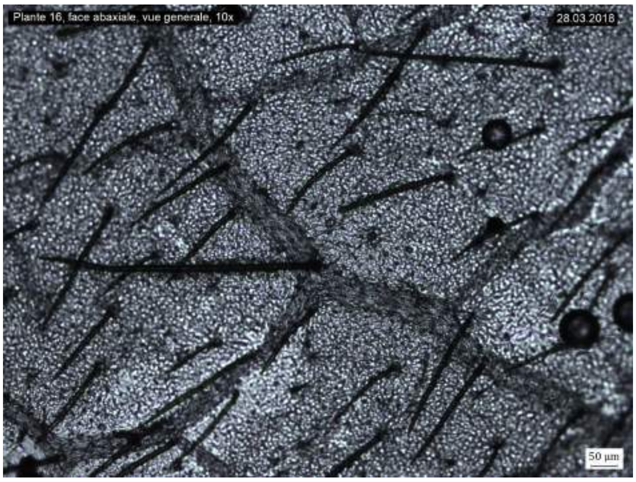


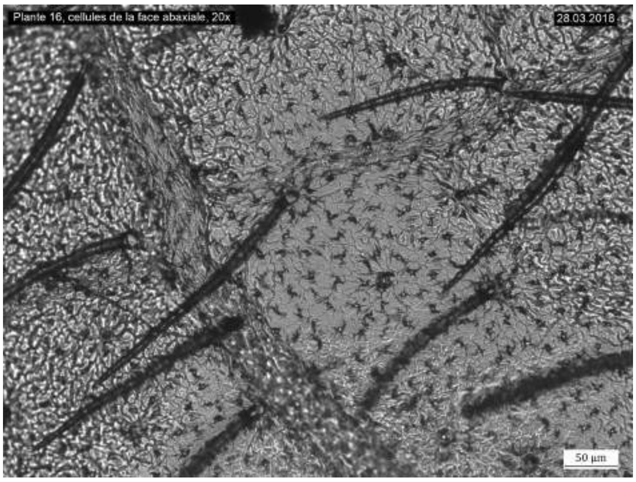


Nailpolish method (method 1)

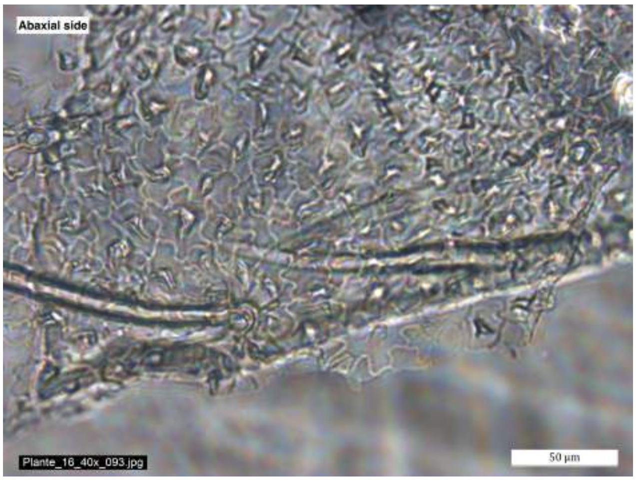


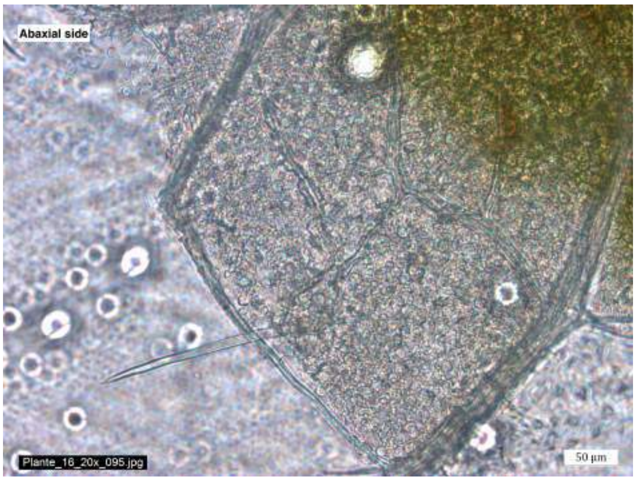






Discoloration method (method 2)





Herbarium plant

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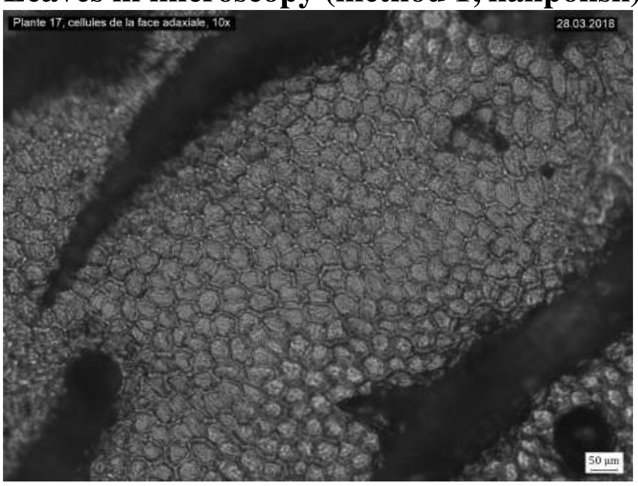
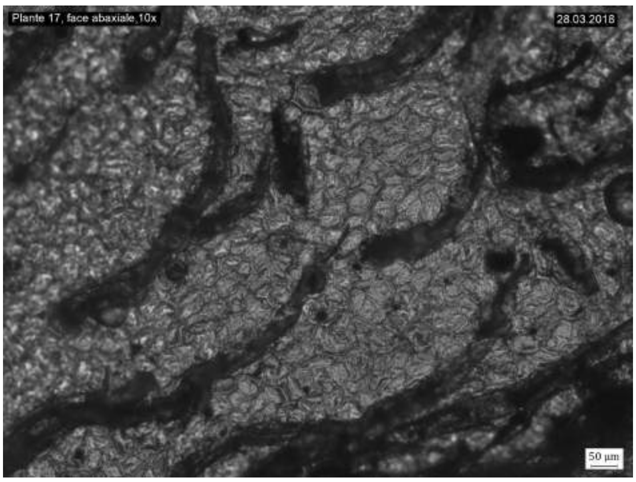
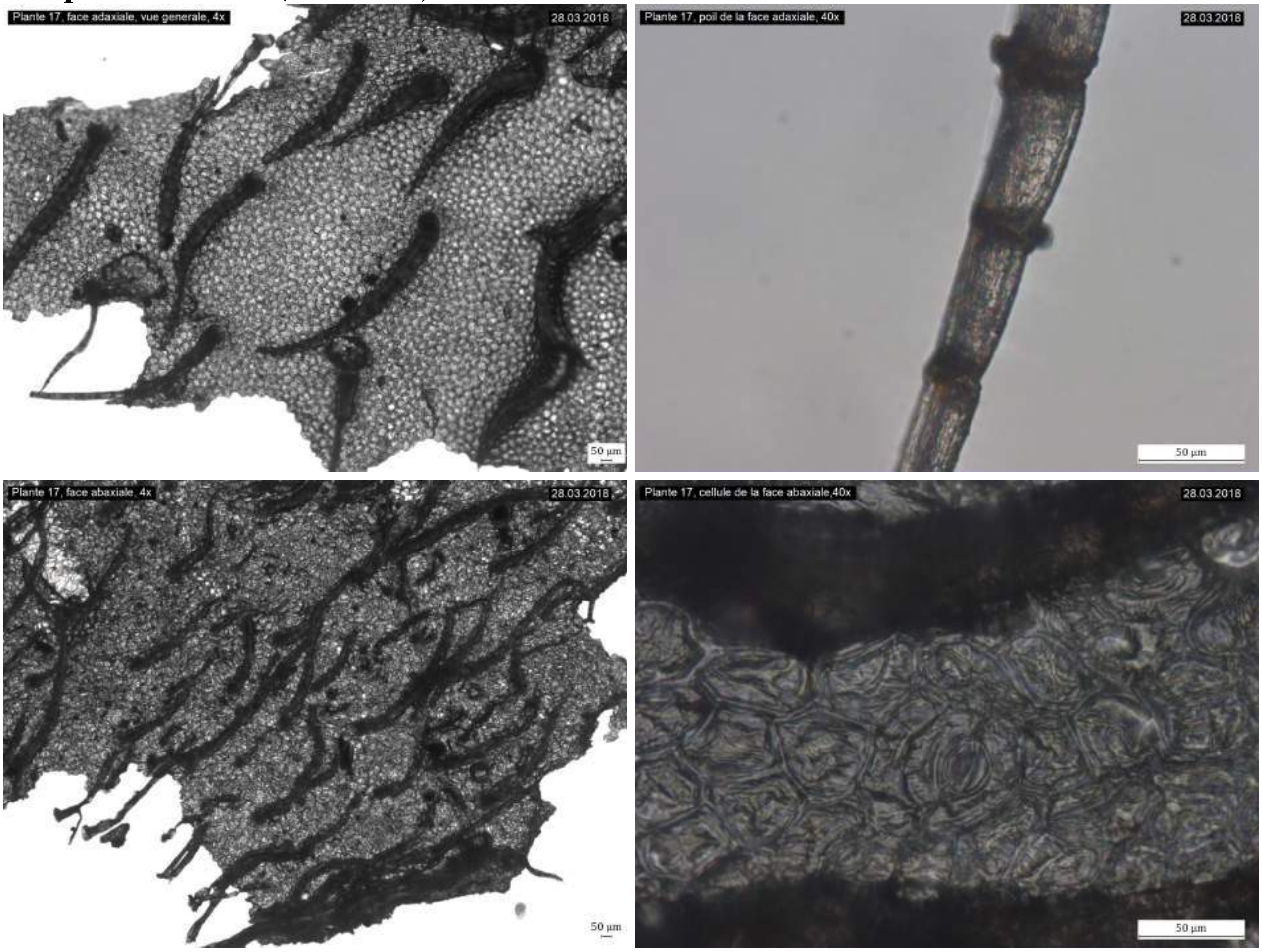
Leaves in macroscopy

Leaves in microscopy (method 1, nailpolish)

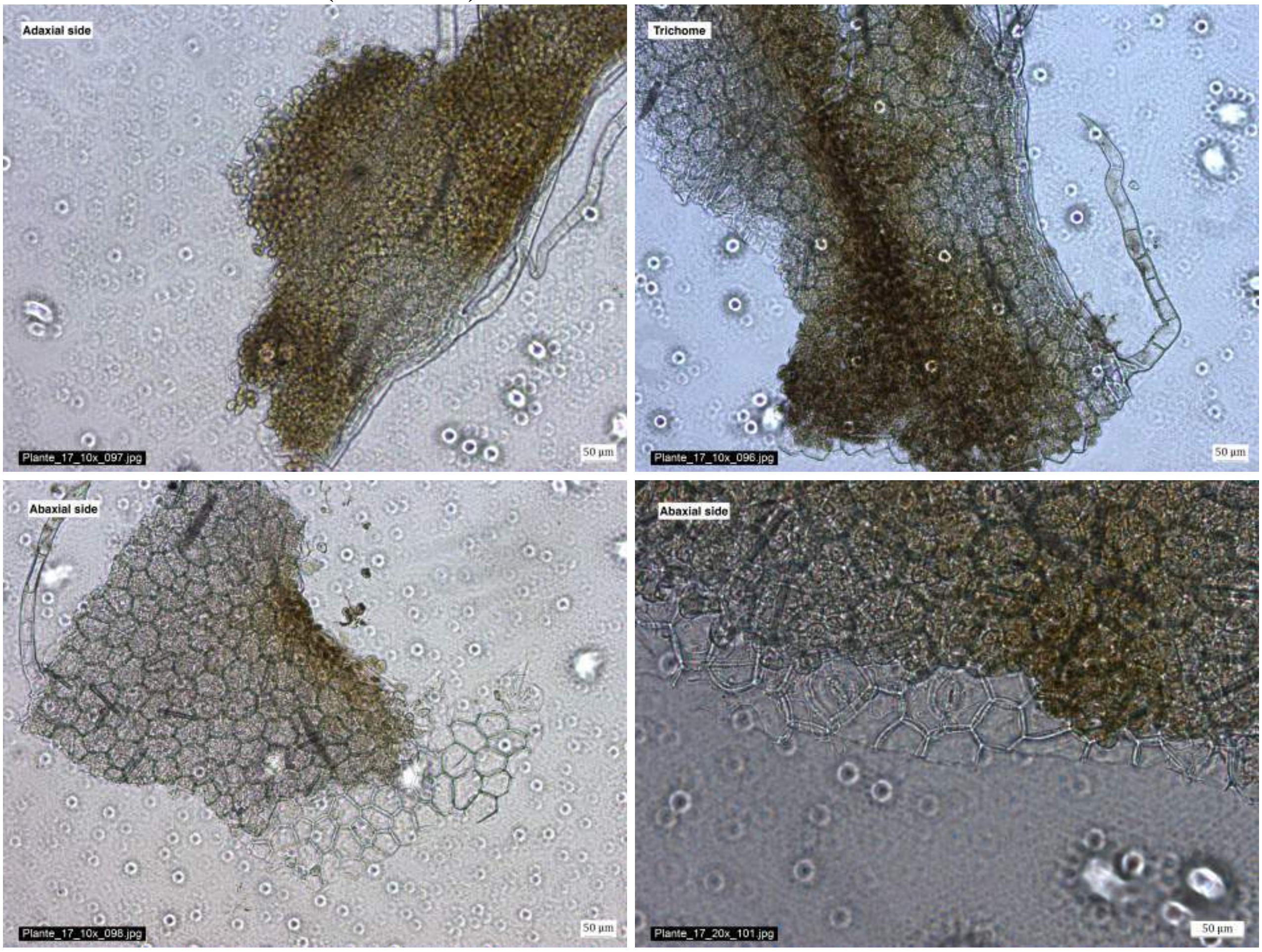




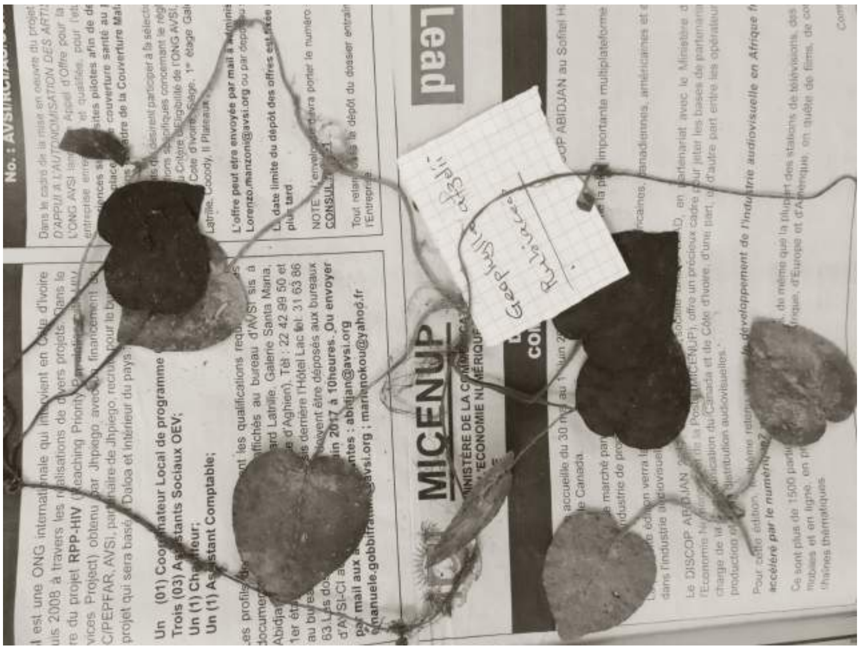
Nailpolish method (method 1)



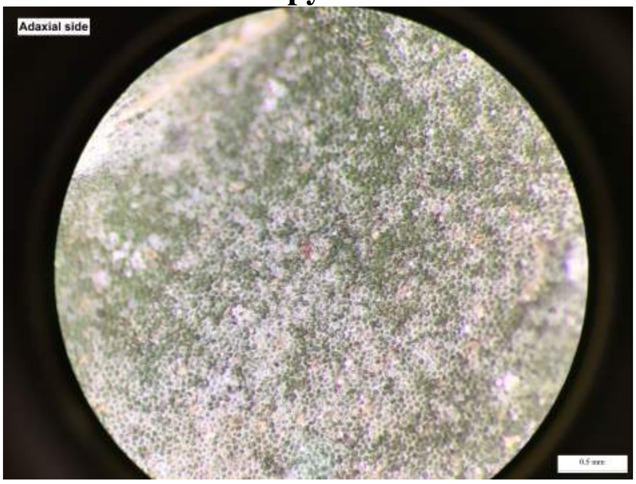
Discoloration method (method 2)

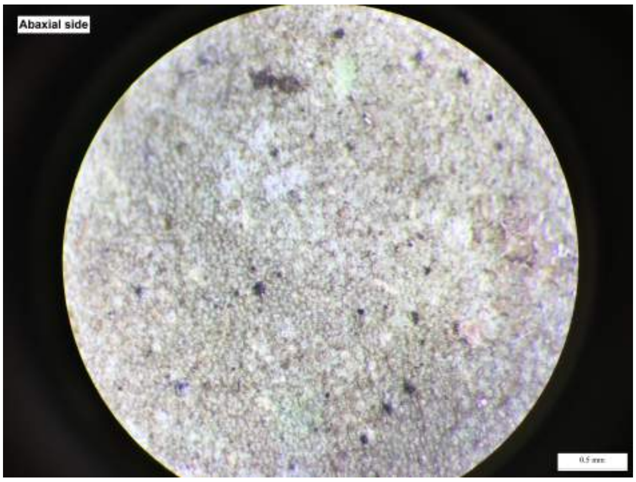


Herbarium plant

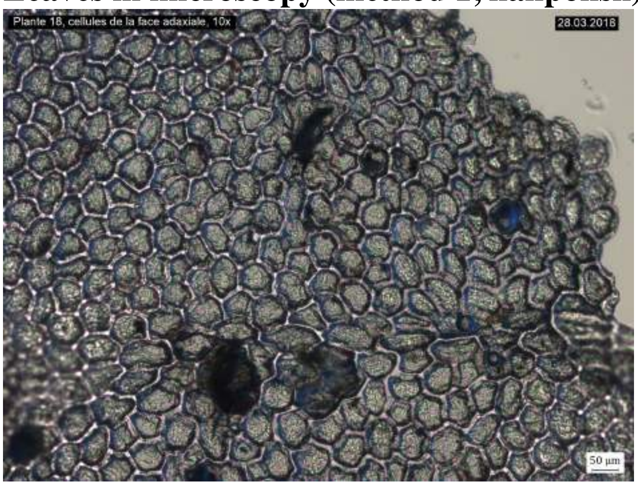


Leaves in macroscopy

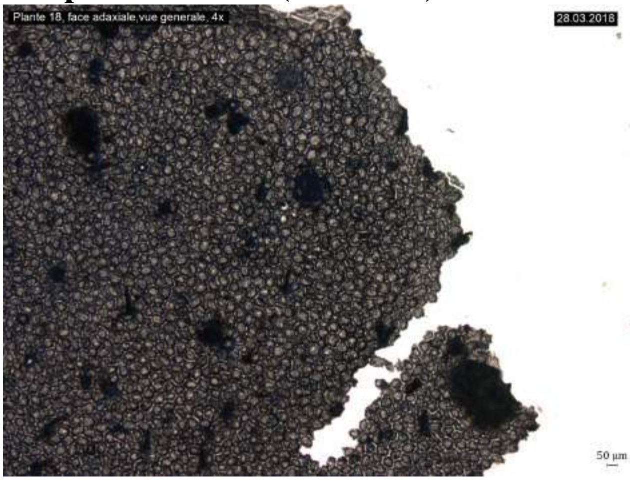


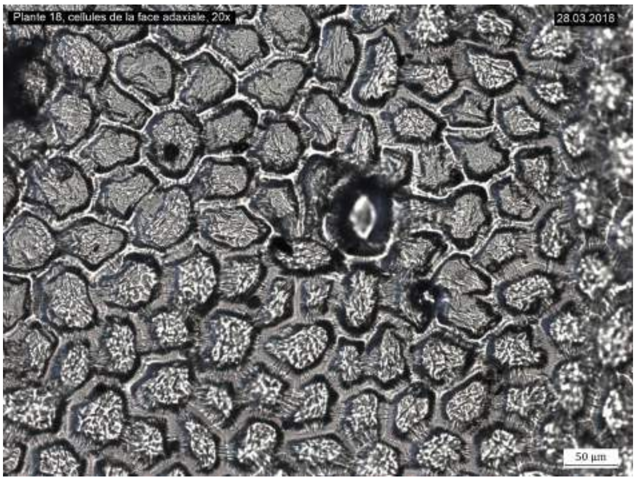


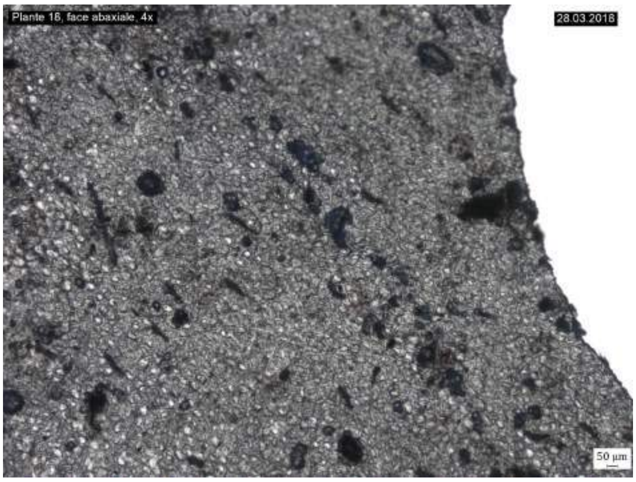
Leaves in microscopy (method 1, nailpolish)

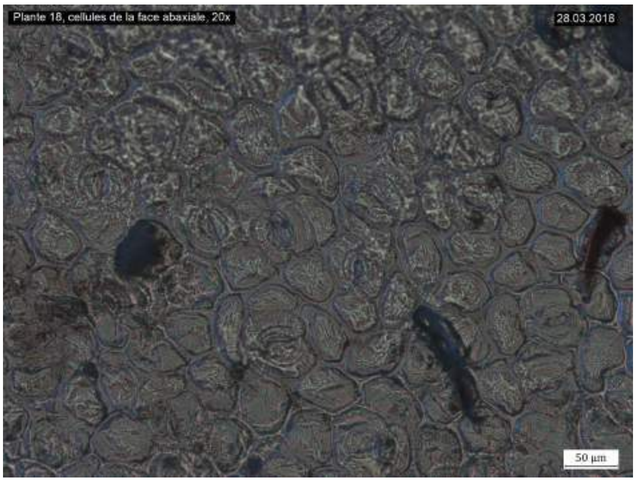


Nailpolish method (method 1)

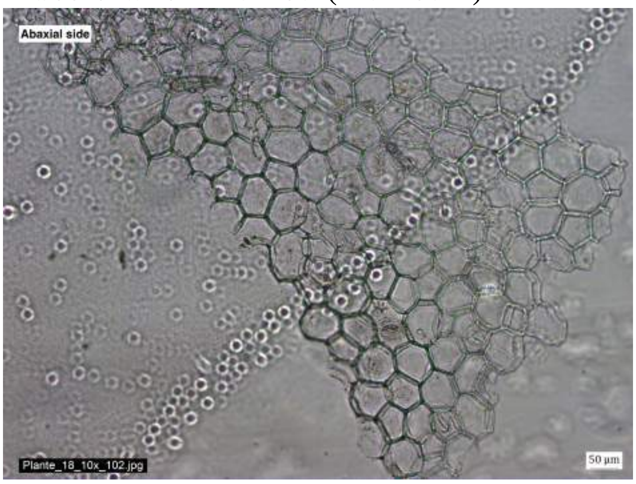


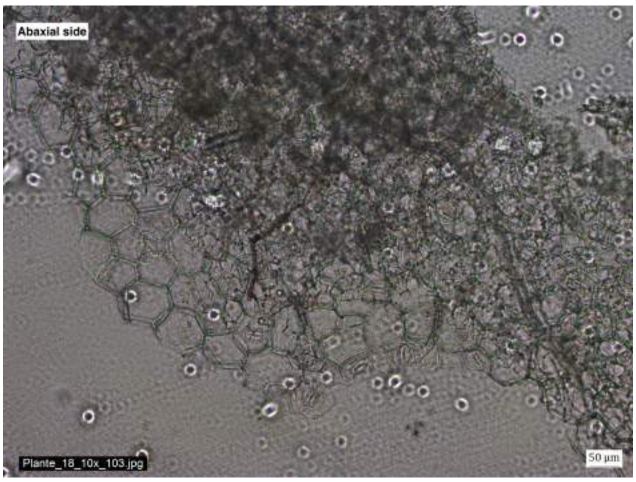


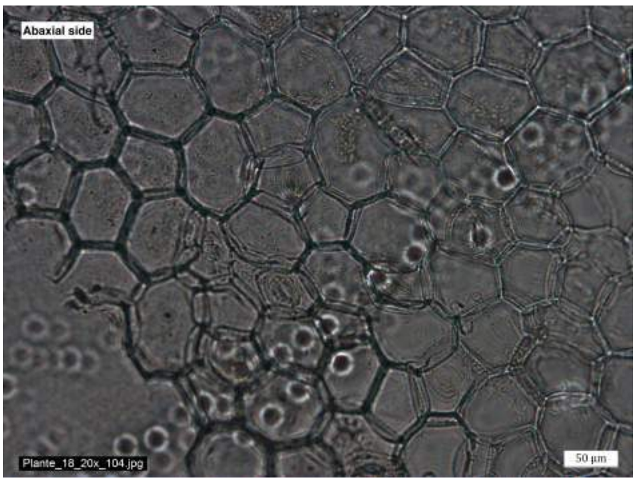




Discoloration method (method 2)







Herbarium plant

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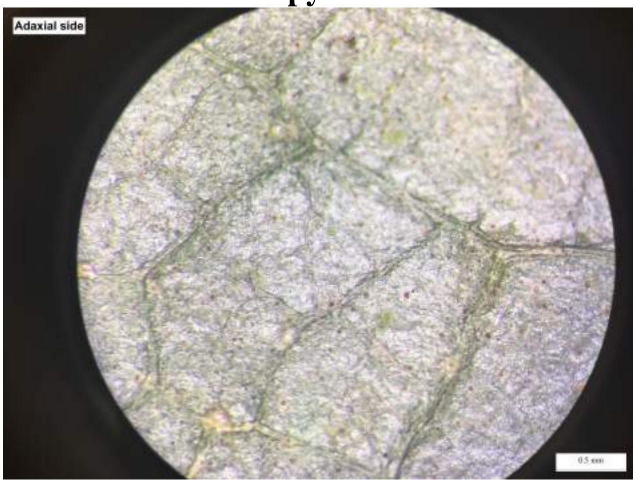
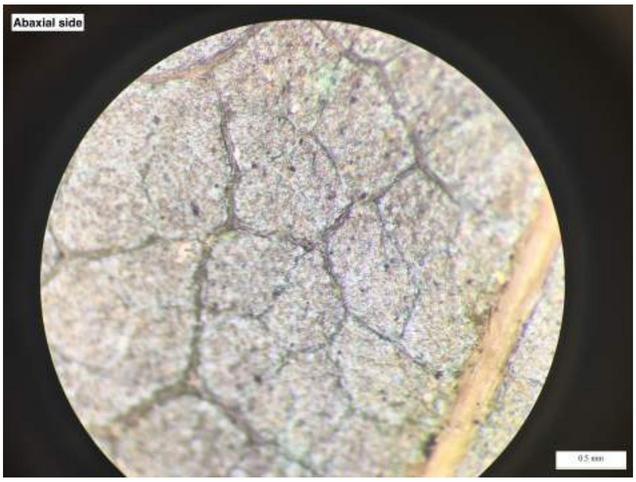
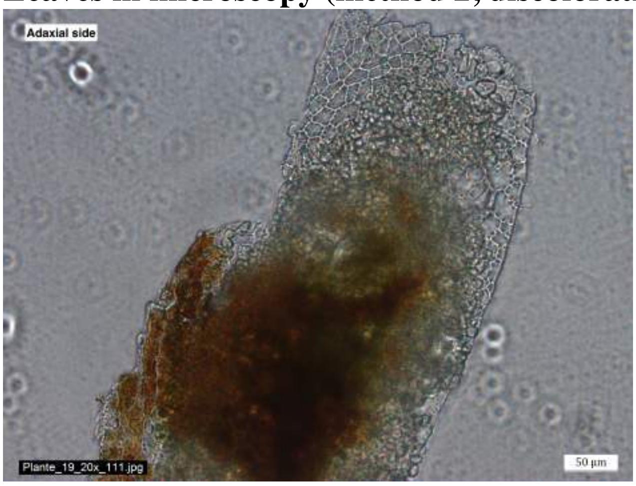
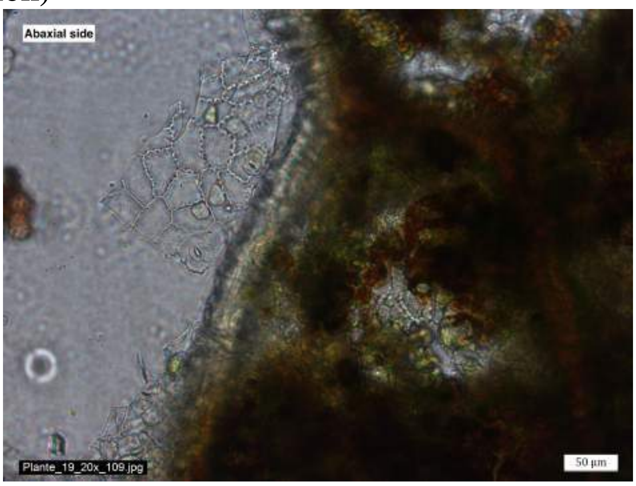
Leaves in macroscopy



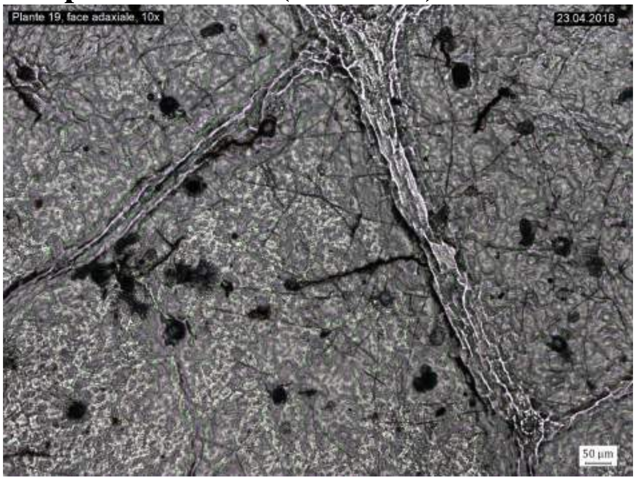


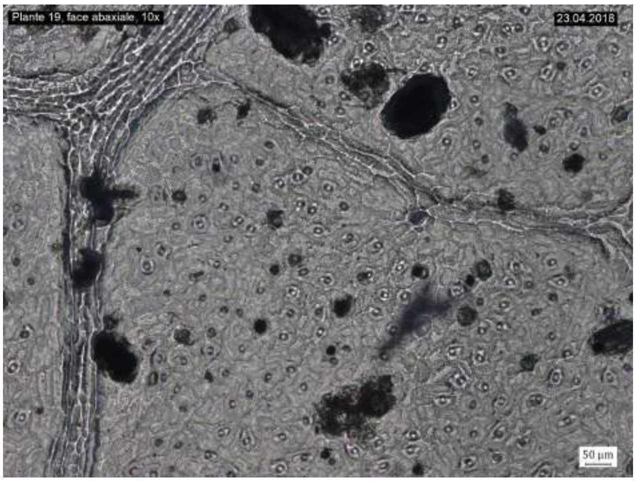
Leaves in microscopy (method 2, discoloration)

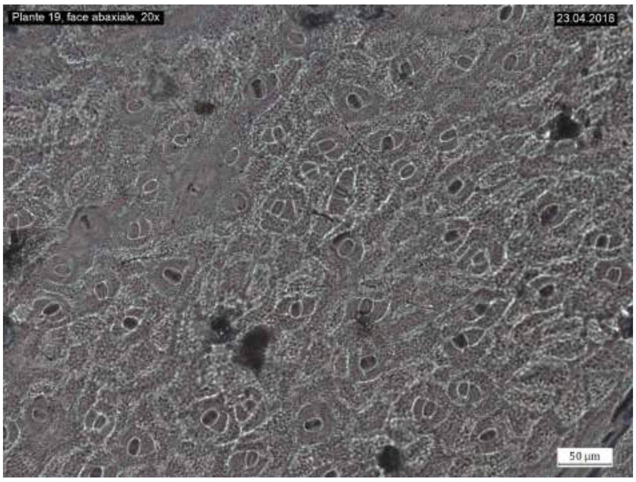




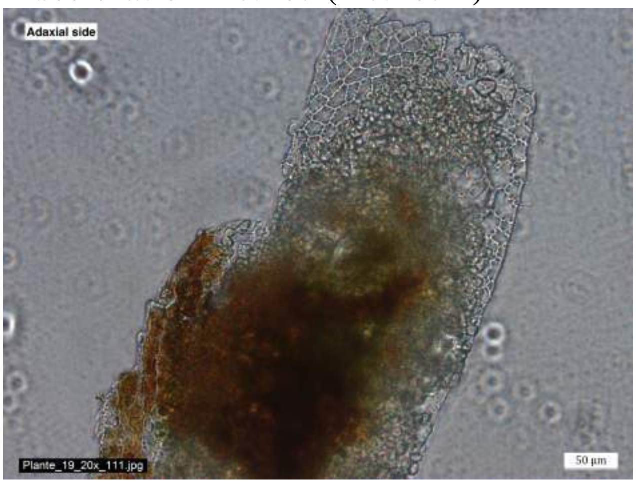
Nailpolish method (method 1)

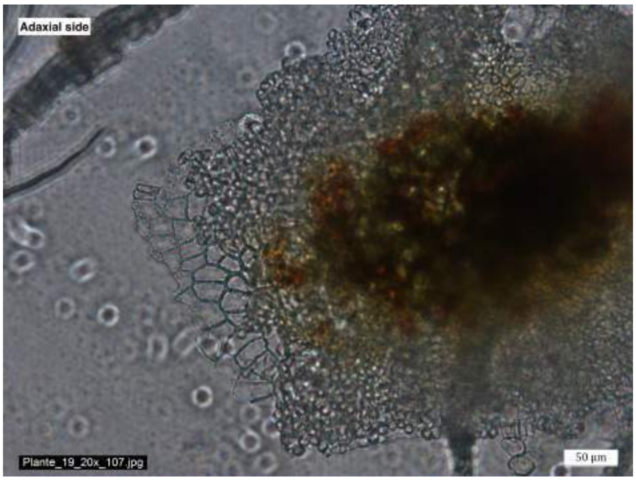


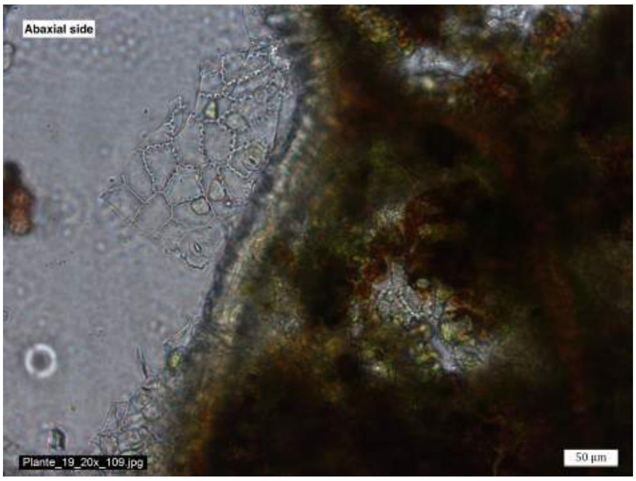




Discoloration method (method 2)







Herbarium plant

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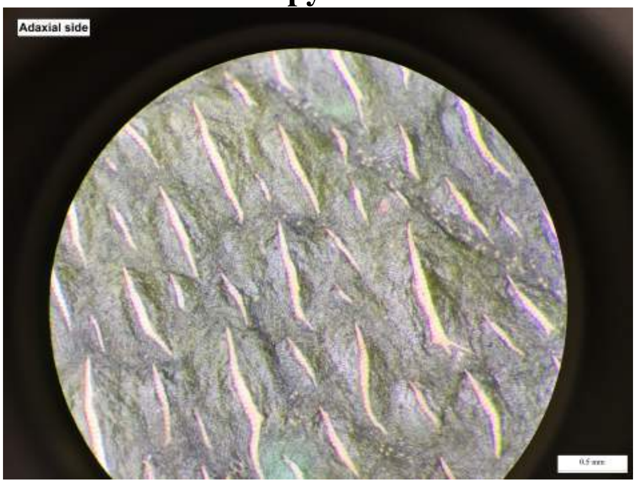
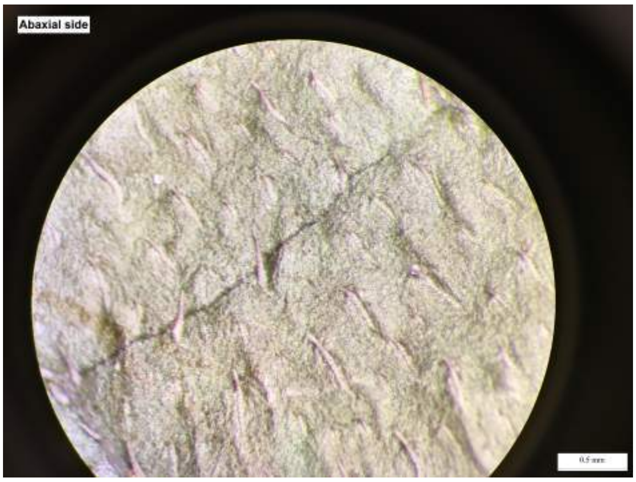
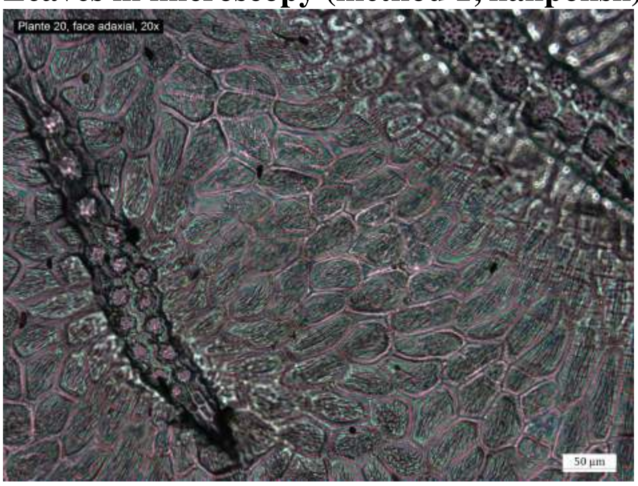
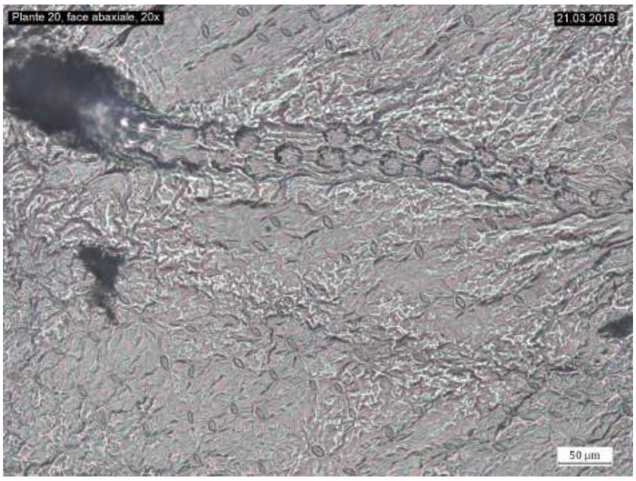
Leaves in macroscopy



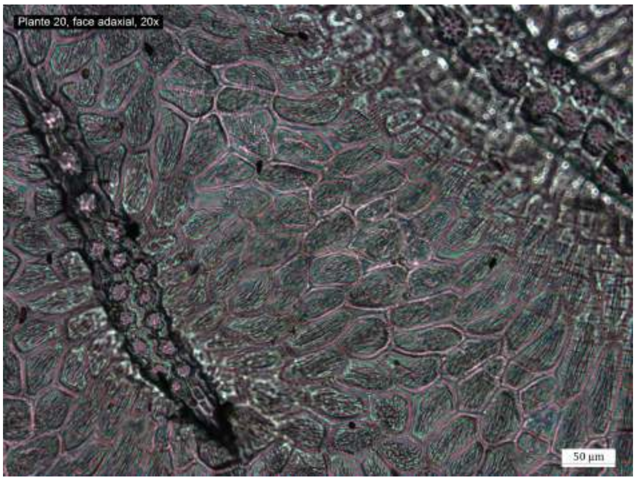


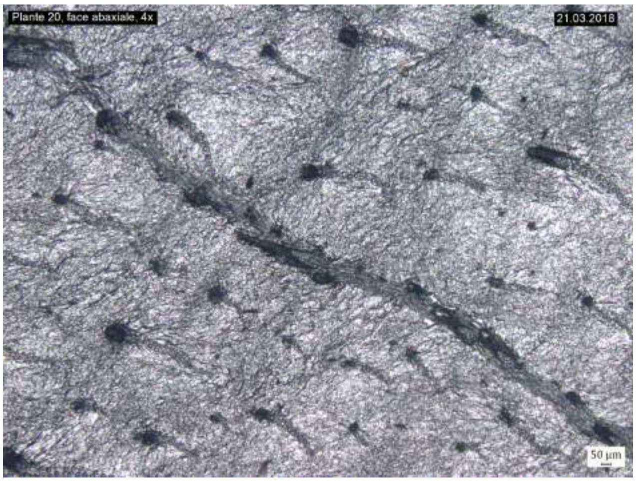
Leaves in microscopy (method 1, nailpolish)

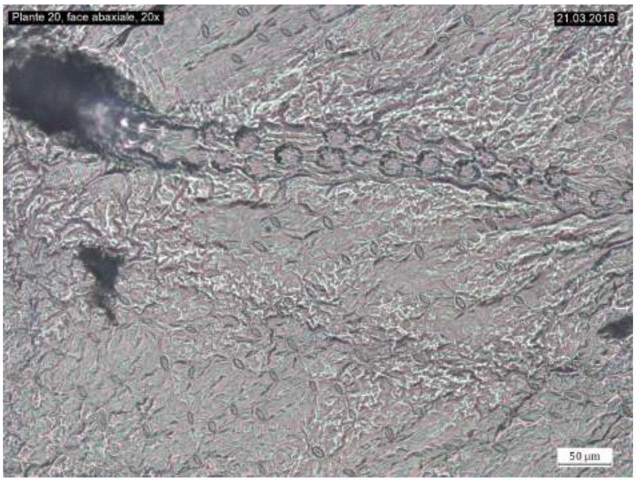




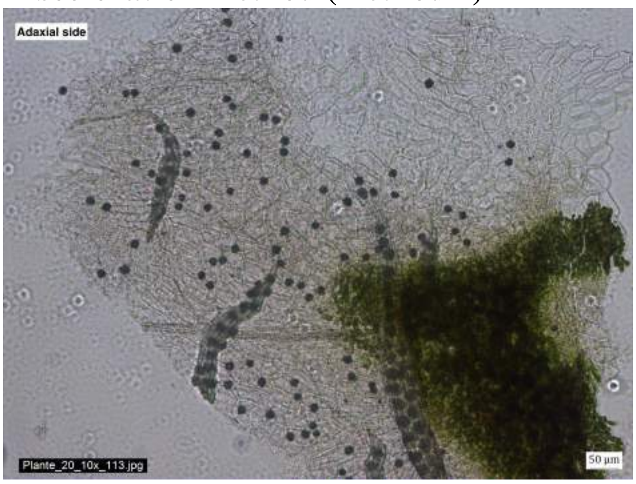
Nailpolish method (method 1)

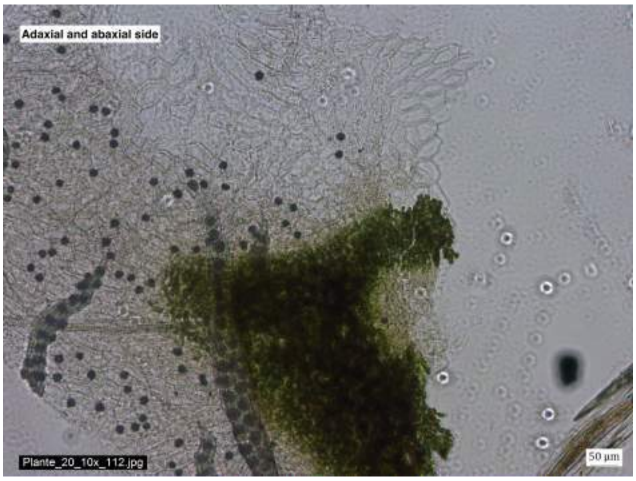


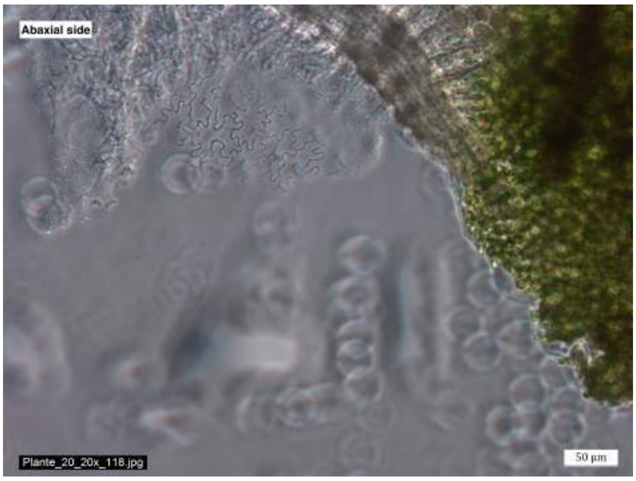




Discoloration method (method 2)

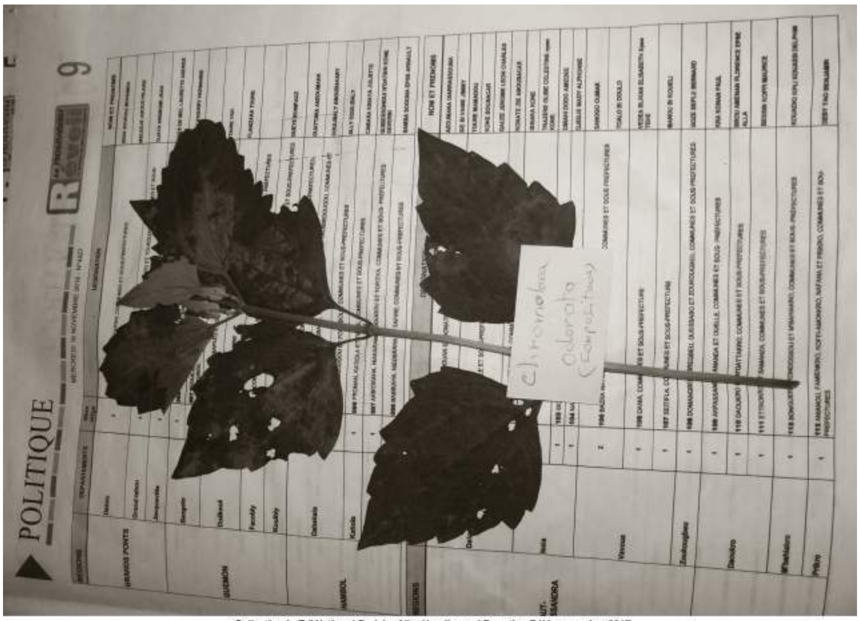






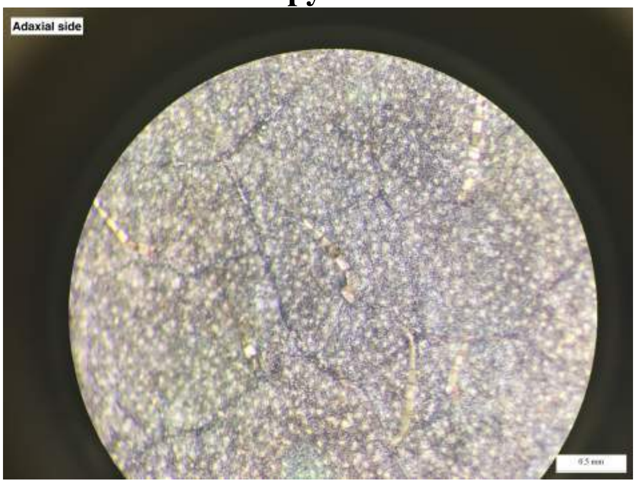
Chromolaena odorata (Plant 21) ASTERACEAE

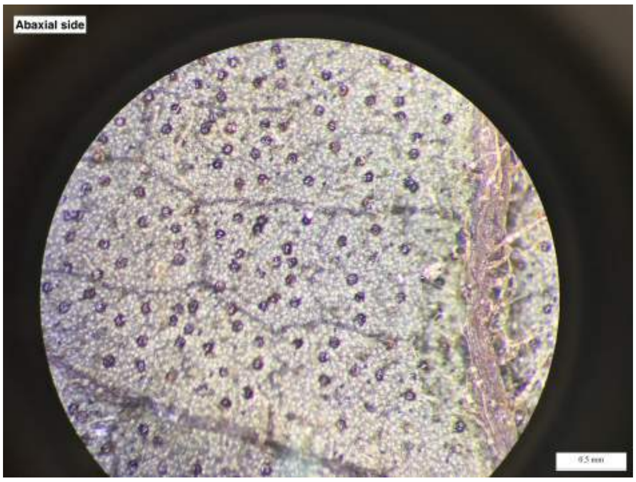
Herbarium plant



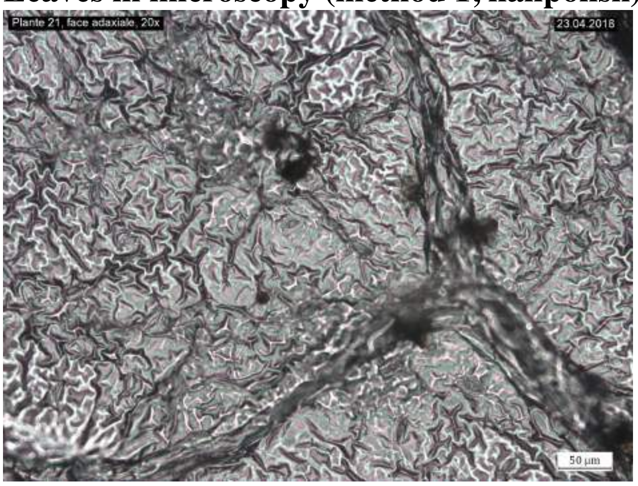
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

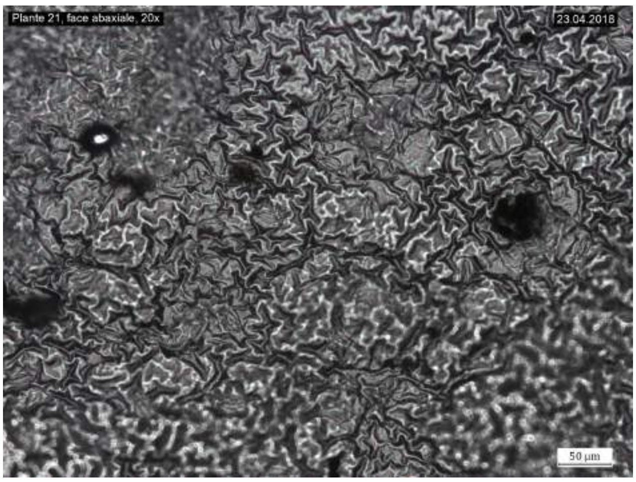
Leaves in macroscopy



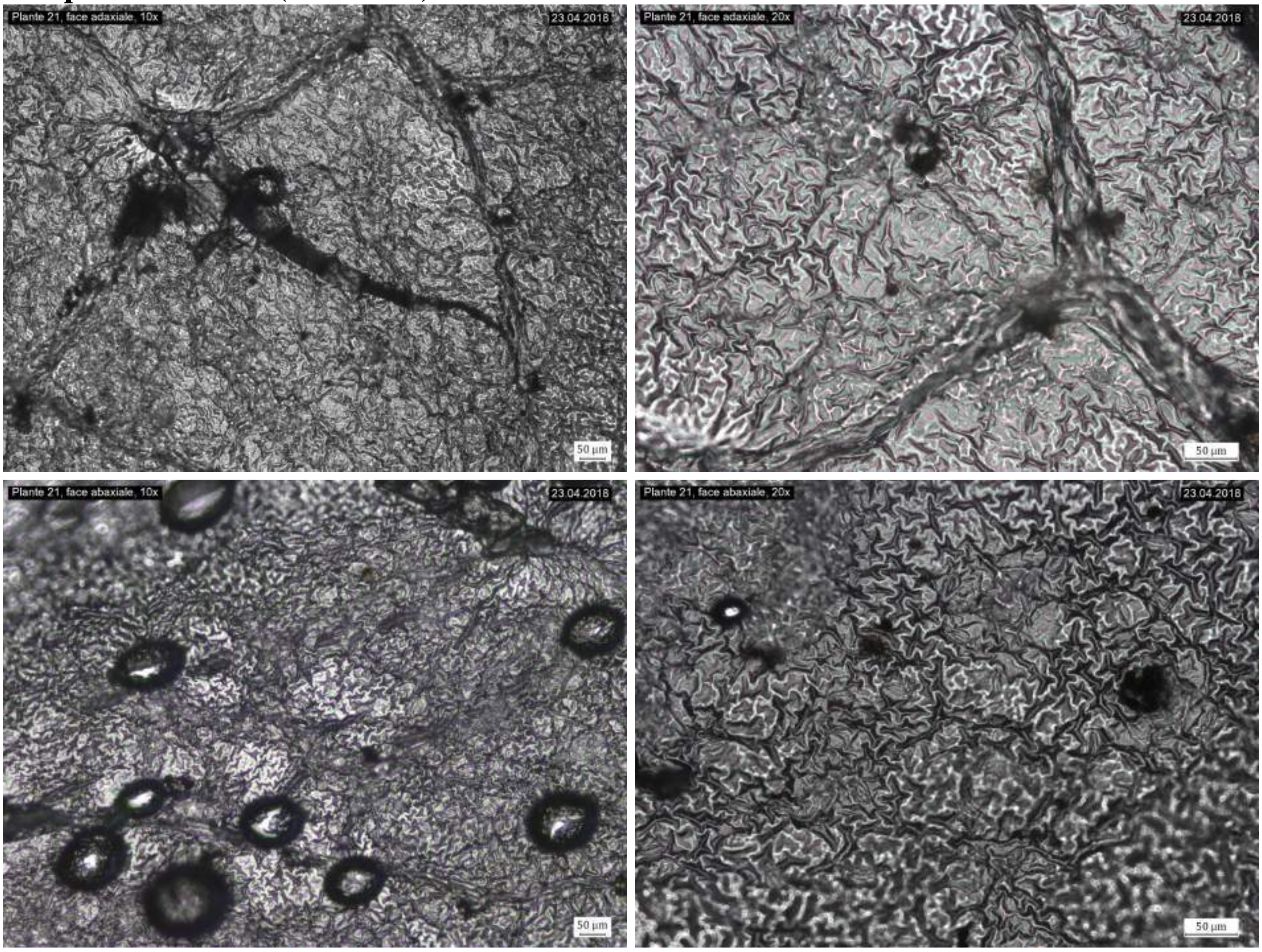


Leaves in microscopy (method 1, nailpolish)





Nailpolish method (method 1)



Discoloration method (method 2)

No references available

Herbarium plant

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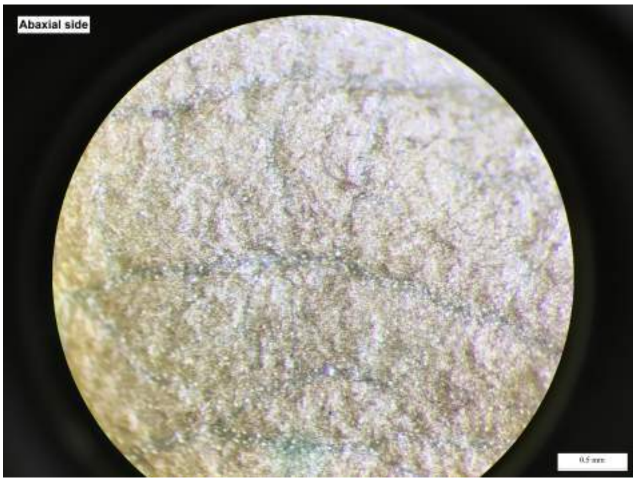
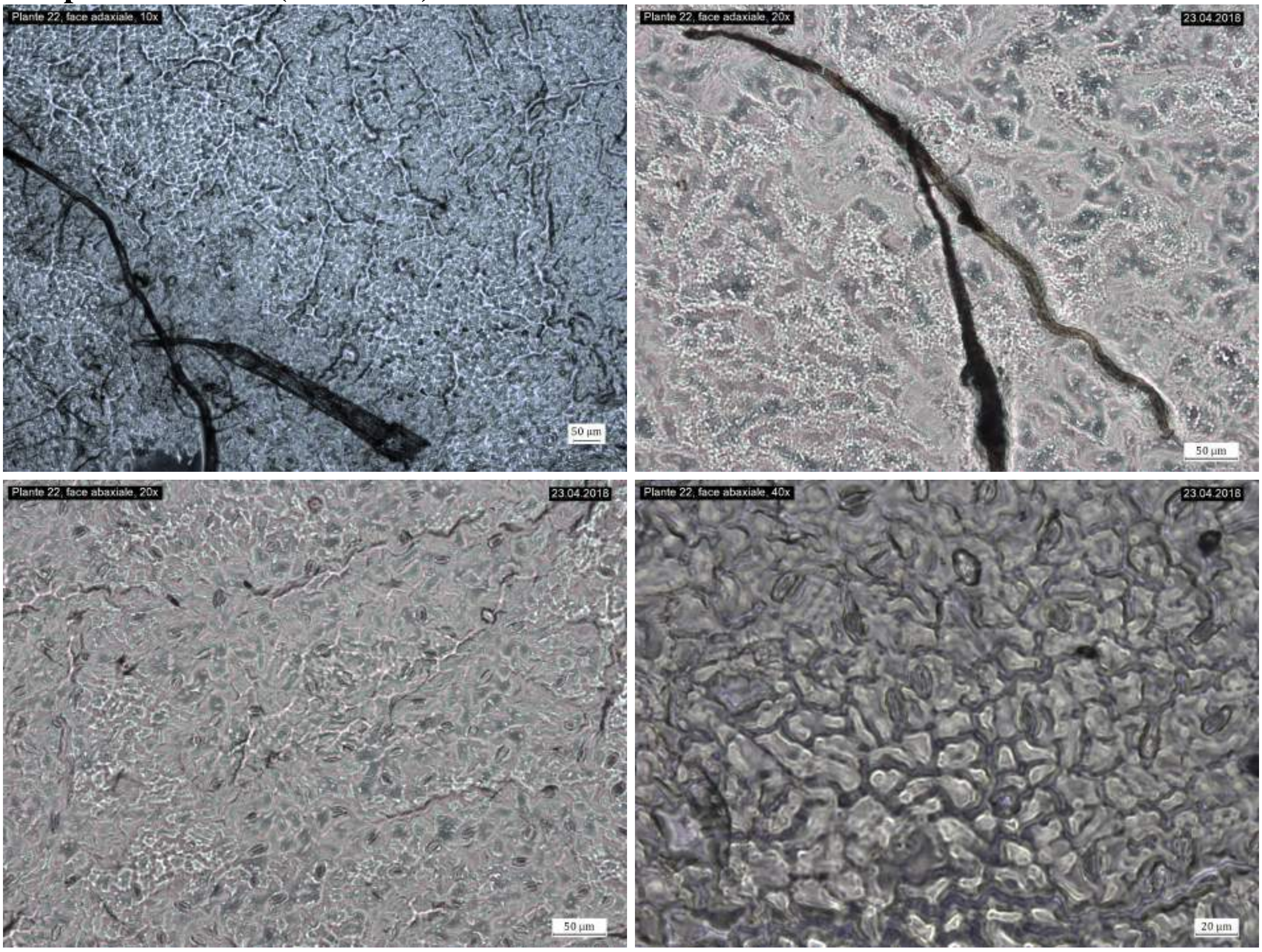
Leaves in macroscopy

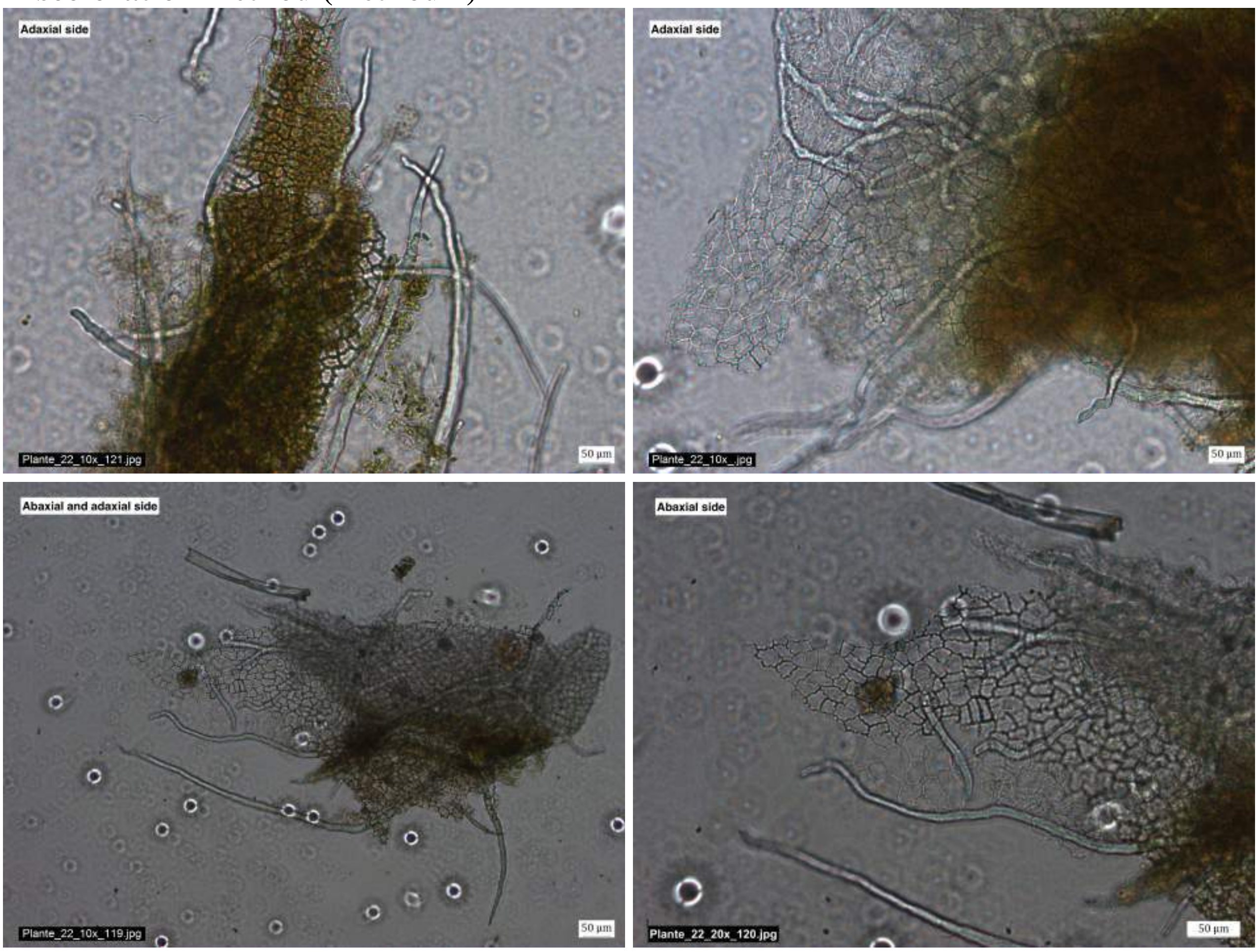


Leaves in microscopy (method 2, discoloration)

Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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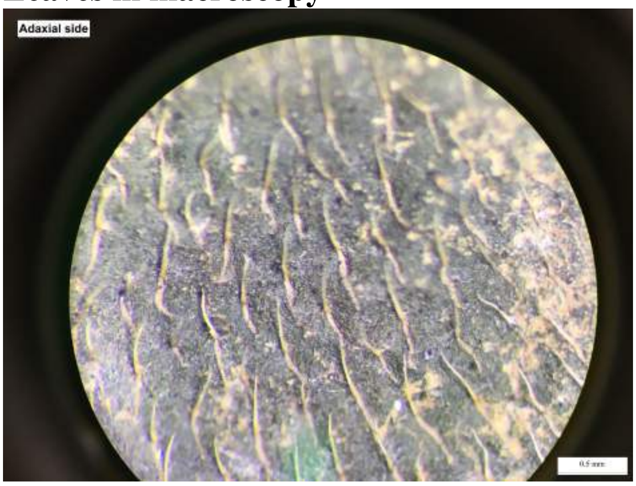
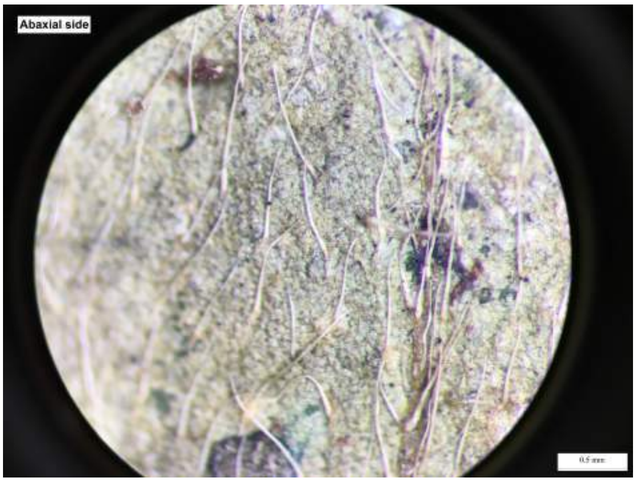
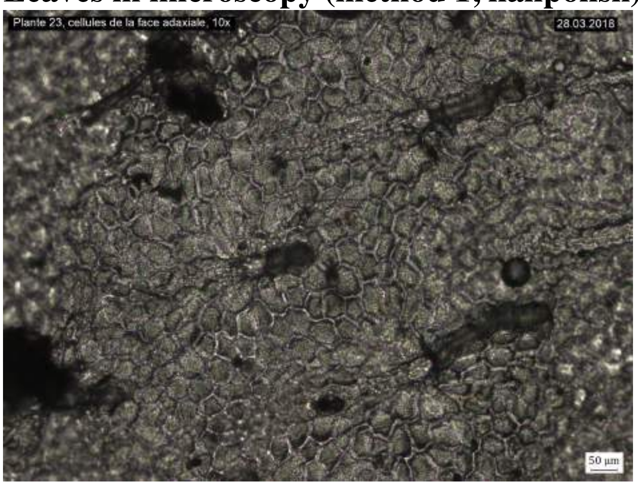
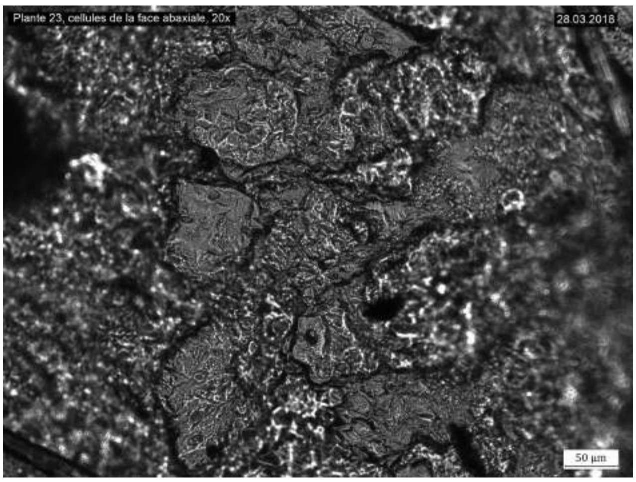
Leaves in macroscopy



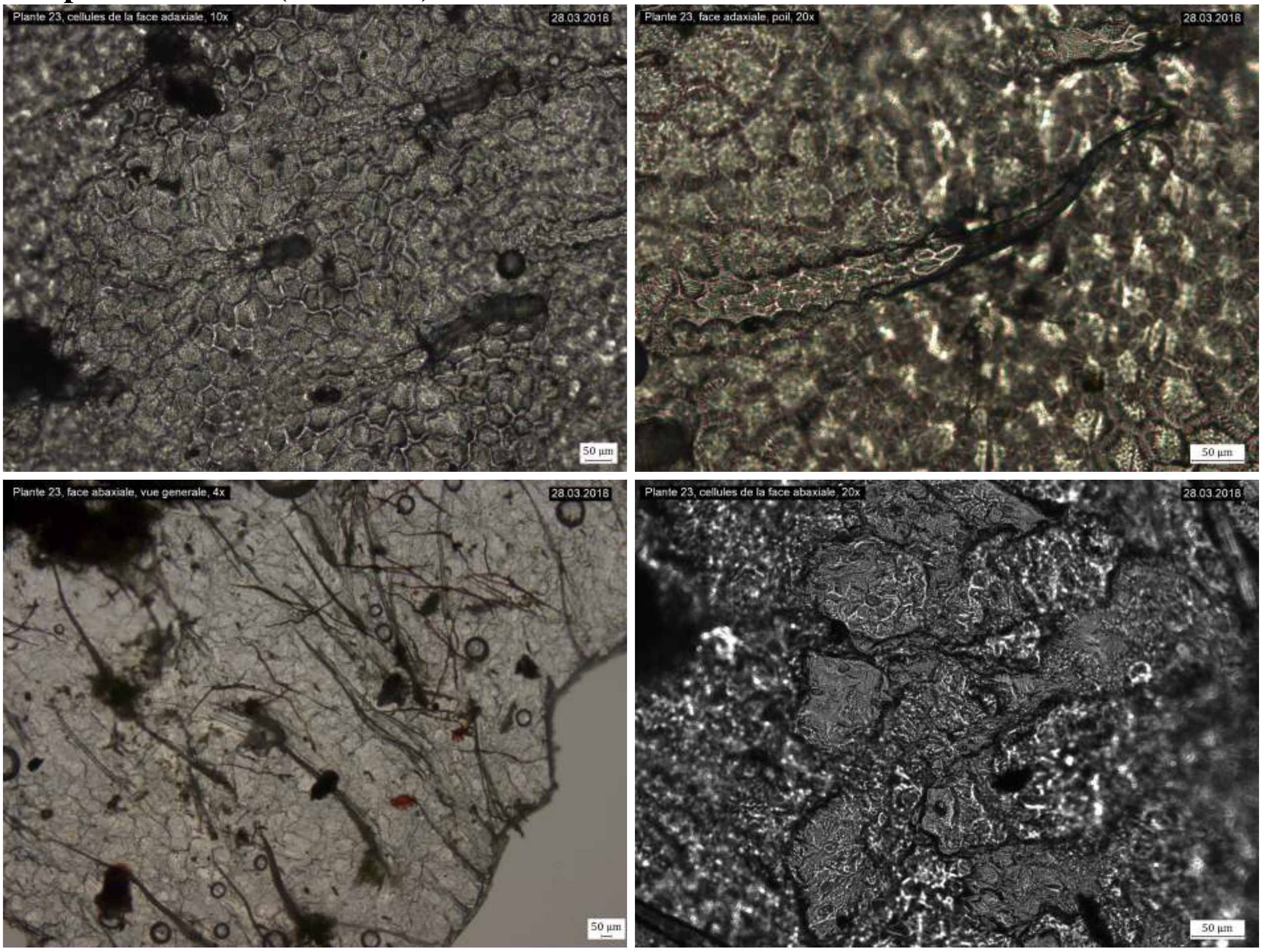


Leaves in microscopy (method 1, nailpolish)





Nailpolish method (method 1)



Discoloration method (method 2)

No references available

Herbarium plant

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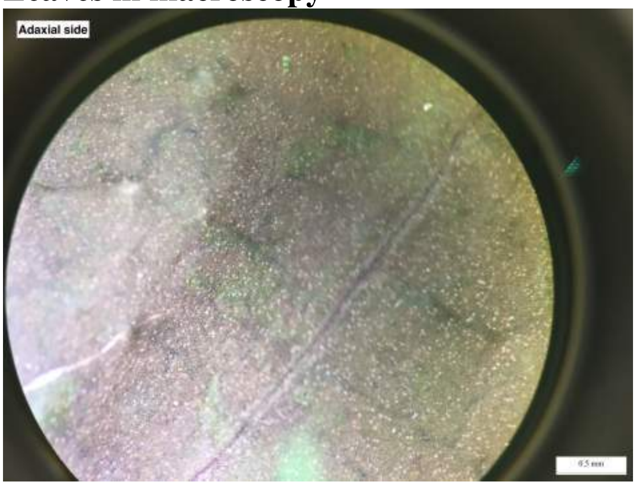
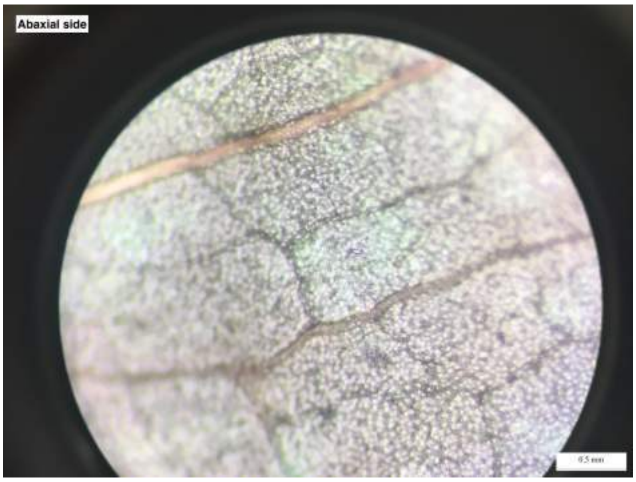
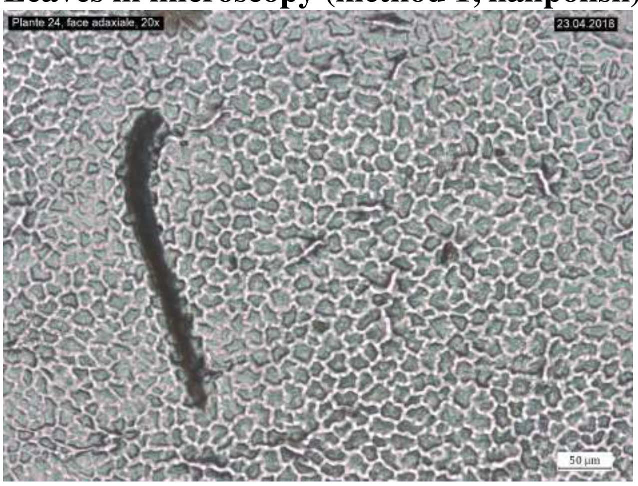
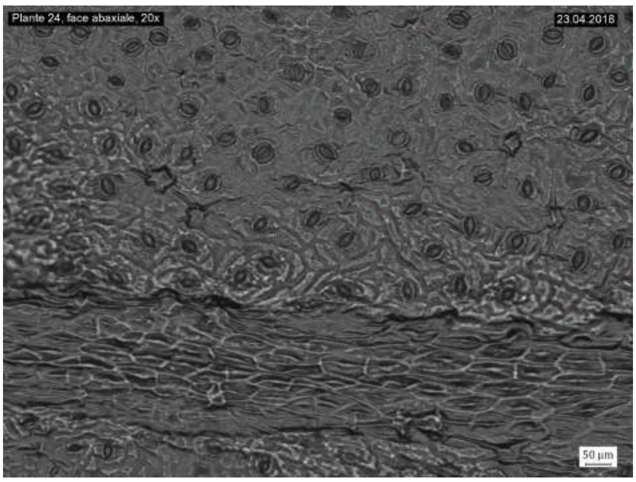
Leaves in macroscopy



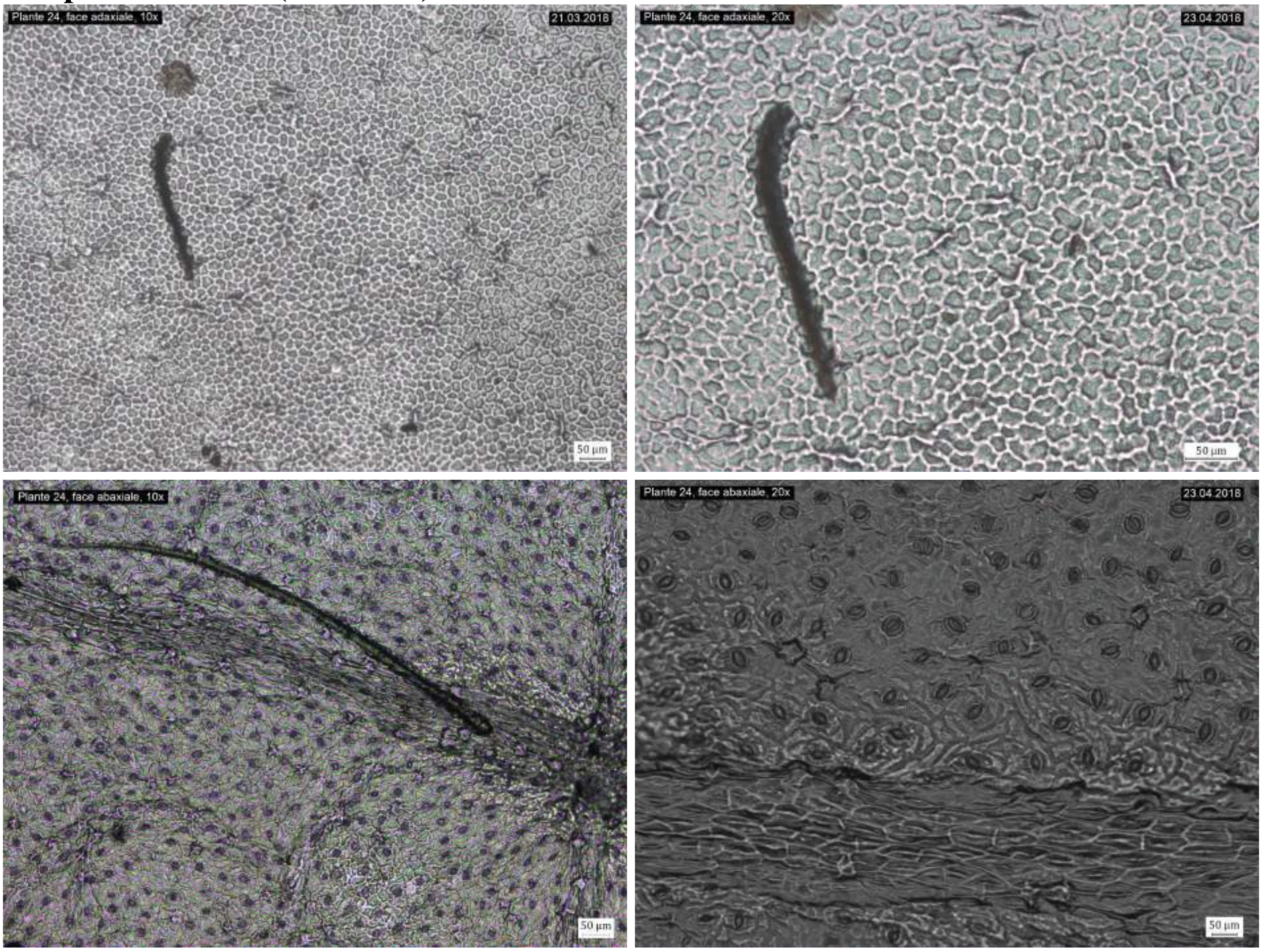


Leaves in microscopy (method 1, nailpolish)





Nailpolish method (method 1)



Discoloration method (method 2)

No references available

Herbarium plant

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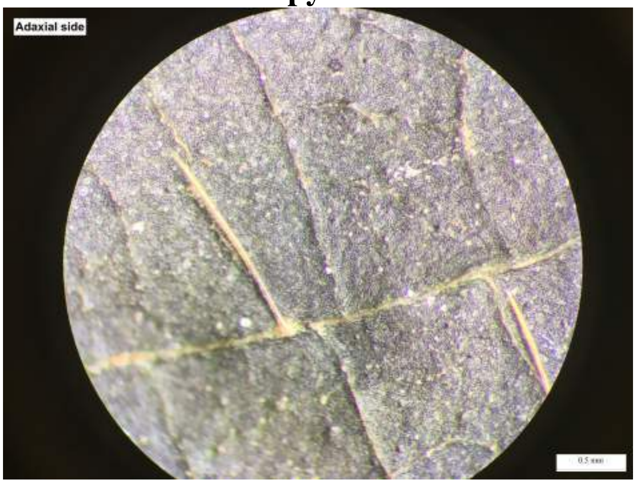
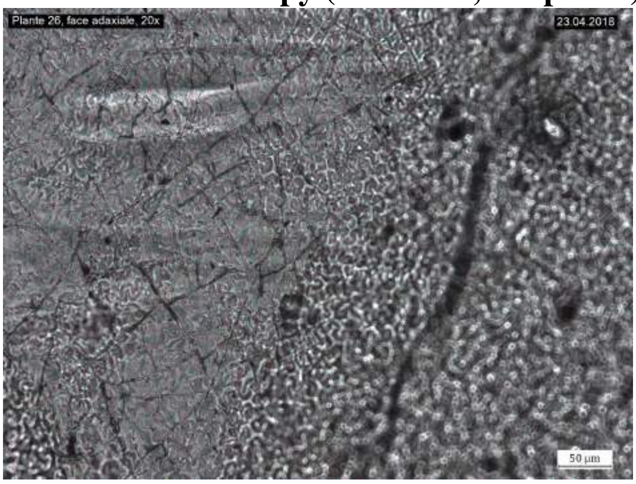
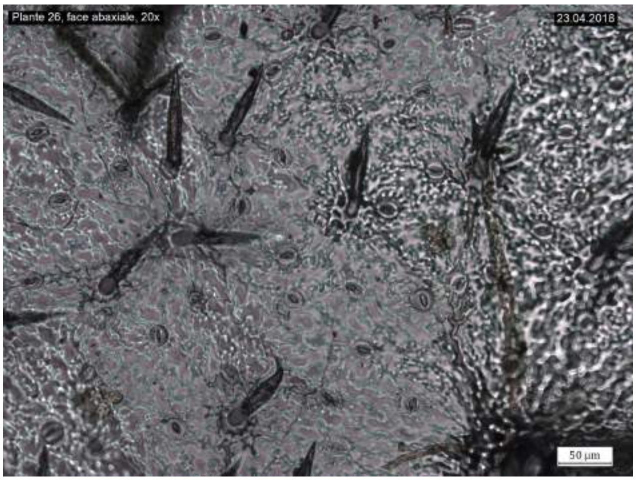
Leaves in macroscopy

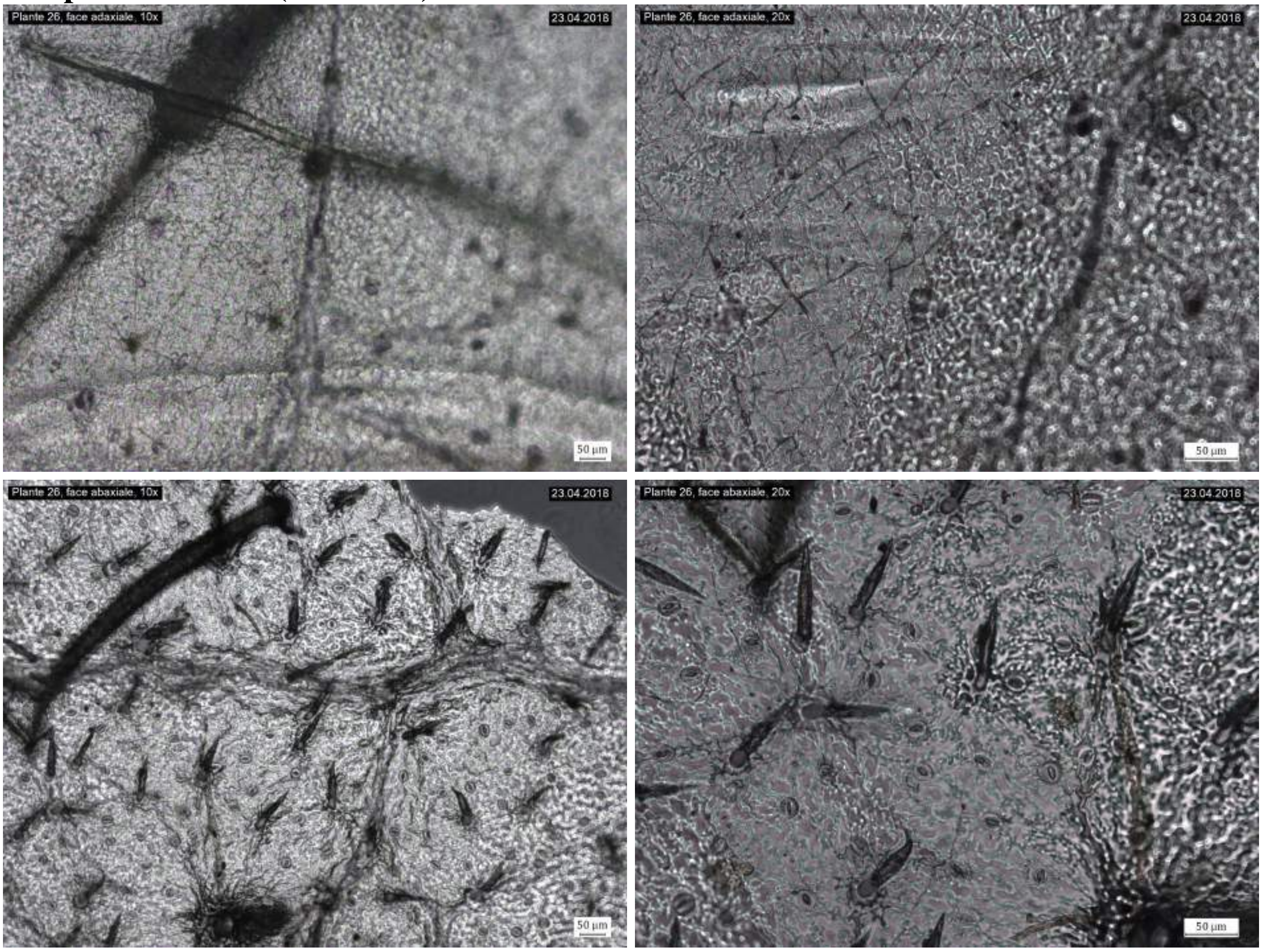


Leaves in microscopy (method 1, nailpolish)

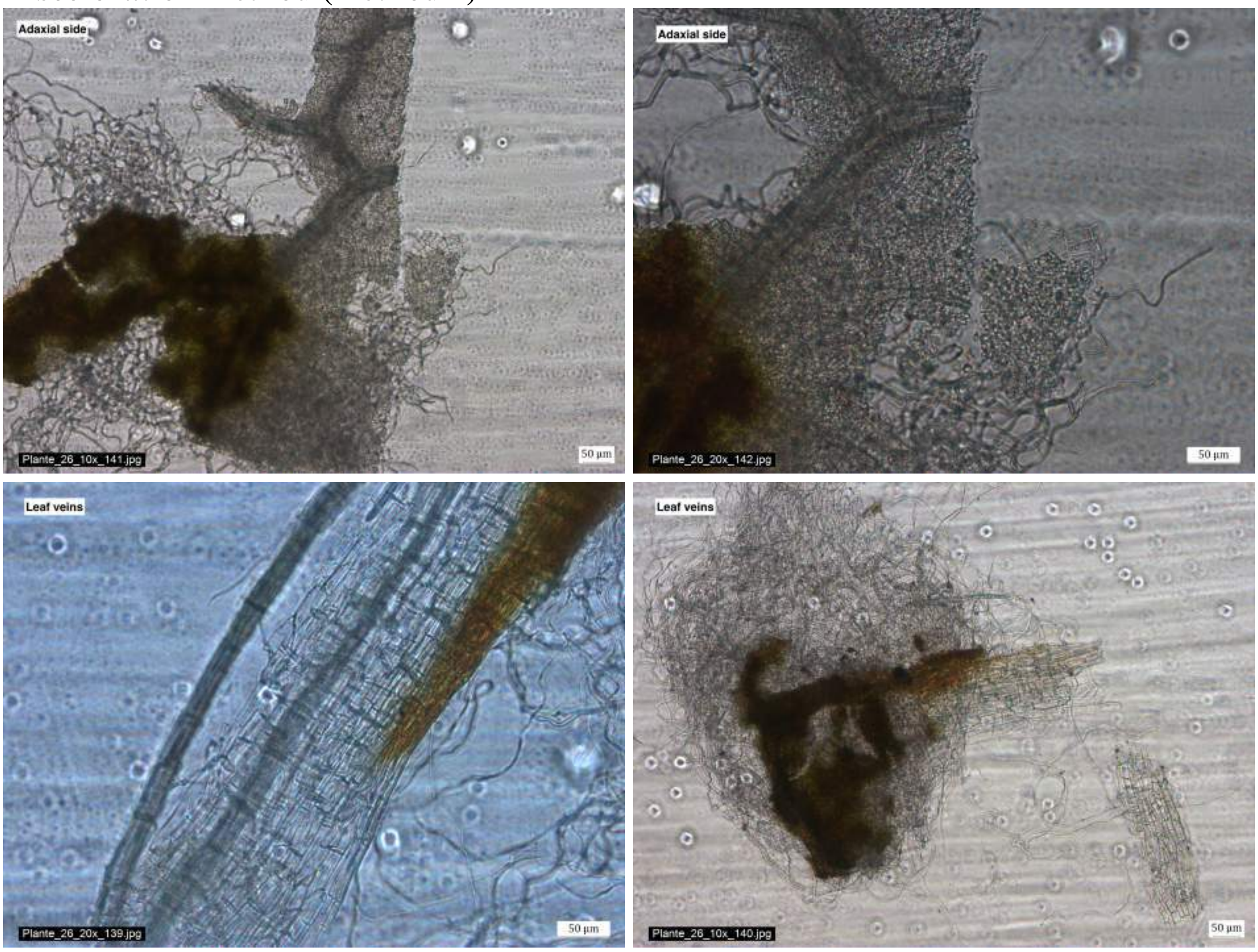




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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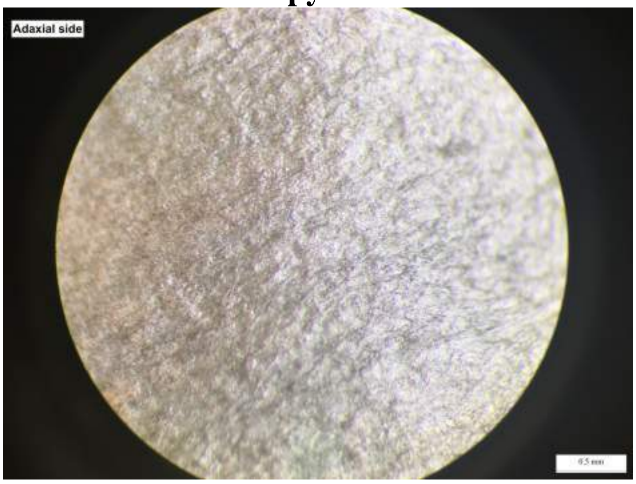
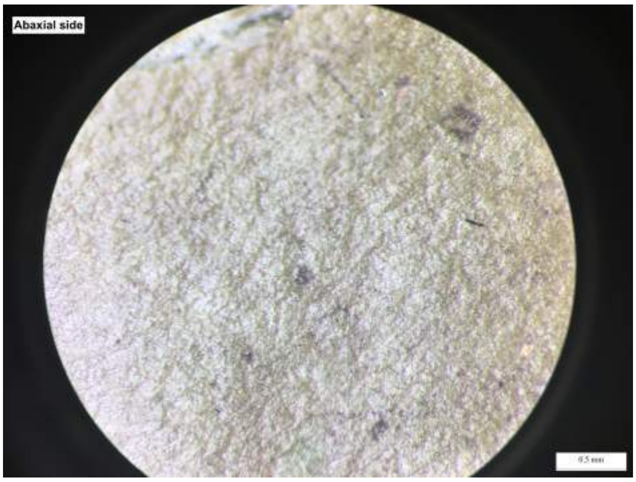
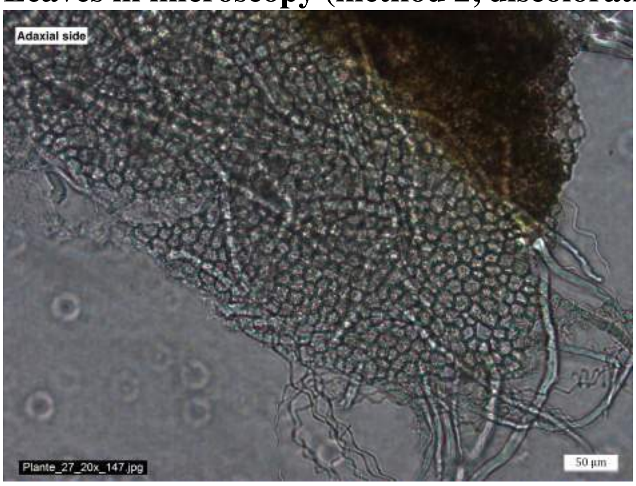
Leaves in macroscopy

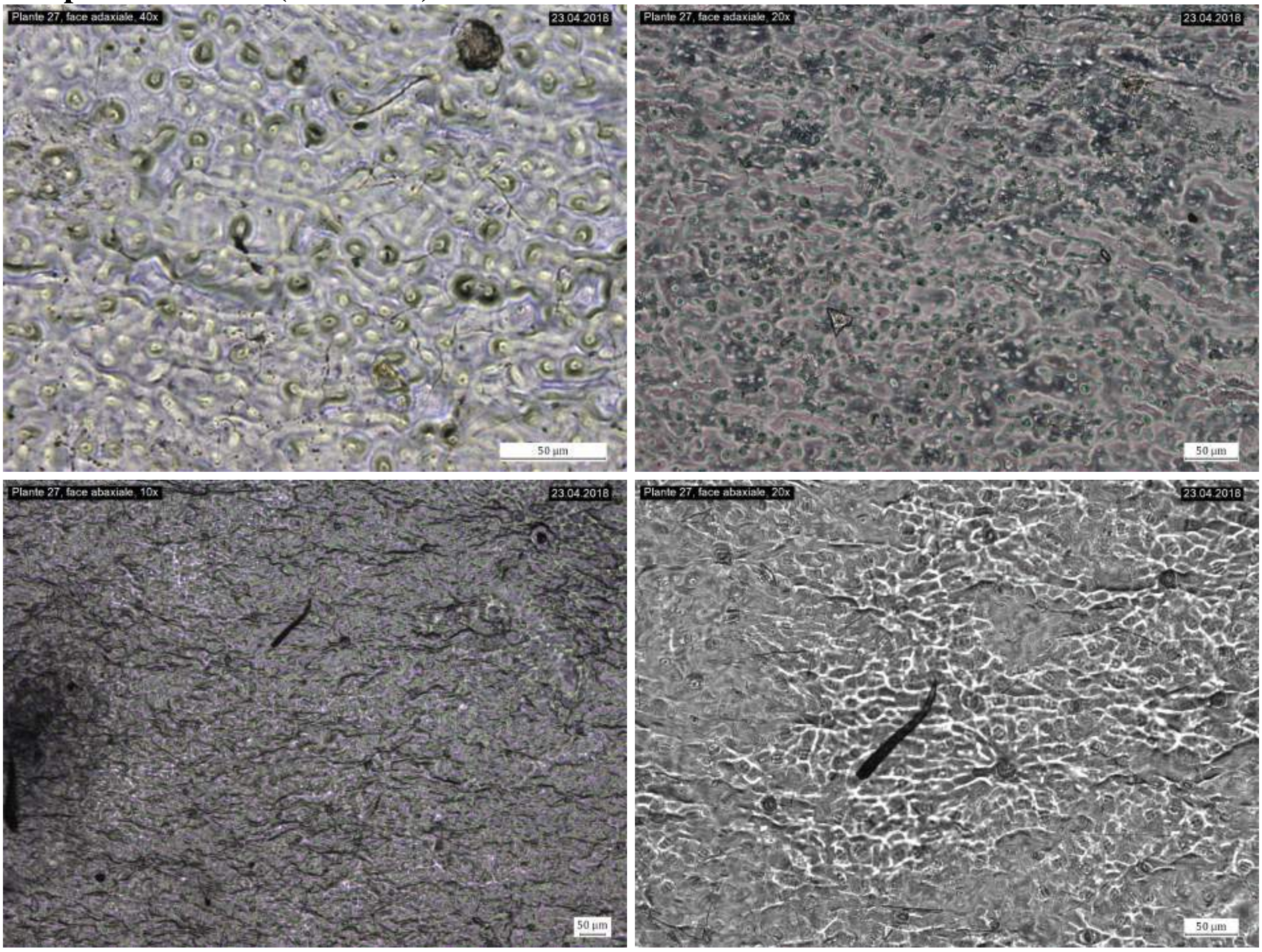




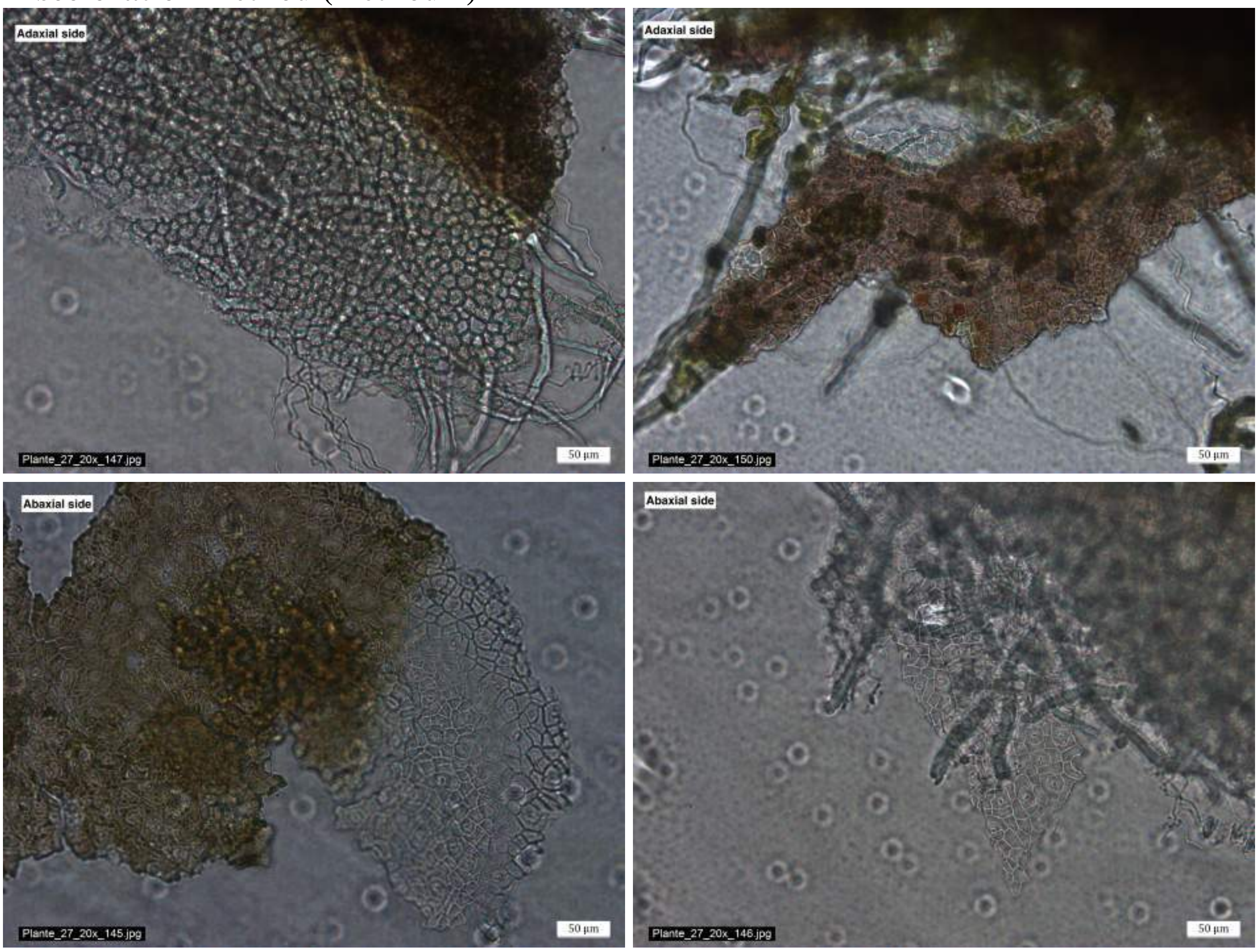
Leaves in microscopy (method 2, discoloration)



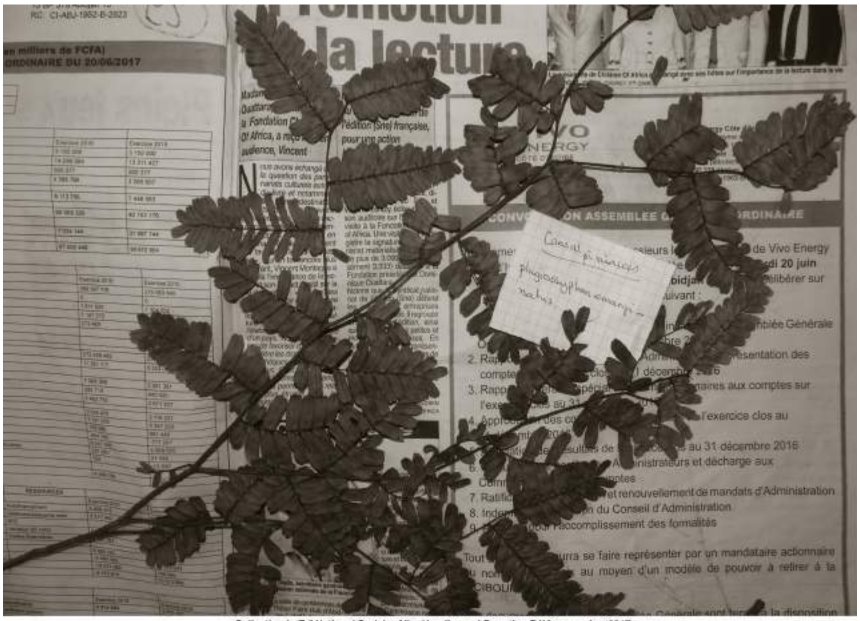
Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant



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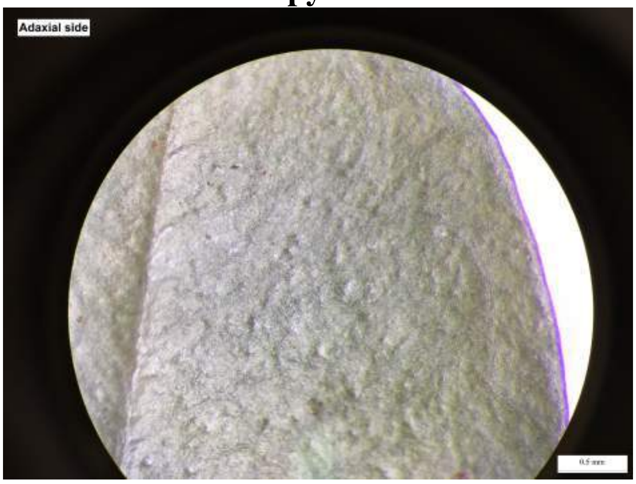
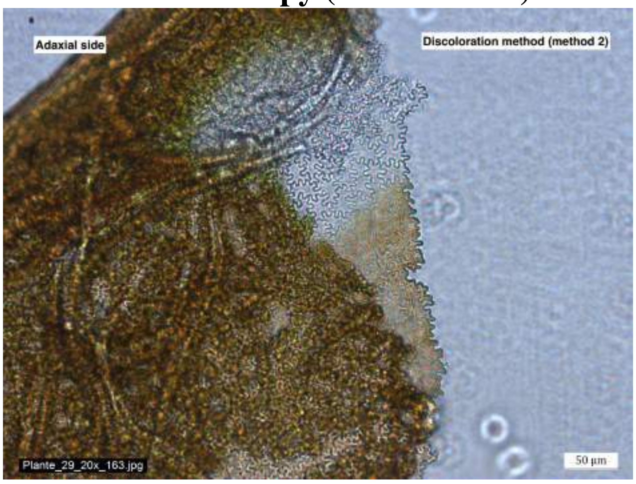
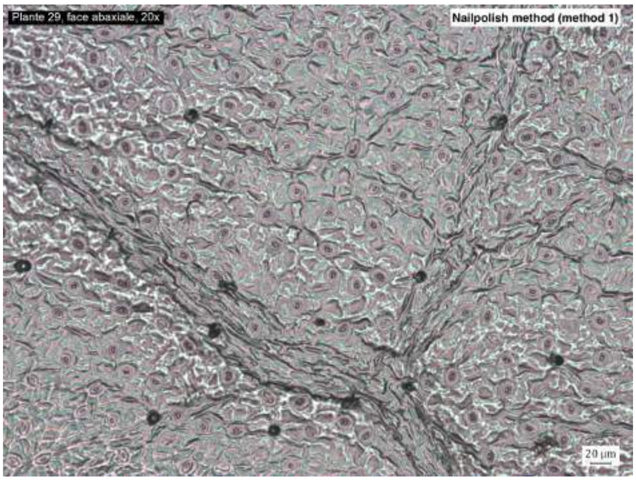
Leaves in macroscopy

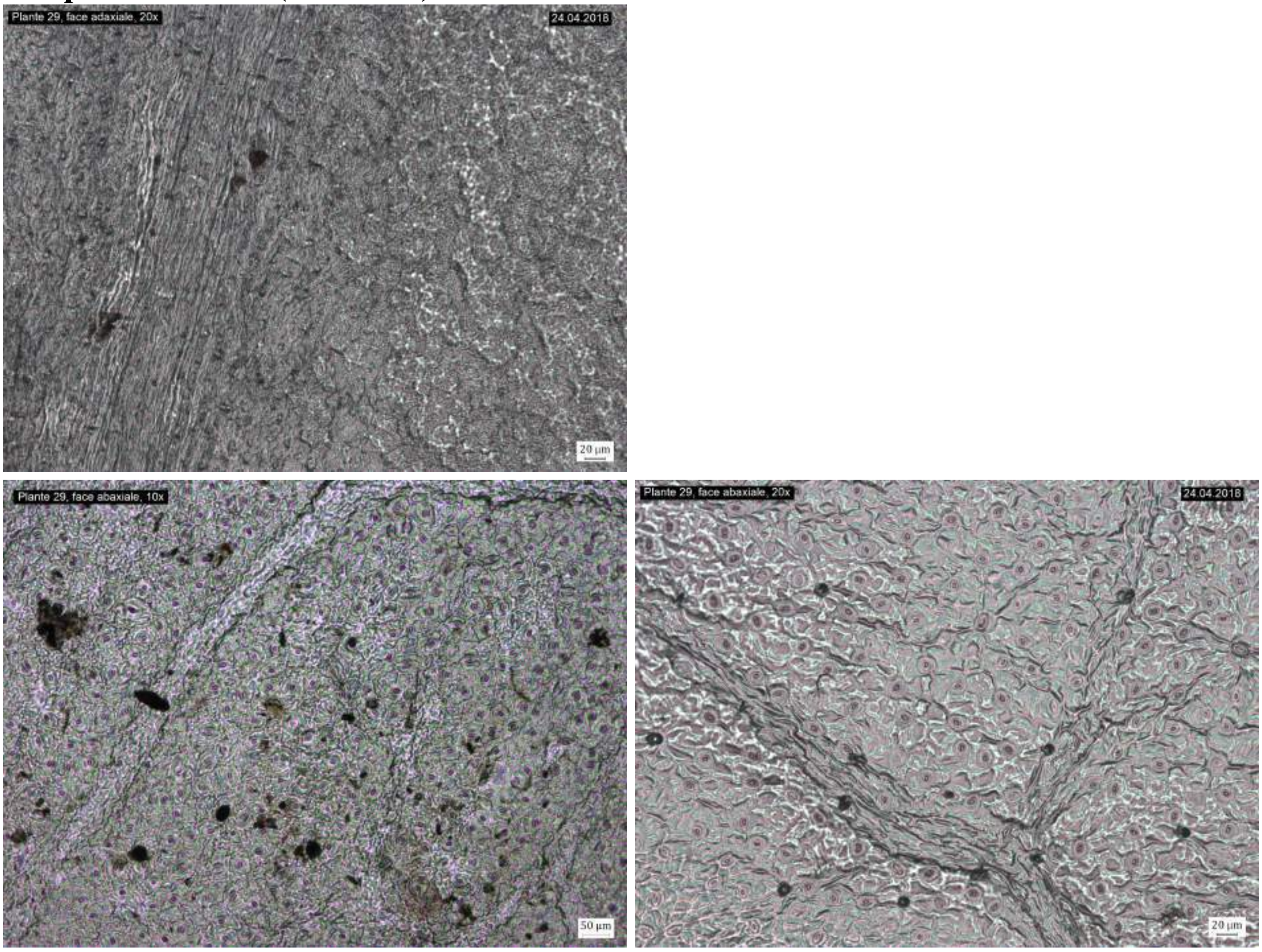


Leaves in microscopy (two methods)

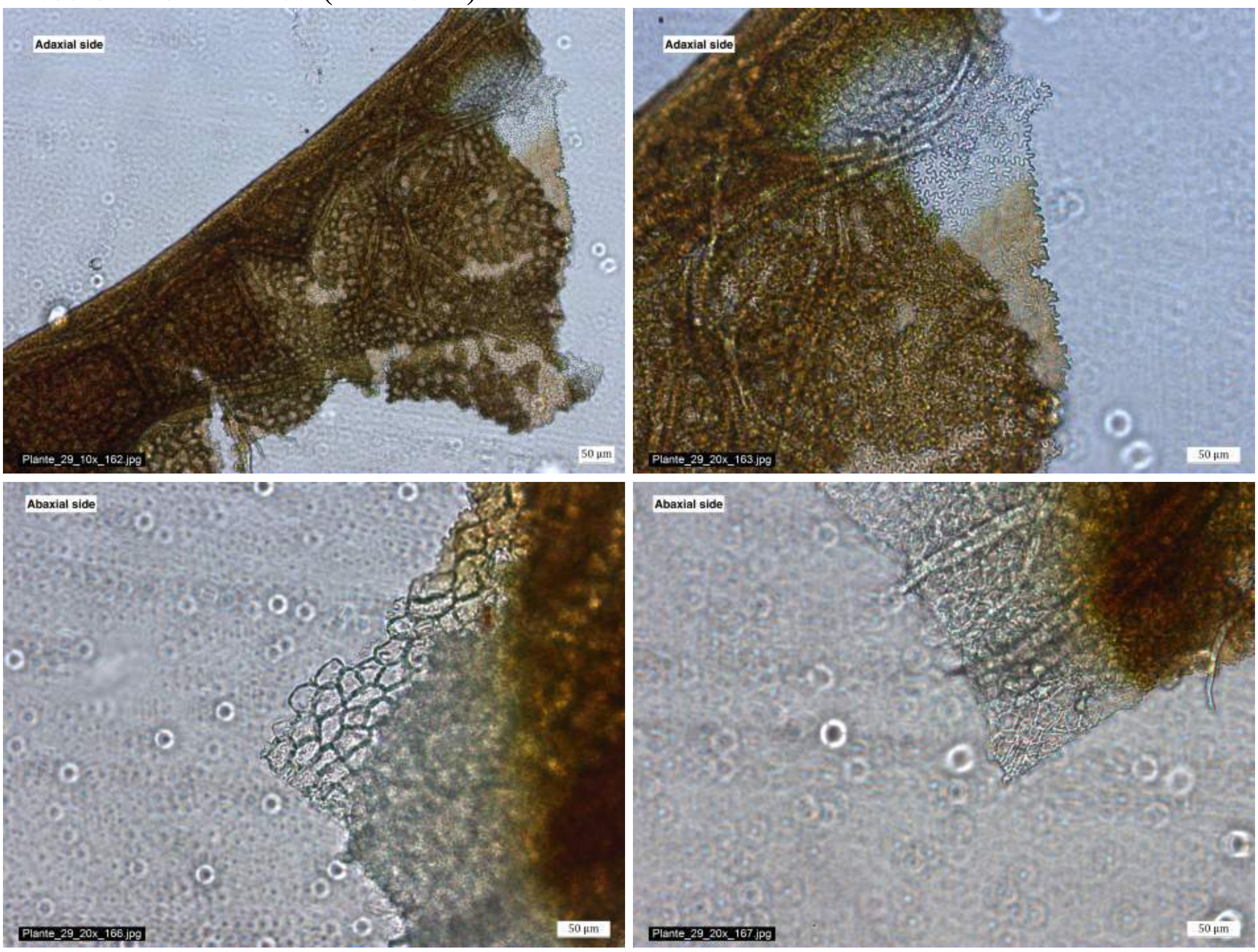




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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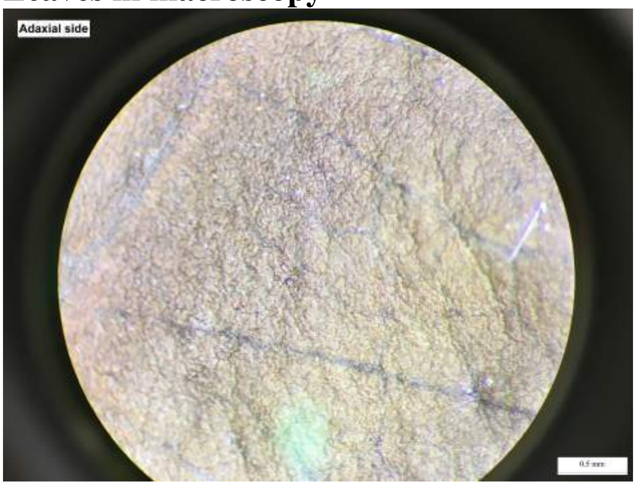
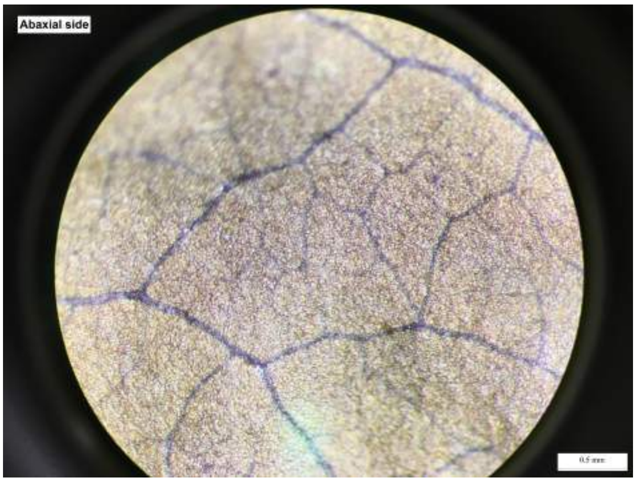
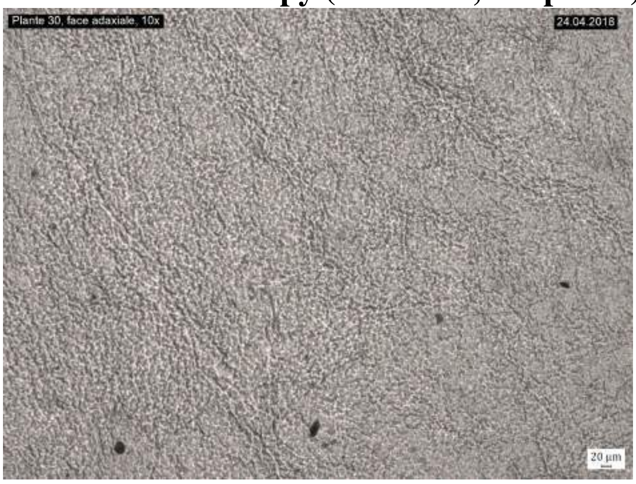
Confirmation of the determination by Saturnin Dougounein the Centre Suisse des Recherches Scientifiques en Côte d'Ivoire (CSRS)

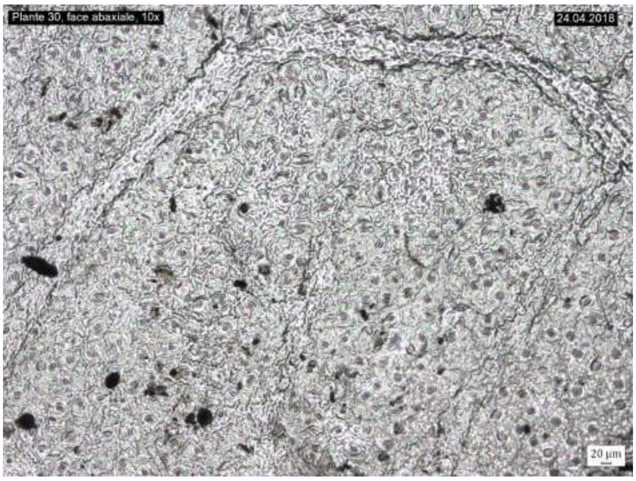
Leaves in macroscopy



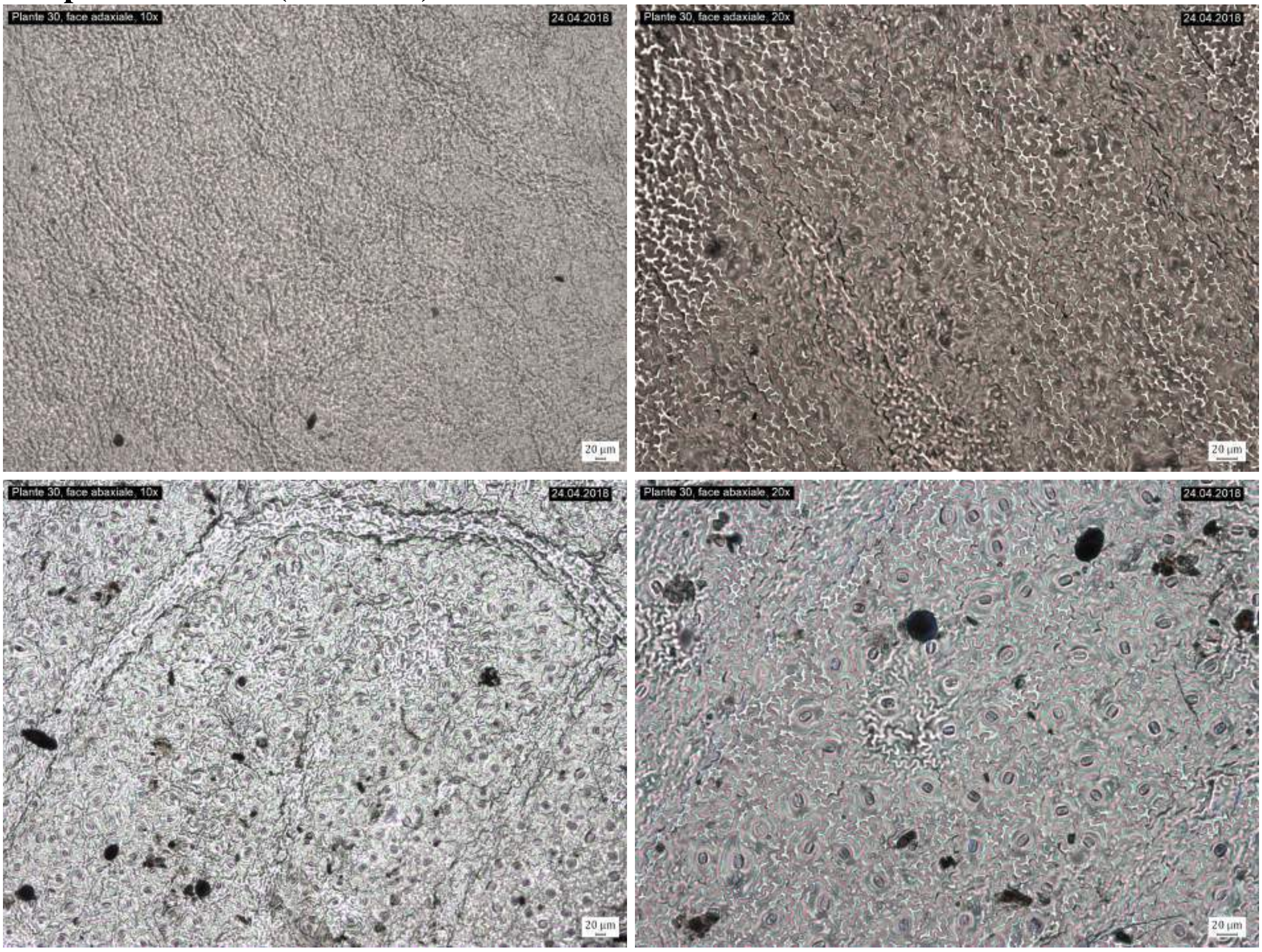


Leaves in microscopy (method 1, nailpolish)

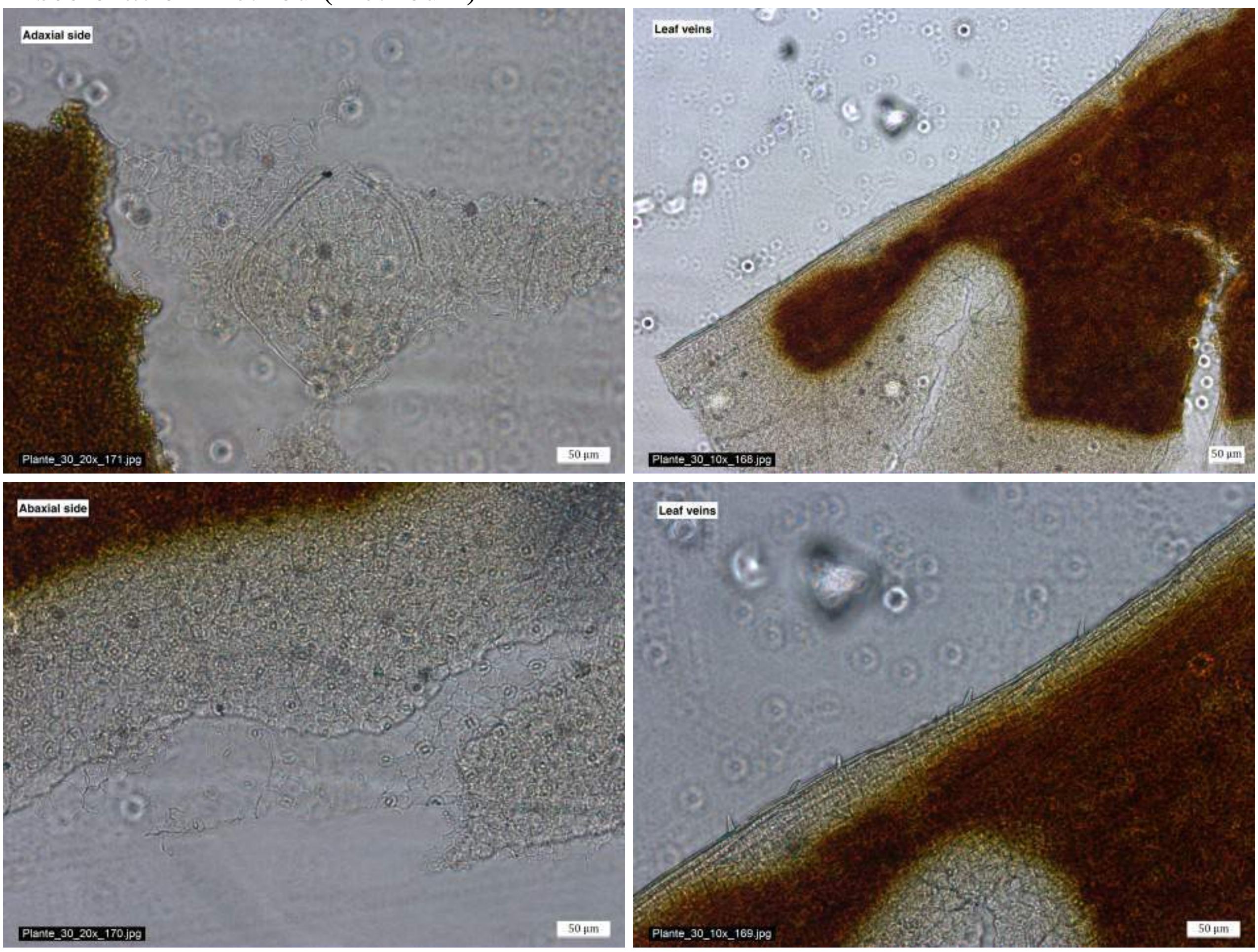




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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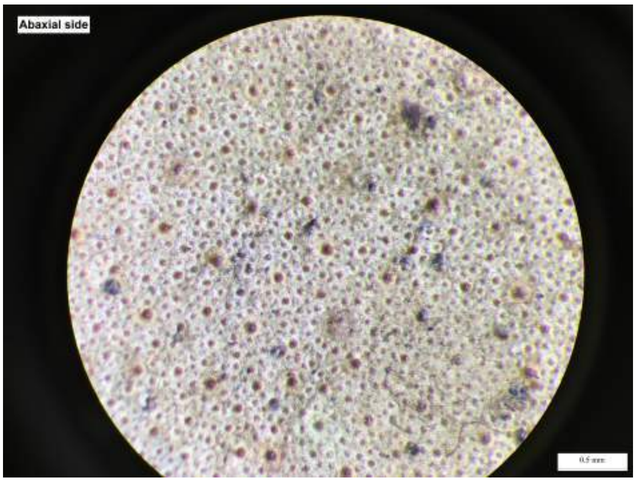
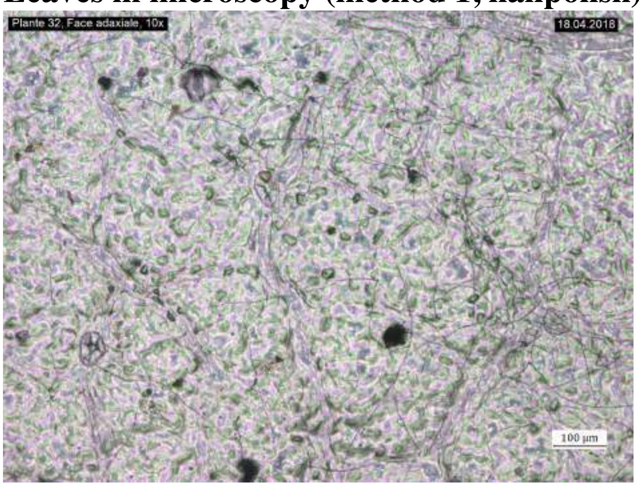
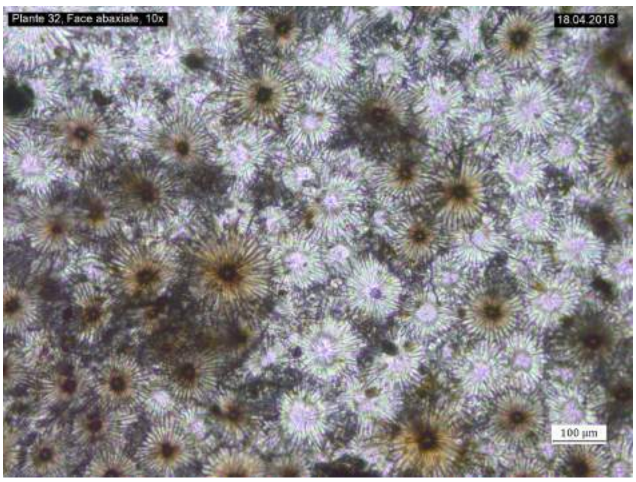
Leaves in macroscopy

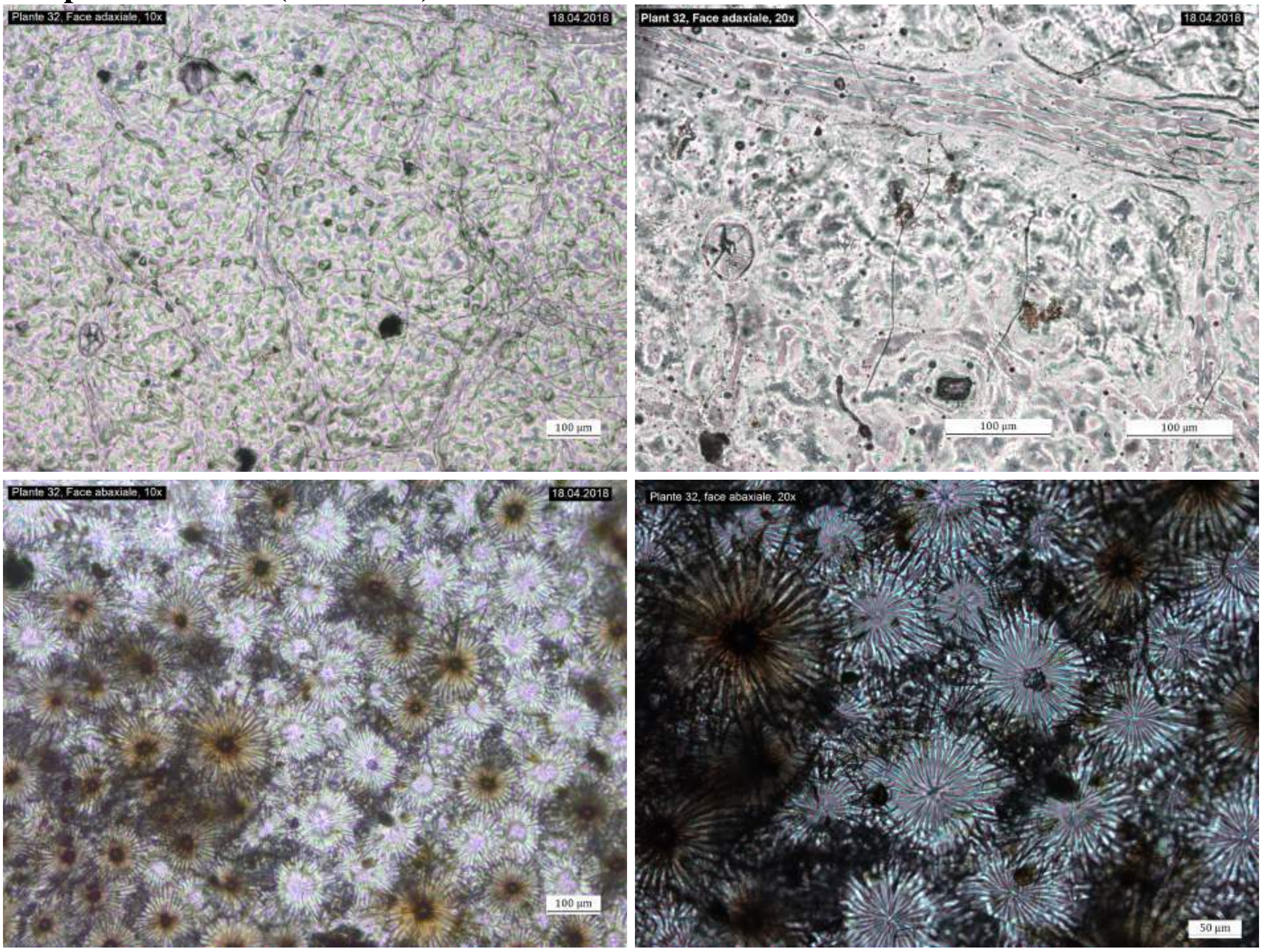


Leaves in microscopy (method 1, nailpolish)

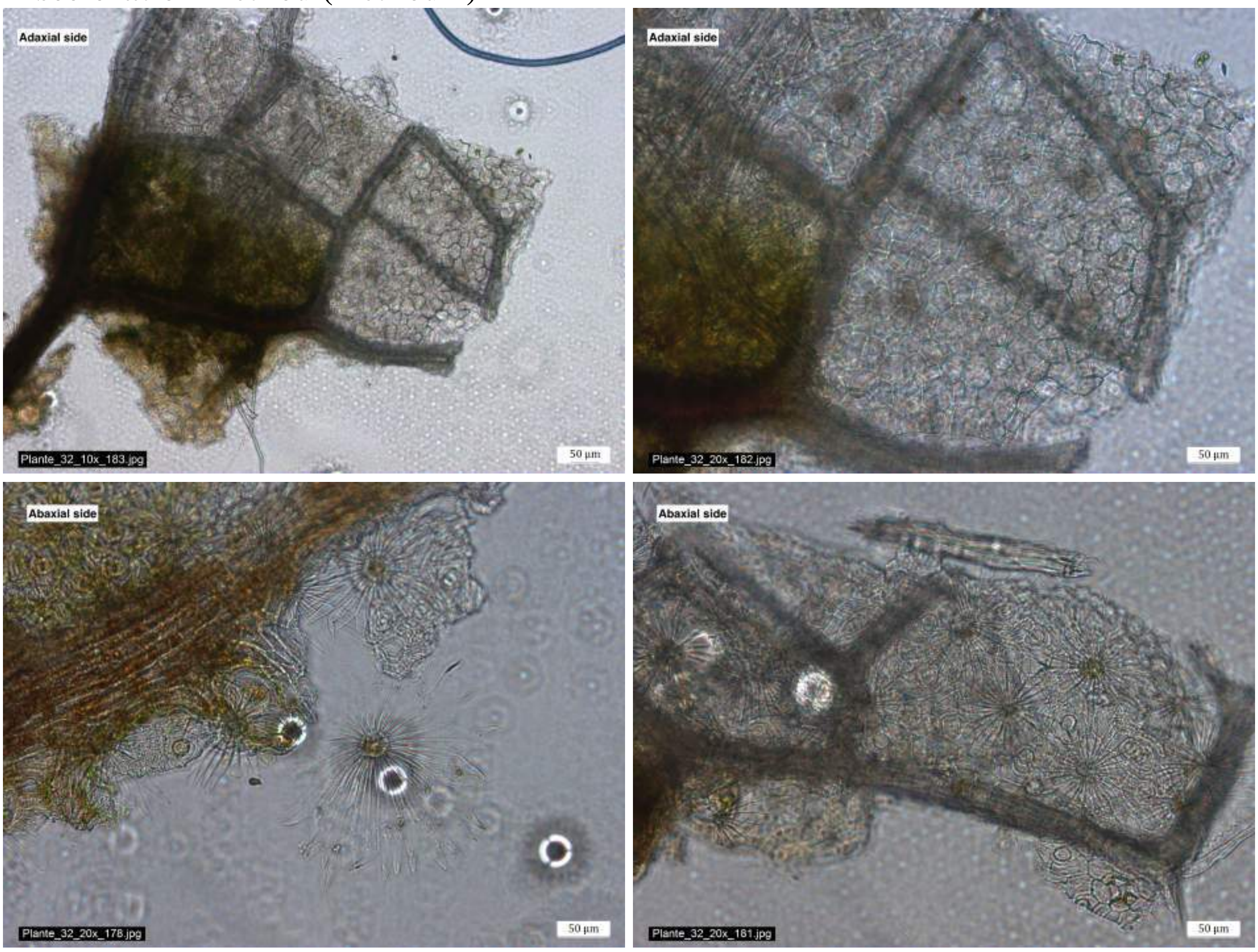




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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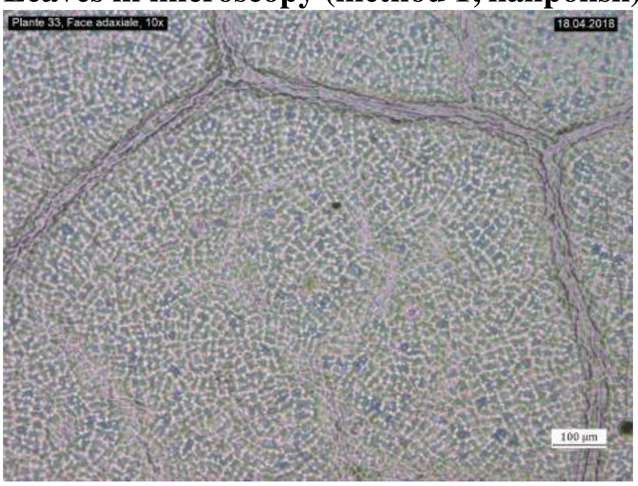
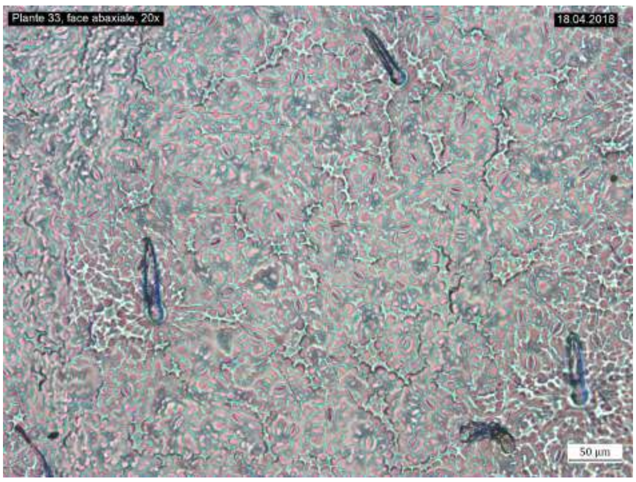
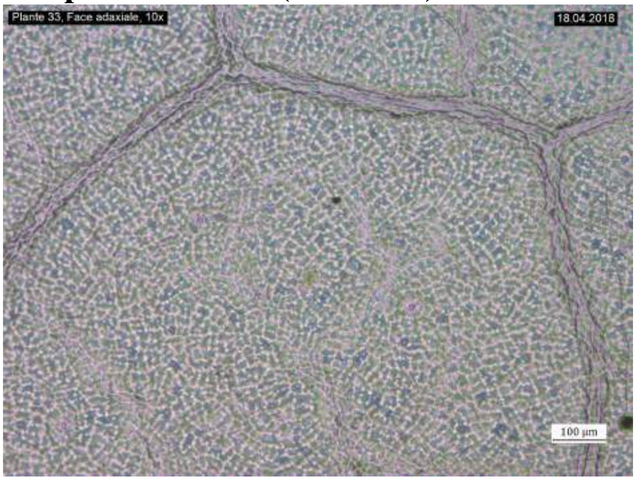
Leaves in macroscopy

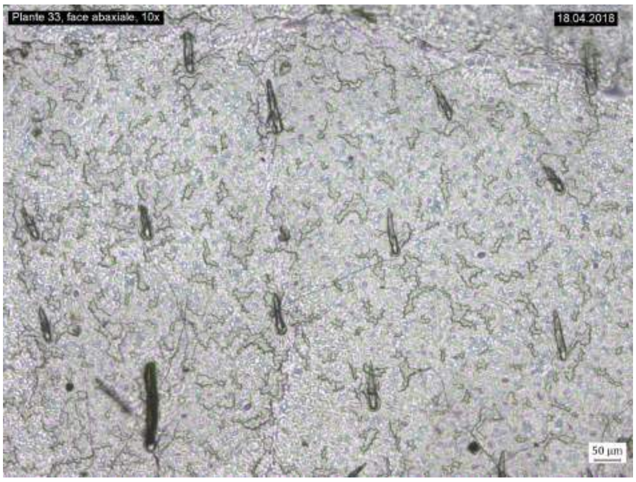
Leaves in microscopy (method 1, nailpolish)

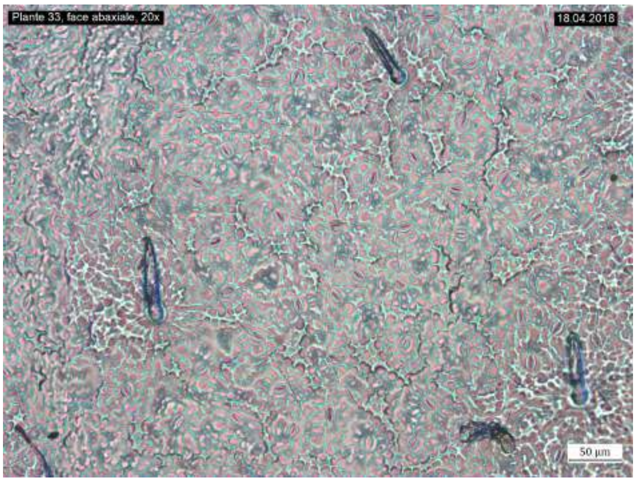




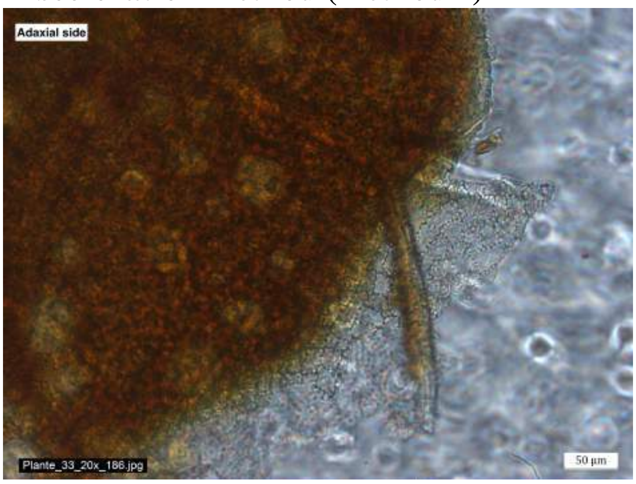
Nailpolish method (method 1)

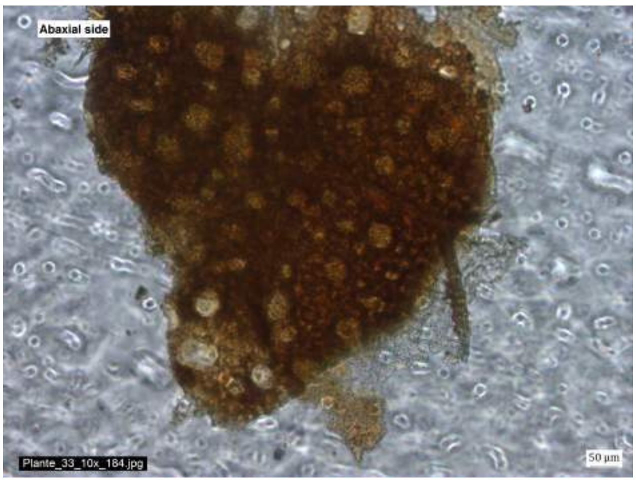






Discoloration method (method 2)





Herbarium plant

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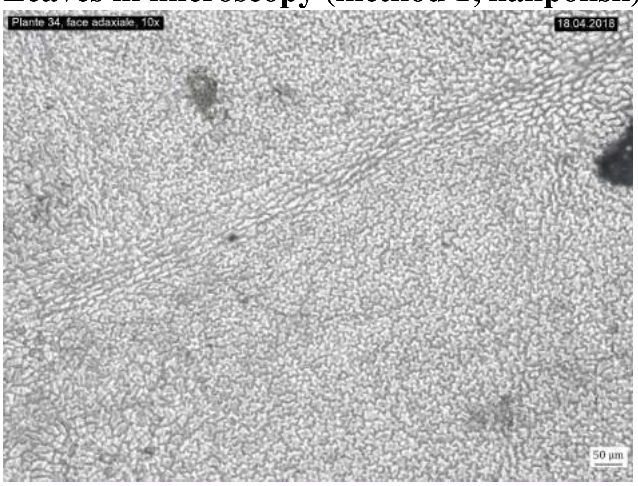
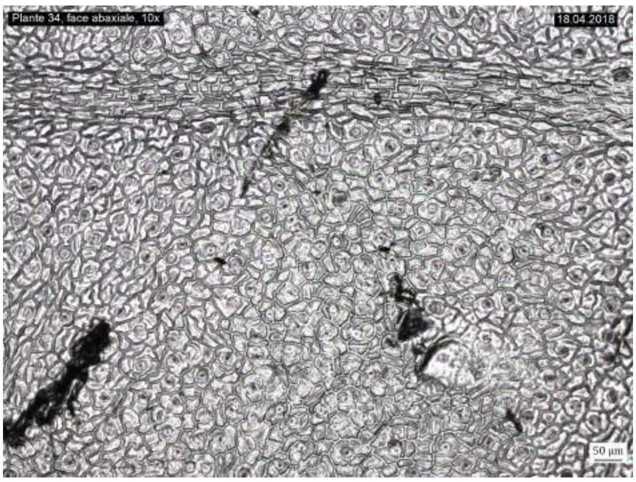
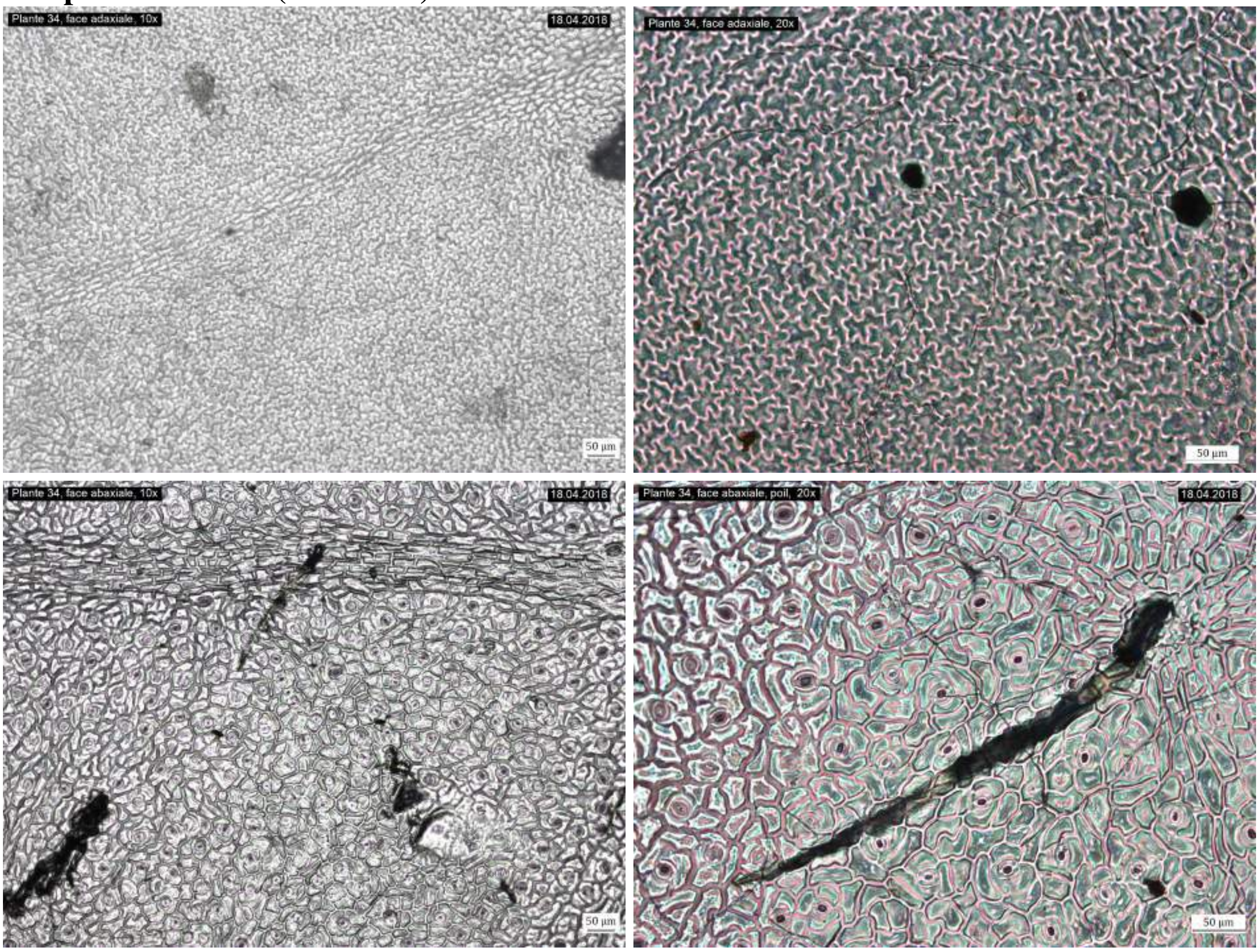
Leaves in macroscopy

Leaves in microscopy (method 1, nailpolish)

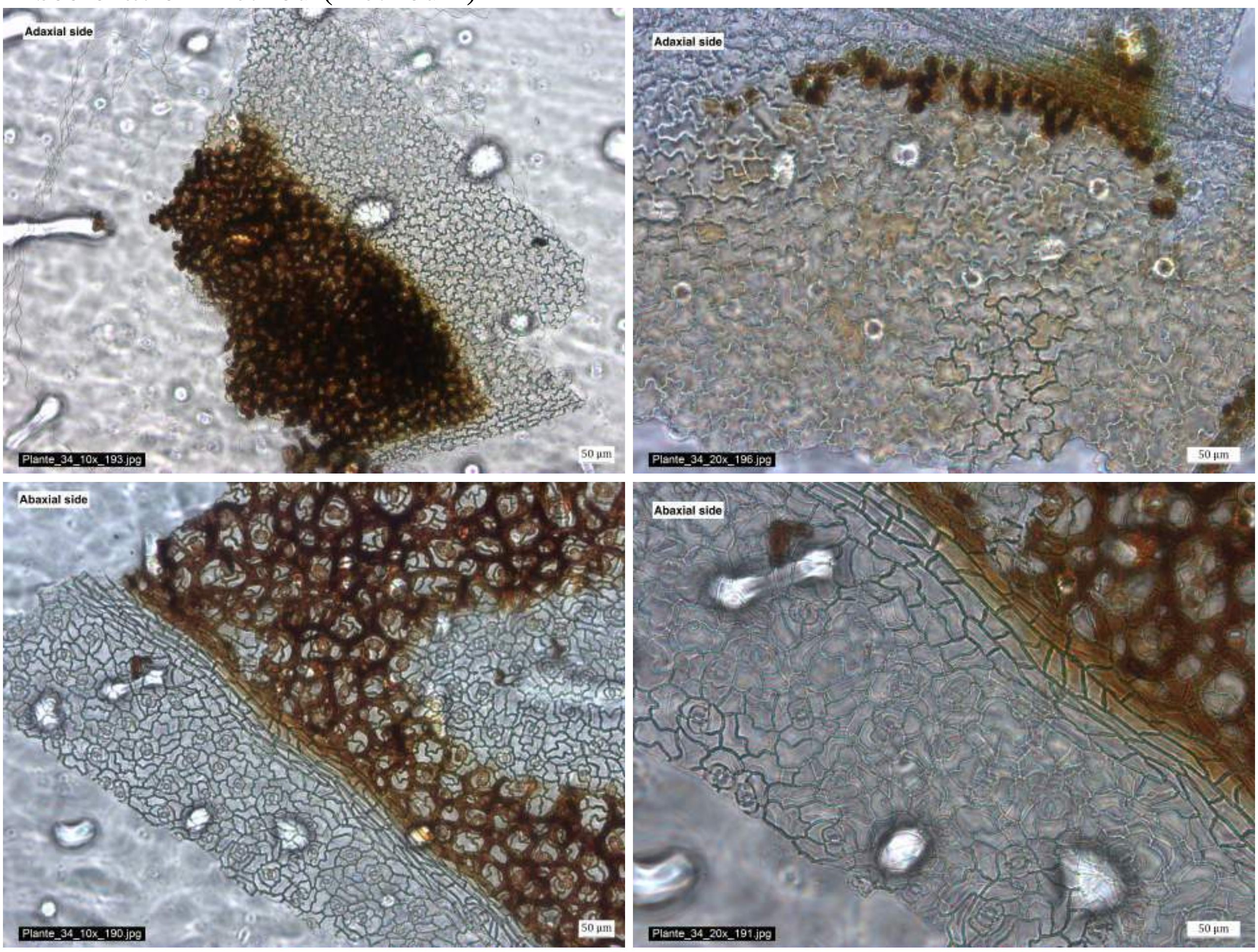




Nailpolish method (method 1)



Discoloration method (method 2)



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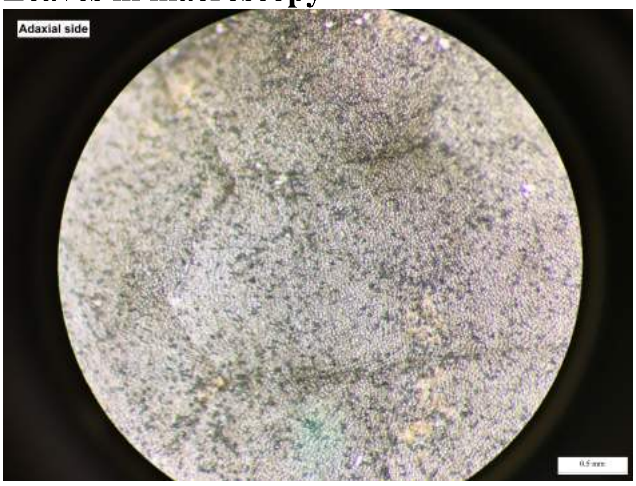
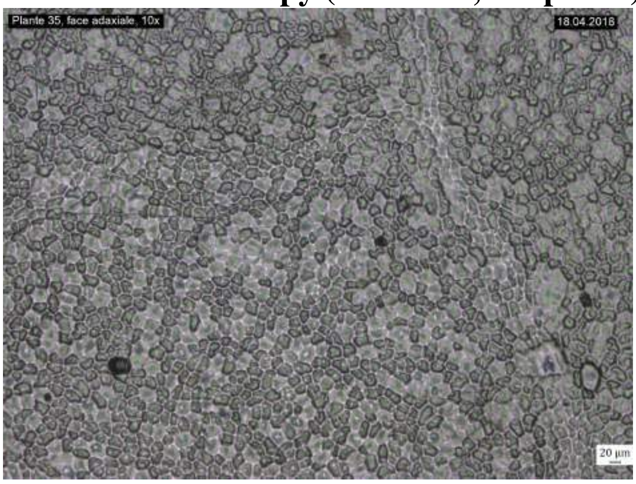
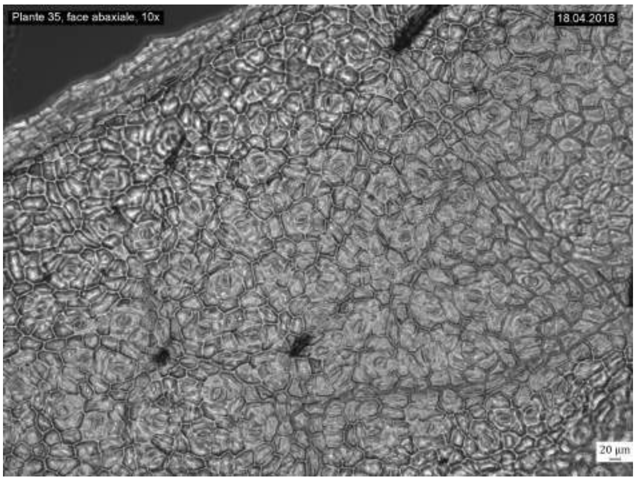
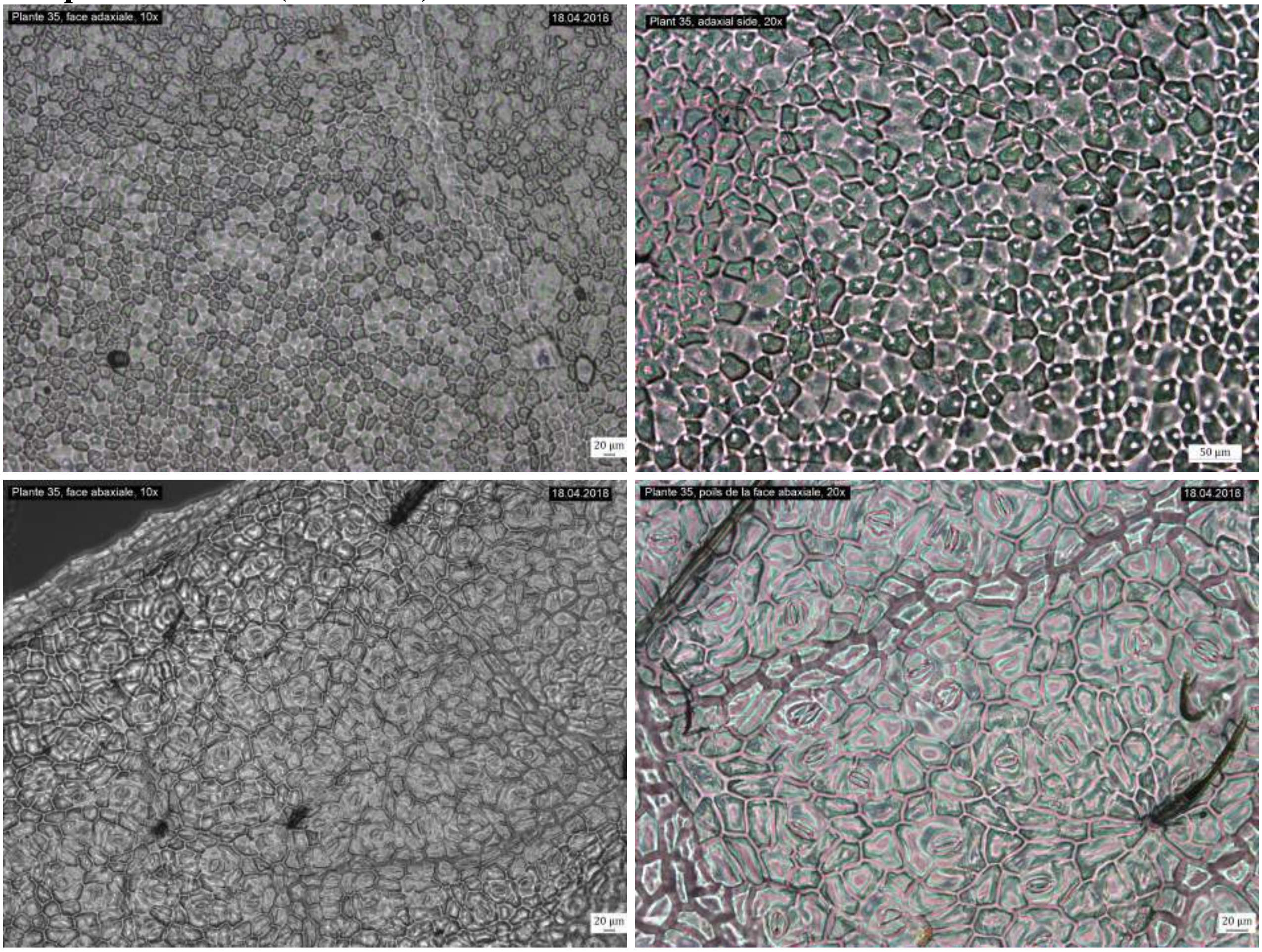


Leaves in microscopy (method 1, nailpolish)

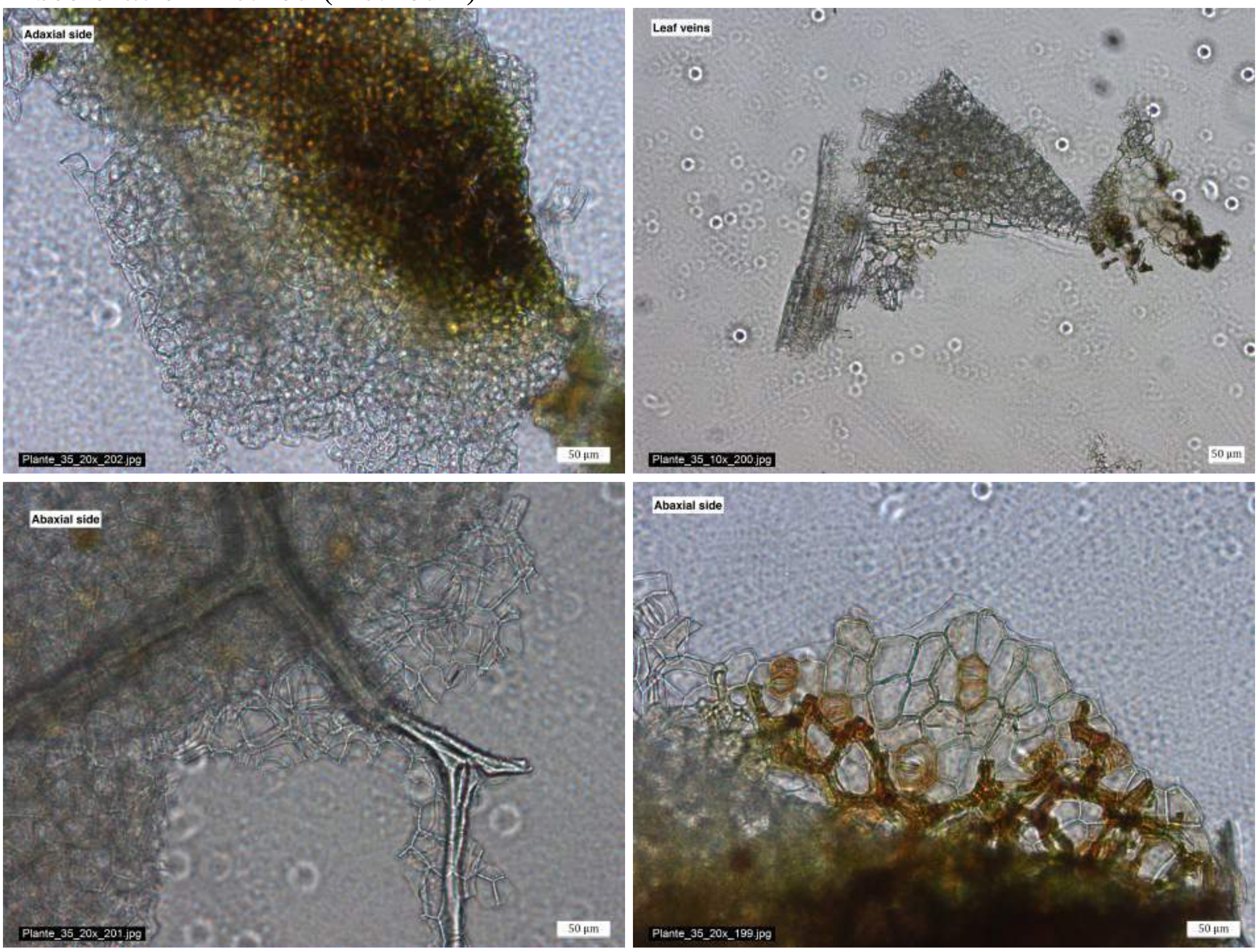




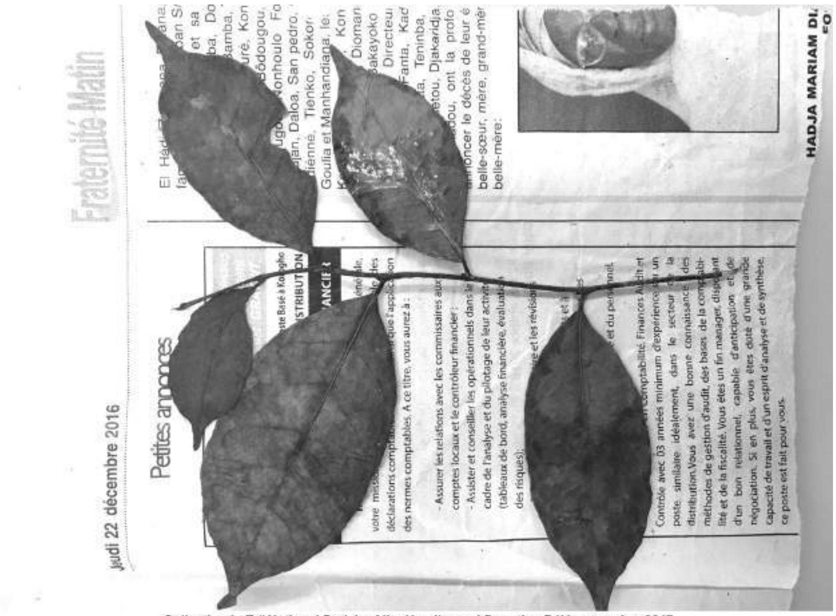
Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant



Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
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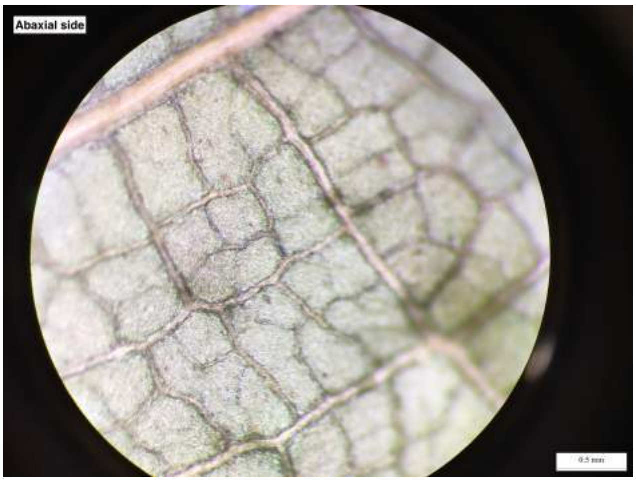
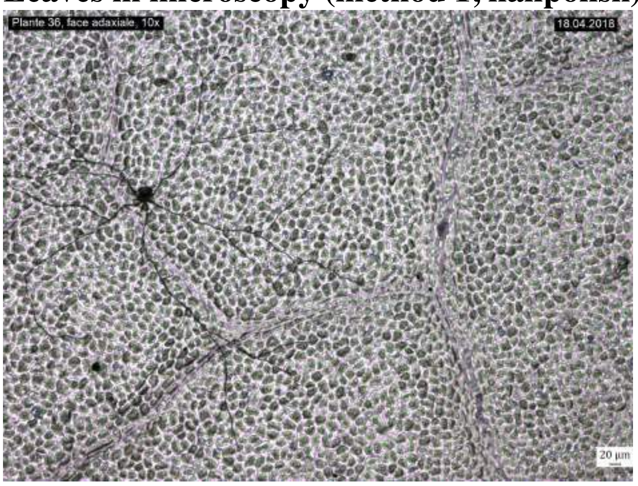
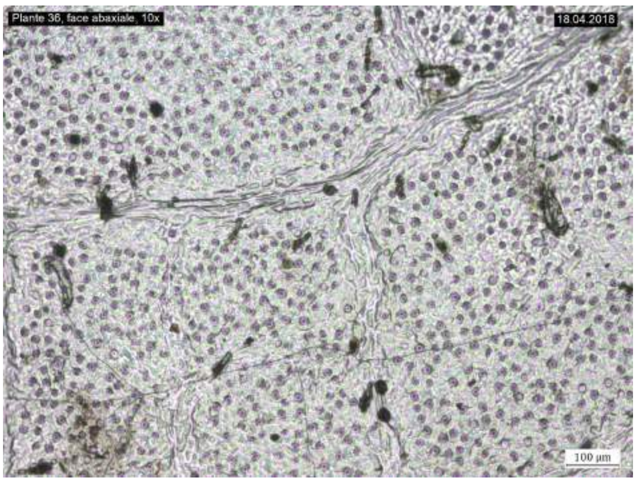
Leaves in macroscopy

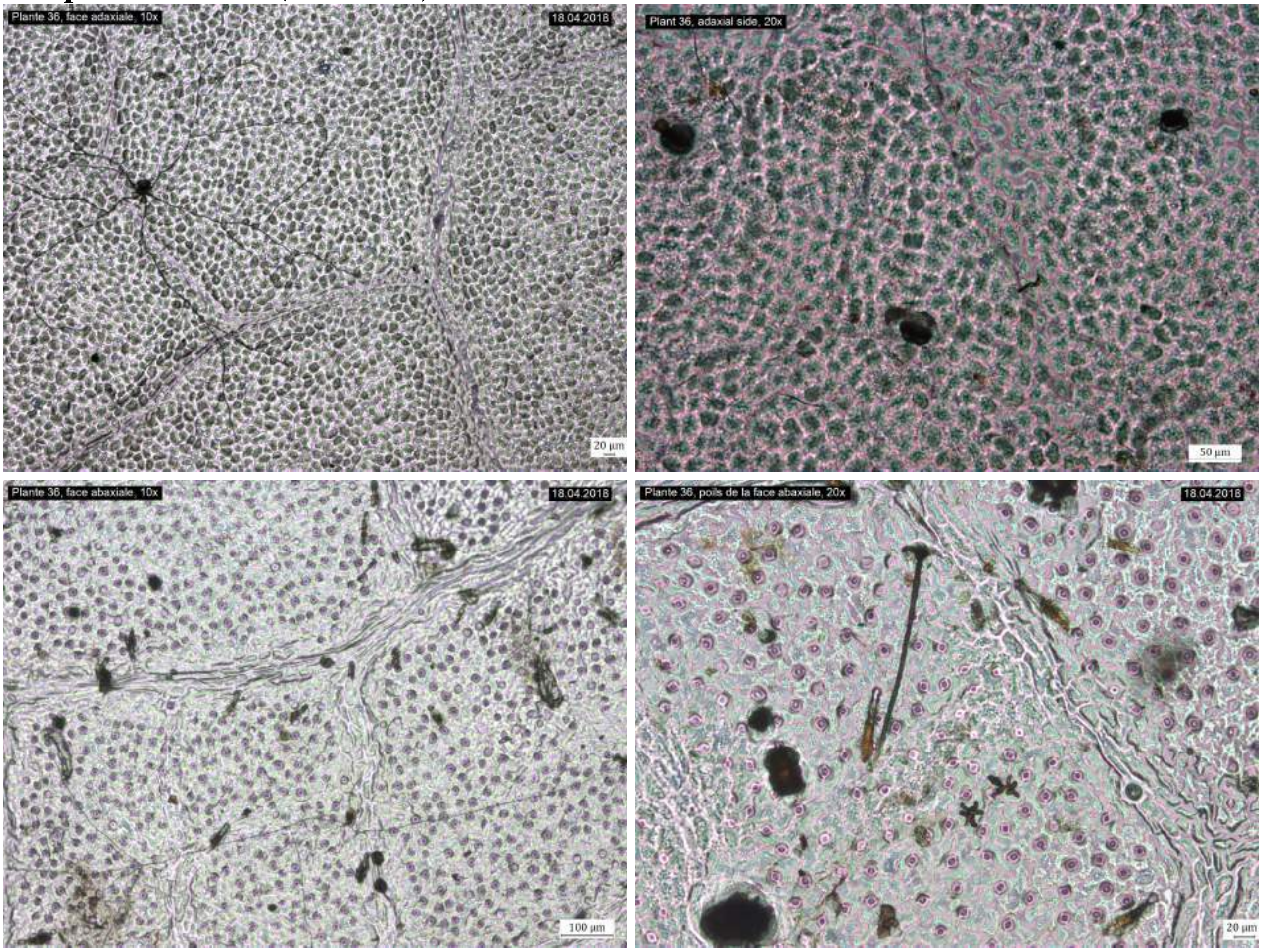


Leaves in microscopy (method 1, nailpolish)

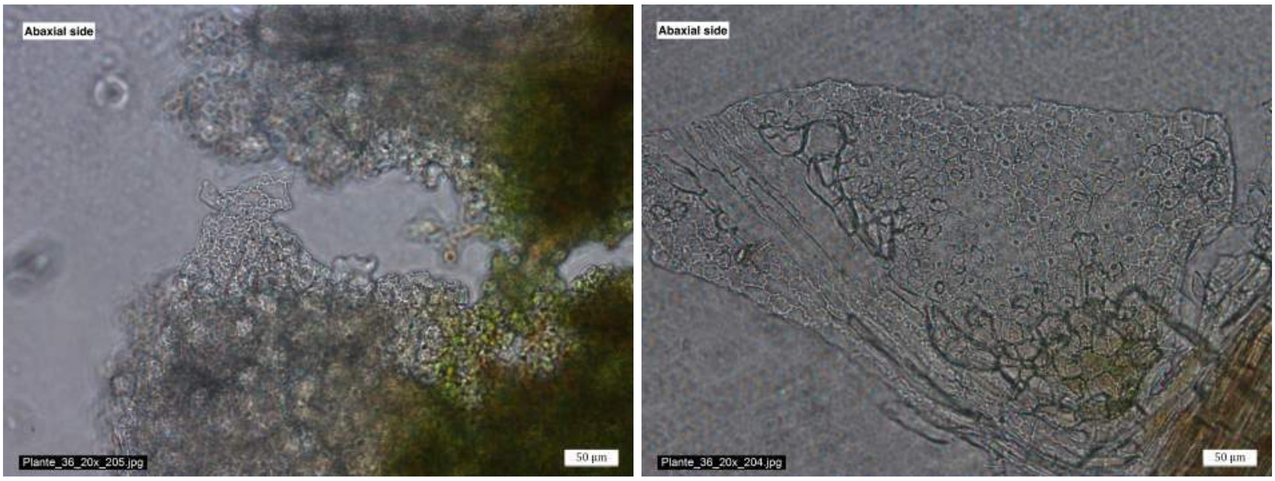




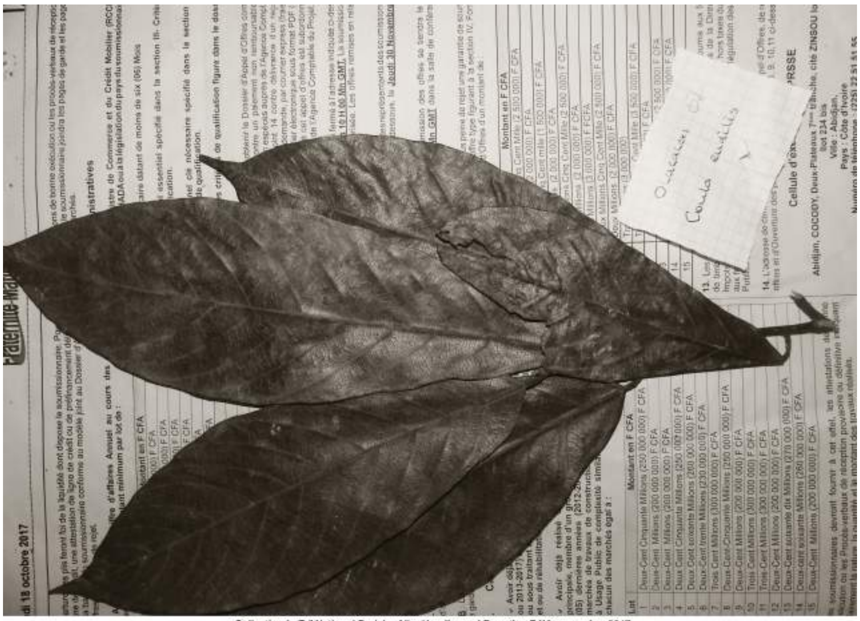
Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant



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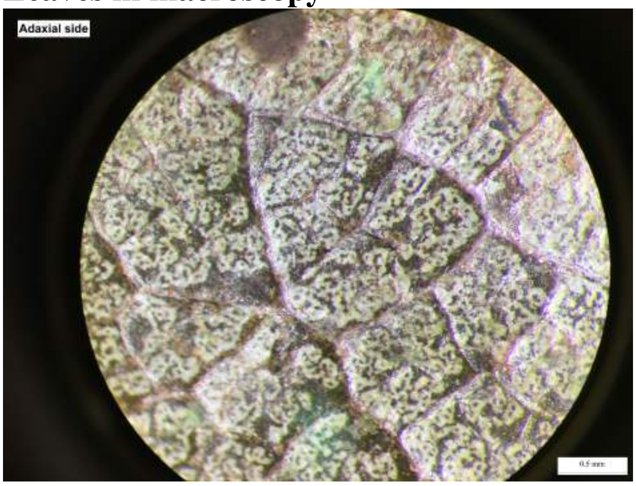
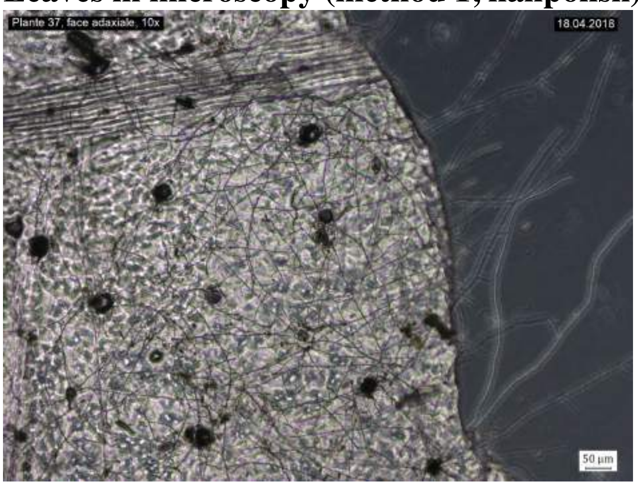
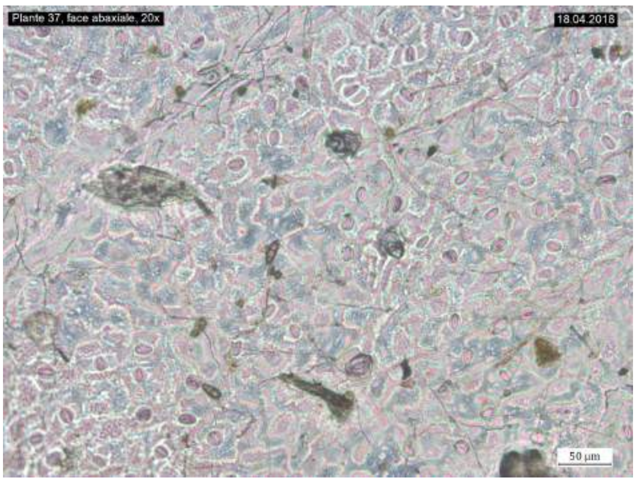
Leaves in macroscopy

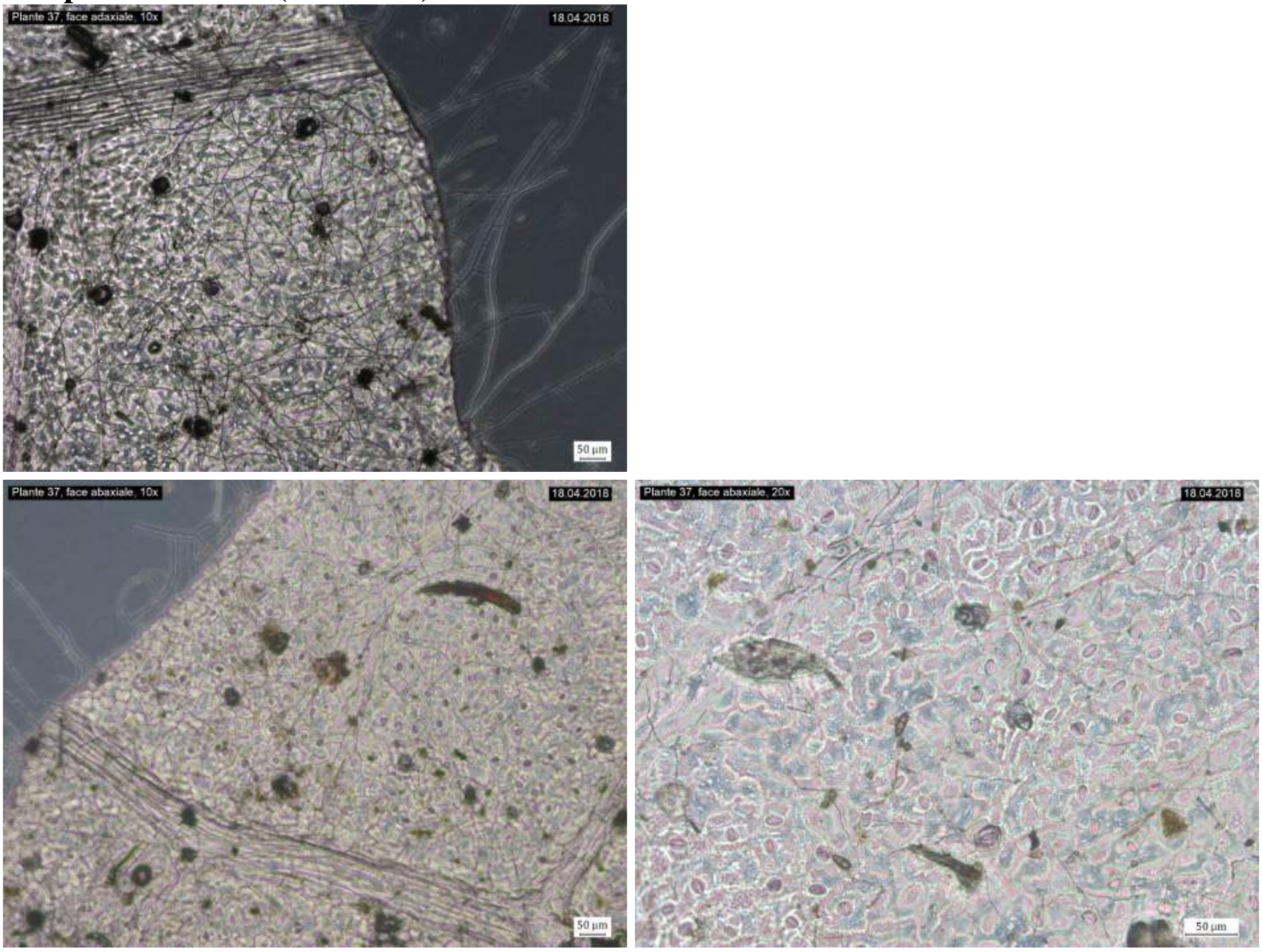


Leaves in microscopy (method 1, nailpolish)

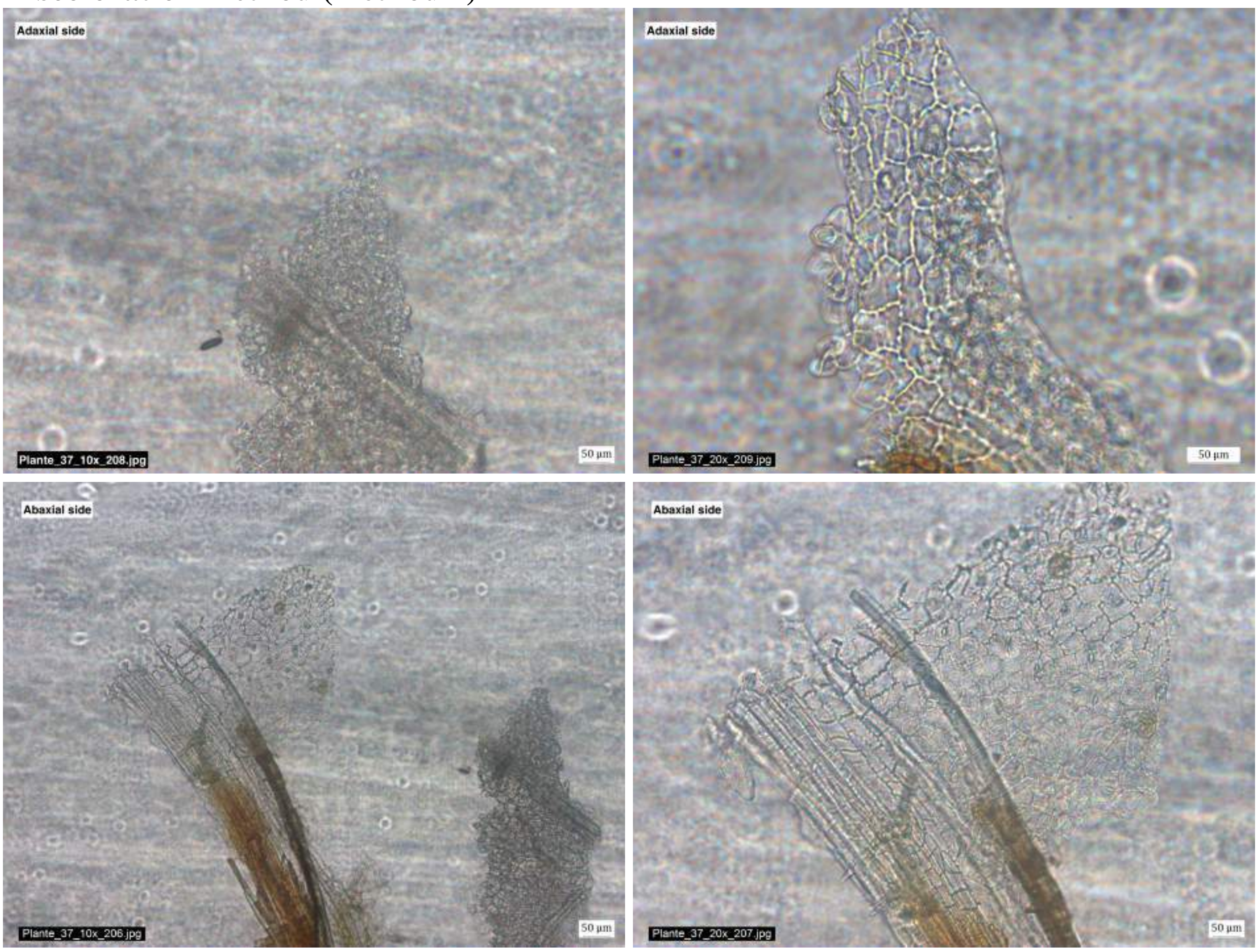




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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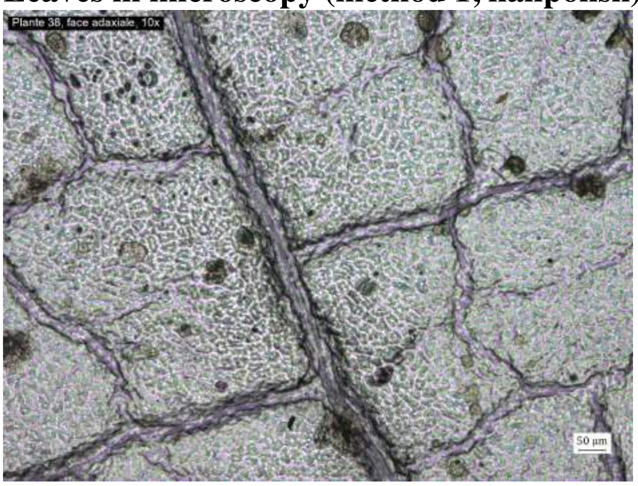
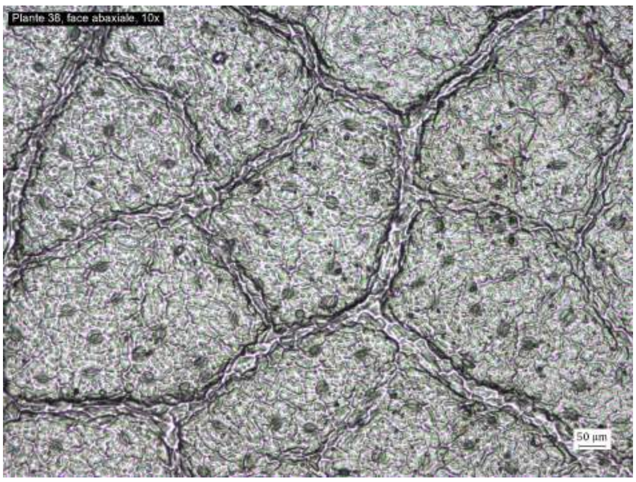
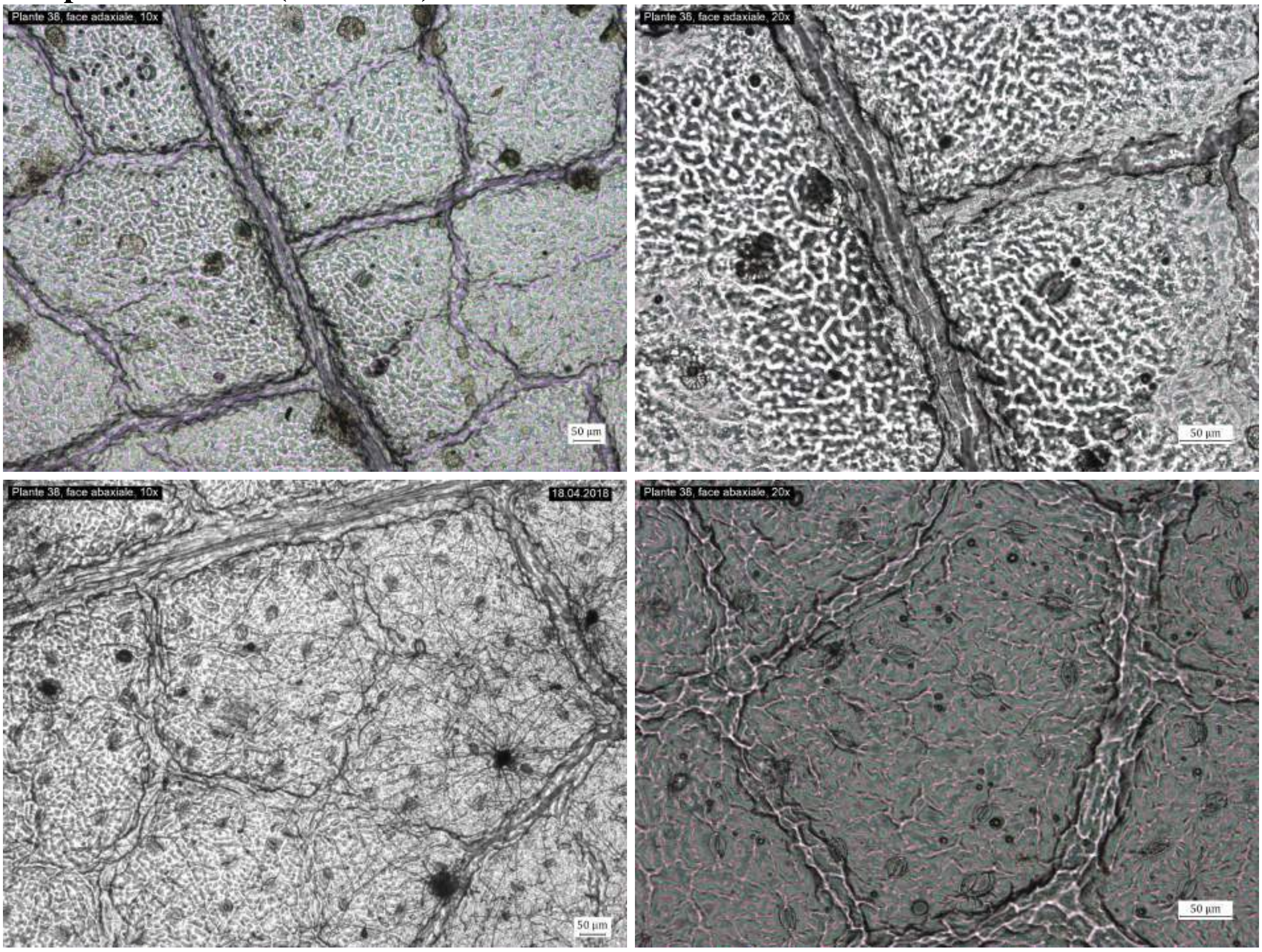
Leaves in macroscopy

Leaves in microscopy (method 1, nailpolish)

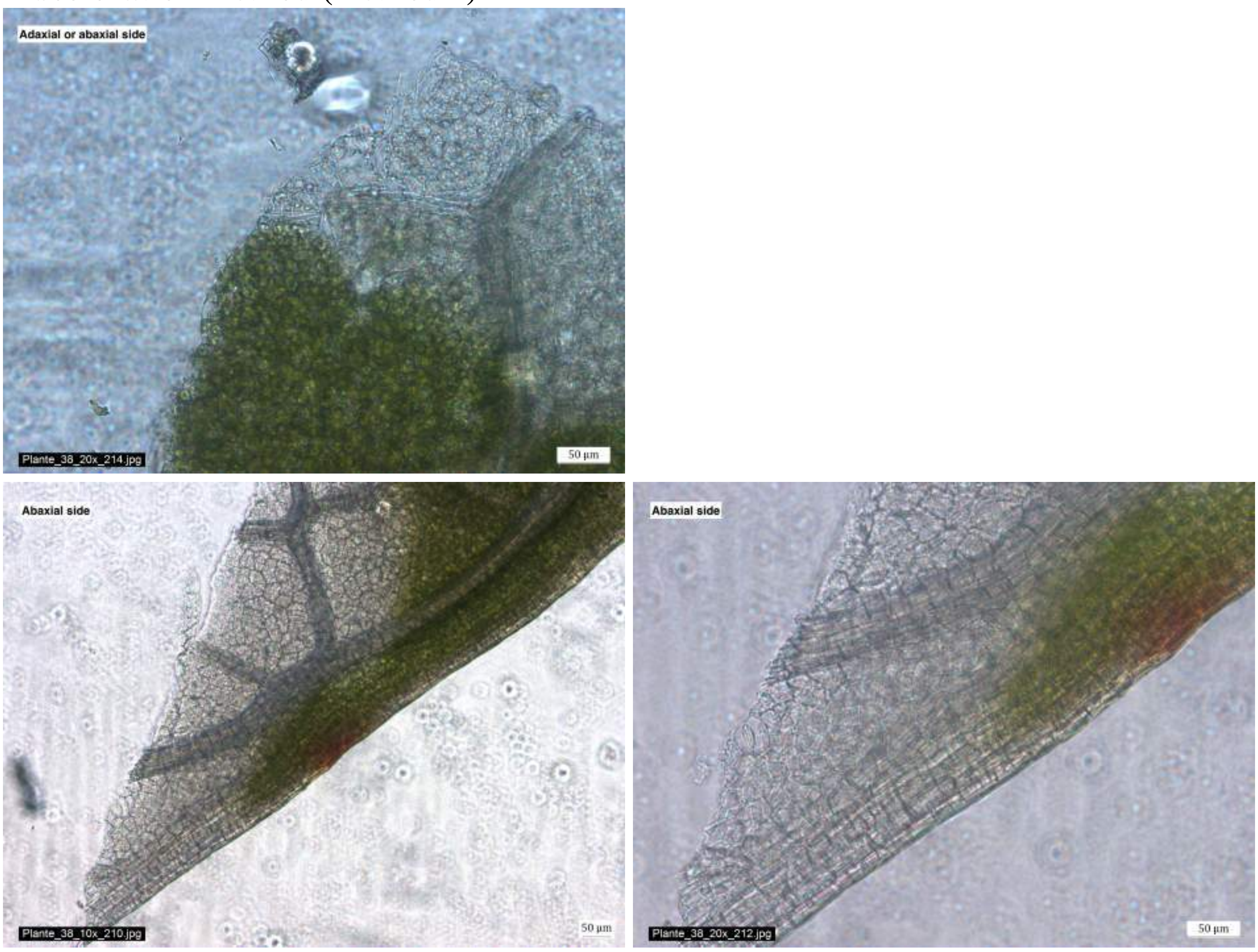




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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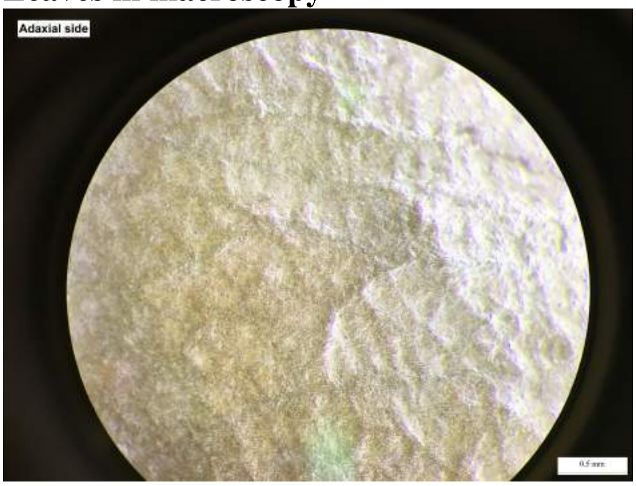
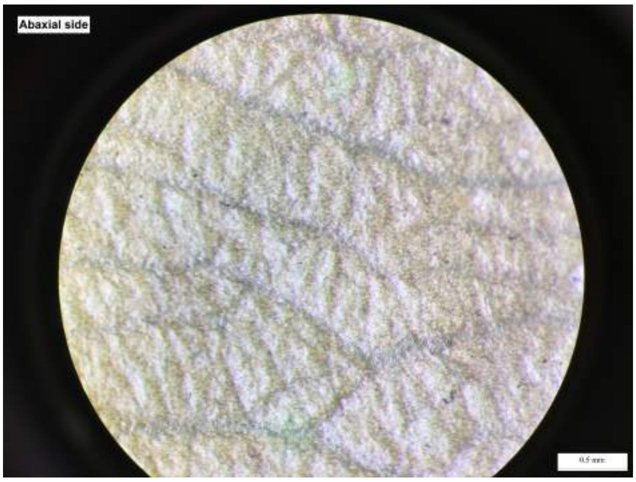
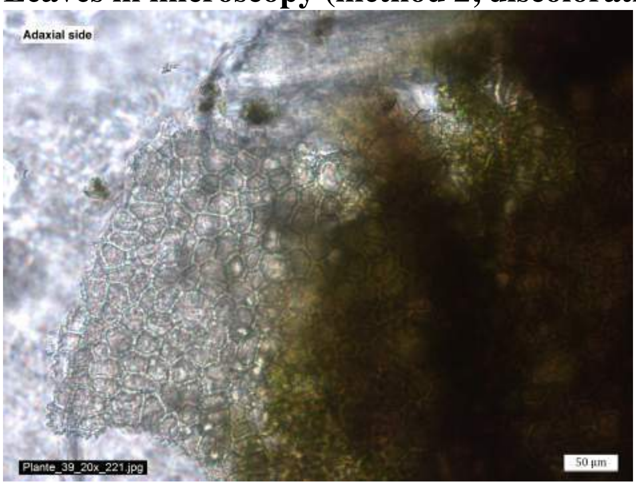
Leaves in macroscopy

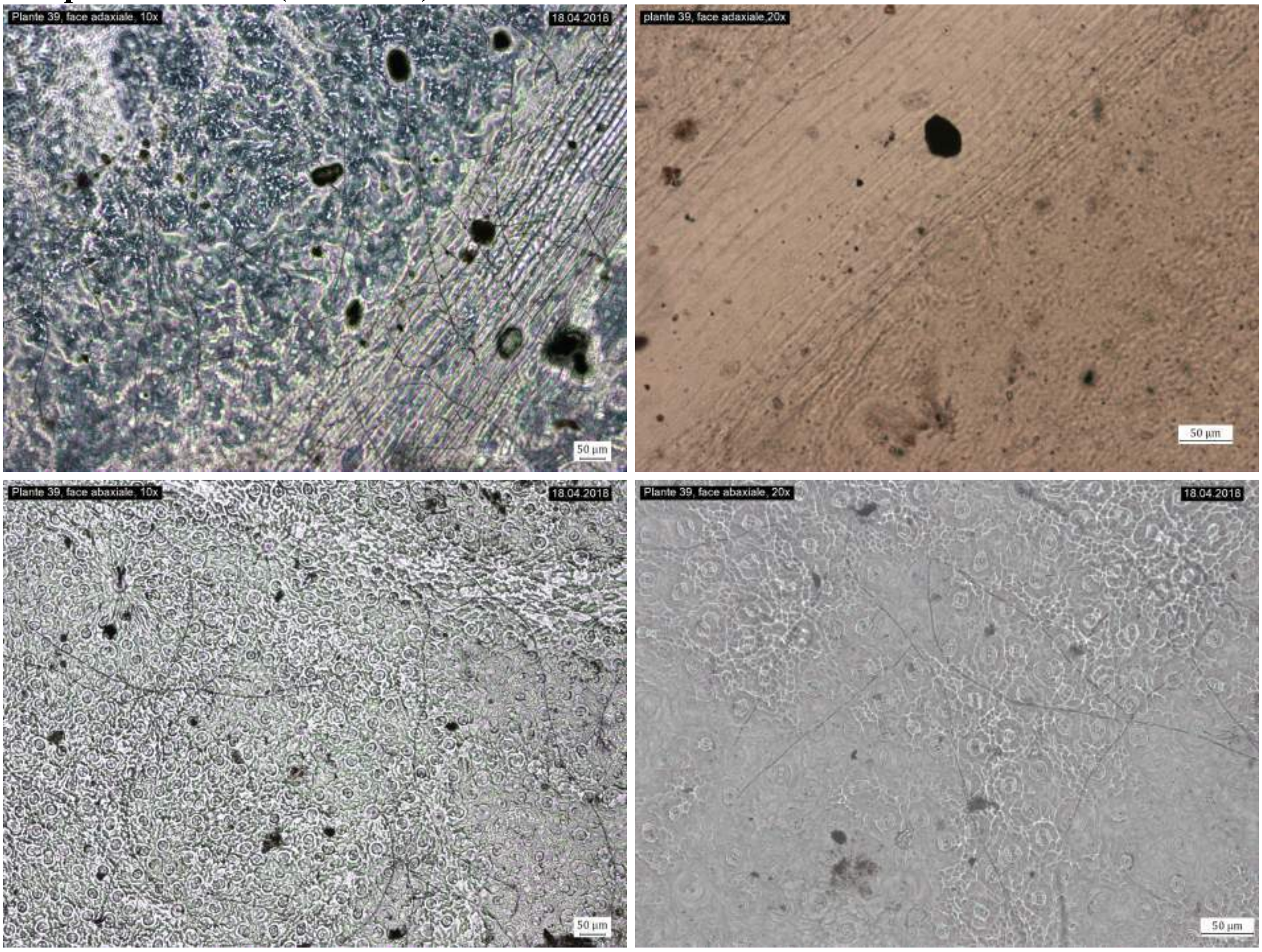




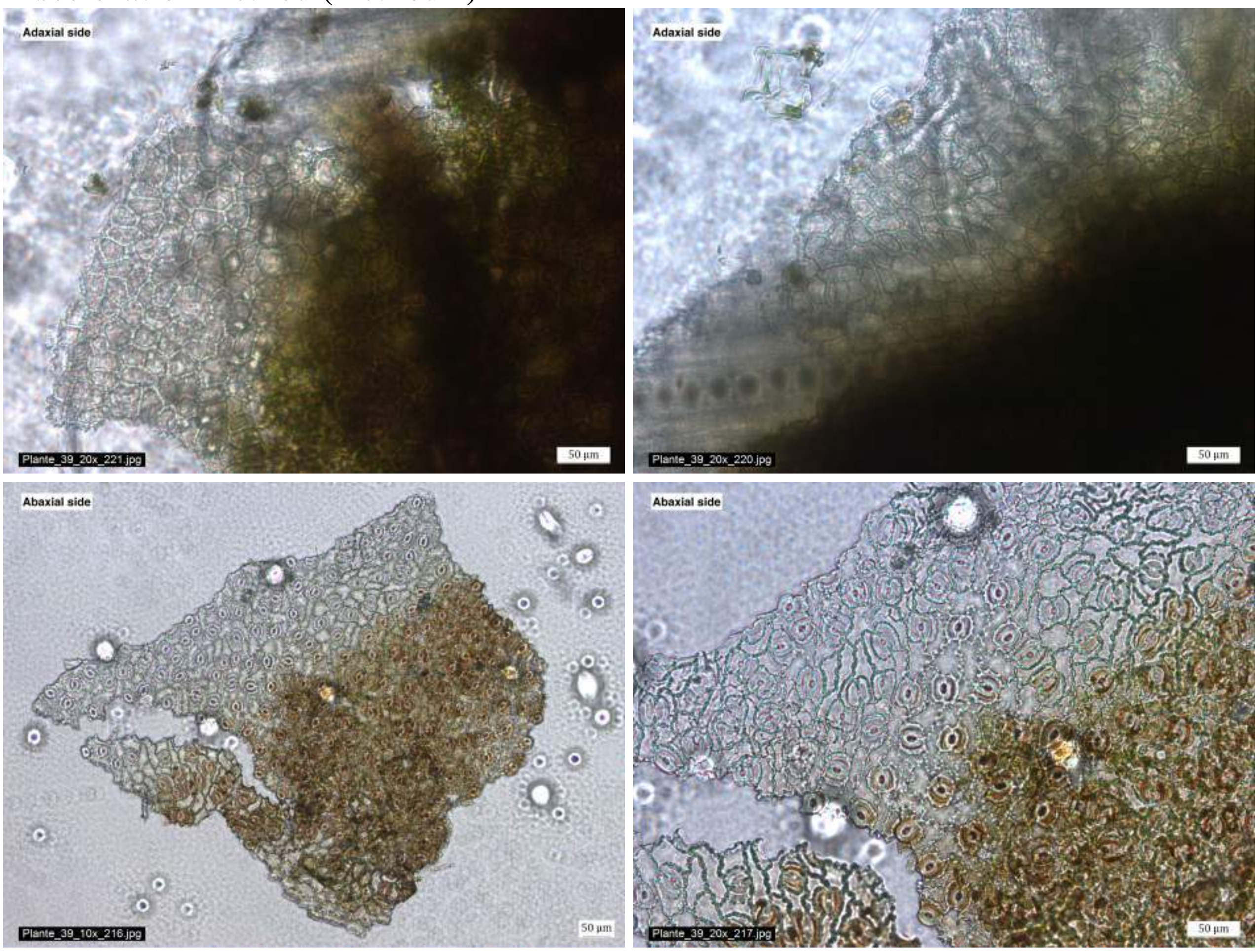
Leaves in microscopy (method 2, discoloration)



Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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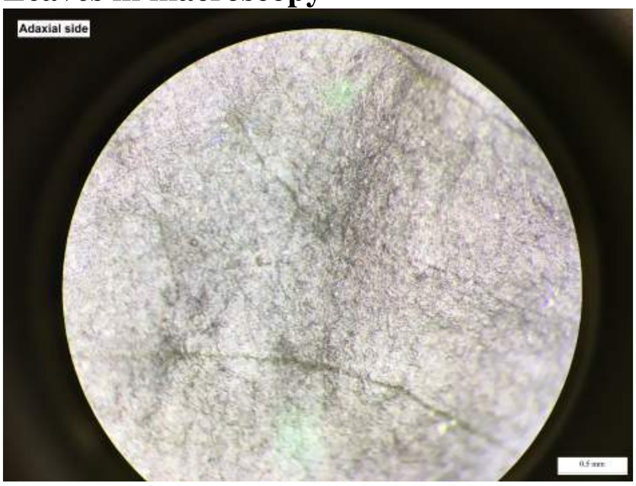
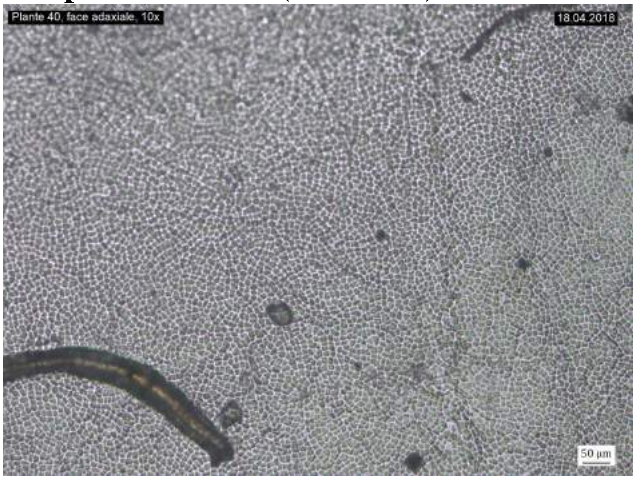
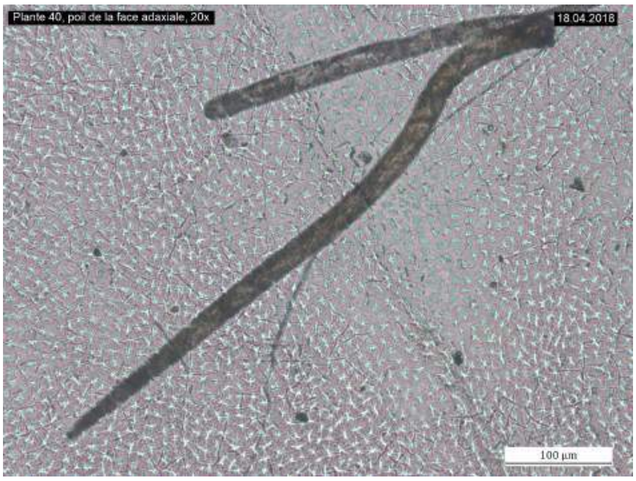
Leaves in macroscopy



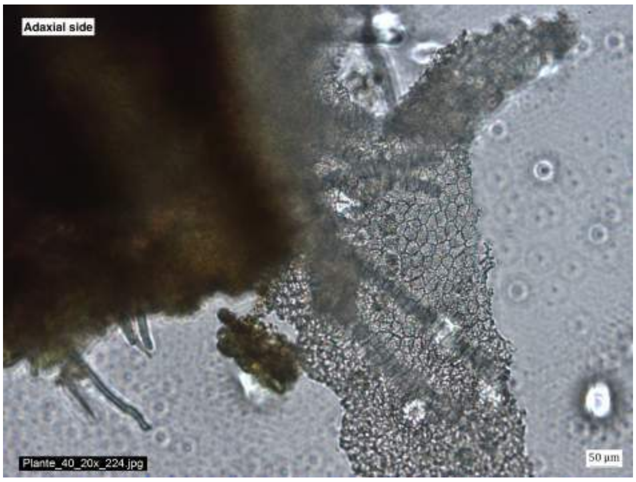
Leaves in microscopy (method 1, nailpolish)

Nailpolish method (method 1)





Discoloration method (method 2)



Herbarium plant

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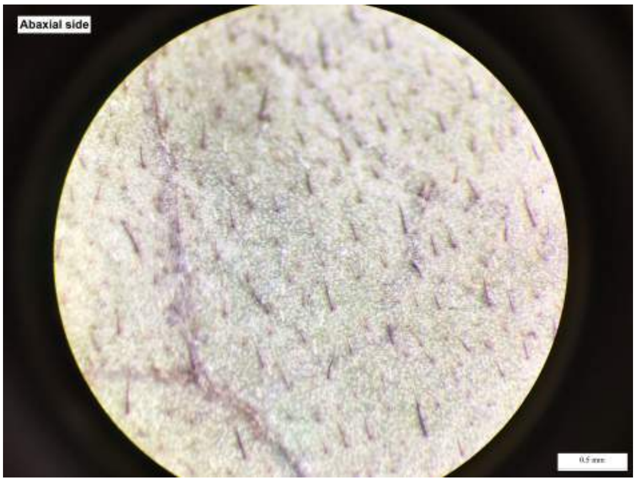
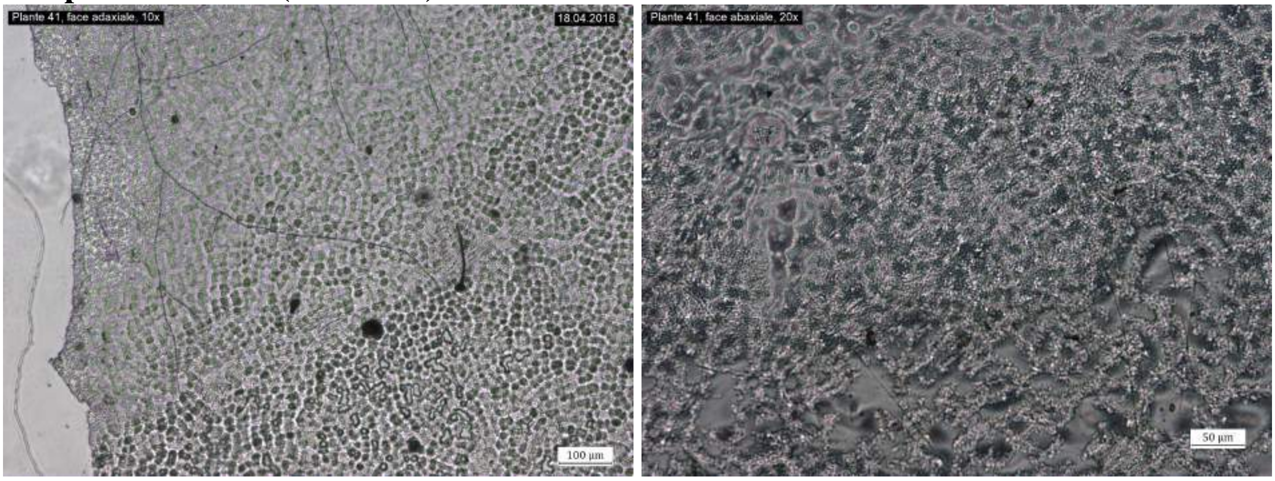
Leaves in macroscopy

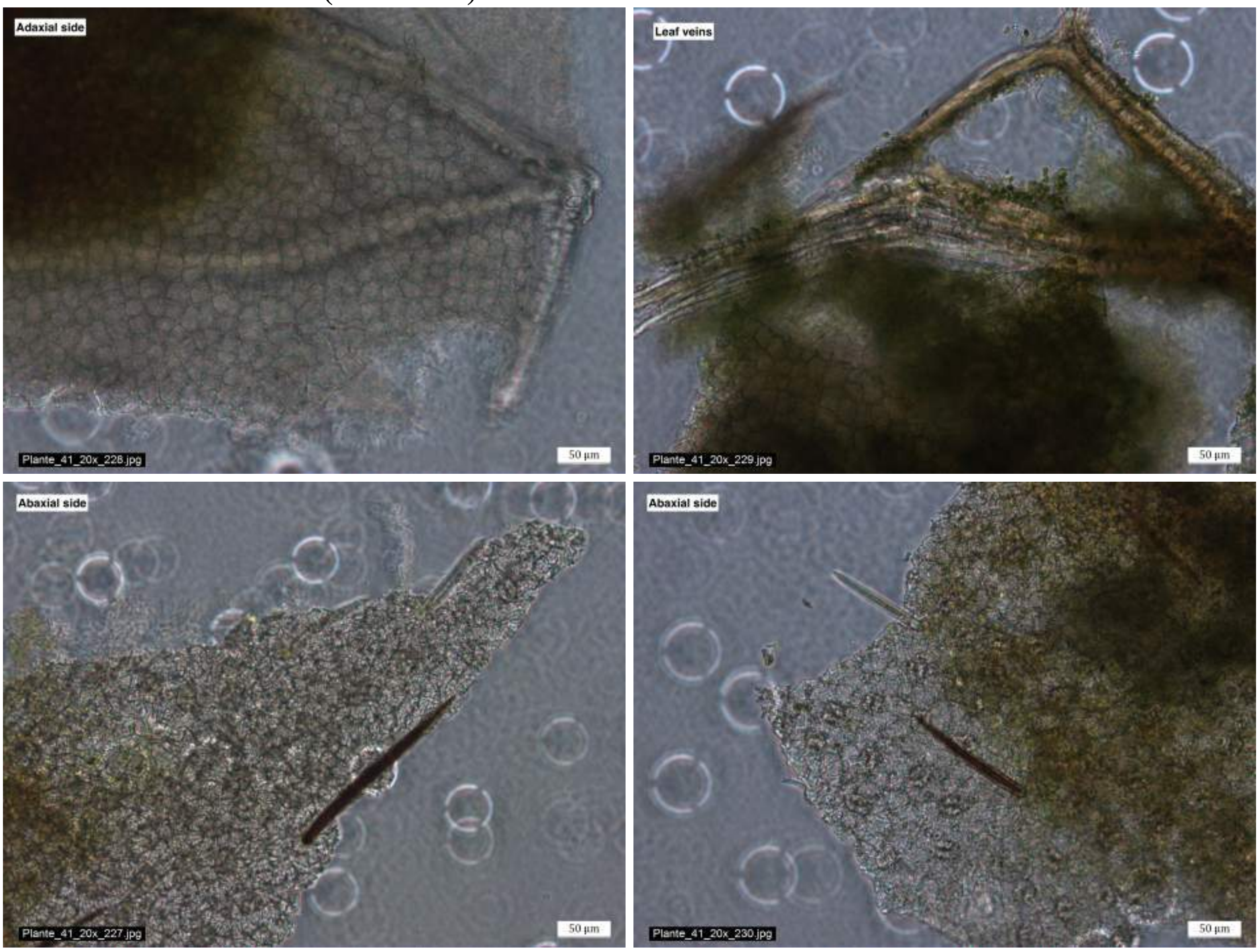


Leaves in microscopy (method 2, discoloration)

Nailpolish method (method 1)



Discoloration method (method 2)



Diospyros soubreana (Plant 42) EBENACEAE

Herbarium plant

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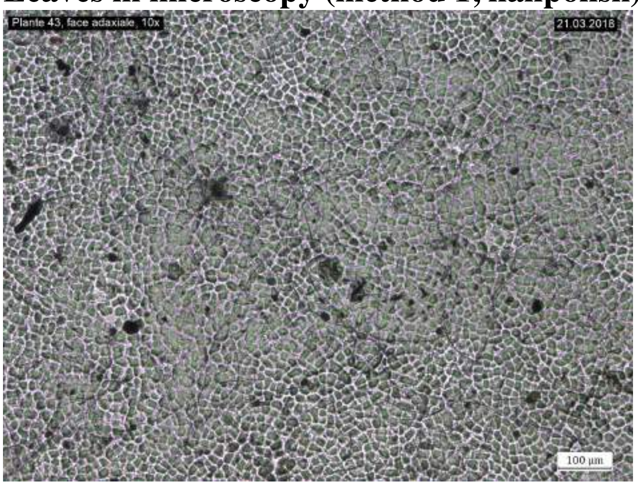
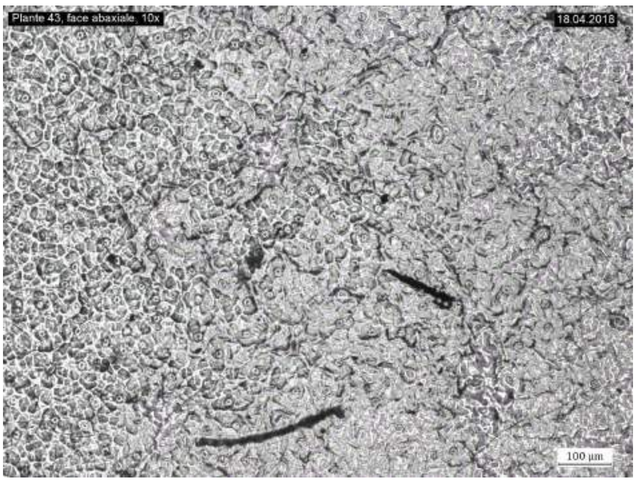
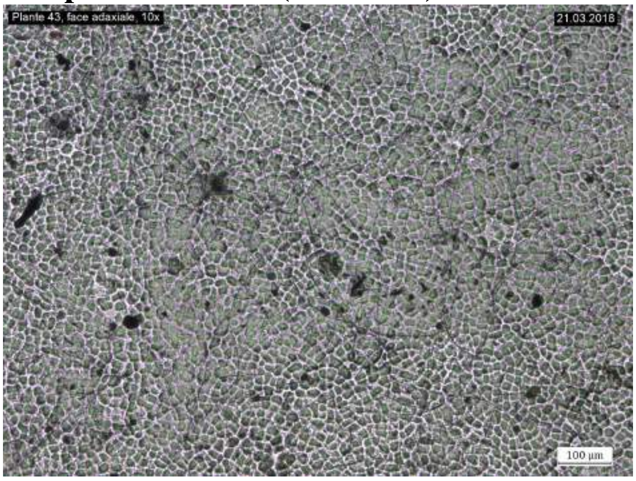
Leaves in macroscopy

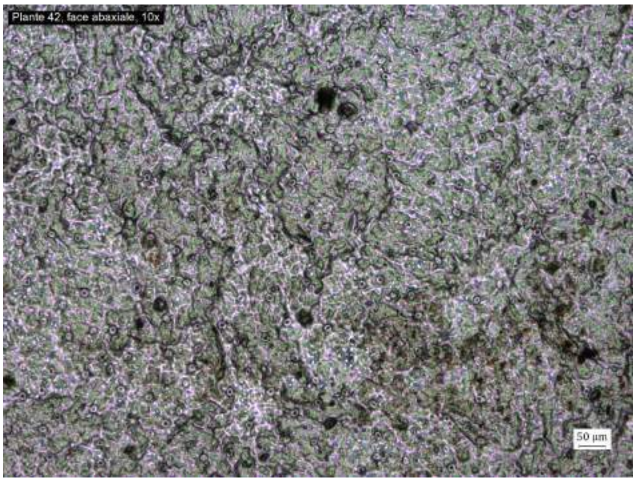
Leaves in microscopy (method 1, nailpolish)

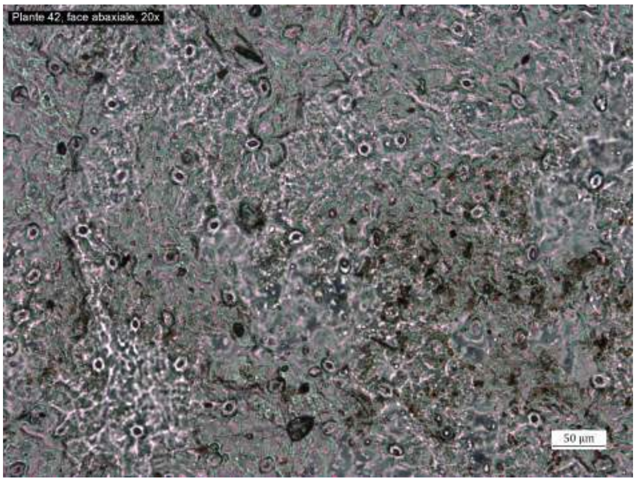




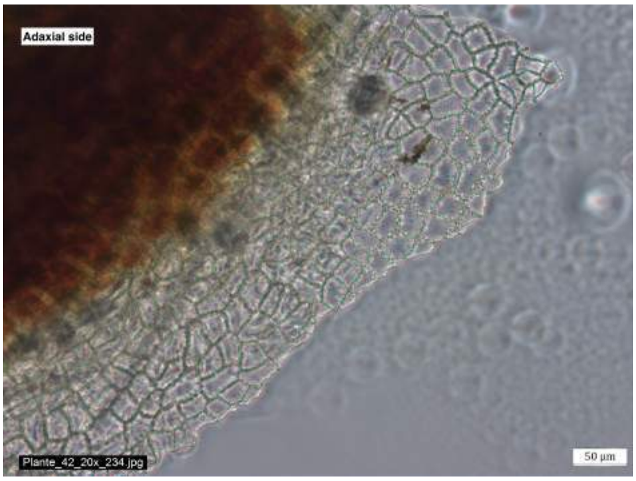
Nailpolish method (method 1)

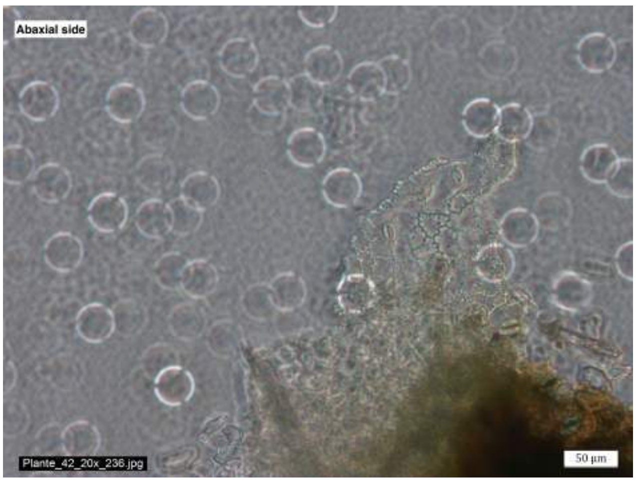


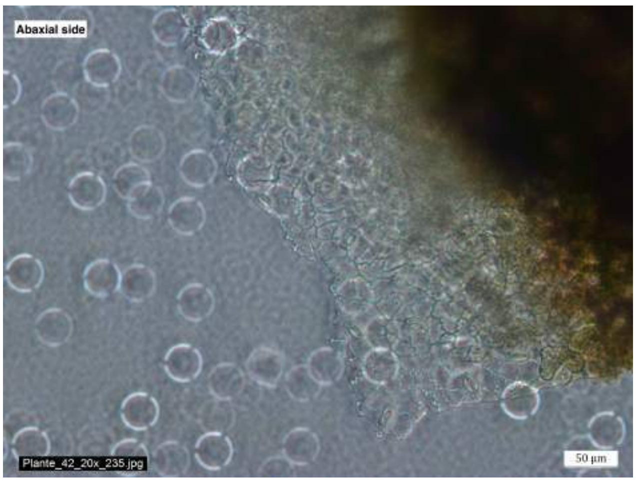




Discoloration method (method 2)







Herbarium plant

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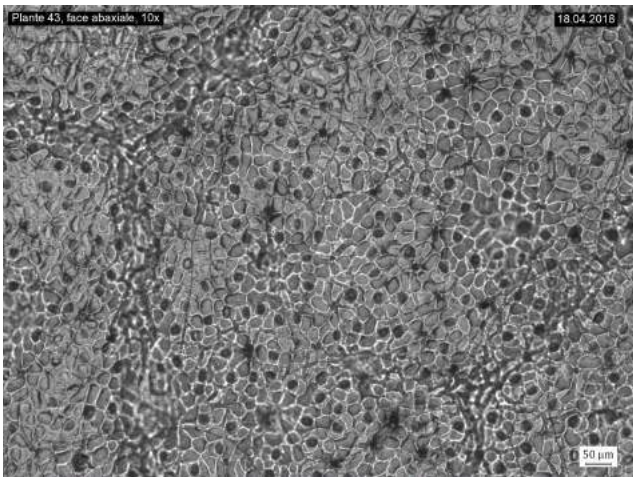
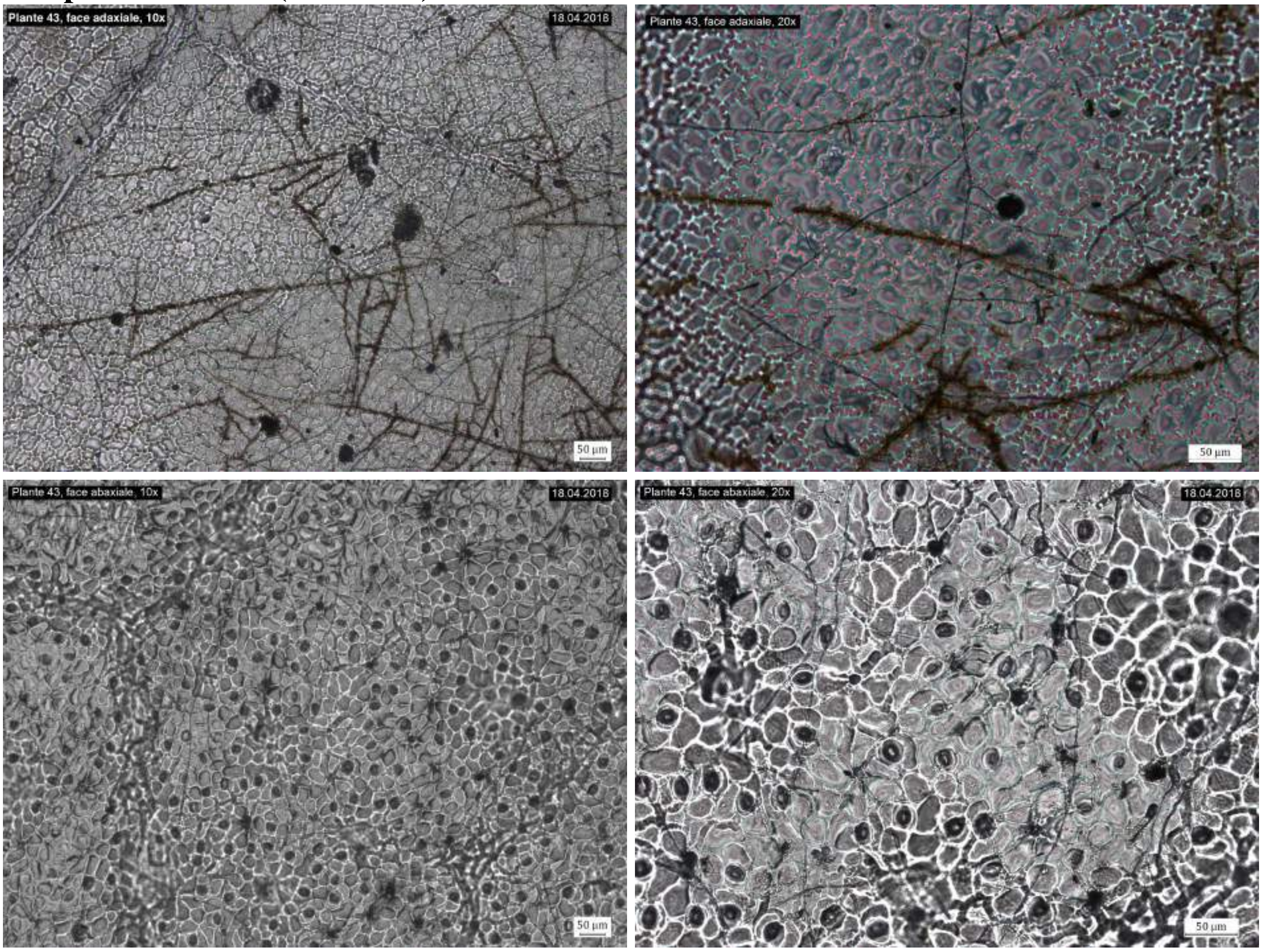
Leaves in macroscopy

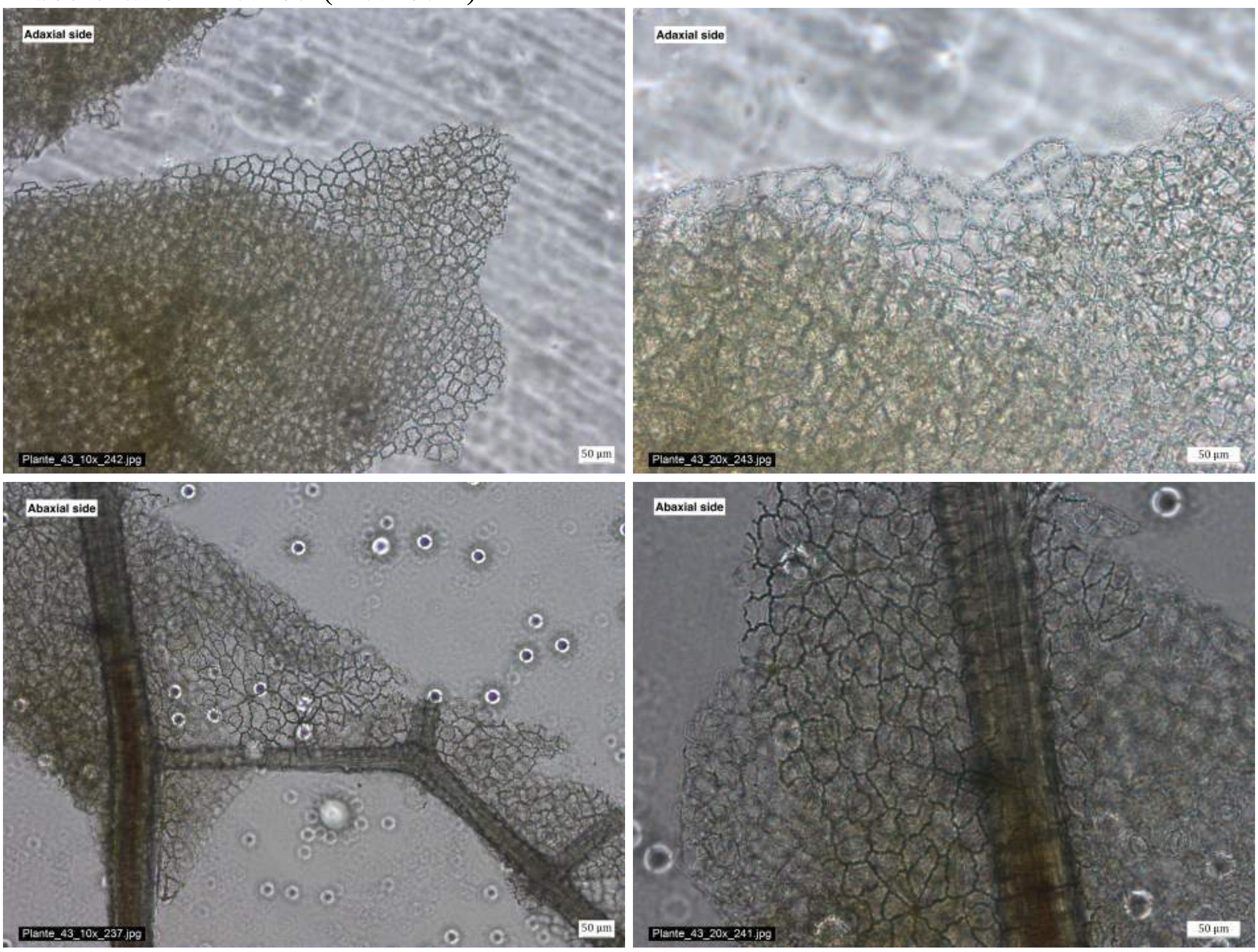
Leaves in microscopy (method 1, nailpolish)



Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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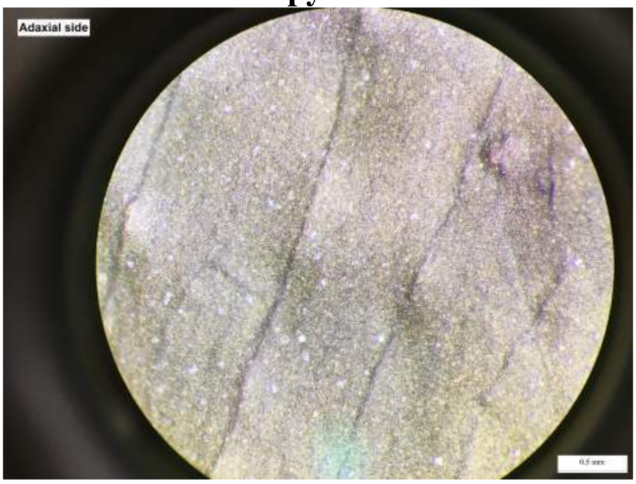
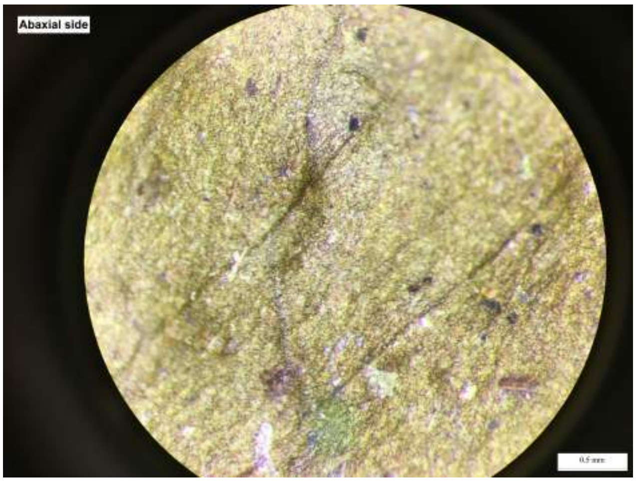
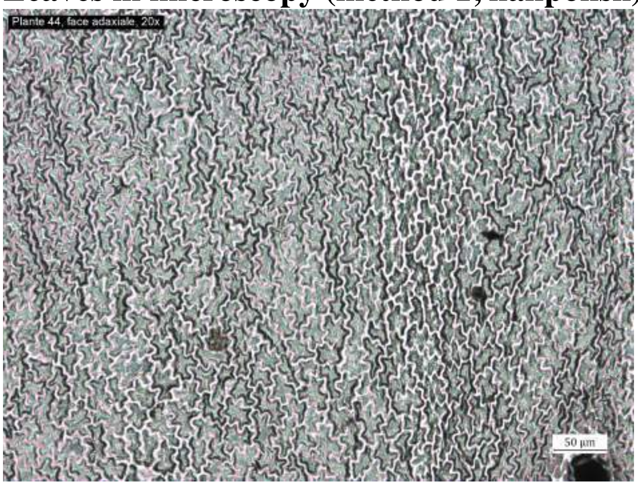
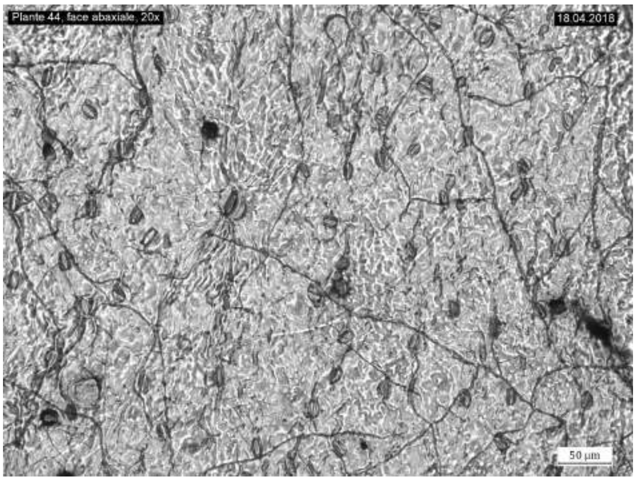
Leaves in macroscopy



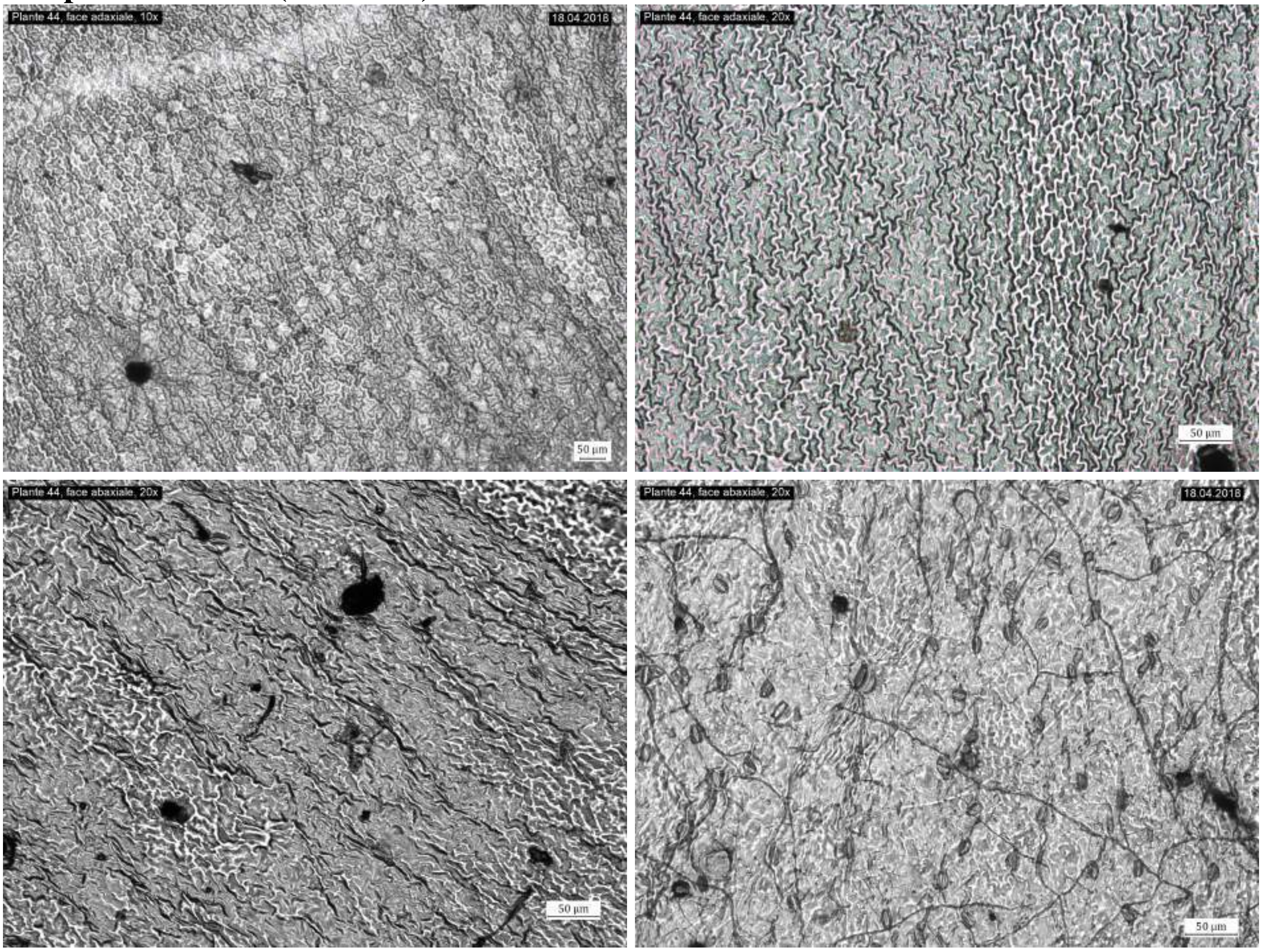


Leaves in microscopy (method 1, nailpolish)

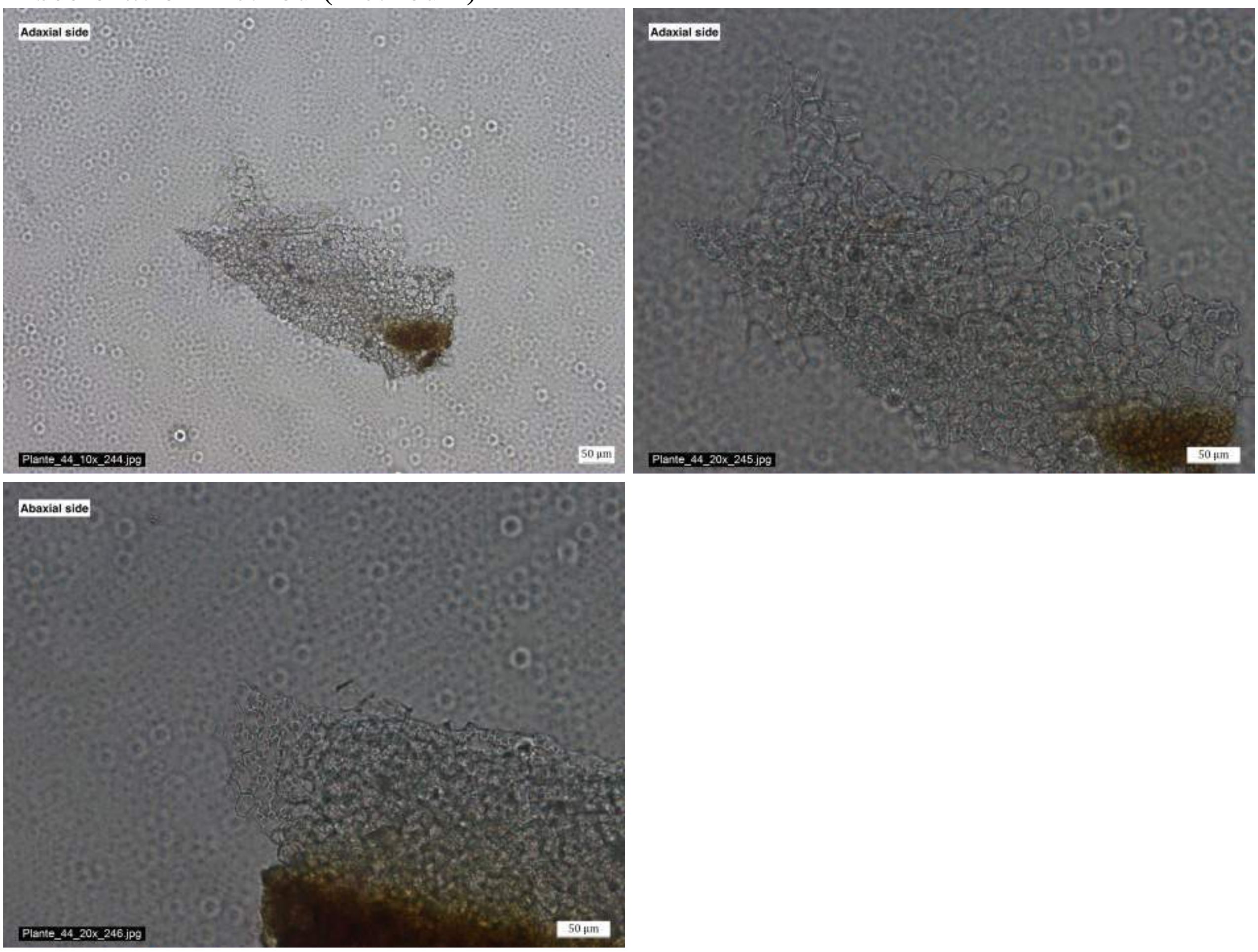




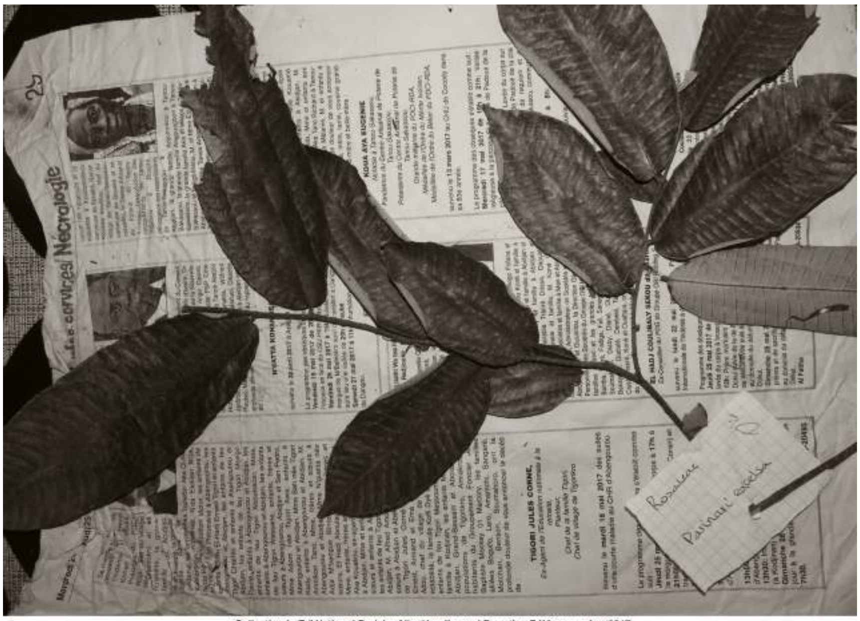
Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant



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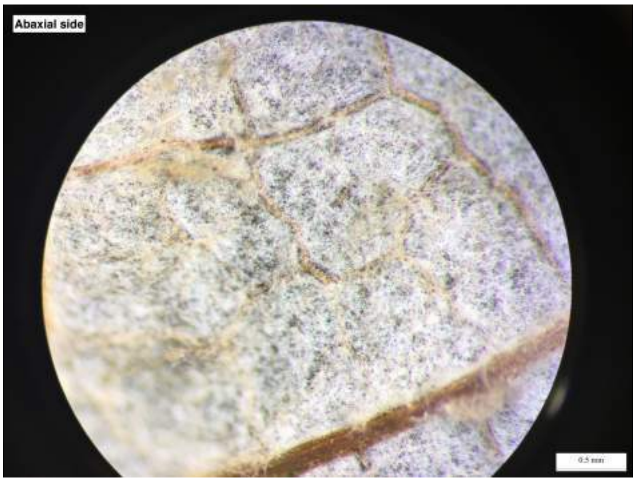
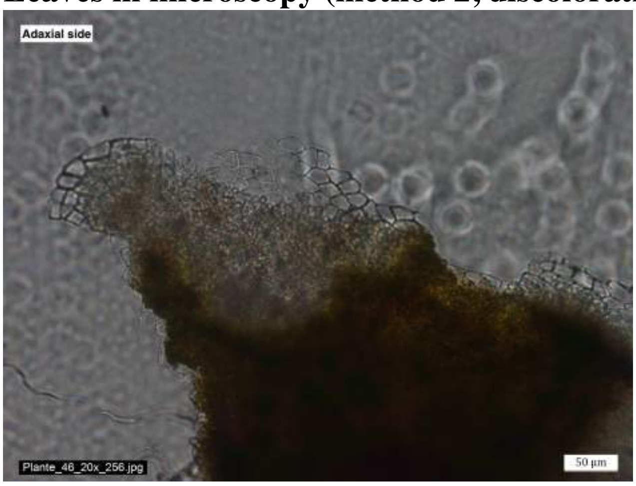
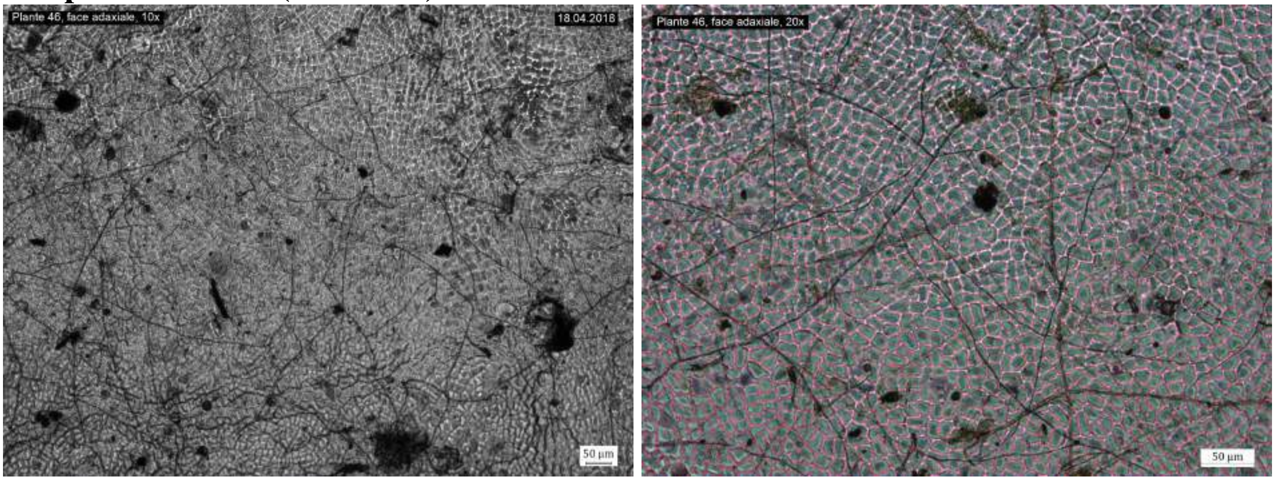
Leaves in macroscopy



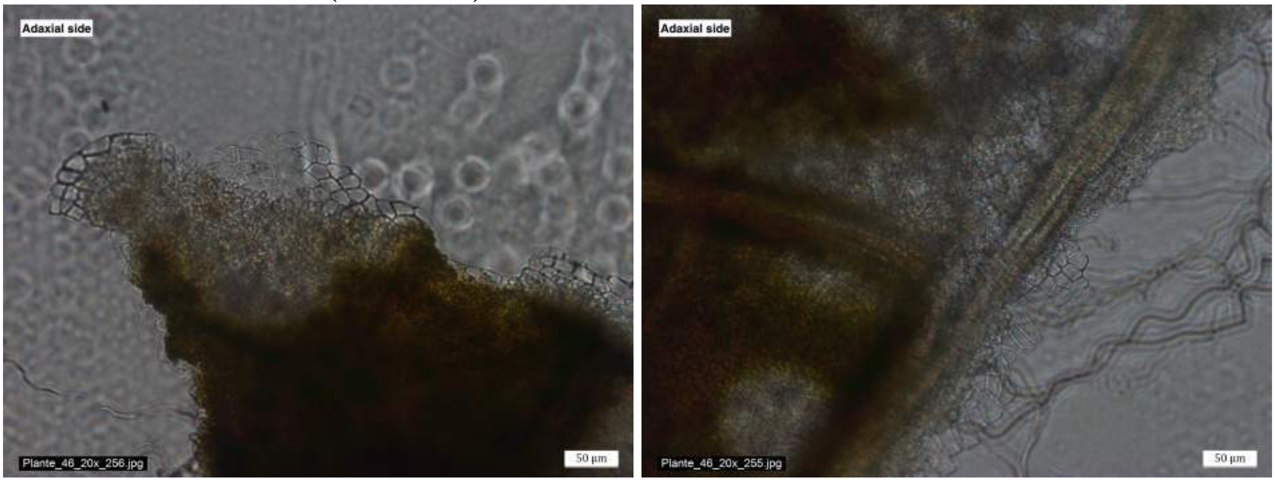
Leaves in microscopy (method 2, discoloration)



Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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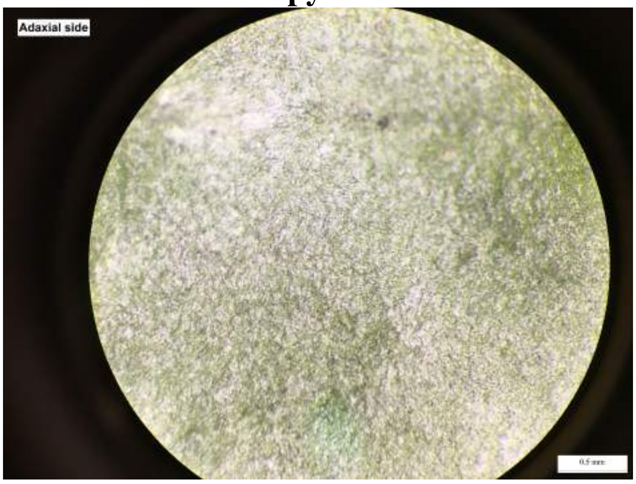
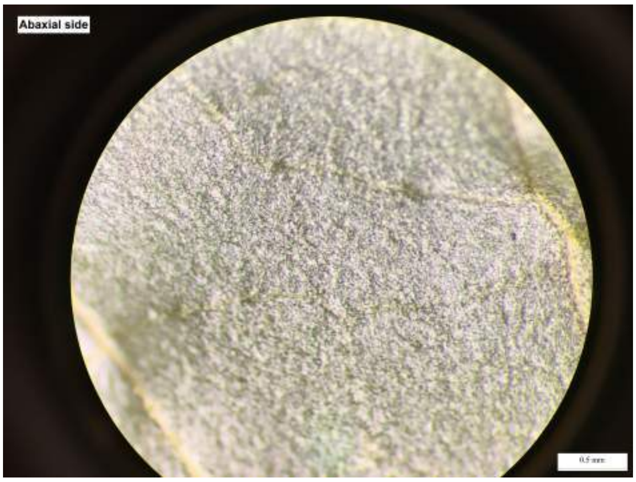
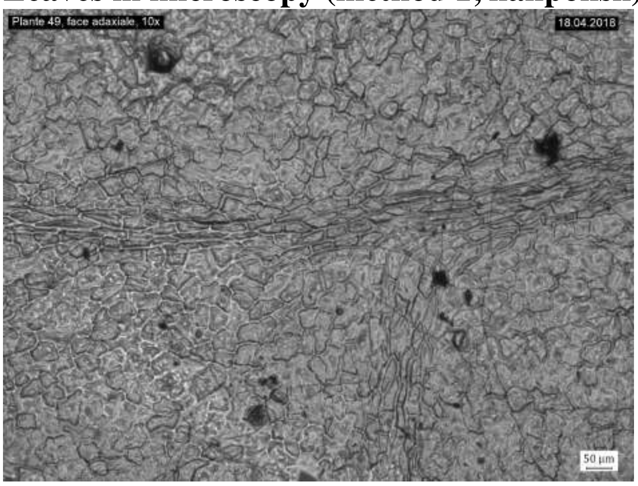
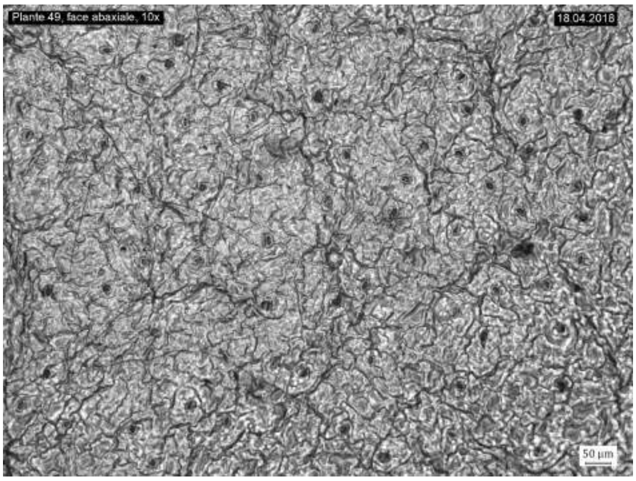
Leaves in macroscopy



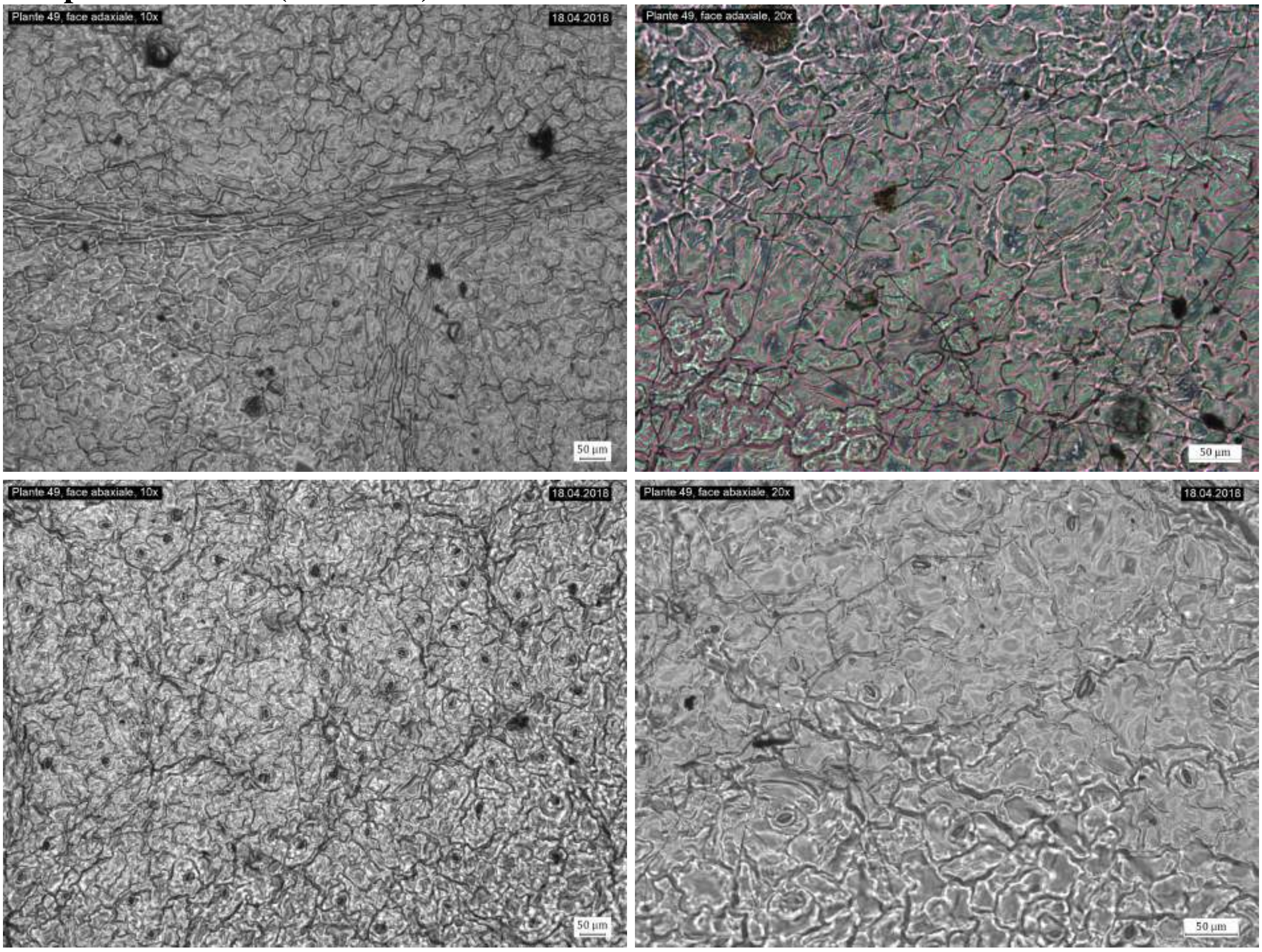


Leaves in microscopy (method 1, nailpolish)

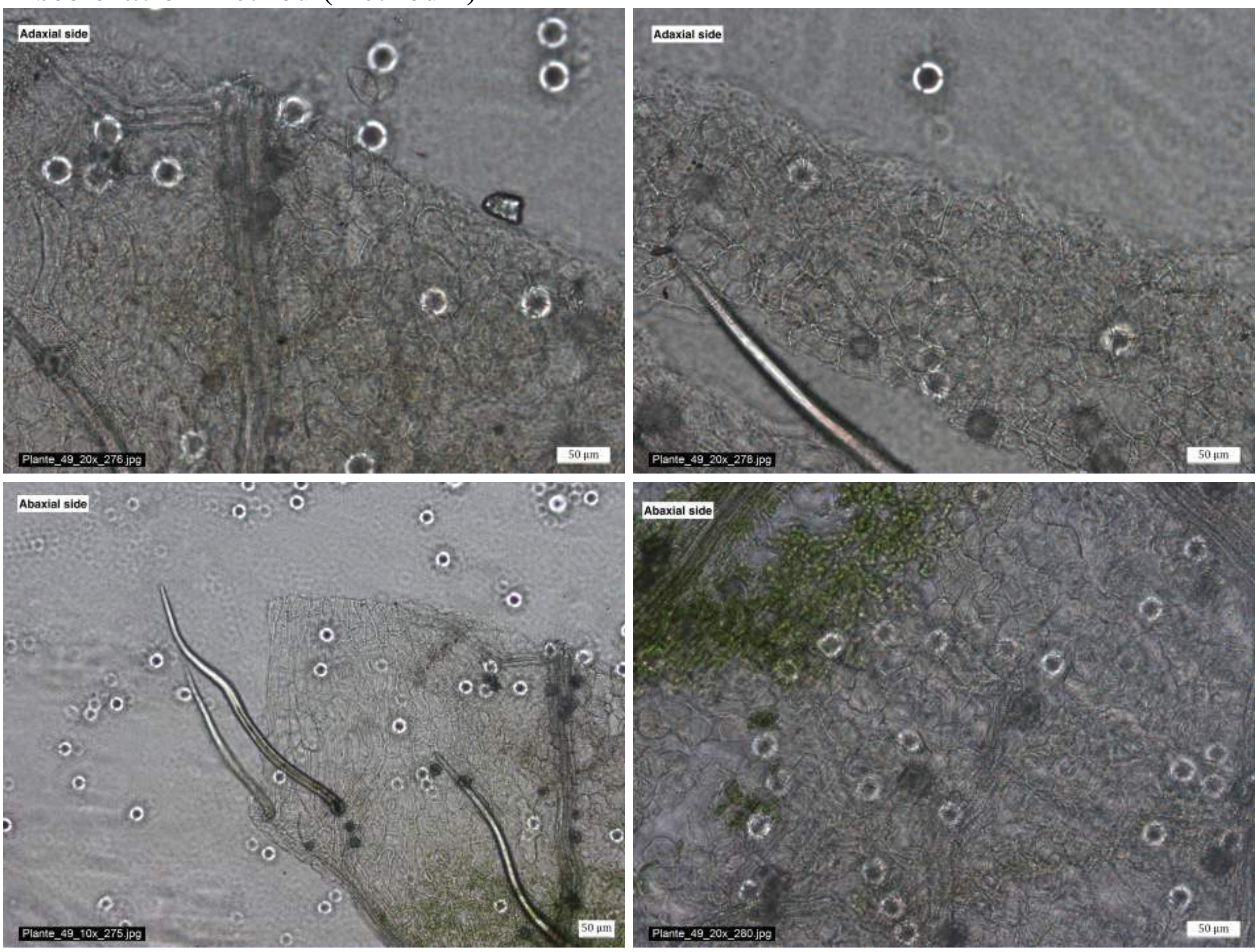




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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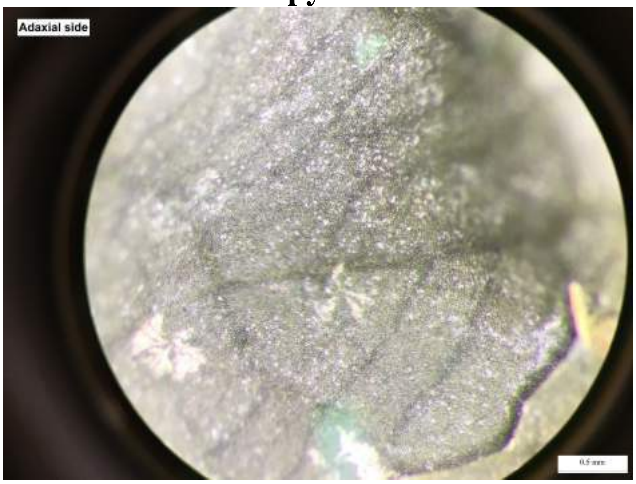
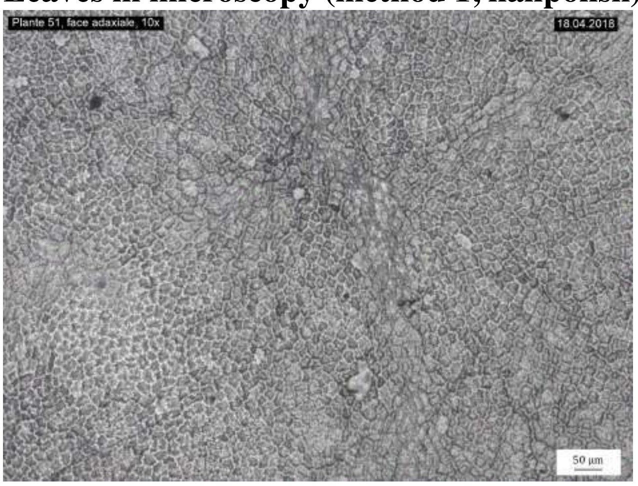
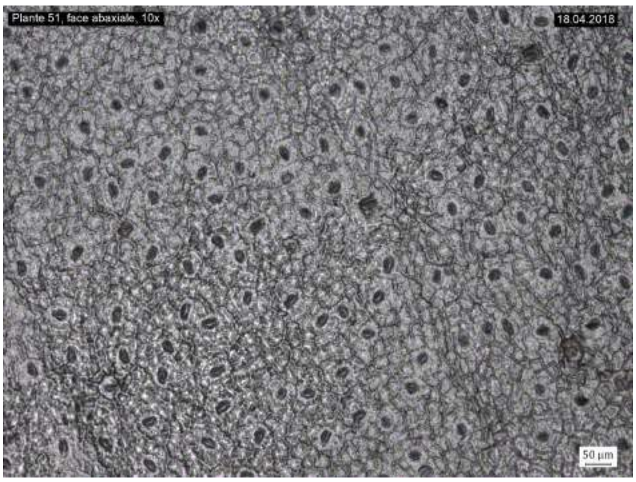
Leaves in macroscopy

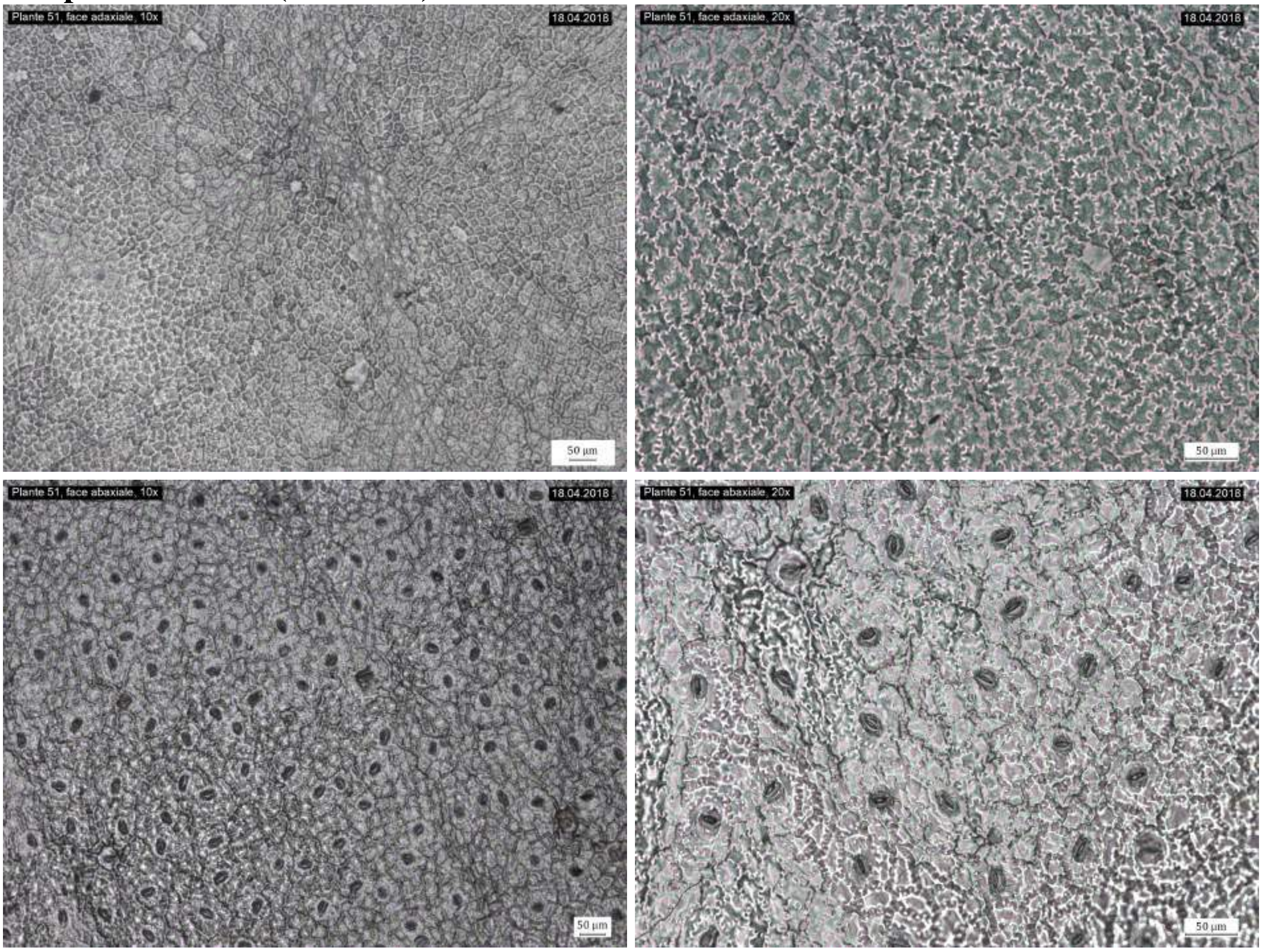


Leaves in microscopy (method 1, nailpolish)

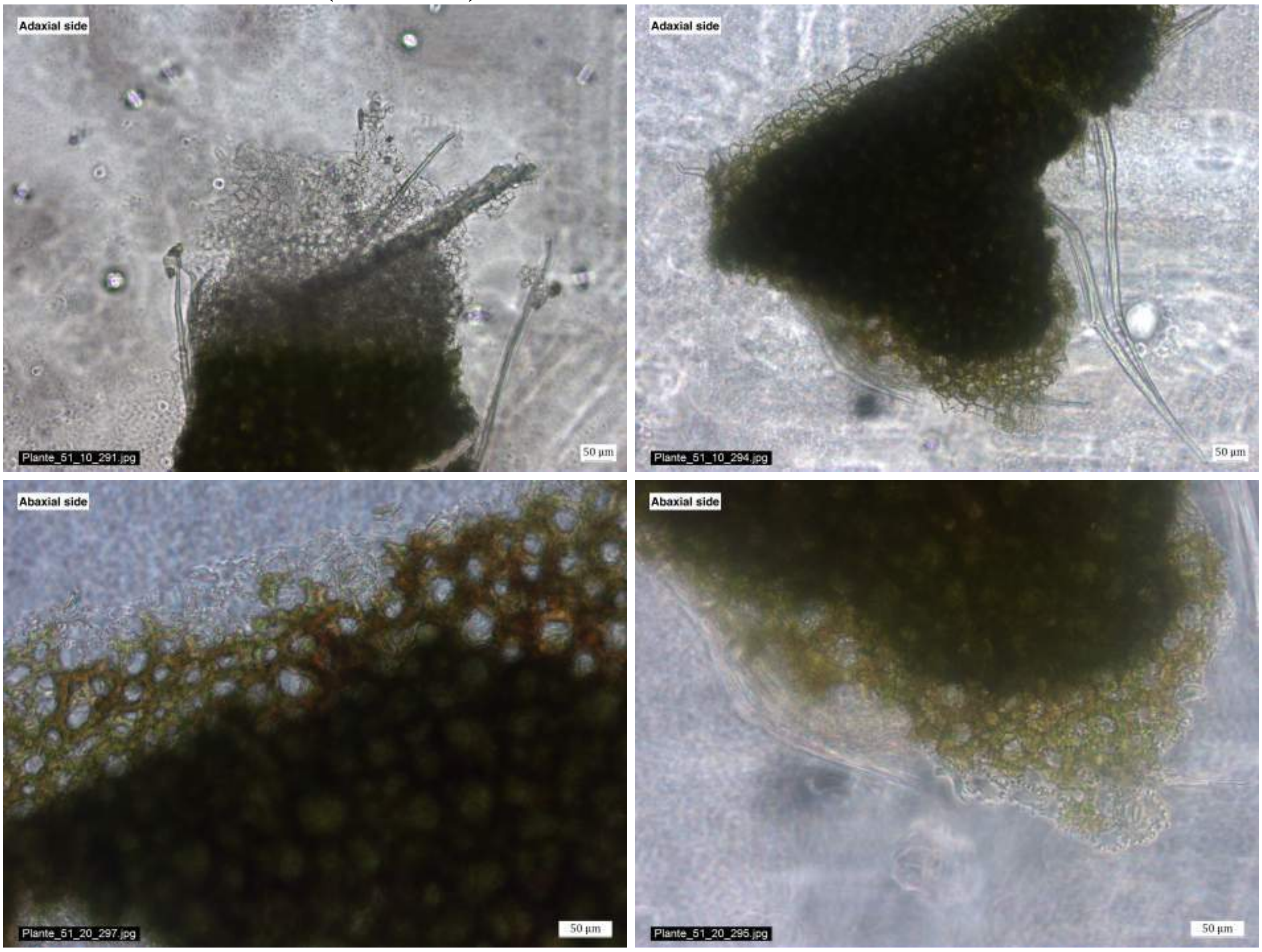




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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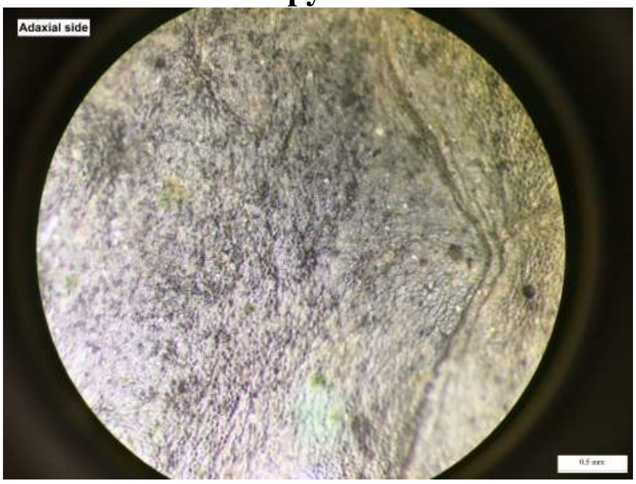
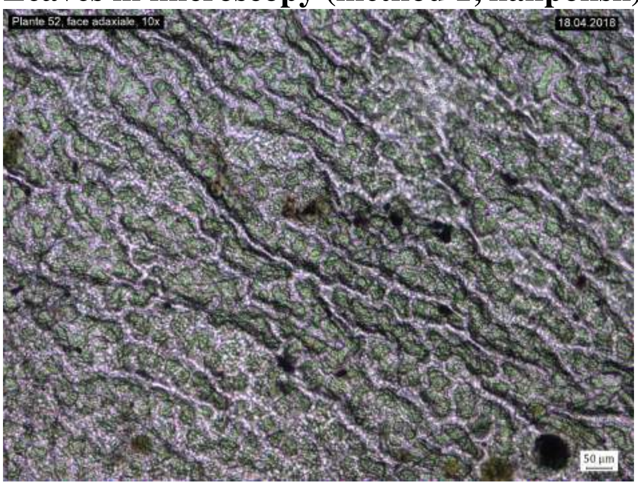
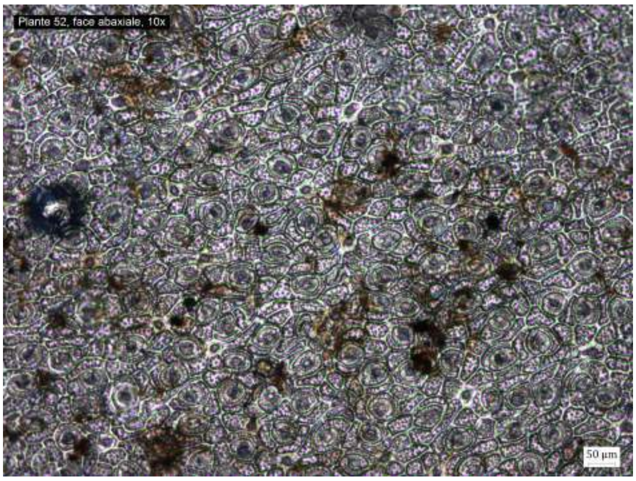
Leaves in macroscopy

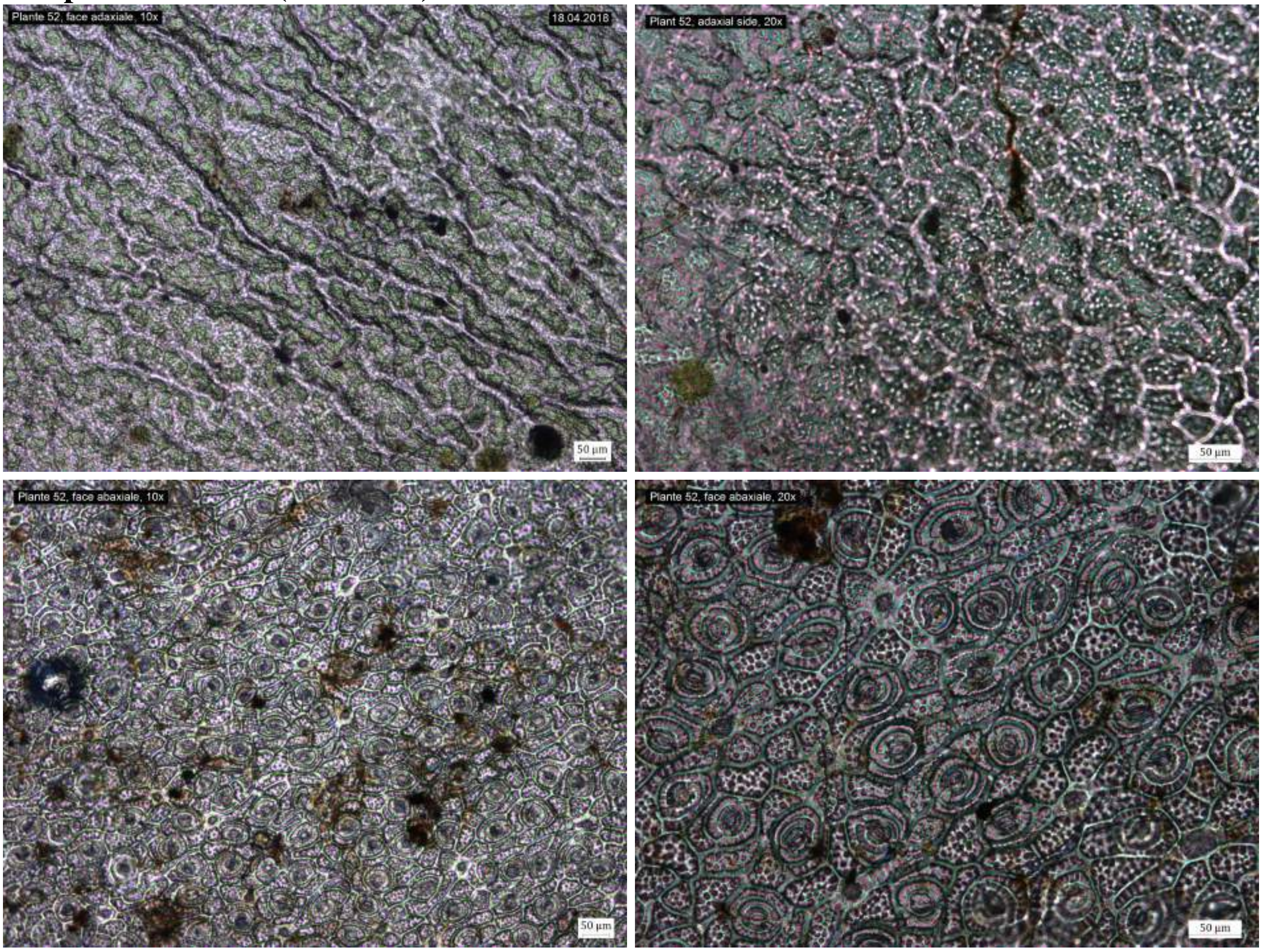


Leaves in microscopy (method 1, nailpolish)

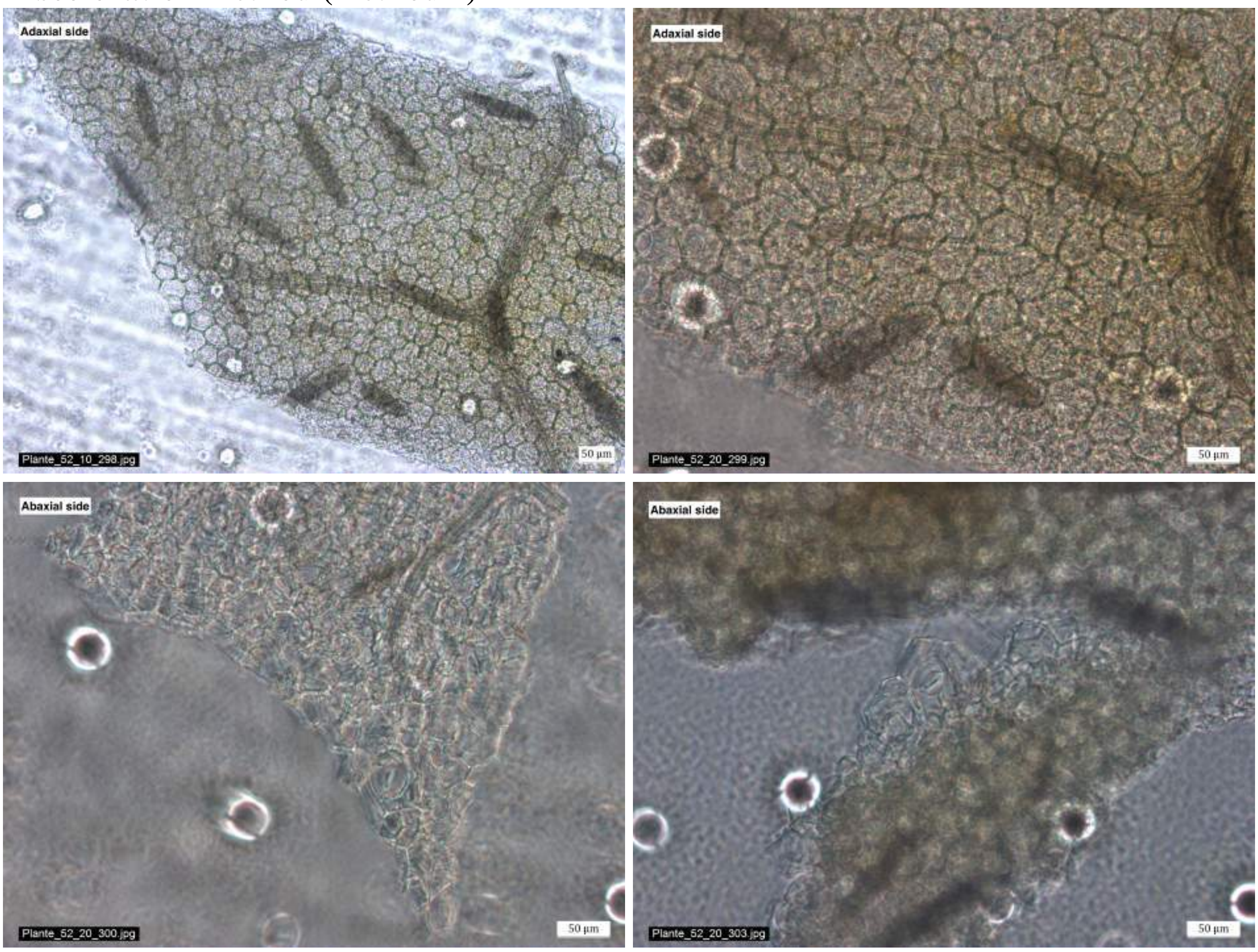




Nailpolish method (method 1)



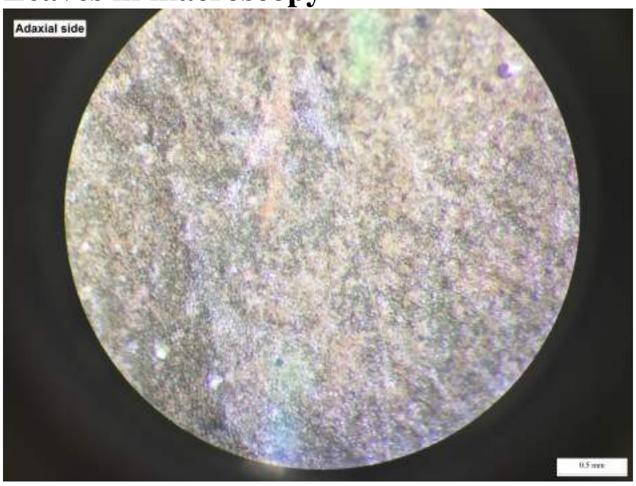
Discoloration method (method 2)

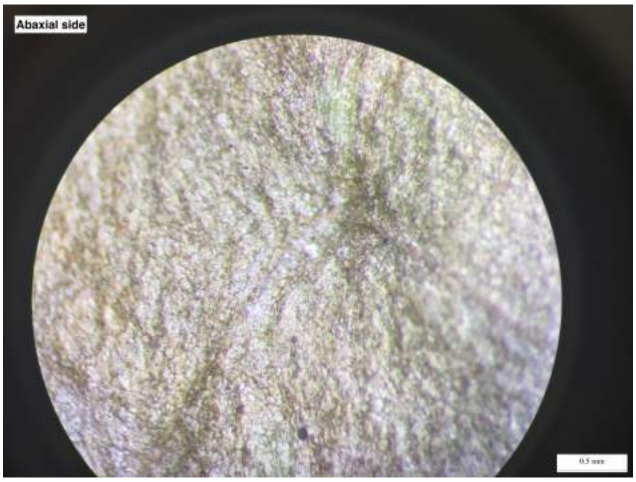


Herbarium plant

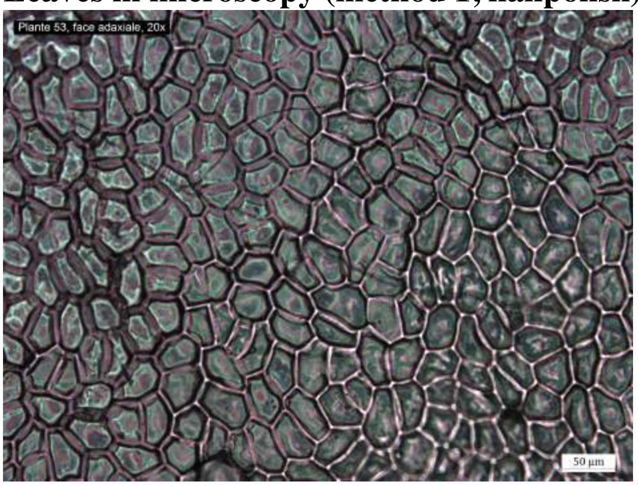
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

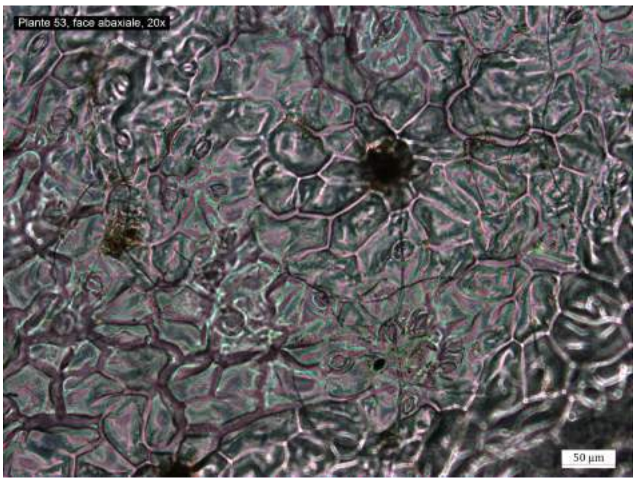
Leaves in macroscopy



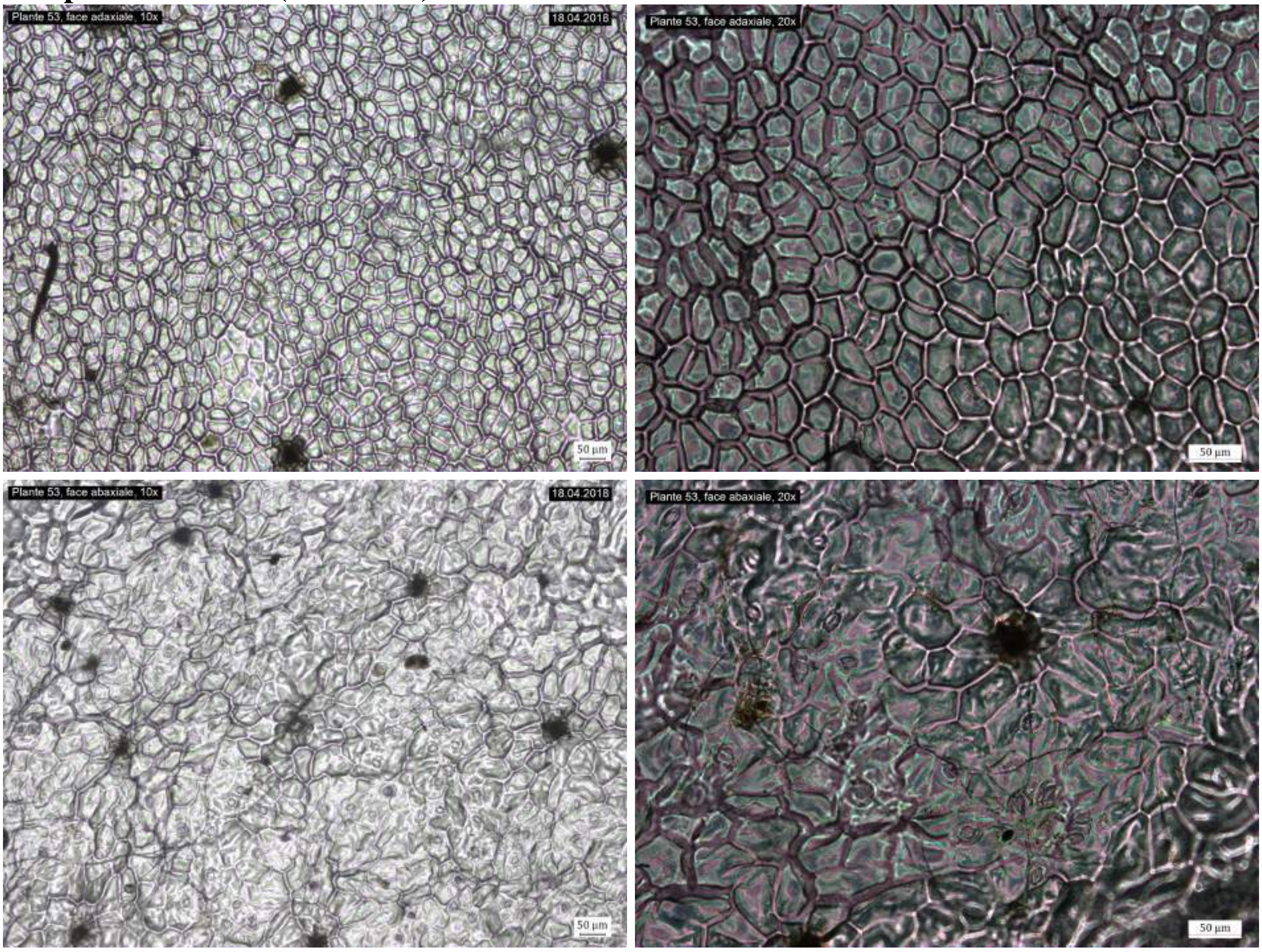


Leaves in microscopy (method 1, nailpolish)

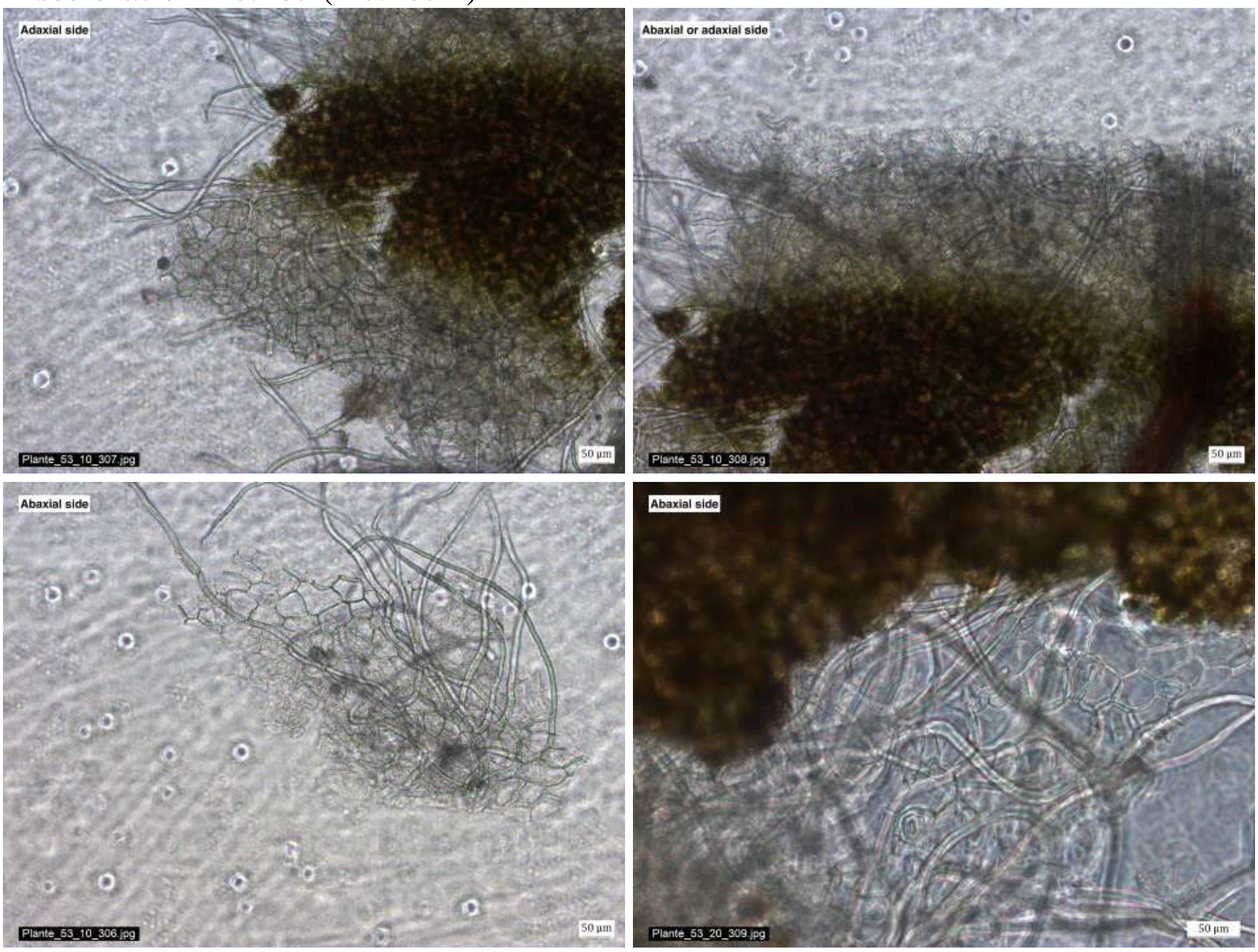




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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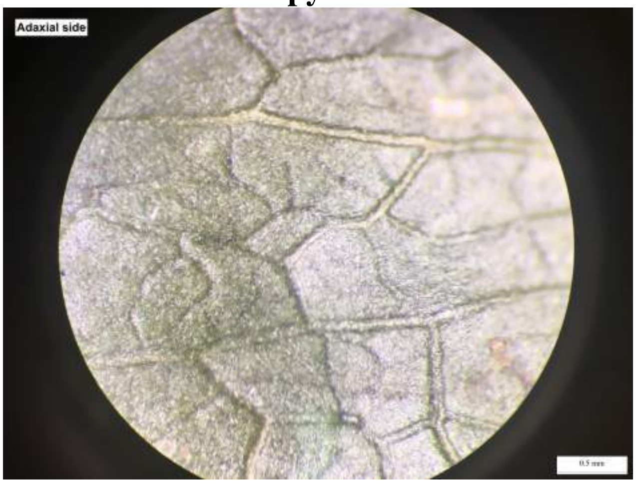
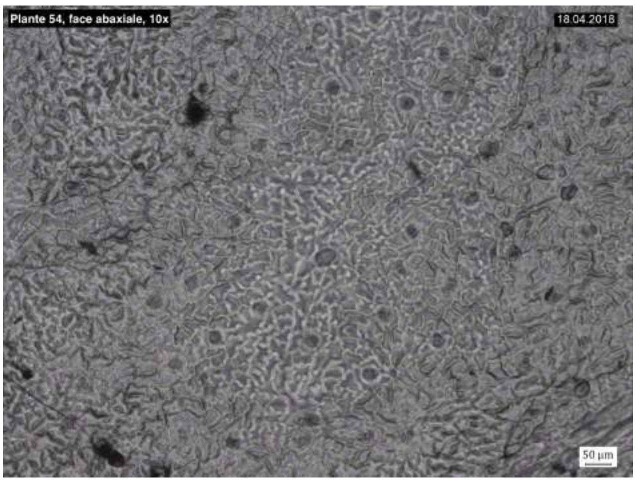
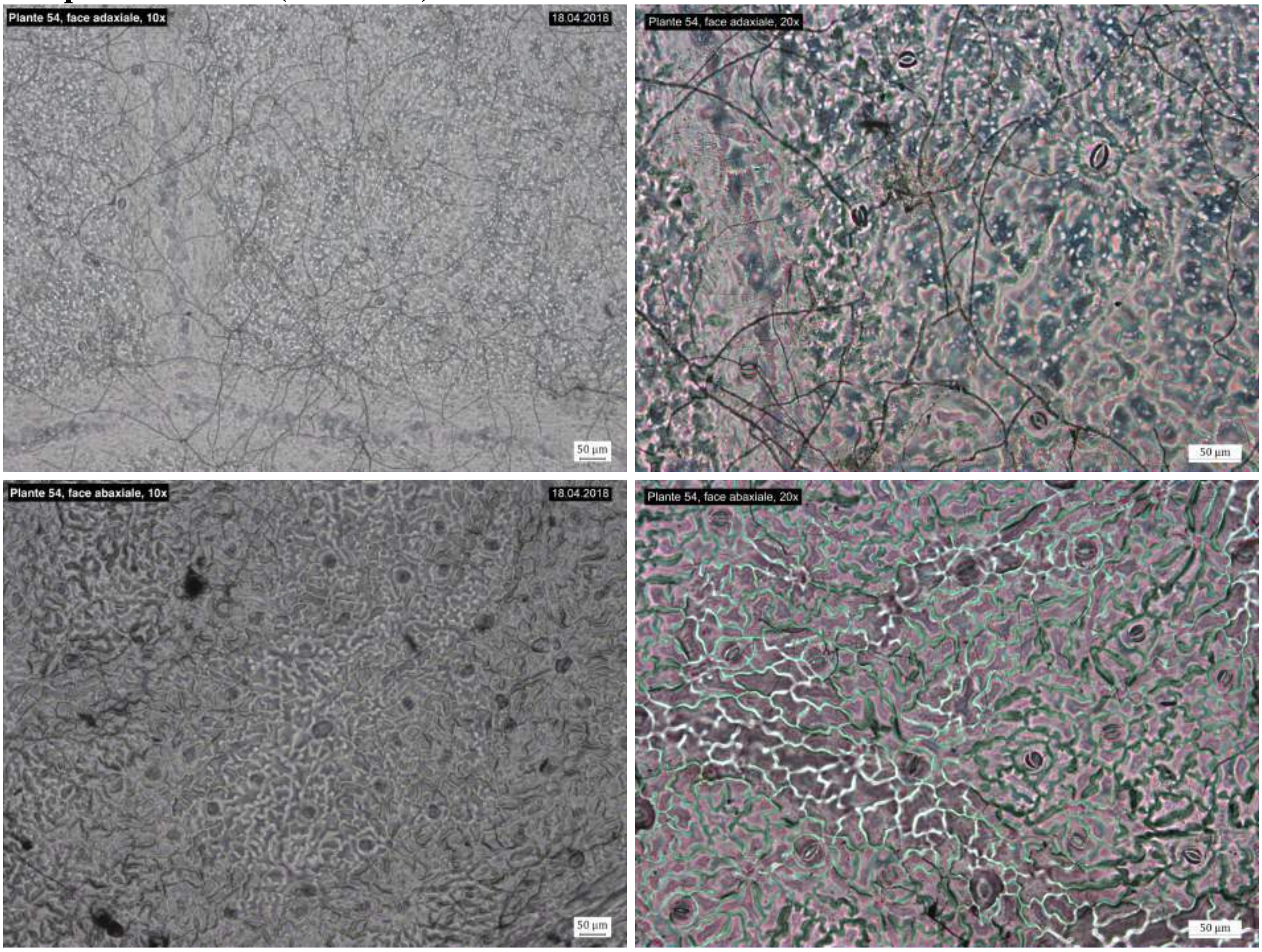
Leaves in macroscopy



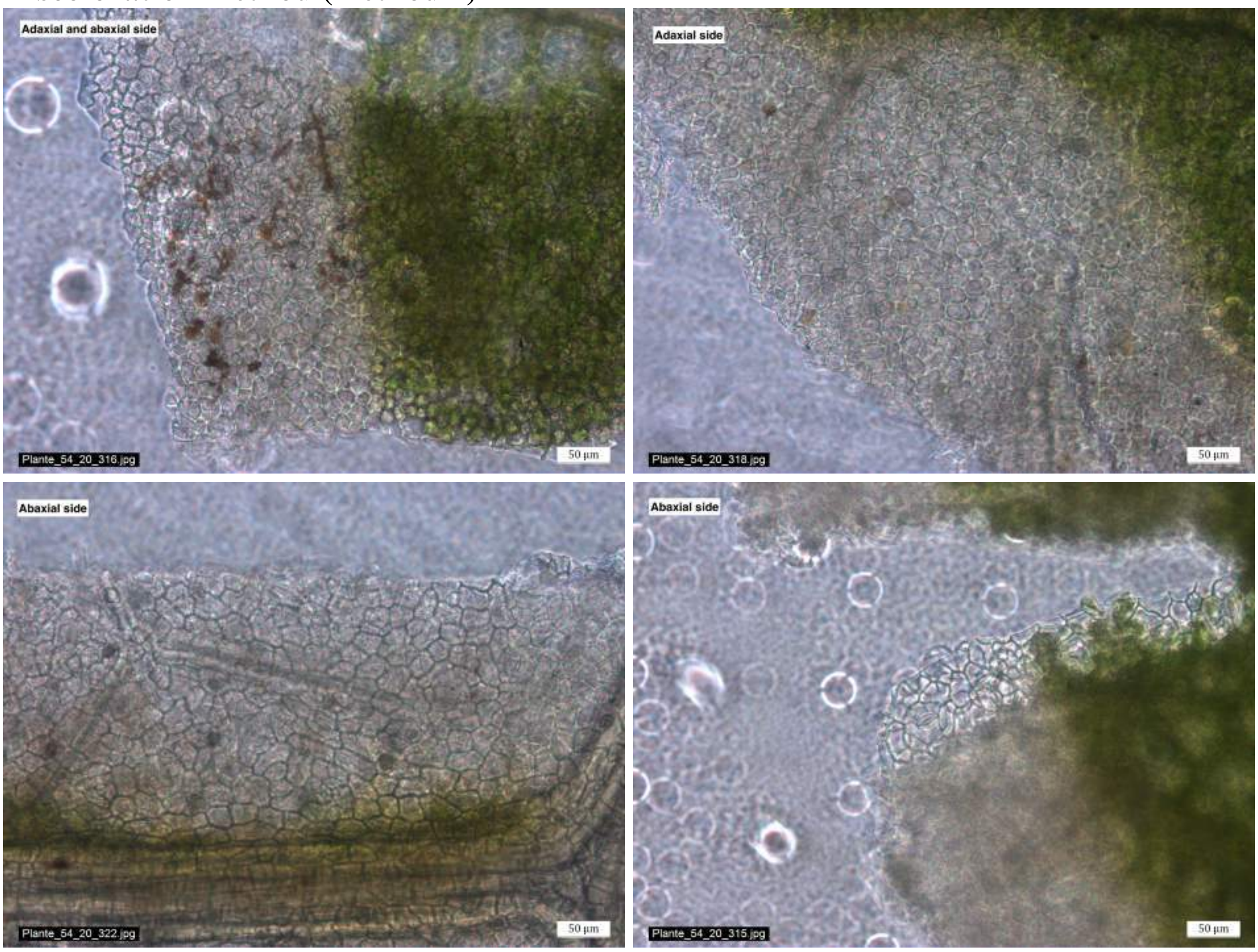
Leaves in microscopy (method 1, nailpolish)



Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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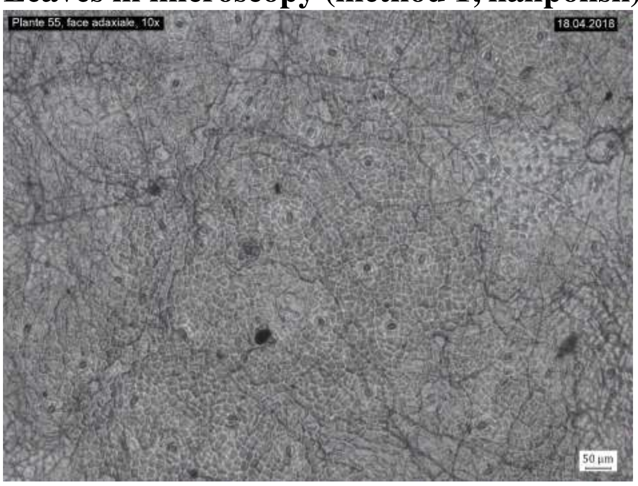
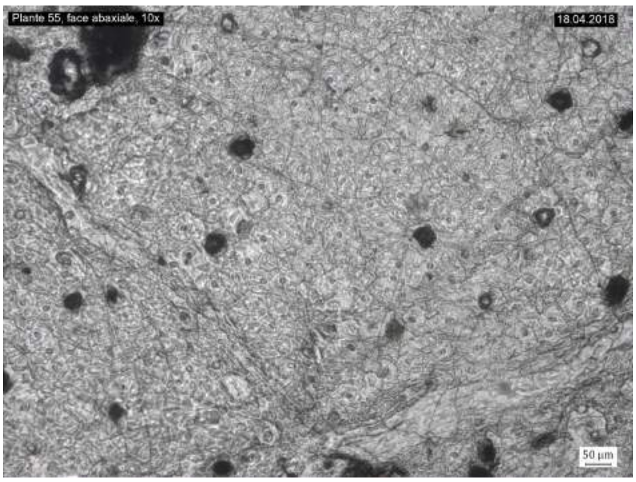
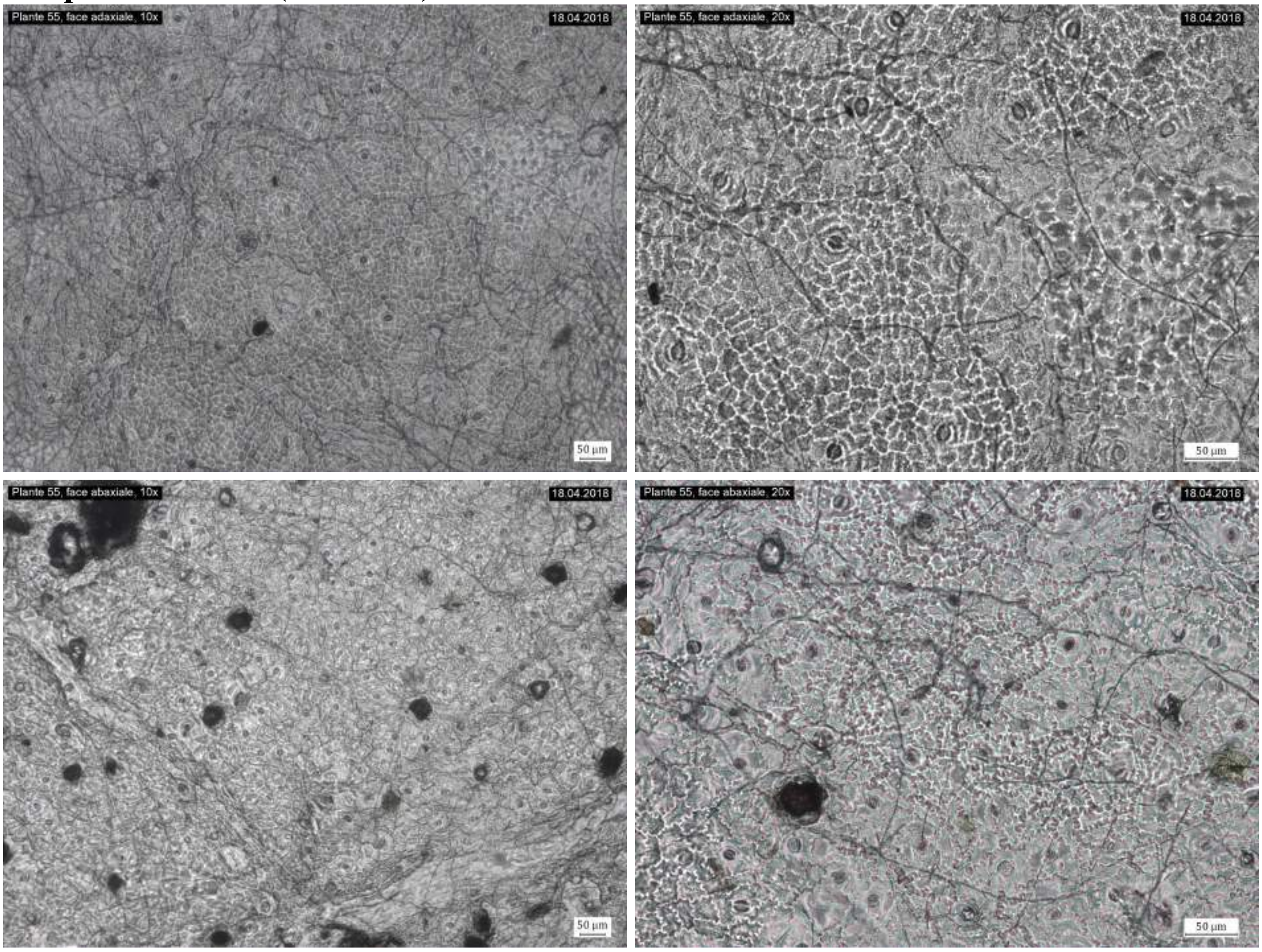
Leaves in macroscopy

Leaves in microscopy (method 1, nailpolish)

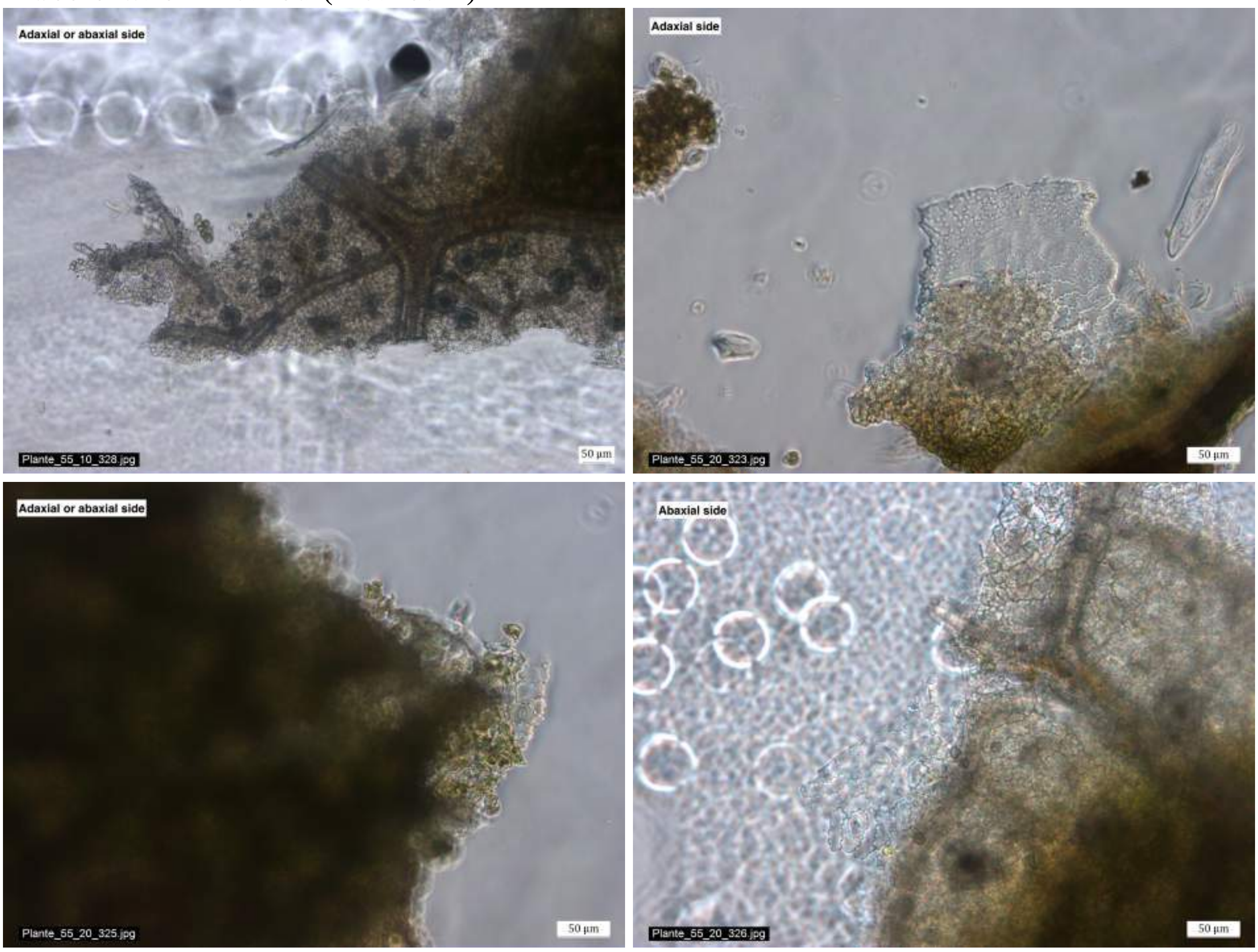




Nailpolish method (method 1)



Discoloration method (method 2)



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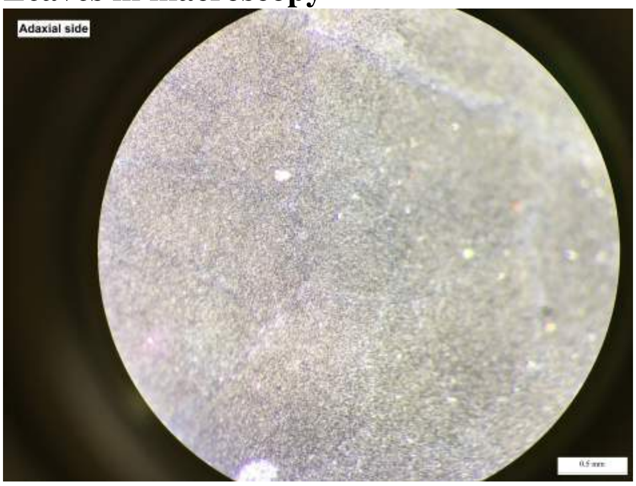
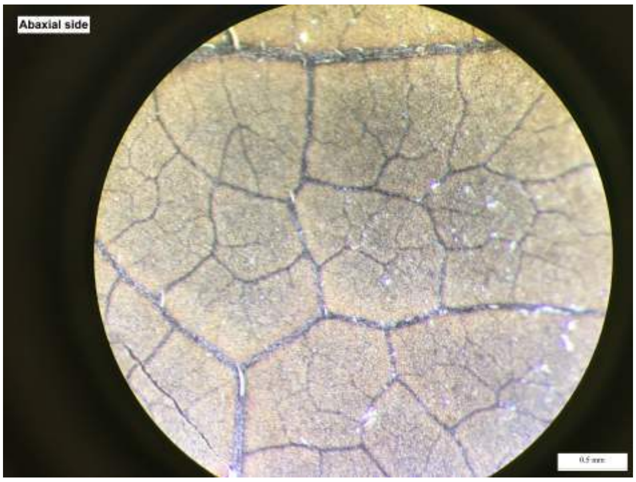
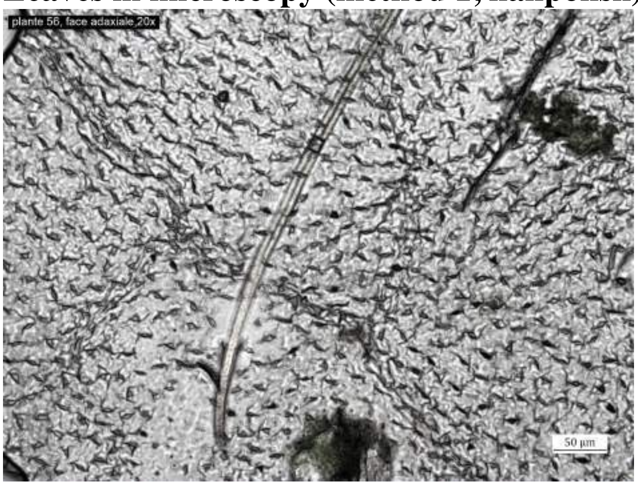
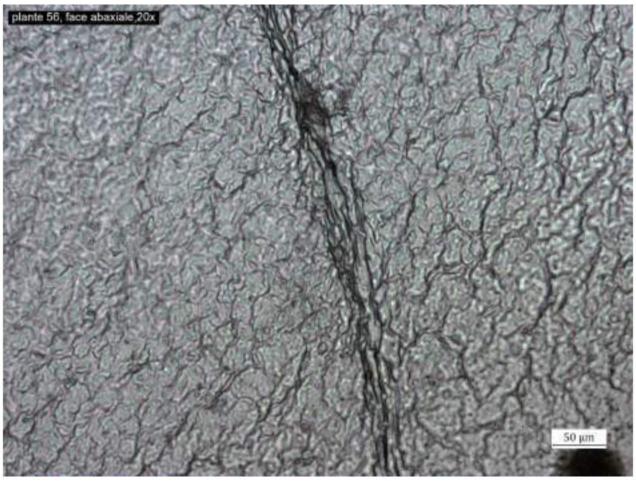
Leaves in macroscopy



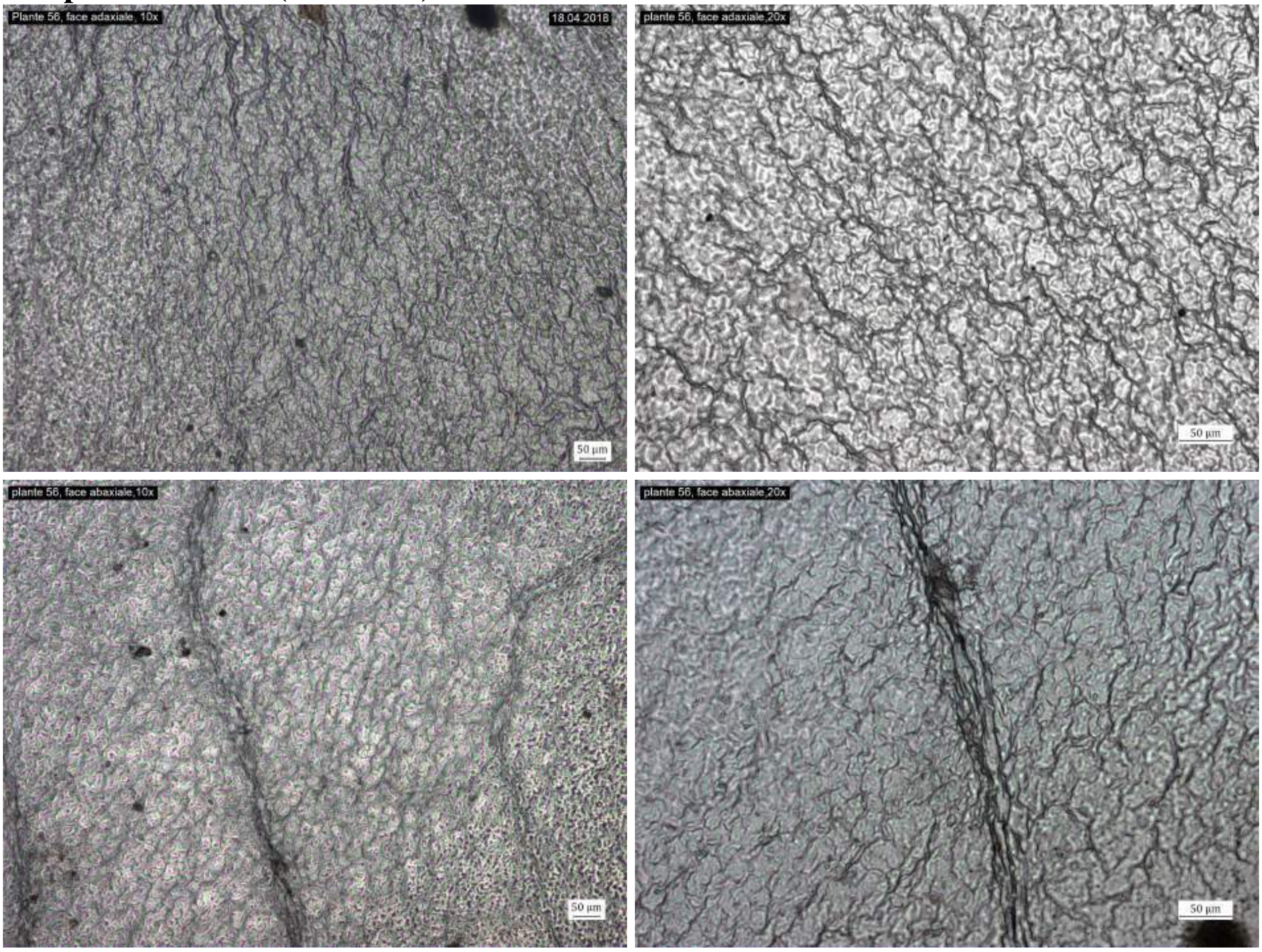


Leaves in microscopy (method 1, nailpolish)

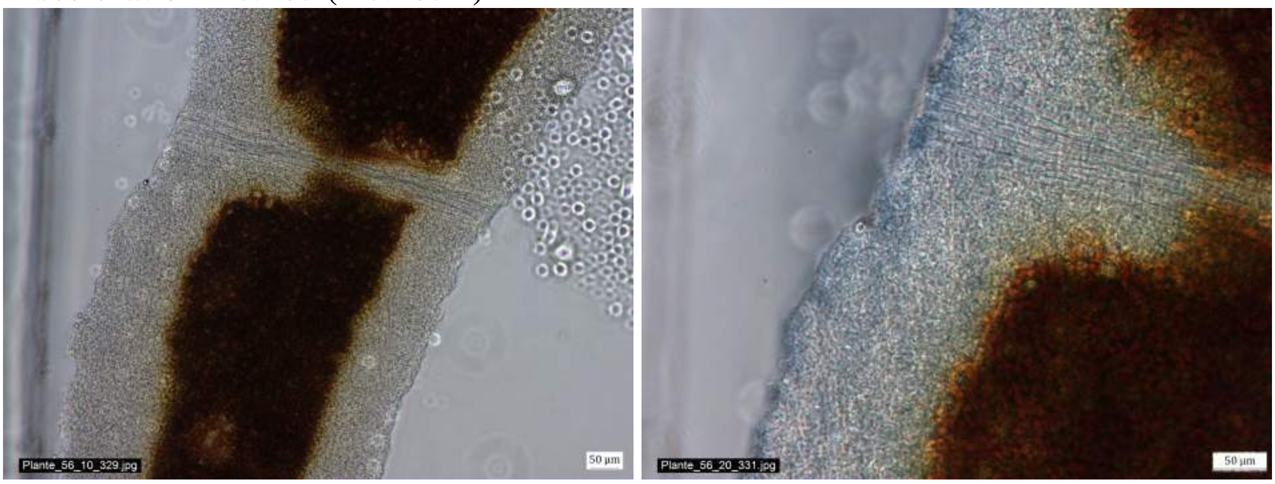




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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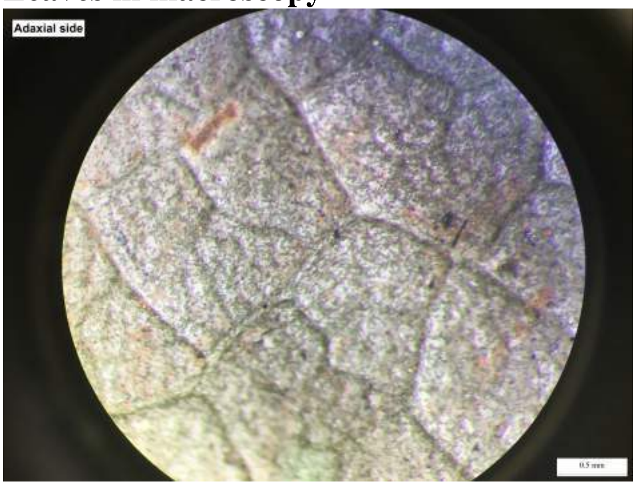
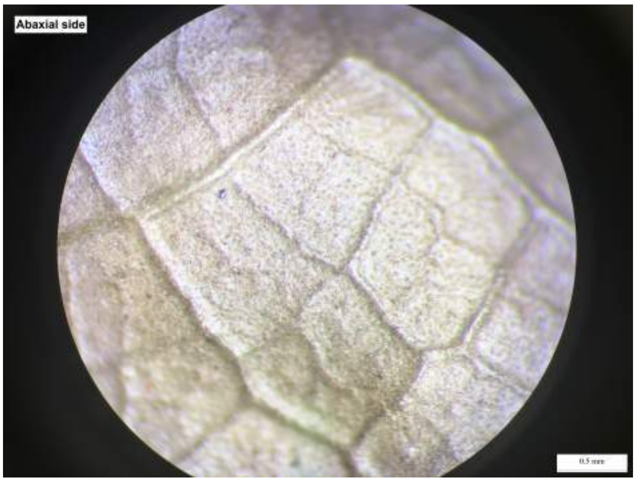
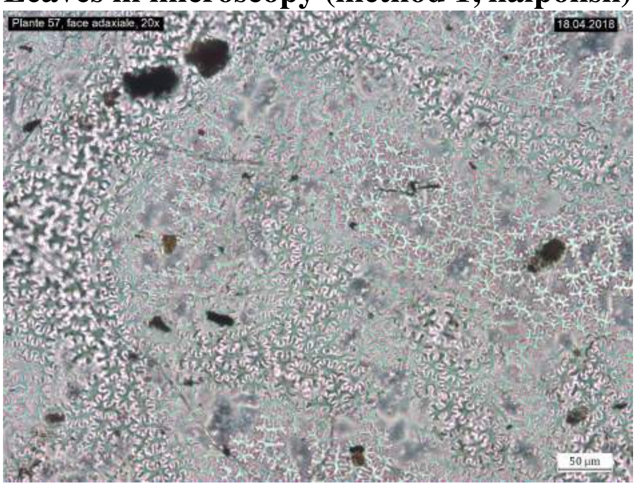
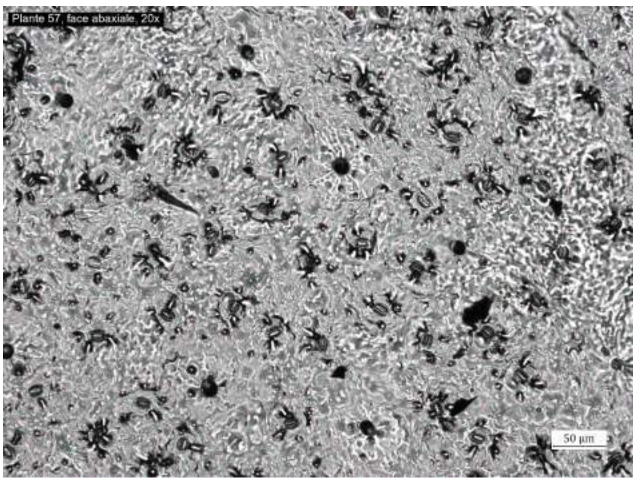
Leaves in macroscopy



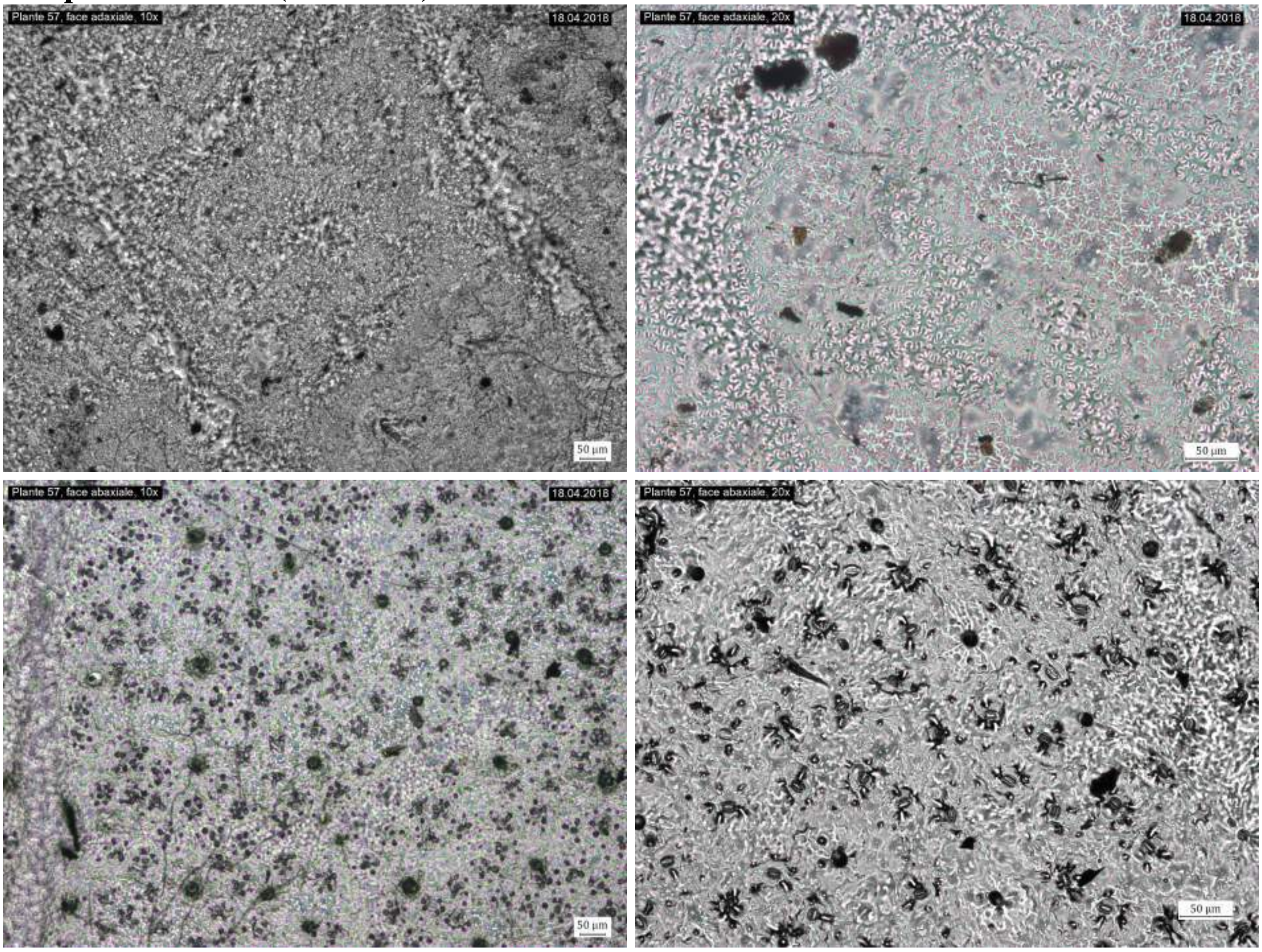


Leaves in microscopy (method 1, naipolish)





Nailpolish method (method 1)



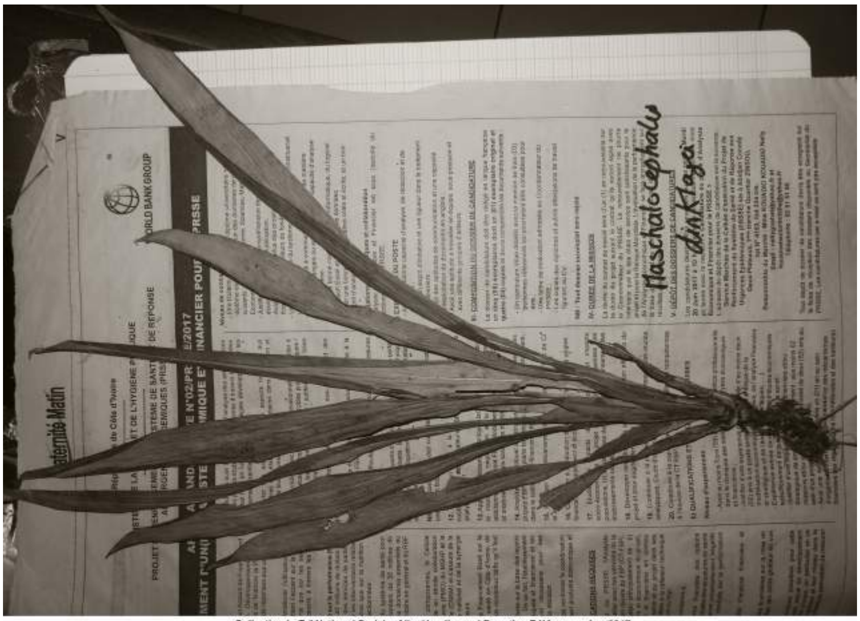
Discoloration method (method 2)

No references available

MONOCOTYLEDONAE

Maschalocephalus dinklagei (Plant 10), *Streptogyna crinita* (Plant 14), *Marantochloa purpurea* (Plant 15), *Costus afer* (Plant 25), *Hypselodelphys violaceae* (Plant 28), *Palisota hirsuta* (Plant 31), S*cleria boivinii* (Plant 45), *Centotheca lappacea* (Plant 47), *Dracaena phyronides* (Plant 48), *Raphia hookerii* (Plant 50), T*aumathococcus daniellii* (Plant 58), *Draceana surculosa* (Plant 59), Elaeis guineensis (Plant 60)

Herbarium plant



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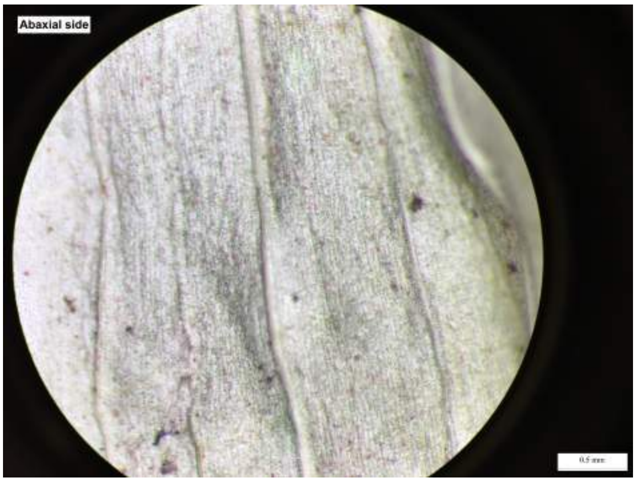
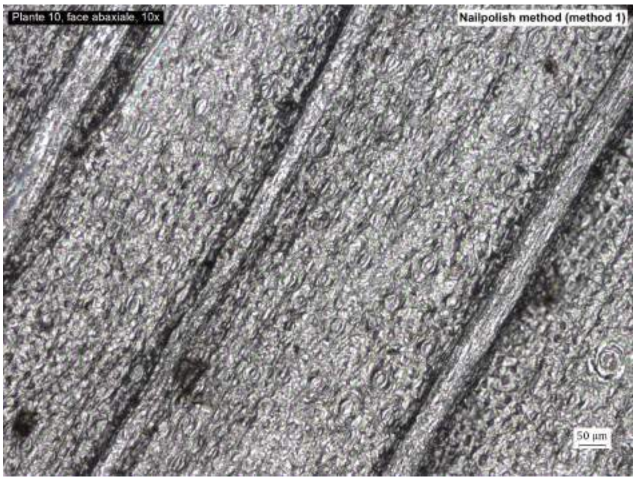
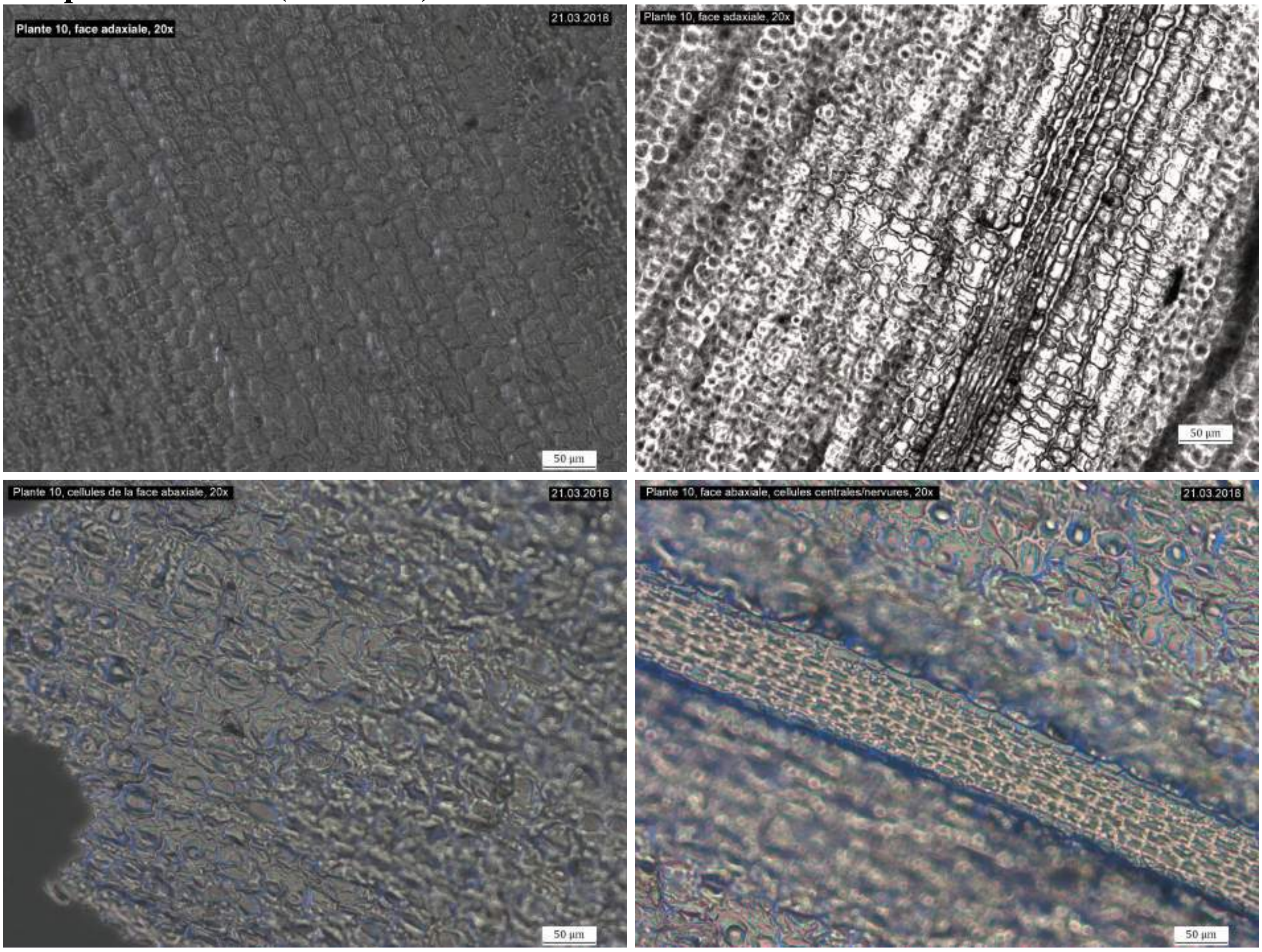
Leaves in macroscopy



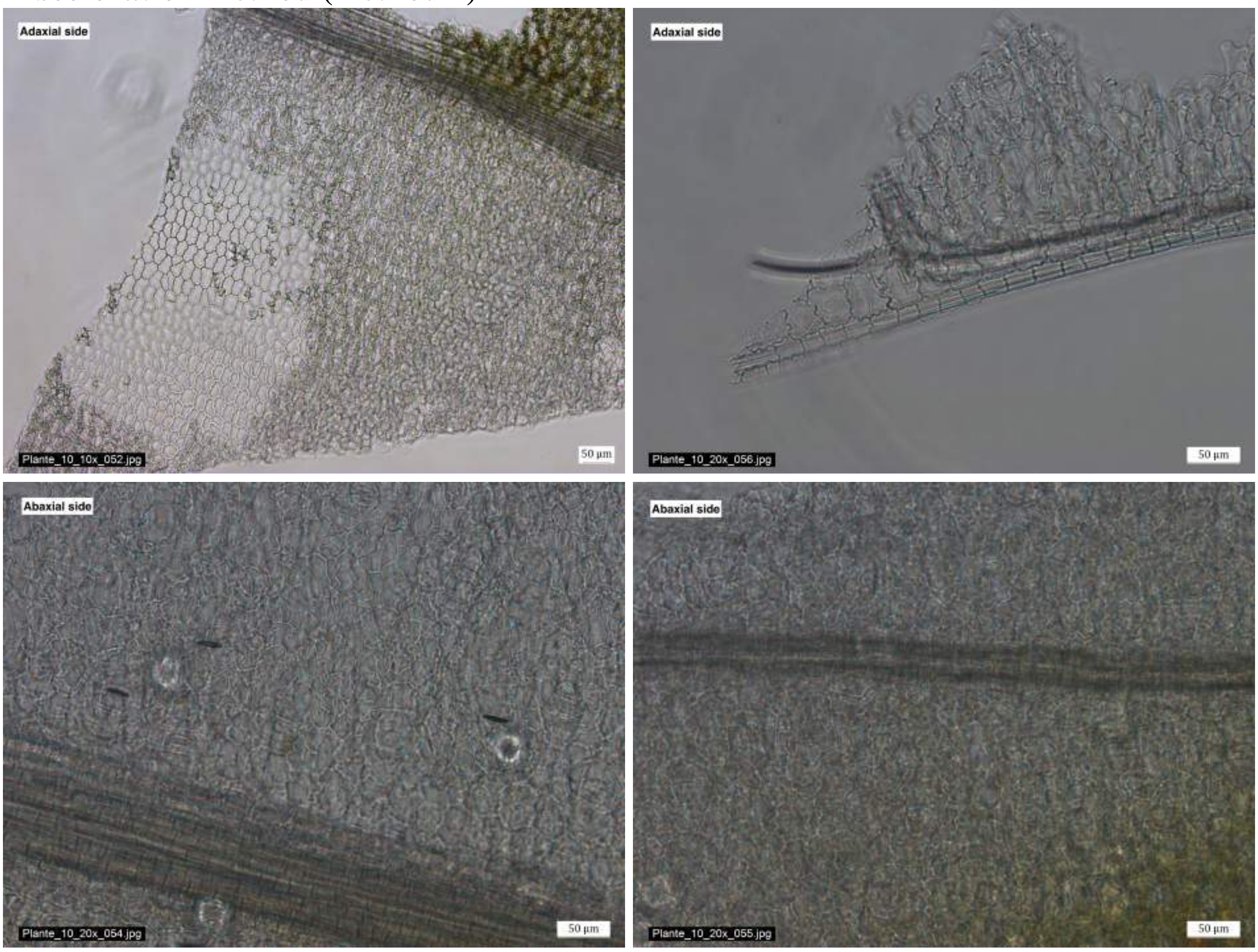
Leaves in microscopy (two methods)



Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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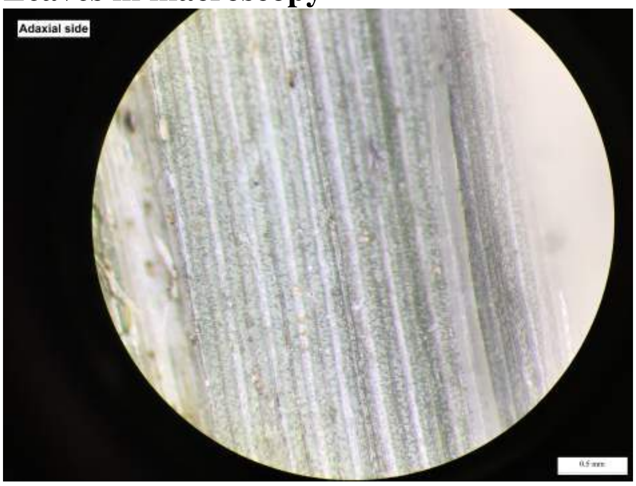
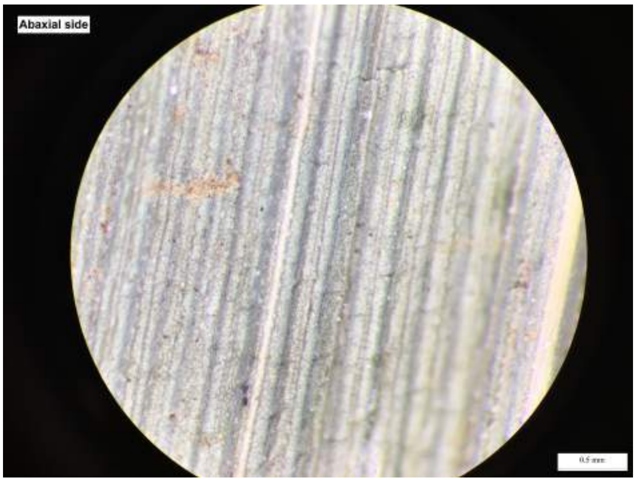
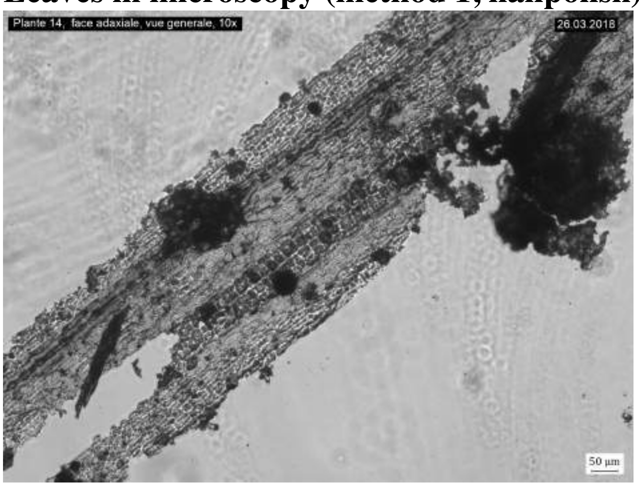
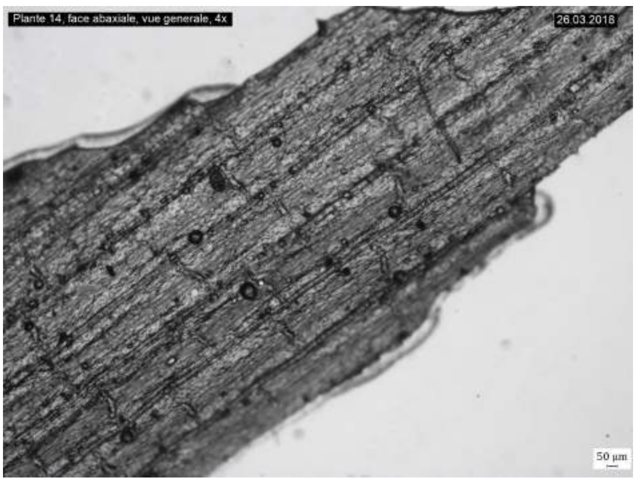
Leaves in macroscopy



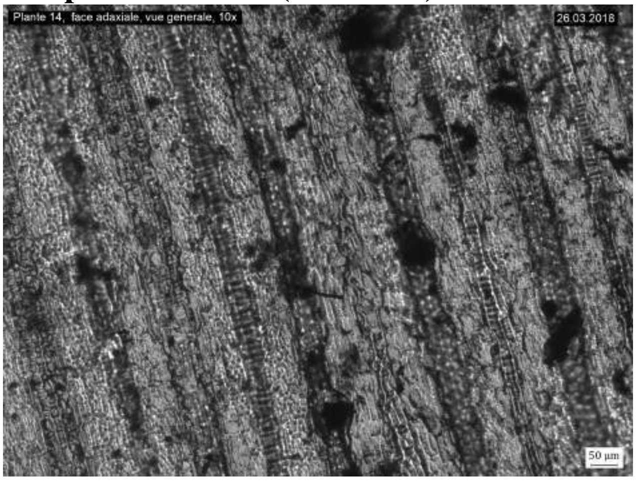


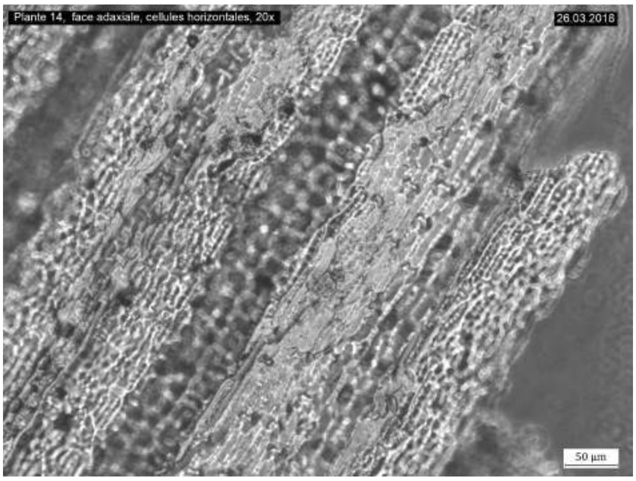
Leaves in microscopy (method 1, nailpolish)

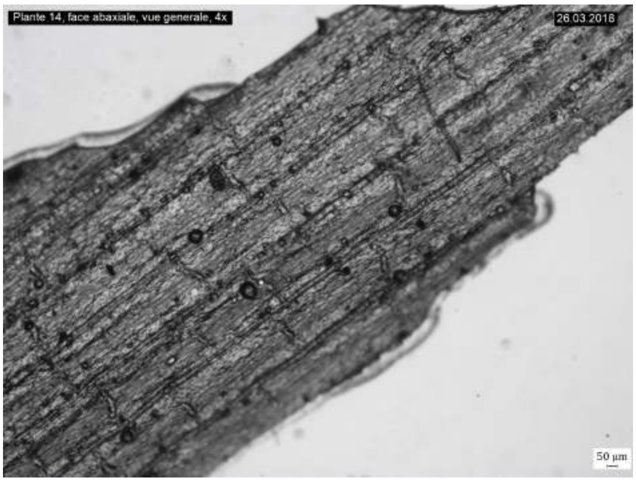


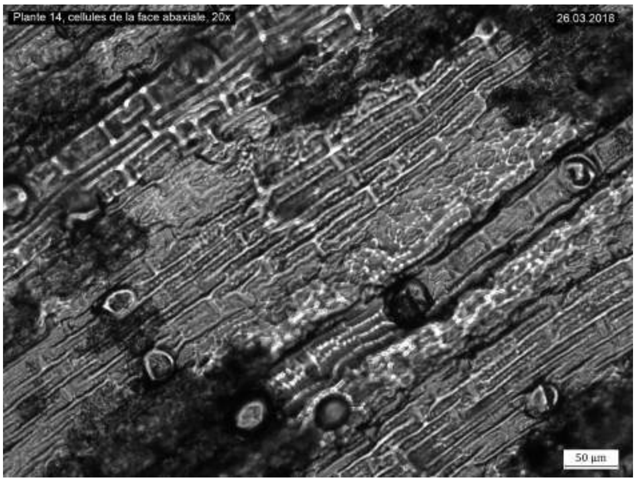


Nailpolish method (method 1)

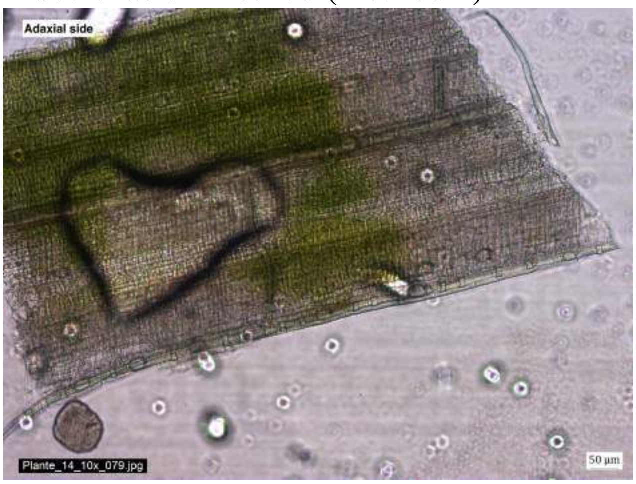


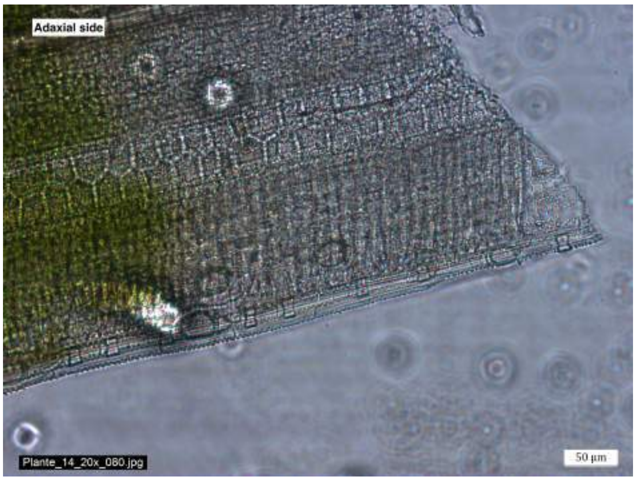






Discoloration method (method 2)





Herbarium plant

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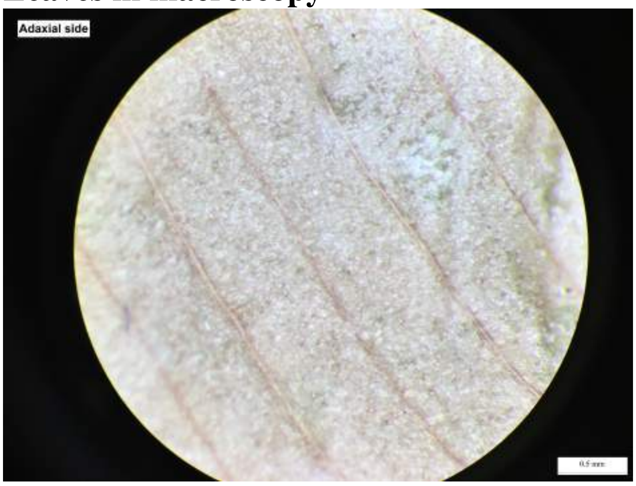
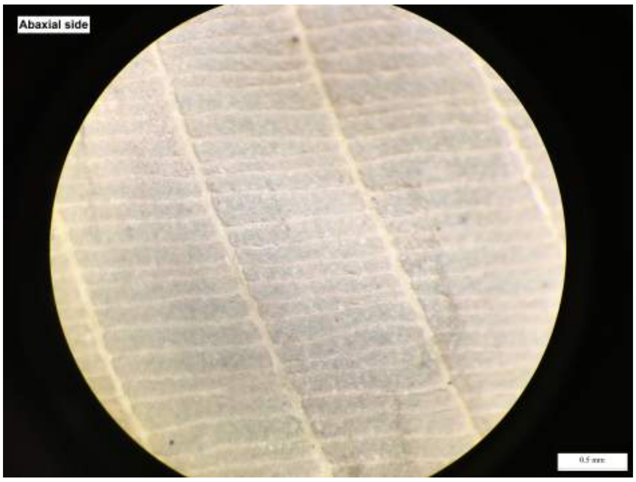
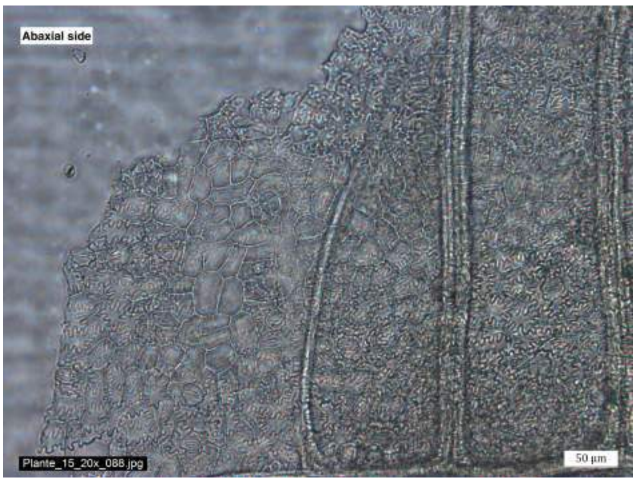
Leaves in macroscopy

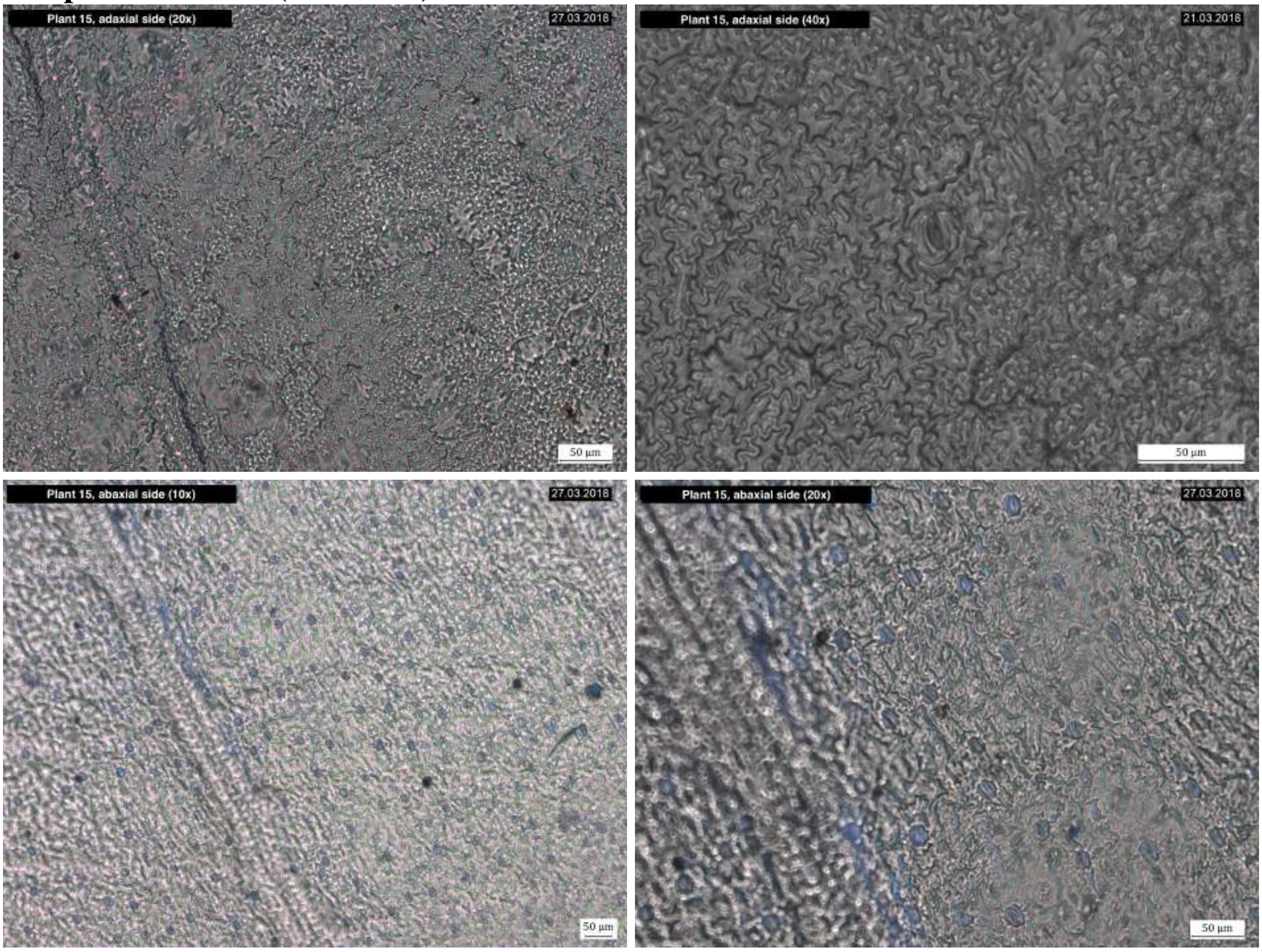




Leaves in microscopy (method 1, nailpolish)



Nailpolish method (method 1)



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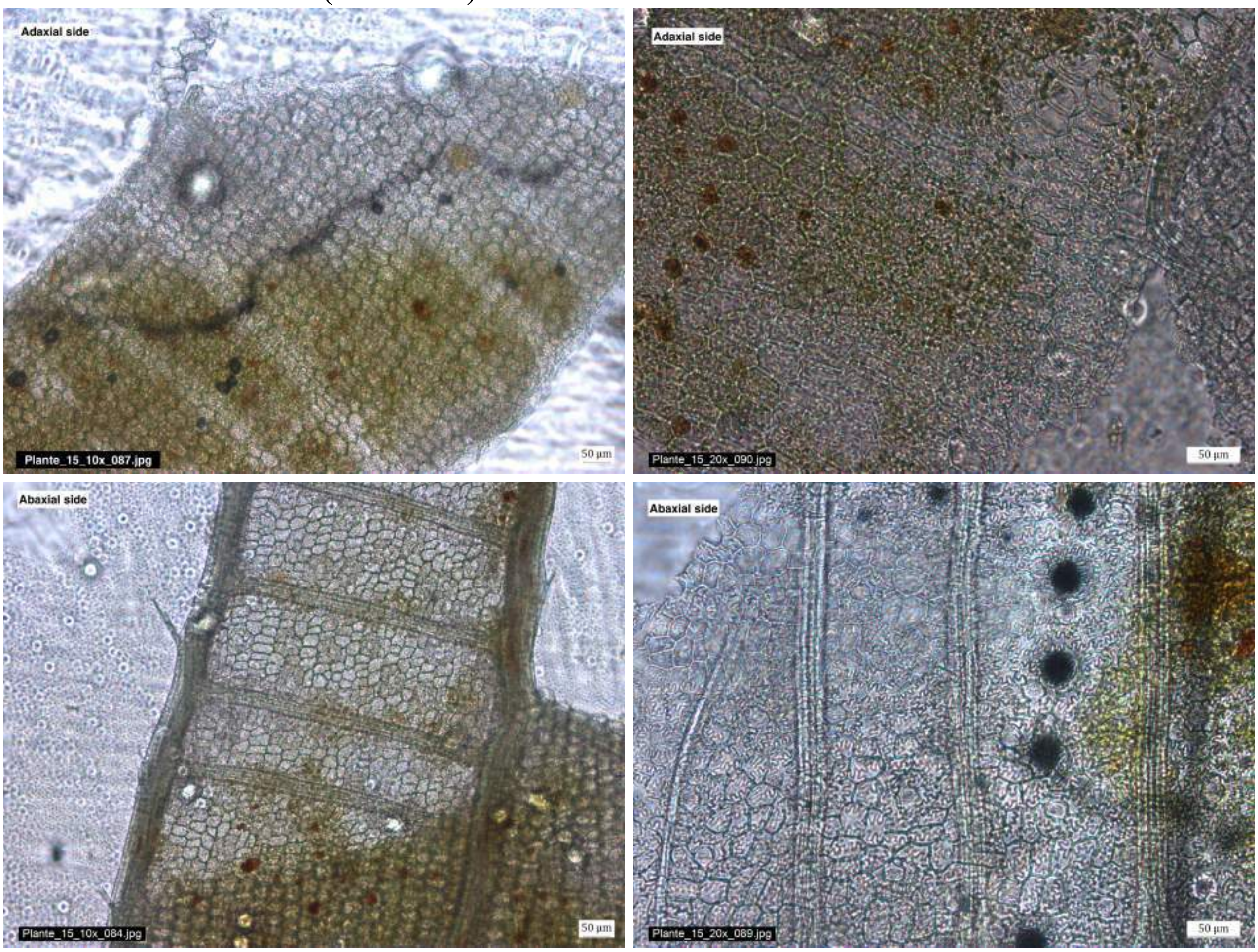

Herbarium plant

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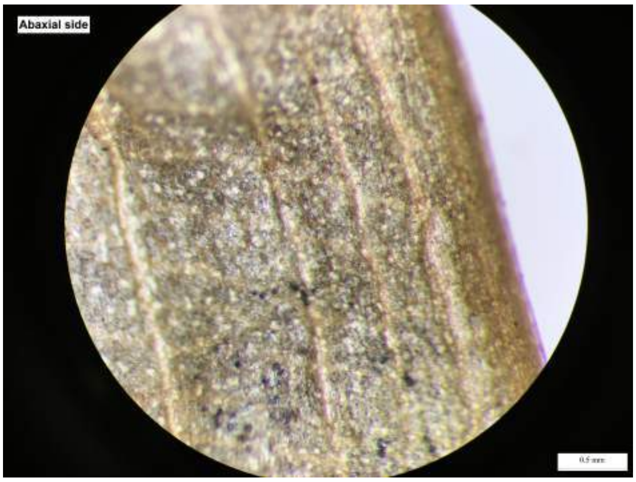
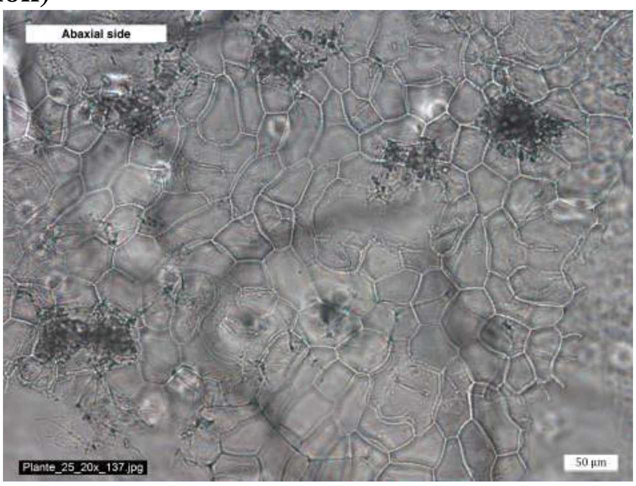
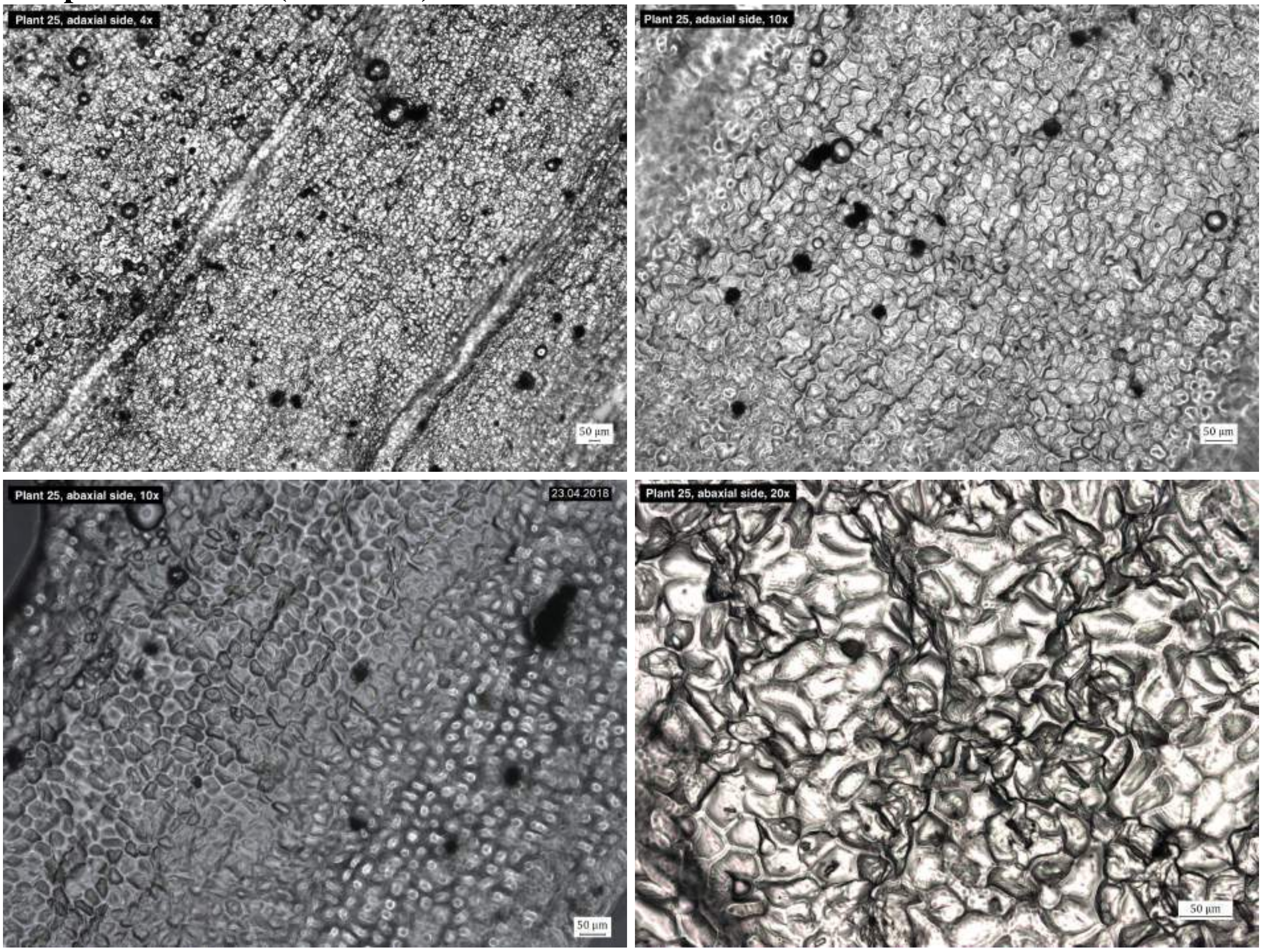
Leaves in macroscopy



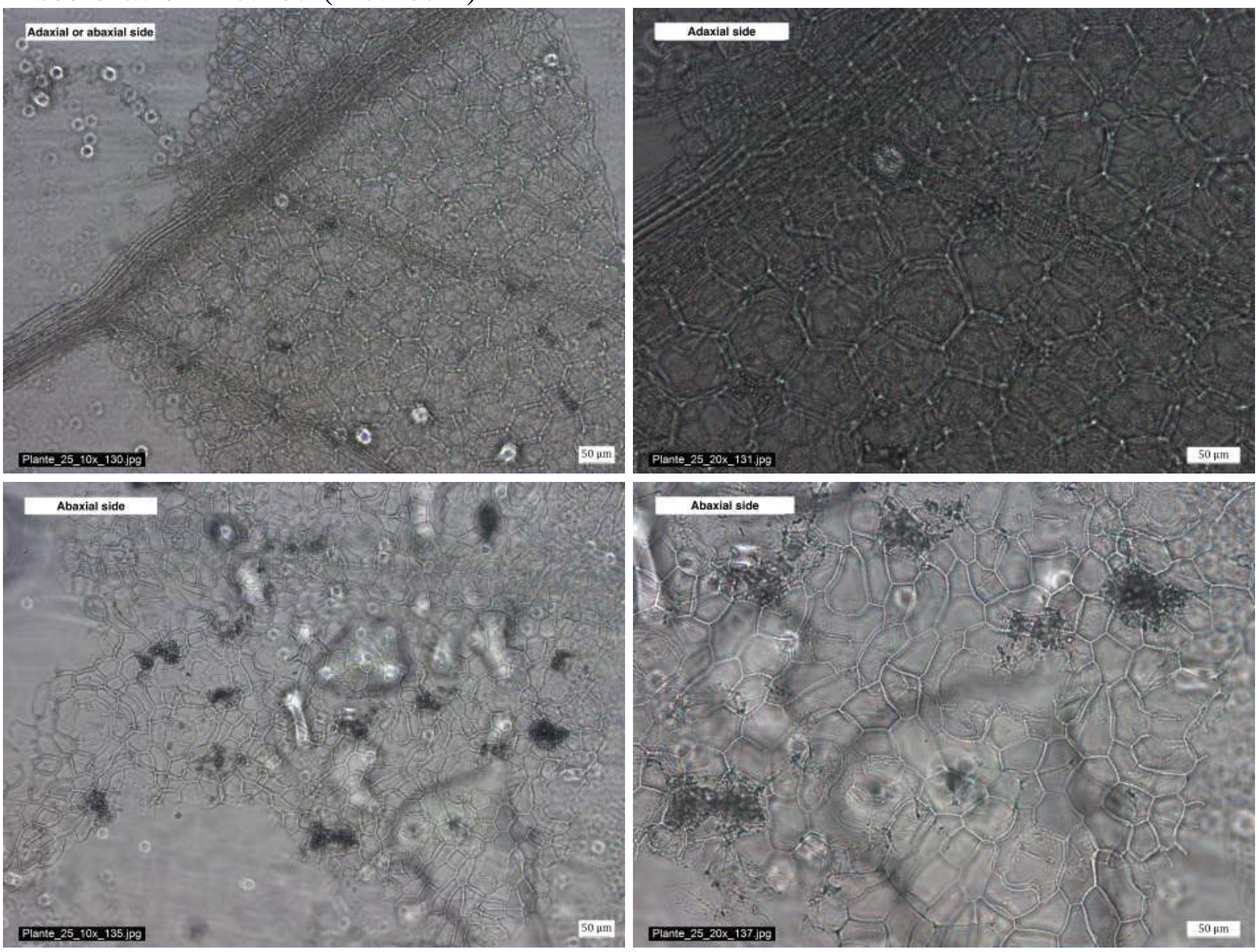
Leaves in microscopy (method 2, discoloration)



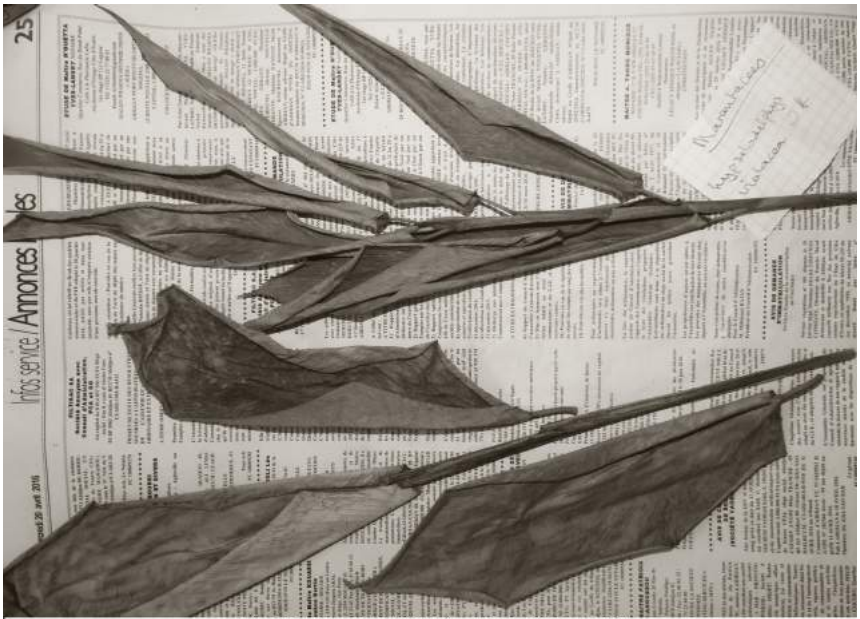
Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant



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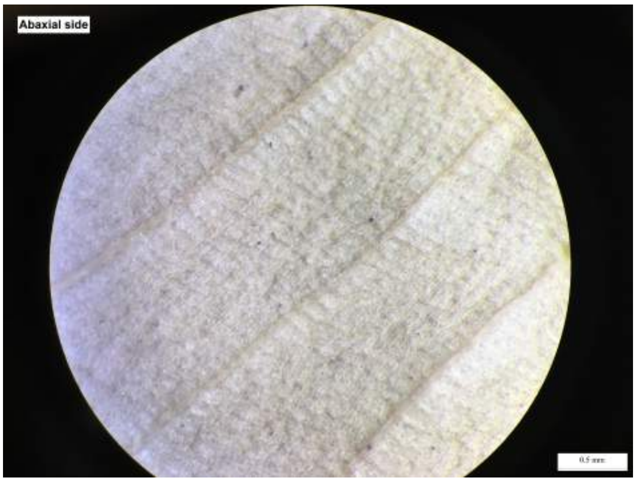
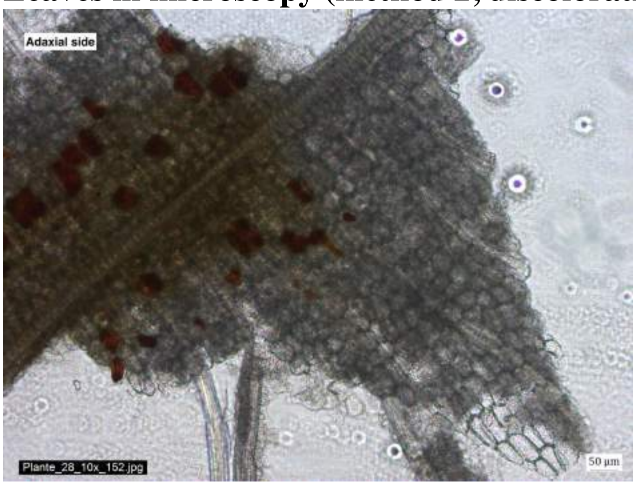
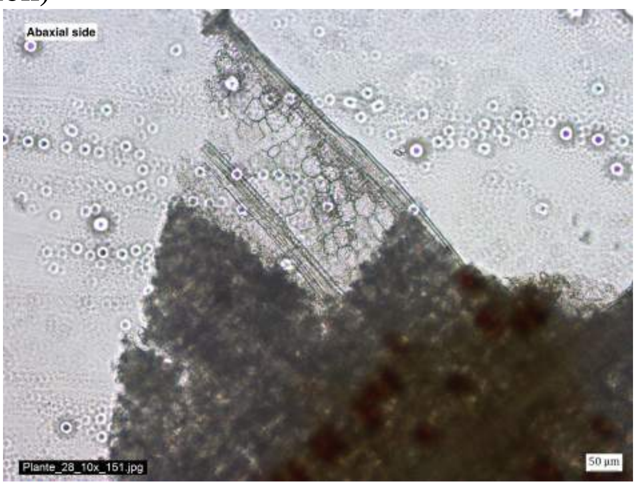
Leaves in macroscopy

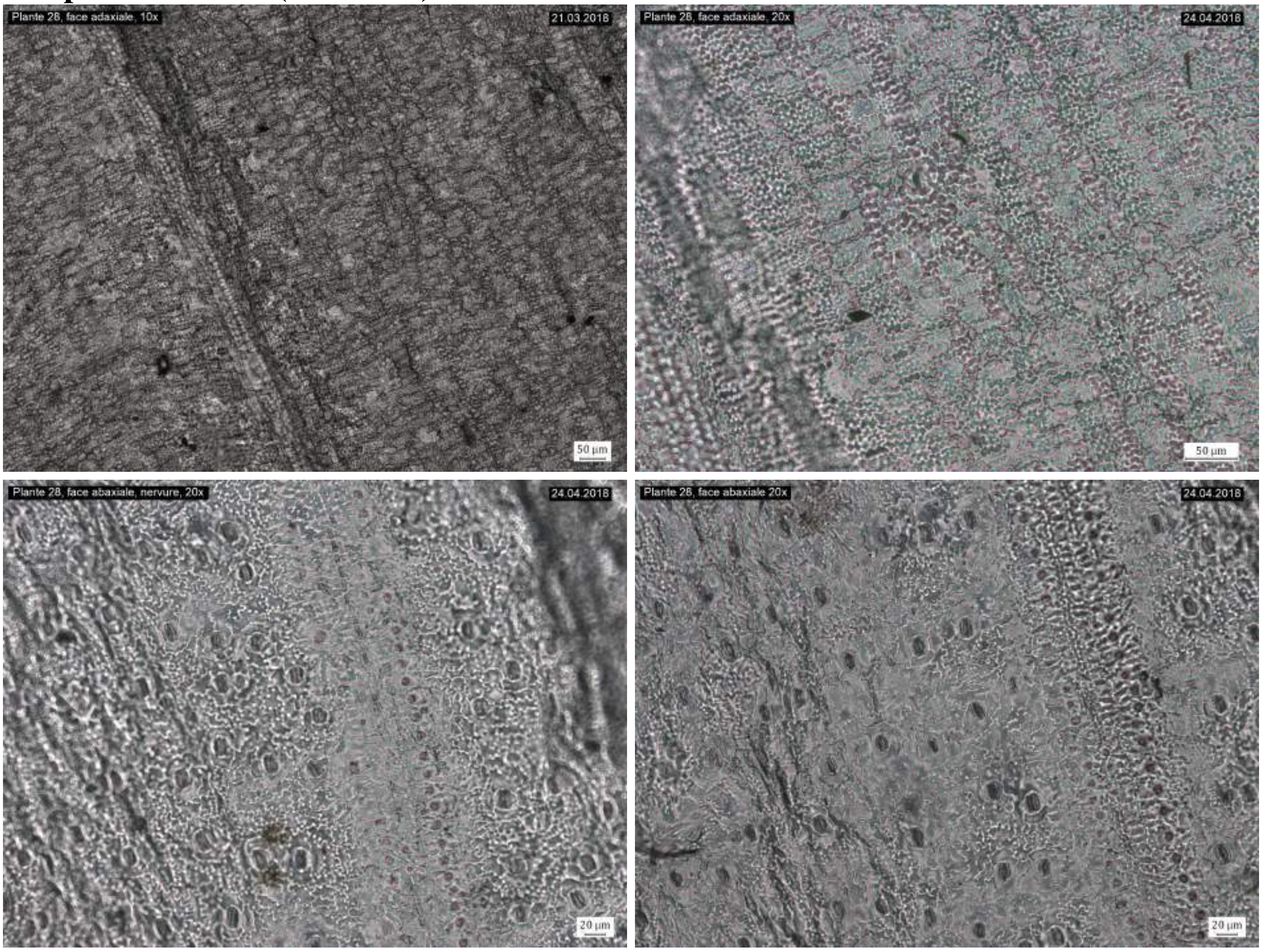


Leaves in microscopy (method 2, discoloration)

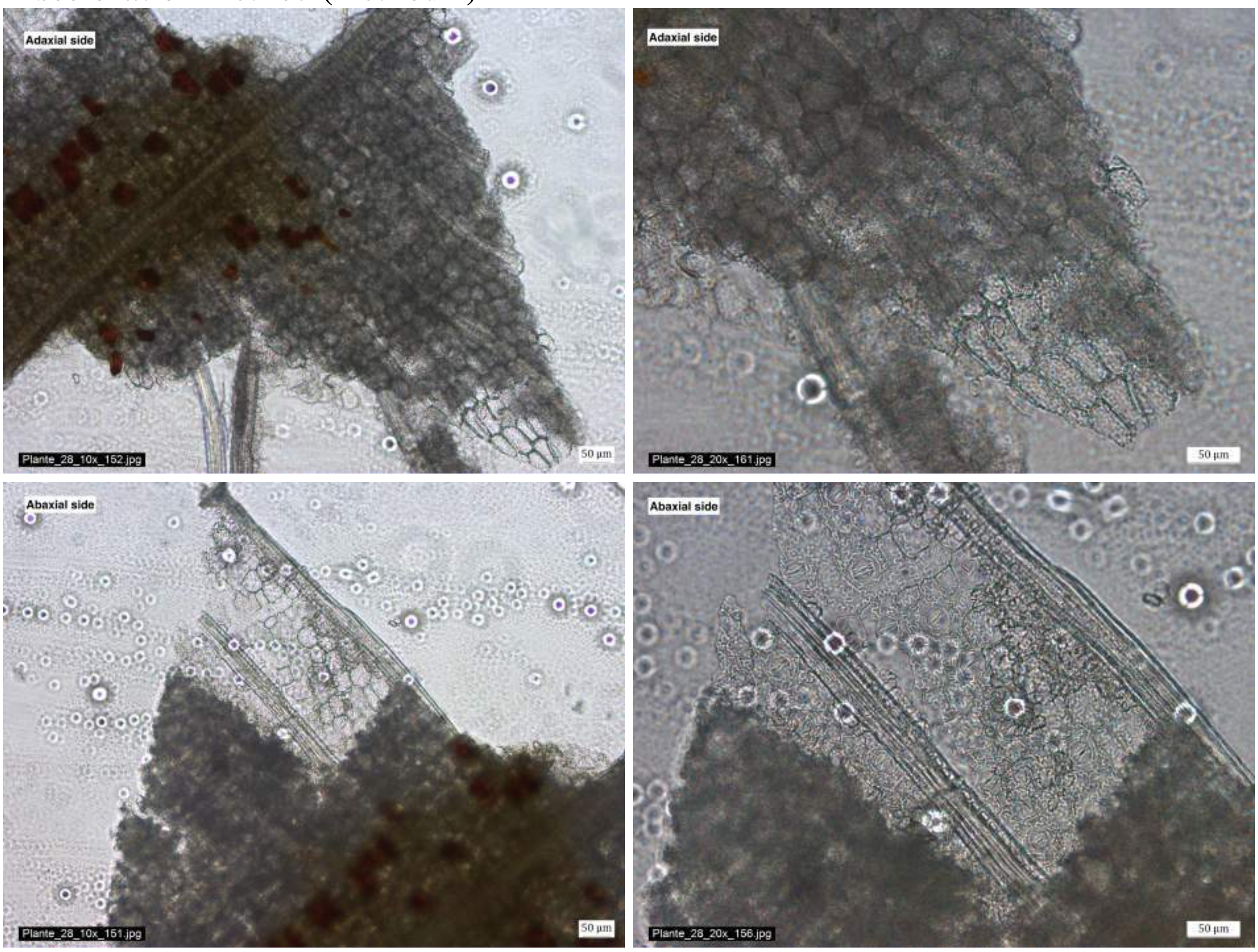




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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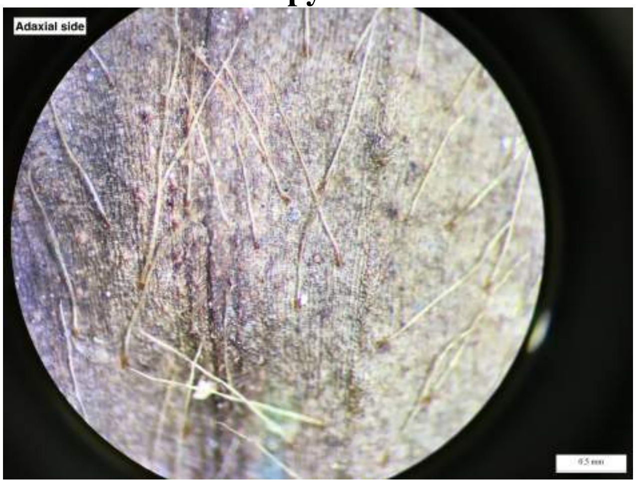
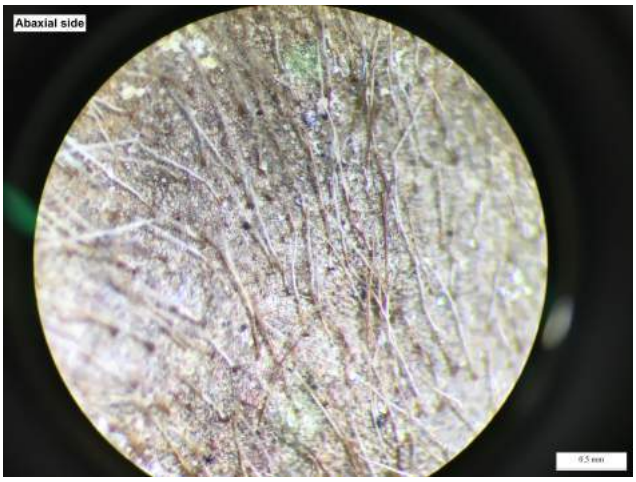
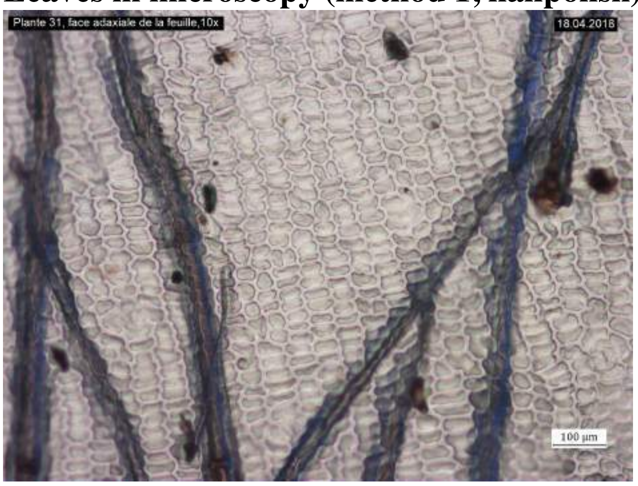
Leaves in macroscopy

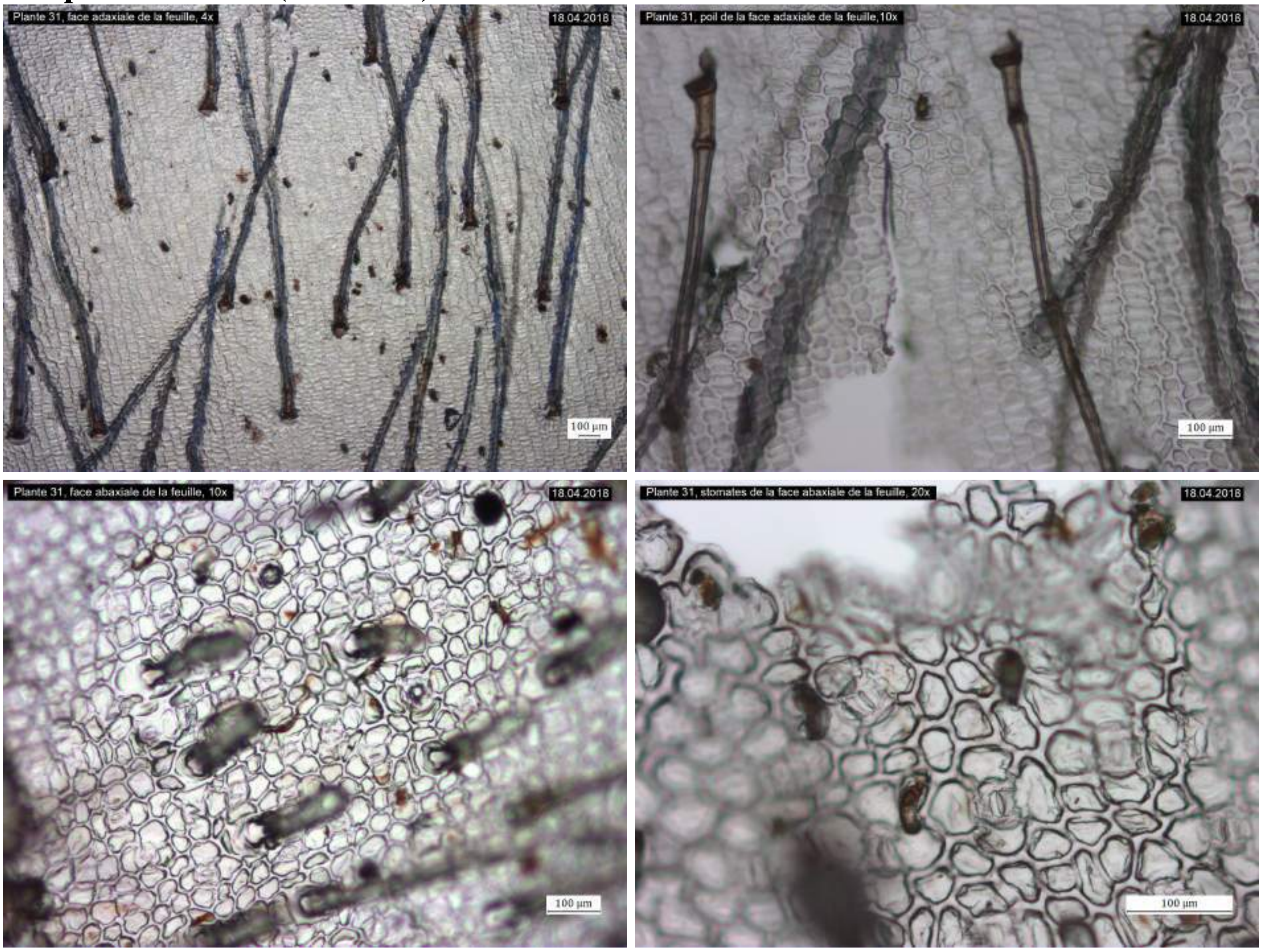




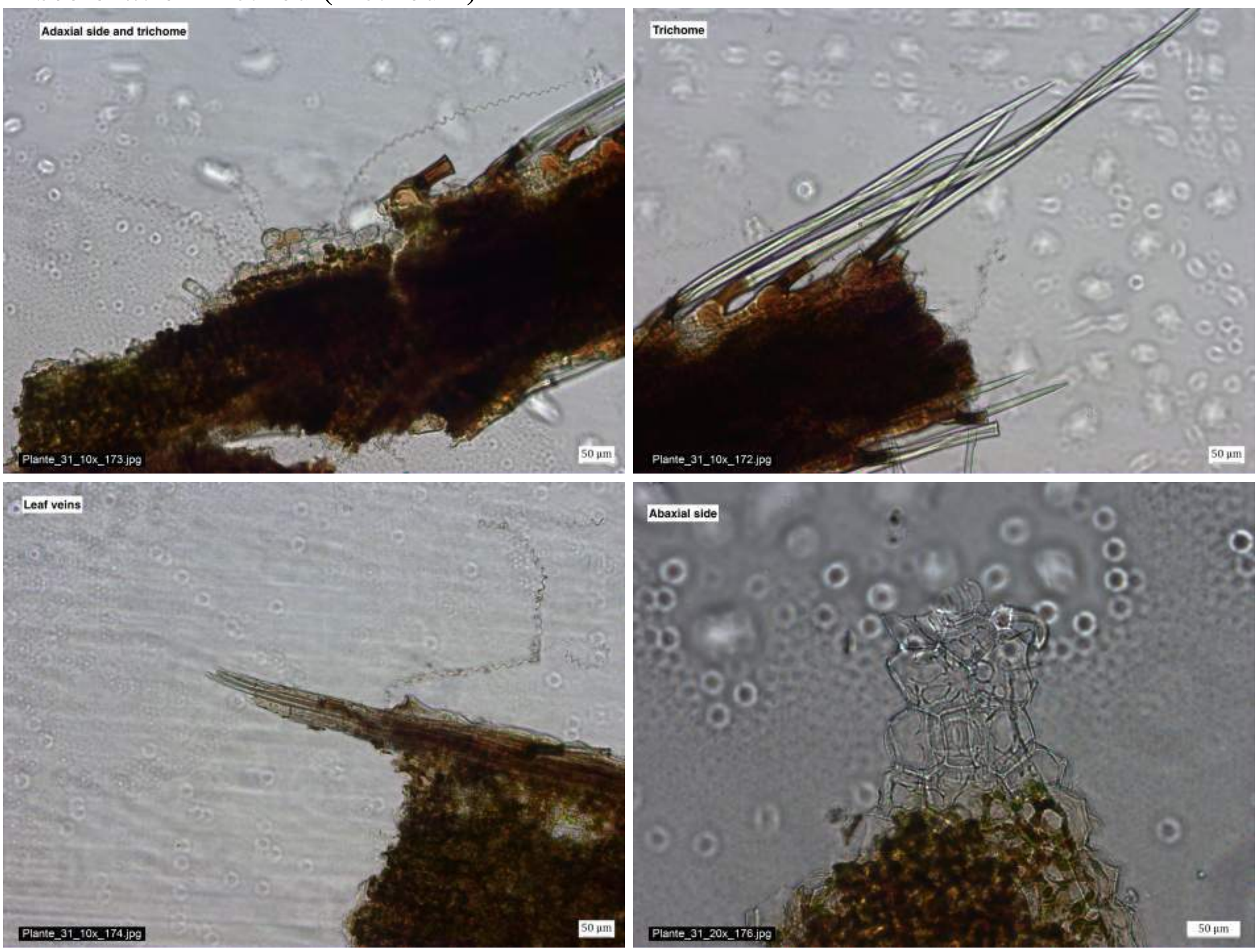
Leaves in microscopy (method 1, nailpolish)



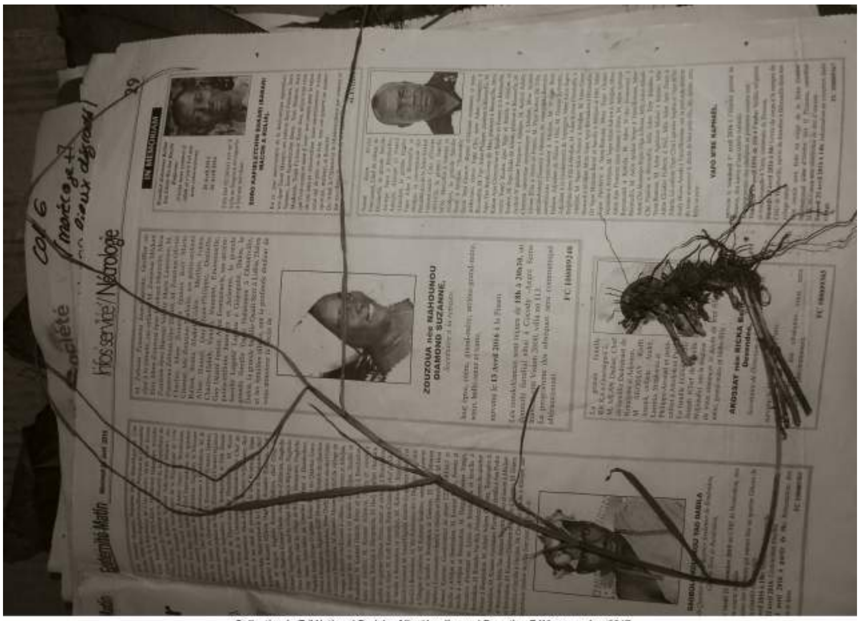
Nailpolish method (method 1)



Discoloration method (method 2)

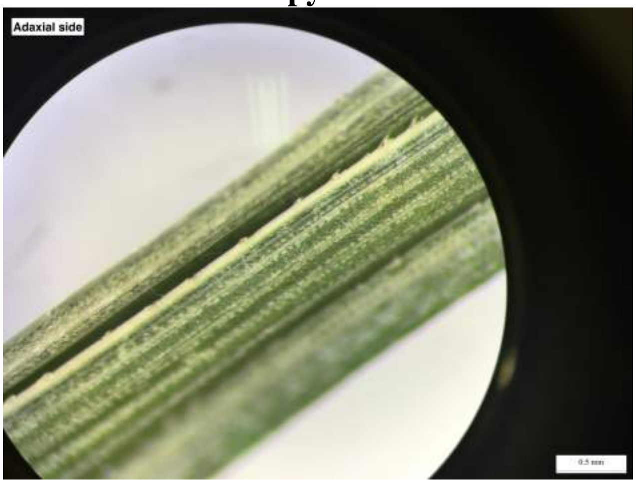


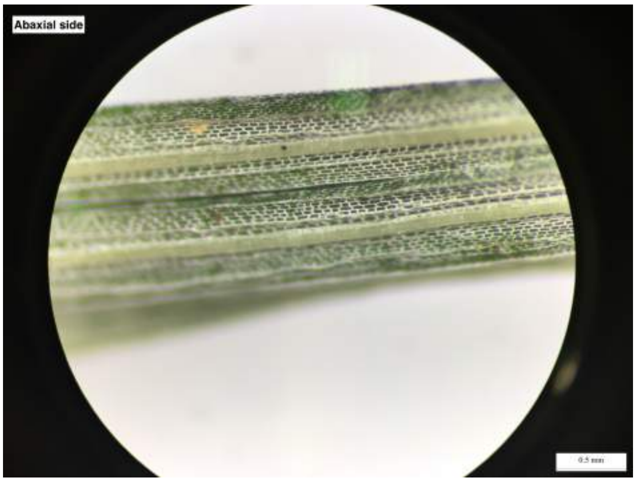
Herbarium plant



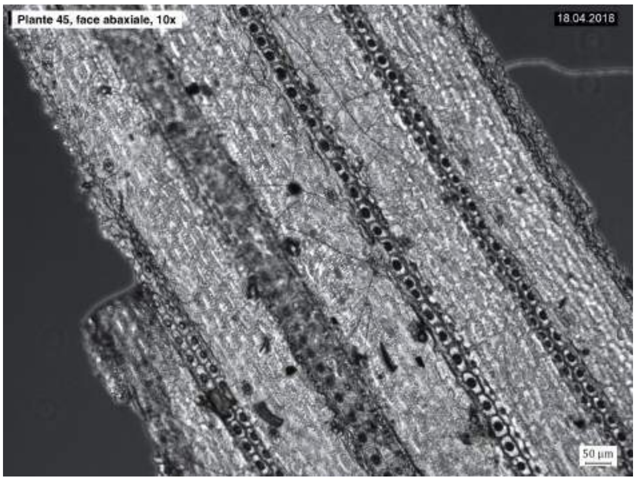
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

Leaves in macroscopy

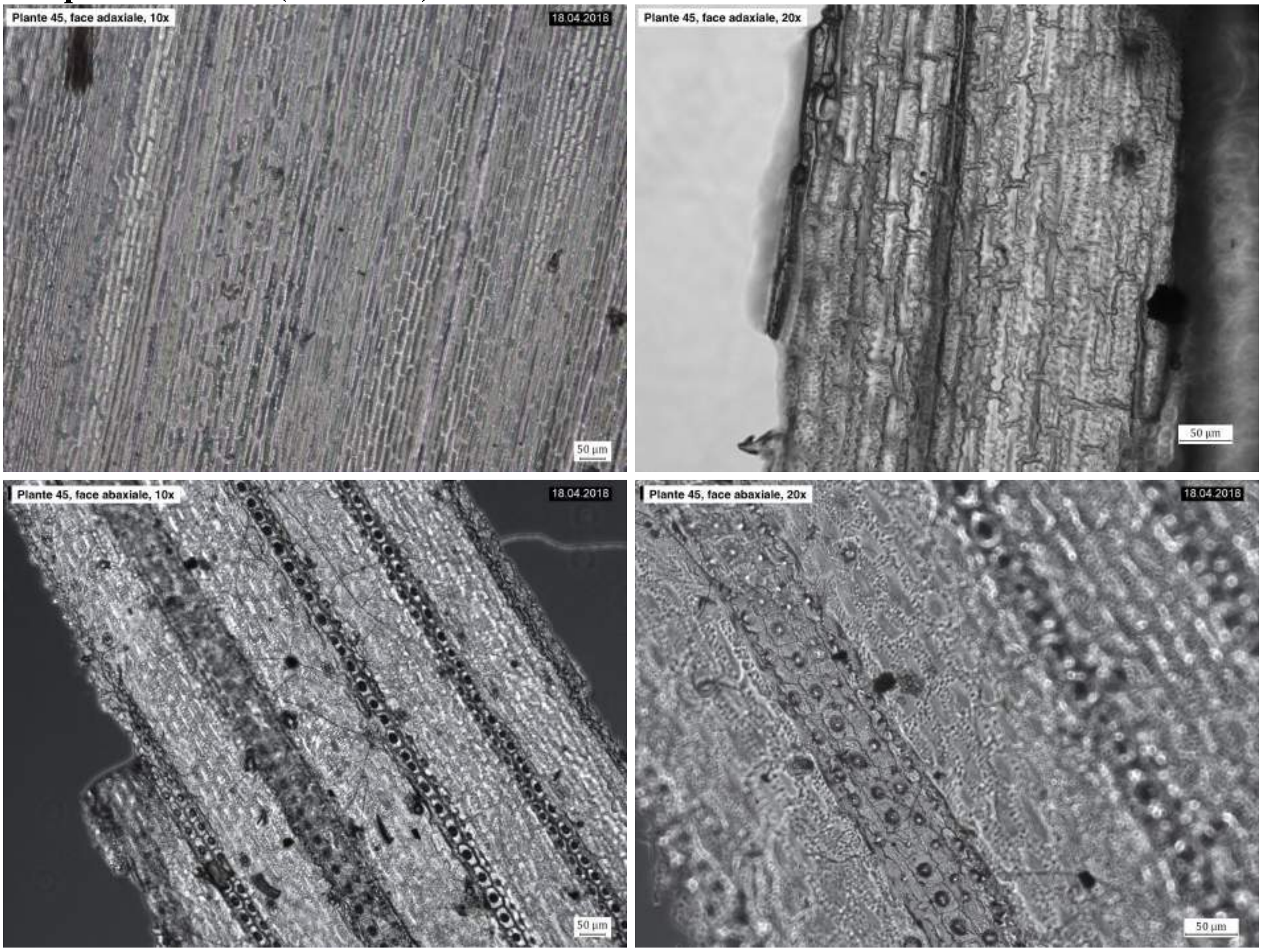




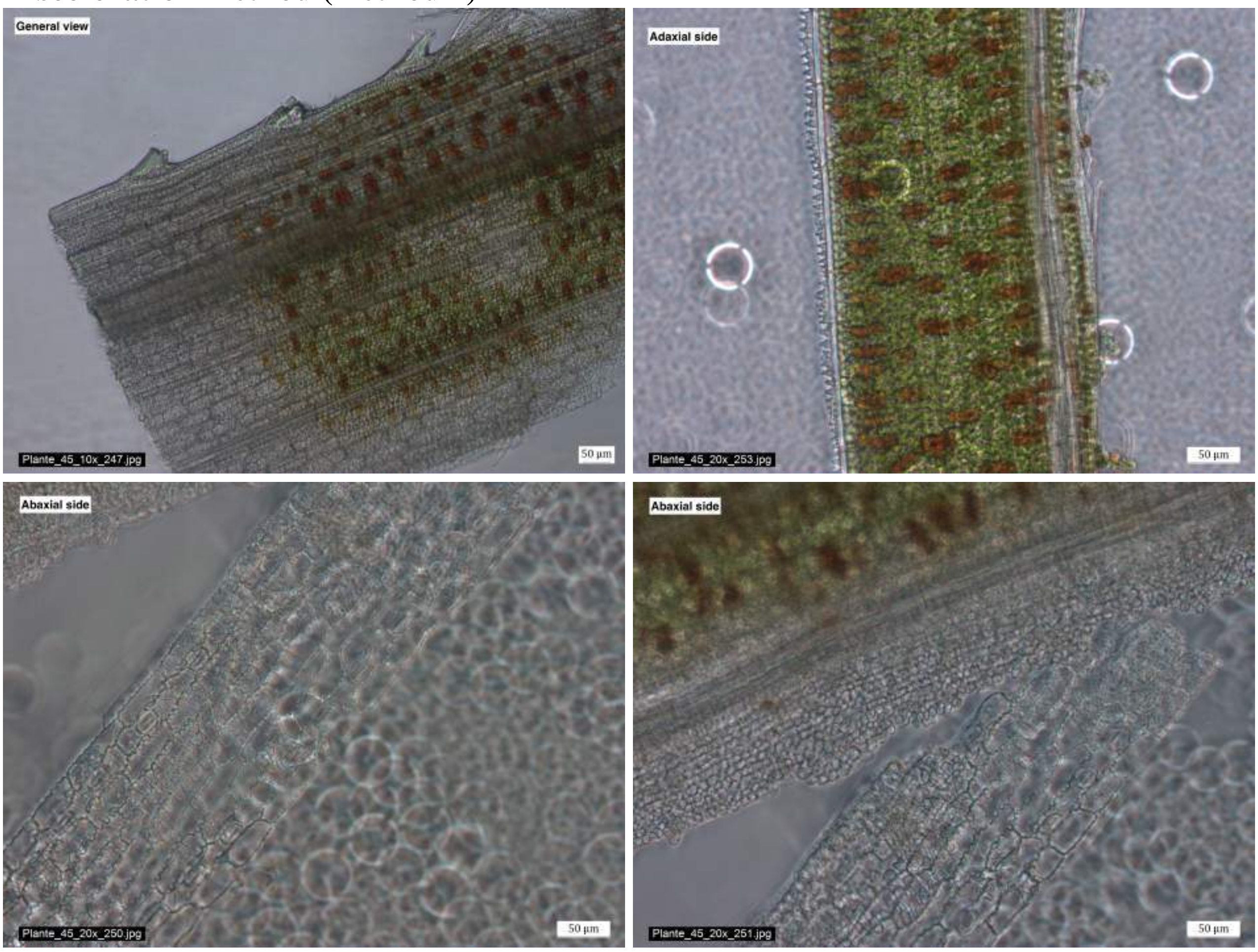
Leaves in microscopy (method 1, nailpolish)



Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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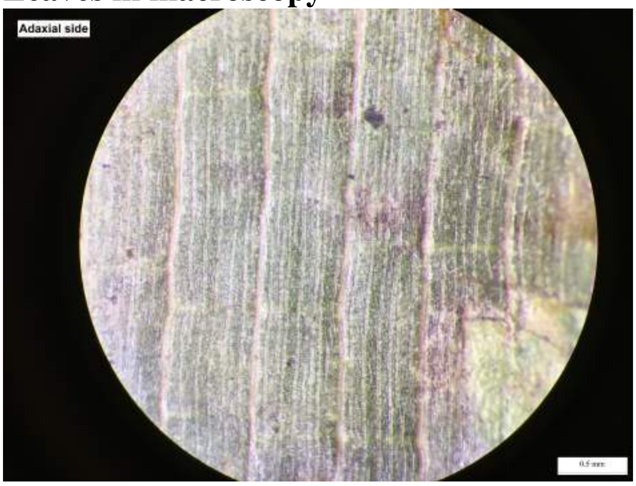
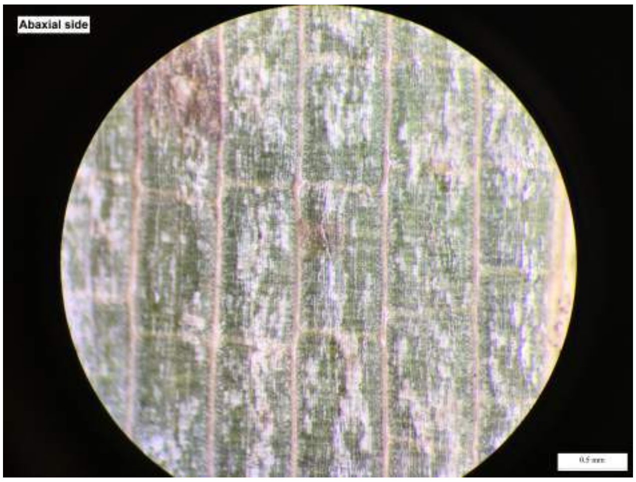
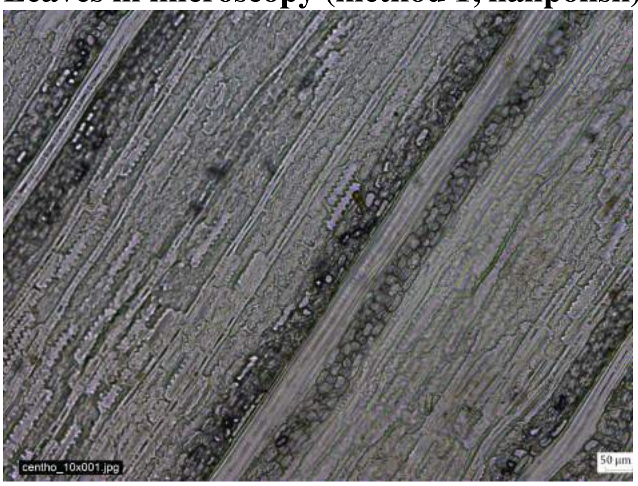
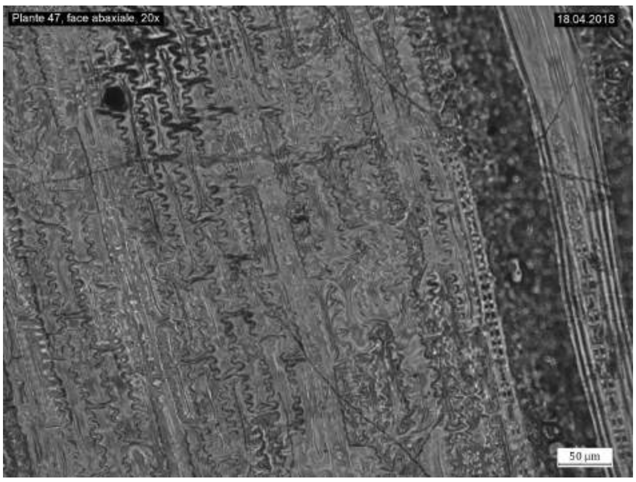
Leaves in macroscopy



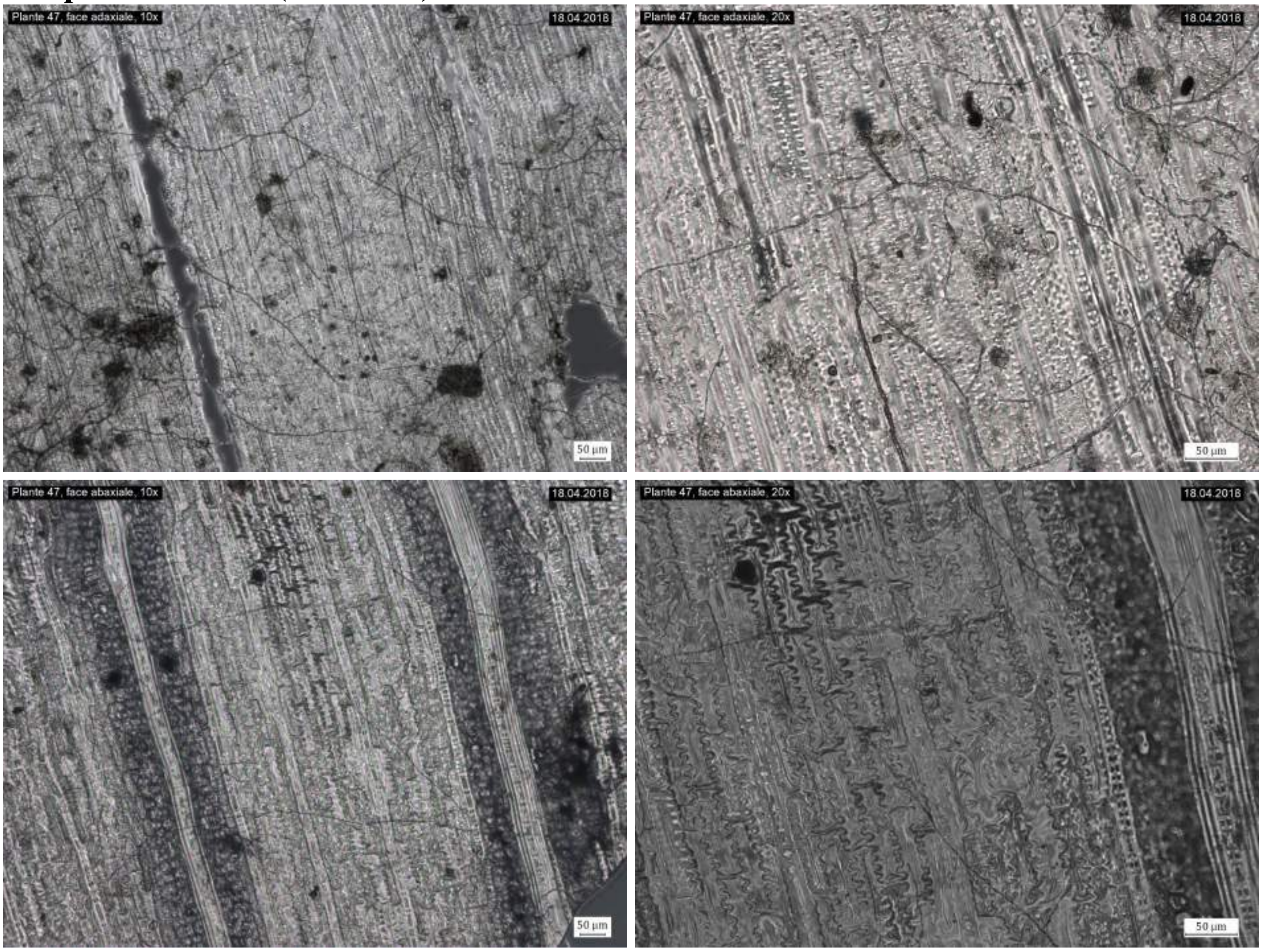


Leaves in microscopy (method 1, nailpolish)

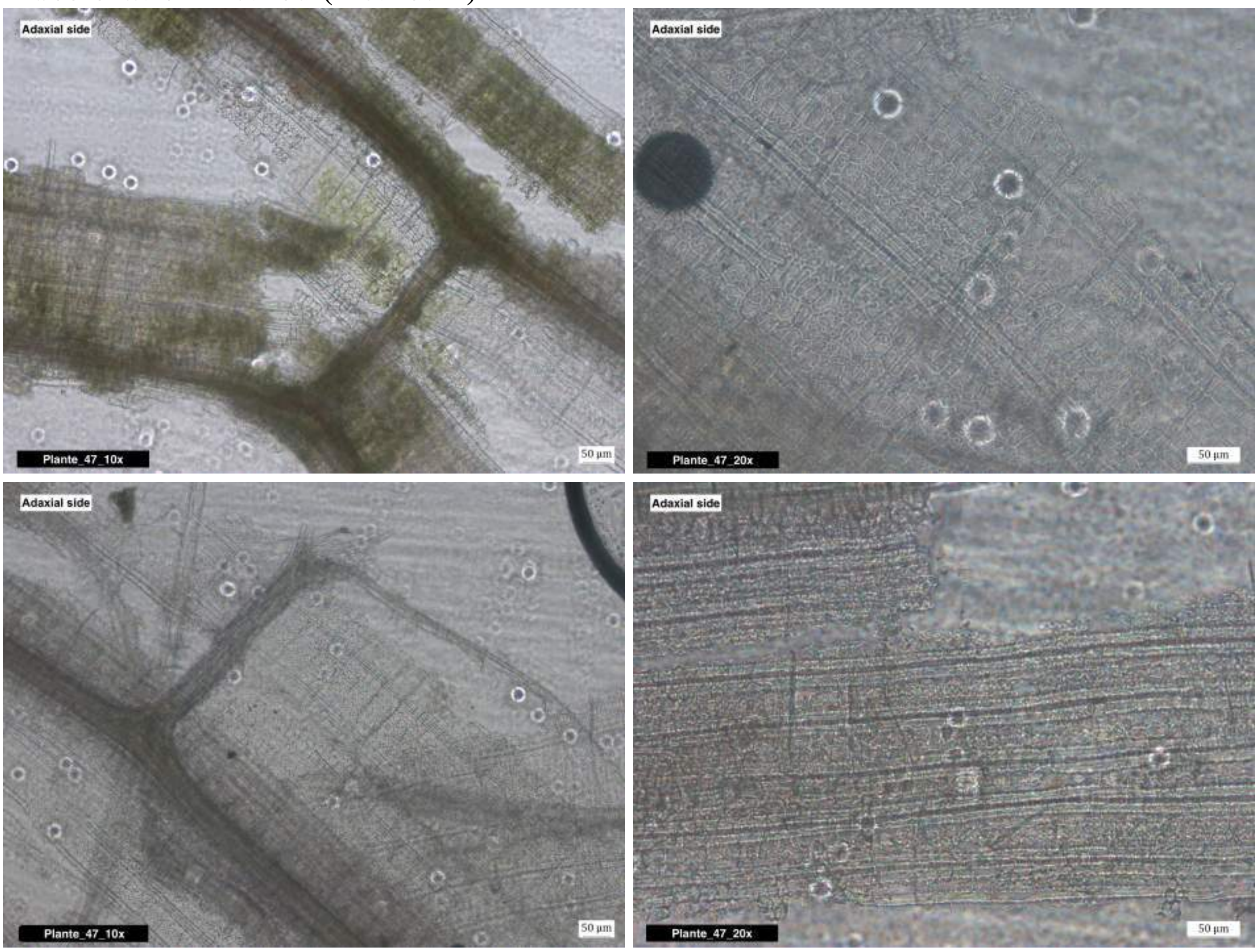




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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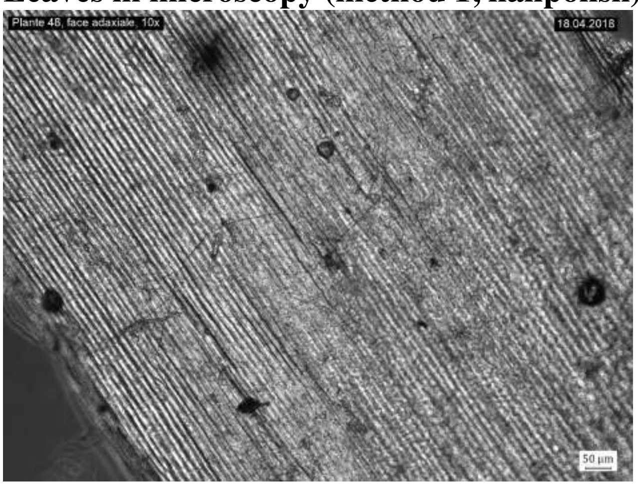
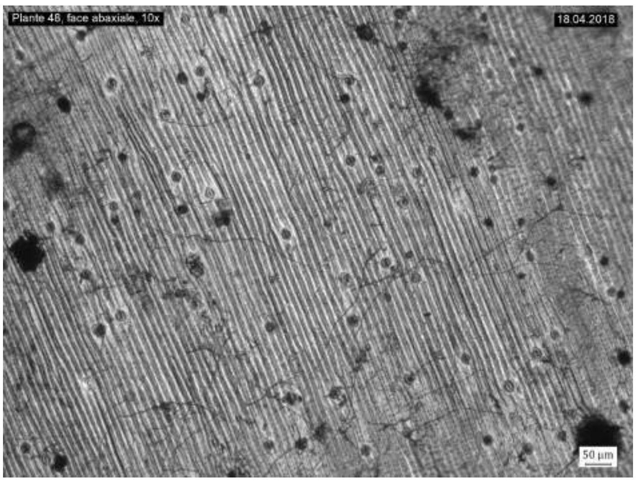
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

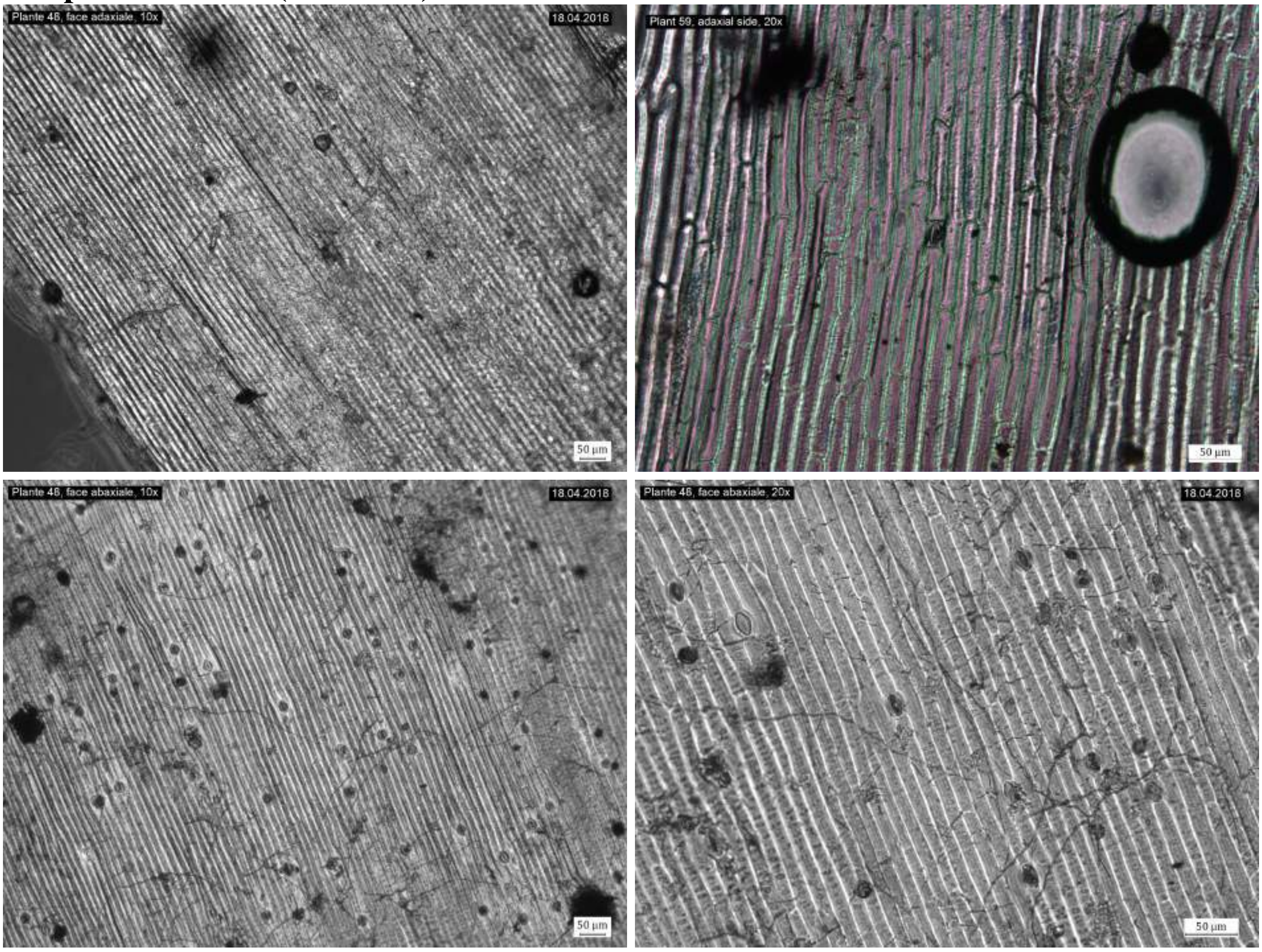
Leaves in macroscopy

Leaves in microscopy (method 1, nailpolish)

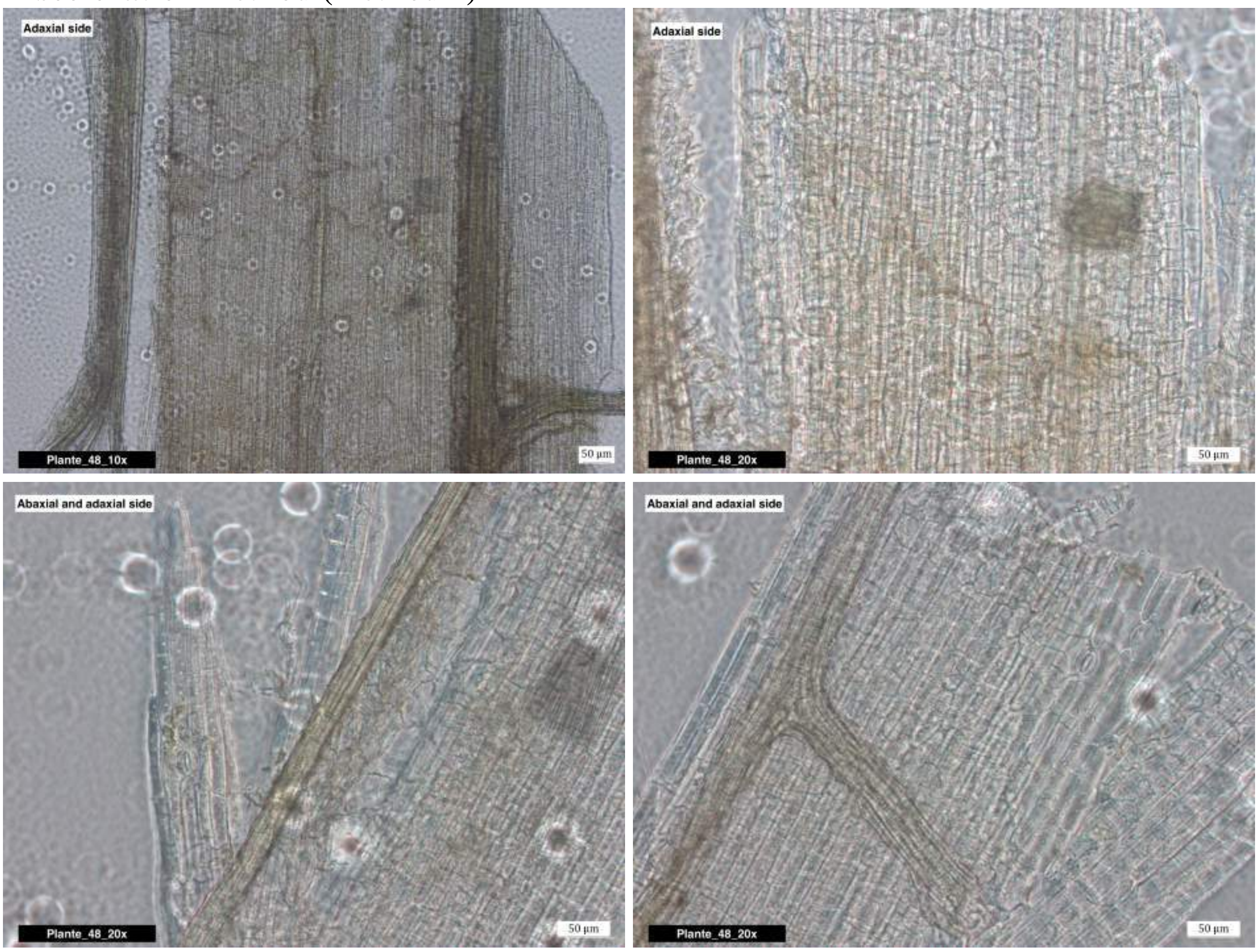




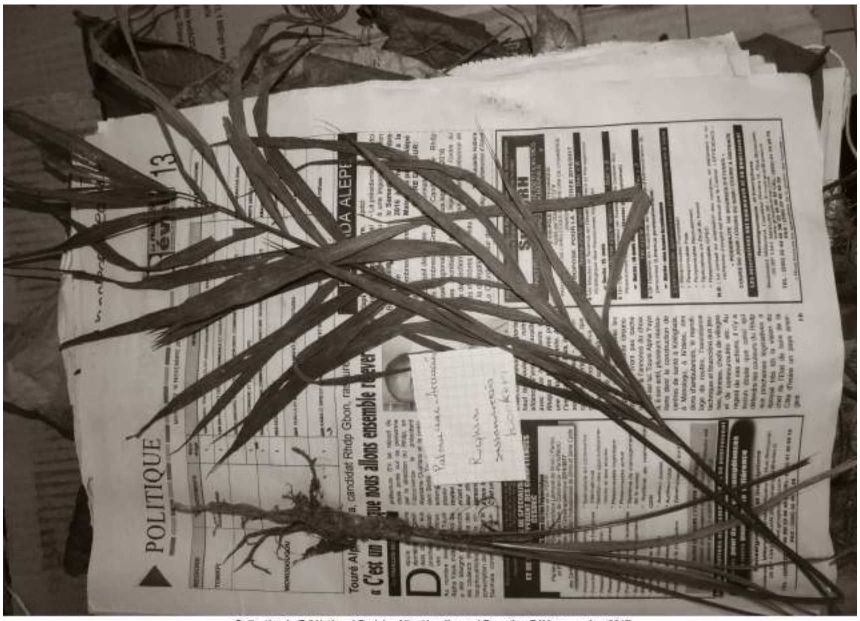
Nailpolish method (method 1)



Discoloration method (method 2)

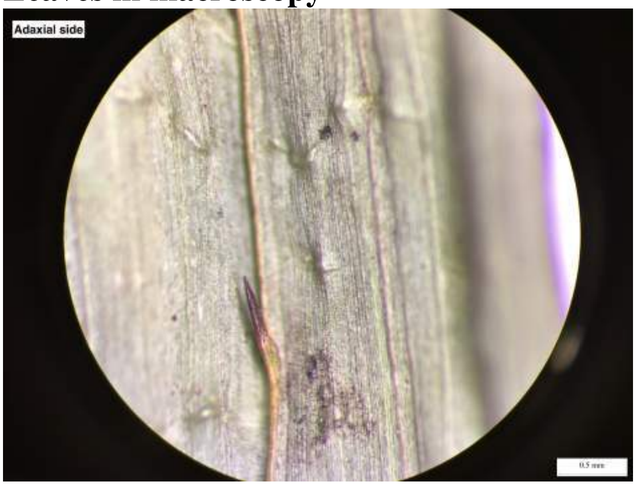


Herbarium plant

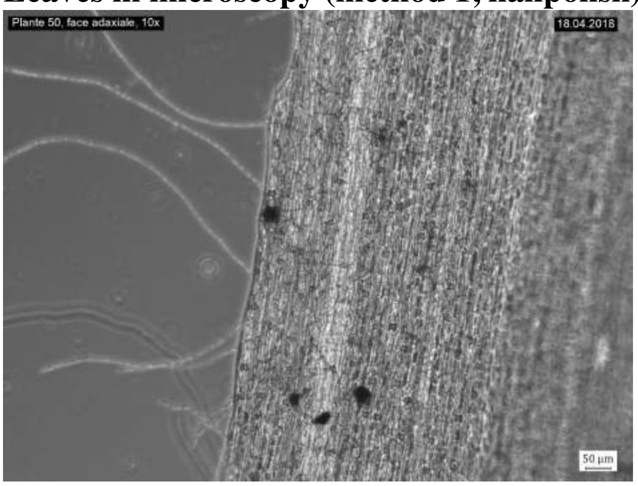


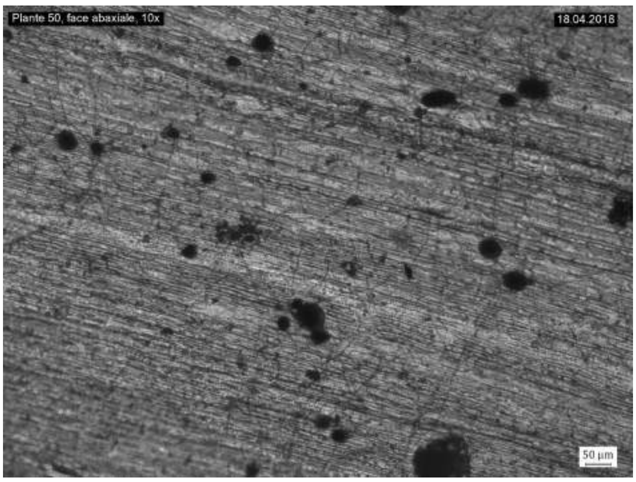
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

Leaves in macroscopy

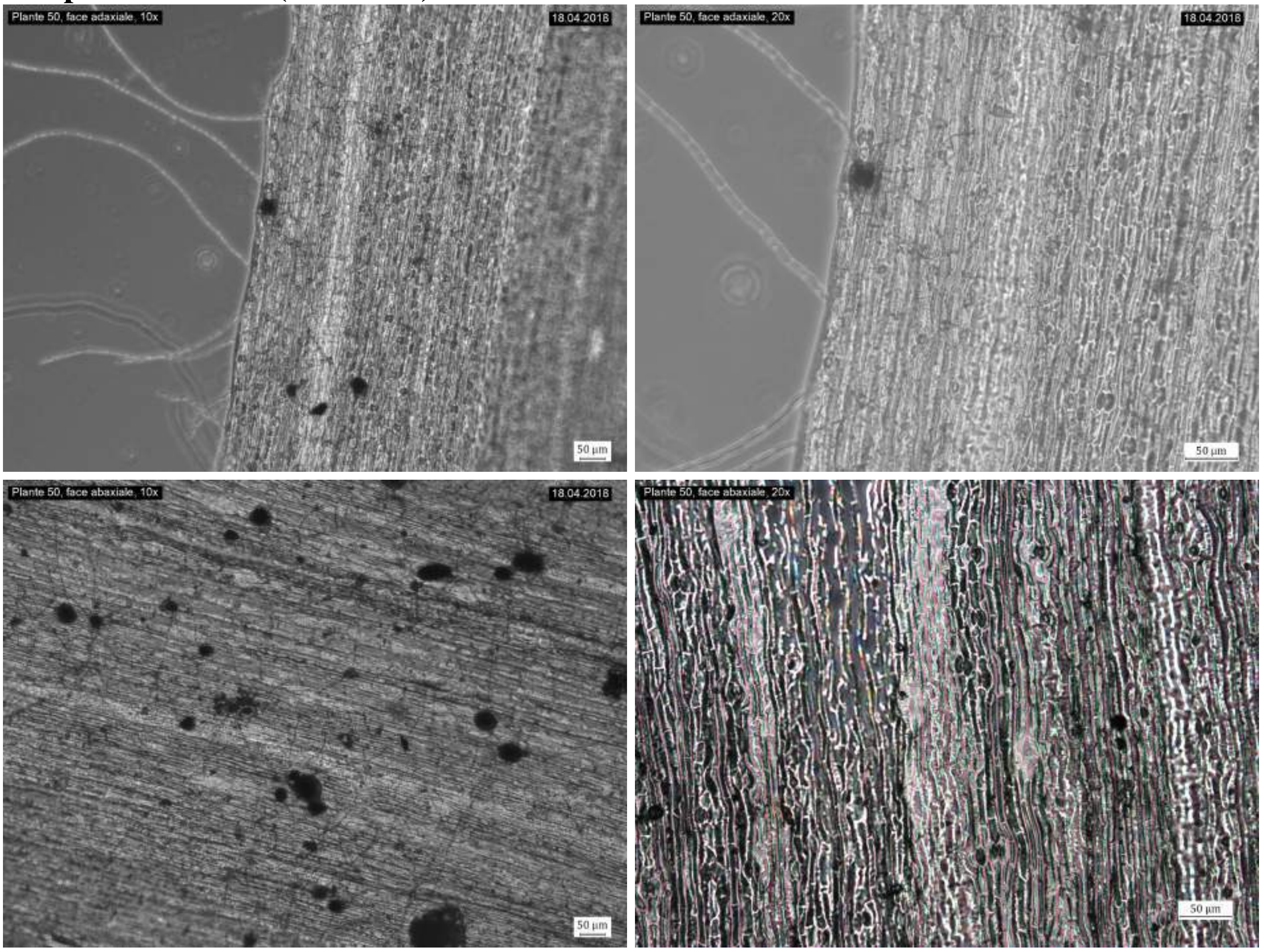


Leaves in microscopy (method 1, nailpolish)

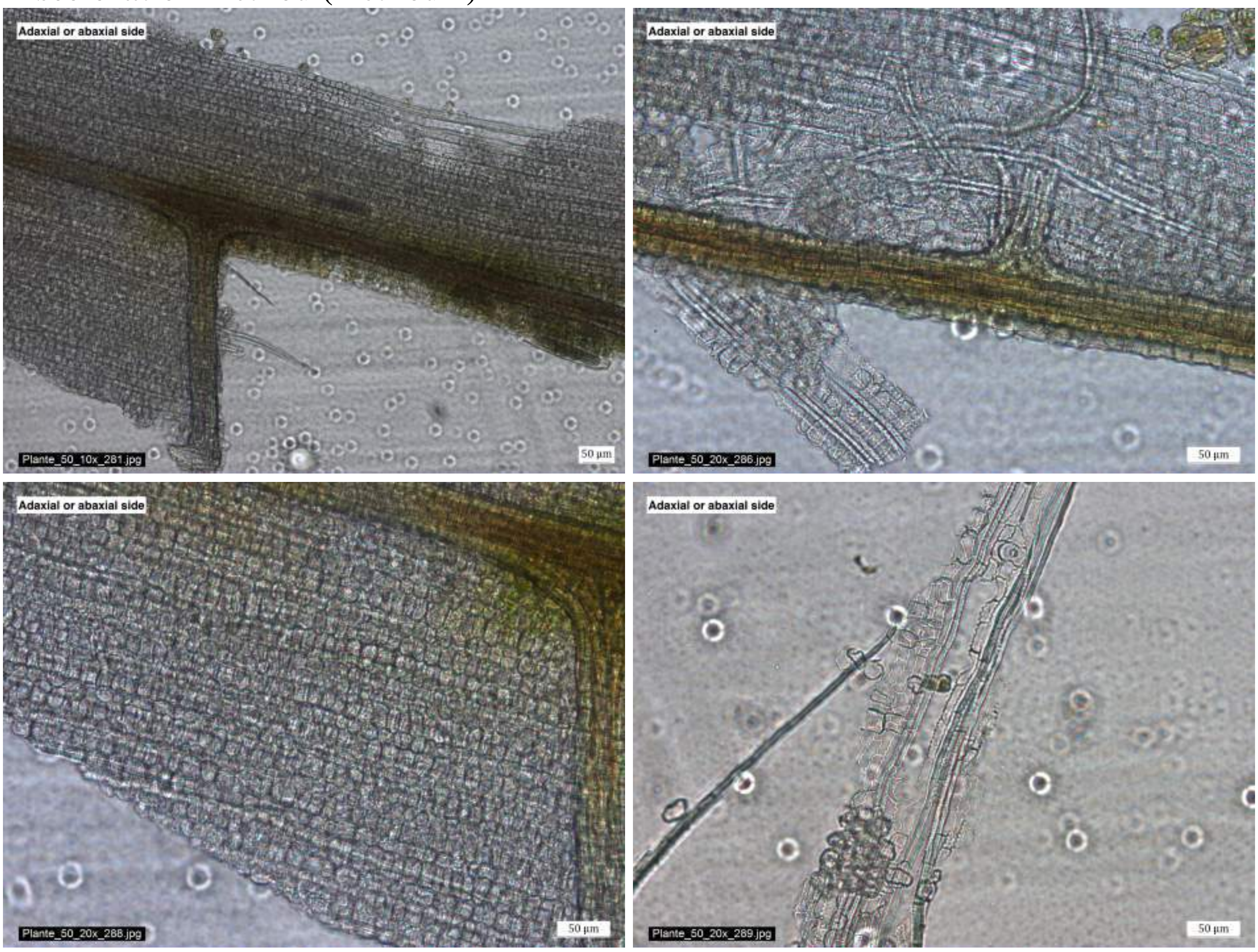




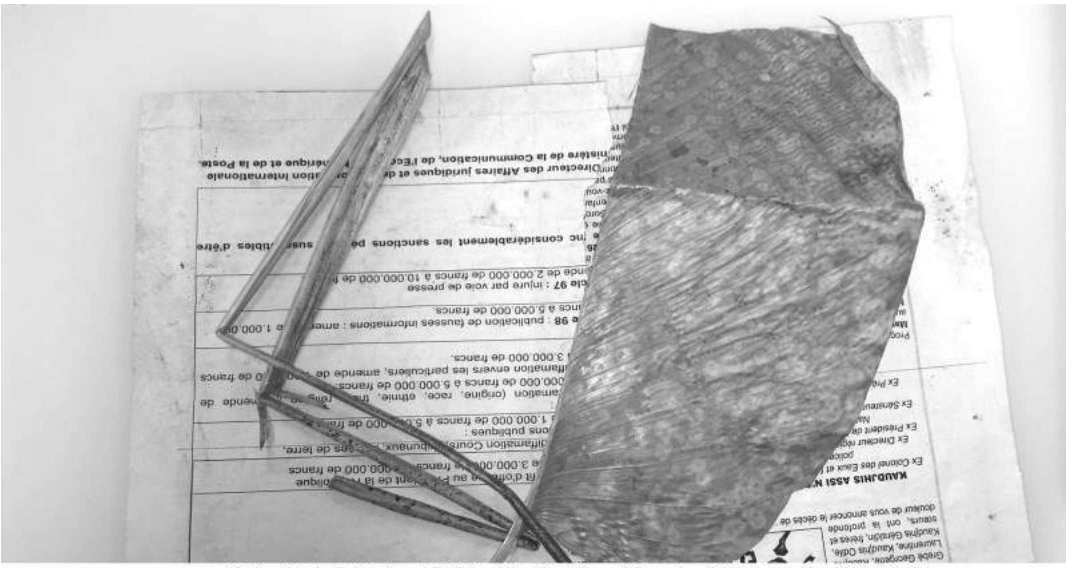
Nailpolish method (method 1)



Discoloration method (method 2)

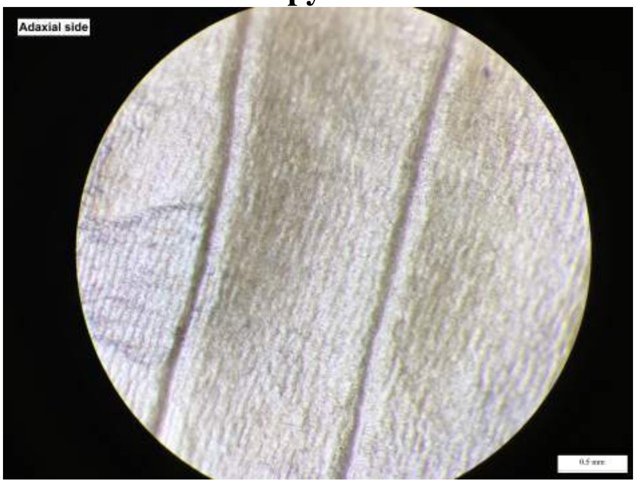


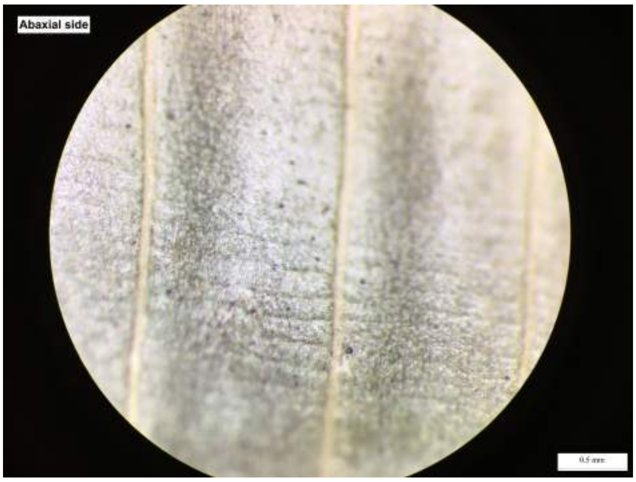
Herbarium plant



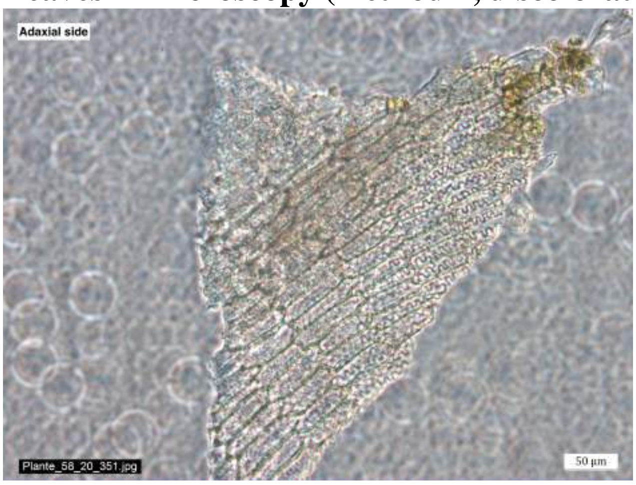
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougounein the Centre Suisse des Recherches Scientifiques en Côte d'Ivoire (CSRS)

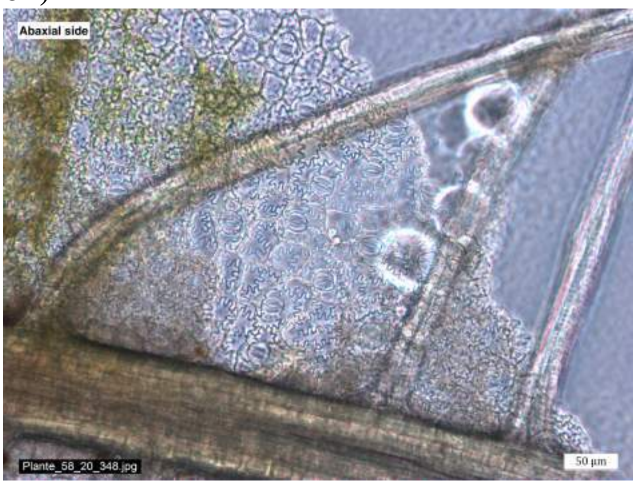
Leaves in macroscopy



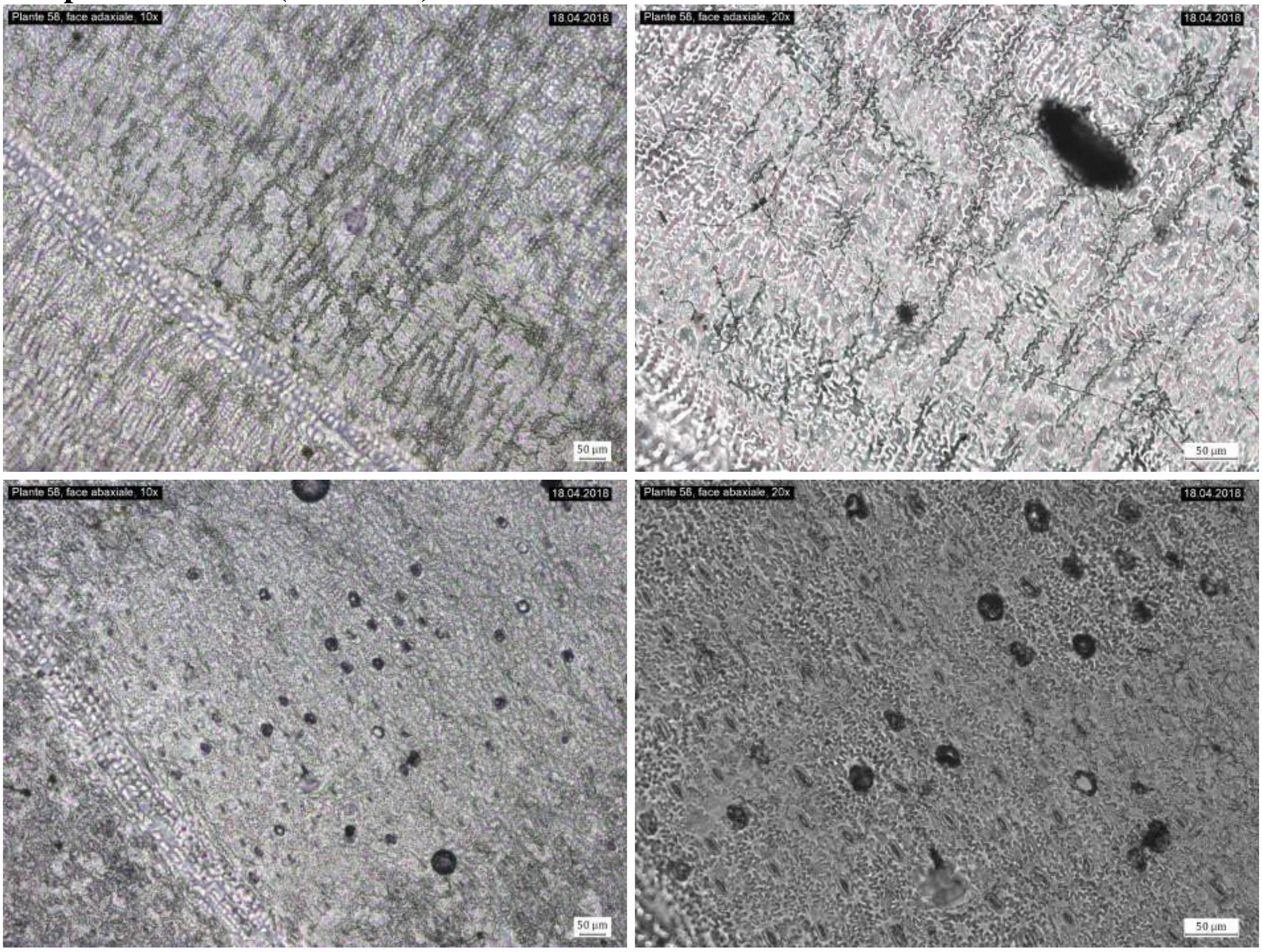


Leaves in microscopy (method 2, discoloration)

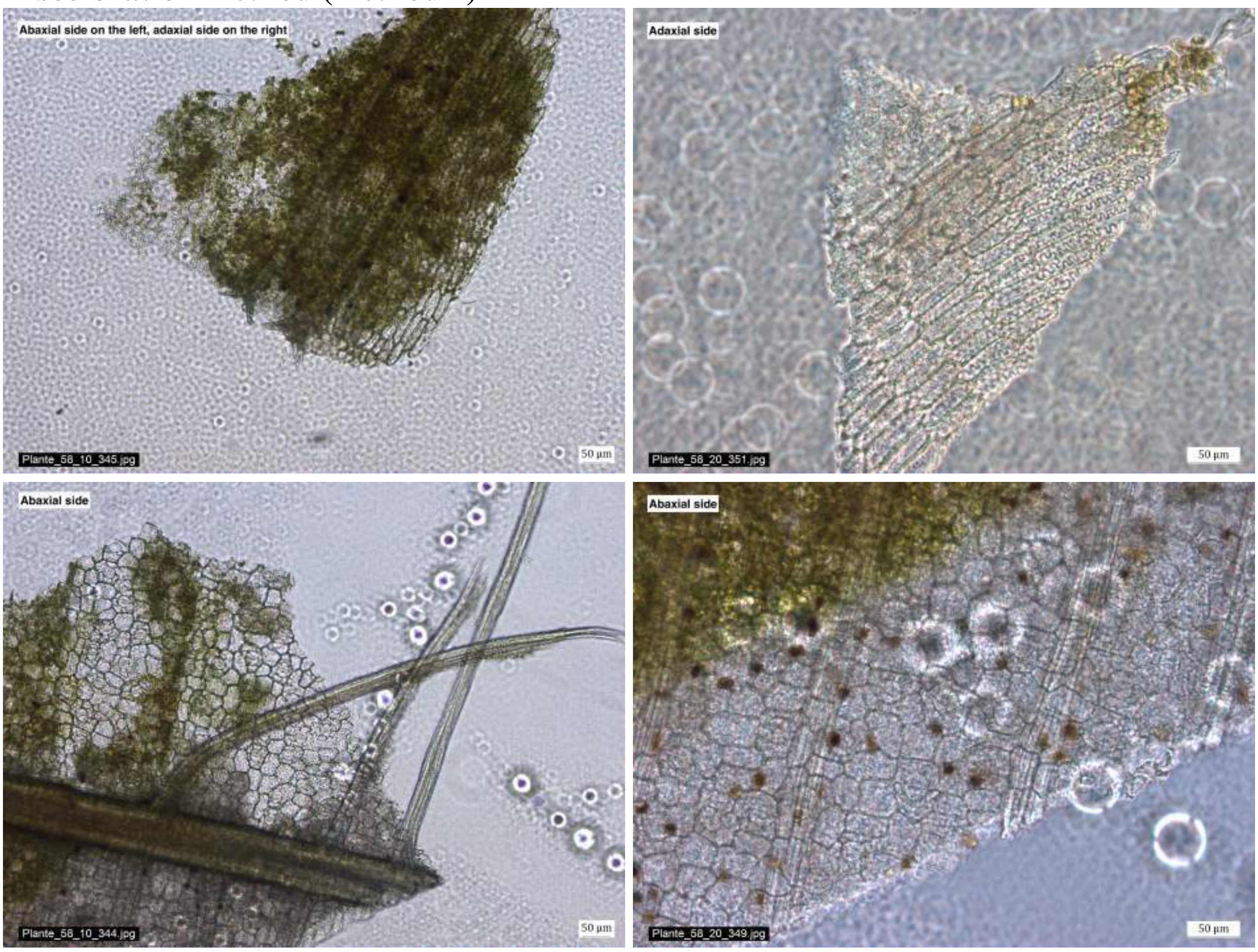




Nailpolish method (method 1)



Discoloration method (method 2)



Herbarium plant

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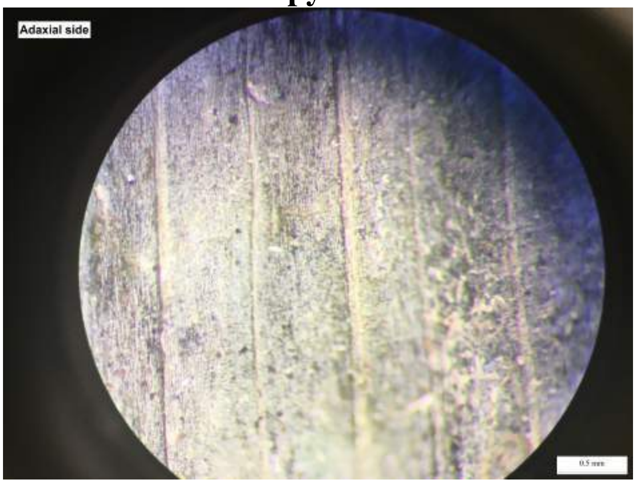
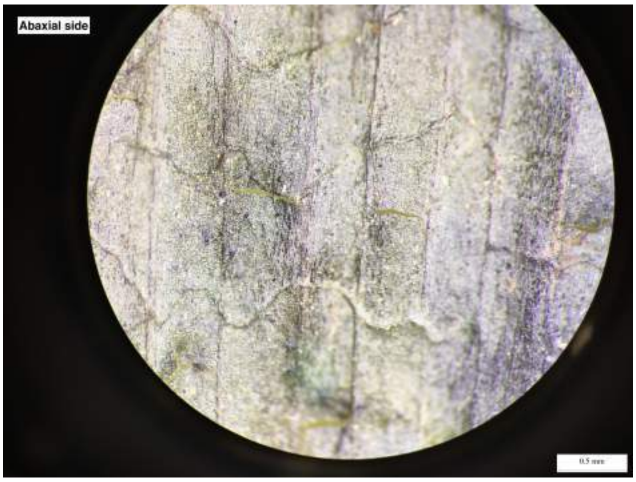
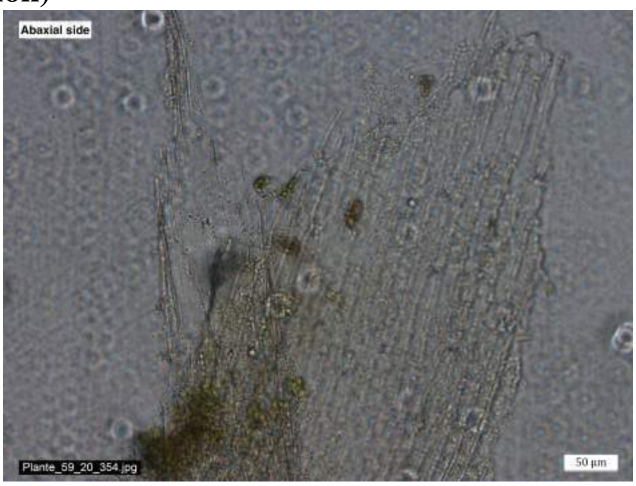
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

Leaves in macroscopy

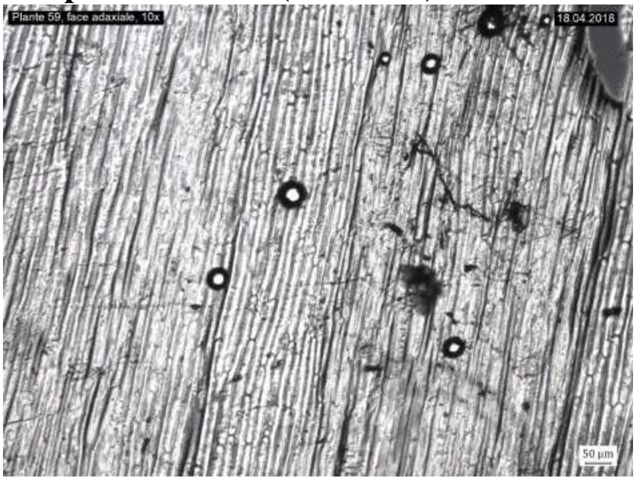


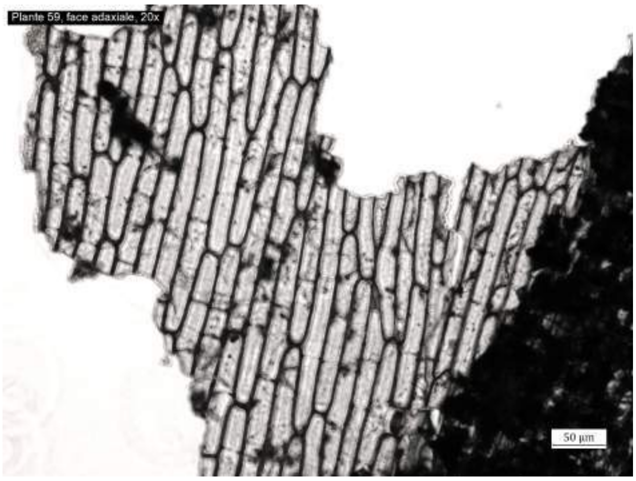


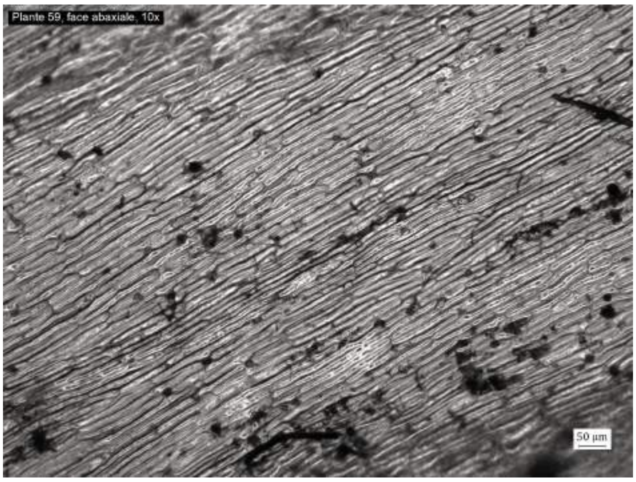
Leaves in microscopy (method 2, discoloration)

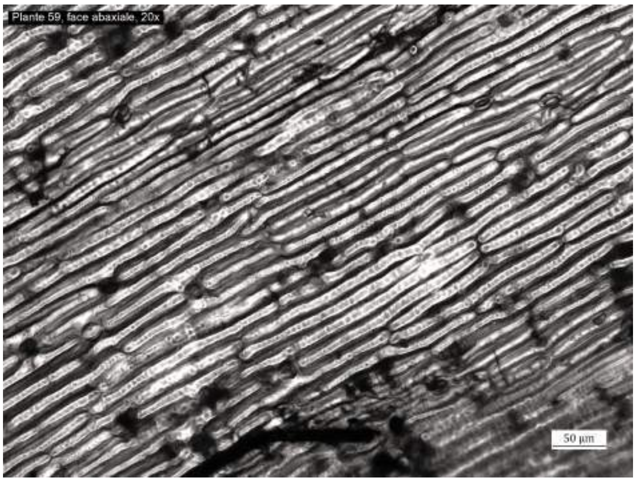


Nailpolish method (method 1)

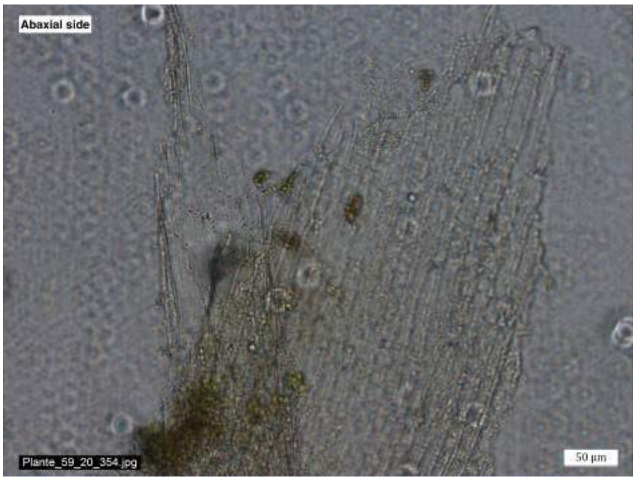






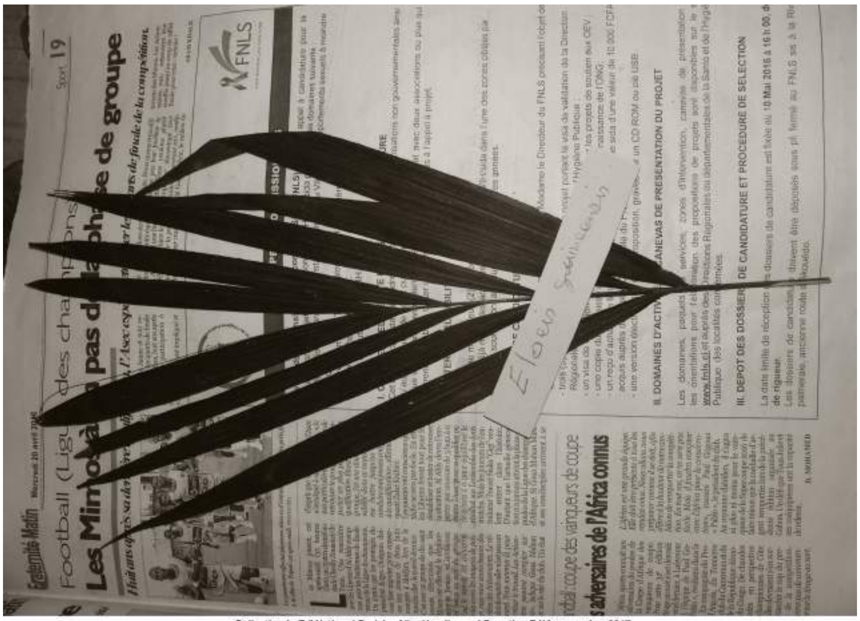


Discoloration method (method 2)



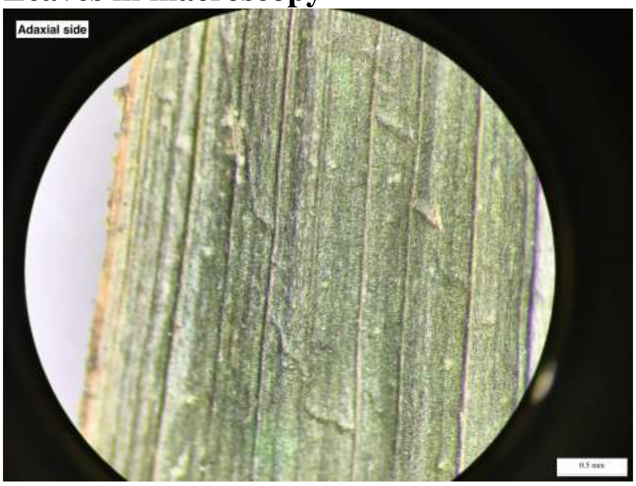
Elaeis guineensis (Plant 60) ARECACEAE

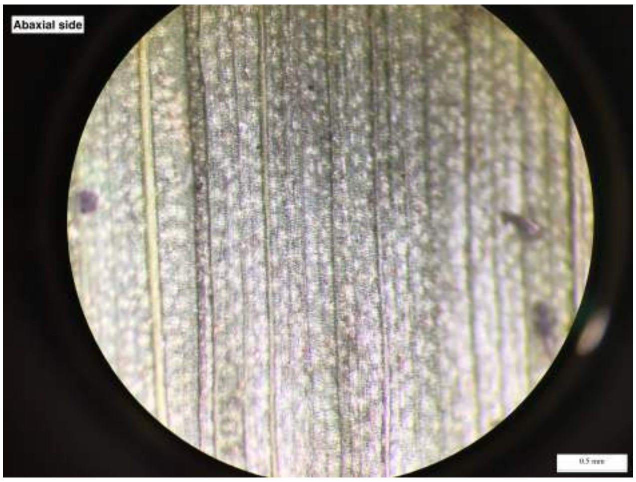
Herbarium plant



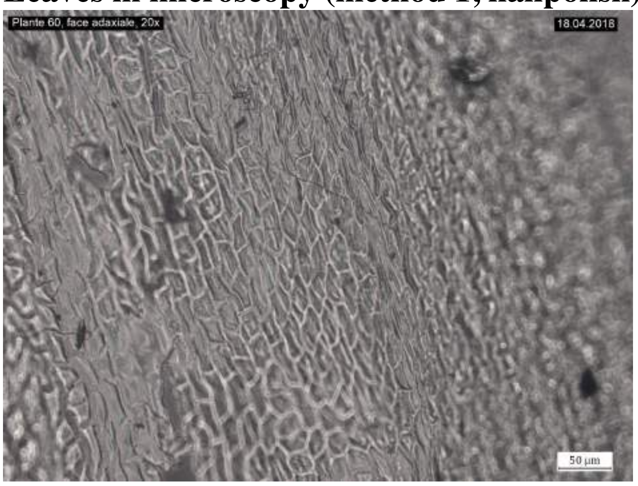
Collection in Taï National Park by Alba Hendier and Donatien Bélé, november 2017
Confirmation of the determination by Saturnin Dougoune in the Centre Suisse des Recherches Scientifiques (CSRS)

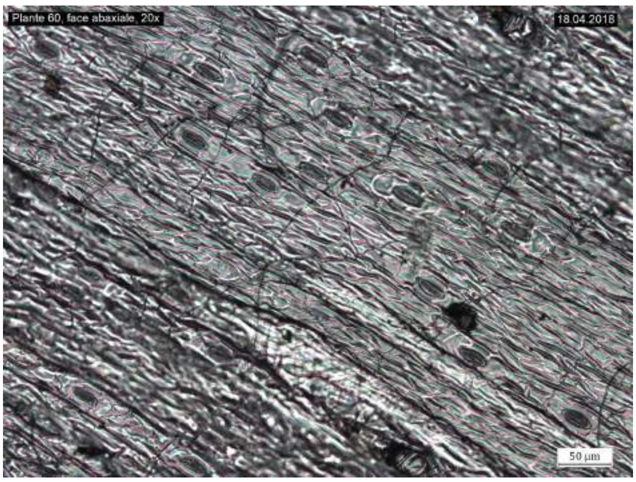
Leaves in macroscopy



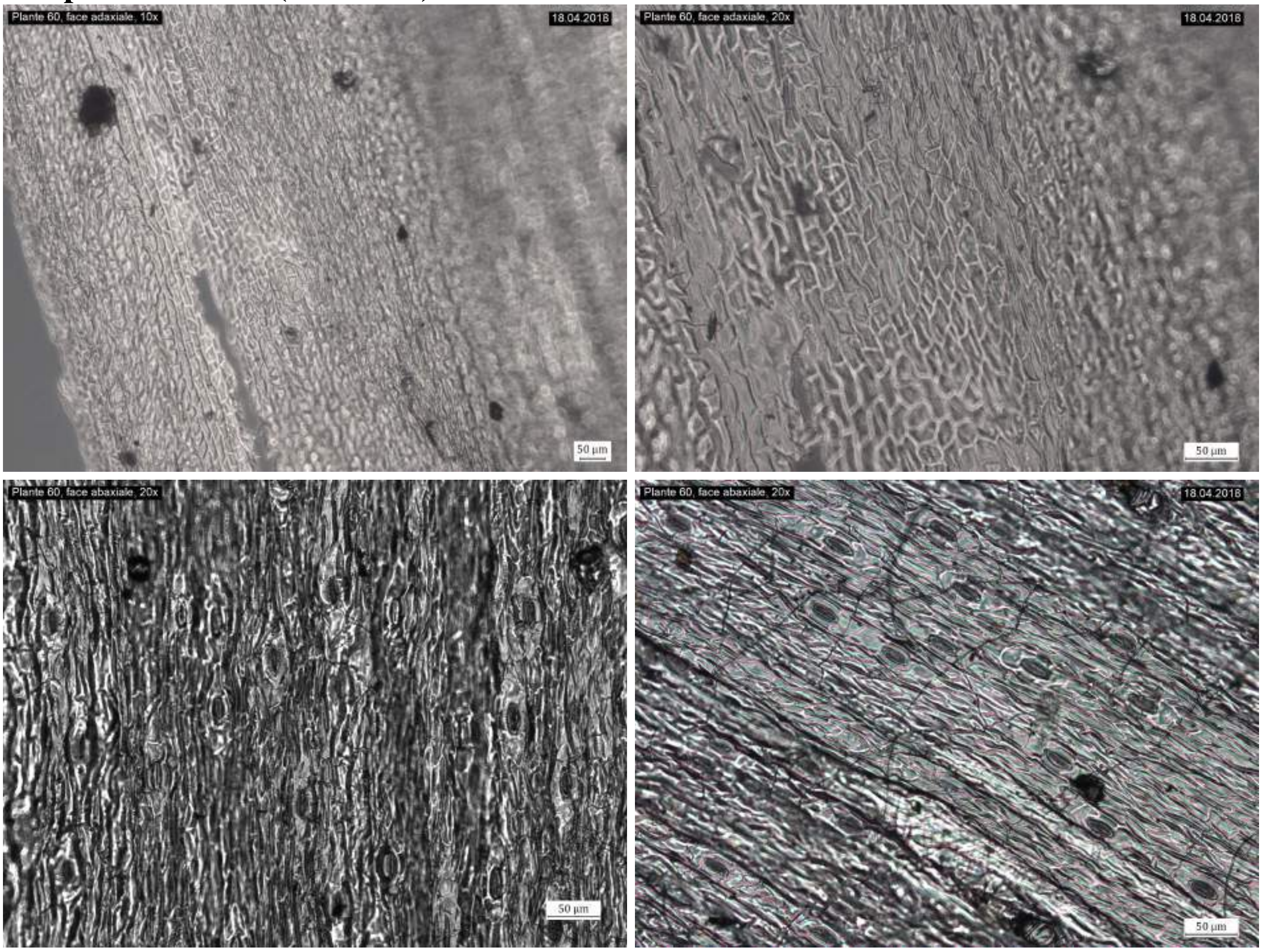


Leaves in microscopy (method 1, nailpolish)

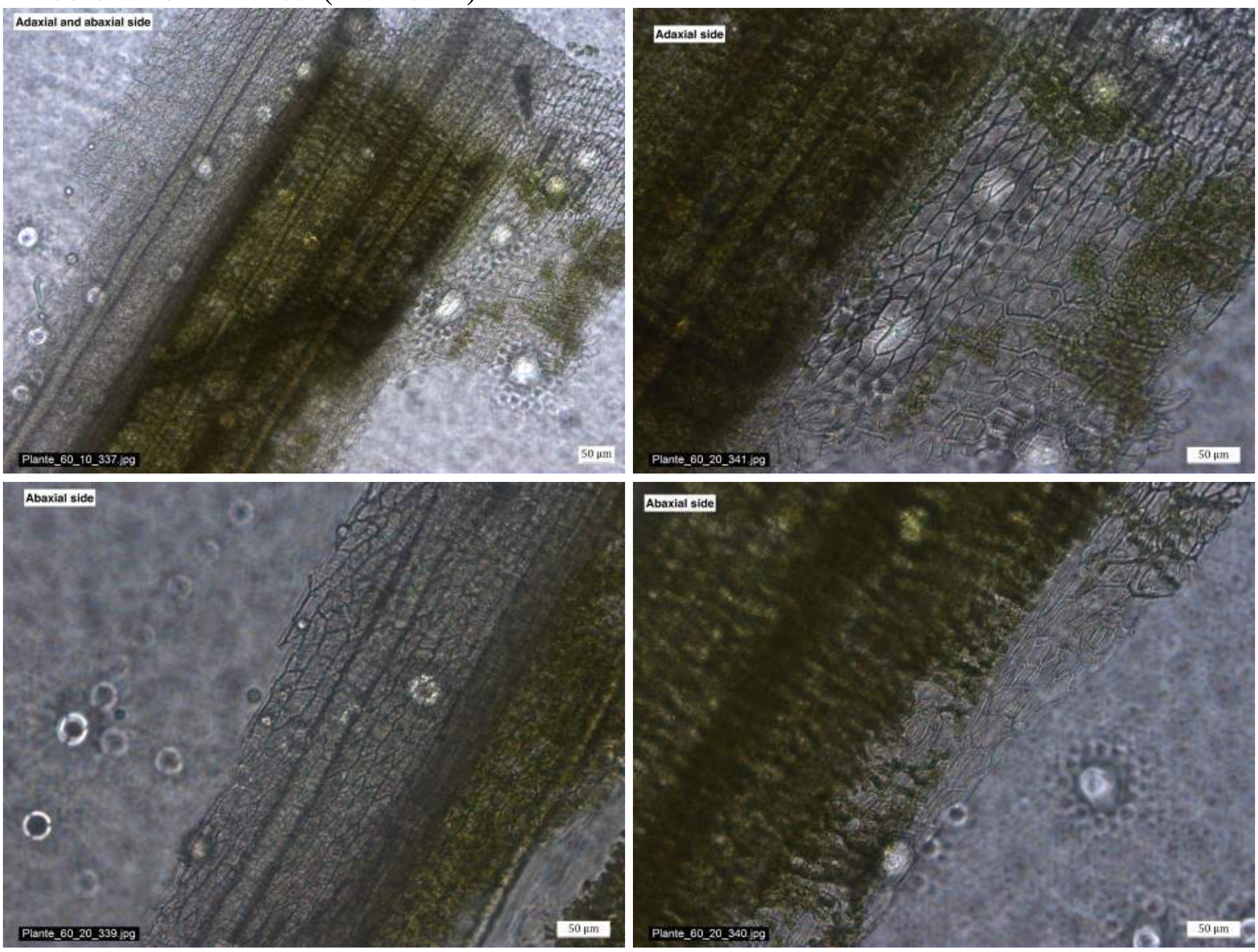




Nailpolish method (method 1)

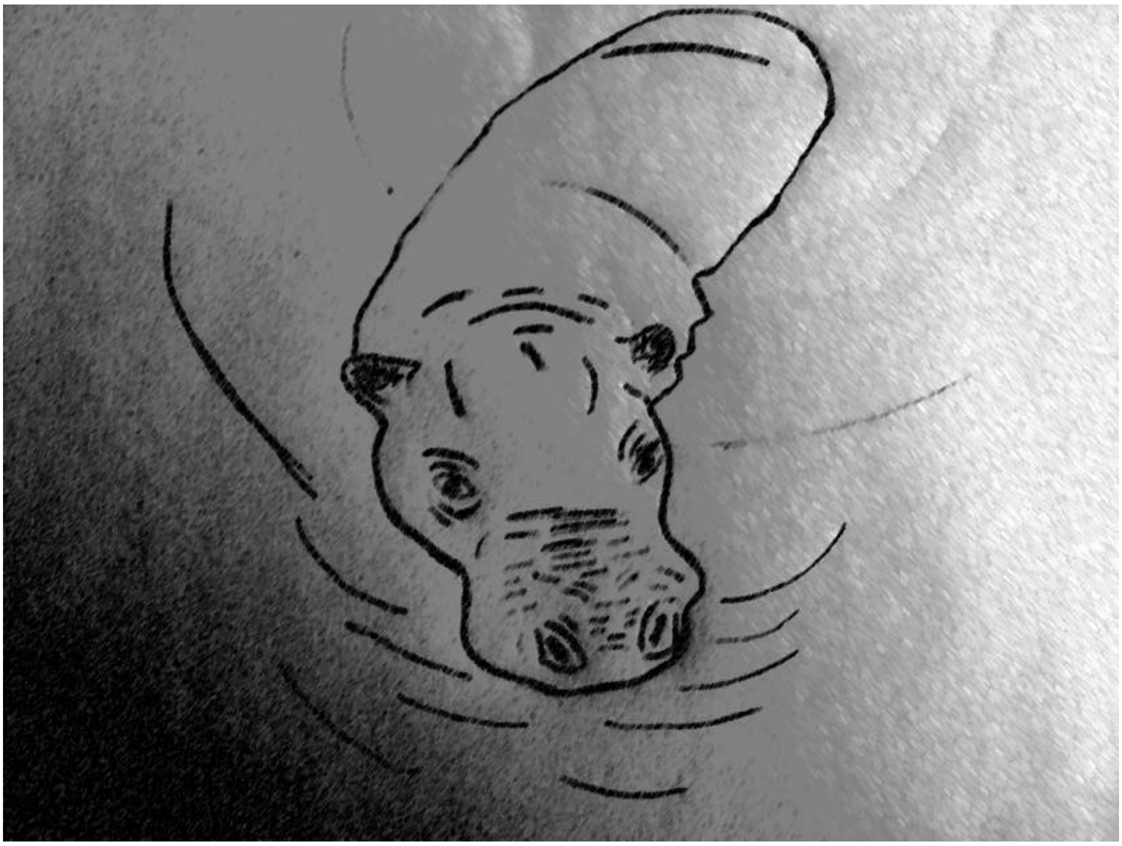


Discoloration method (method 2)



11. FAECES FRAGMENTS IMAGE DATABASE

Faeces Fragments Image Database



of wild
Pygmy Hippopotamus (*Choeropsis liberiensis)*
living in the Taï National Park (TNP)

Created for a diet determination study (Msc Thesis)
Alba Hendier
2019

CONTENT

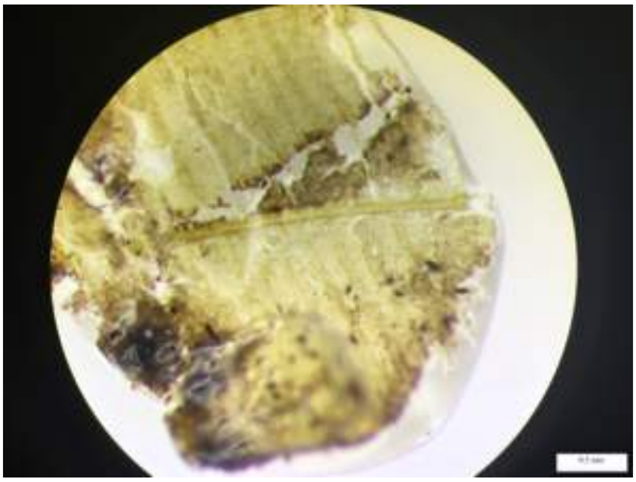
This document contains 480 fragments of wild hippopotamus droppings from the Taï National Park (TNP), Ivory Coast. These fragments are available to improve our knowledge of the habits and needs of this endangered species.

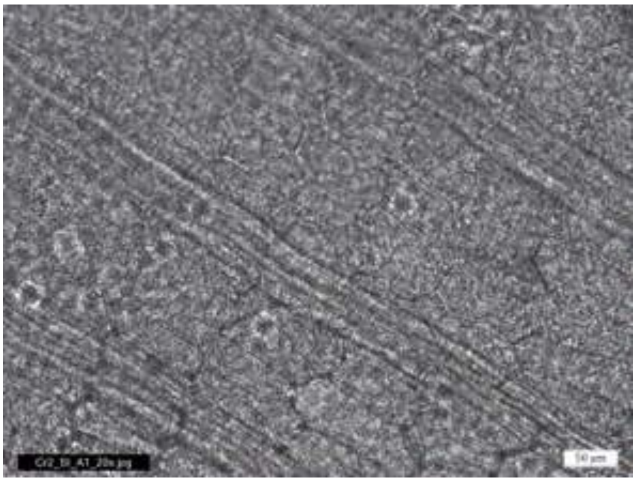
A macroscopic (magnification 60x) and microscopic (magnification 200x) views are available in this document.

The macroscopic fragments were discolored and then photographed with an inverted microscope *Leica OMI 3000 B* using the software LAS V.4.0.

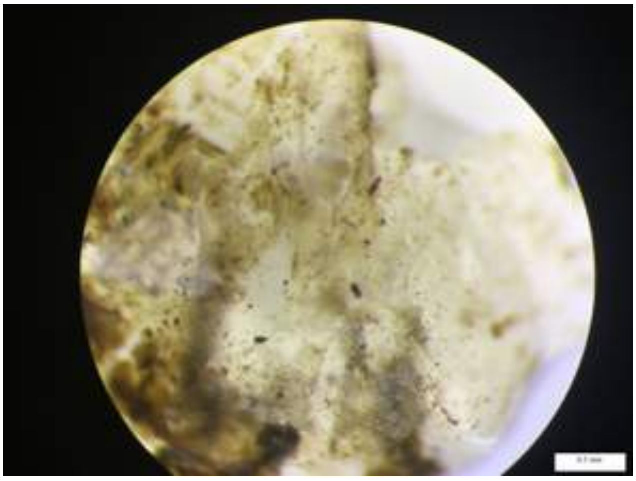
Fragments of the Faece 1

Fragment 1 (1_SI_A1_Cr2) → Inc_1

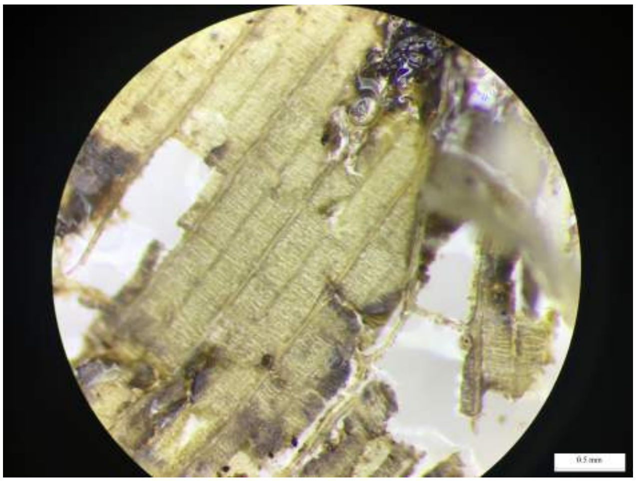


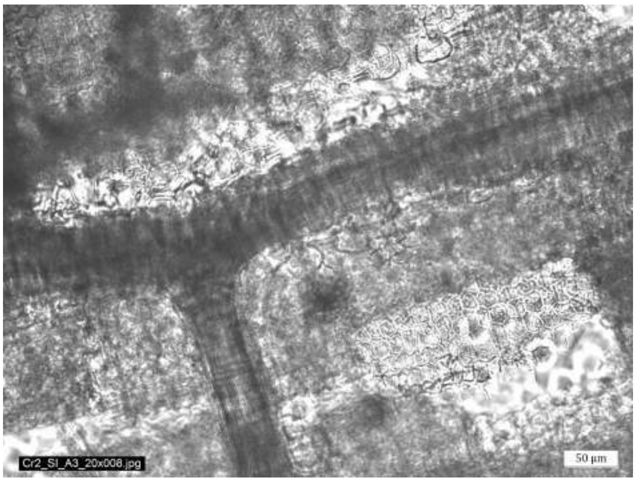


Fragment 2 (2_SI_A2_Cr2) → Inc_2

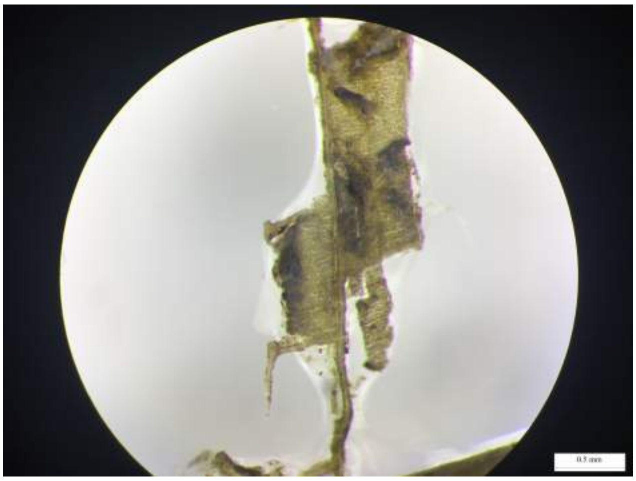


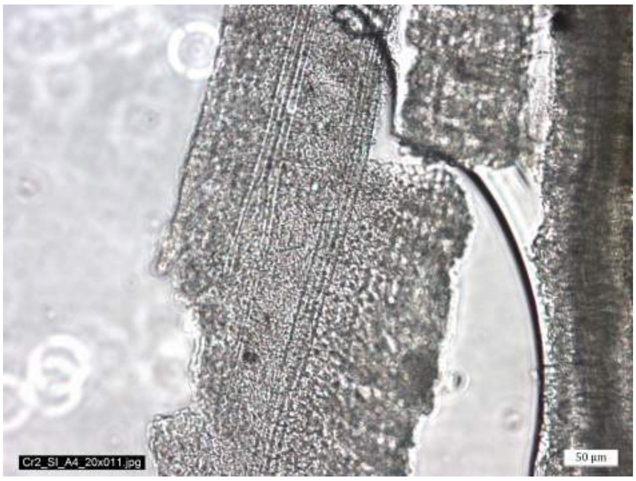
Fragment 3 (3_SI_A3_Cr2) → Inc_3



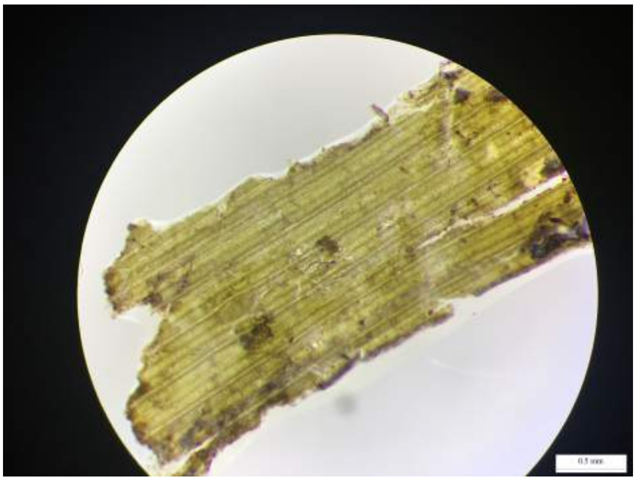


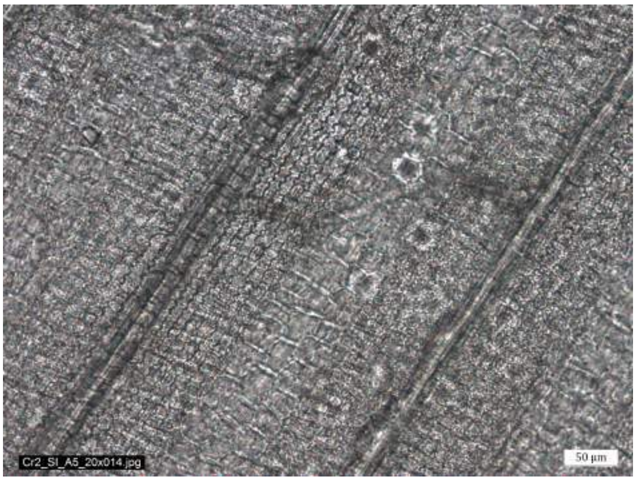
Fragment 4 (4_SI_A4_Cr2)



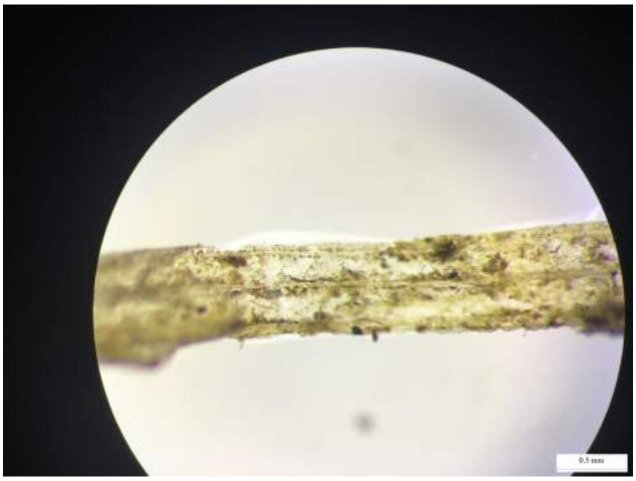


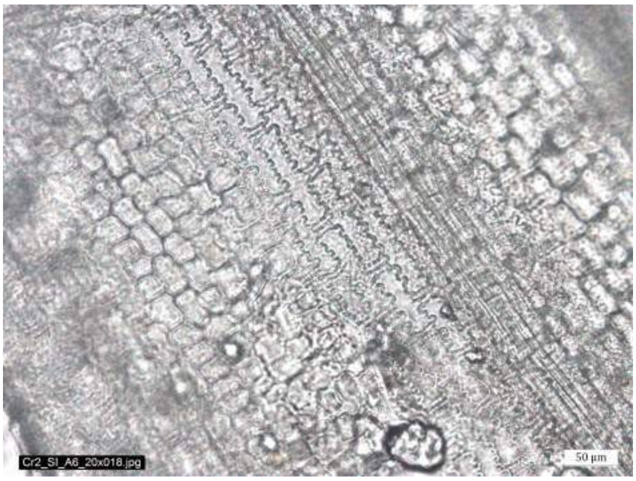
Fragment 5 (5_SI_A5_Cr2) → **Inc_4**



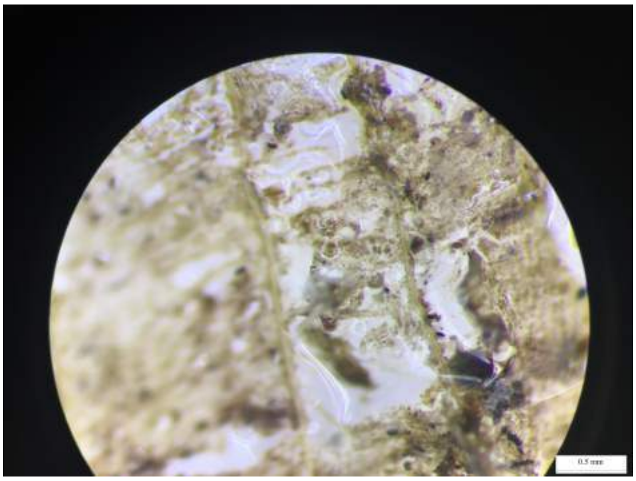
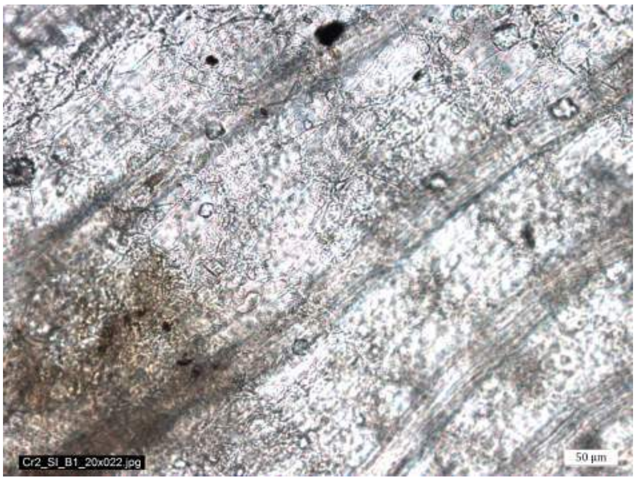


Fragment 6 (6_SI_A6_Cr2)

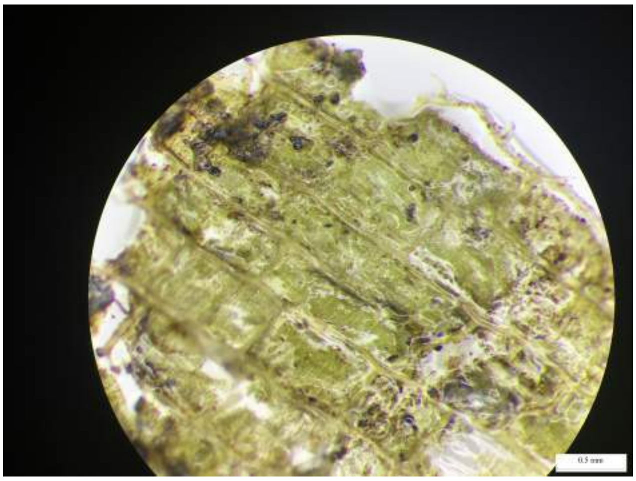
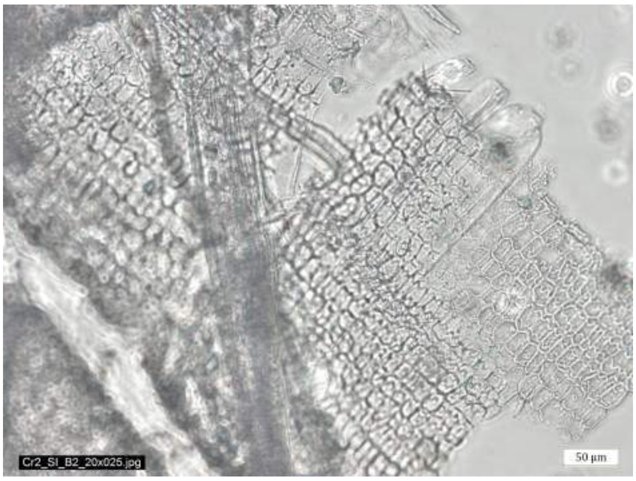




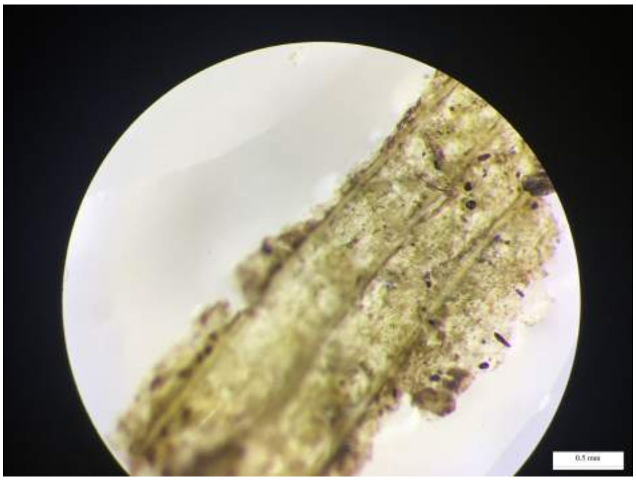
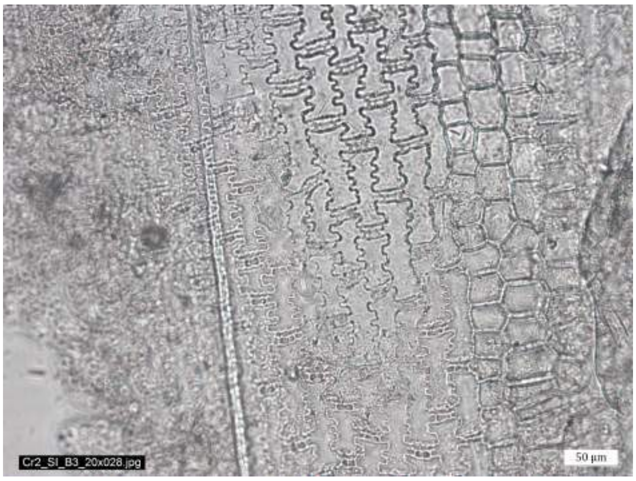
Fragment 7 (7_SI_B1_Cr2)

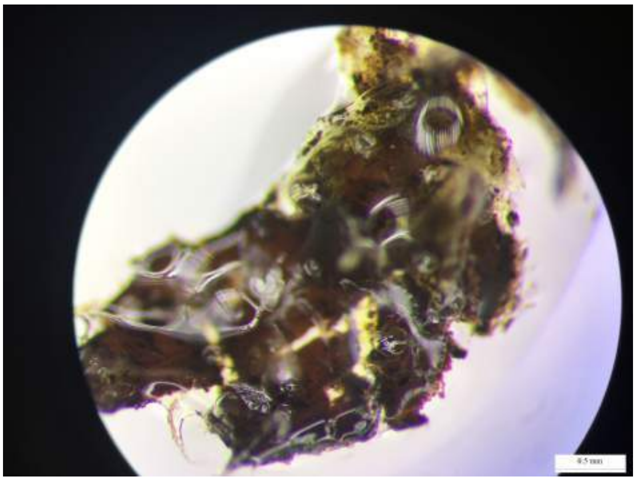
Fragment 8 (8_SI_B2_Cr2)

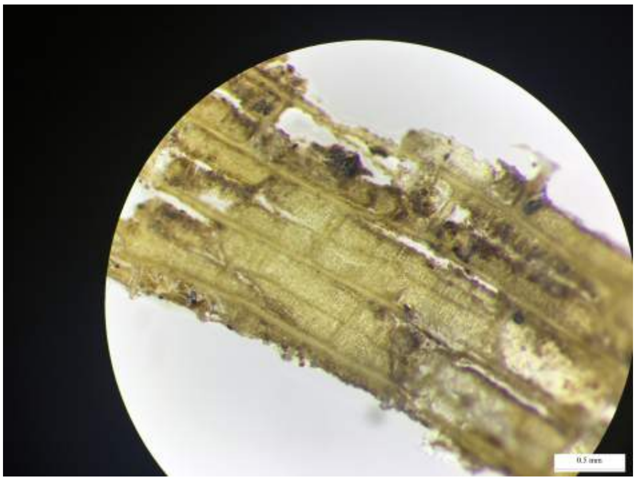
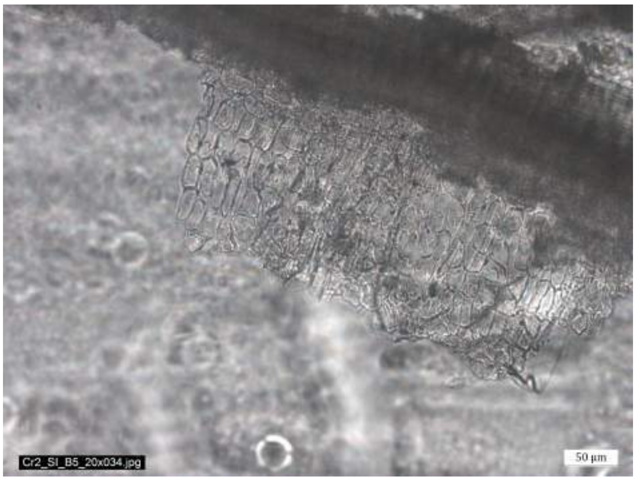
Fragment 9 (9_SI_B3_Cr2)

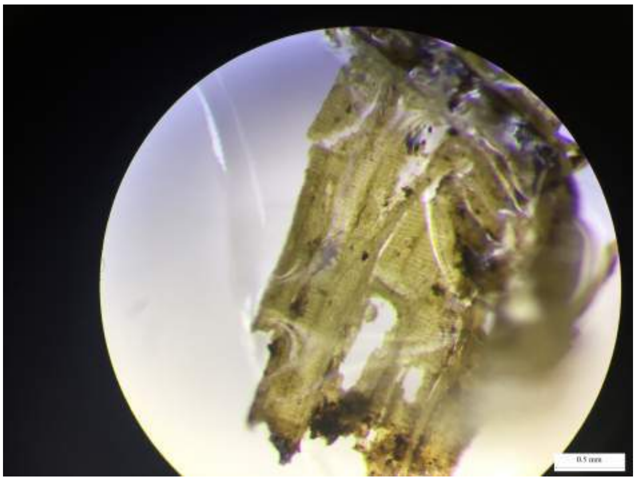
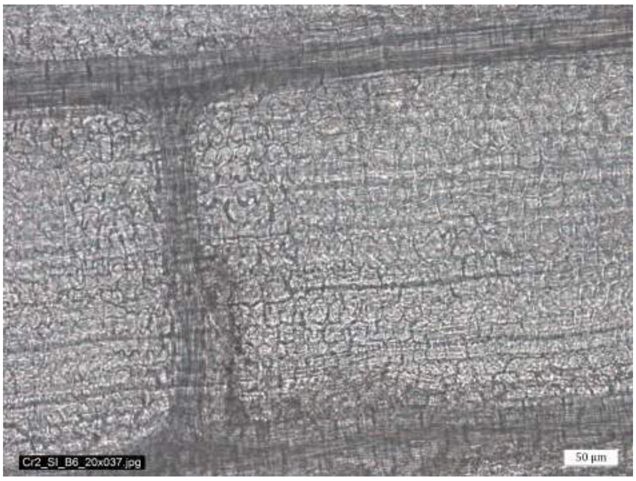
Fragment 10 (10_SI_B4_Cr2)



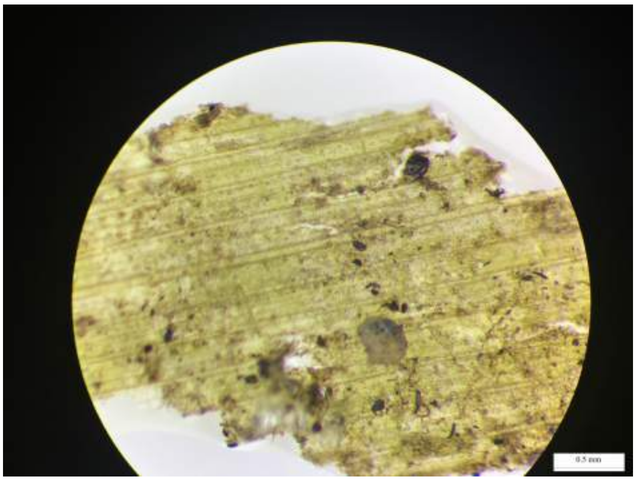

Fragment 11 (11_SI_B5_Cr2)

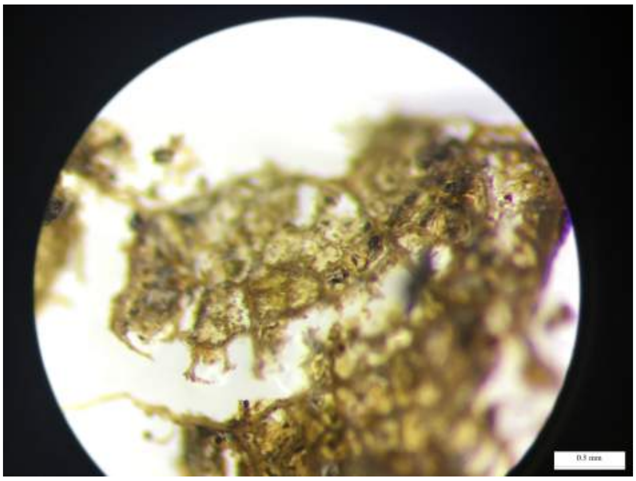
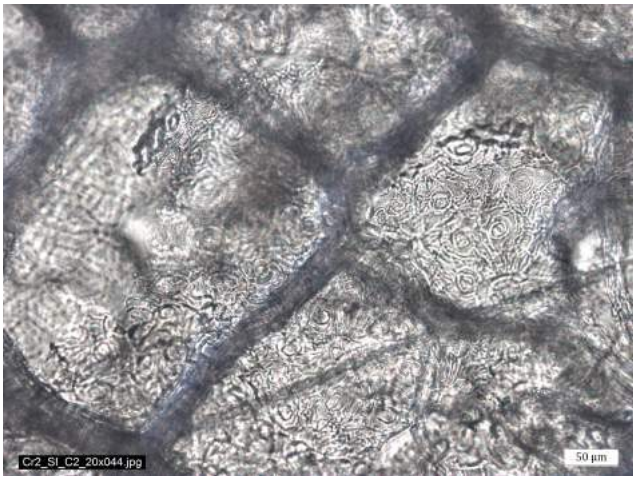
Fragment 12 (12_SI_B6_Cr2)

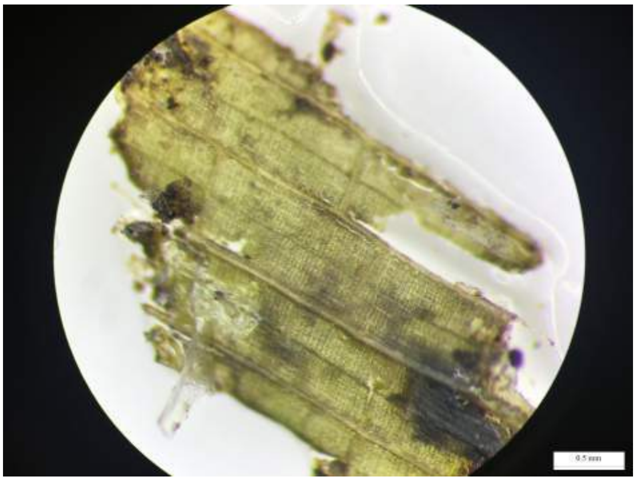
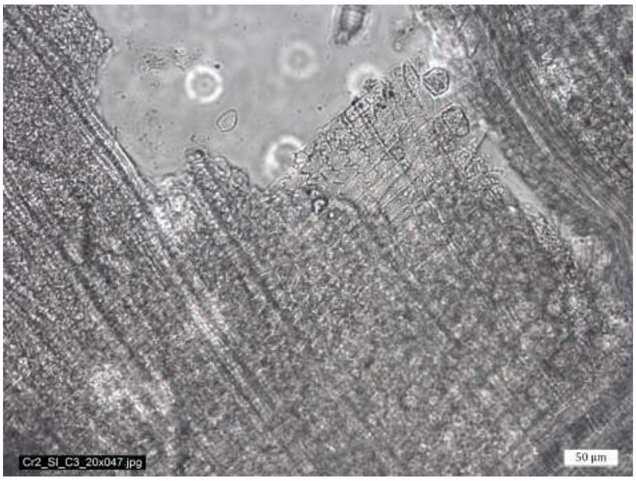
Fragment 13 (13_SI_C1_Cr2)



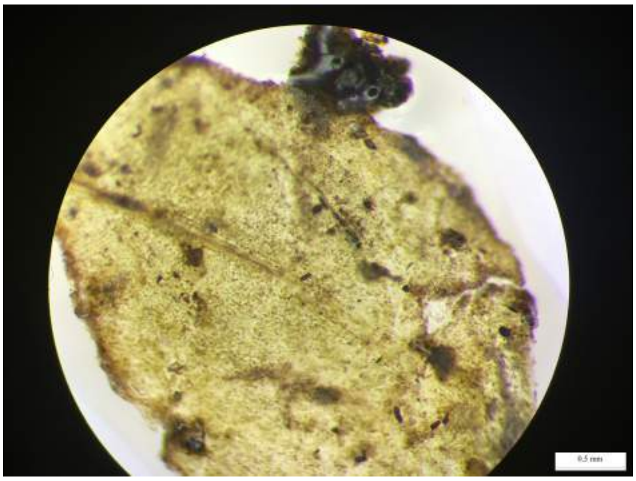

Fragment 14 (14_SI_C2_Cr2) → Inc_5

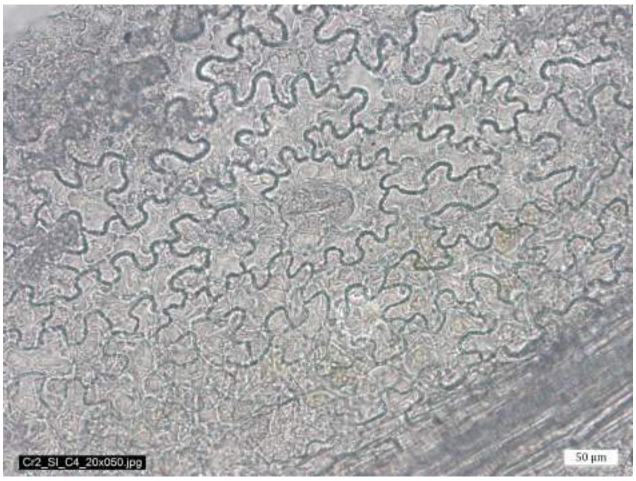



Fragment 15 (15_SI_C3_Cr2)

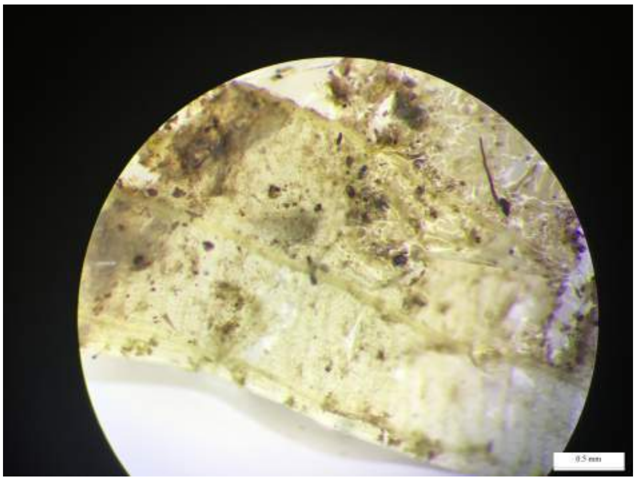



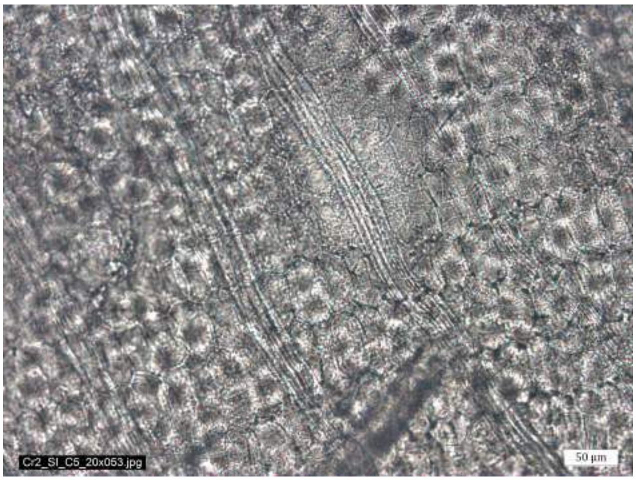
Fragment 16 (16_SI_C4_Cr2) → Inc_6



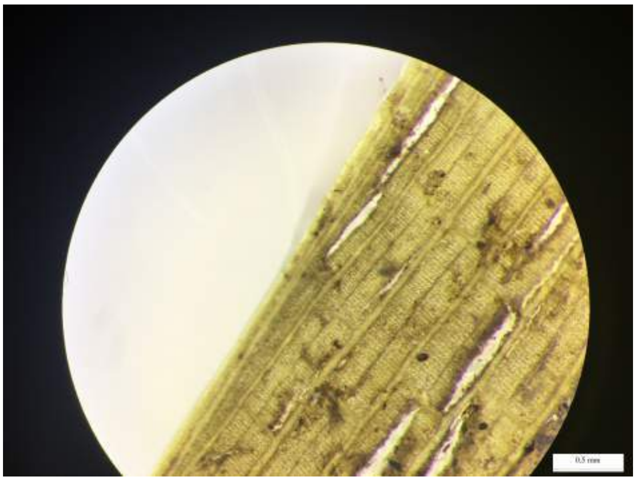


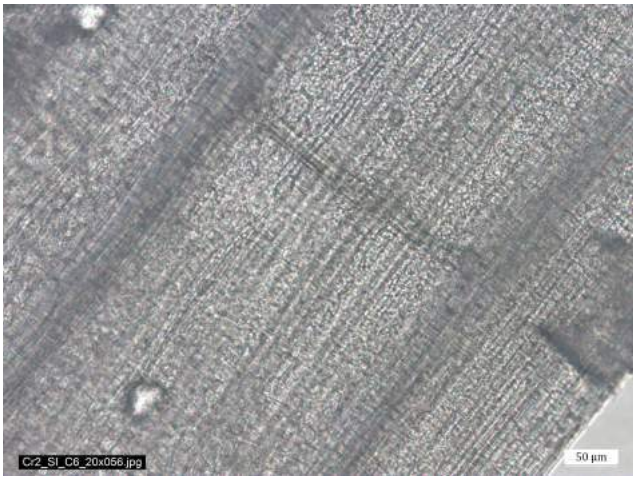
Fragment 17 (17_SI_C5_Cr2)



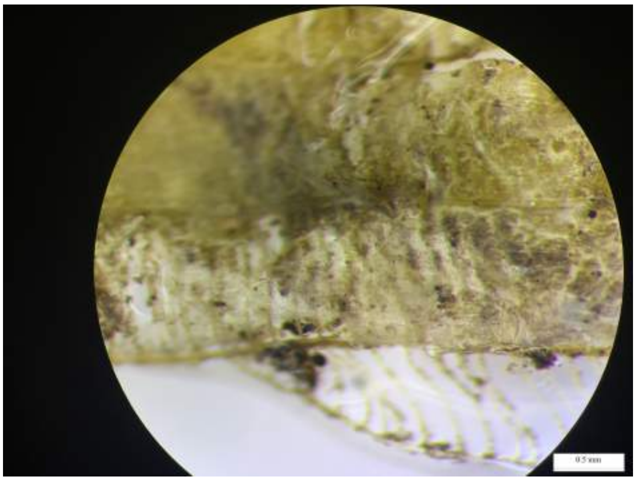


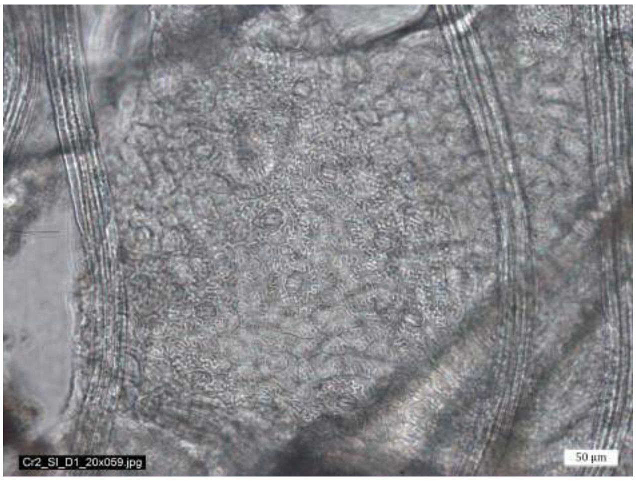
Fragment 18 (18_SI_C6_Cr2)



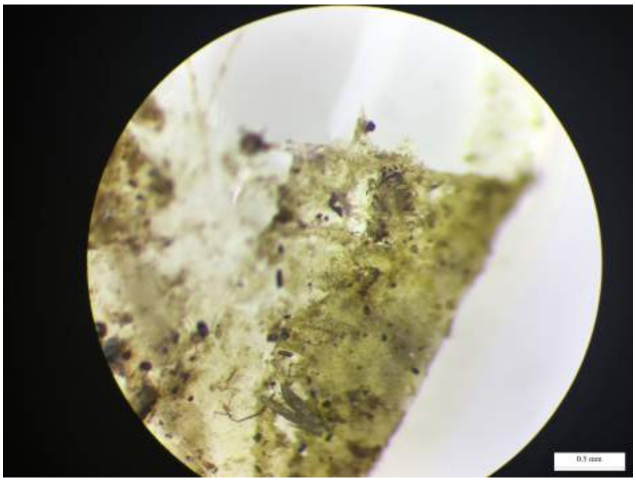


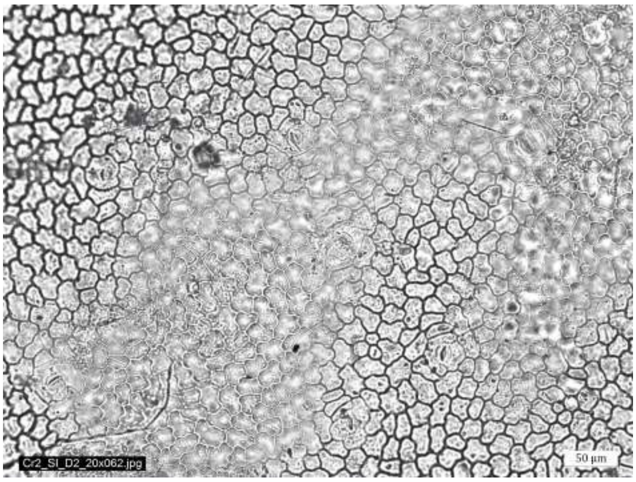
Fragment 19 (19_SI_D1_Cr2) → Inc_7



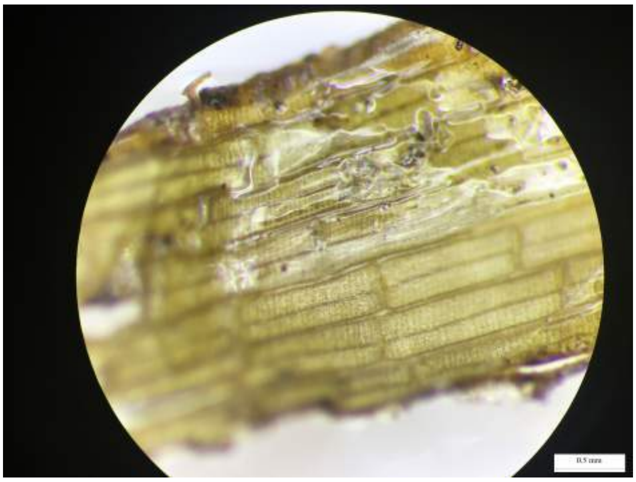


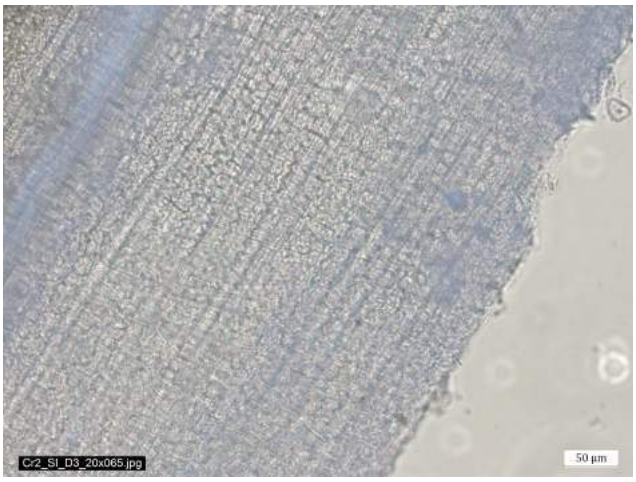
Fragment 20 (20_SI_D2_Cr2) → Inc_8



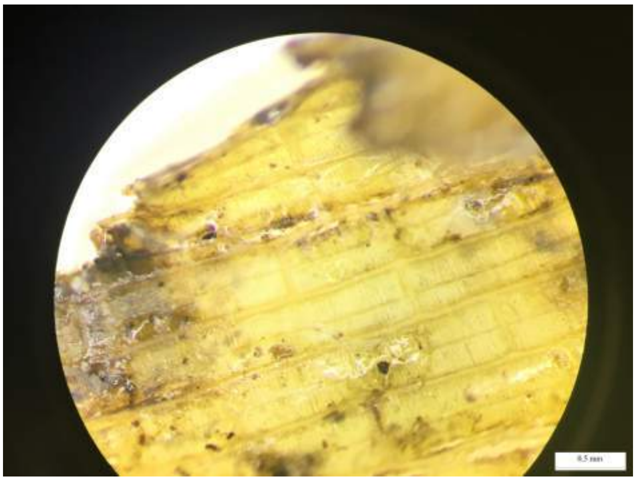


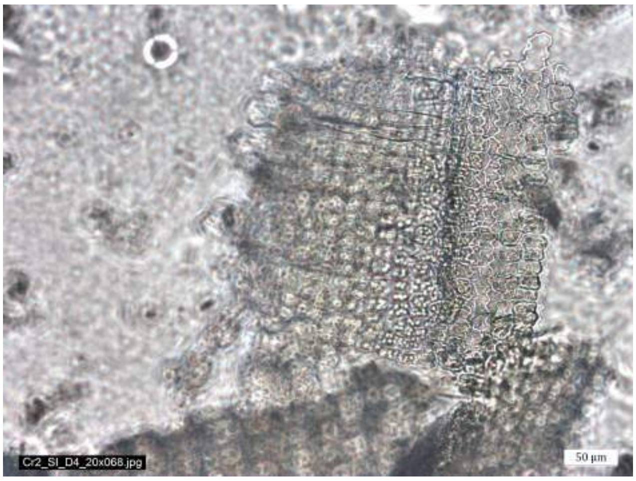
Fragment 21 (21_SI_D3_Cr2)



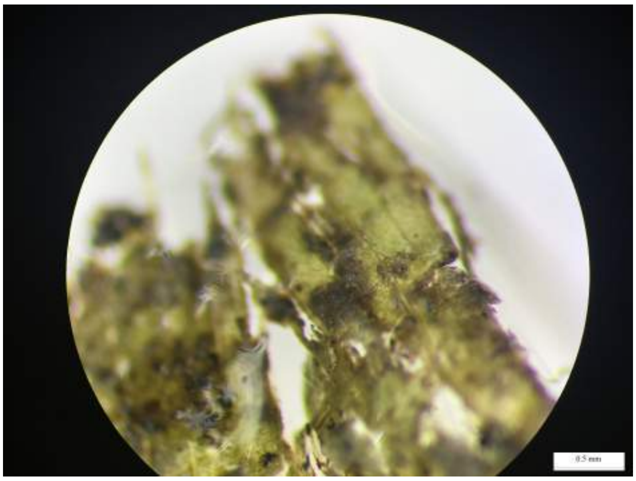


Fragment 22 (22_SI_D4_Cr2)

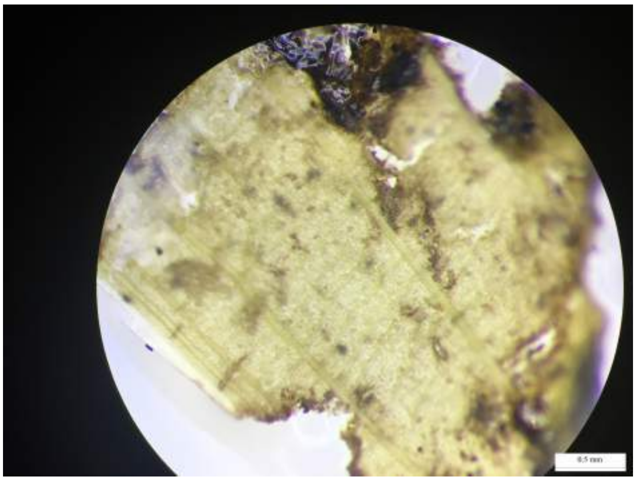


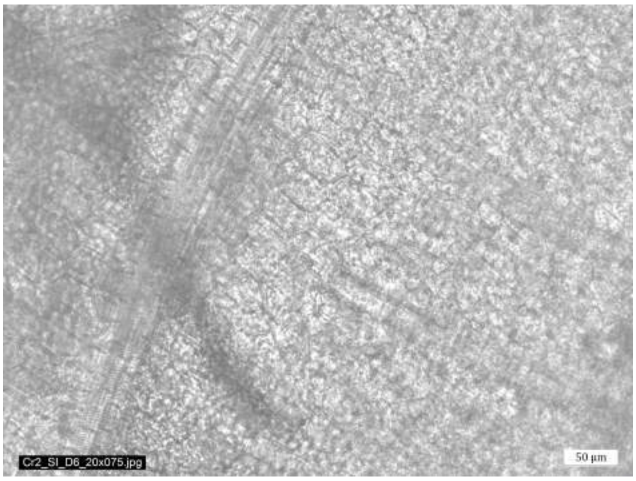


Fragment 23 (23_SI_D5_Cr)

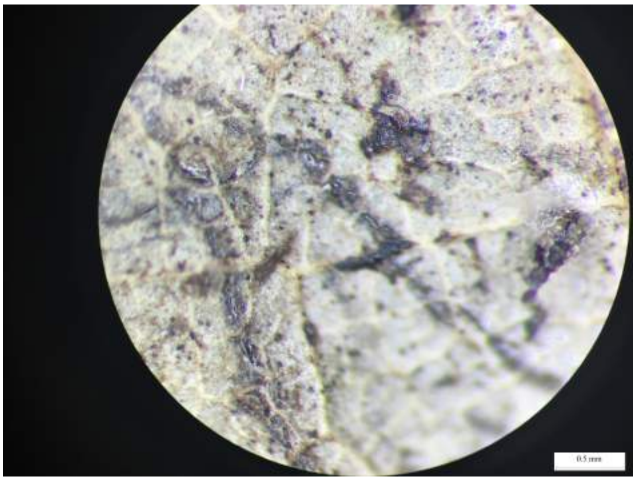


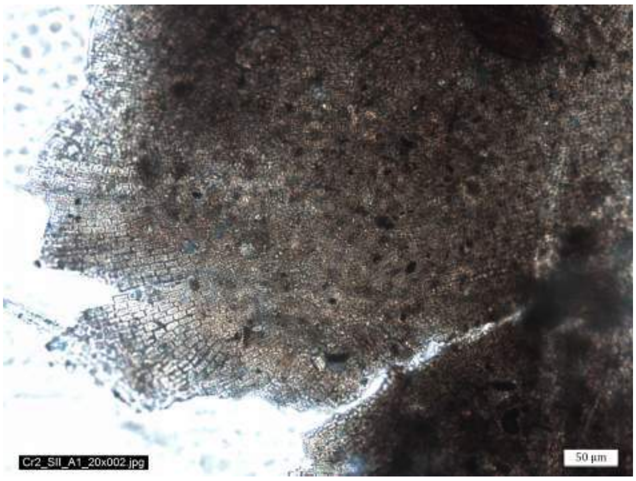
Fragment 24 (24_SI_D6_Cr2)



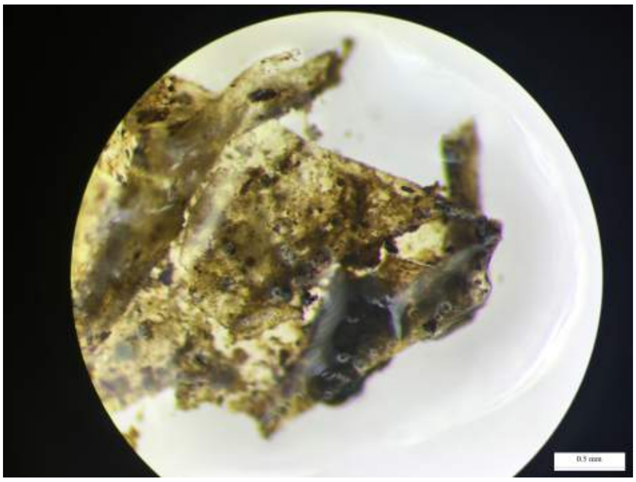


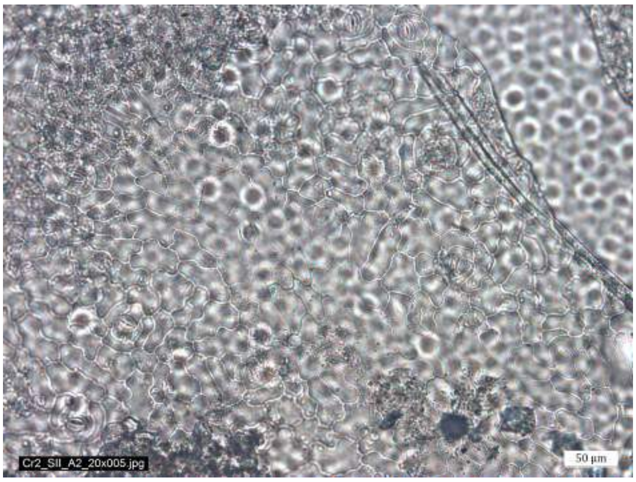
Fragment 25 (25_SII_A1_Cr2) → Inc_9



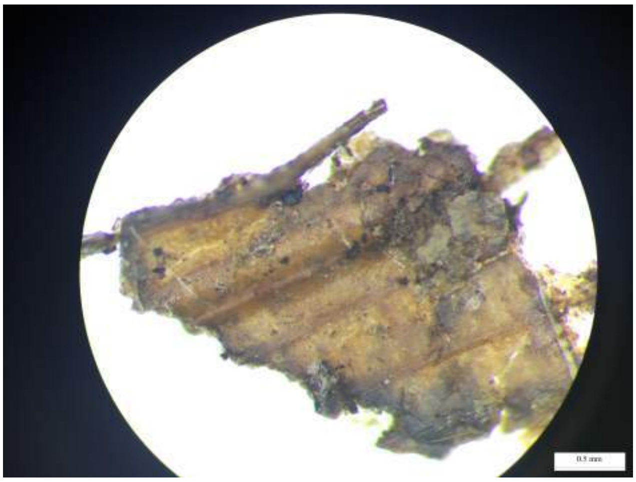


Fragment 26 (26_SII_A2_Cr2) → Inc_10

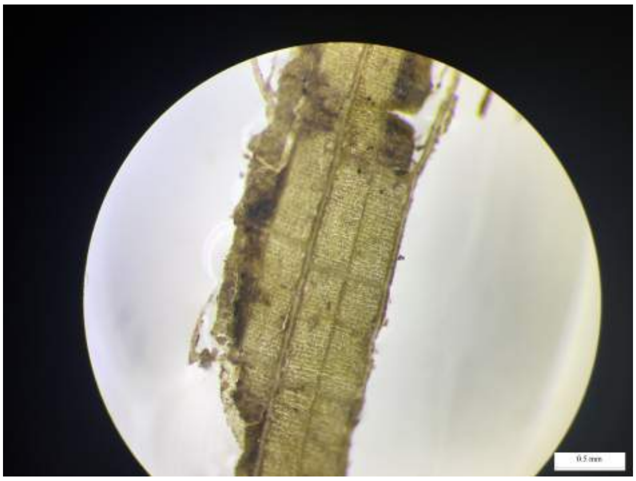


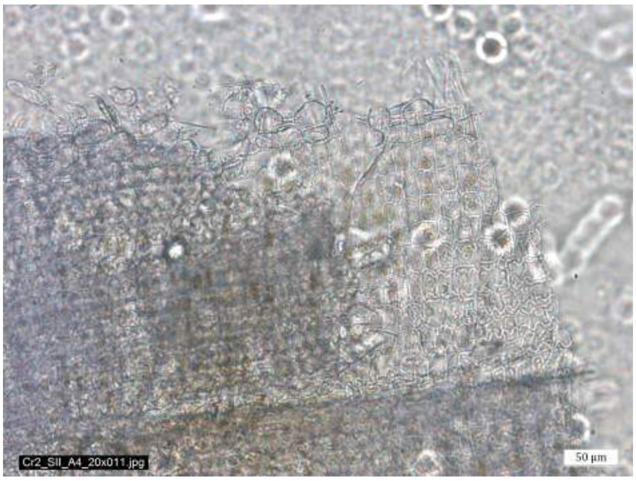


Fragment 27 (27_SII_A3_Cr)

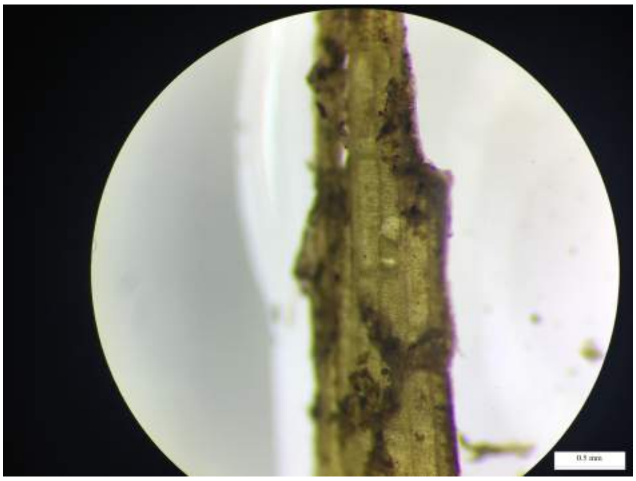


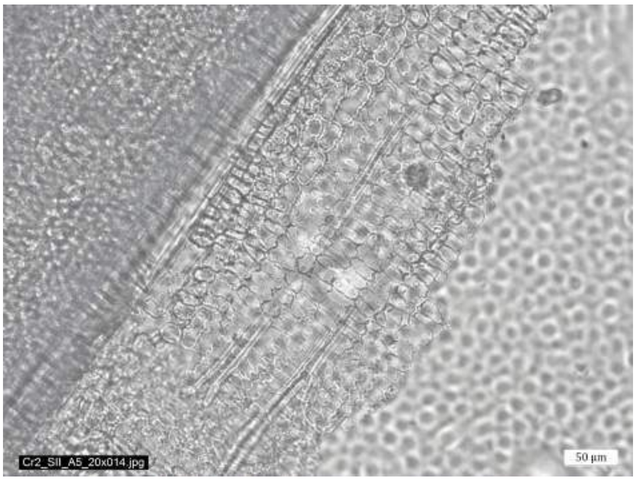
Fragment 28 (28_SII_A4_Cr2)



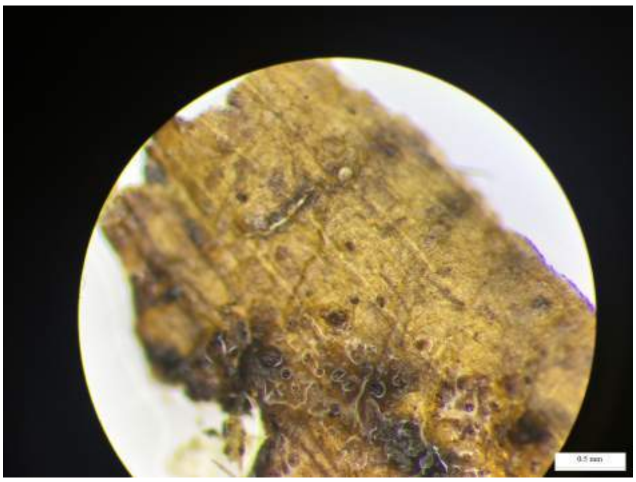


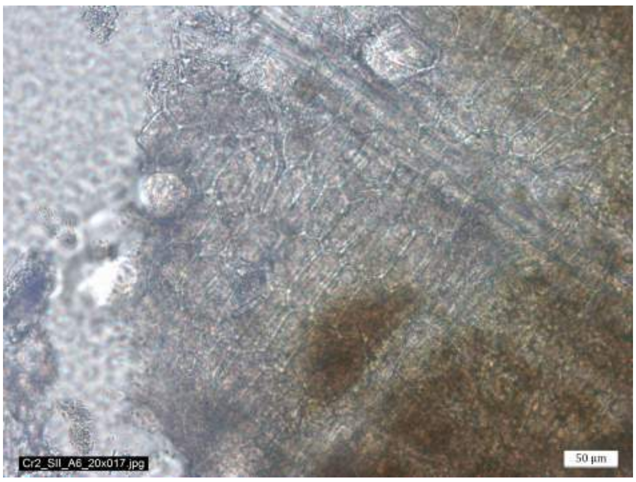
Fragment 29 (29_SII_A5_Cr2)



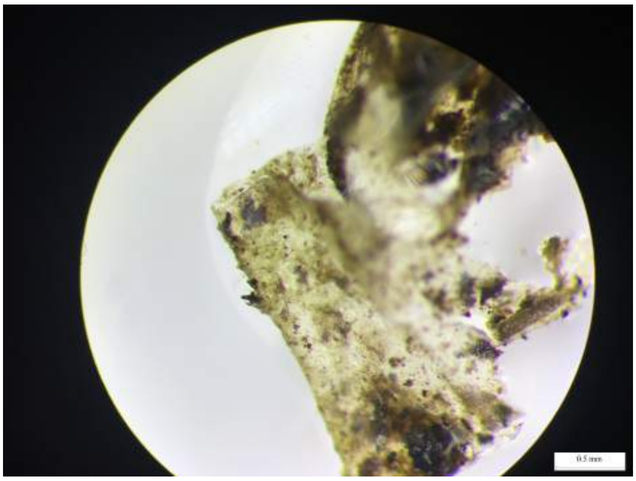
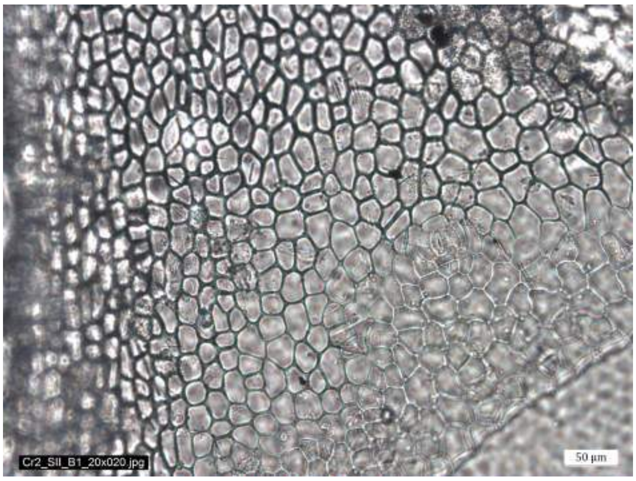


Fragment 30 (30_SII_A6_Cr2)

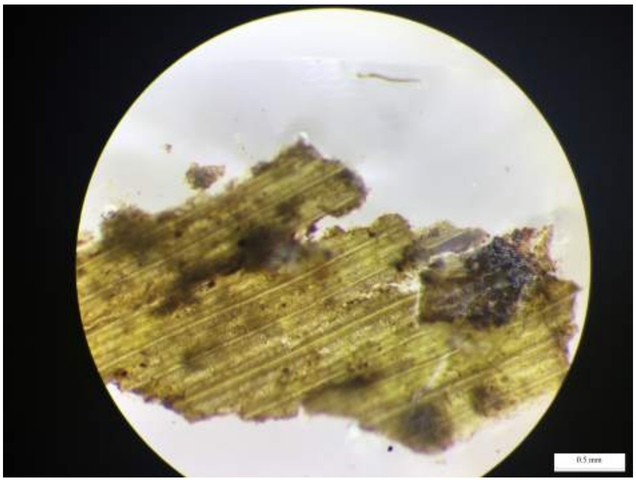
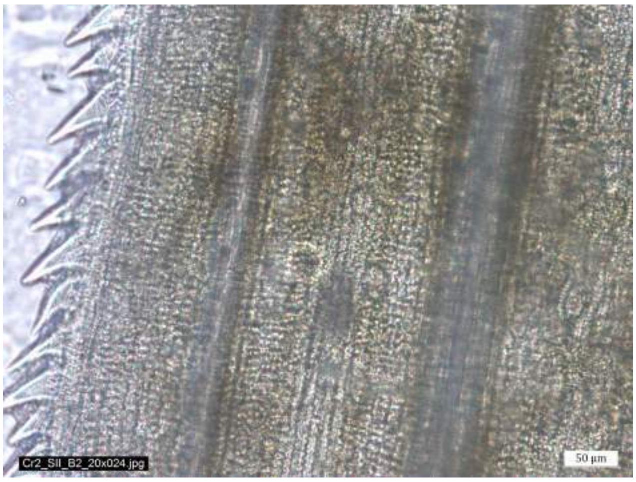




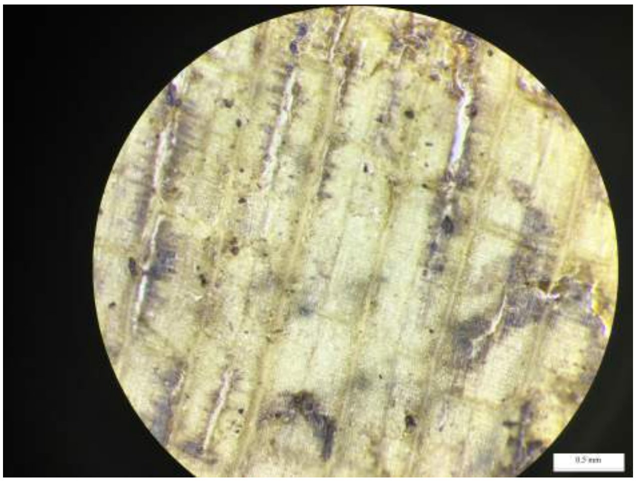
Fragment 31 (31_SII_B1_Cr2) → Inc_11

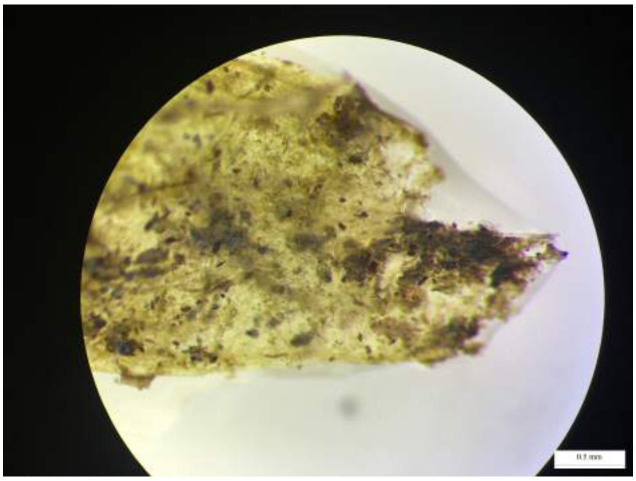
Fragment 32 (32_SII_B2_Cr2) → Inc_12

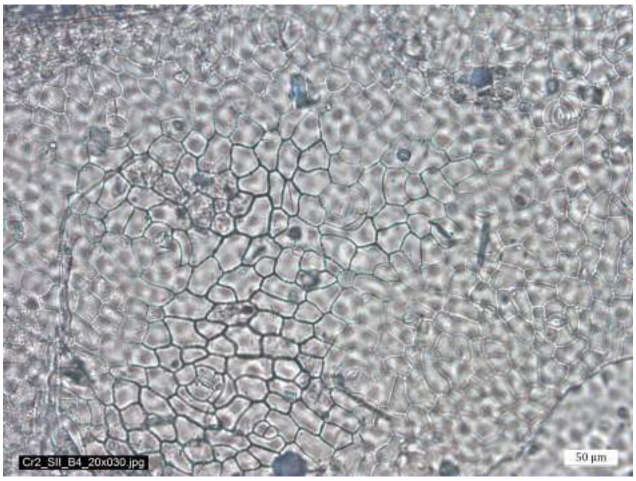



Fragment 33 (33_SII_B3_Cr2)

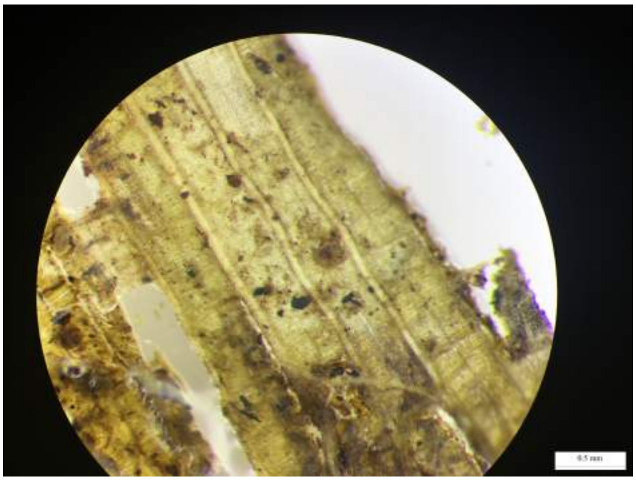



Fragment 34 (34_SII_B4_Cr2)

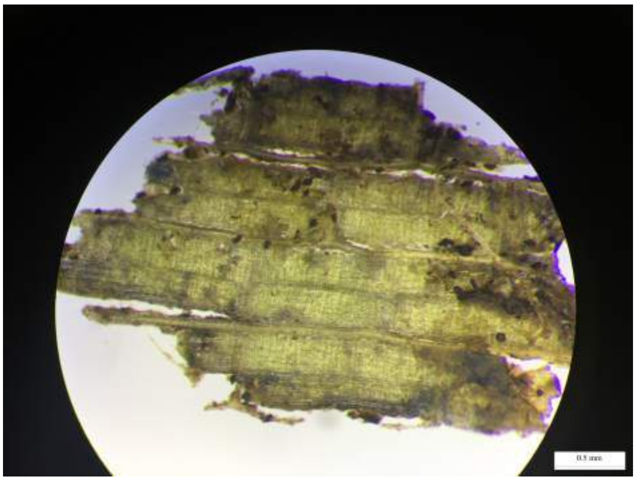


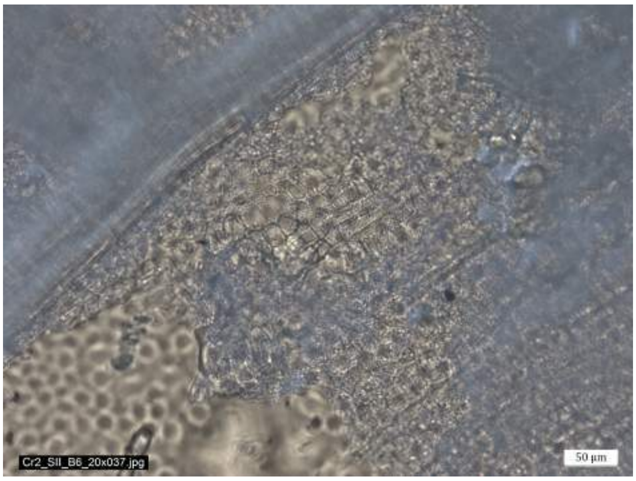


Fragment 35 (5_SII_B5_Cr2)

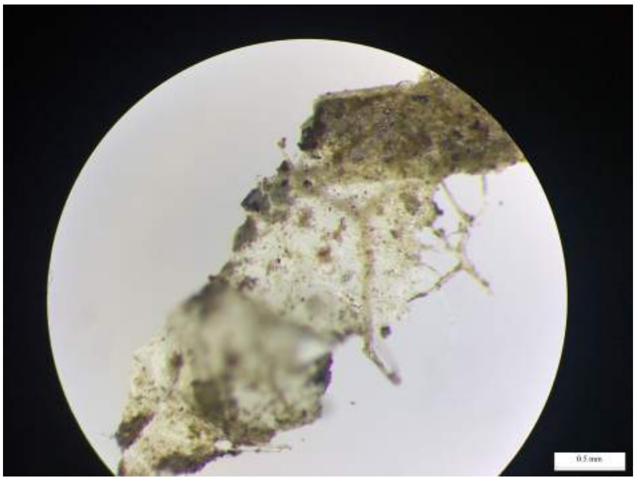


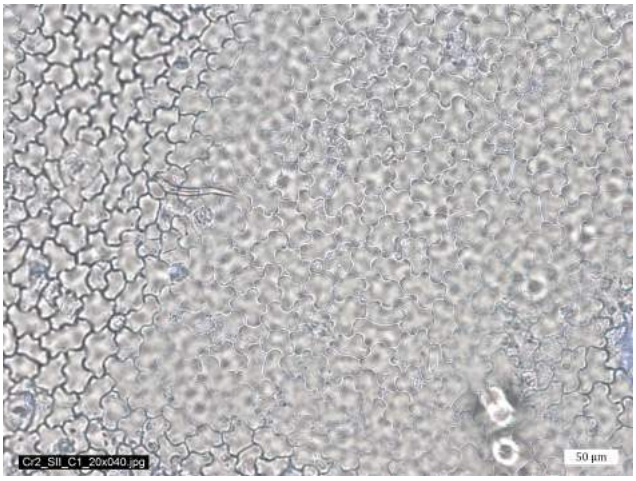
Fragment 36 (36_SII_B6_Cr2)



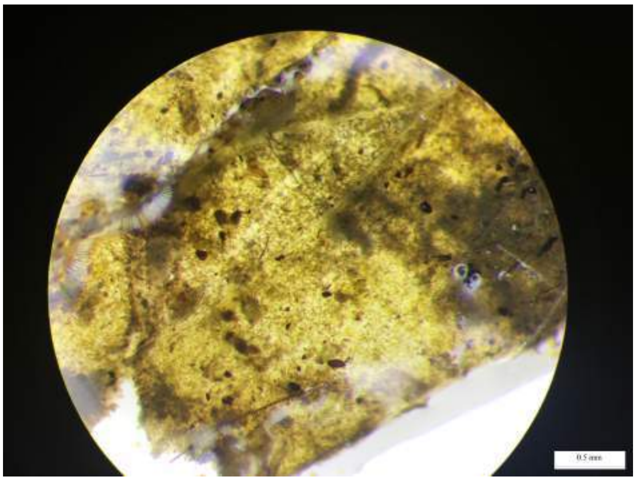


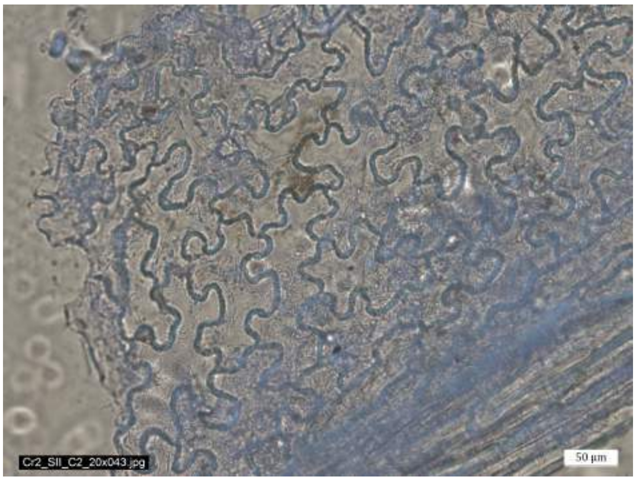
Fragment 37 (37_SII_C1_Cr2)



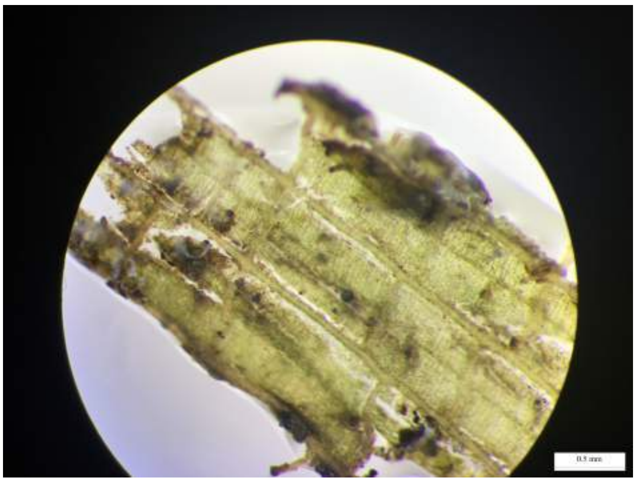


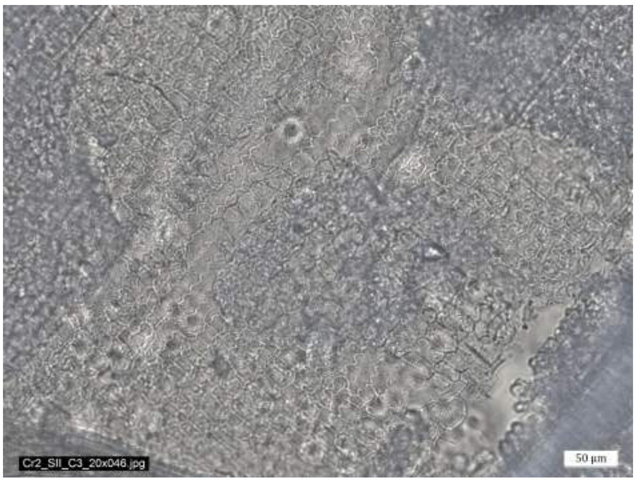
Fragment 38 (38_SII_C2_Cr2)



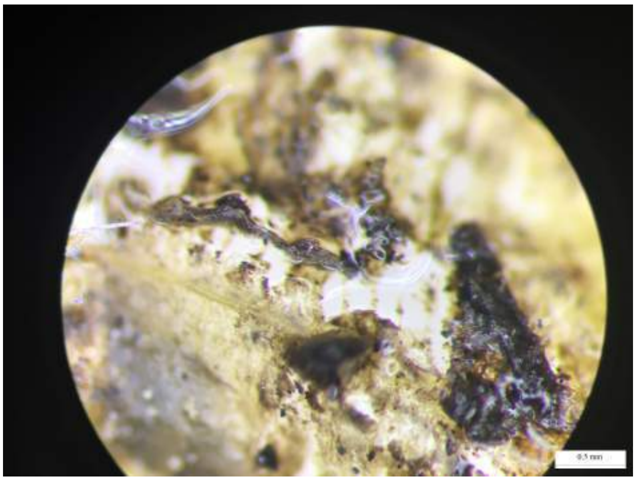


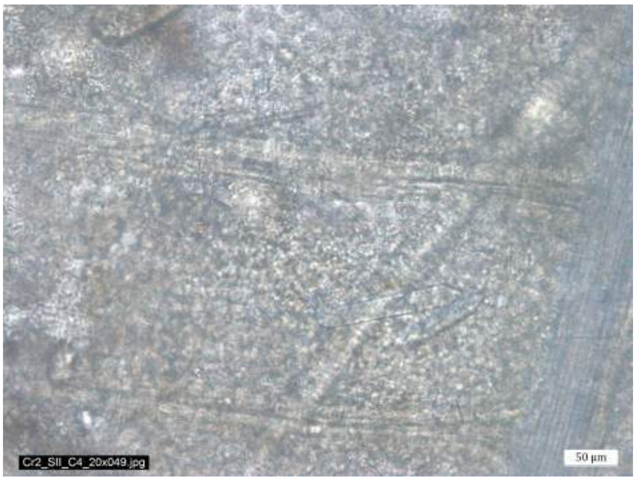
Fragment 39 (39_SII_C3_Cr2)



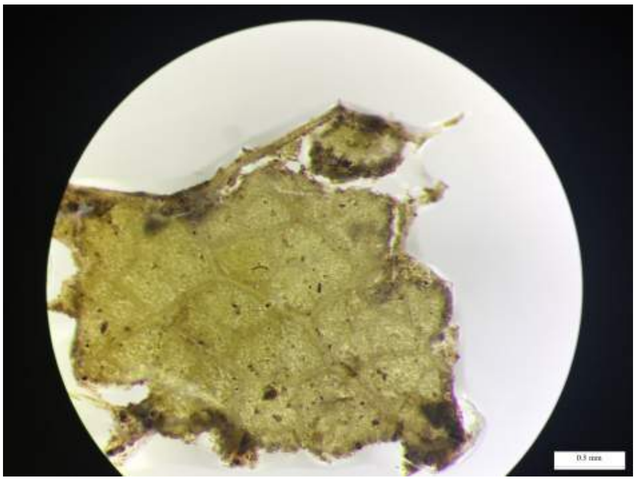


Fragment 40 (40_SII_C4_Cr2)

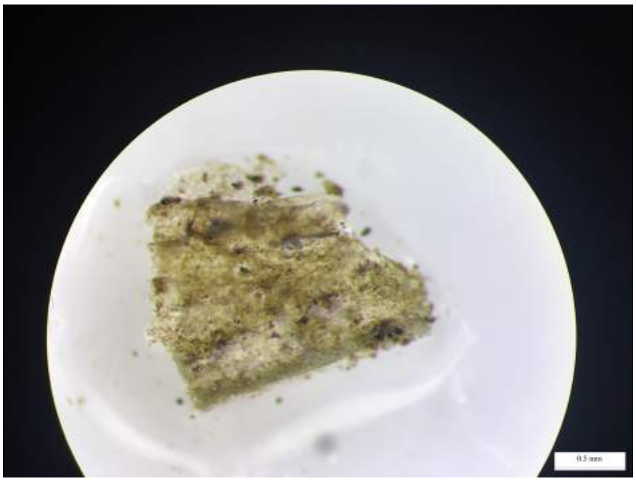


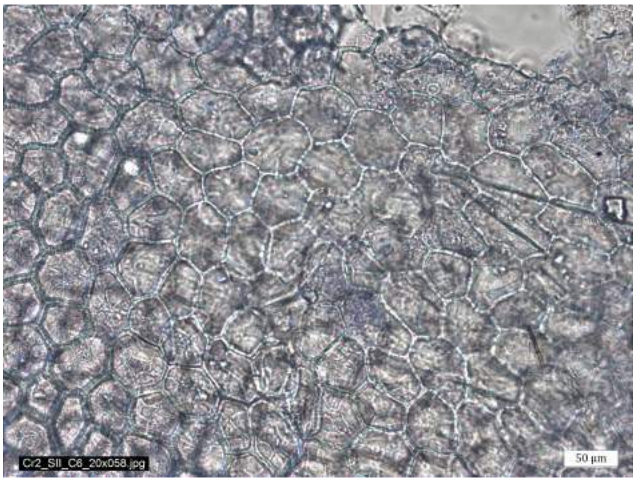


Fragment 41 (41_SII_C5_Cr2) → Inc_13

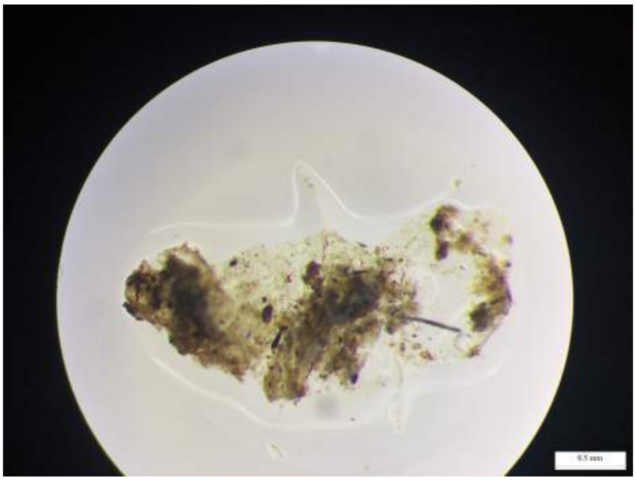


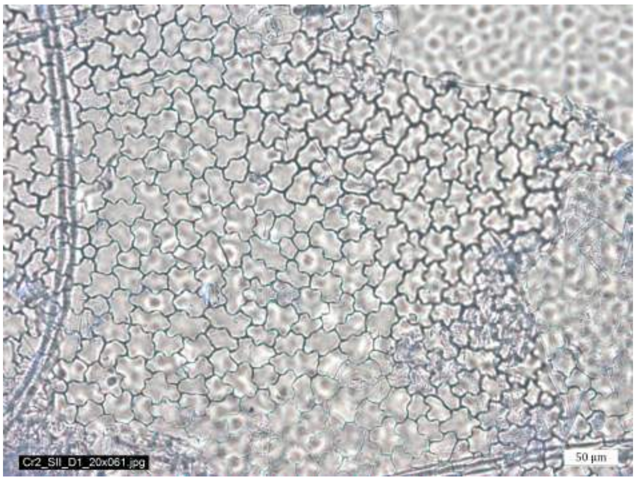
Fragment 42 (42_SII_C6_Cr2) → Inc_14



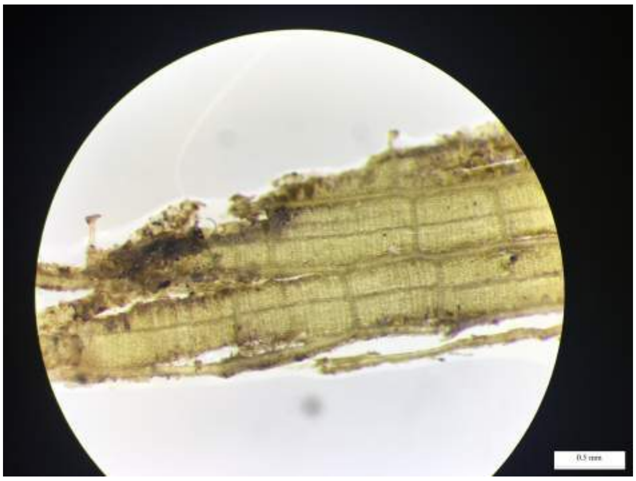


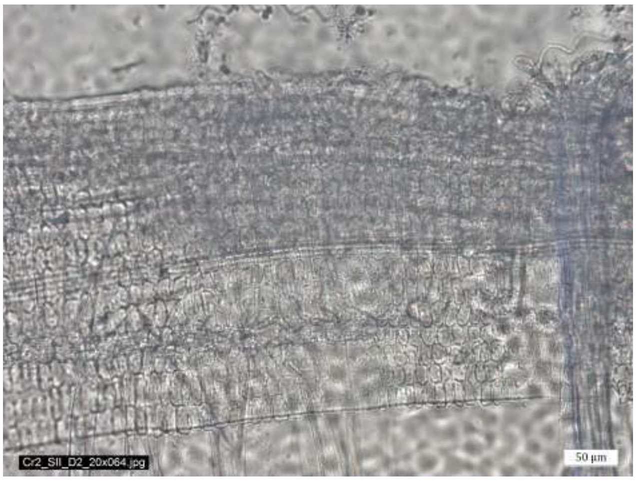
Fragment 43 (43_SII_D1_Cr2)



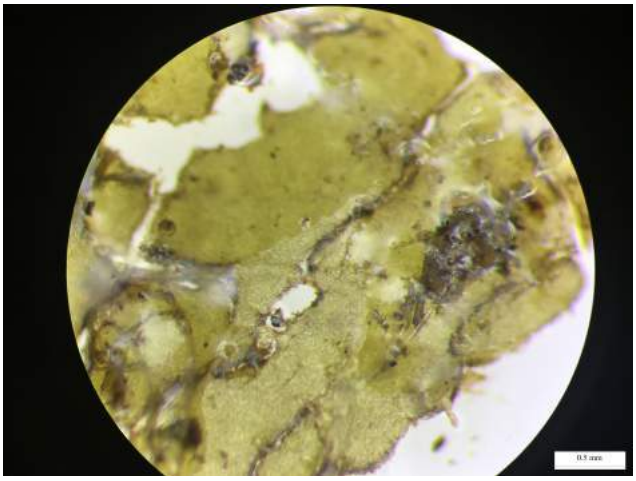


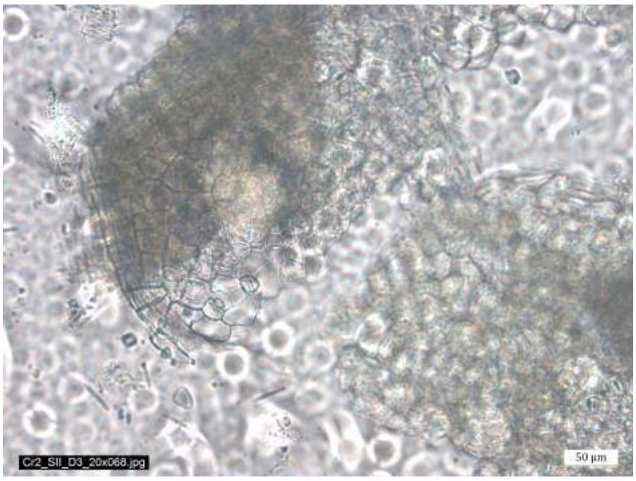
Fragment 44 (44_SII_D2_Cr2)



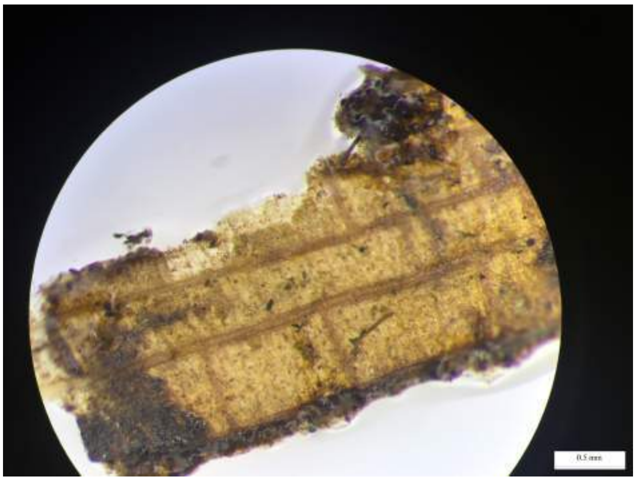


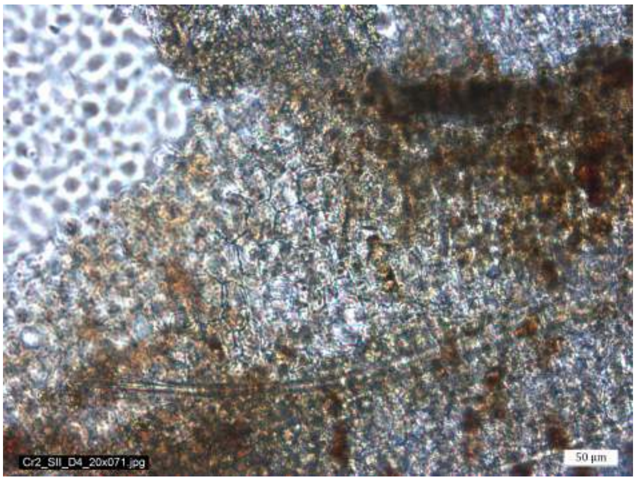
Fragment 45 (45_SII_D3_Cr2) → **Inc_15**



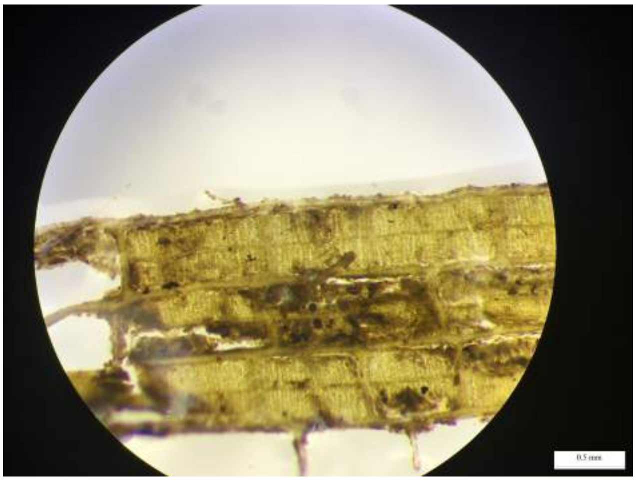


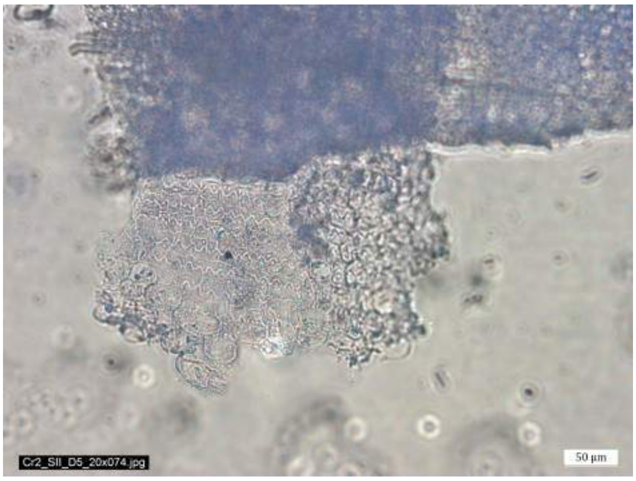
Fragment 46 (46_SII_D4_Cr2)



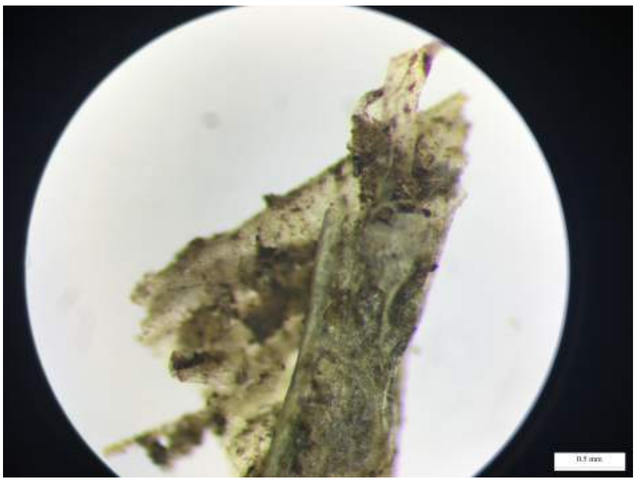


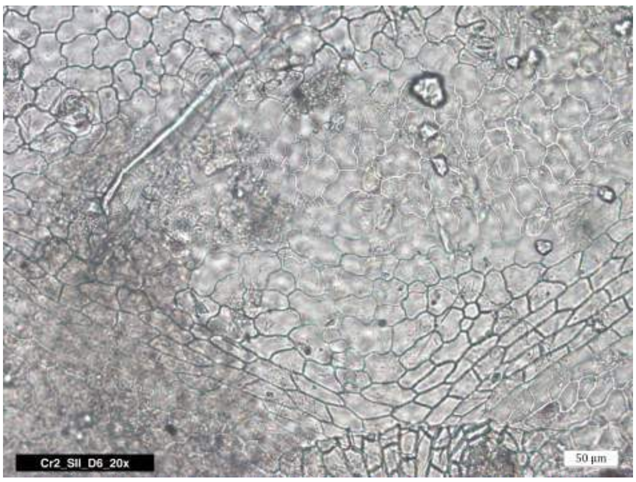
Fragment 47 (47_SII_D5_Cr2)





Fragment 48 (48_SII_D6_Cr2)





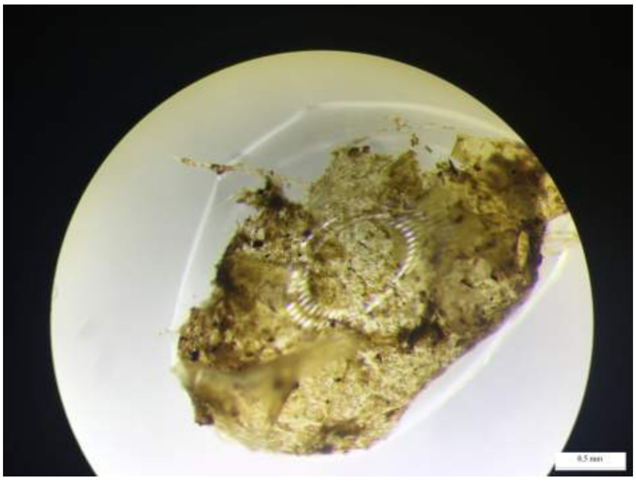
Fragments of the Faece 2

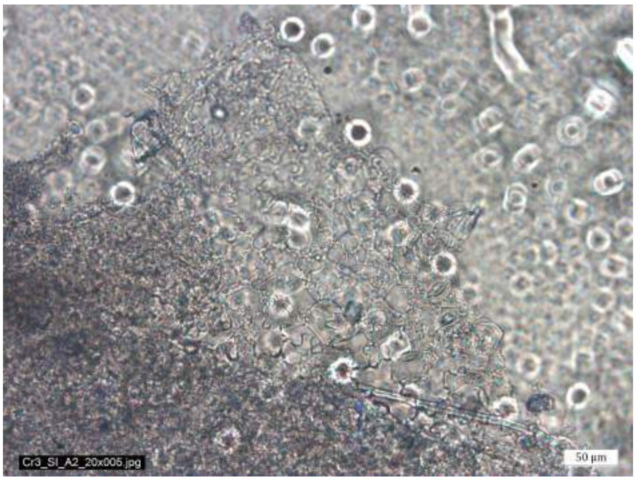
Fragment 1 (1_SI_A1_Cr3)

No references

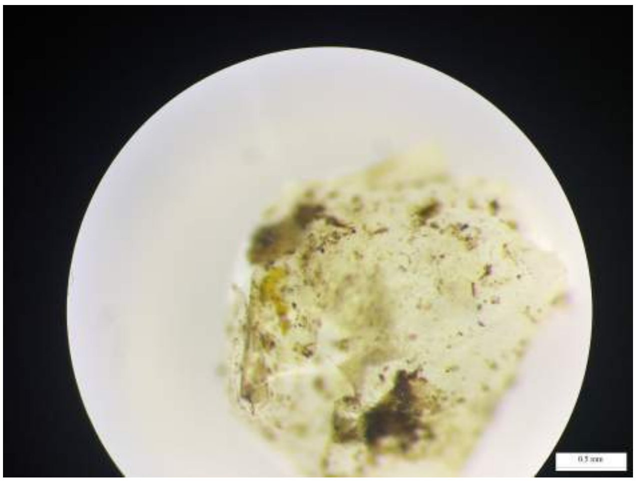
No references

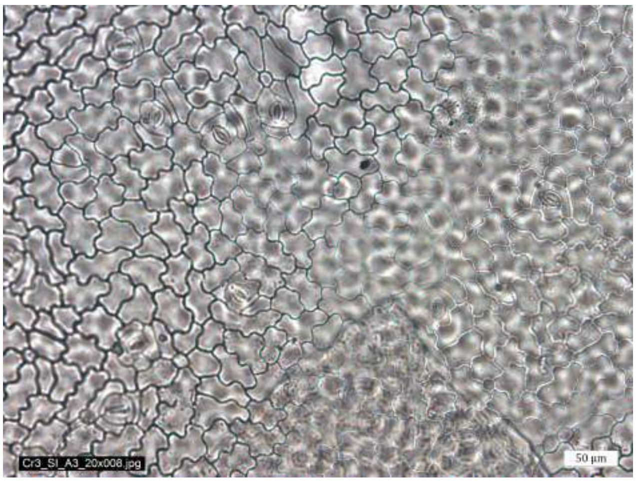
Fragment 2 (2_SI_A2_Cr3) → Inc_16



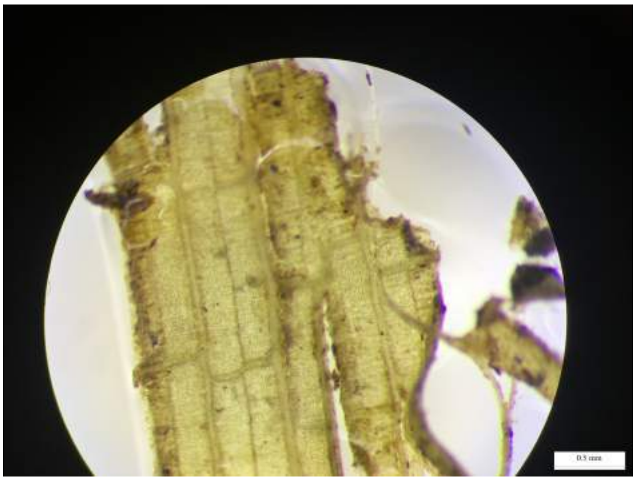


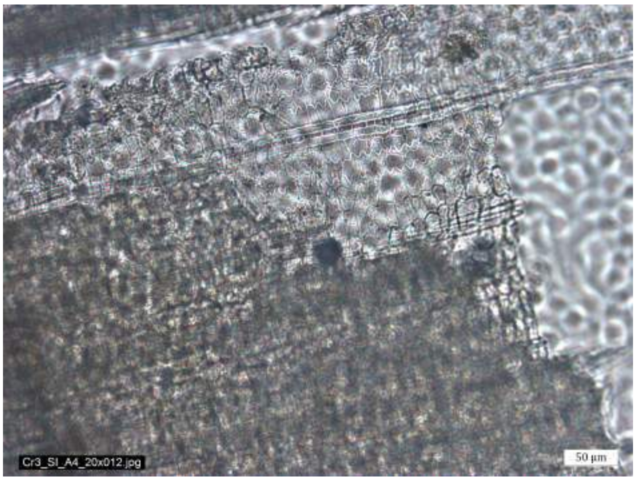
Fragment 3 (3_SI_A3_Cr3) → Inc_17



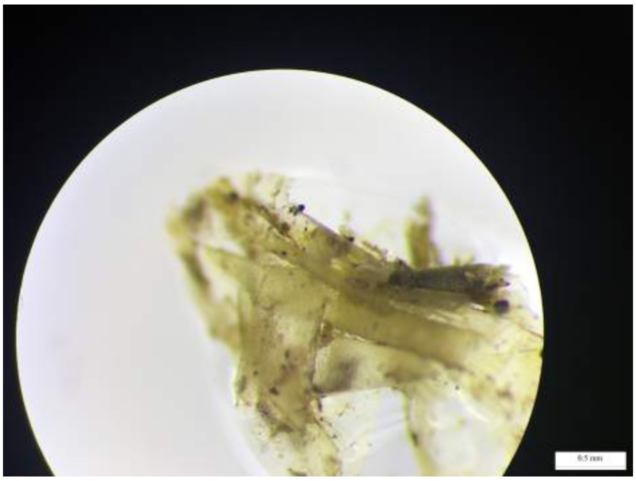


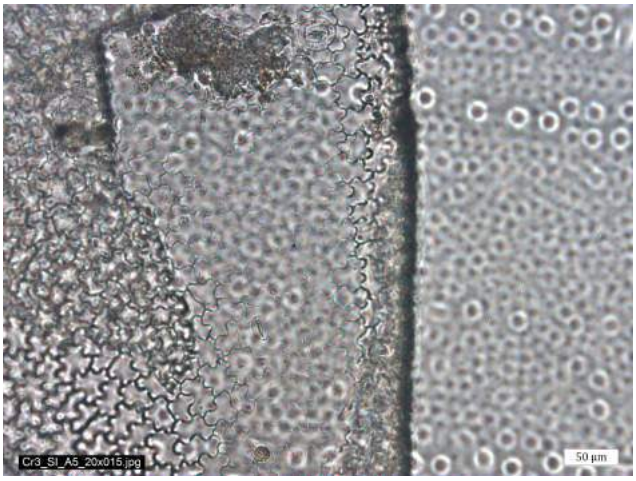
Fragment 4 (4_SI_A4_Cr3) → Inc_18



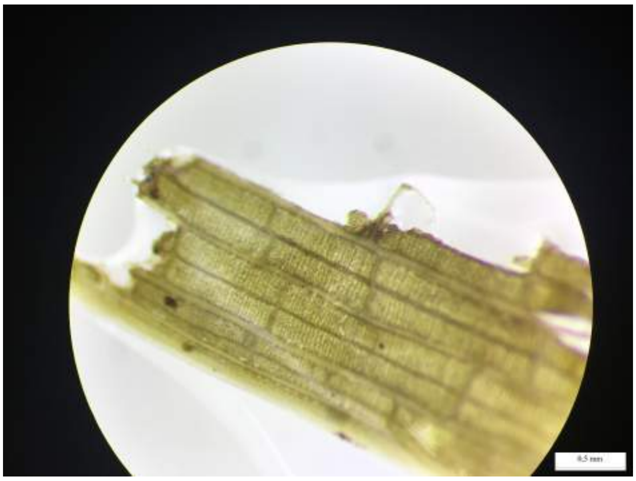


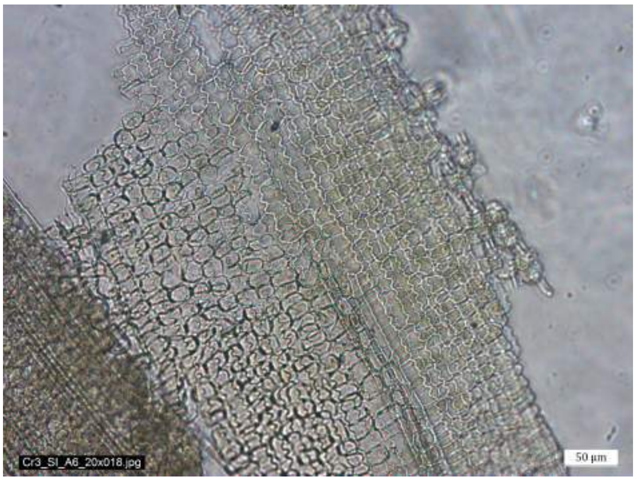
Fragment 5 (5_SI_A5_Cr3)



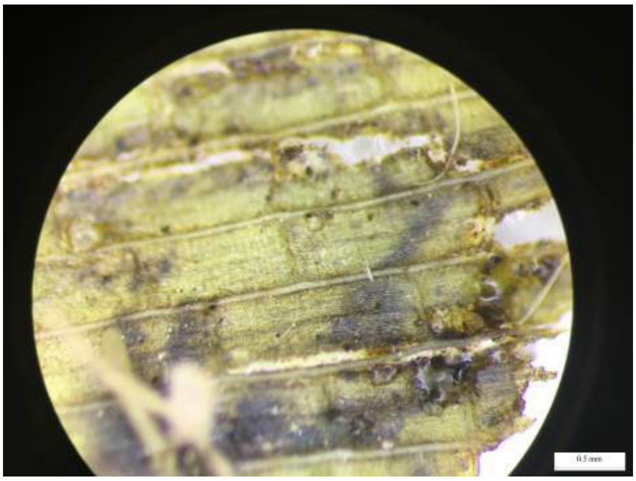


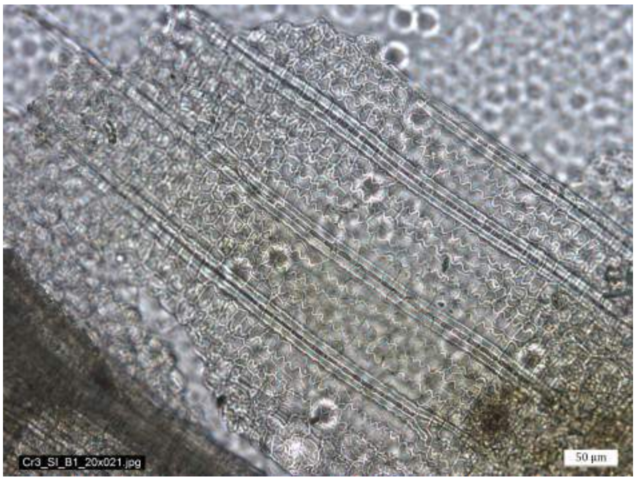
Fragment 6 (6_SI_A6_Cr3)



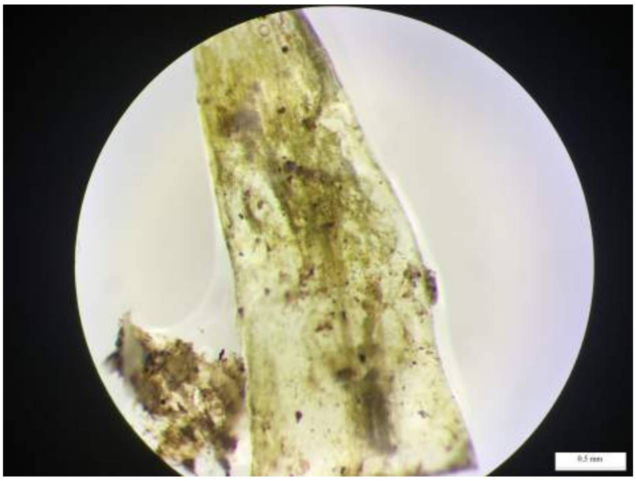


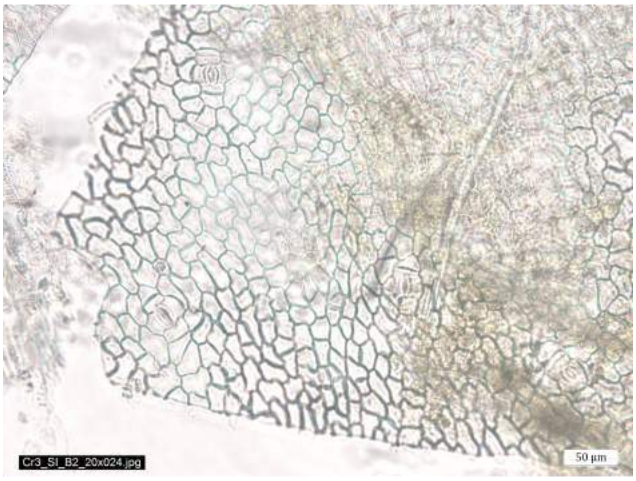
Fragment 7 (7_SI_B1_Cr3)



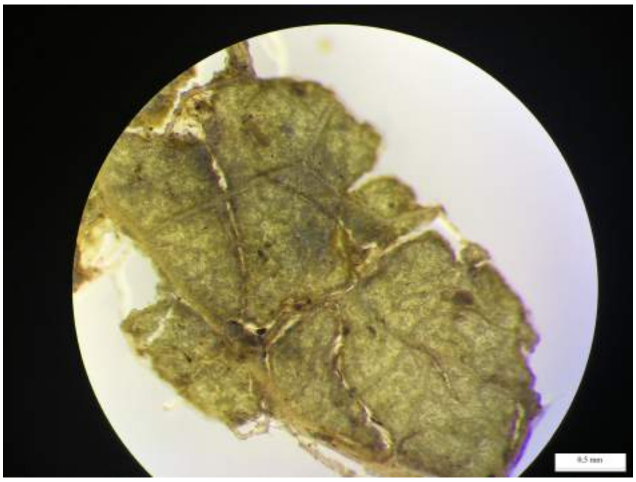


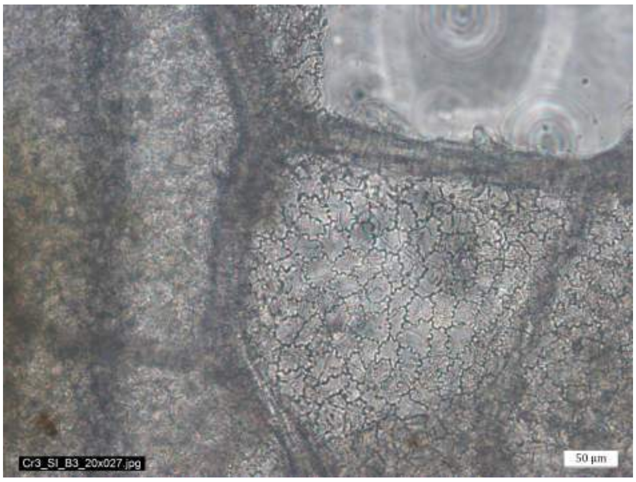
Fragment 8 (8_SI_B2_Cr3) → Inc_19



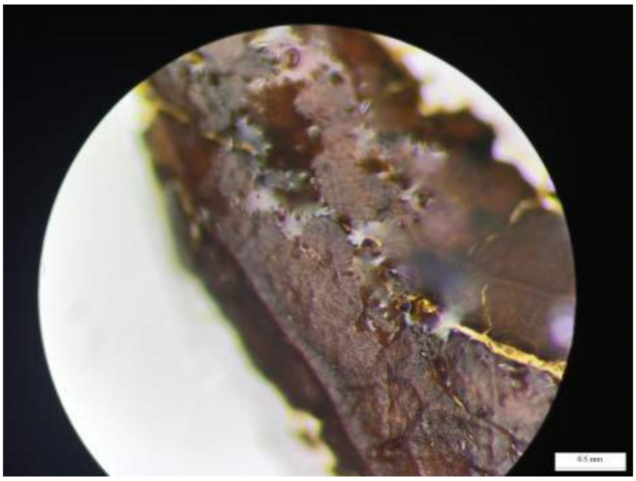


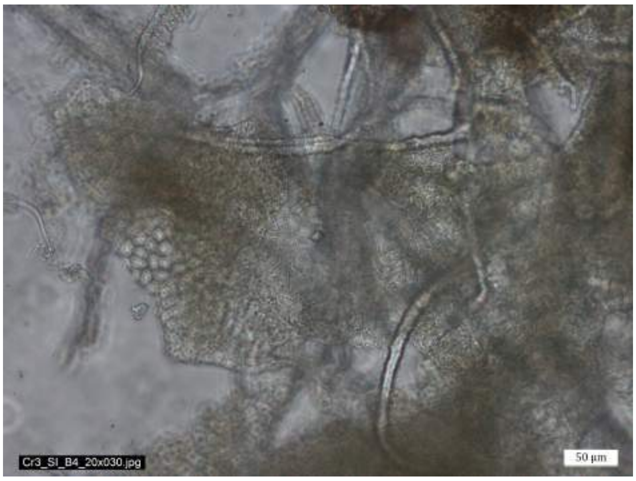
Fragment 9 (9_SI_B3_Cr3) → Inc_20



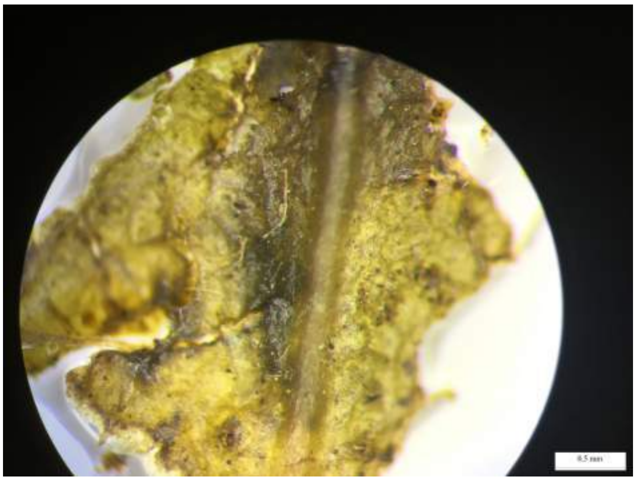


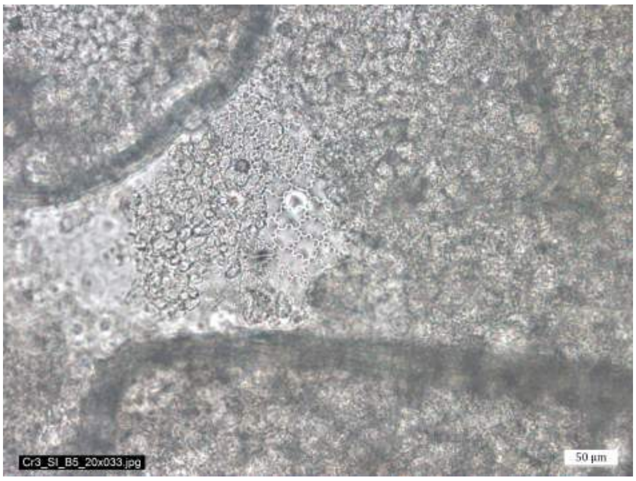
Fragment 10 (10_SI_B4_Cr3) → Inc_21



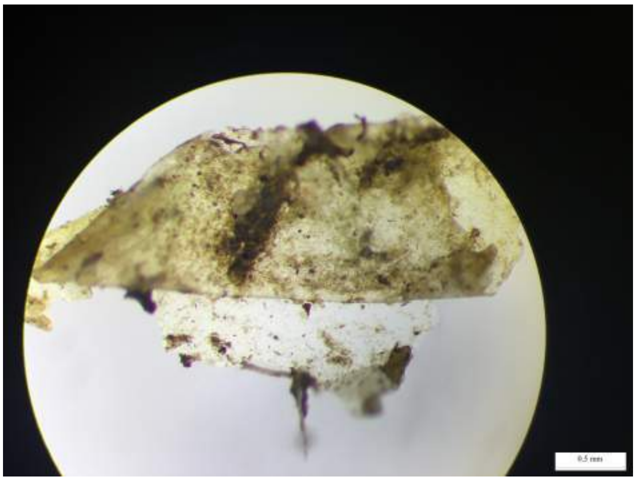


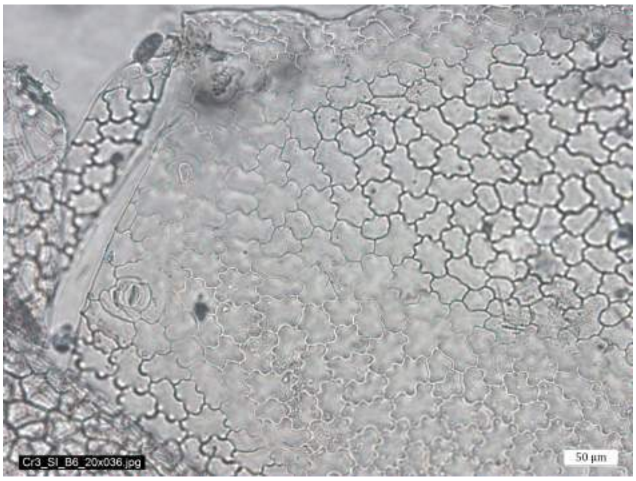
Fragment 11 (11_SI_B5_Cr3)



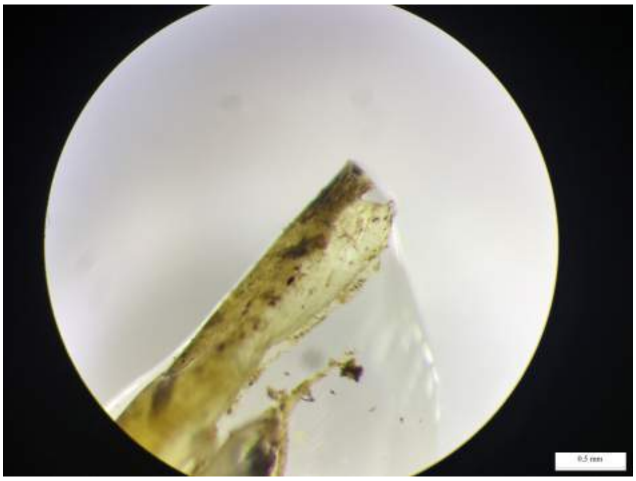


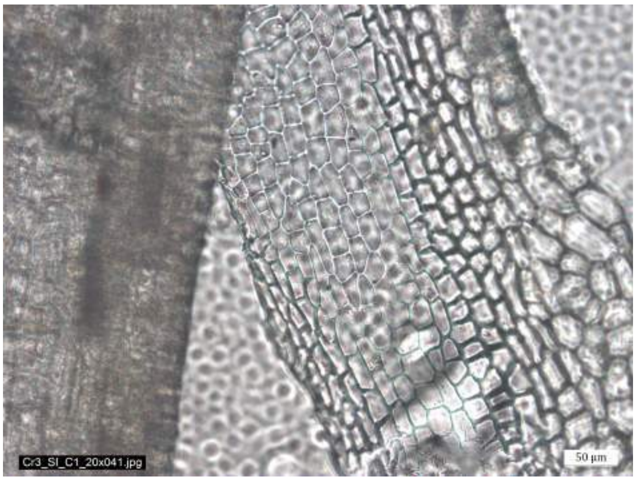
Fragment 12 (12_SI_B6_Cr3)



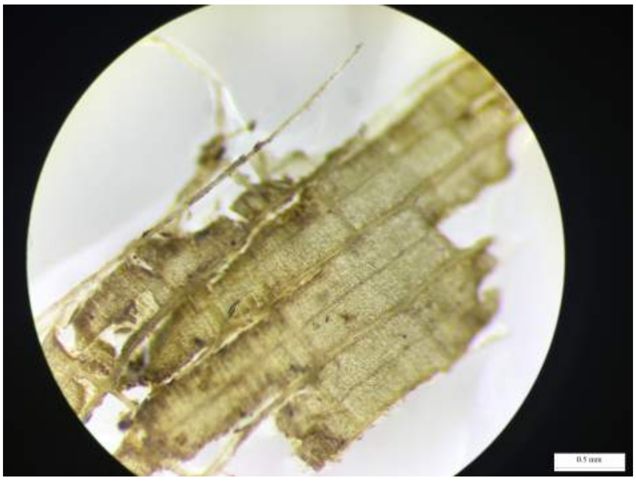


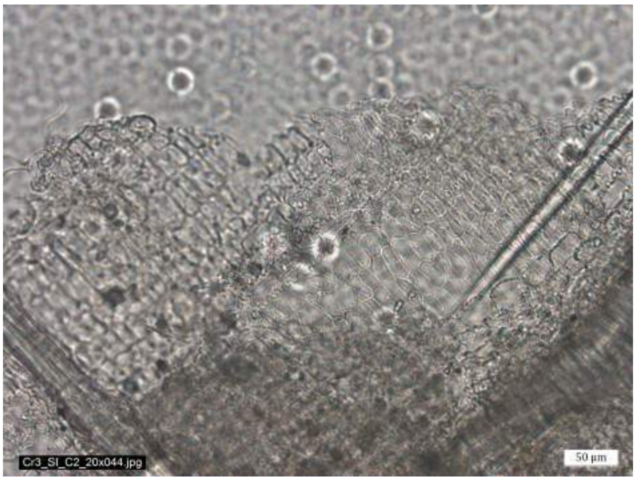
Fragment 13 (13_SI_C1_Cr3) → Inc_22



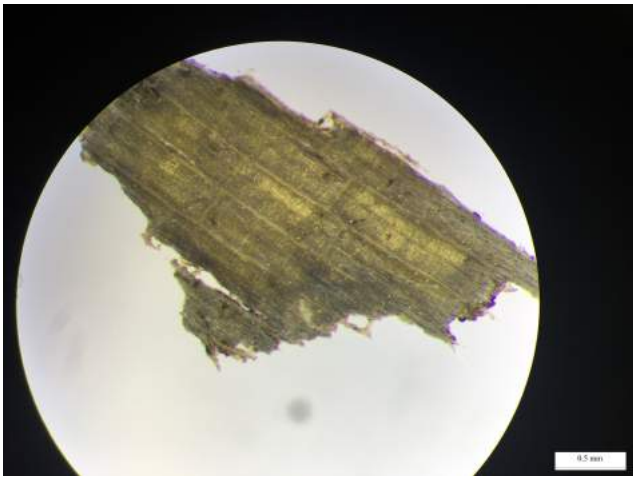


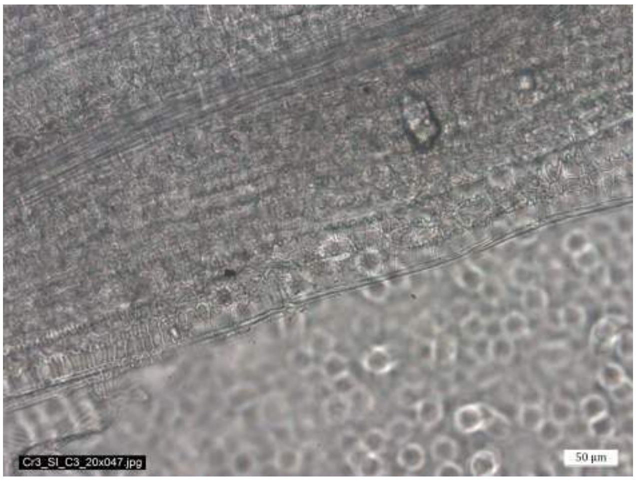
Fragment 14 (14_SI_C2_Cr3)



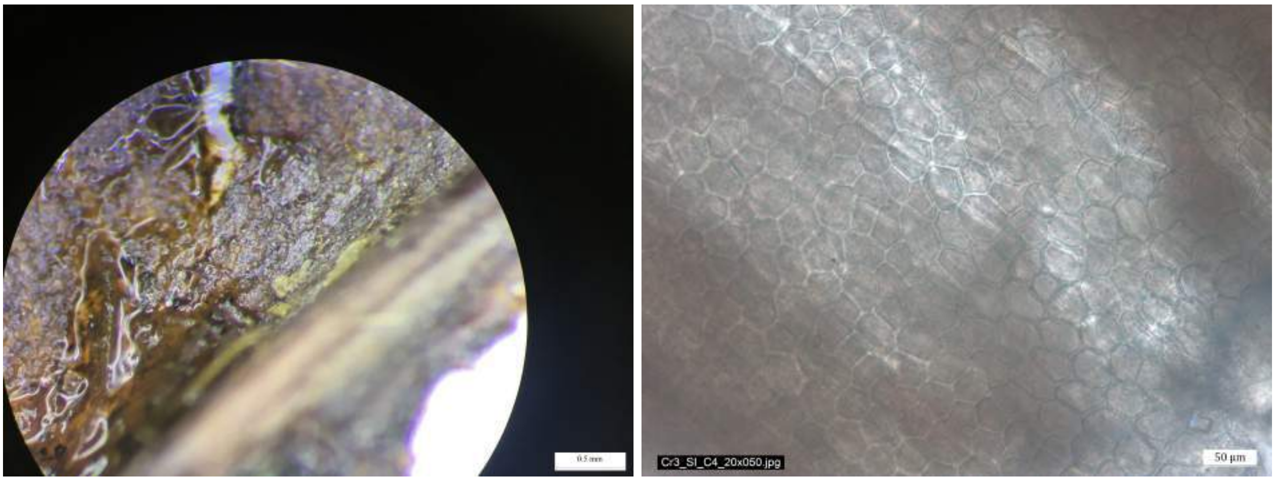


Fragment 15 (15_SI_C3_Cr3)

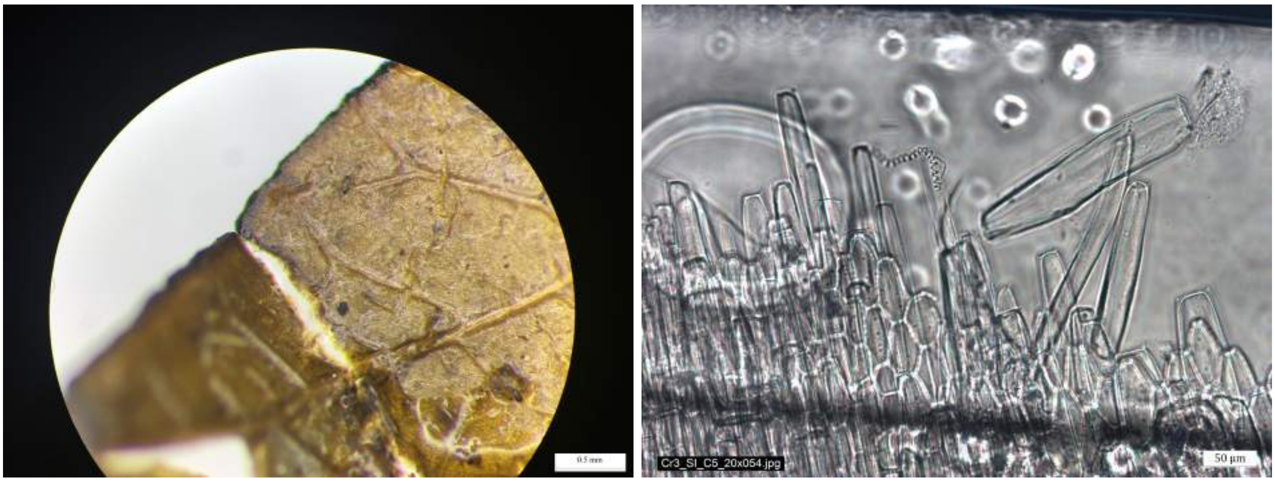




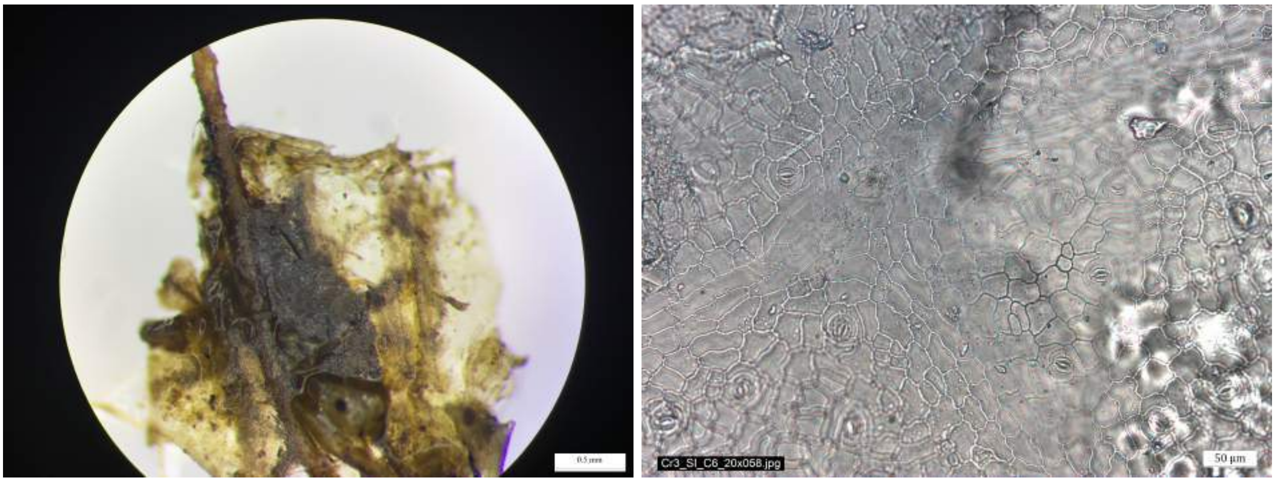
Fragment 16 (16_SI_C4_Cr3) → Inc_23



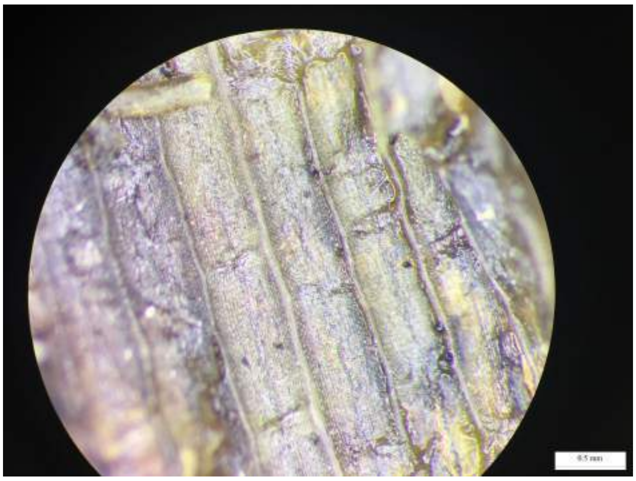
Fragment 17 (17_SI_C5_Cr3) → Inc_24

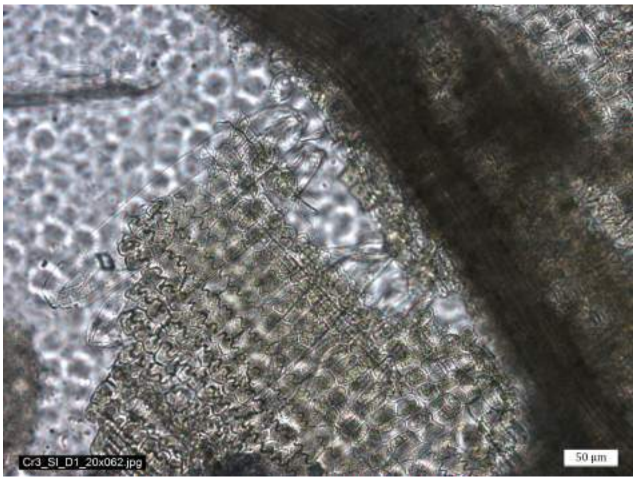


Fragment 18 (18_SI_C6_Cr3) → Inc_25

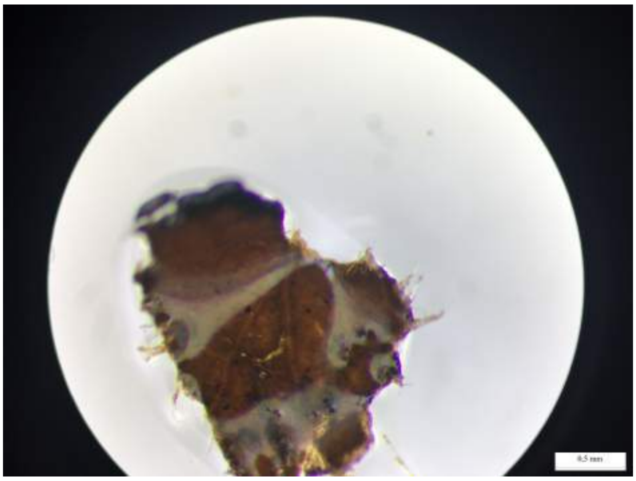


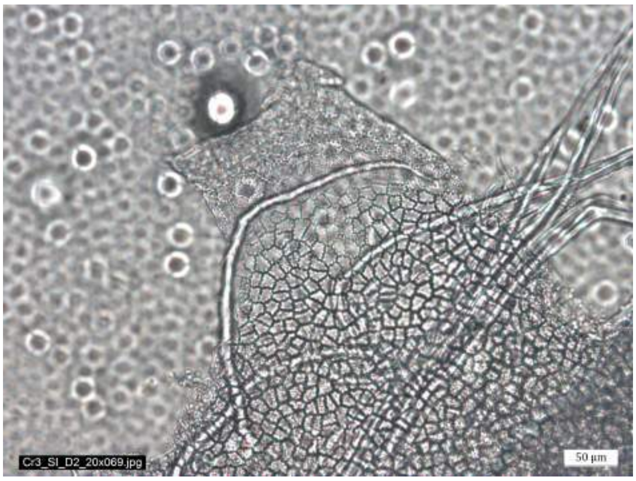
Fragment 19 (19_SI_D1_Cr3)



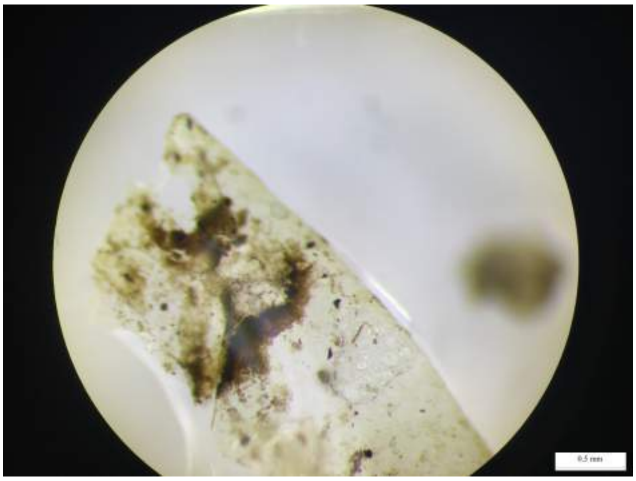


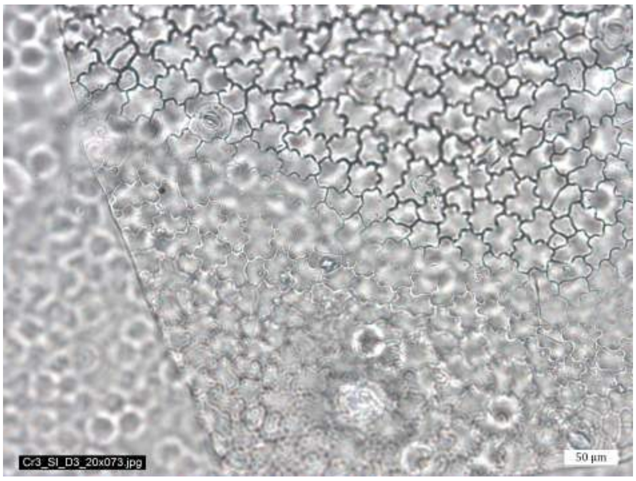
Fragment 20 (20_SI_D2_Cr3) → Inc_26



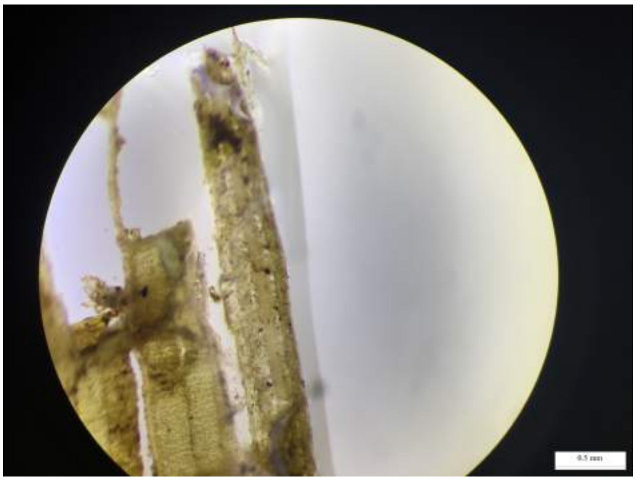


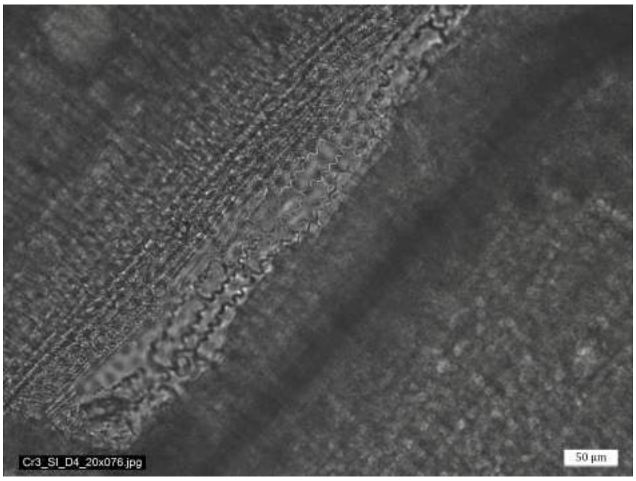
Fragment 21 (21_SI_D3_Cr3)



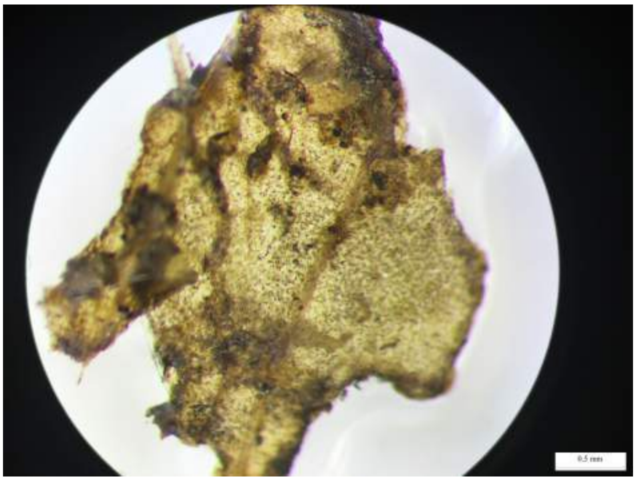


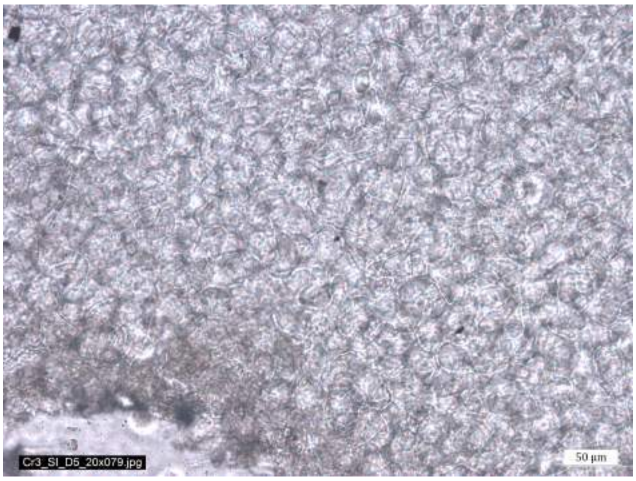
Fragment 22 (22_SI_D4_Cr3)



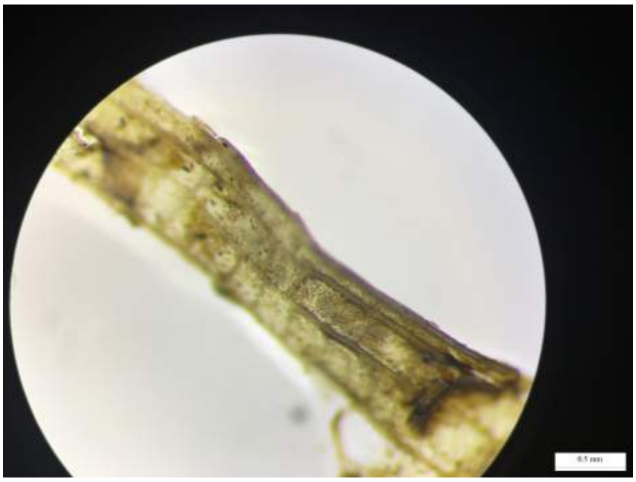


Fragment 23 (23_SI_D5_Cr) → Inc_27

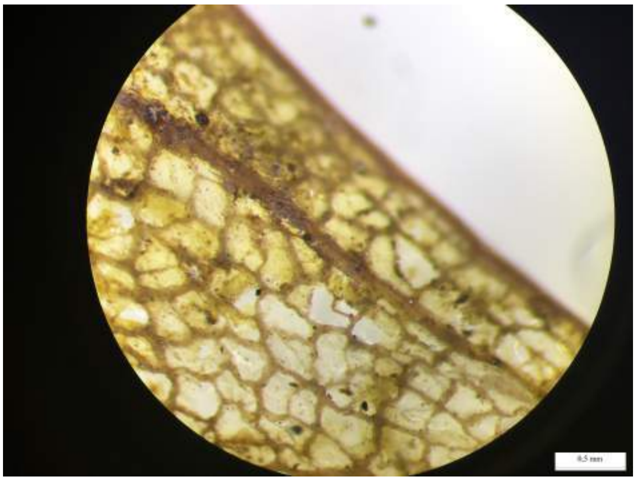


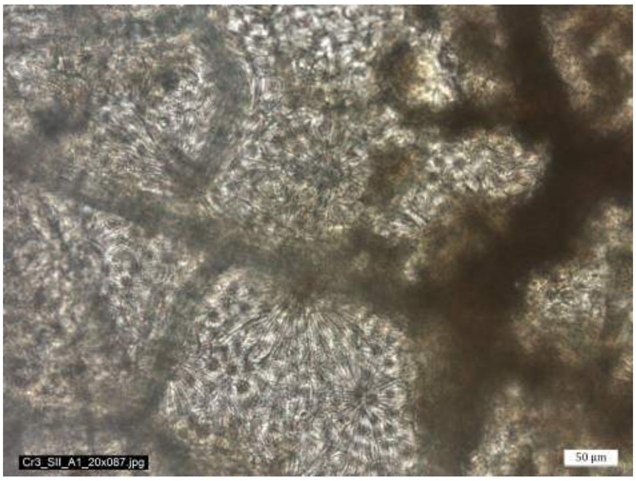


Fragment 24 (24_SI_D6_Cr3) → Inc_28

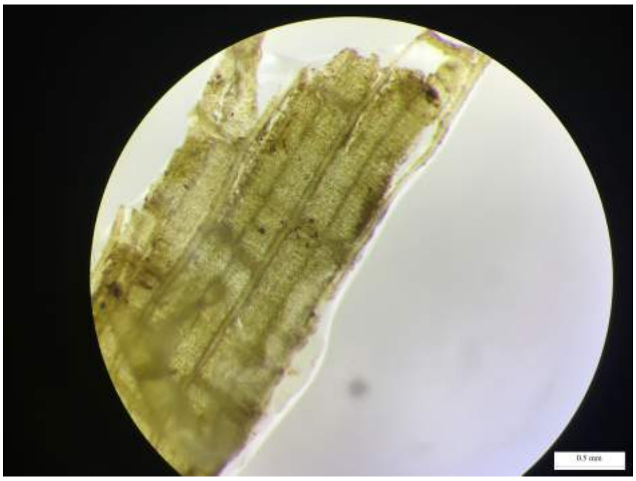


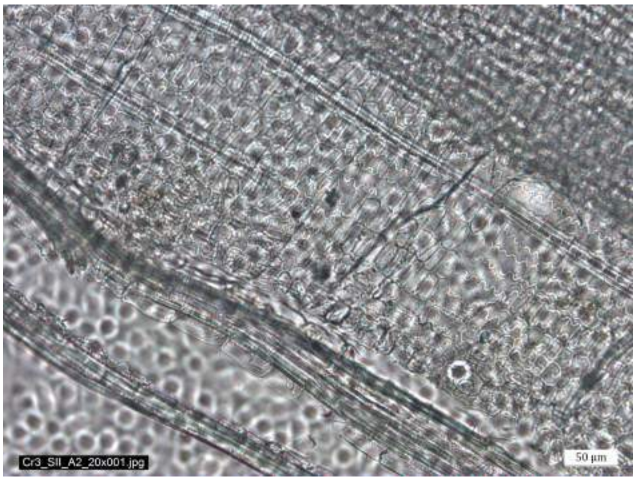
Fragment 25 (25_SII_A1_Cr3) → Inc_29



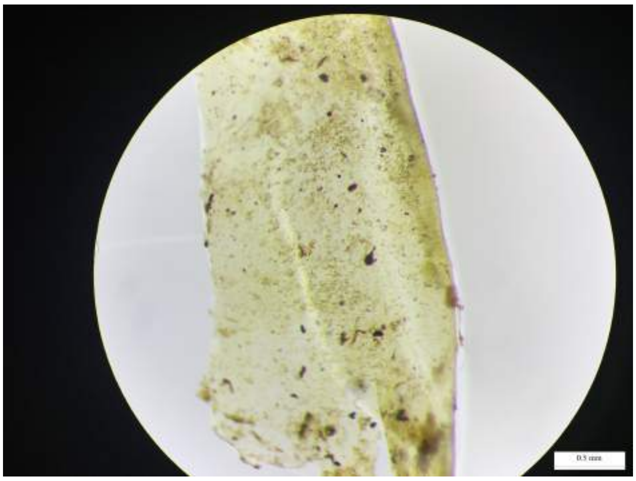


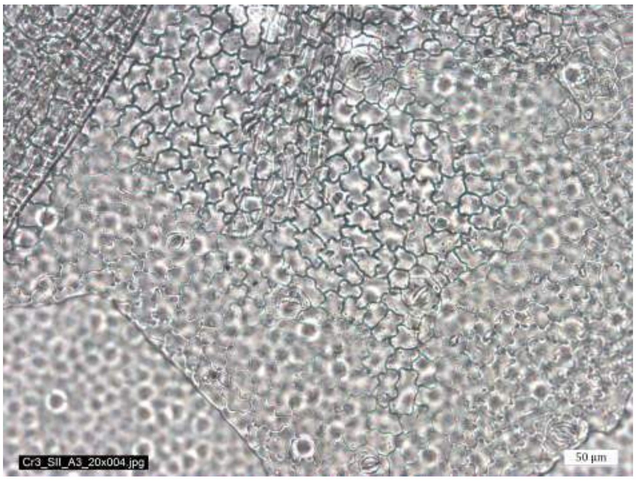
Fragment 26 (26_SII_A2_Cr3)



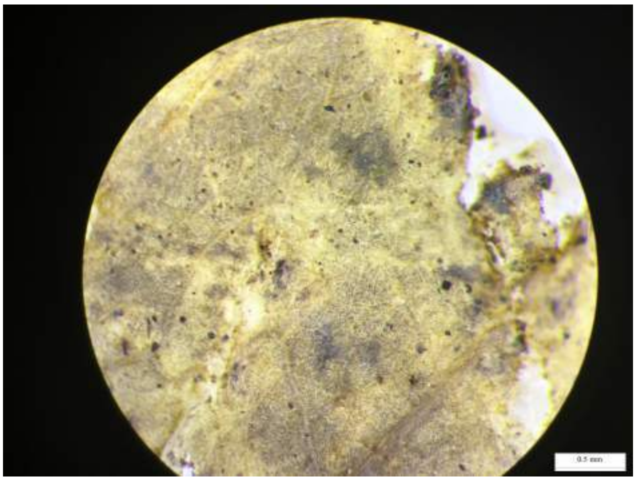
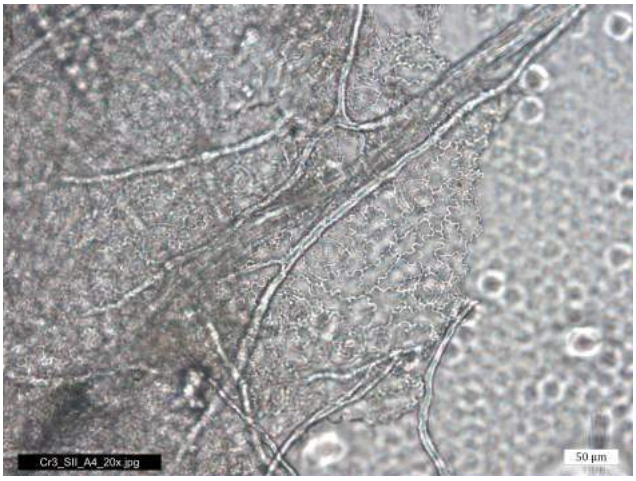


Fragment 27 (27_SII_A3_Cr)

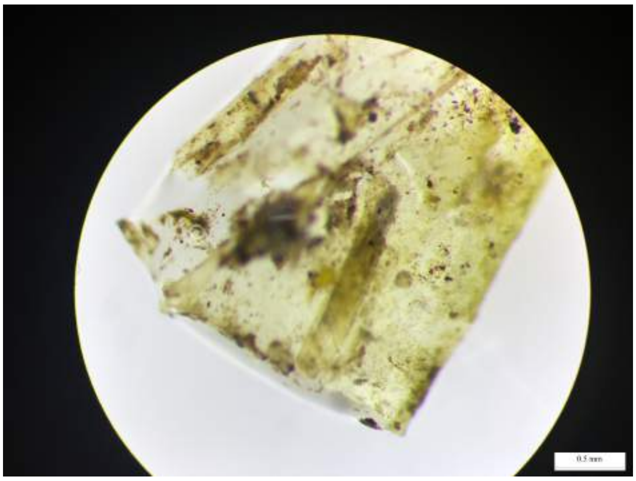
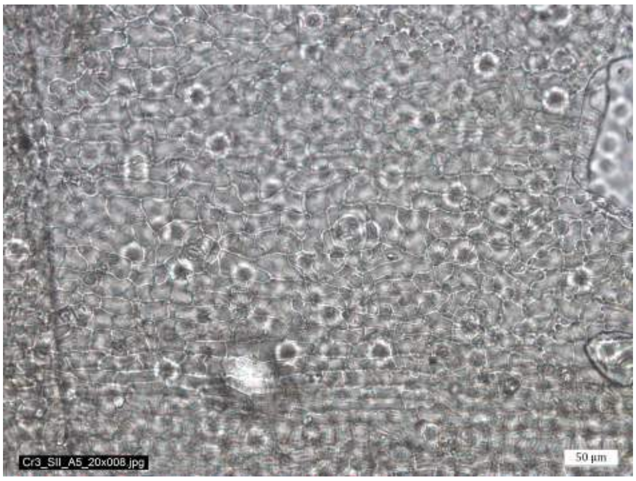




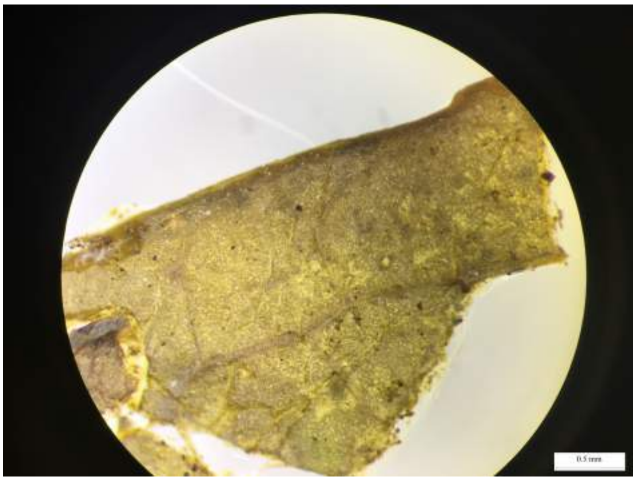
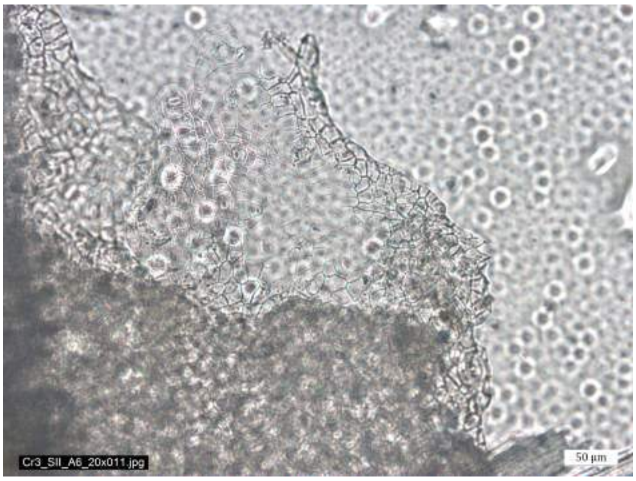
Fragment 28 (28_SII_A4_Cr3) → Inc_30

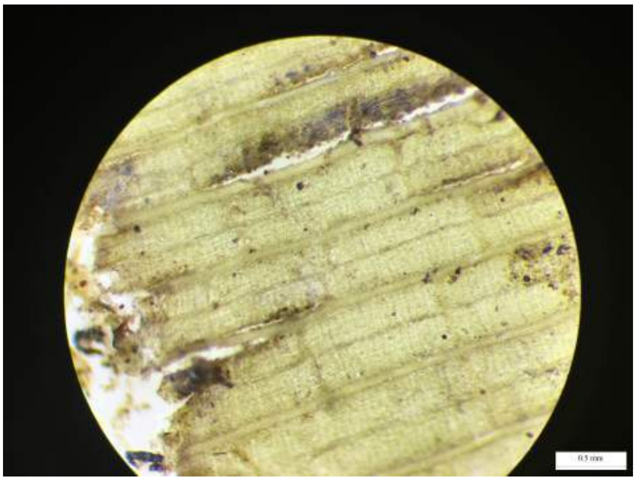
Fragment 29 (29_SII_A5_Cr3)

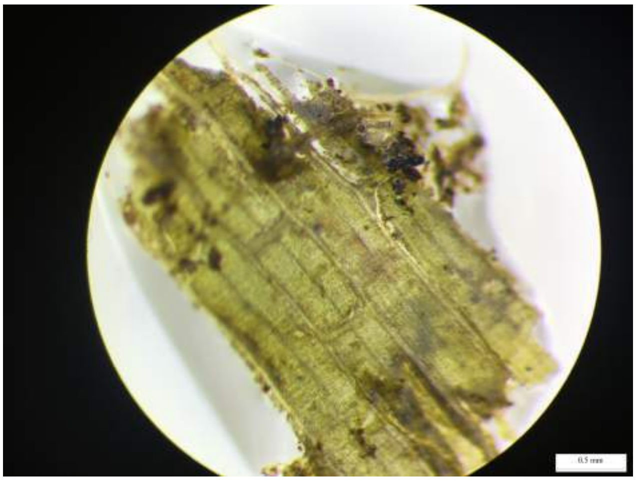
Fragment 30 (30_SII_A6_Cr3)

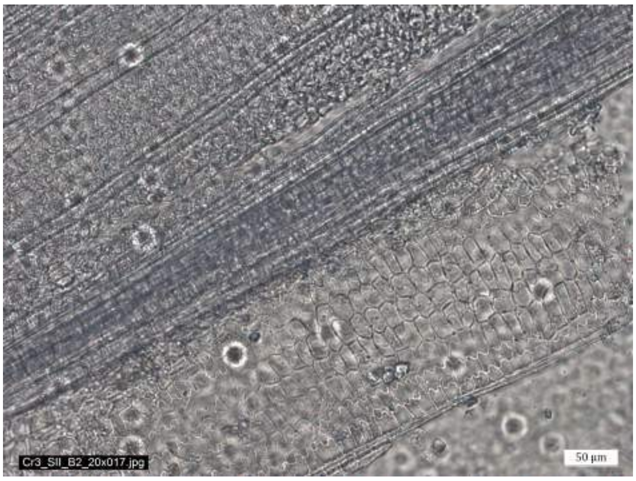



Fragment 31 (31_SII_B1_Cr3)

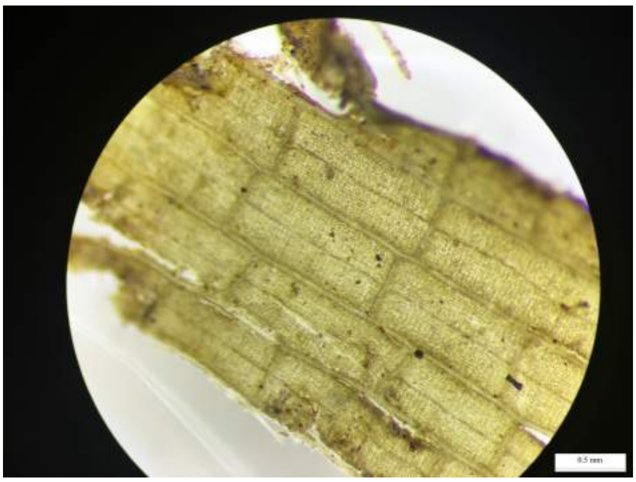


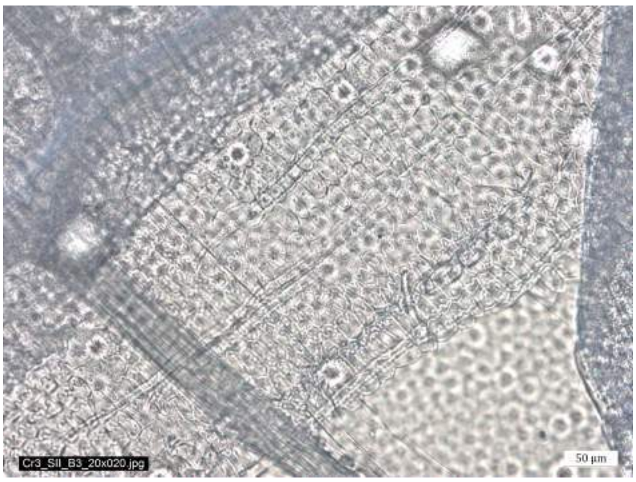
Fragment 32 (32_SII_B2_Cr3)



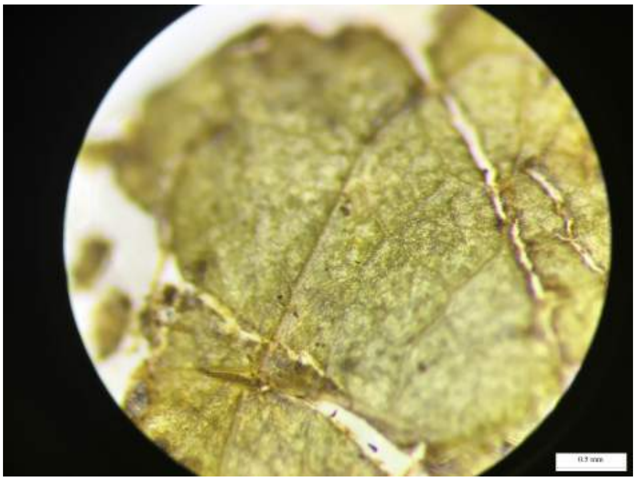


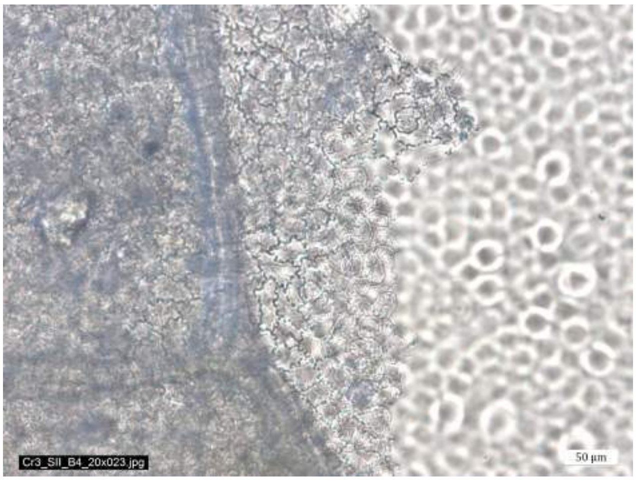
Fragment 33 (33_SII_B3_Cr3)



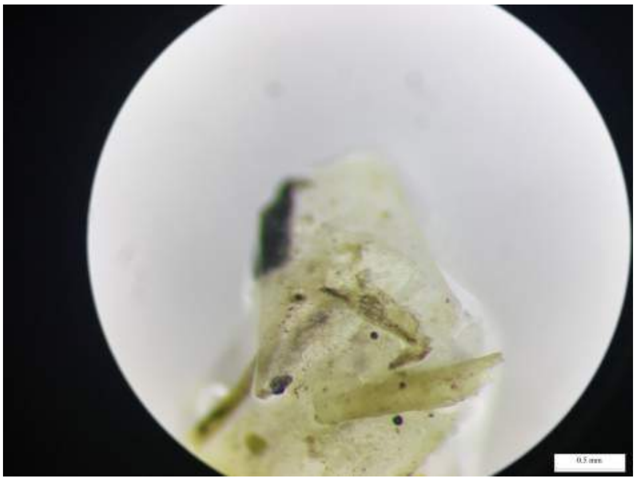


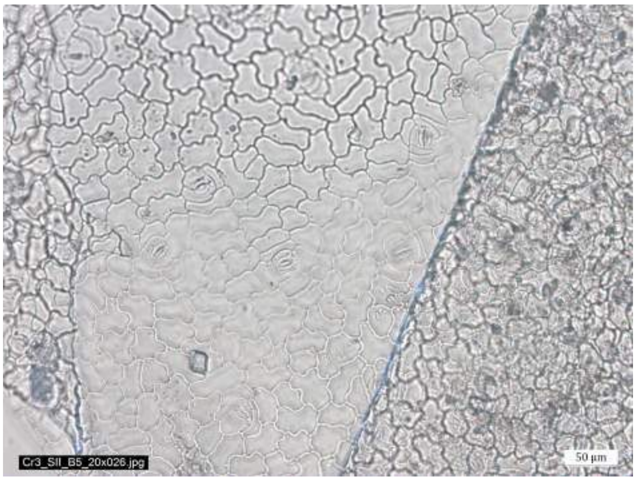
Fragment 34 (34_SII_B4_Cr3)



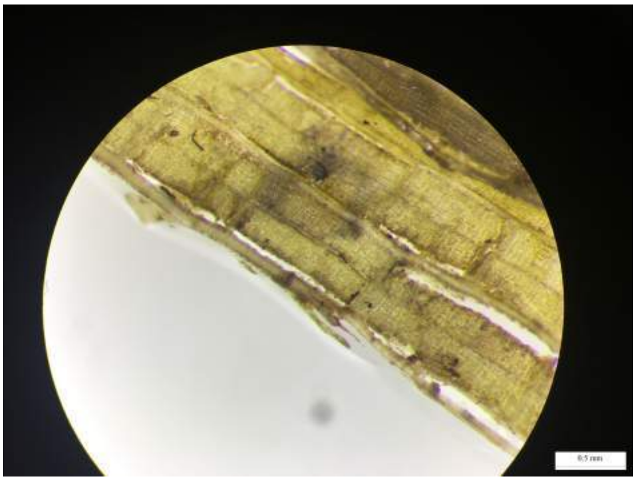


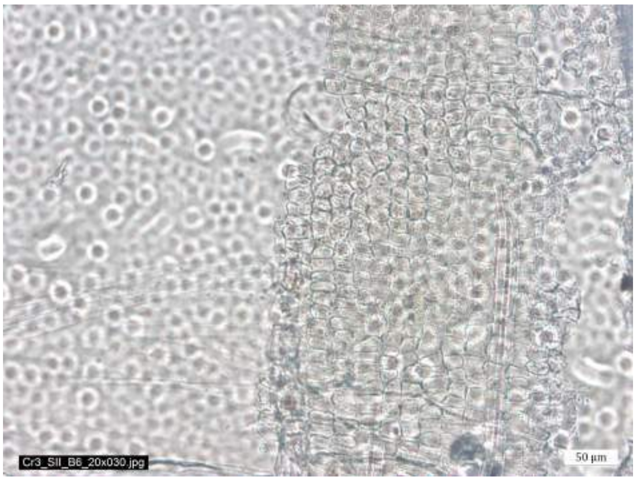
Fragment 35 (5_SII_B5_Cr3)



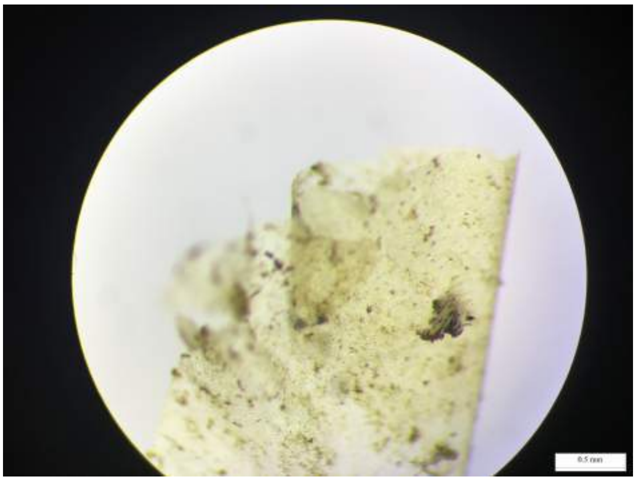


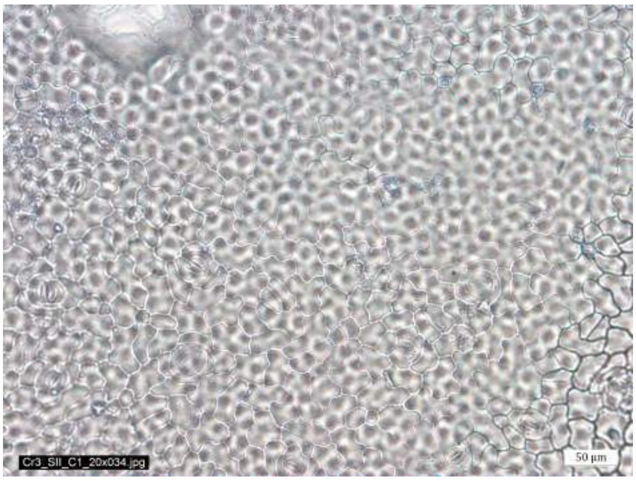
Fragment 36 (36_SII_B6_Cr3)



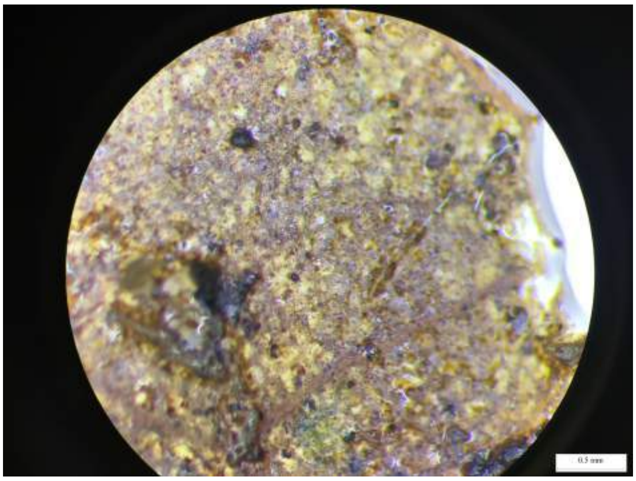


Fragment 37 (37_SII_C1_Cr3)

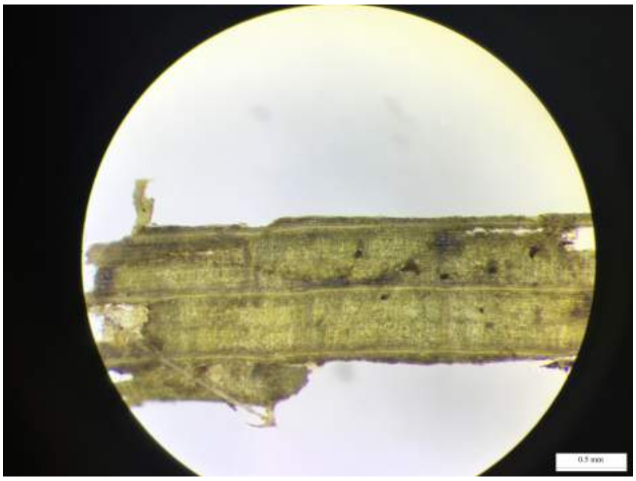


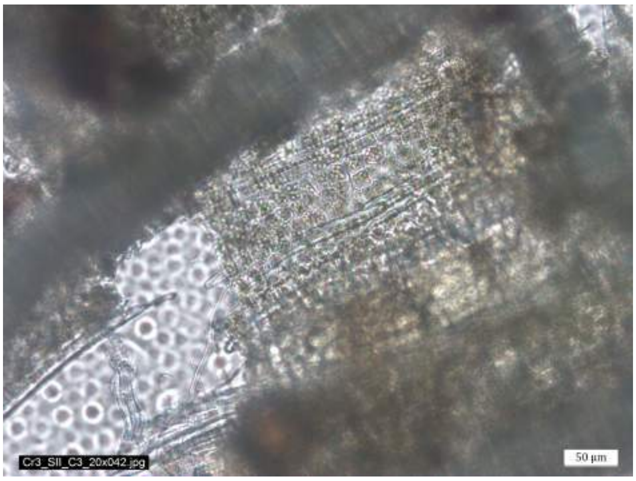


Fragment 38 (38_SII_C2_Cr3)

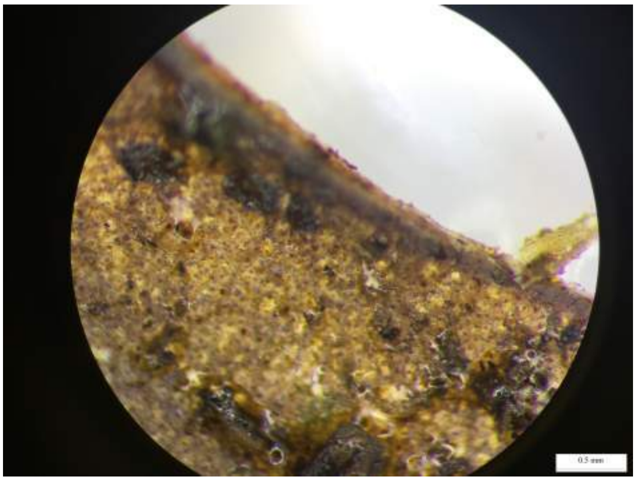


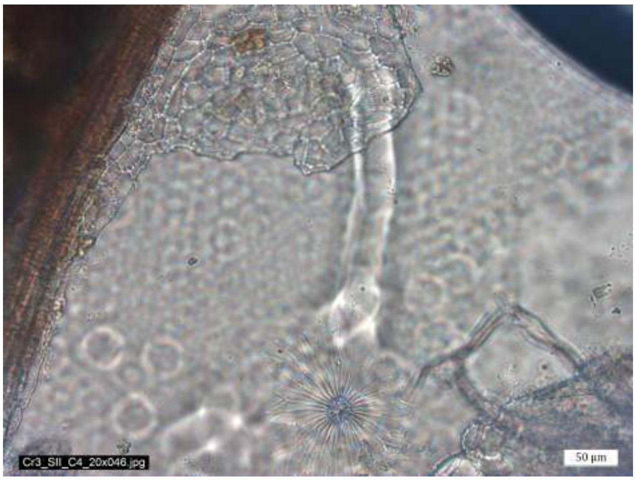
Fragment 39 (39_SII_C3_Cr3)



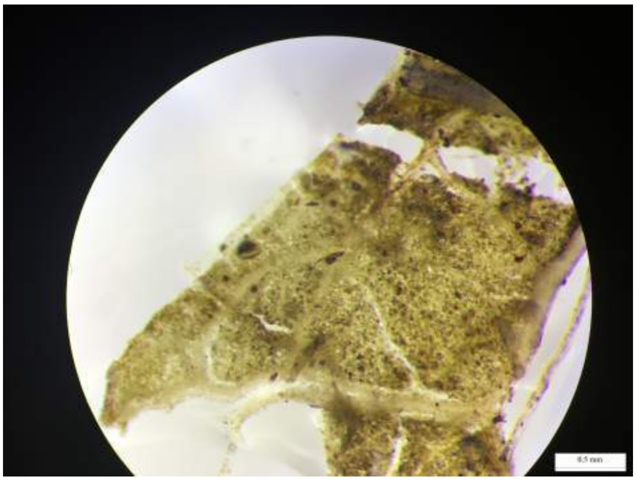


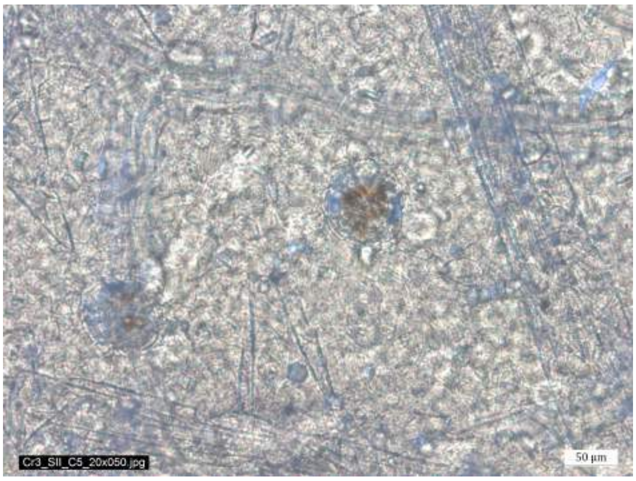
Fragment 40 (40_SII_C4_Cr3)



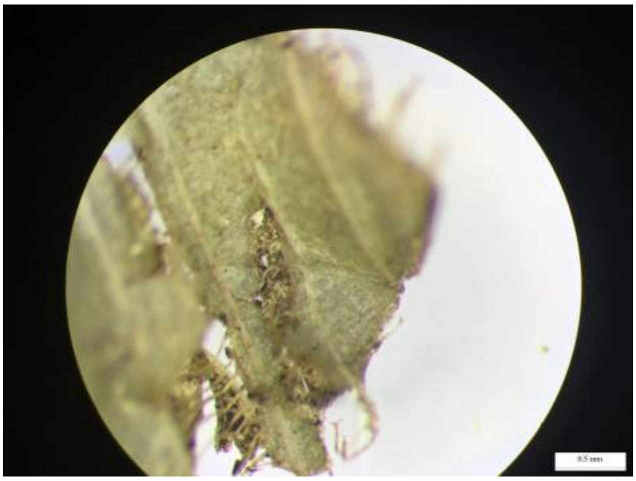


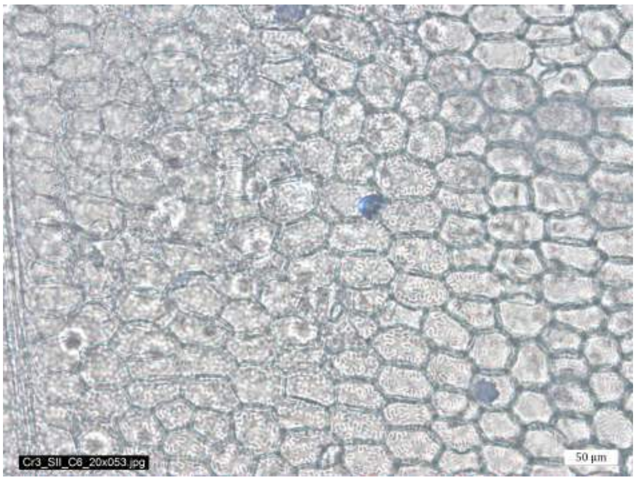
Fragment 41 (41_SII_C5_Cr3)



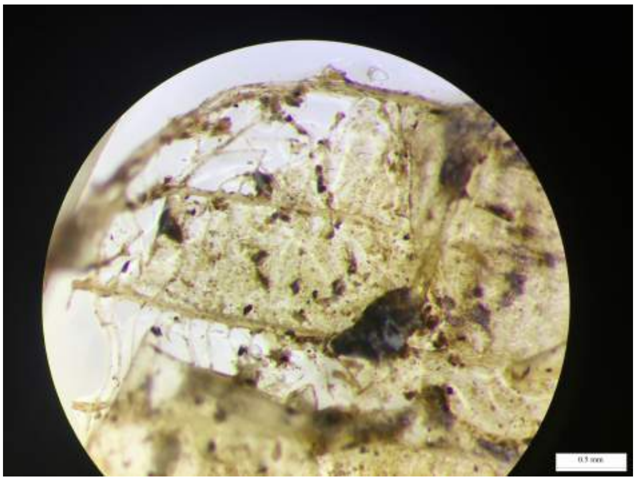


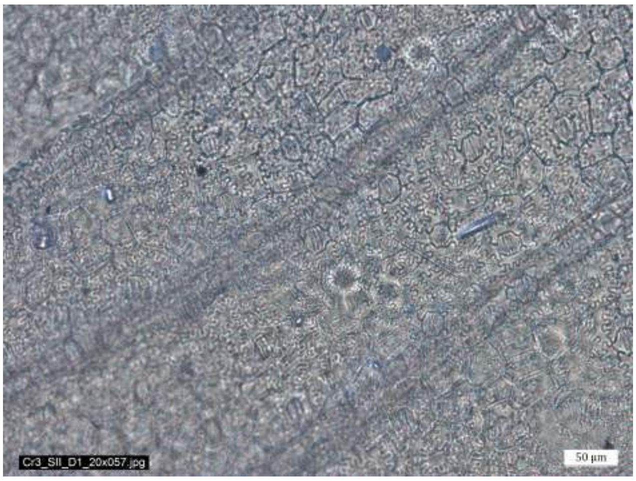
Fragment 42 (42_SII_C6_Cr3) → Inc_31



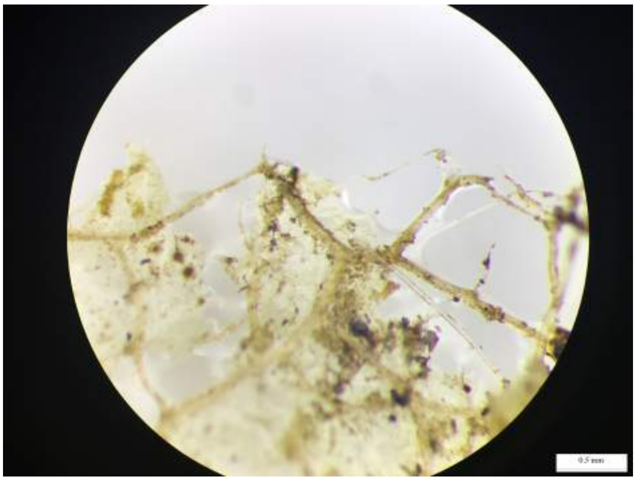


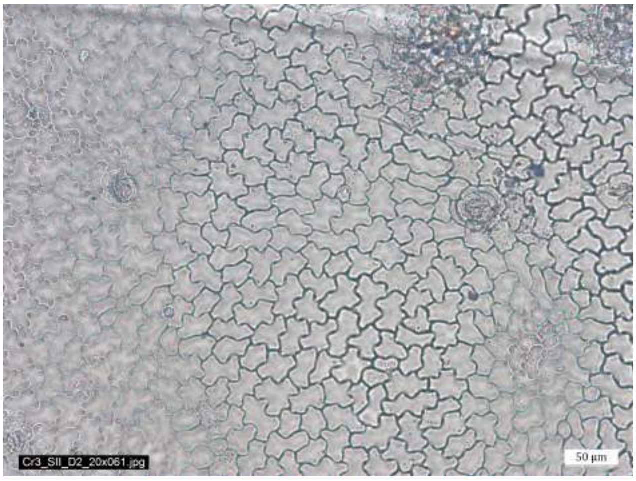
Fragment 43 (43_SII_D1_Cr3)



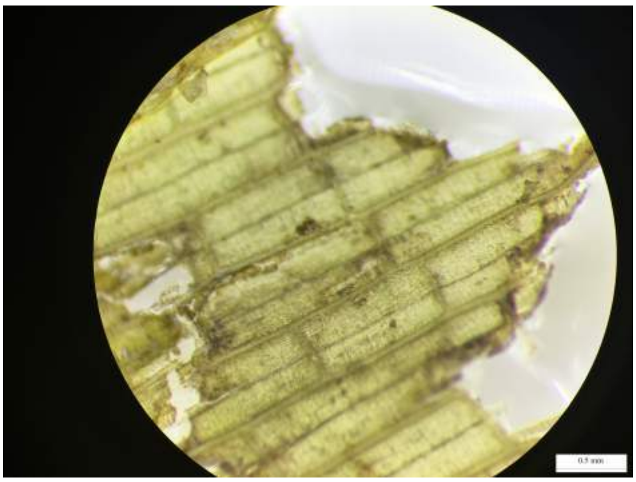


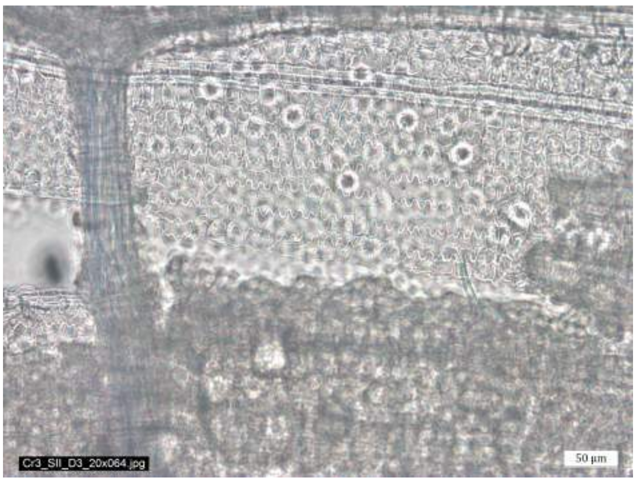
Fragment 44 (44_SII_D2_Cr3)



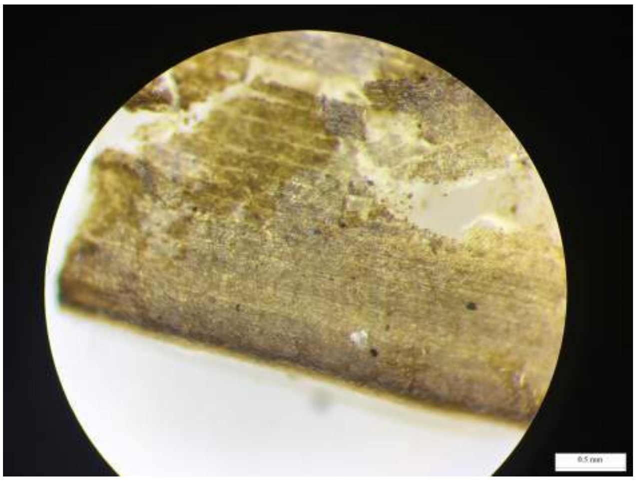


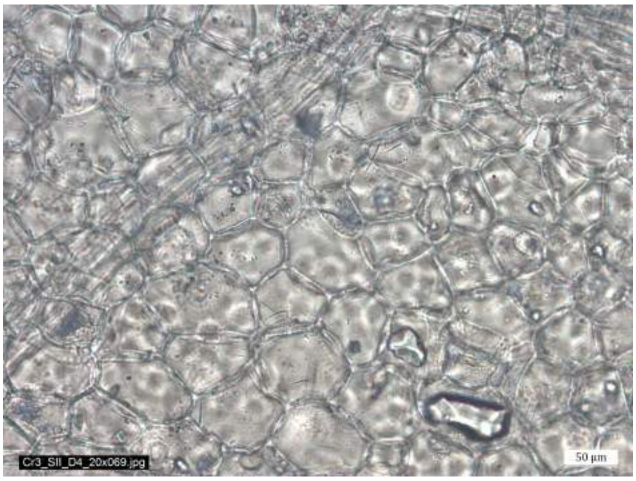
Fragment 45 (45_SII_D3_Cr3)



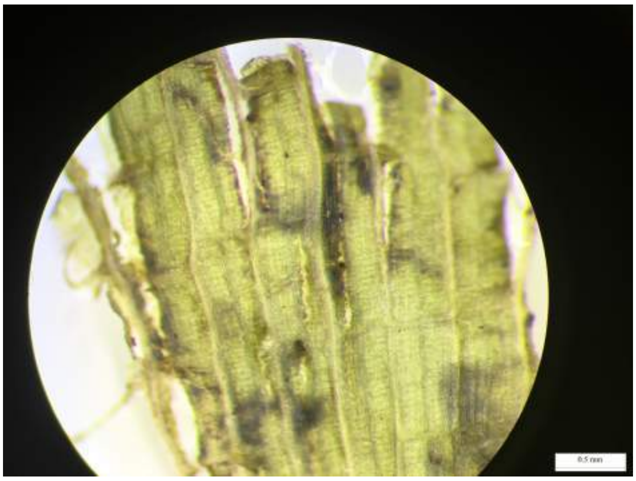


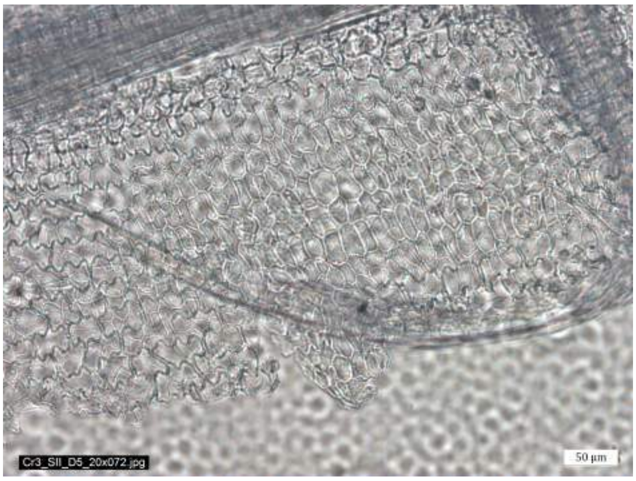
Fragment 46 (46_SII_D4_Cr3)



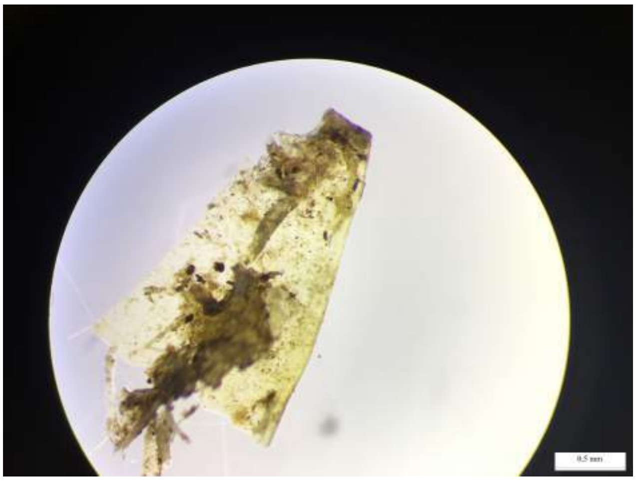


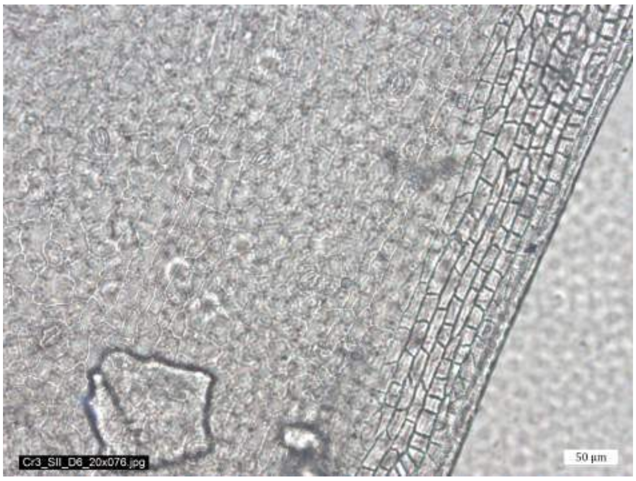
Fragment 47 (47_SII_D5_Cr3)





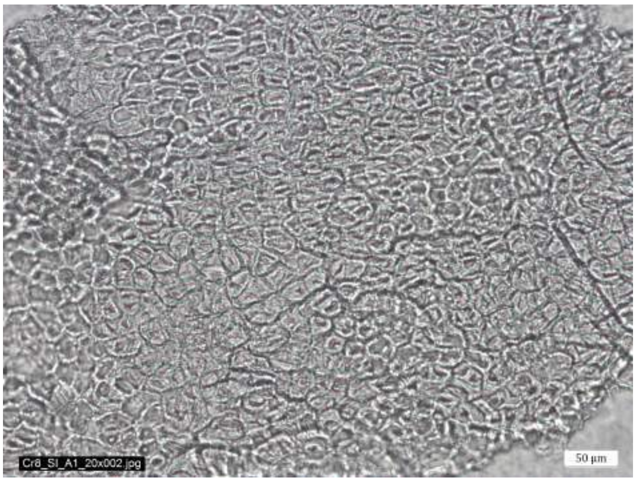
Fragment 48 (48_SII_D6_Cr3)



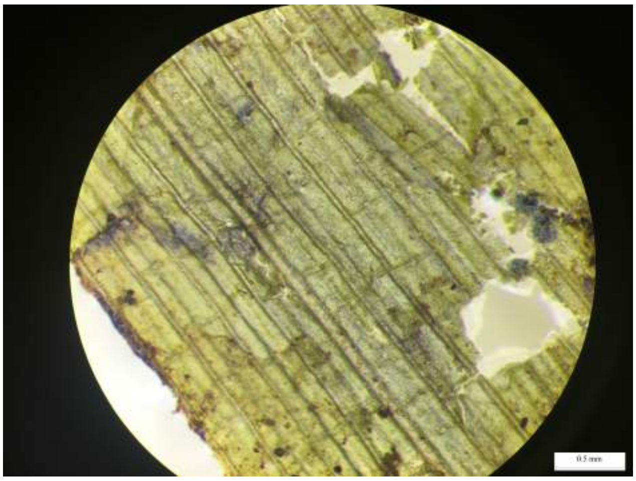
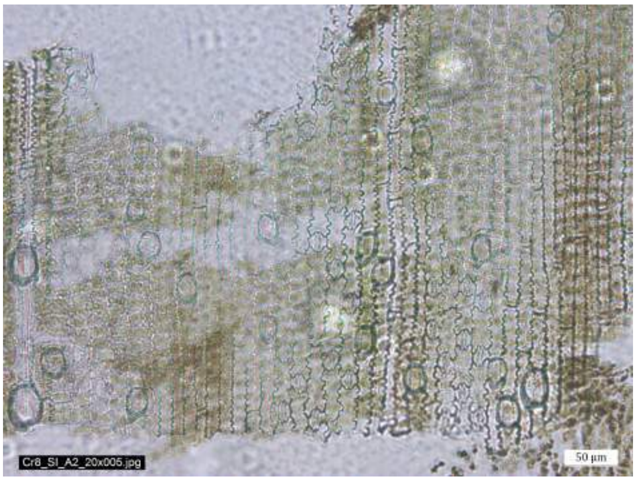


Fragments of the Faece 3

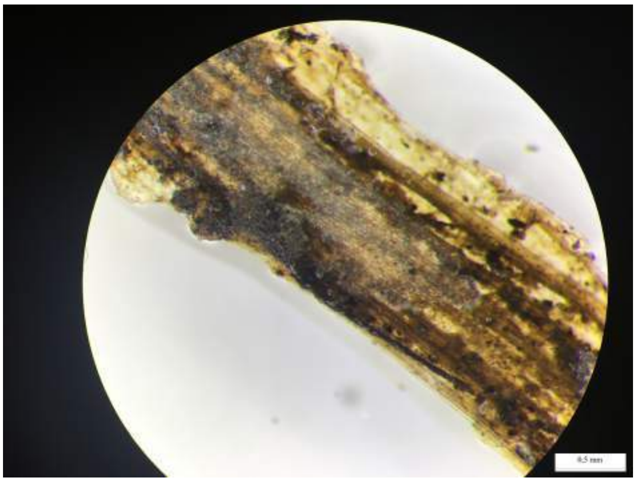
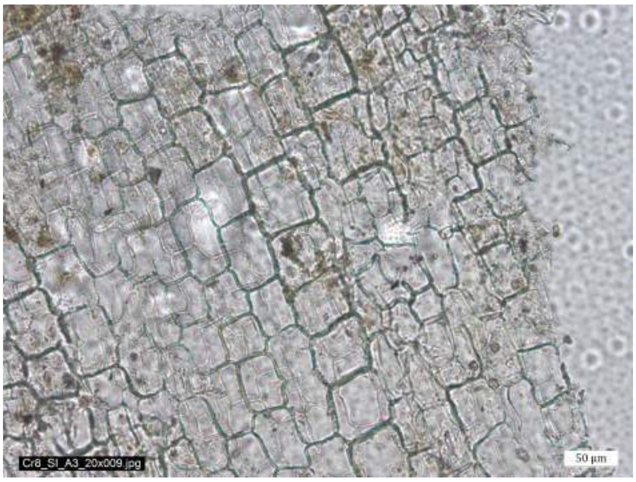
Fragment 1 (1_SI_A1_Cr8) → Inc_32

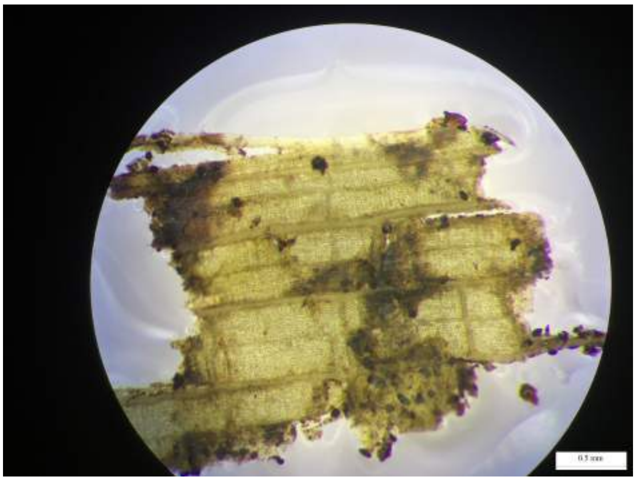
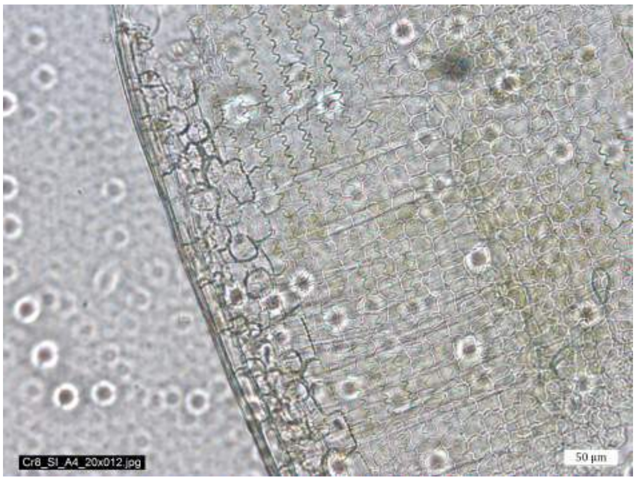
Fragment 2 (2_SI_A2_Cr8) → Inc_33

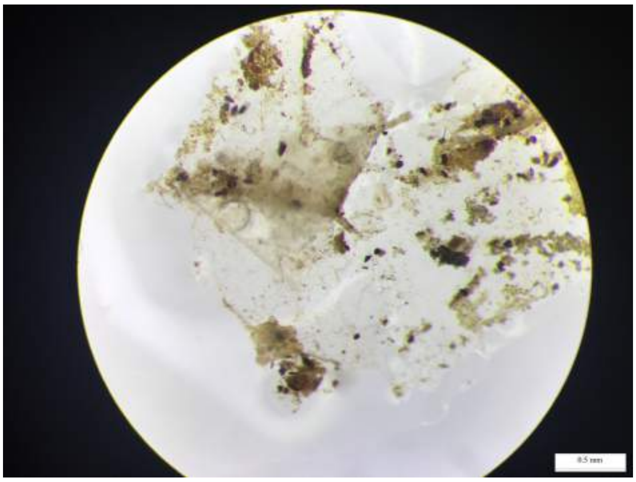
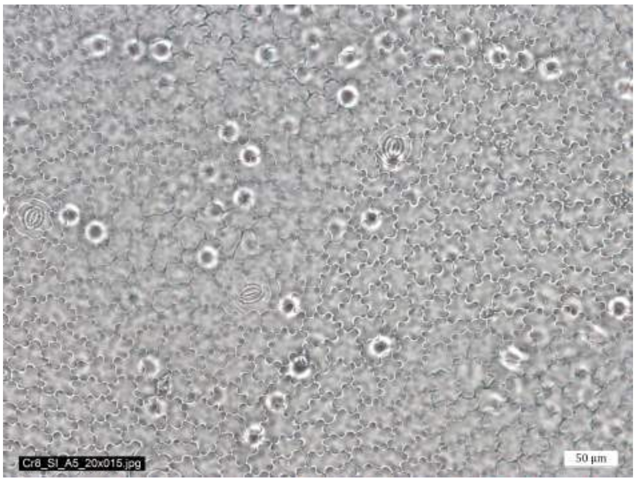
Fragment 3 (3_SI_A3_Cr8) → Inc_34

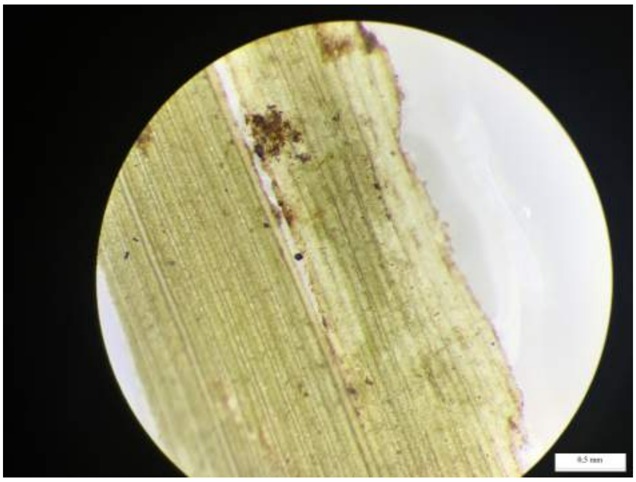
Fragment 4 (4_SI_A4_Cr8) → Inc_35

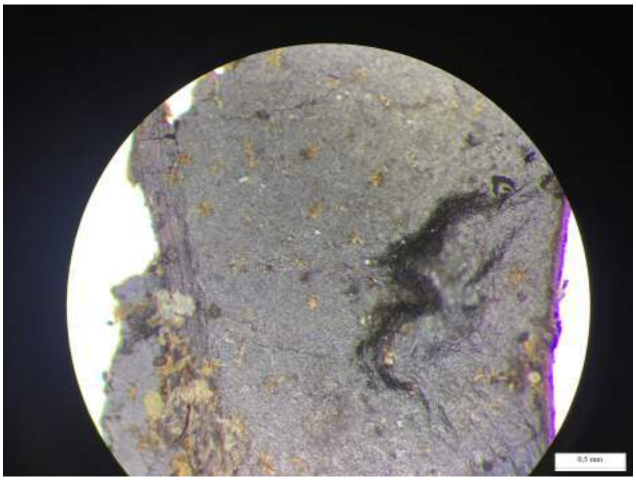
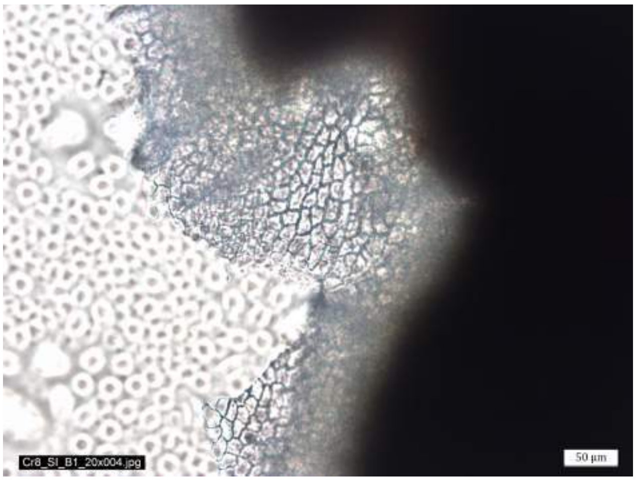
Fragment 5 (5_SI_A5_Cr8) → Inc_36

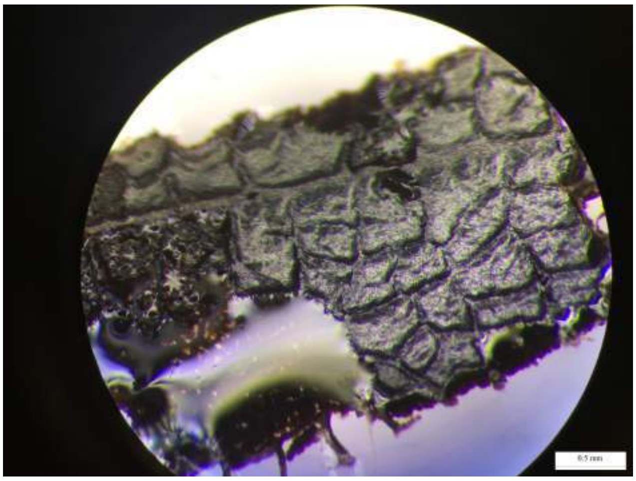
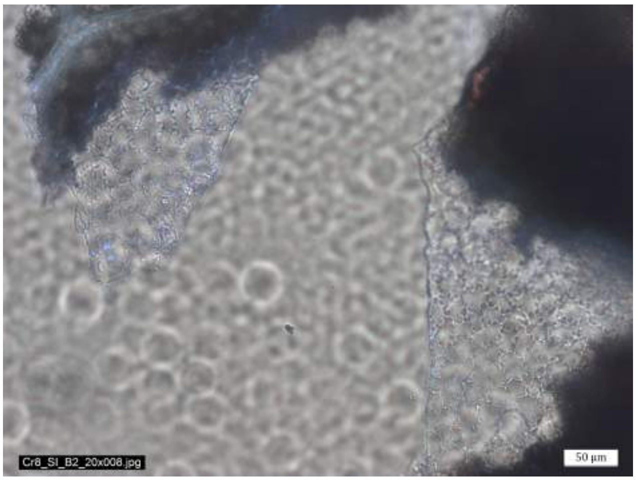
Fragment 6 (6_SI_A6_Cr8)



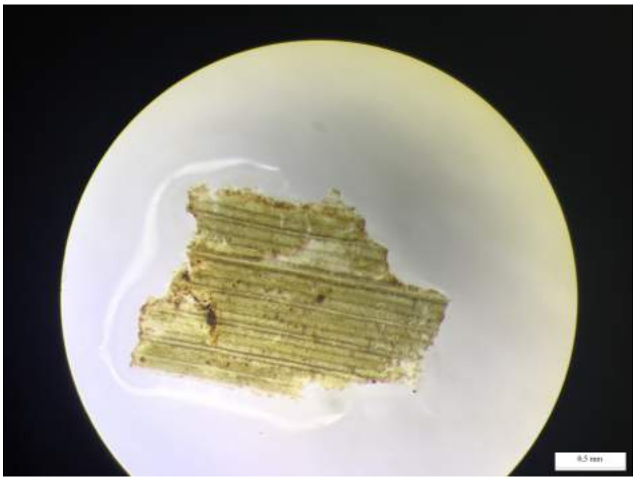

Fragment 7 (7_SI_B1_Cr8) → Inc_37

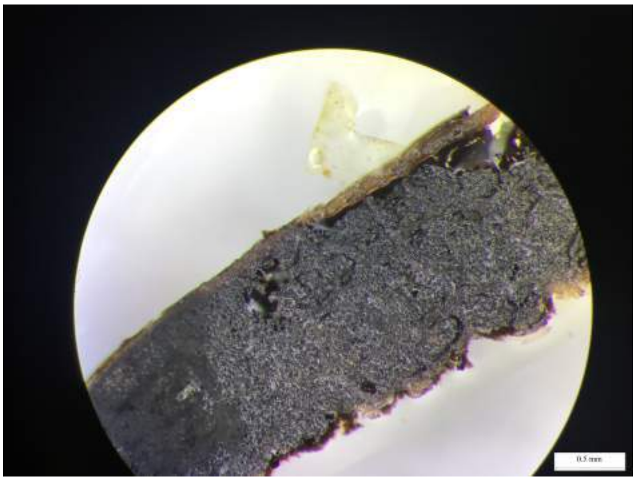
Fragment 8 (8_SI_B2_Cr8)

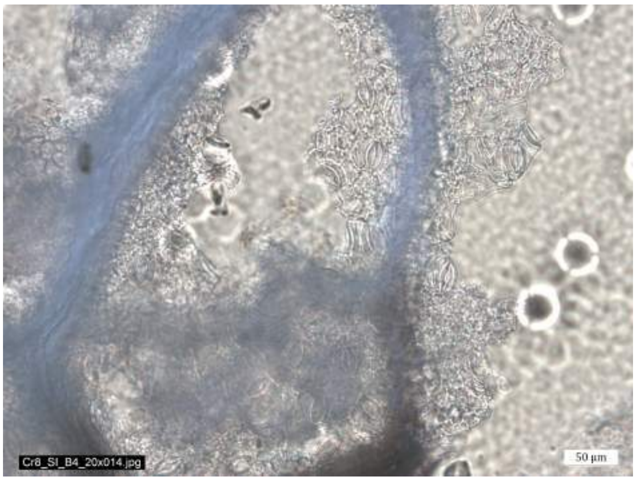



Fragment 9 (9_SI_B3_Cr8)

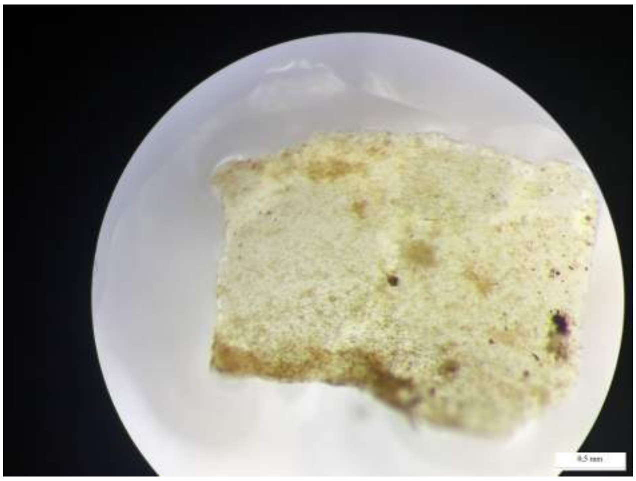


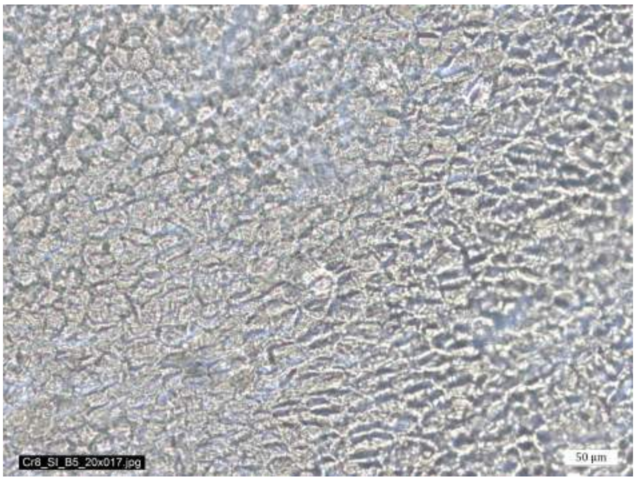

Fragment 10 (10_SI_B4_Cr8)



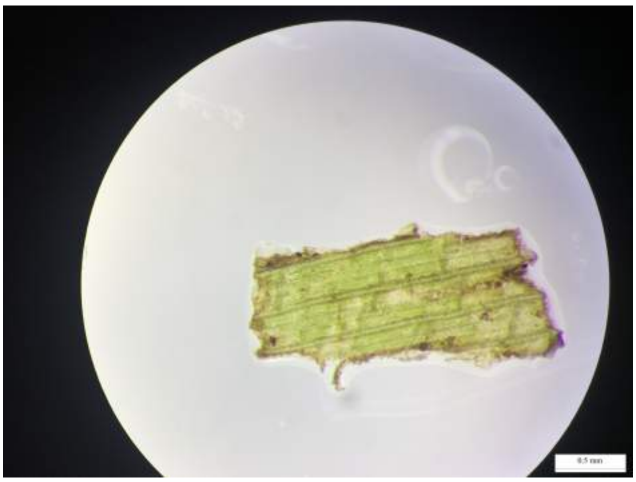


Fragment 11 (11_SI_B5_Cr8)



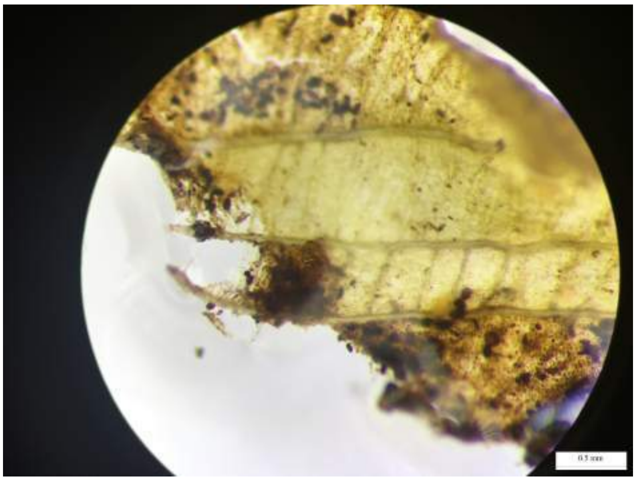


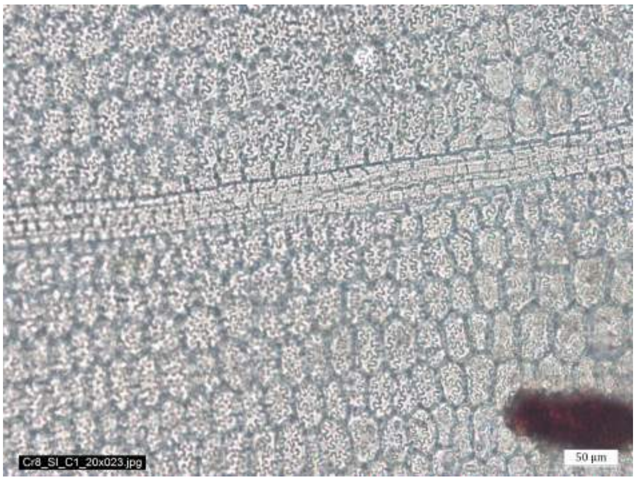
Fragment 12 (12_SI_B6_Cr8)



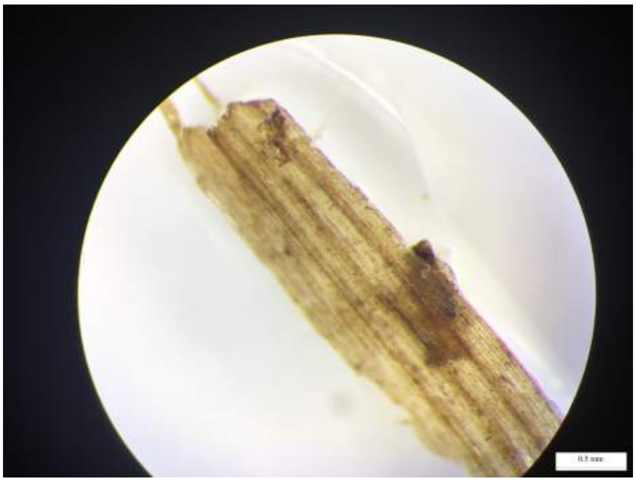
No references

Fragment 13 (13_SI_C1_Cr8) → Inc_38

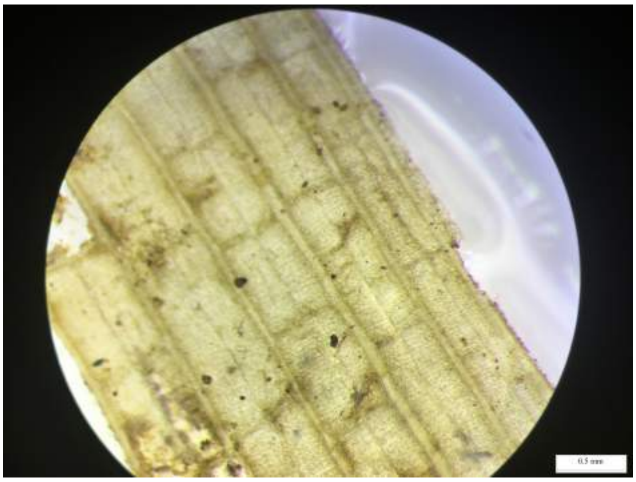




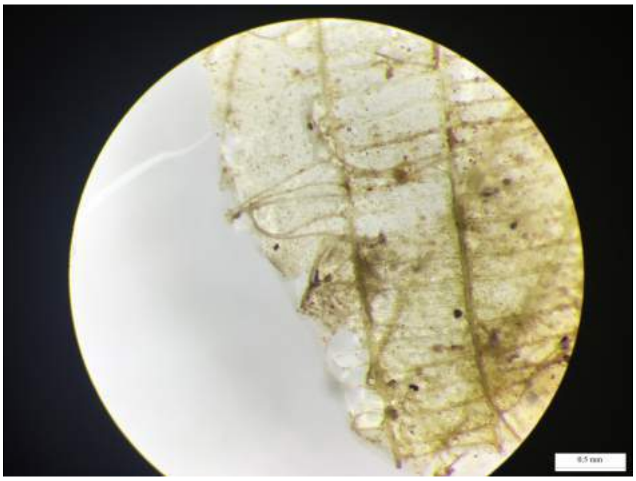
Fragment 14 (14_SI_C2_Cr8) → Inc_39



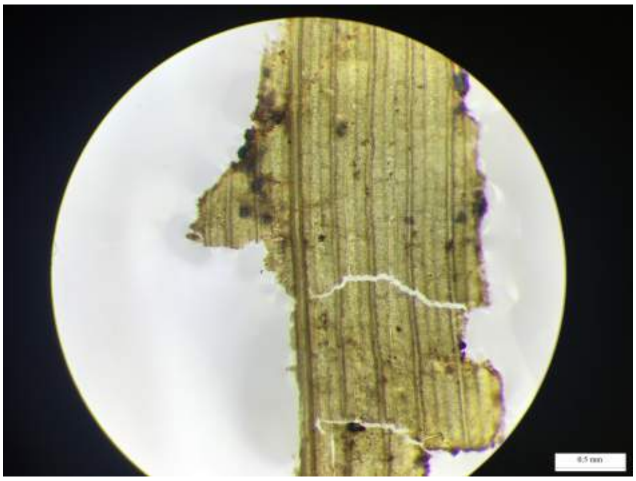
Fragment 15 (15_SI_C3_Cr8)

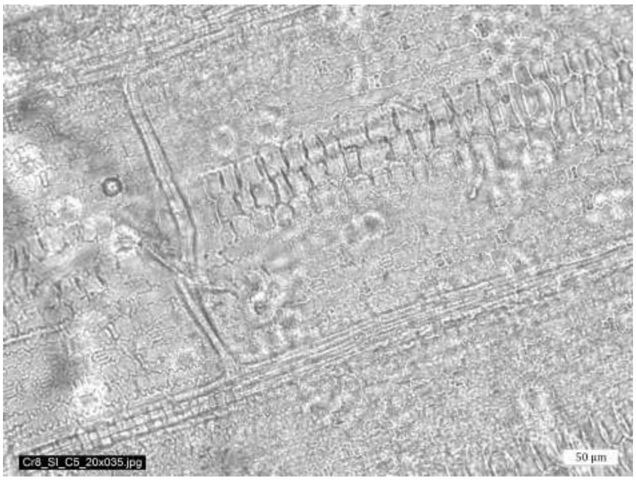


Fragment 16 (16_SI_C4_Cr8) → Inc_40

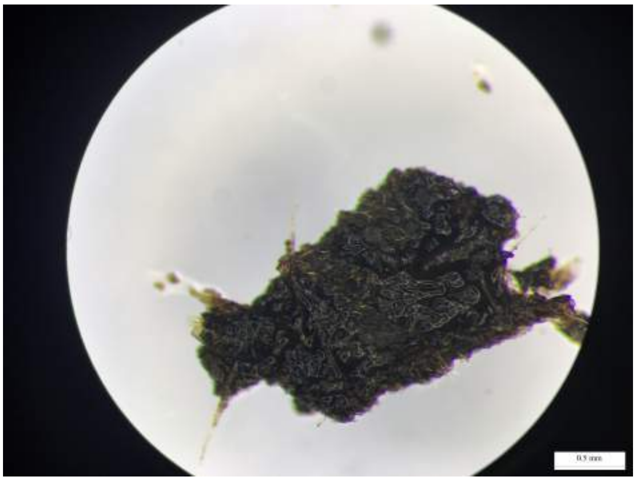


Fragment 17 (17_SI_C5_Cr8)

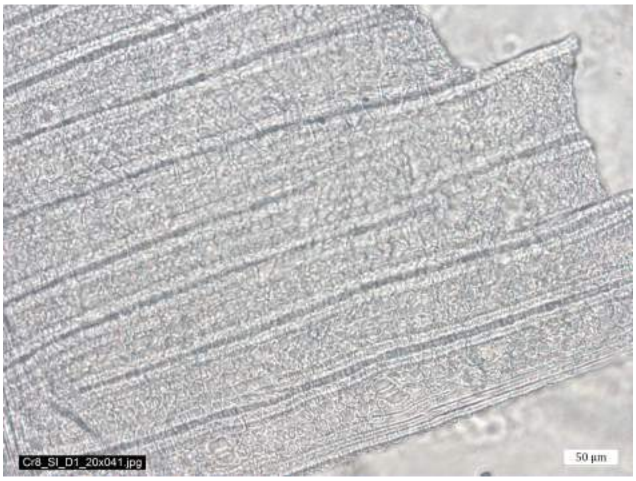




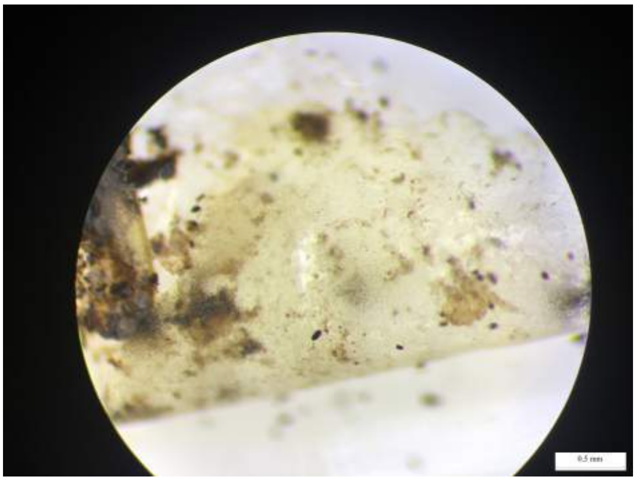
Fragment 18 (18_SI_C6_Cr8)

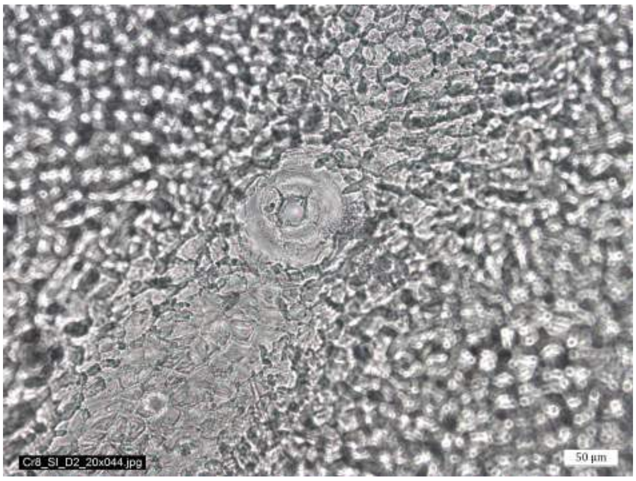


Fragment 19 (19_SI_D1_Cr8)

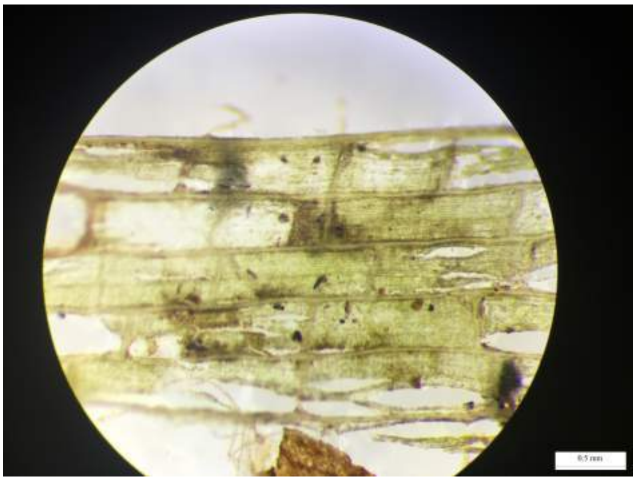


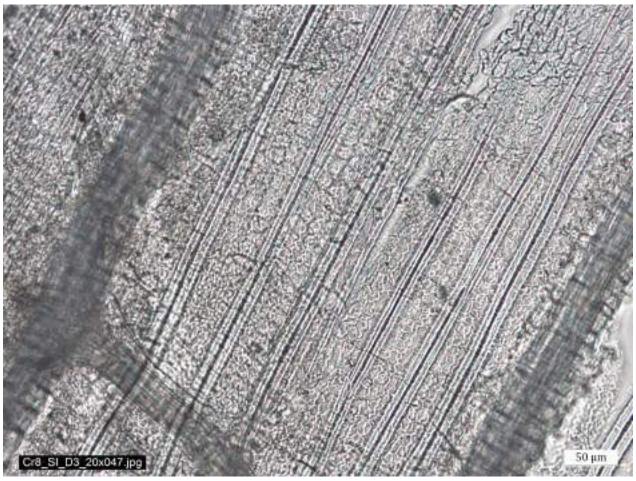
Fragment 20 (20_SI_D2_Cr8)



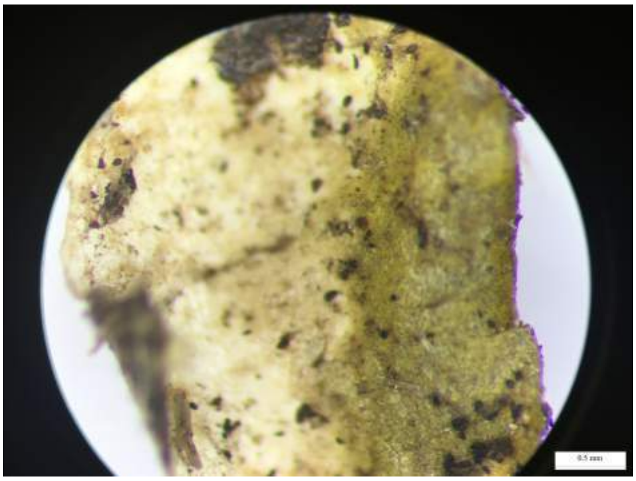


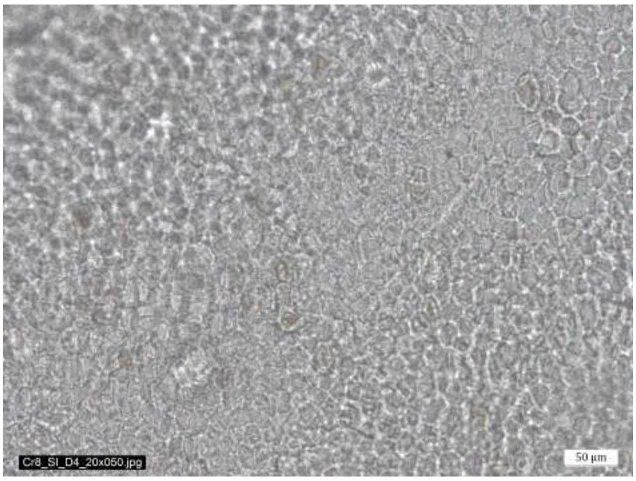
Fragment 21 (21_SI_D3_Cr8)



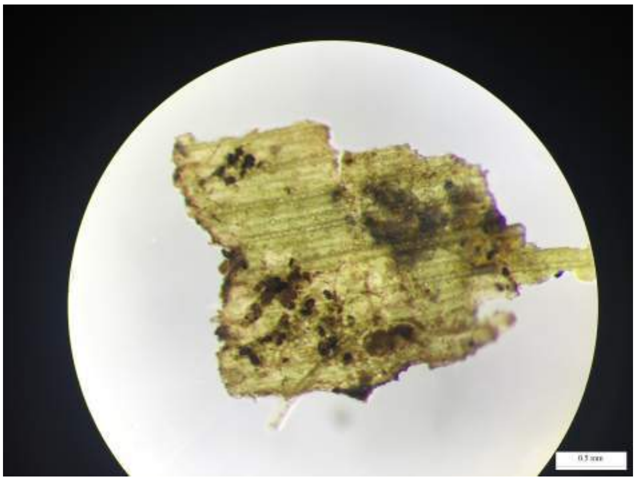


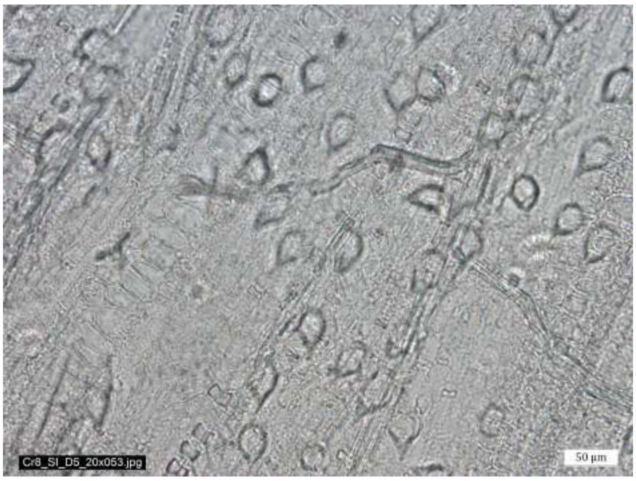
Fragment 22 (22_SI_D4_Cr8)



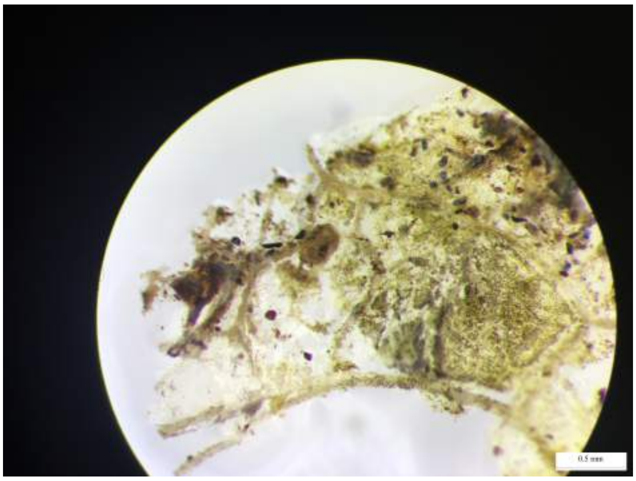


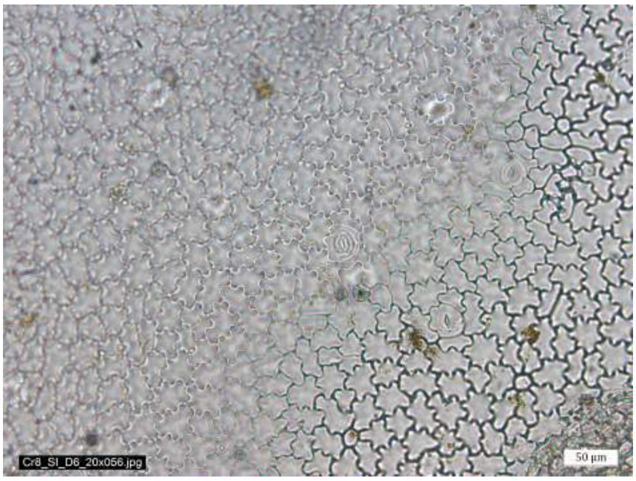
Fragment 23 (23_SI_D5_Cr)



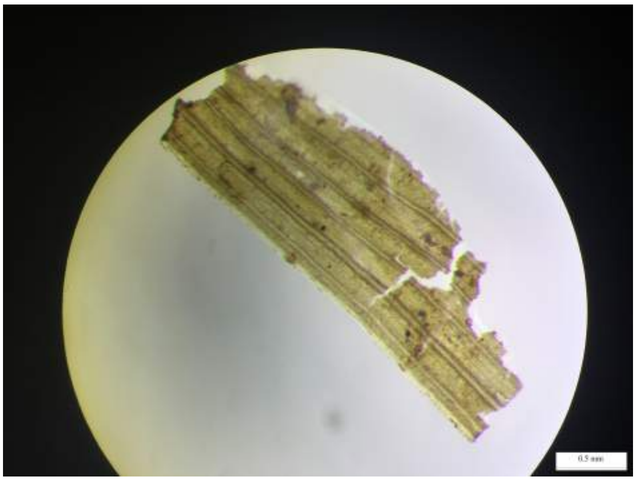


Fragment 24 (24_SI_D6_Cr8)

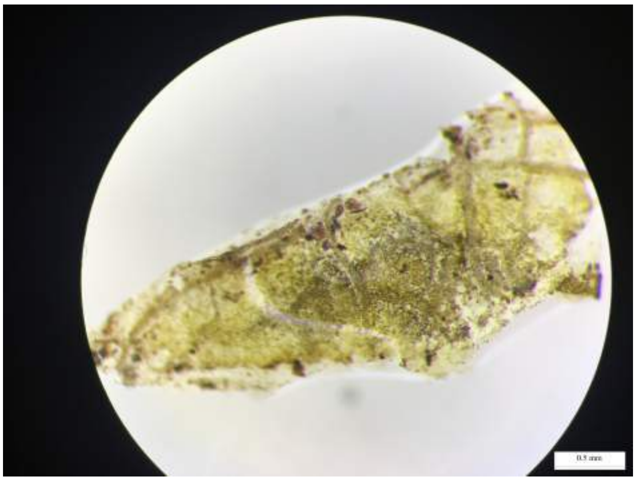


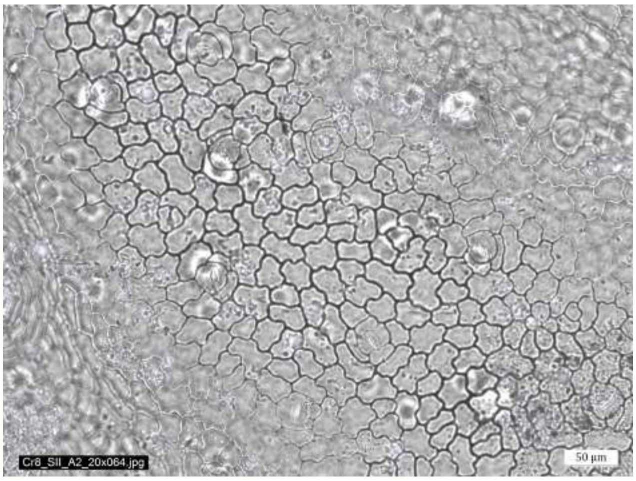


Fragment 25 (25_SII_A1_Cr8)

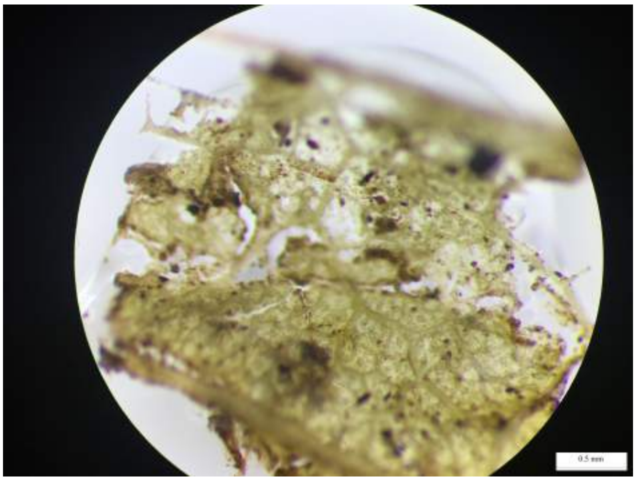


Fragment 26 (26_SII_A2_Cr8)

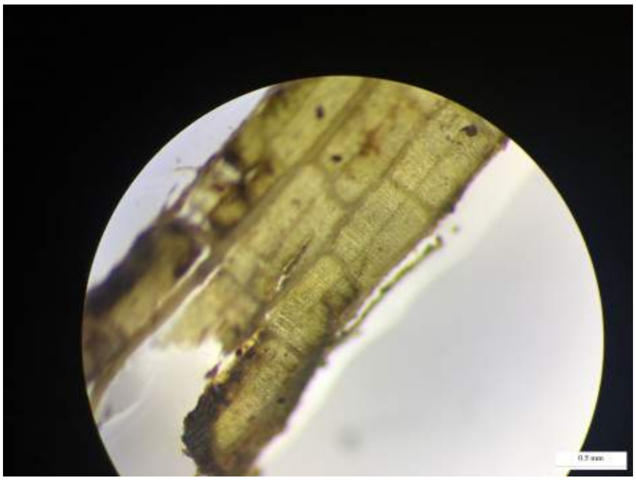


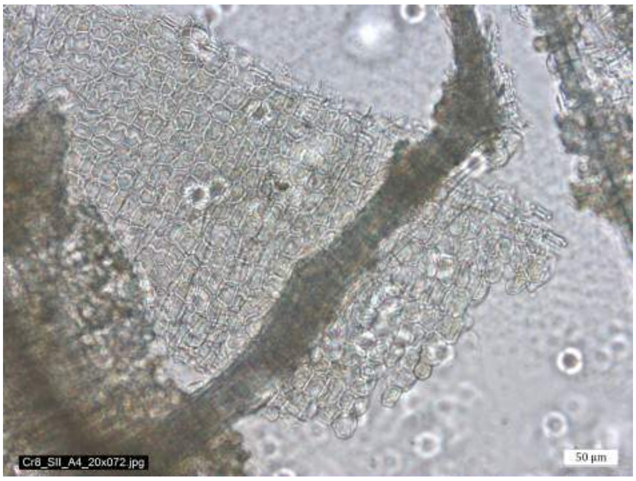


Fragment 27 (27_SII_A3_Cr) → **Inc_41**

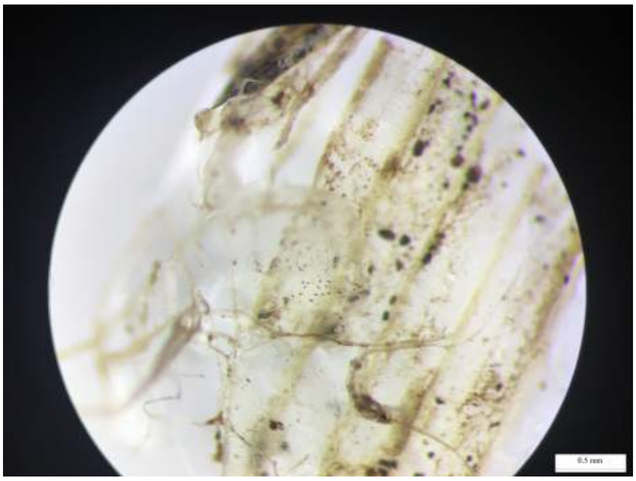


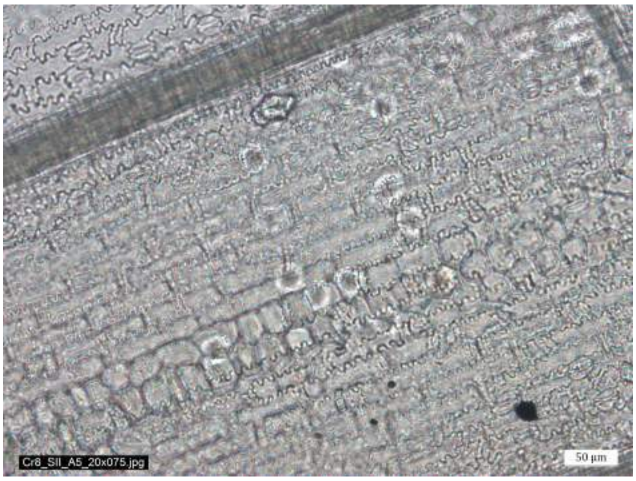
Fragment 28 (28_SII_A4_Cr8)



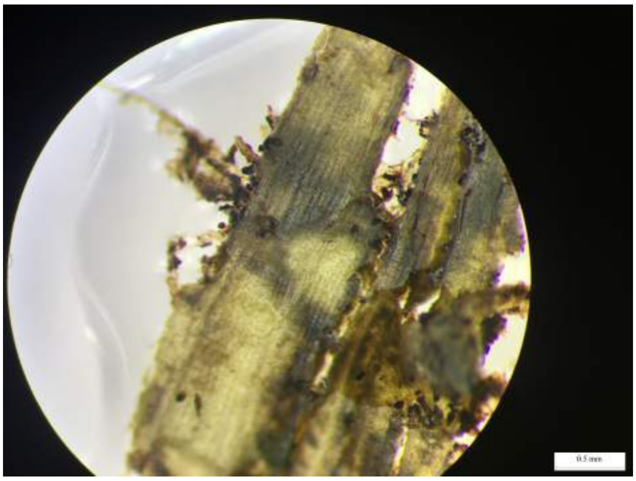


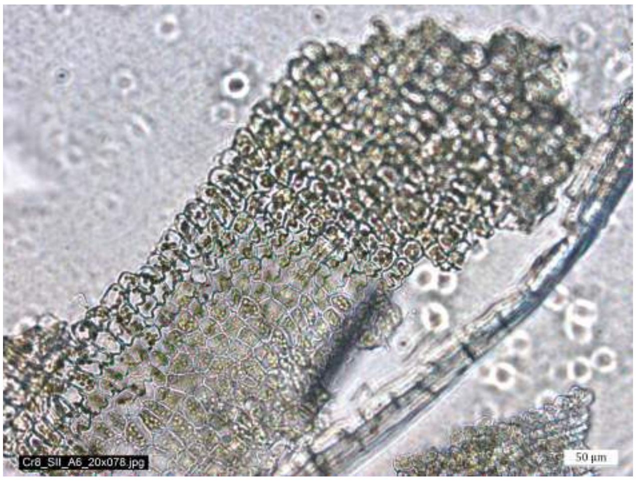
Fragment 29 (29_SII_A5_Cr8)



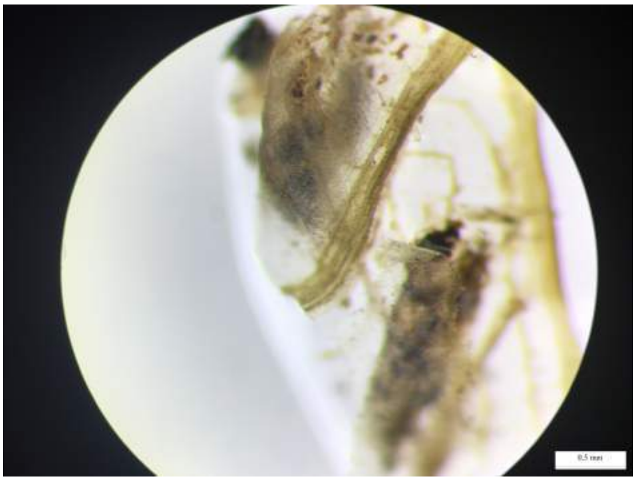


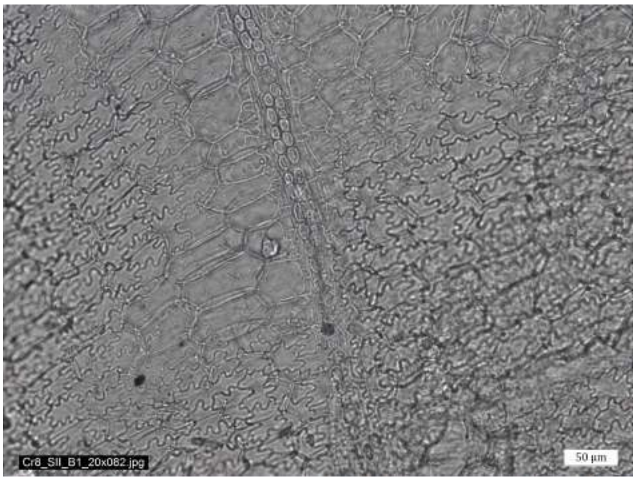
Fragment 30 (30_SII_A6_Cr8)



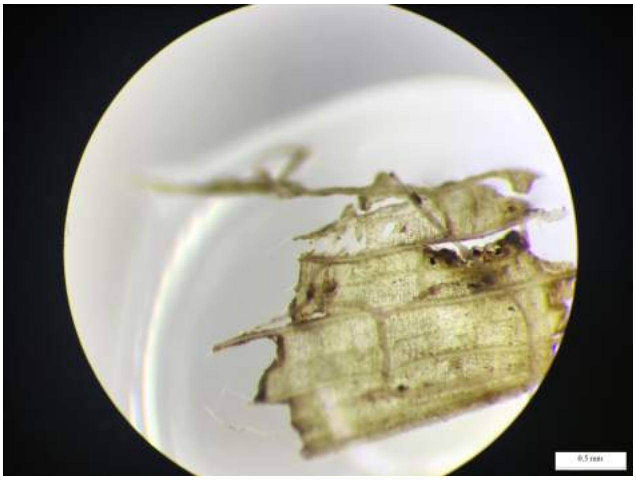


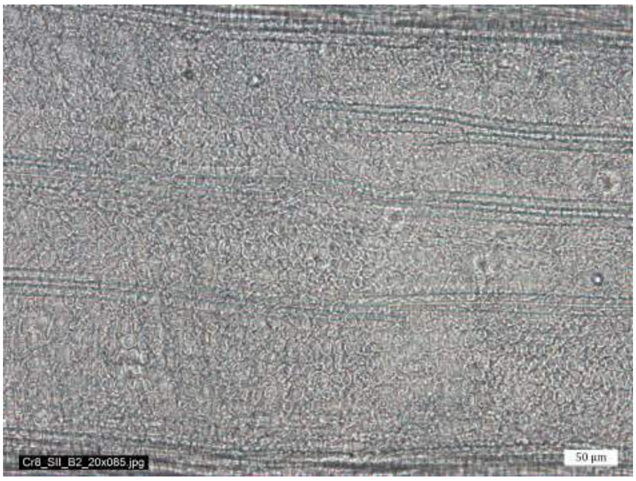
Fragment 31 (31_SII_B1_Cr8)



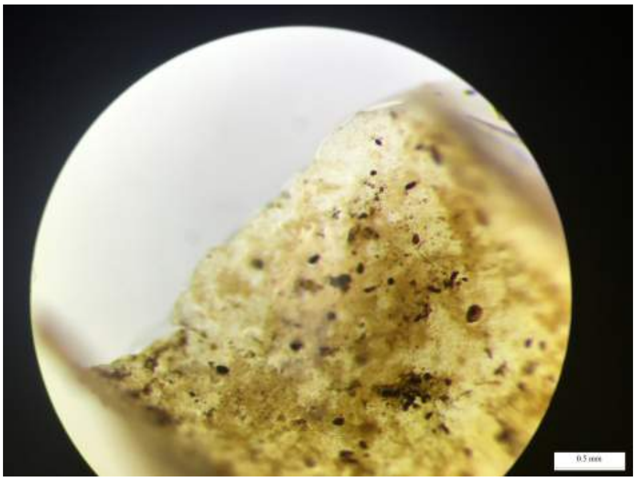


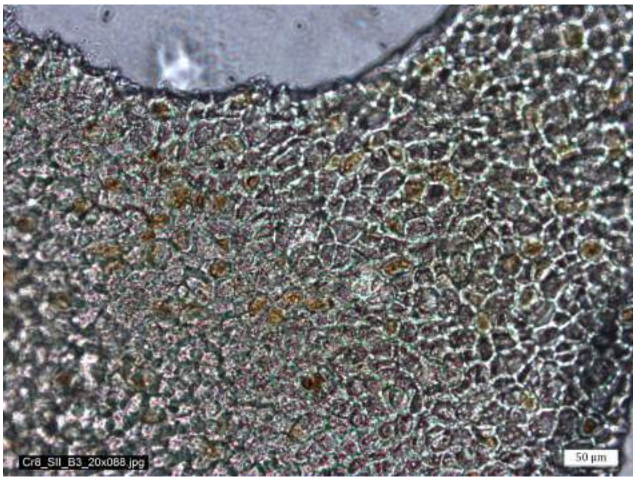
Fragment 32 (32_SII_B2_Cr8)



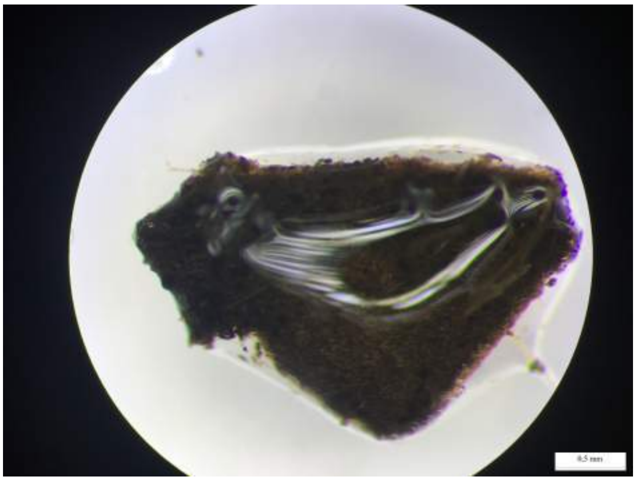


Fragment 33 (33_SII_B3_Cr8)

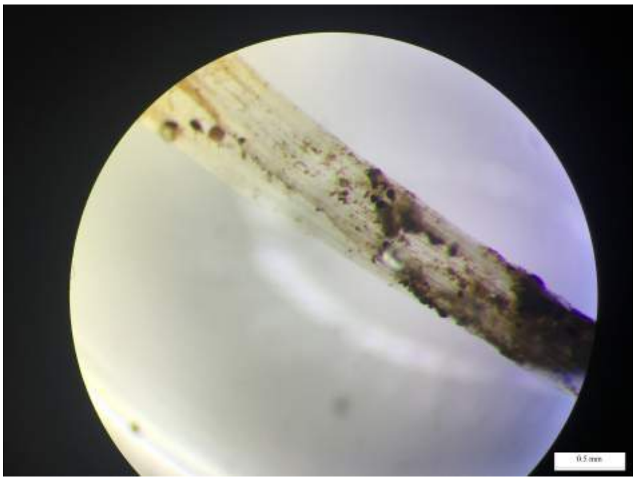


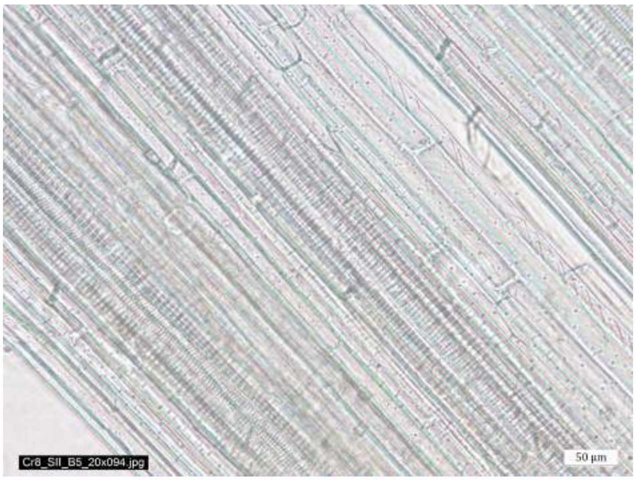


Fragment 34 (34_SII_B4_Cr8)

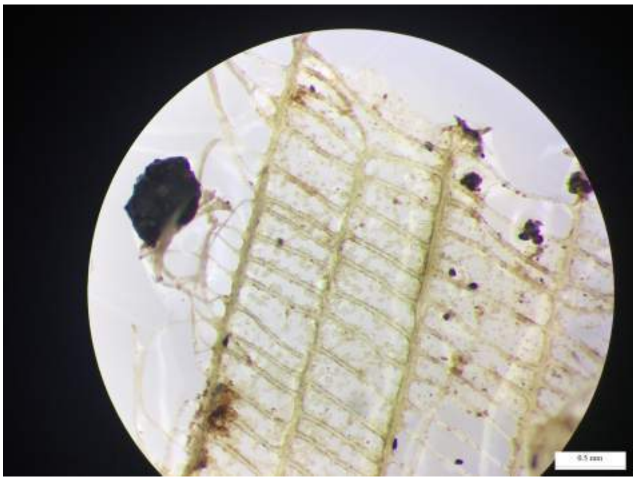


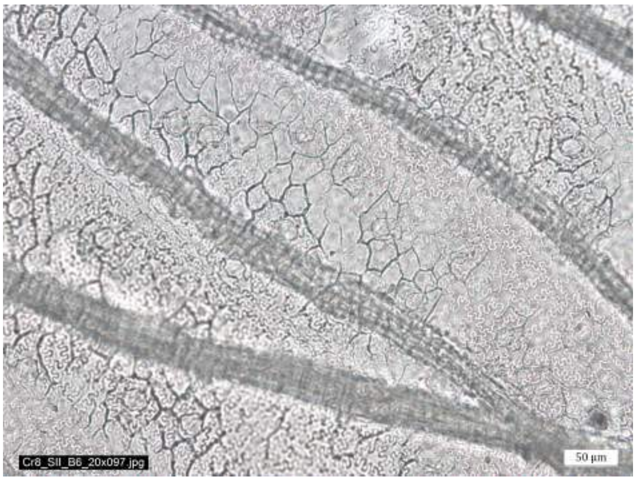
Fragment 35 (5_SII_B5_Cr8)



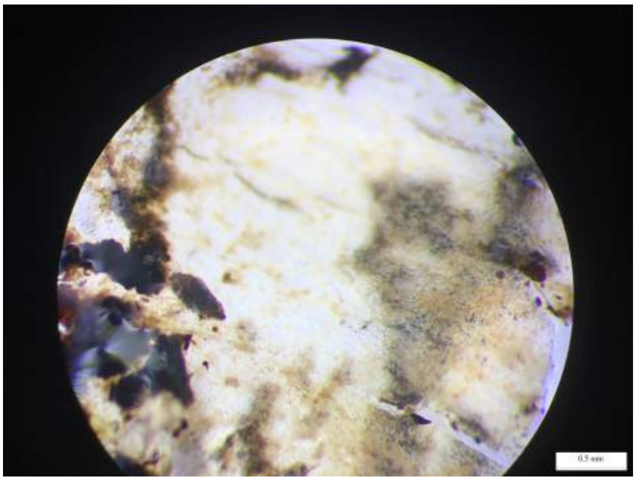
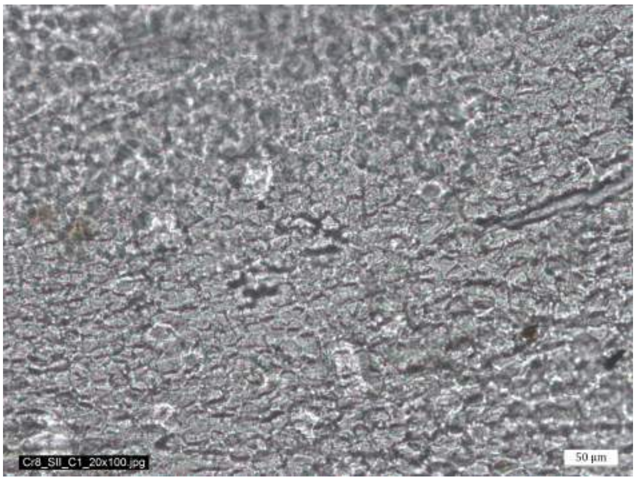


Fragment 36 (36_SII_B6_Cr8)

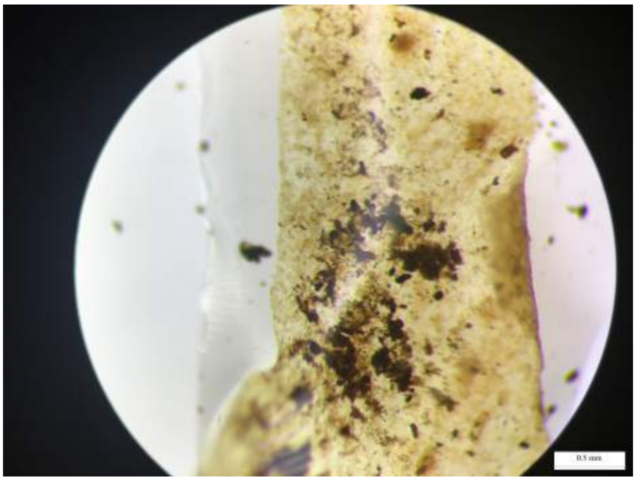
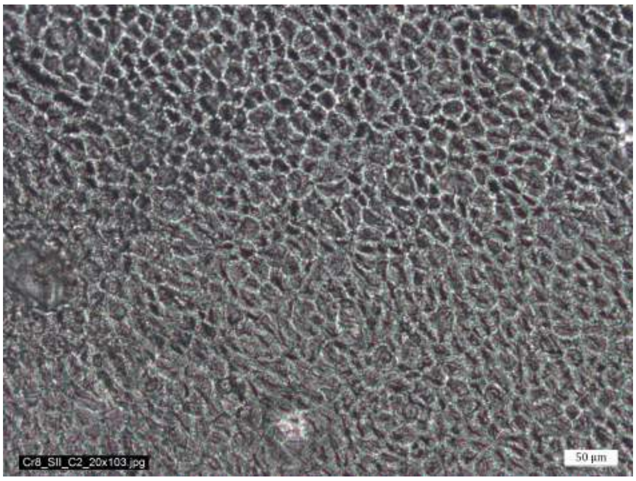




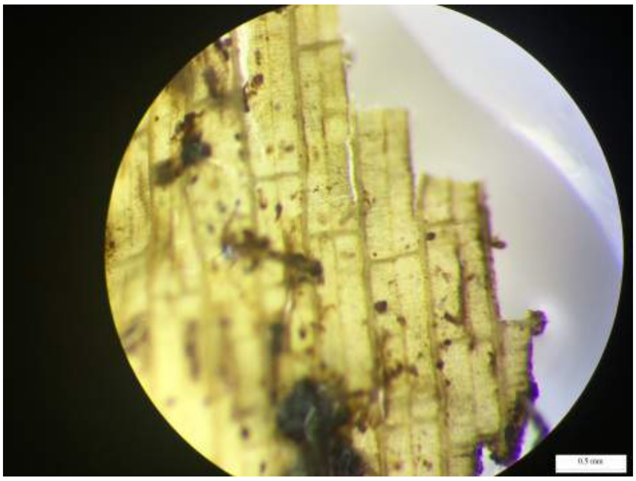
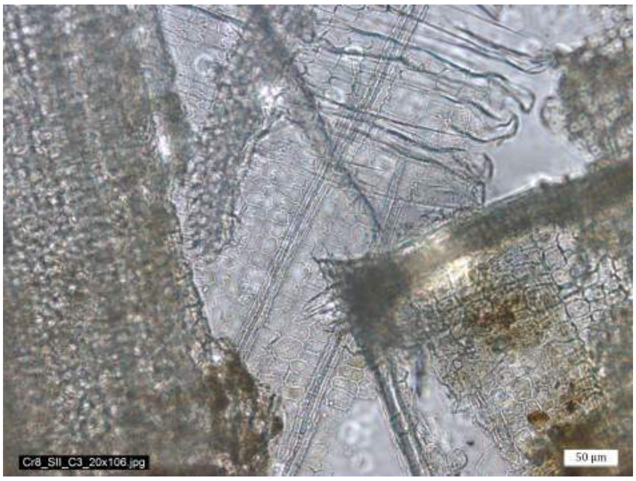
Fragment 37 (37_SII_C1_Cr8)

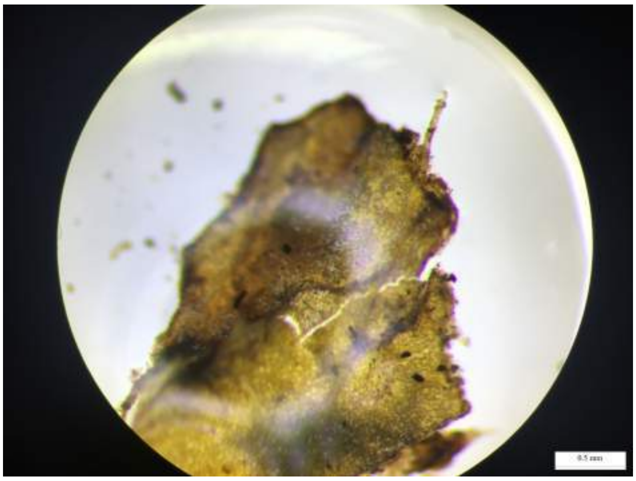
Fragment 38 (38_SII_C2_Cr8)

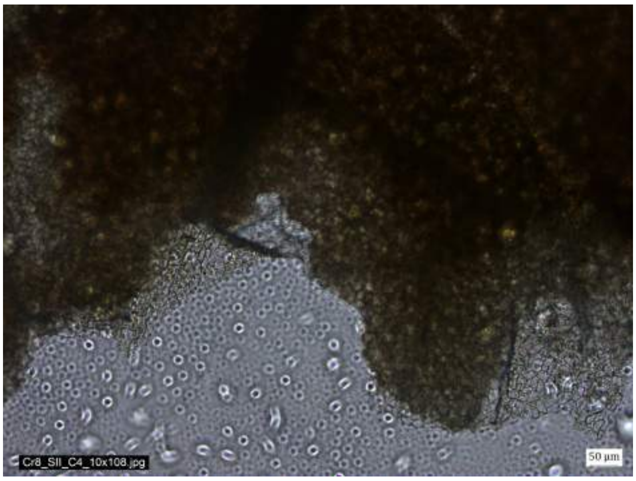



Fragment 39 (39_SII_C3_Cr8)

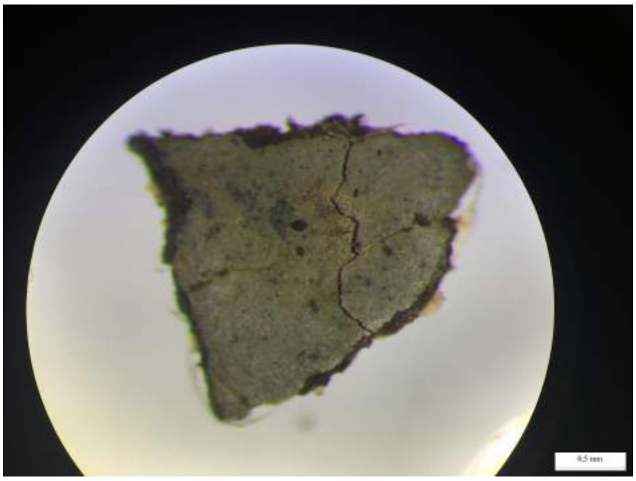



Fragment 40 (40_SII_C4_Cr8)

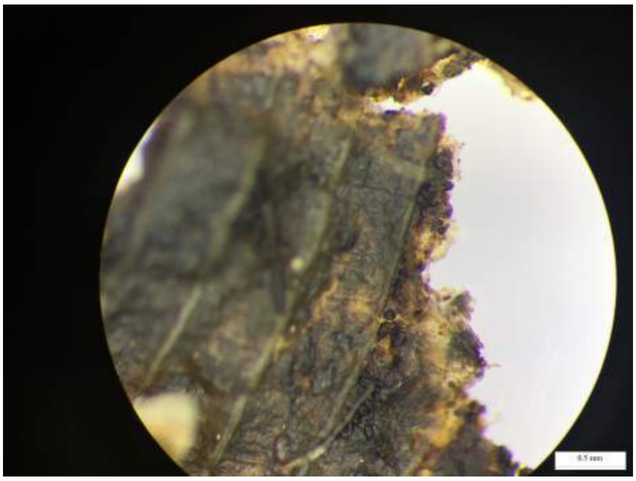


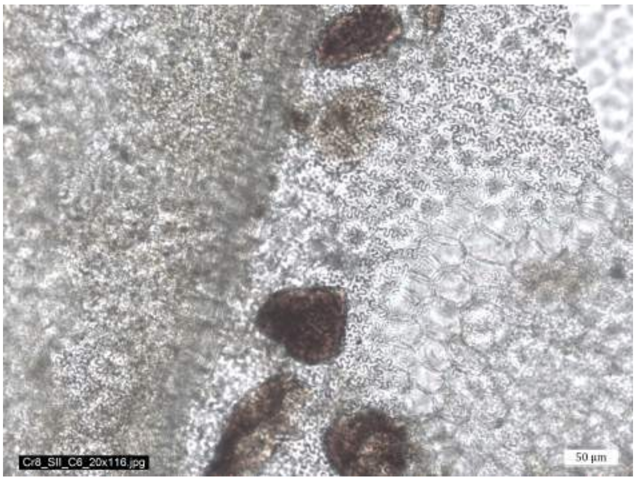


Fragment 41 (41_SII_C5_Cr8)

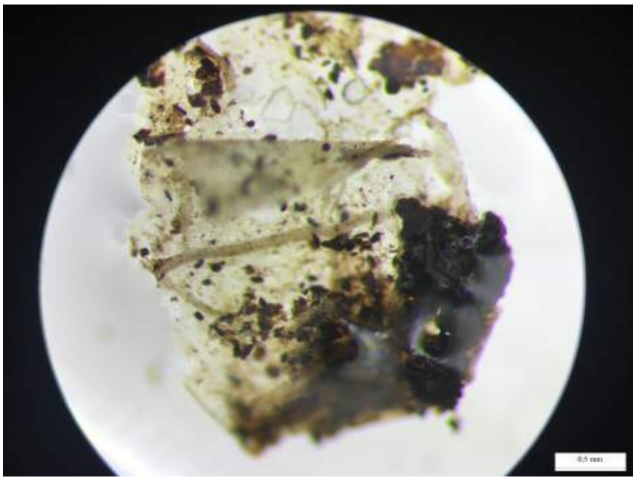


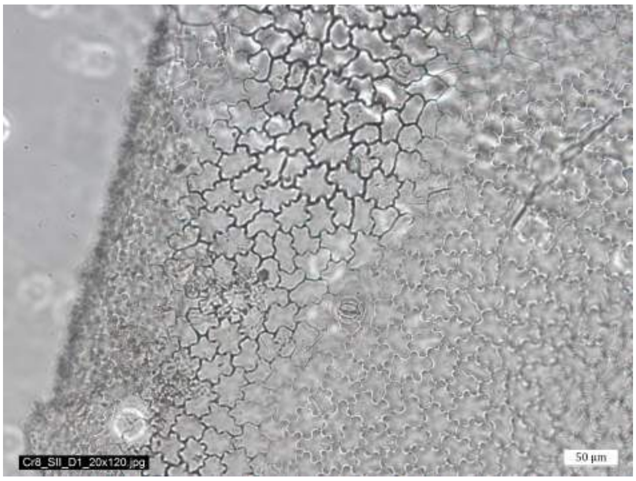
Fragment 42 (42_SII_C6_Cr8)



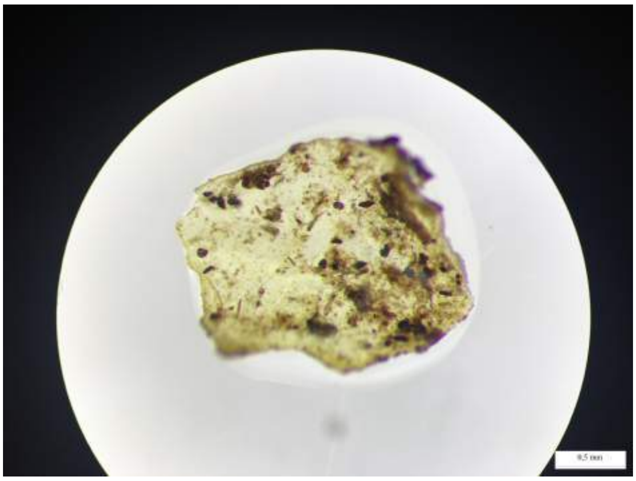


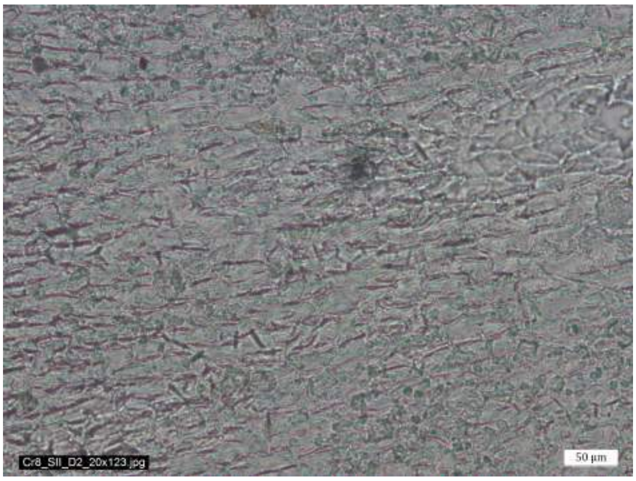
Fragment 43 (43_SII_D1_Cr8)



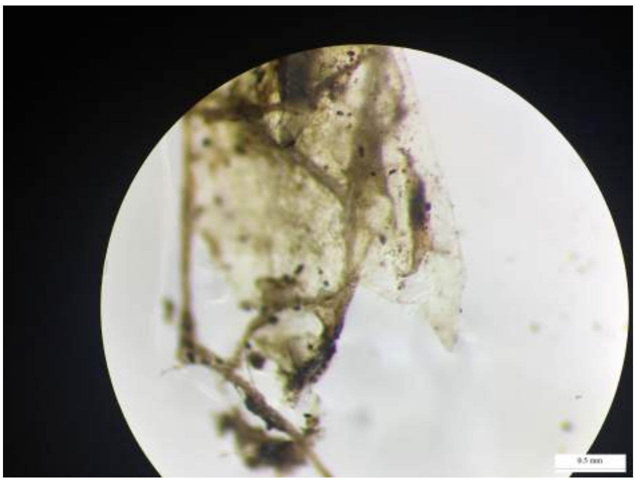


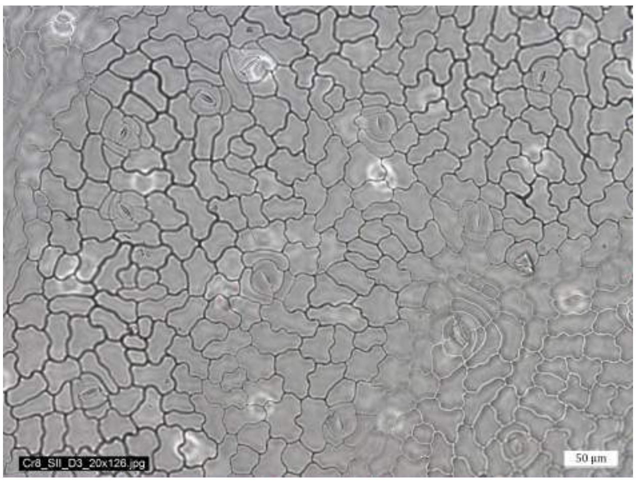
Fragment 44 (44_SII_D2_Cr8)



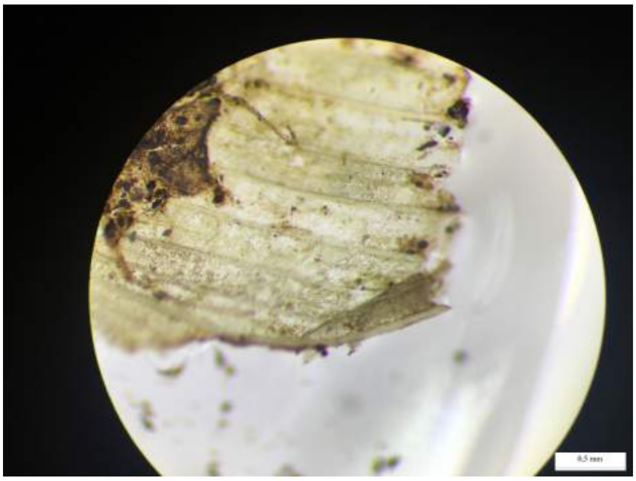


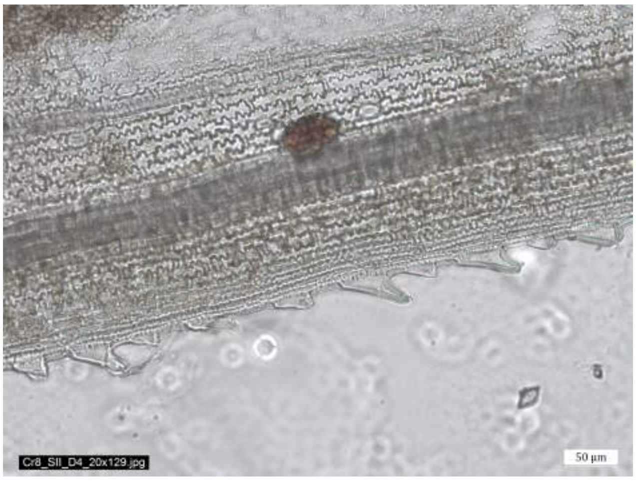
Fragment 45 (45_SII_D3_Cr8)



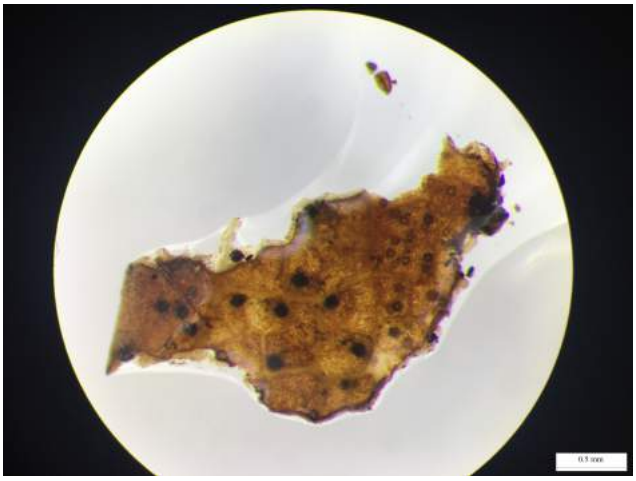


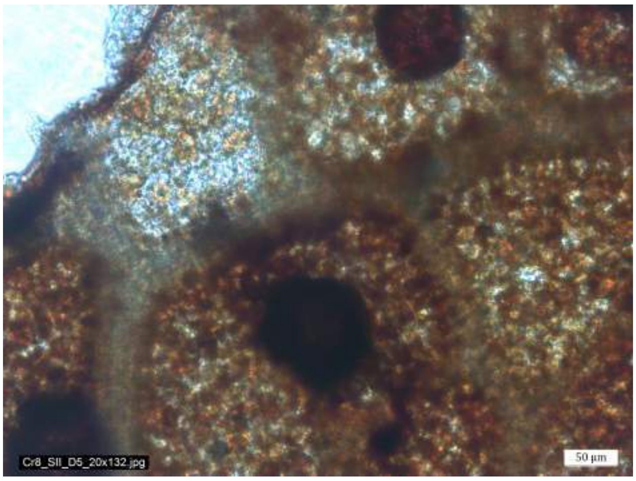
Fragment 46 (46_SII_D4_Cr8)



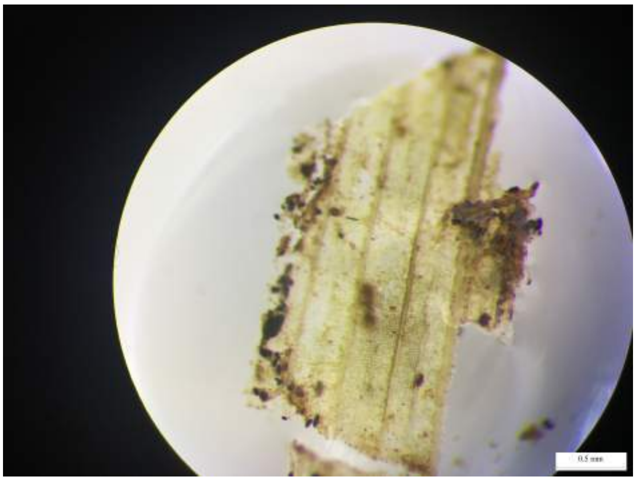


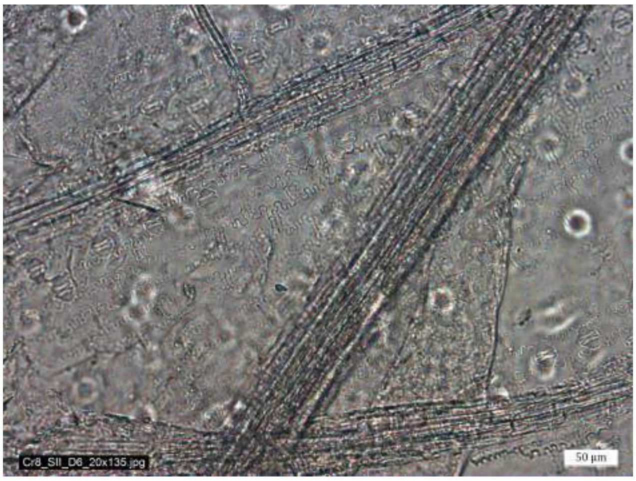
Fragment 47 (47_SII_D5_Cr8)





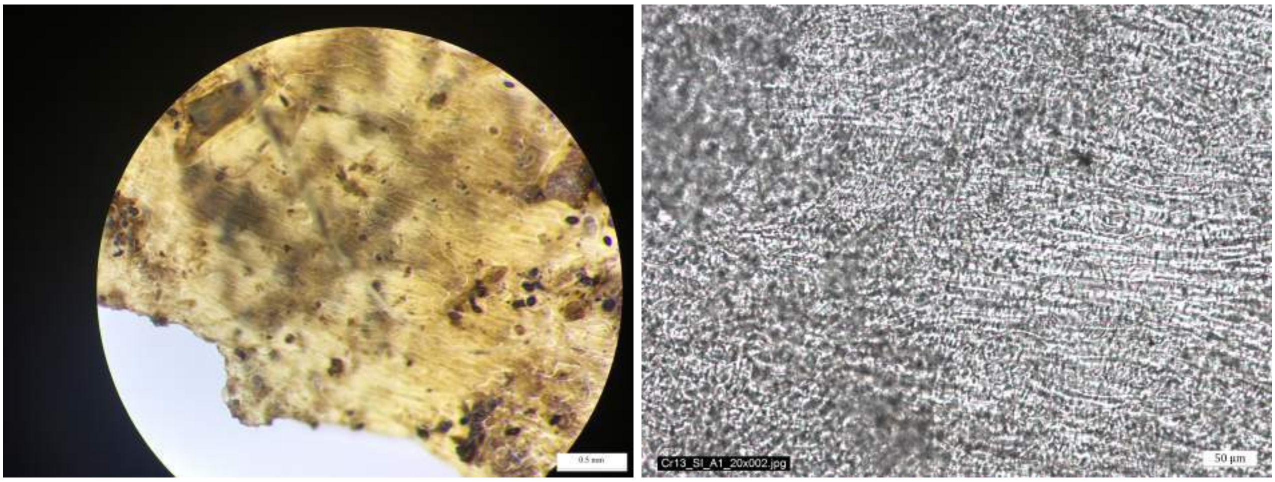
Fragment 48 (48_SII_D6_Cr8) → Inc_42



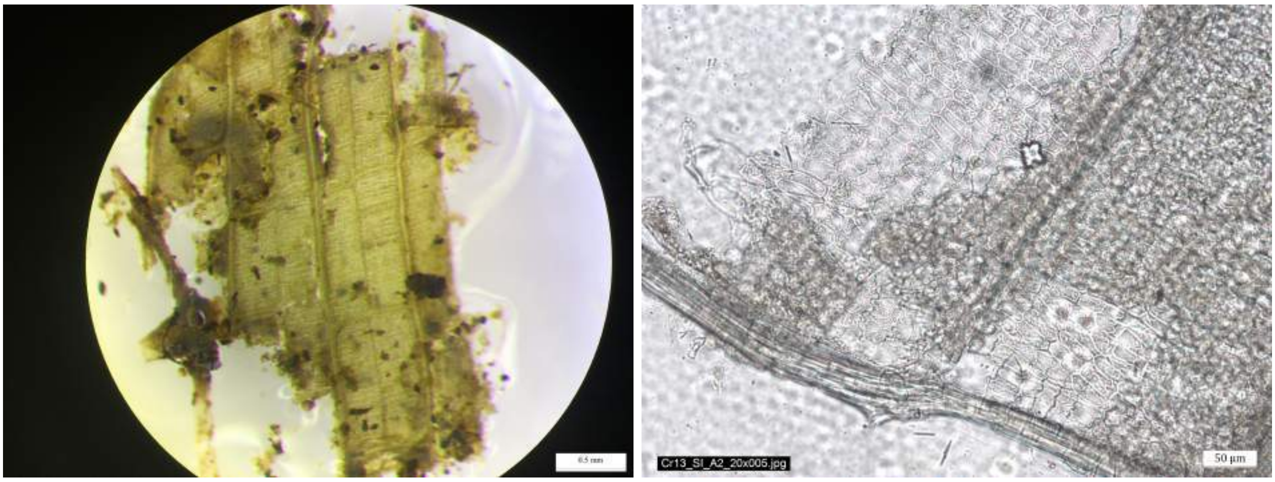


Fragments of the Faece 4

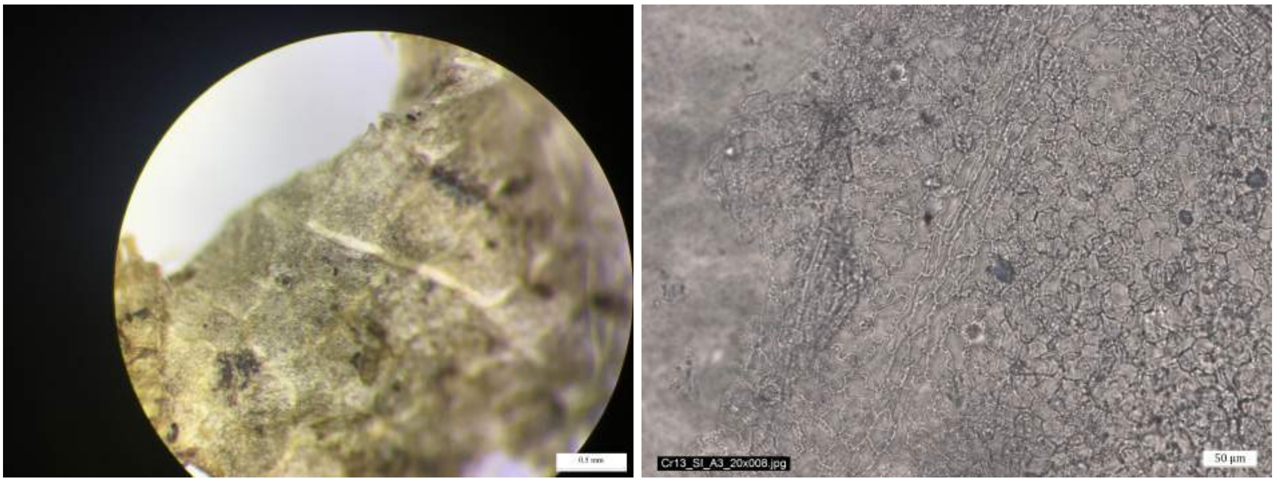
Fragment 1 (1_SI_A1_Cr13)



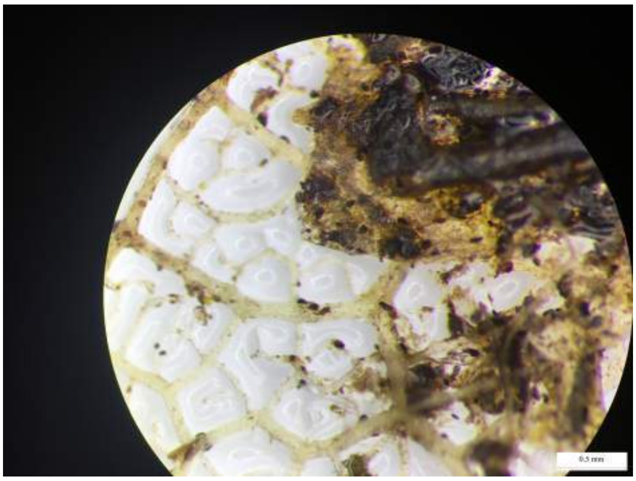
Fragment 2 (2_SI_A2_Cr13) → Inc_43

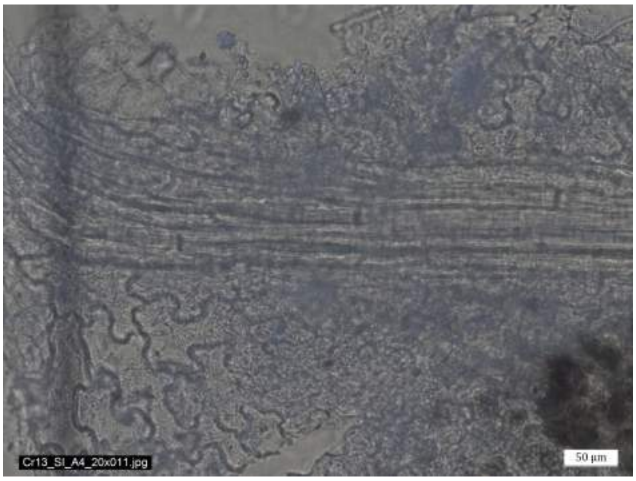


Fragment 3 (3_SI_A3_Cr13)

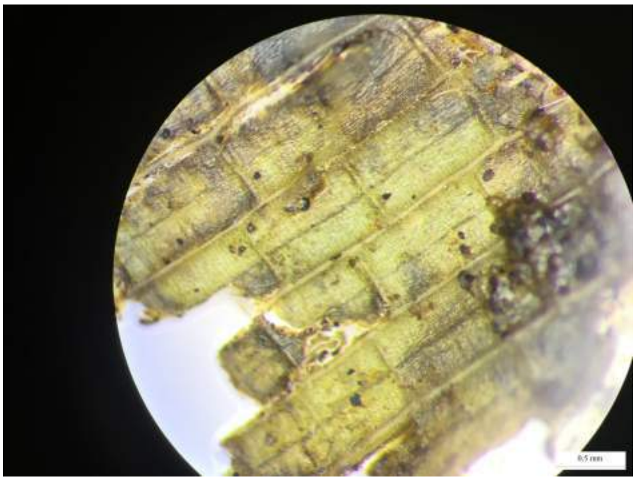


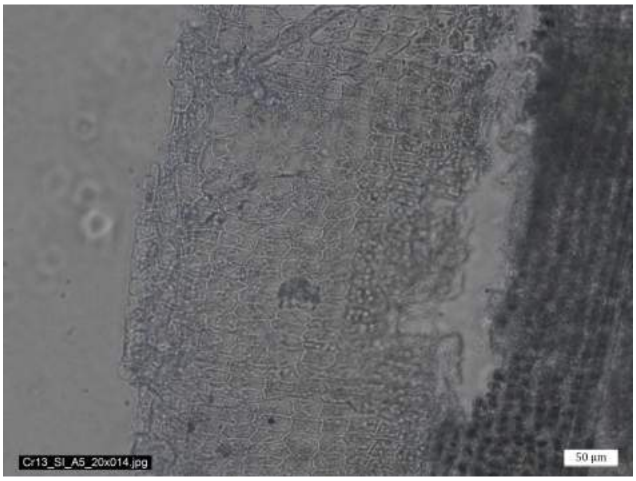
Fragment 4 (4_SI_A4_Cr13) → Inc_44



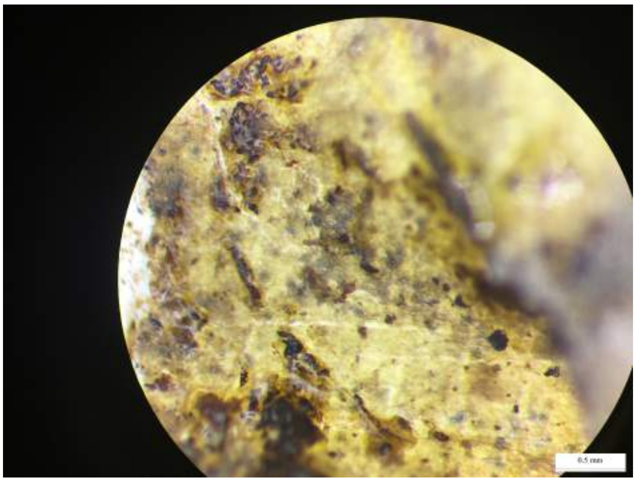


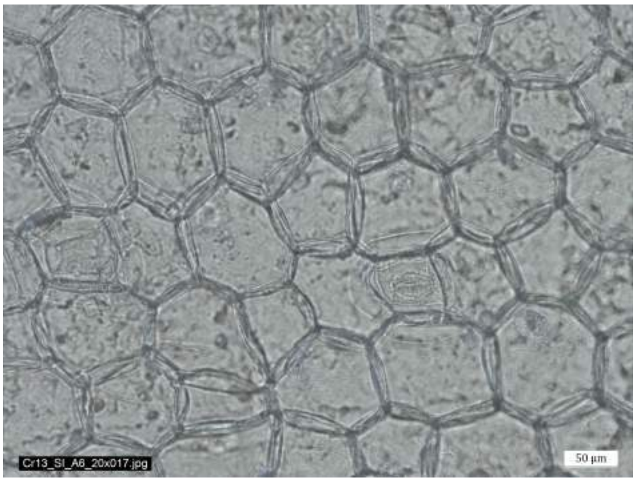
Fragment 5 (5_SI_A5_Cr13)



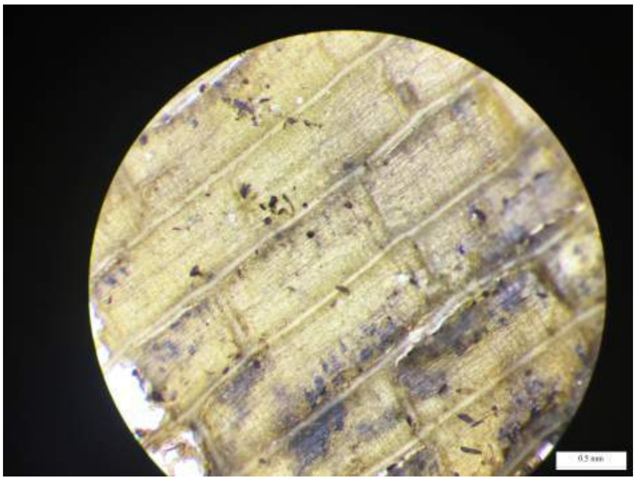


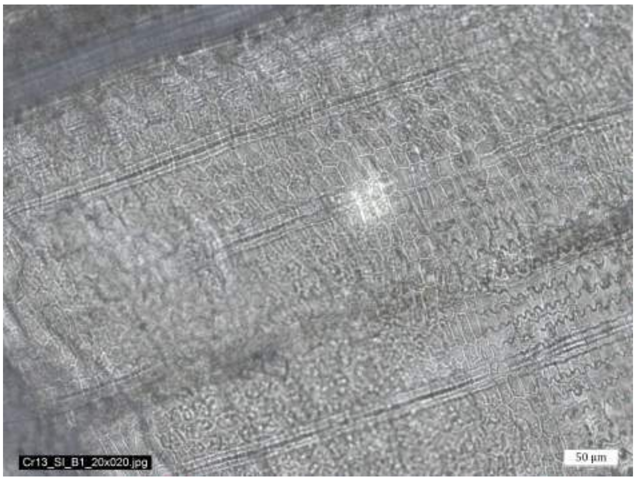
Fragment 6 (6_SI_A6_Cr13) → Inc_45



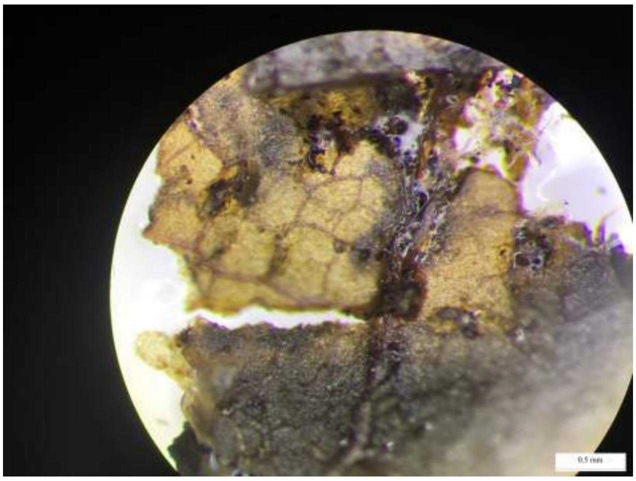


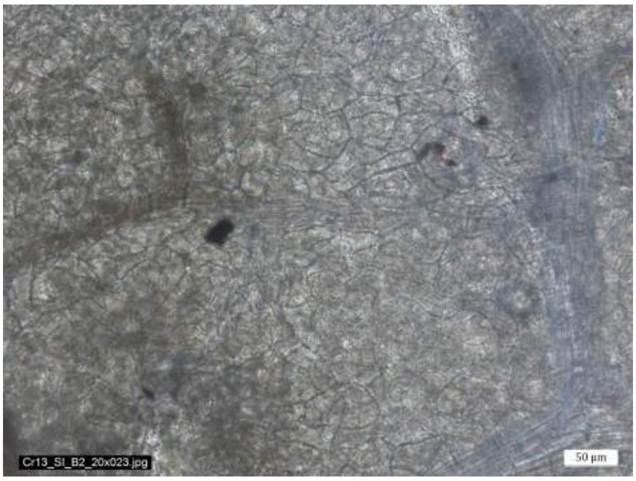
Fragment 7 (7_SI_B1_Cr13)



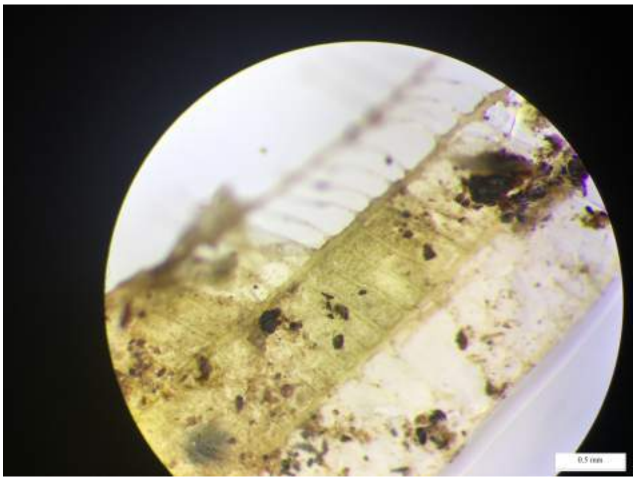


Fragment 8 (8_SI_B2_Cr13)

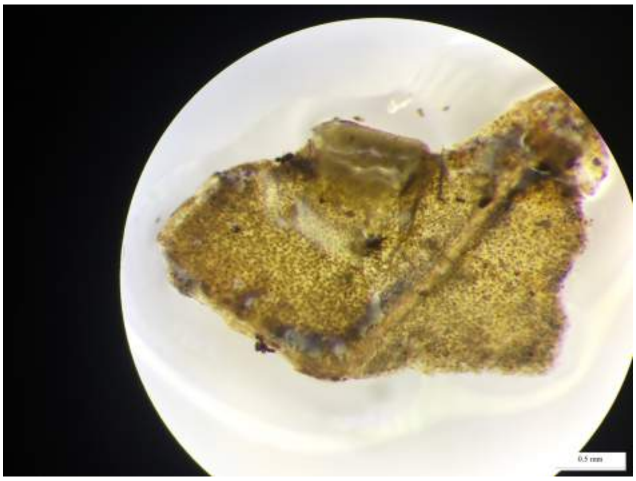


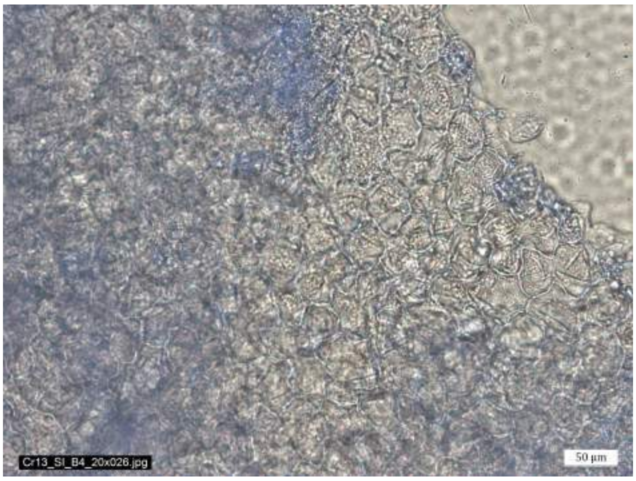


Fragment 9 (9_SI_B3_Cr13)

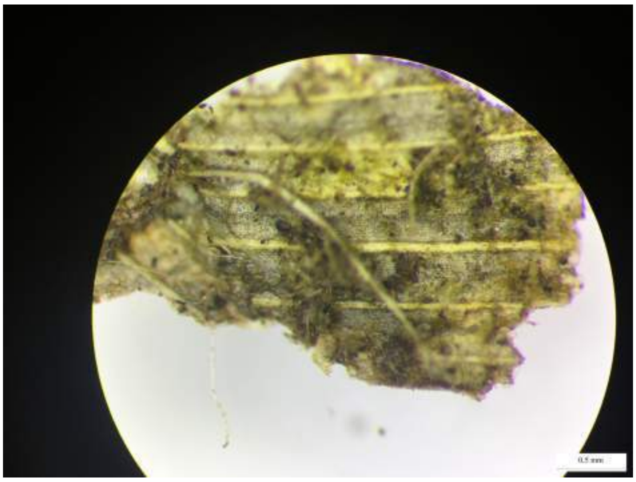


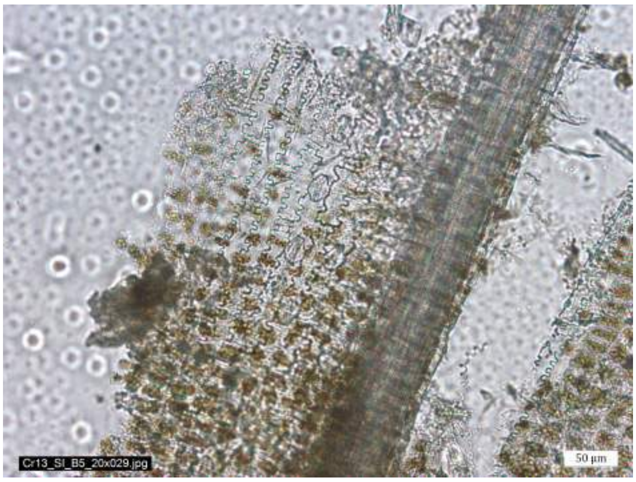
Fragment 10 (10_SI_B4_Cr13) → Inc_46



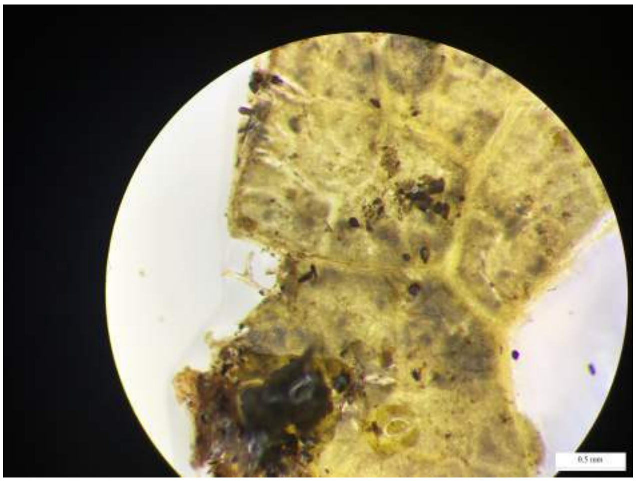


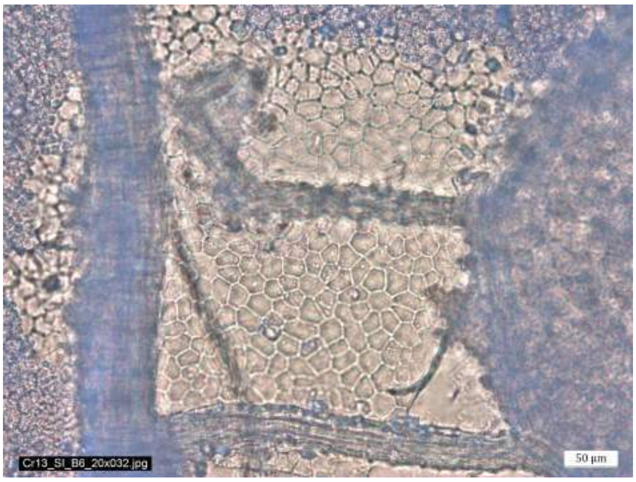
Fragment 11 (11_SI_B5_Cr13) → Inc_47



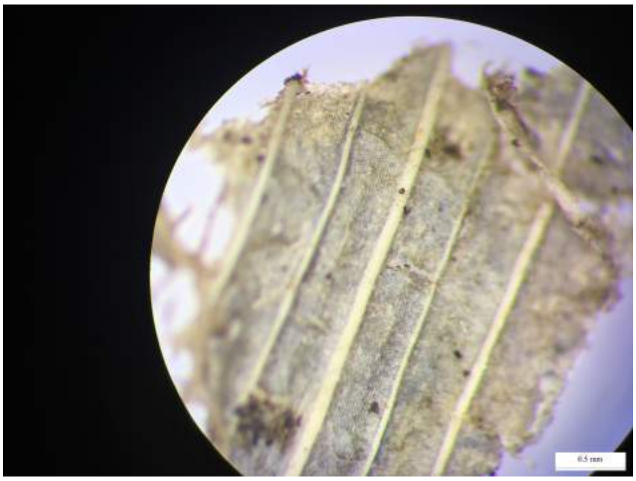
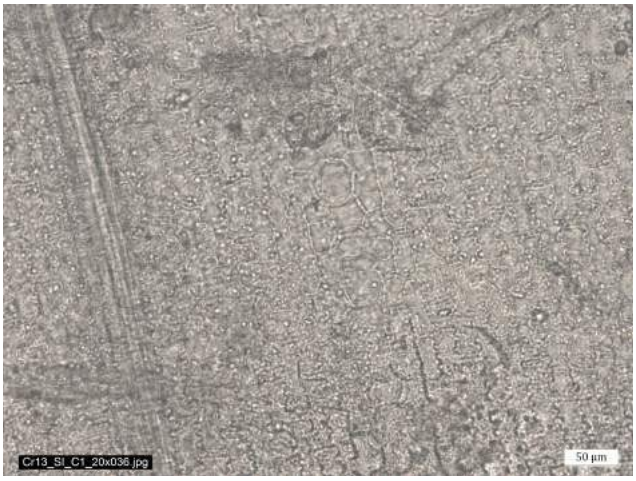


Fragment 12 (12_SI_B6_Cr13) → Inc_48

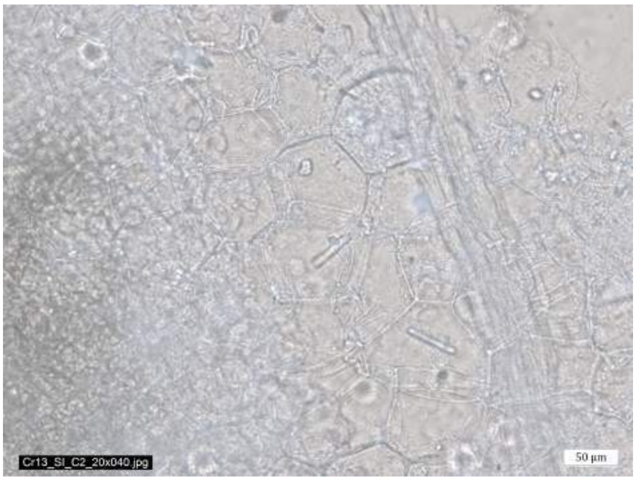




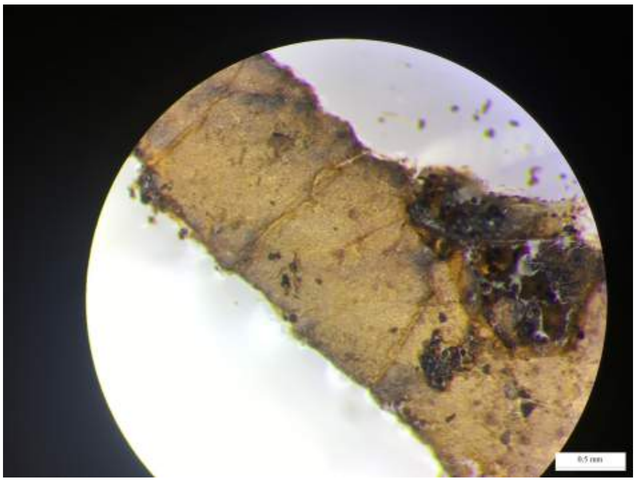
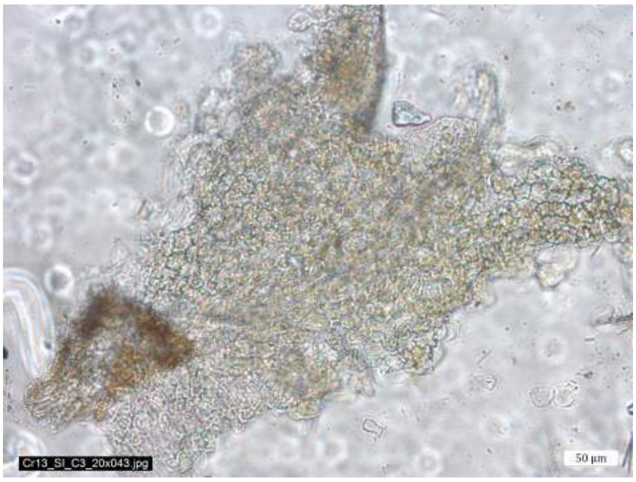
Fragment 13 (13_SI_C1_Cr13) → Inc_49

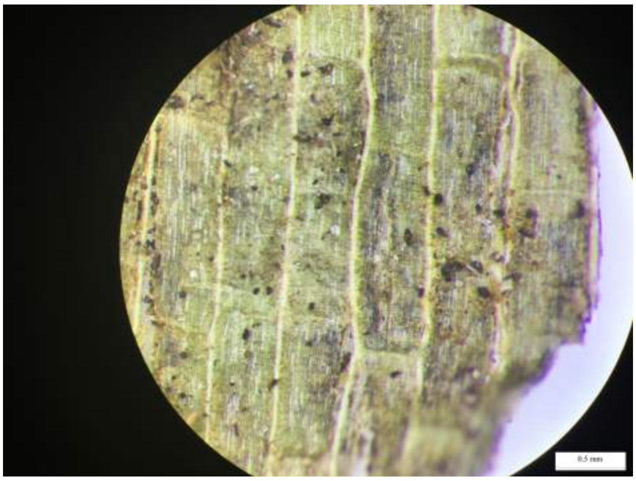
Fragment 14 (14_SI_C2_Cr13)

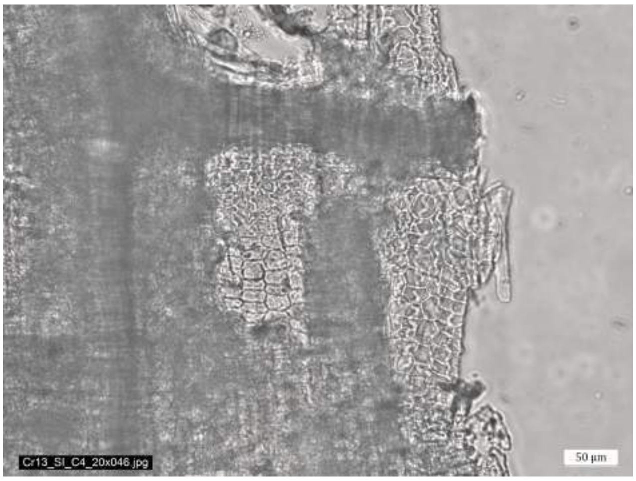



Fragment 15 (15_SI_C3_Cr13) → Inc_50

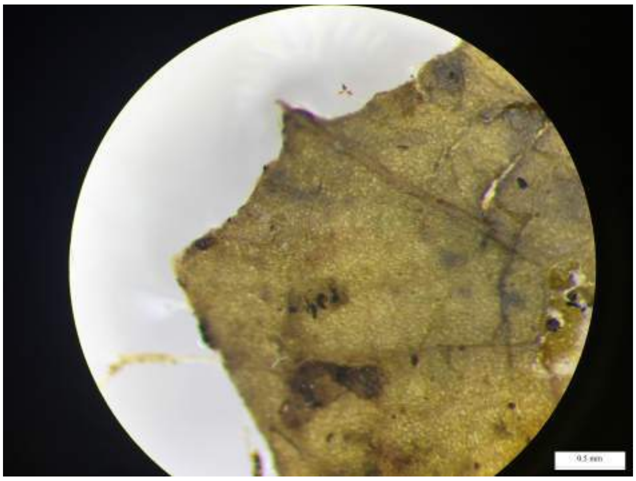



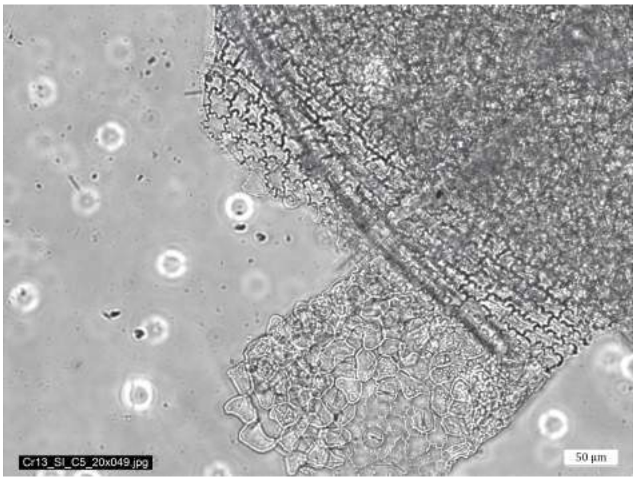
Fragment 16 (16_SI_C4_Cr13)



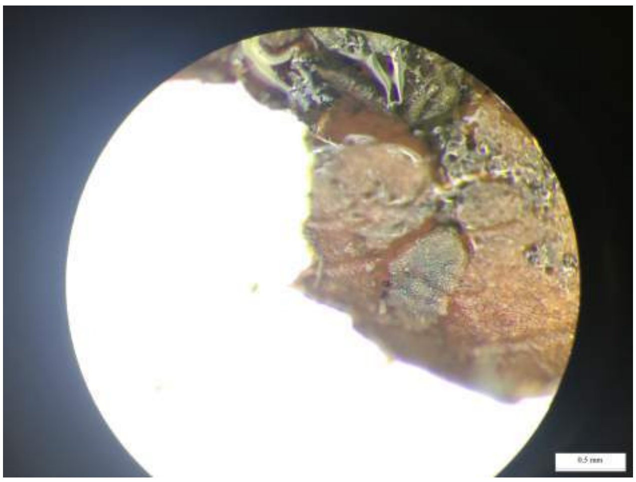


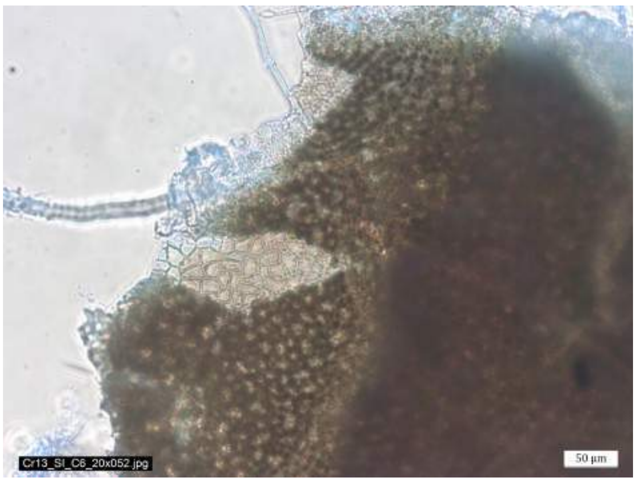
Fragment 17 (17_SI_C5_Cr13)



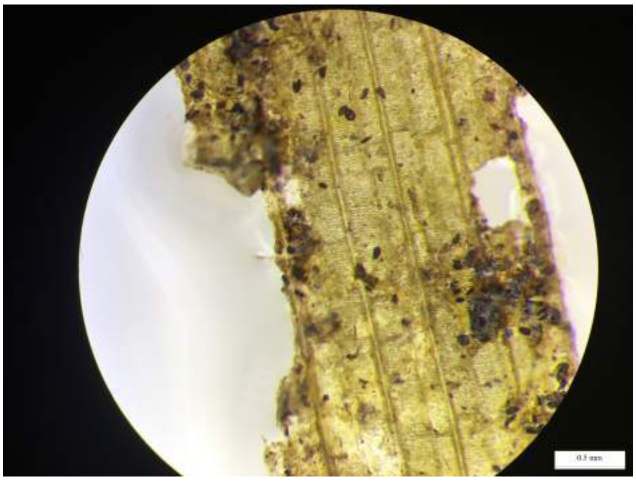


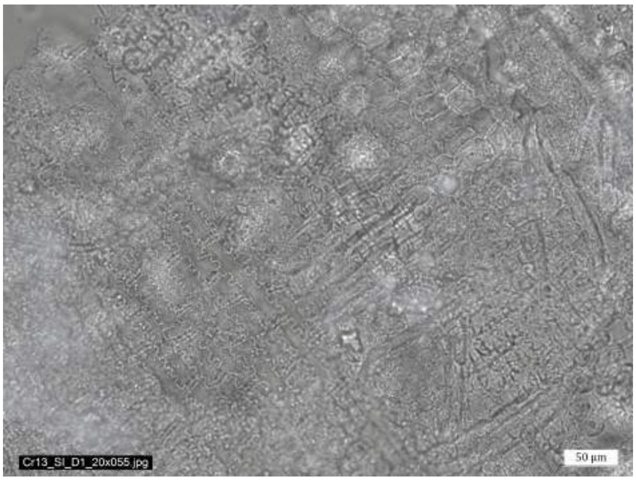
Fragment 18 (18_SI_C6_Cr13) → Inc_51



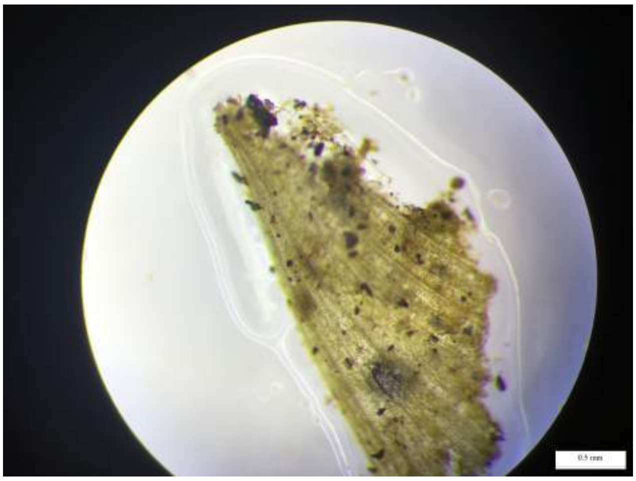


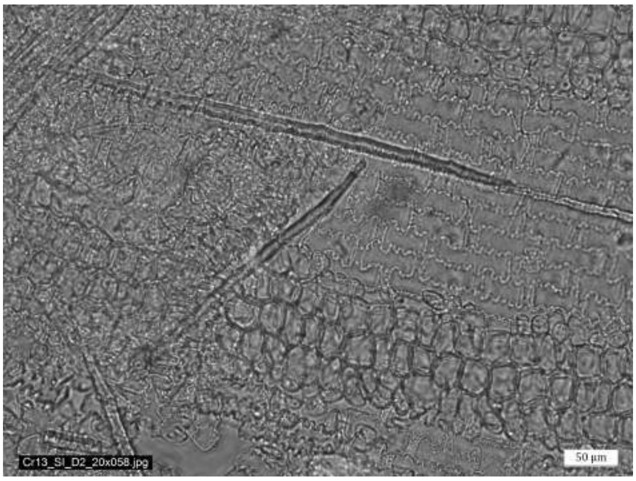
Fragment 19 (19_SI_D1_Cr13)



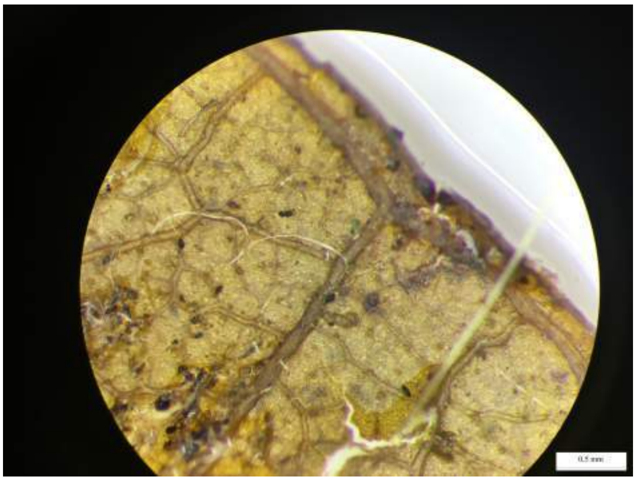


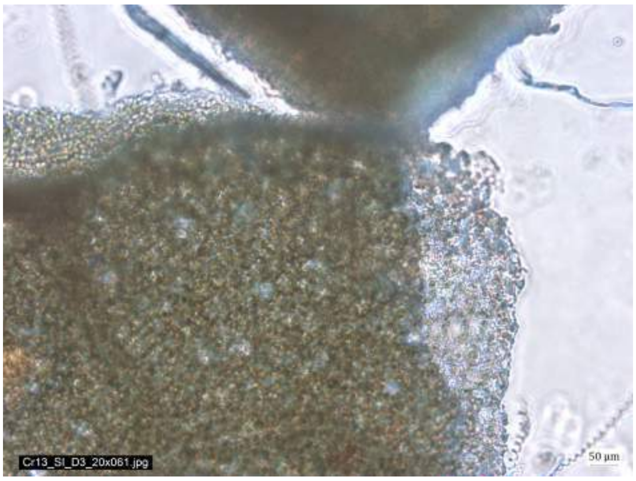
Fragment 20 (20_SI_D2_Cr13)



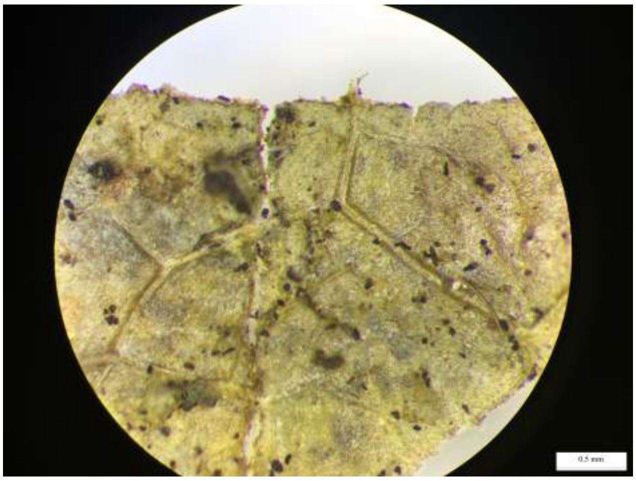


Fragment 21 (21_SI_D3_Cr13)

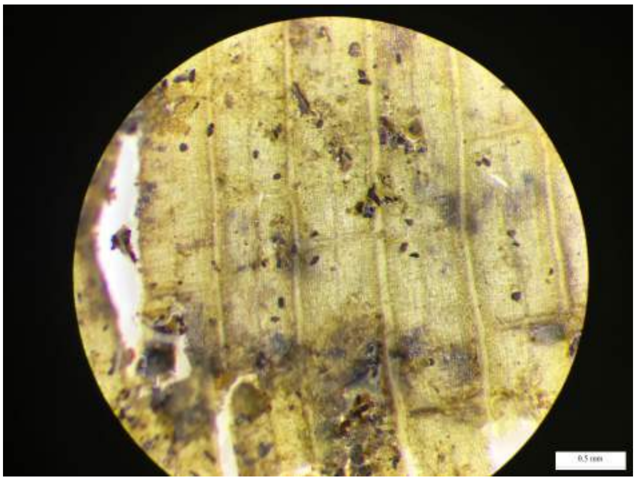




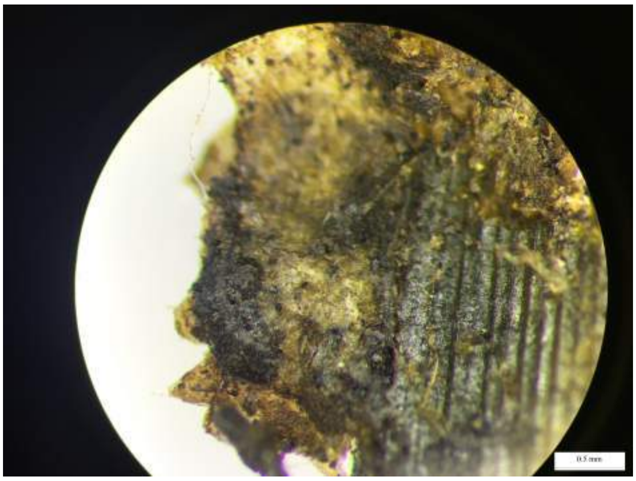
Fragment 22 (22_SI_D4_Cr13) → Inc_52

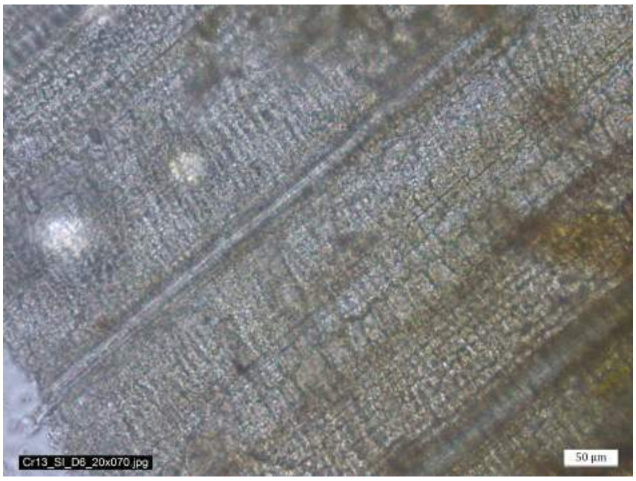


Fragment 23 (23_SI_D5_Cr)

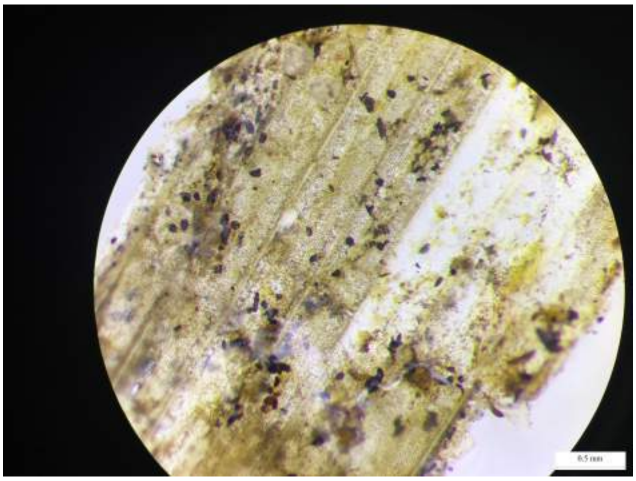


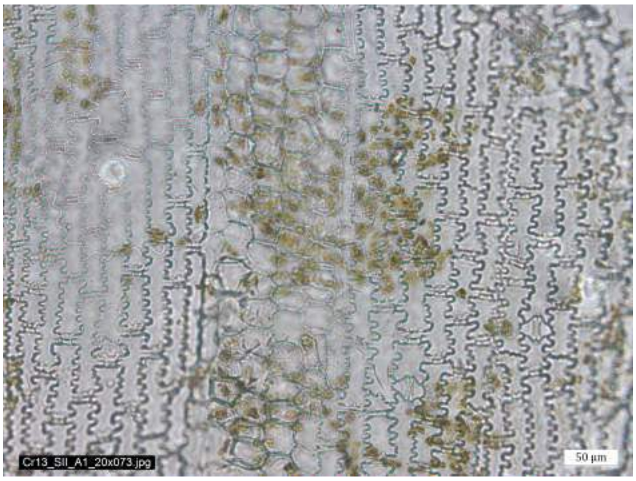
Fragment 24 (24_SI_D6_Cr13)



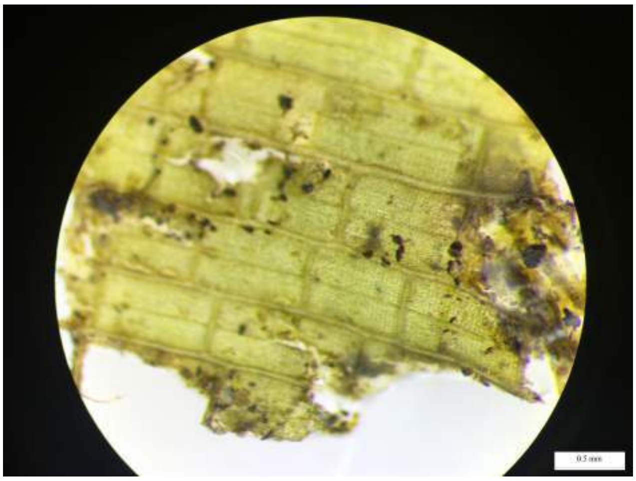


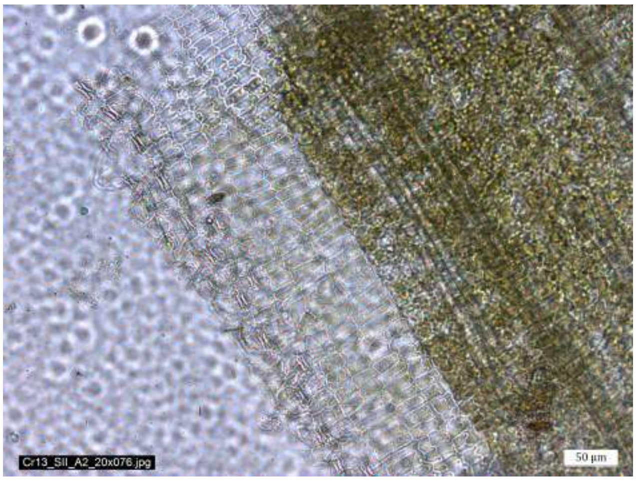
Fragment 25 (25_SII_A1_Cr13)



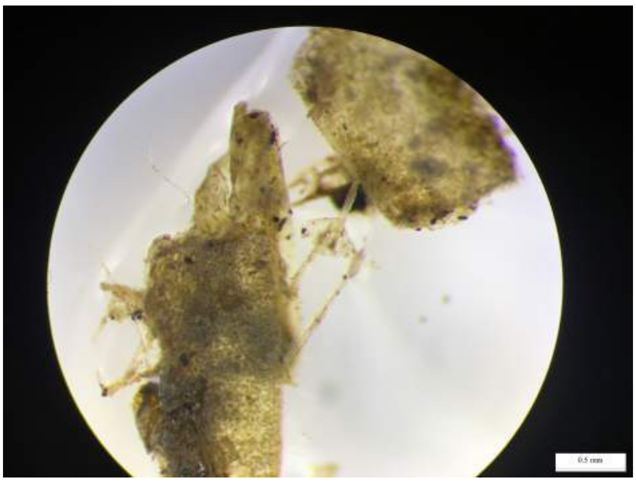


Fragment 26 (26_SII_A2_Cr13)



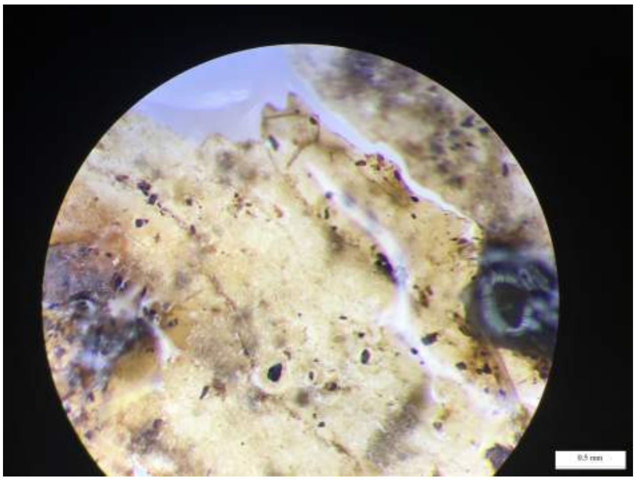


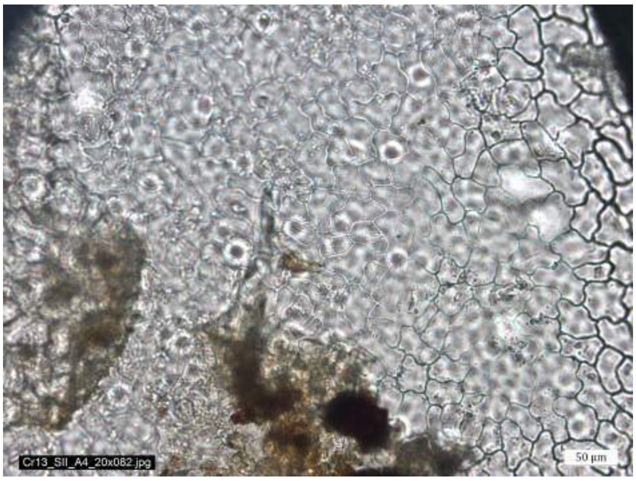
Fragment 27 (27_SII_A3_Cr)



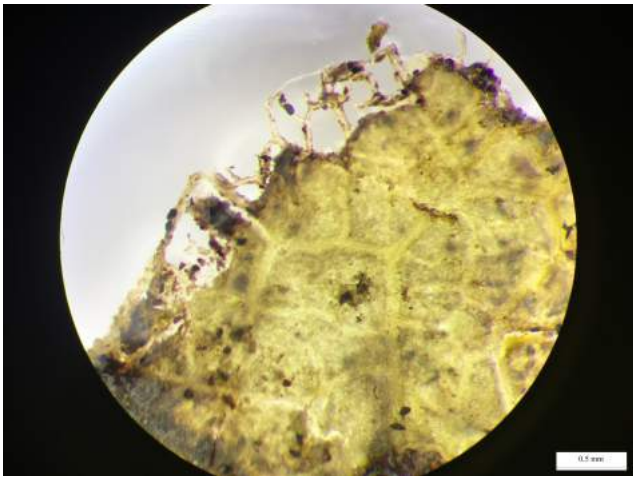
No references

Fragment 28 (28_SII_A4_Cr13) → Inc_53

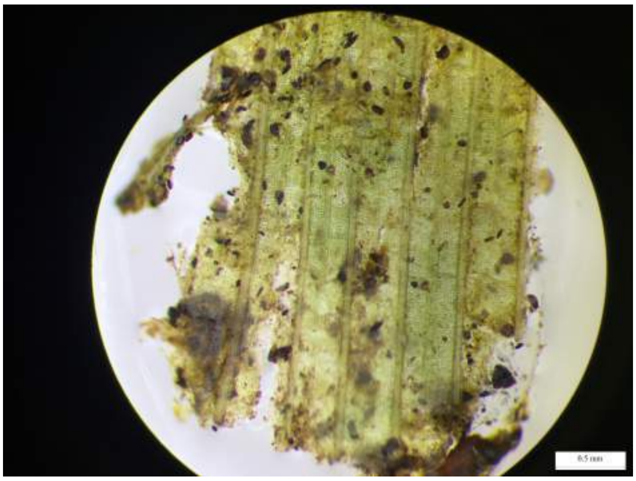


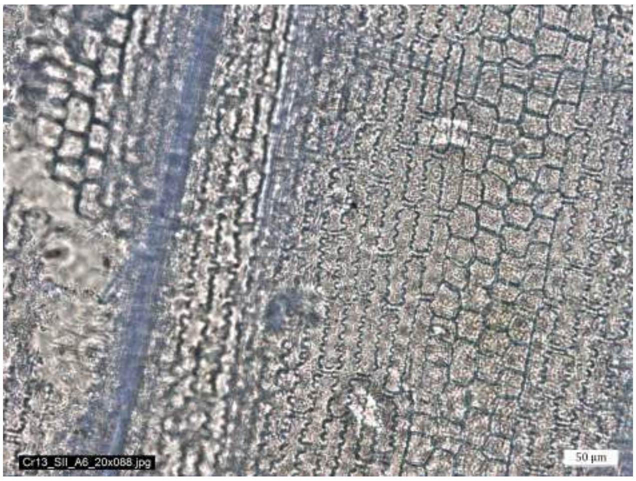


Fragment 29 (29_SII_A5_Cr13)

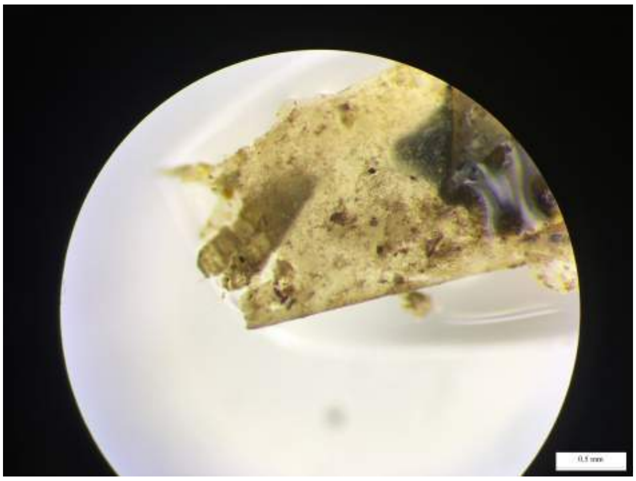


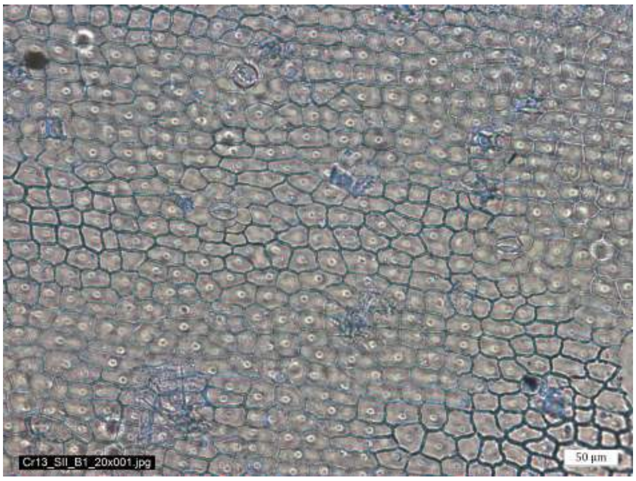
Fragment 30 (30_SII_A6_Cr13)



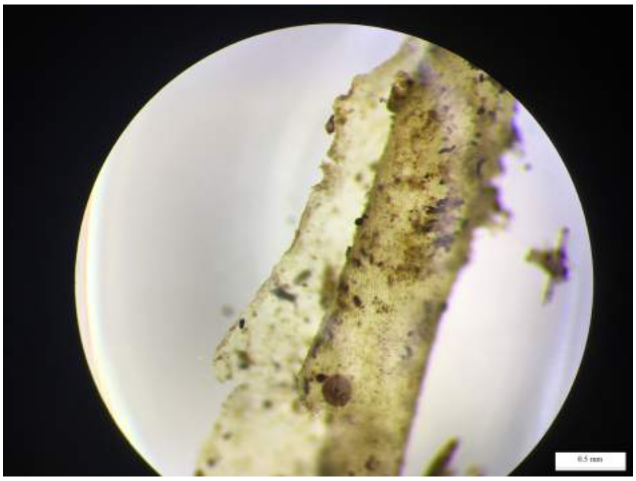


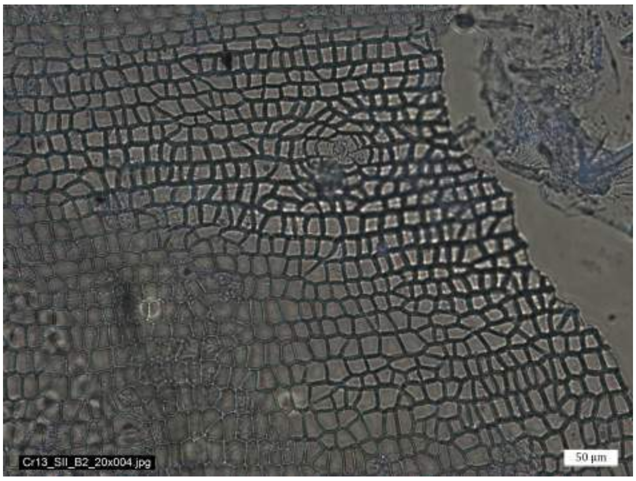
Fragment 31 (31_SII_B1_Cr13)



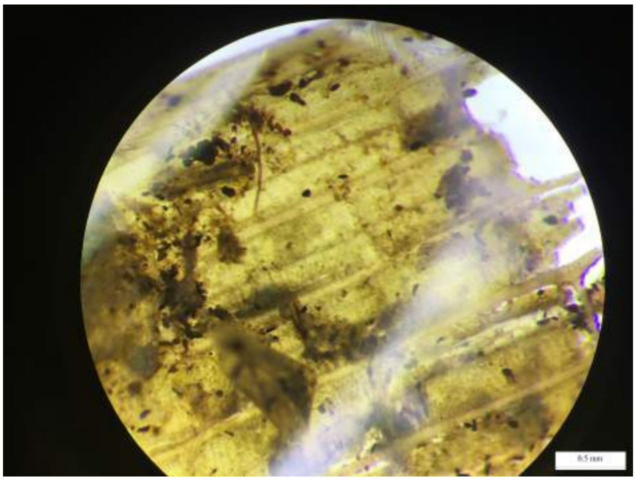


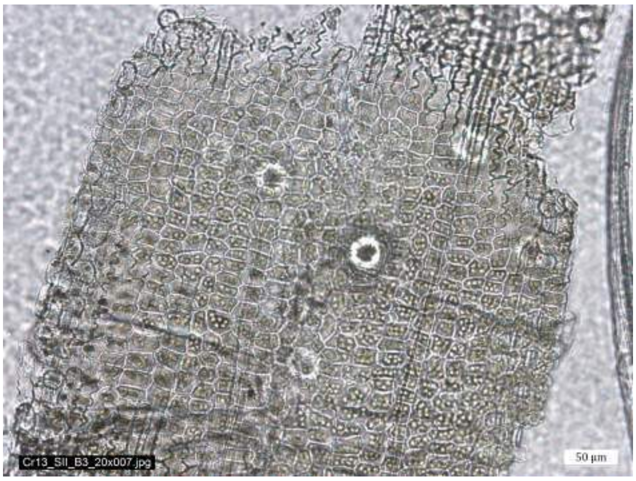
Fragment 32 (32_SII_B2_Cr13) → Inc_54



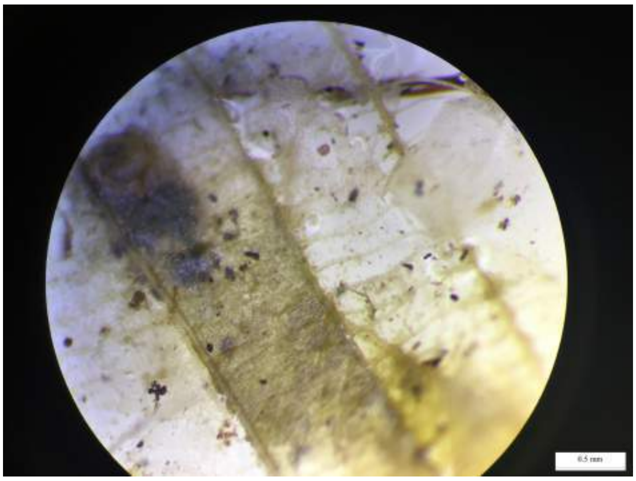


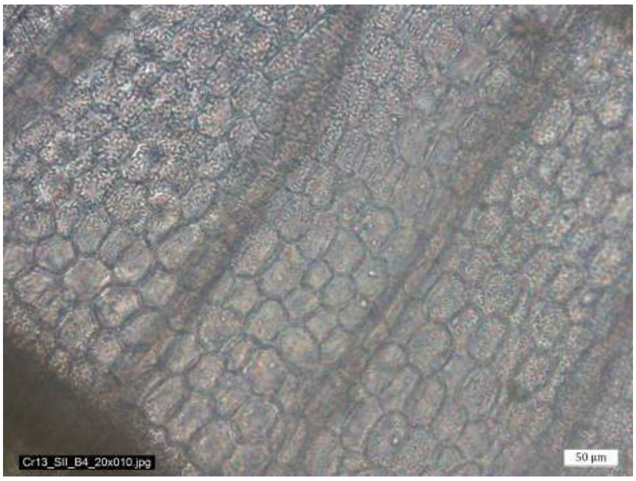
Fragment 33 (33_SII_B3_Cr13)



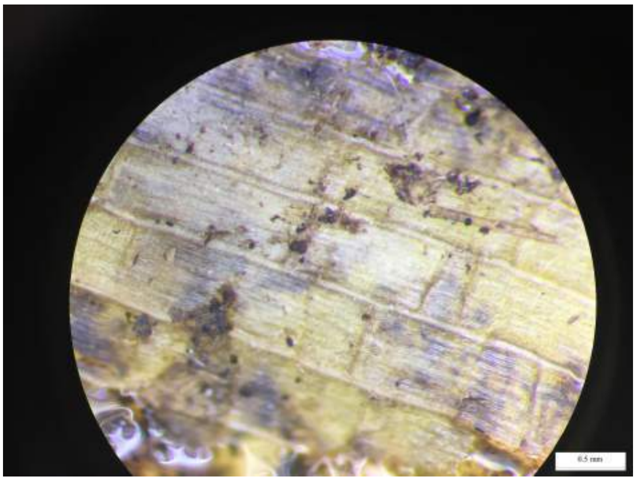


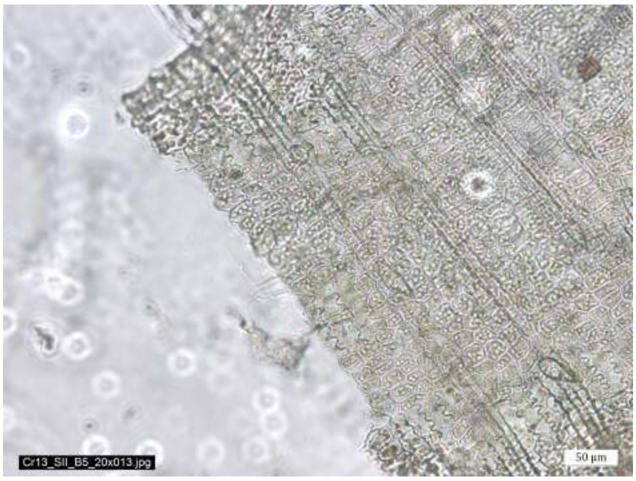
Fragment 34 (34_SII_B4_Cr13)



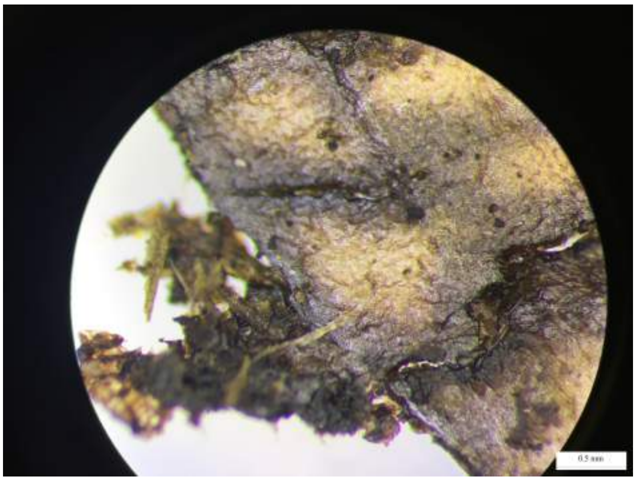


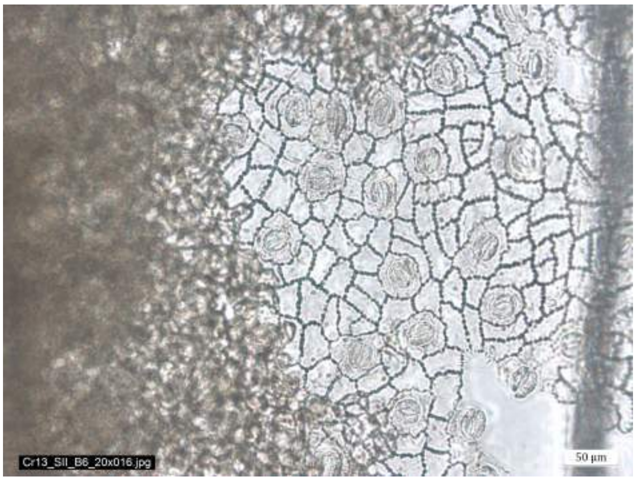
Fragment 35 (5_SII_B5_Cr13)



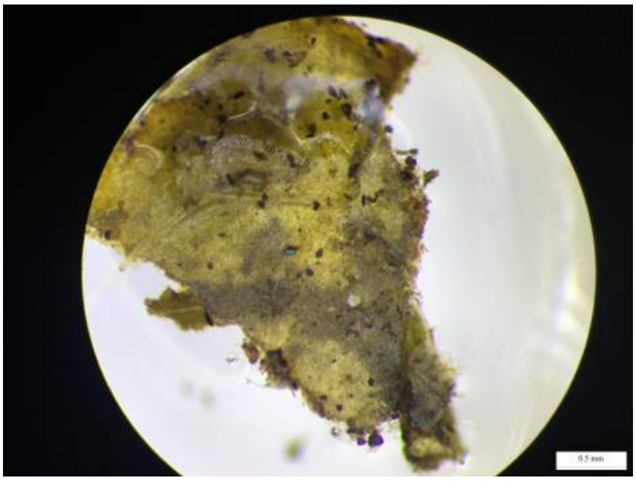


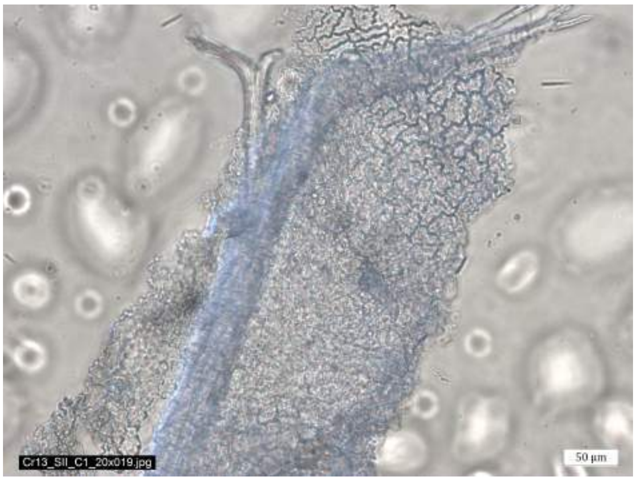
Fragment 36 (36_SII_B6_Cr13) → Inc_55



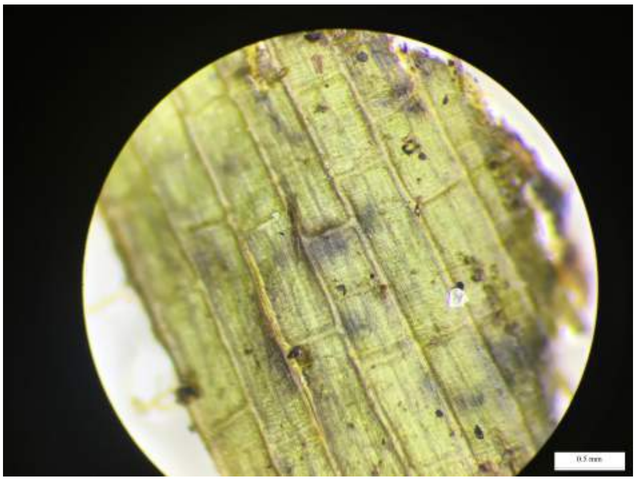


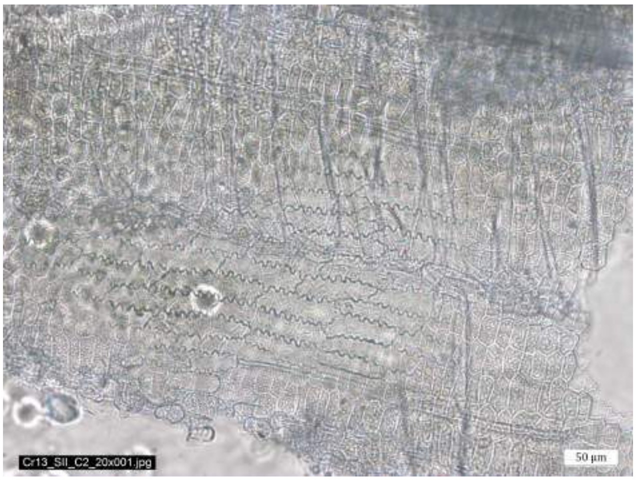
Fragment 37 (37_SII_C1_Cr13)



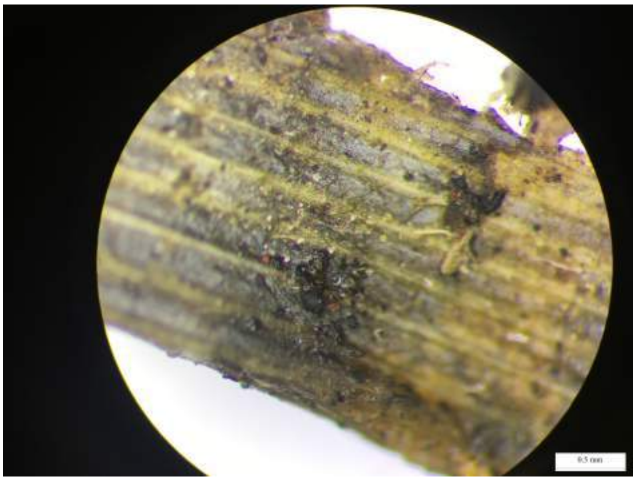


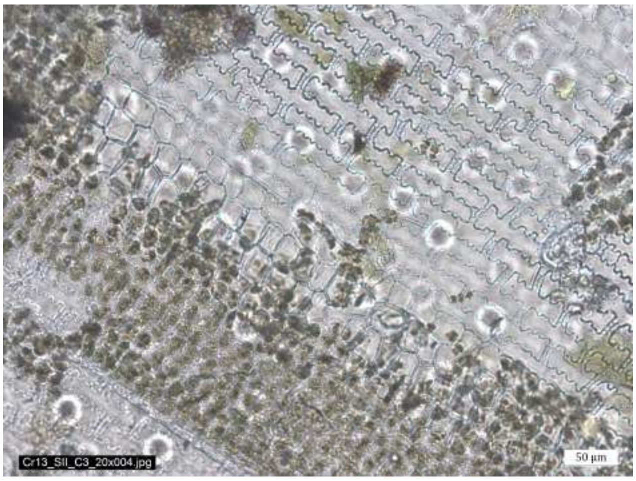
Fragment 38 (38_SII_C2_Cr13)



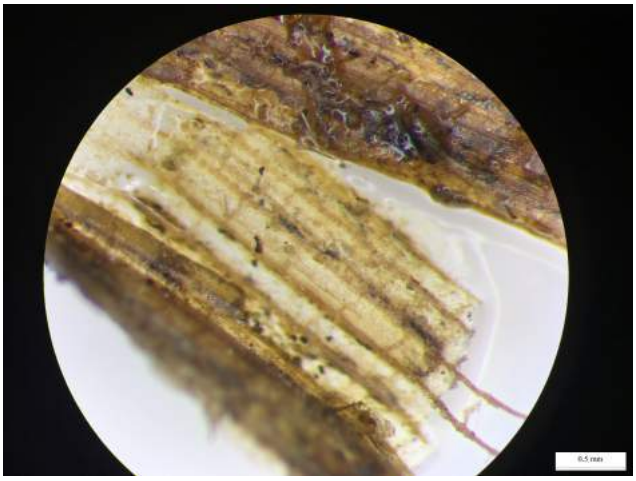


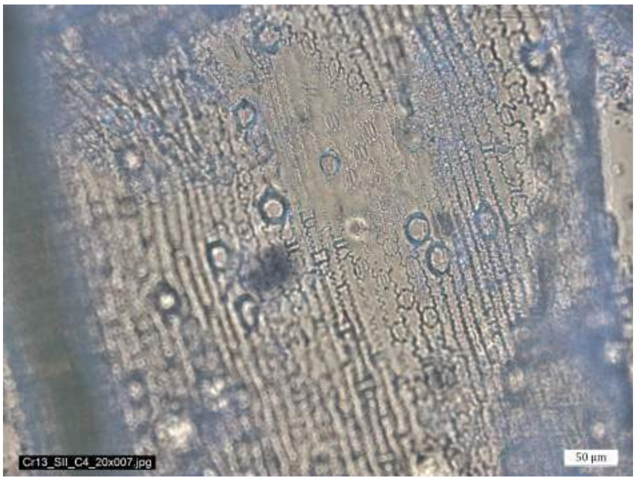
Fragment 39 (39_SII_C3_Cr13)



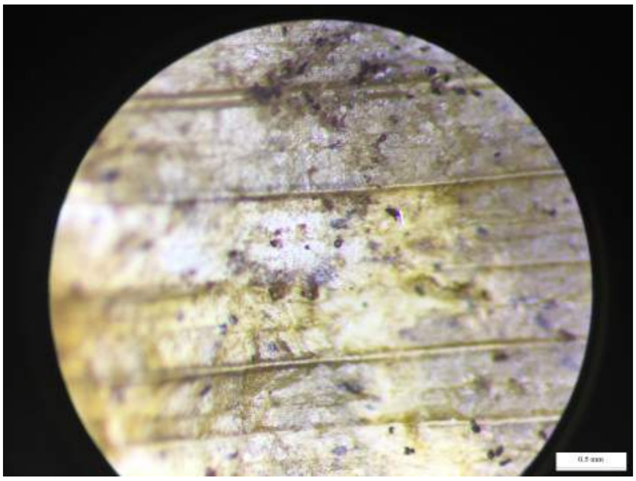


Fragment 40 (40_SII_C4_Cr13)

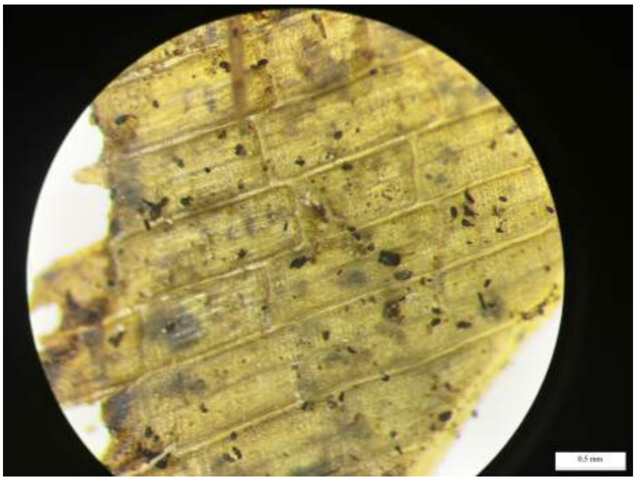


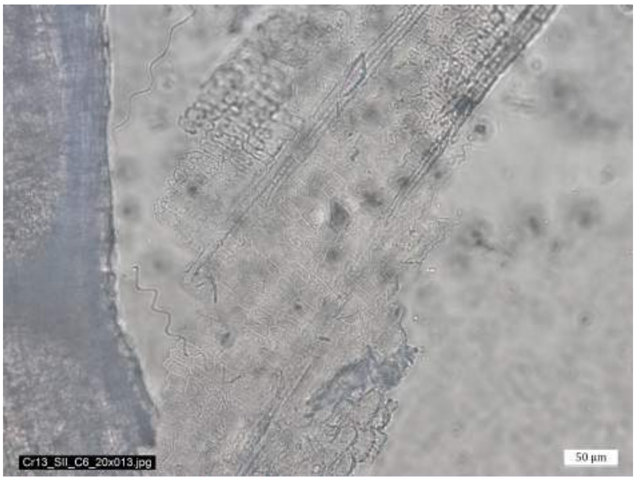


Fragment 41 (41_SII_C5_Cr13)

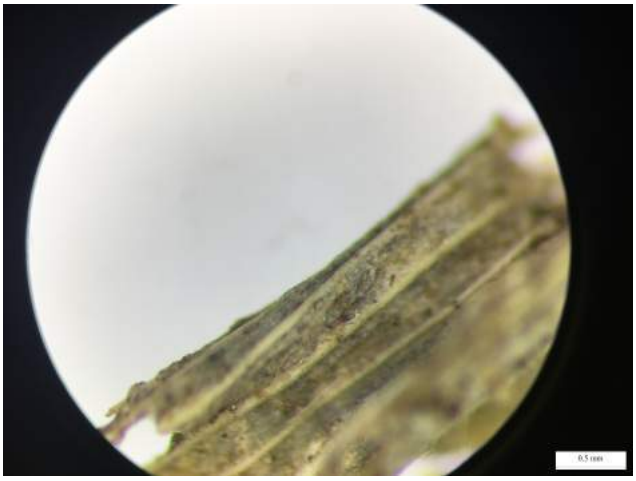


Fragment 42 (42_SII_C6_Cr13)

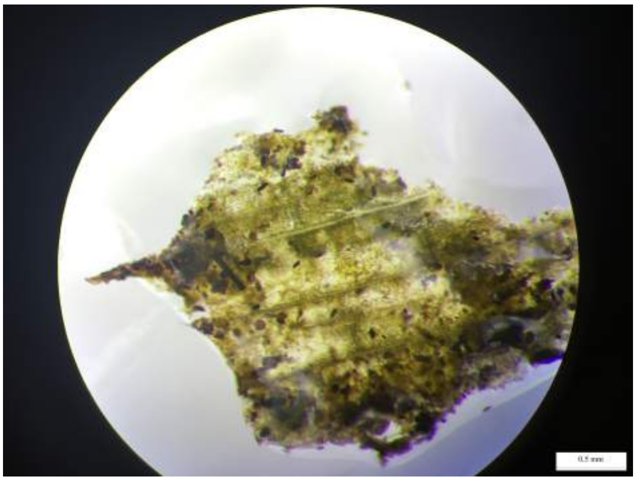


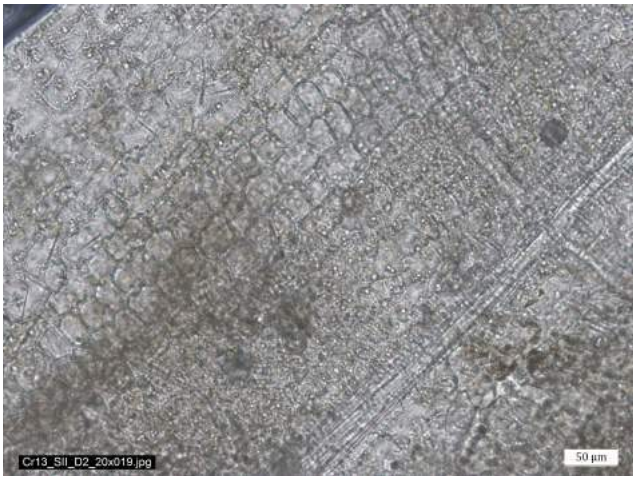


Fragment 43 (43_SII_D1_Cr13)

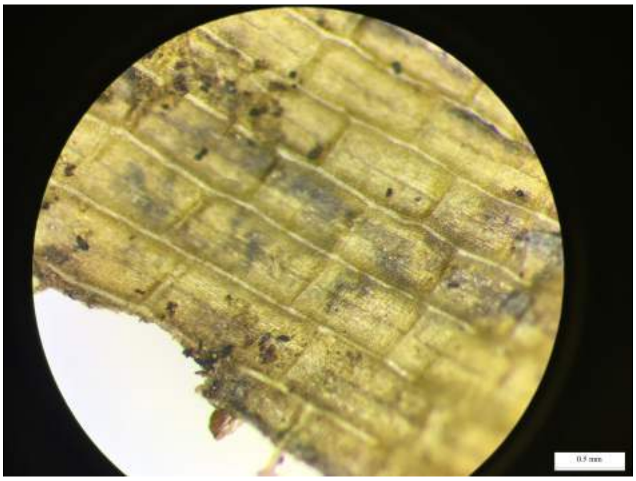


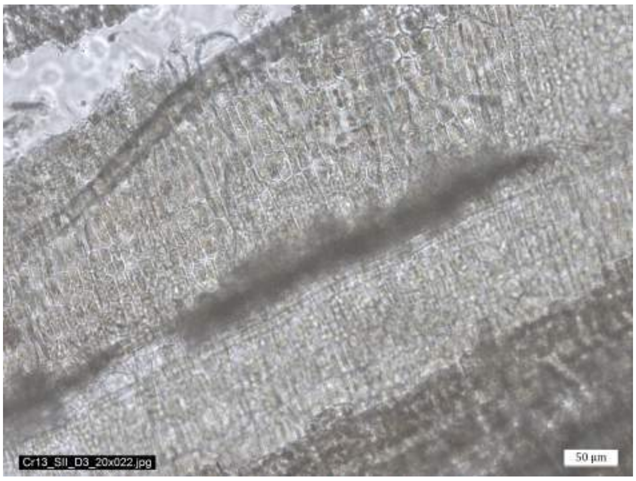
Fragment 44 (44_SII_D2_Cr13)



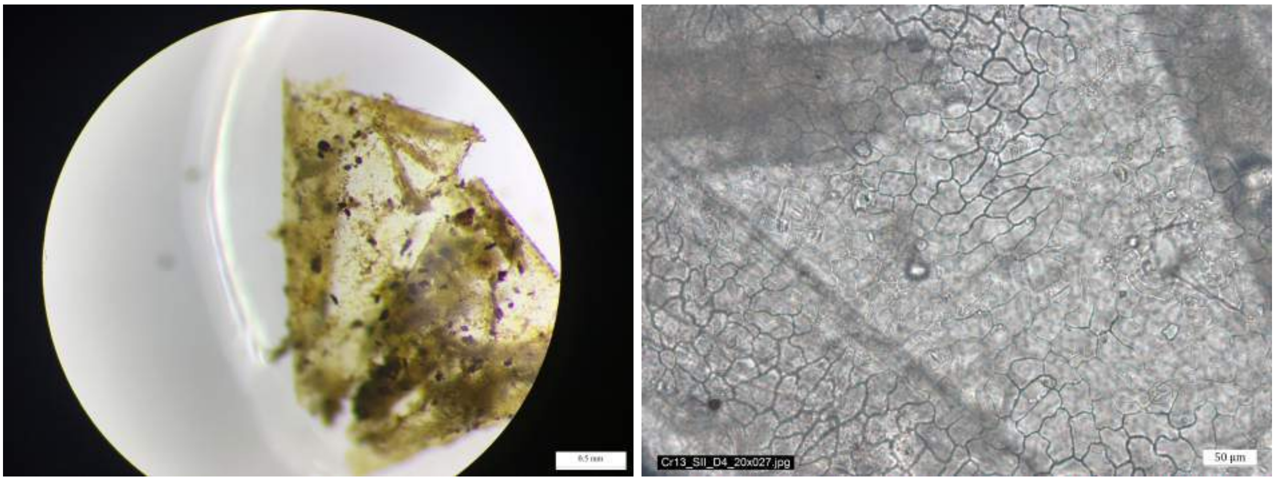


Fragment 45 (45_SII_D3_Cr13)

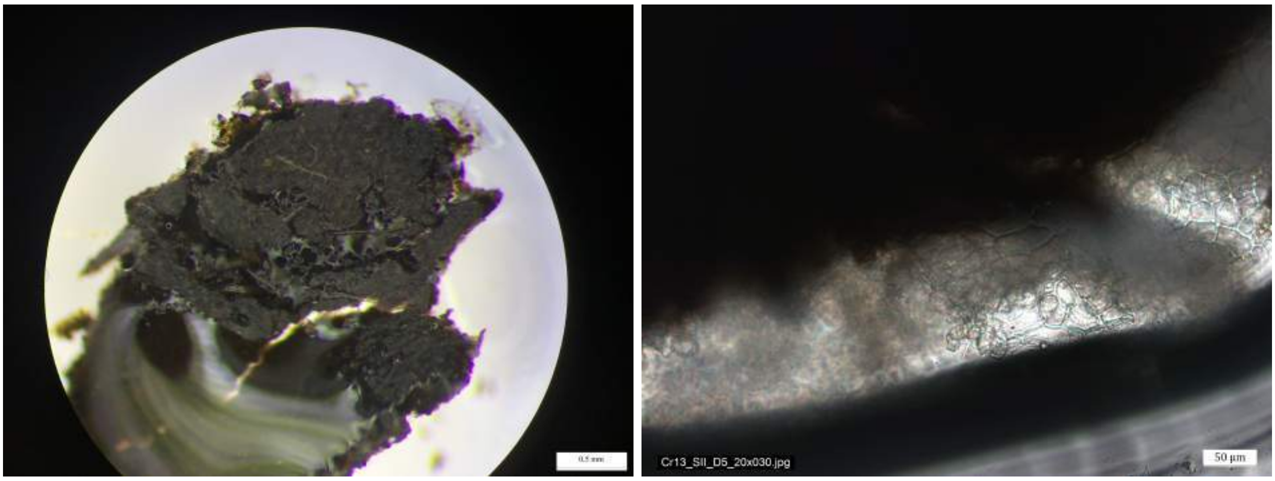




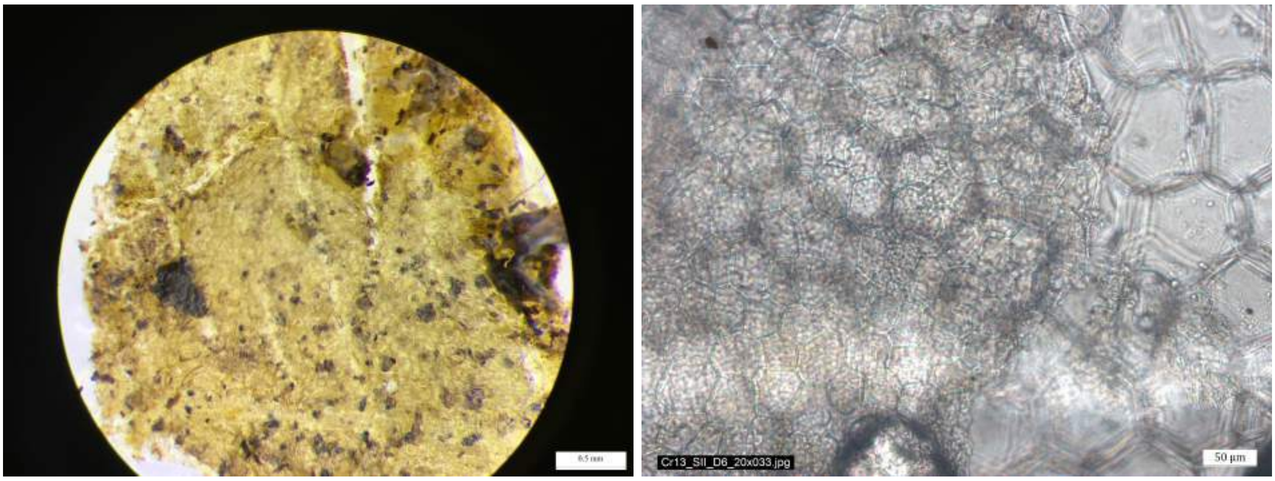
Fragment 46 (46_SII_D4_Cr13)



Fragment 47 (47_SII_D5_Cr13)

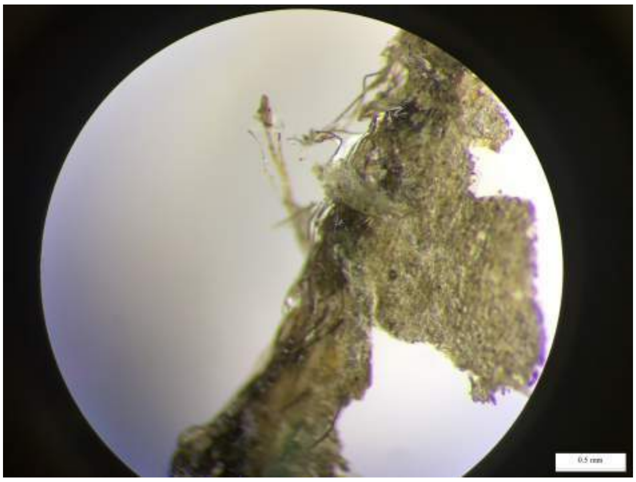


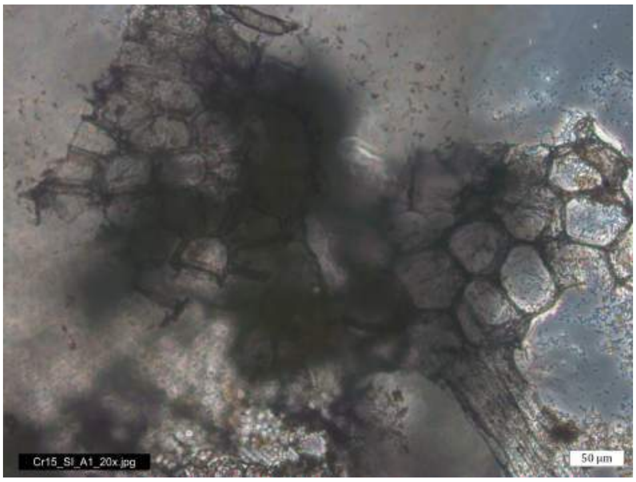
Fragment 48 (48_SII_D6_Cr13)



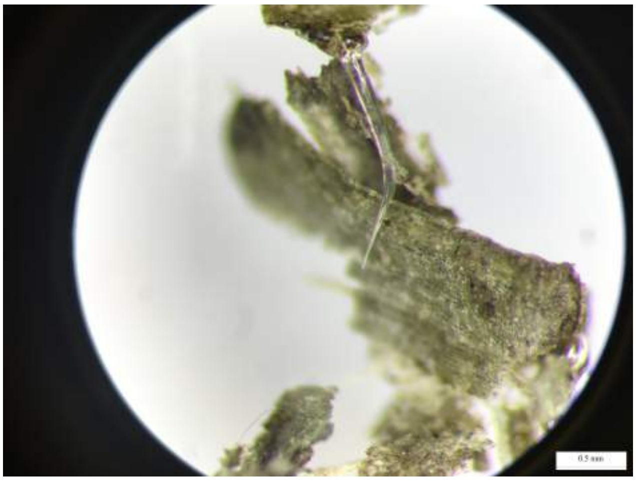
Fragments of the Faece 5

Fragment 1 (1_SI_A1_Cr15) → Inc_56



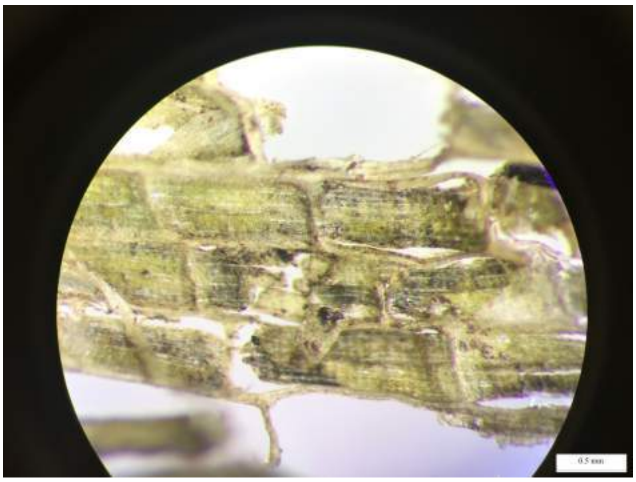


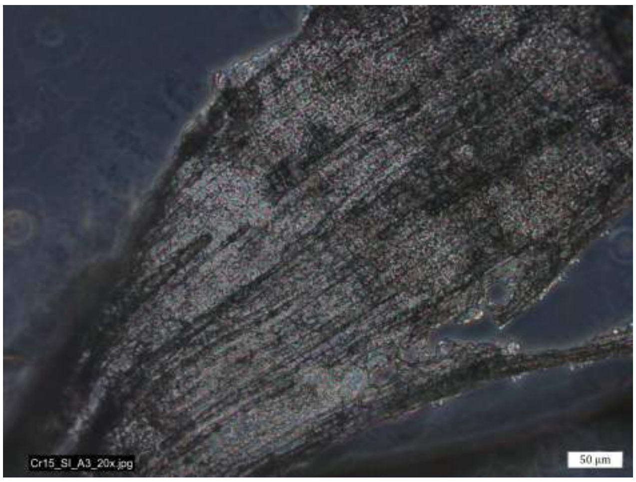
Fragment 2 (2_SI_A2_Cr15)



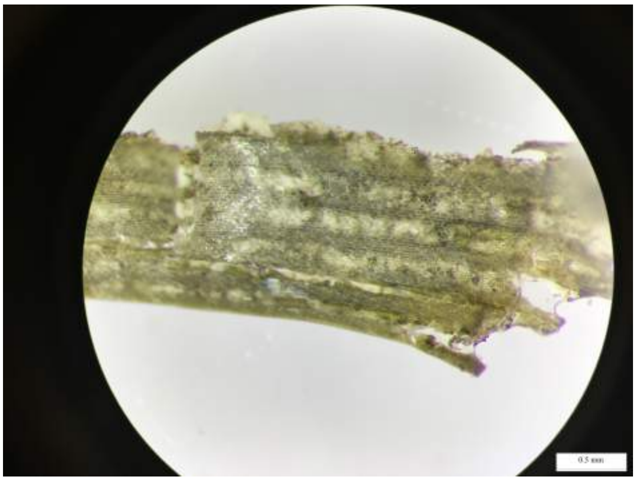
No references

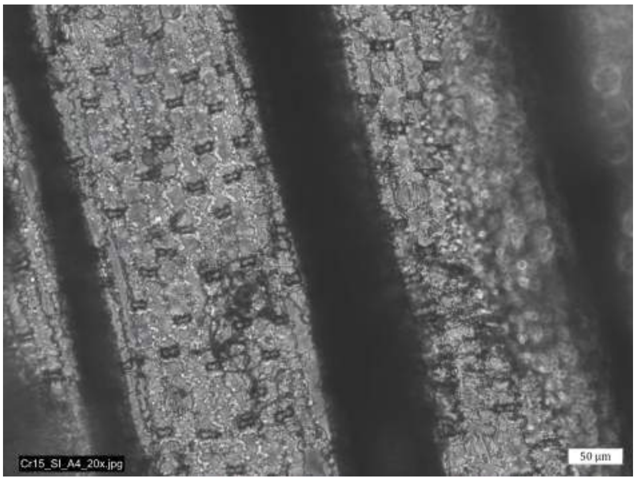
Fragment 3 (3_SI_A3_Cr15) → Inc_57



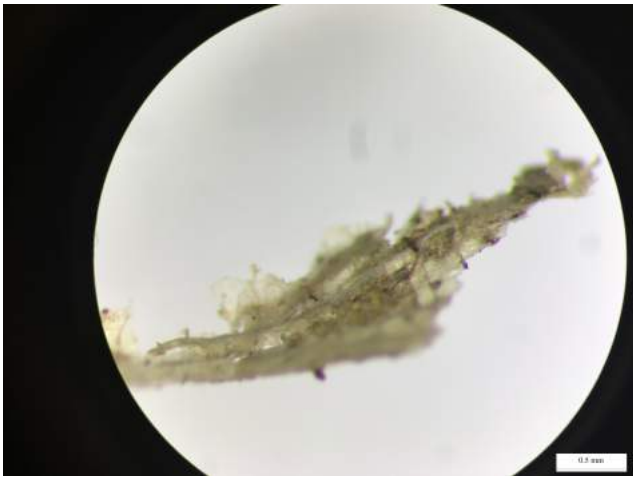


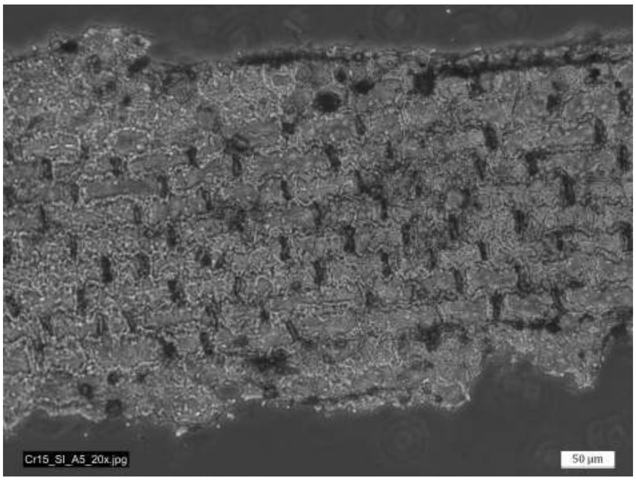
Fragment 4 (4_SI_A4_Cr15)



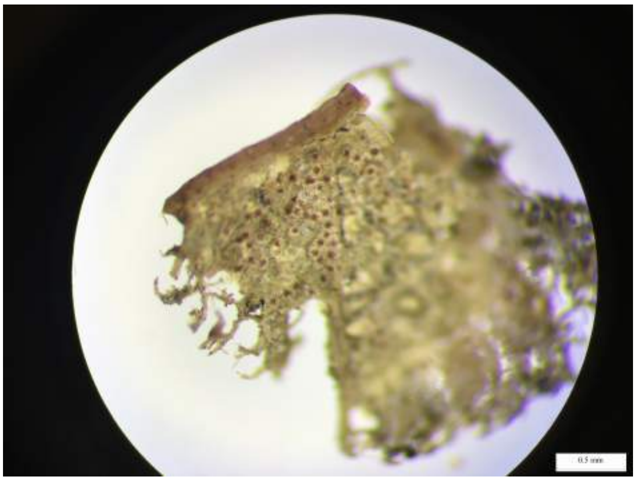


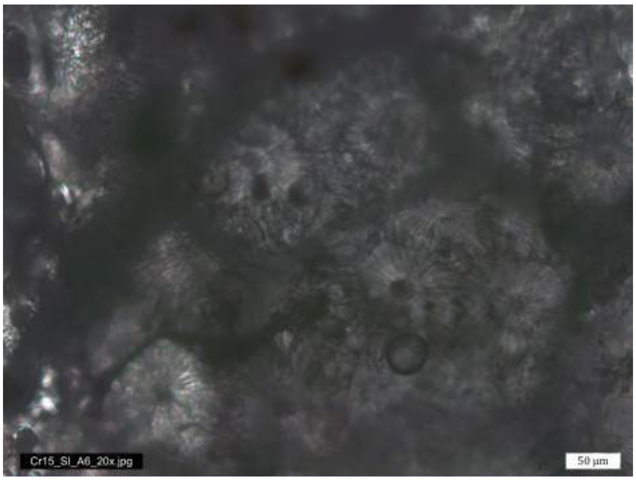
Fragment 5 (5_SI_A5_Cr15)



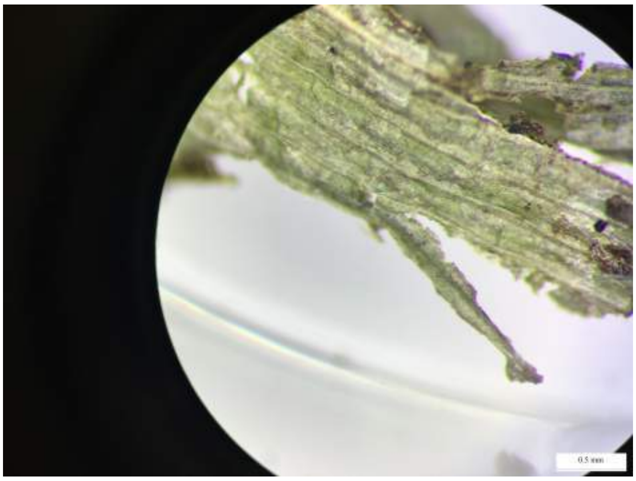


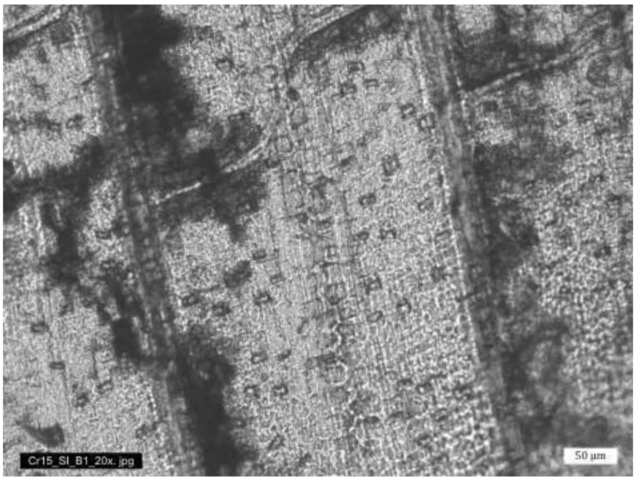
Fragment 6 (6_SI_A6_Cr15) → Inc_58



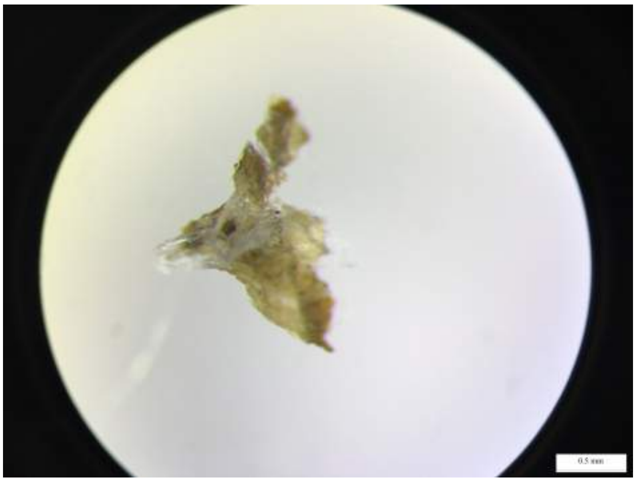


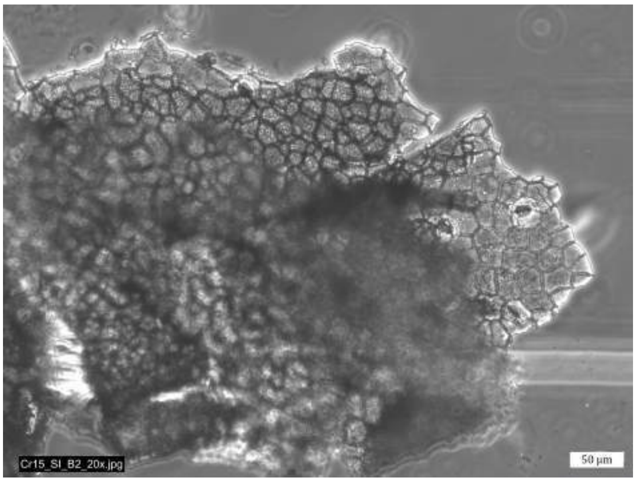
Fragment 7 (7_SI_B1_Cr15) → Inc_59



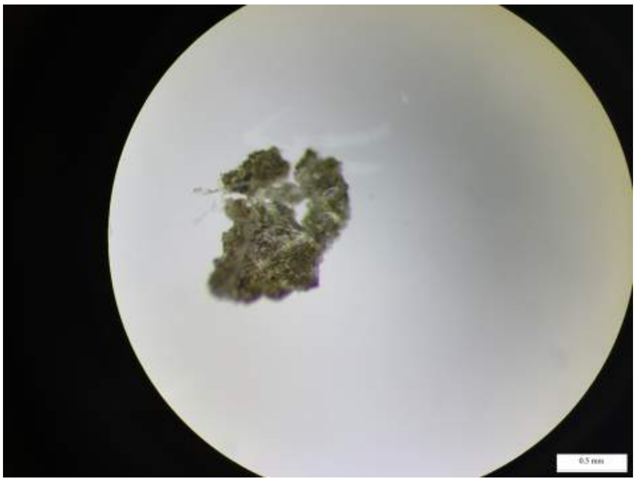


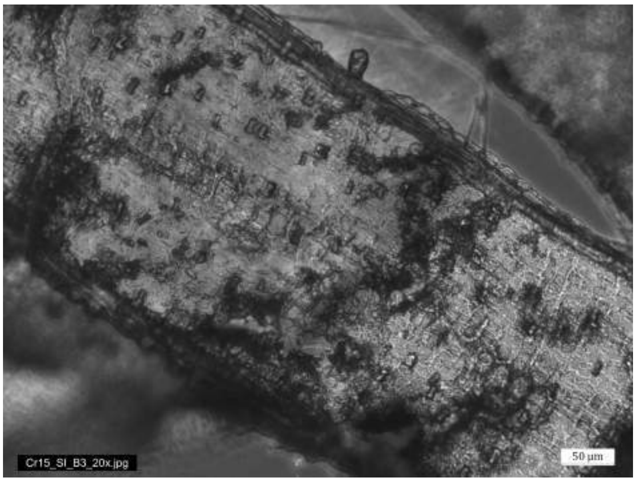
Fragment 8 (8_SI_B2_Cr15) → Inc_60



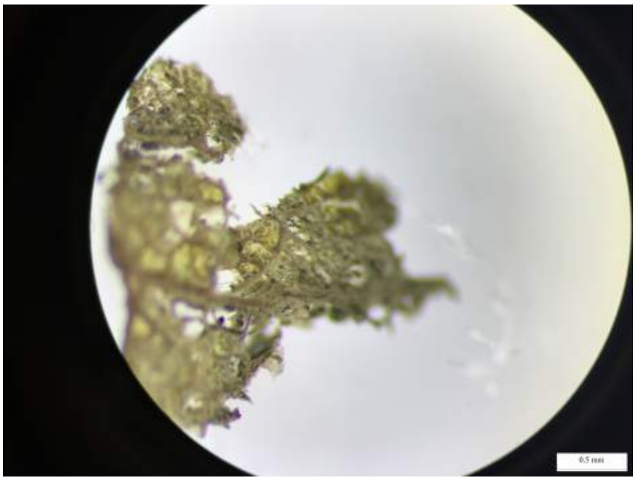


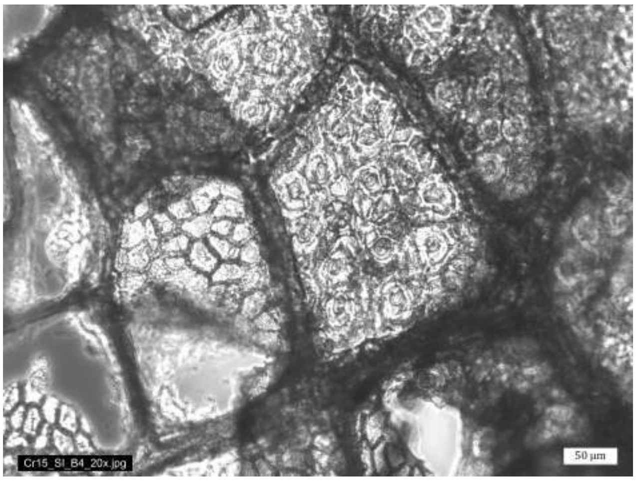
Fragment 9 (9_SI_B3_Cr15)



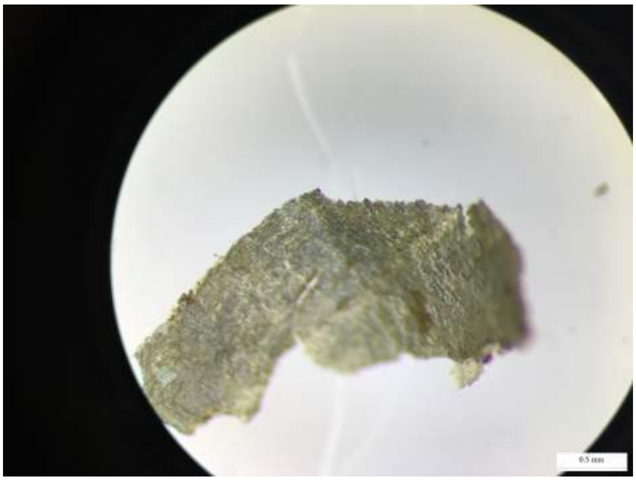


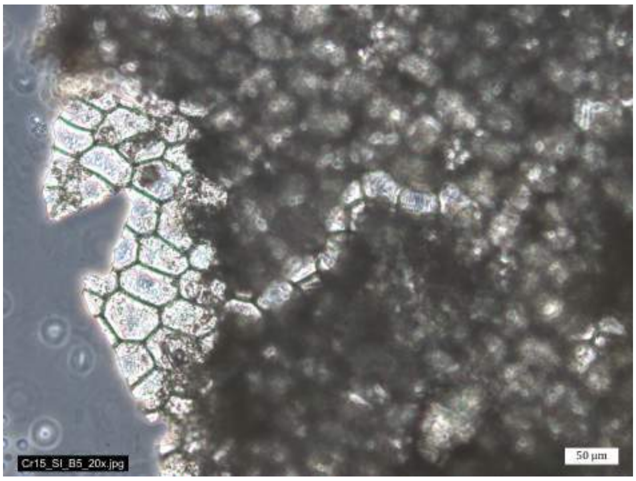
Fragment 10 (10_SI_B4_Cr15)



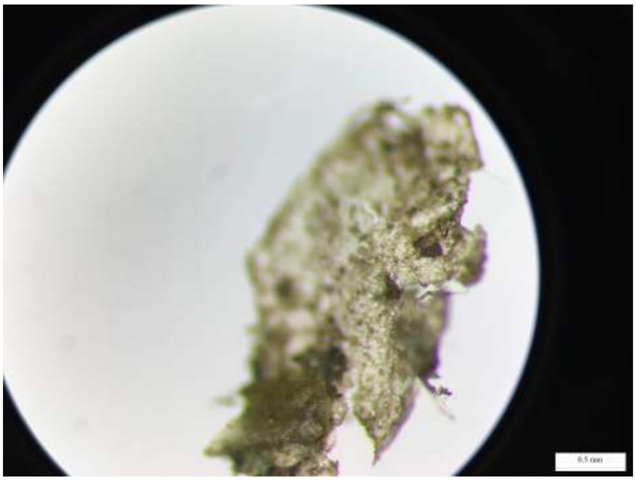


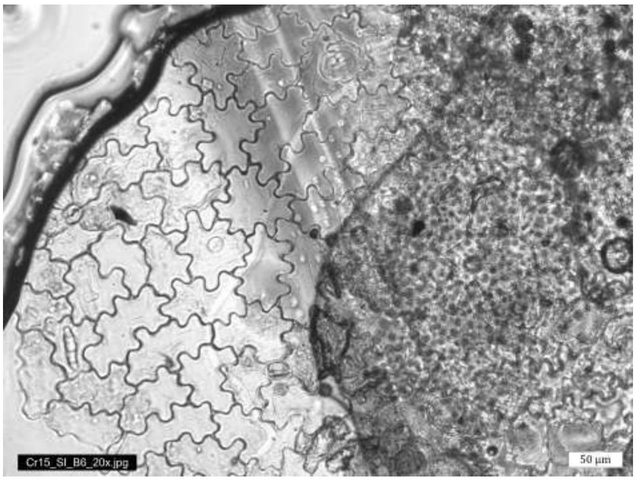
Fragment 11 (11_SI_B5_Cr15)



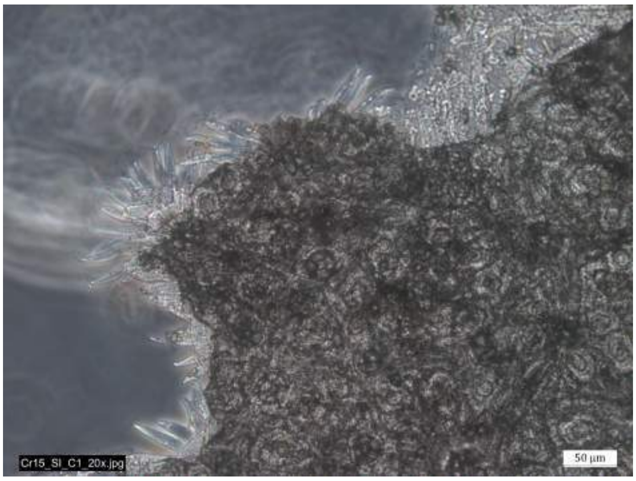


Fragment 12 (12_SI_B6_Cr15) → Inc_61

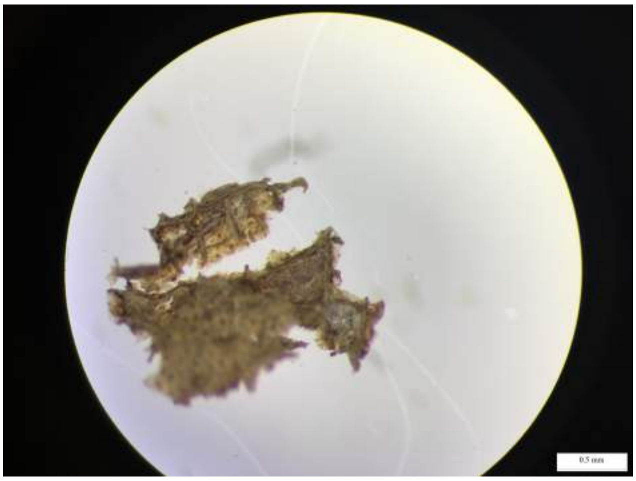


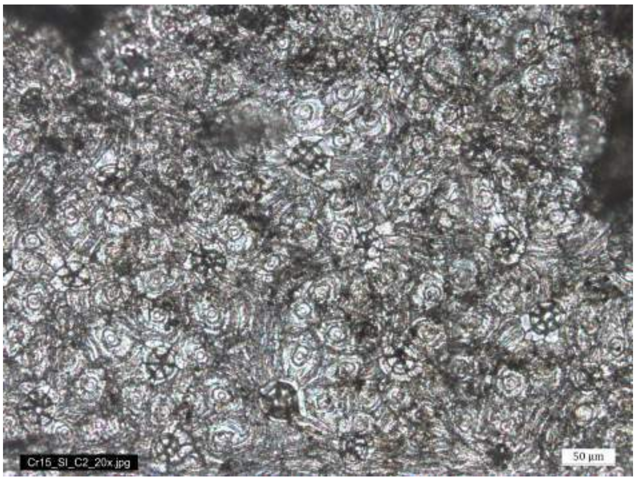


Fragment 13 (13_SI_C1_Cr15)

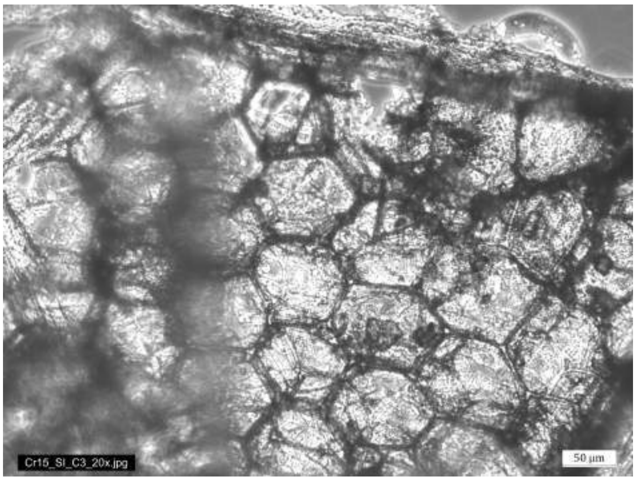


Fragment 14 (14_SI_C2_Cr15)

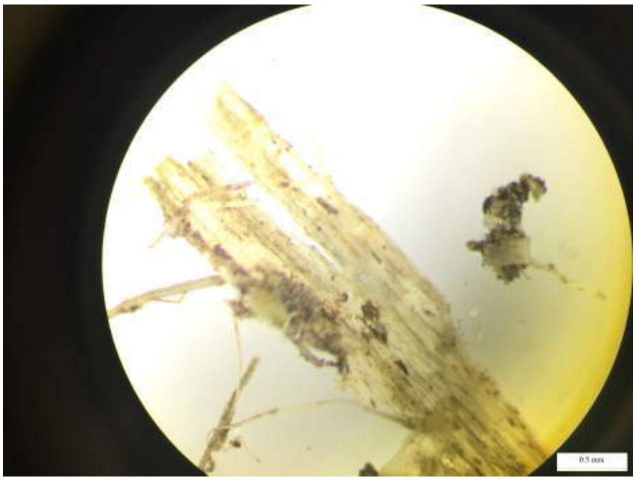
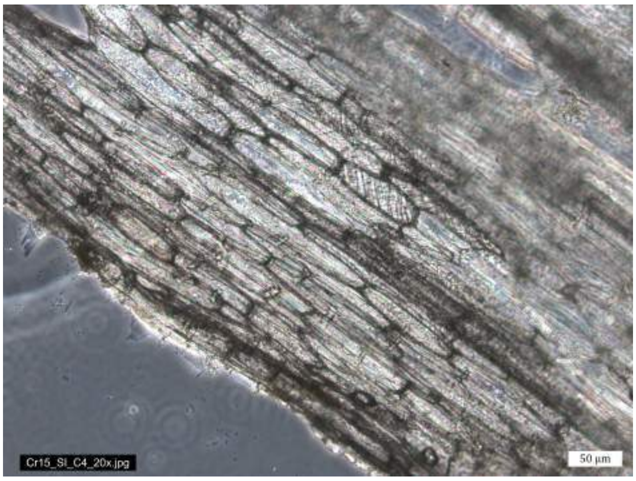




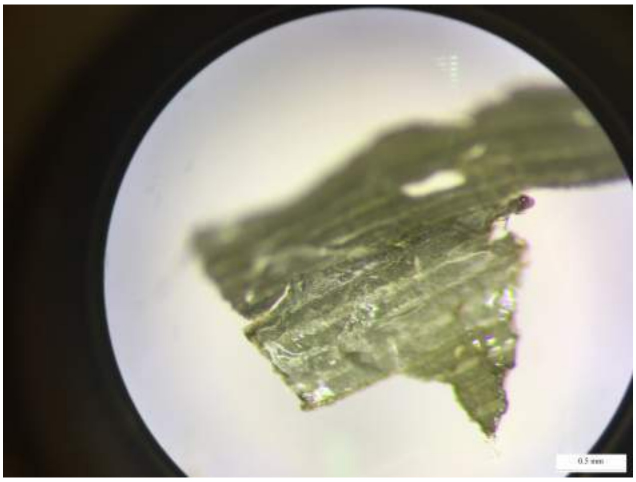
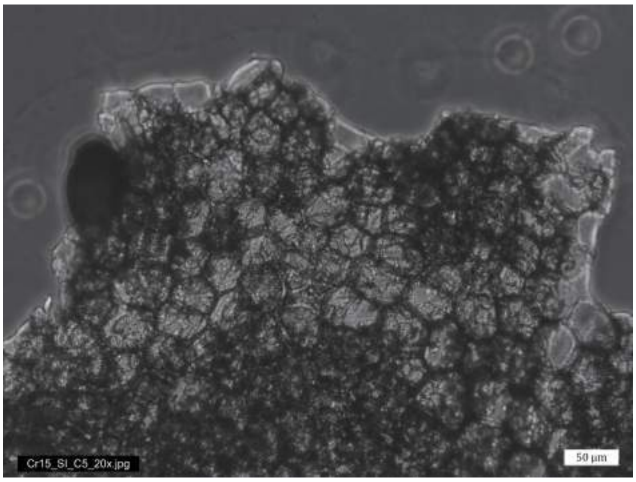
Fragment 15 (15_SI_C3_Cr15)



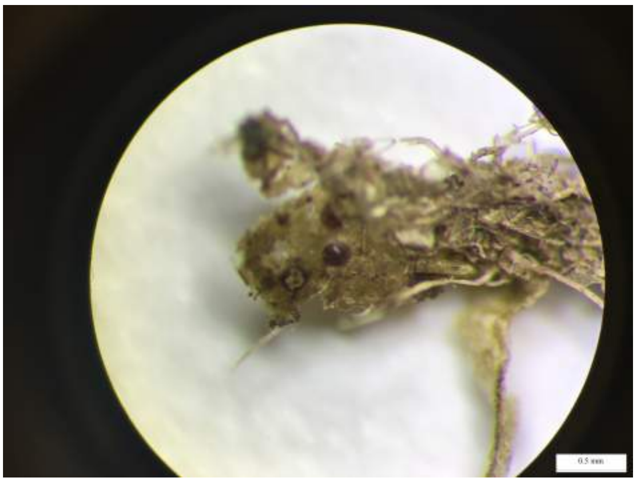
Fragment 16 (16_SI_C4_Cr15) → Inc_62

Fragment 17 (17_SI_C5_Cr15) → Inc_63

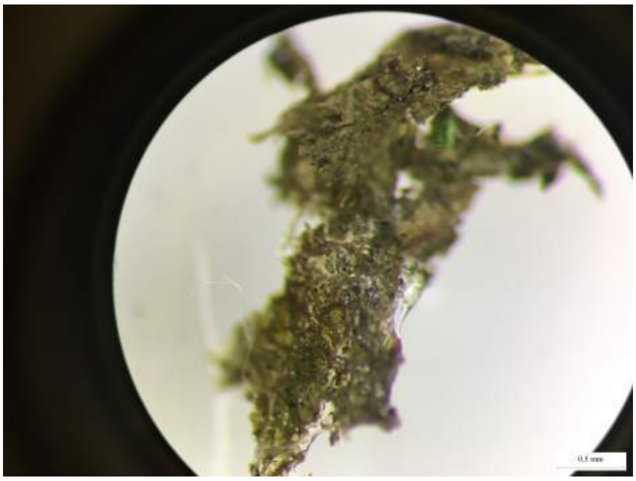
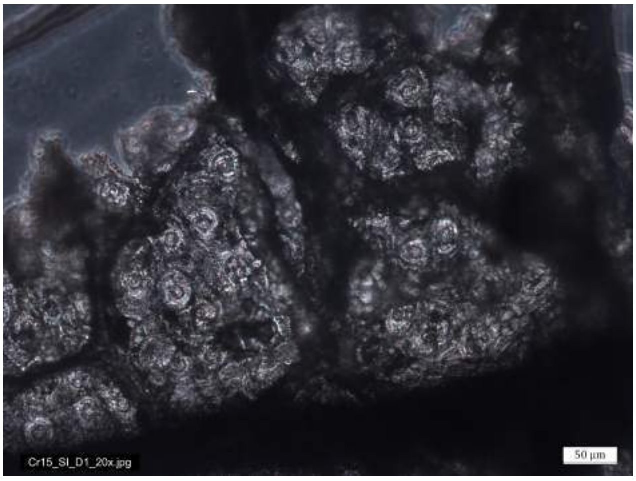



Fragment 18 (18_SI_C6_Cr15)

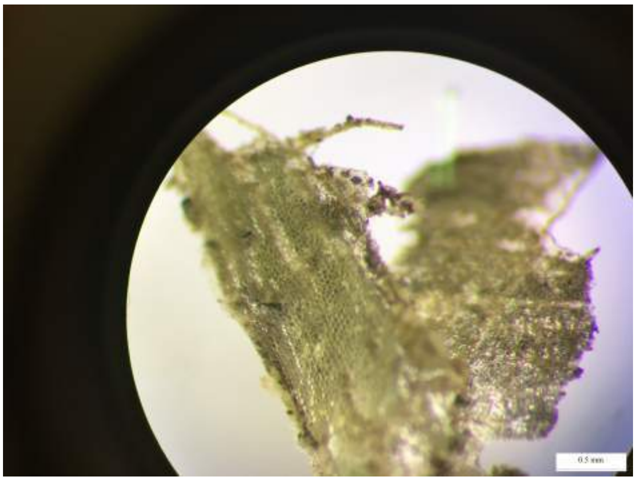
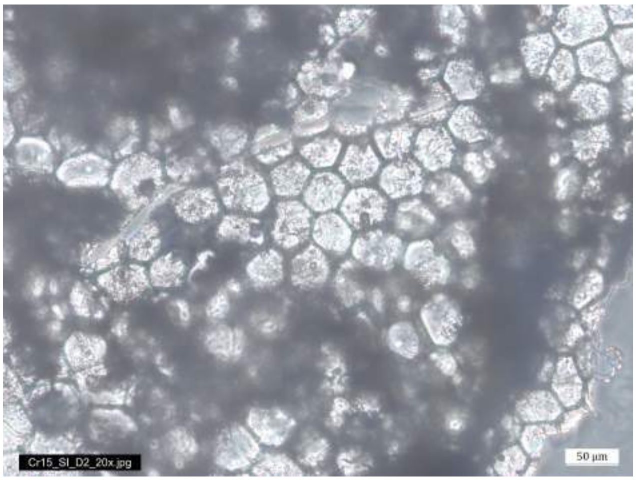


No references

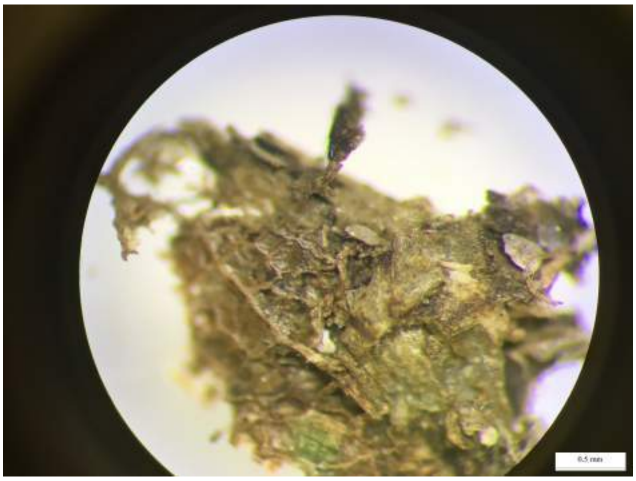
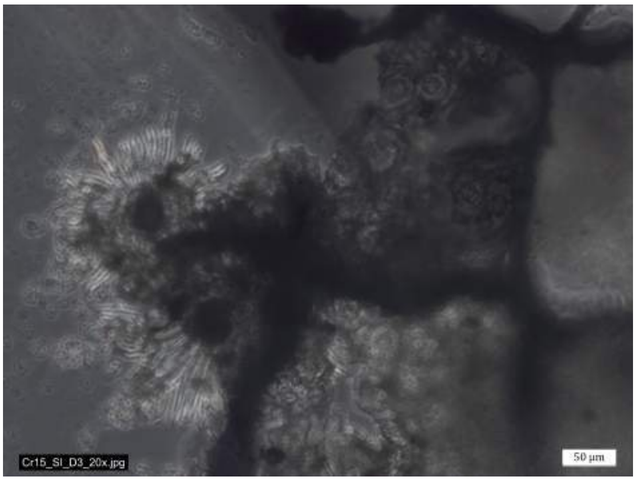
Fragment 19 (19_SI_D1_Cr15)

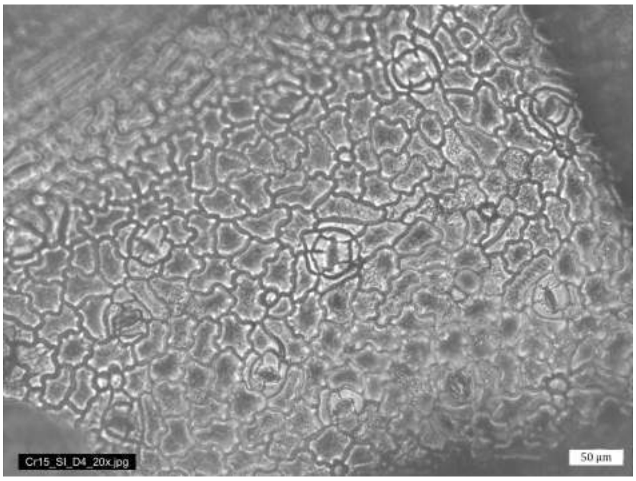
Fragment 20 (20_SI_D2_Cr15)

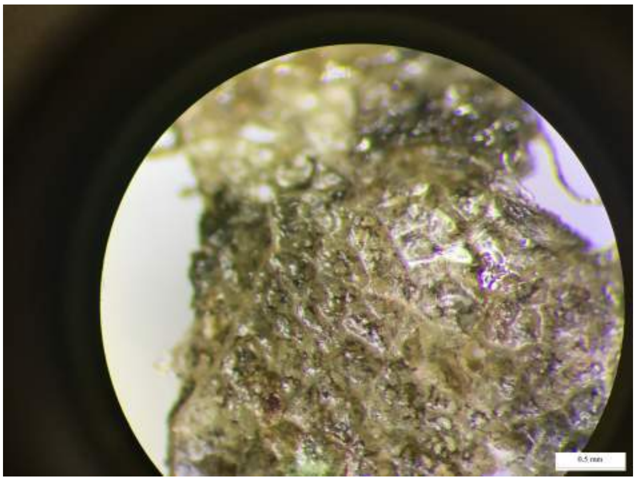
Fragment 21 (21_SI_D3_Cr15)

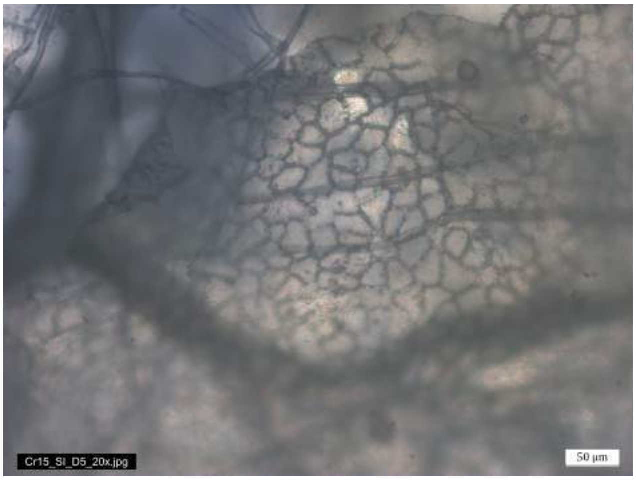



Fragment 22 (22_SI_D4_Cr15) → Inc_64

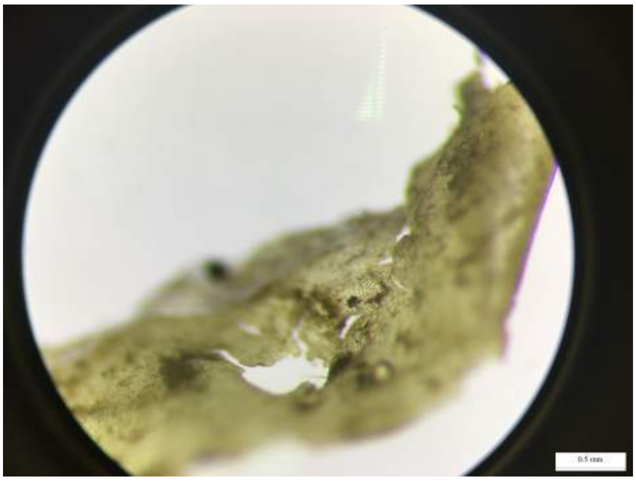


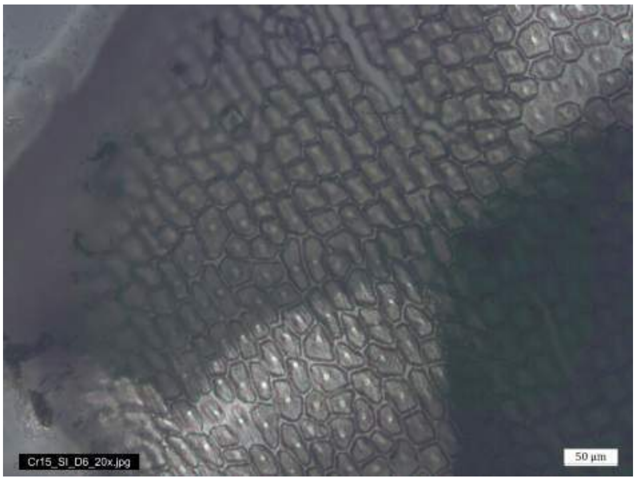
Fragment 23 (23_SI_D5_Cr)



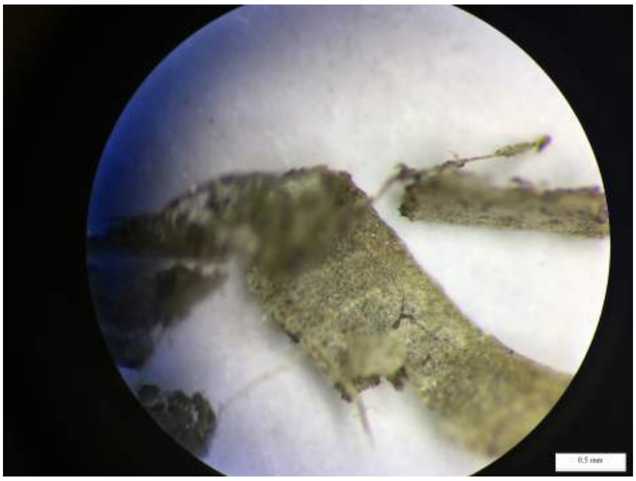


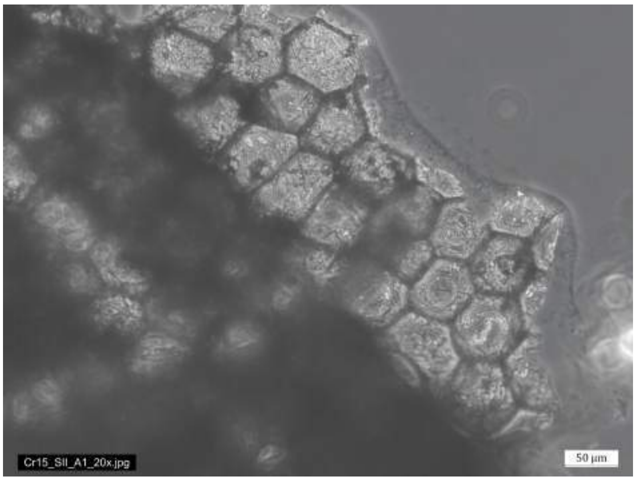
Fragment 24 (24_SI_D6_Cr15)



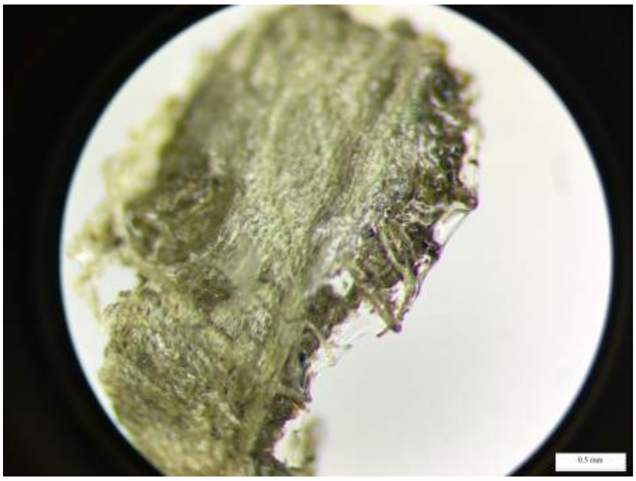


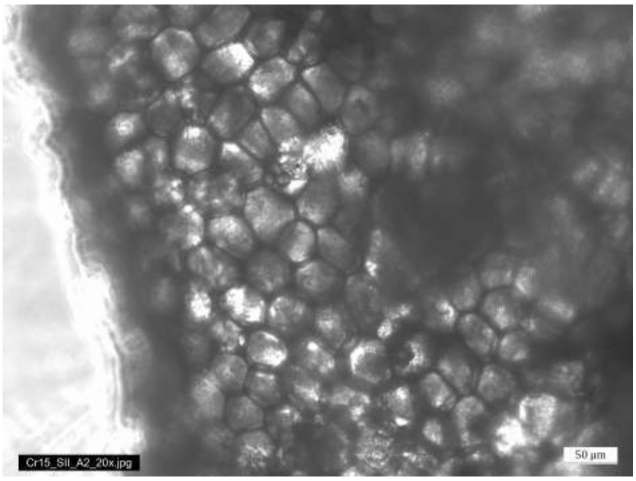
Fragment 25 (25_SII_A1_Cr15)



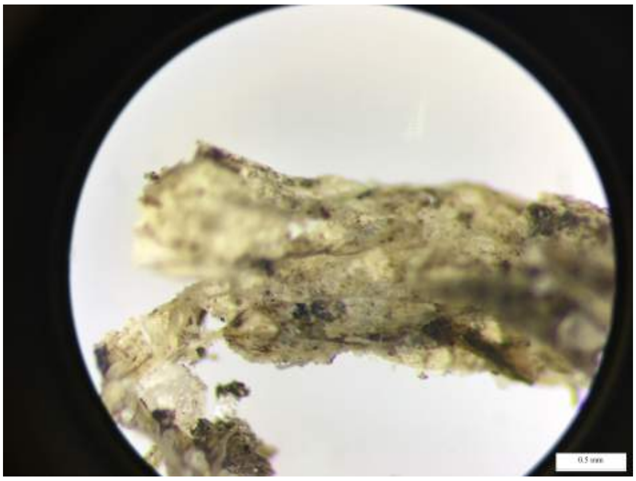


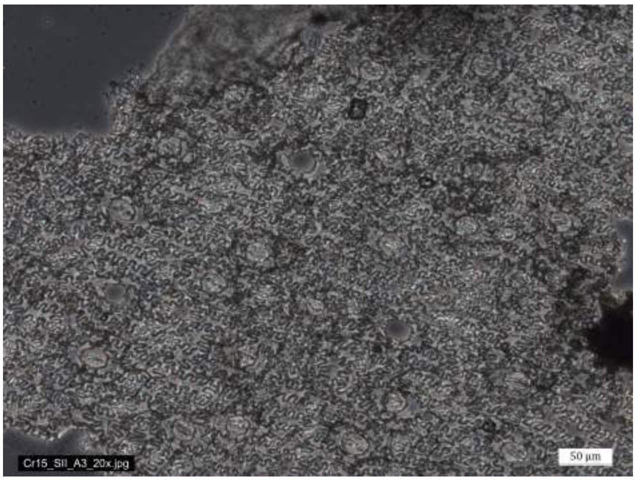
Fragment 26 (26_SII_A2_Cr15)



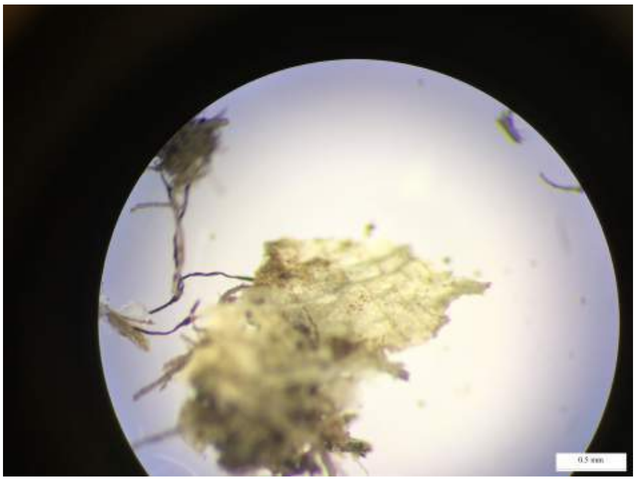


Fragment 27 (27_SII_A3_Cr)

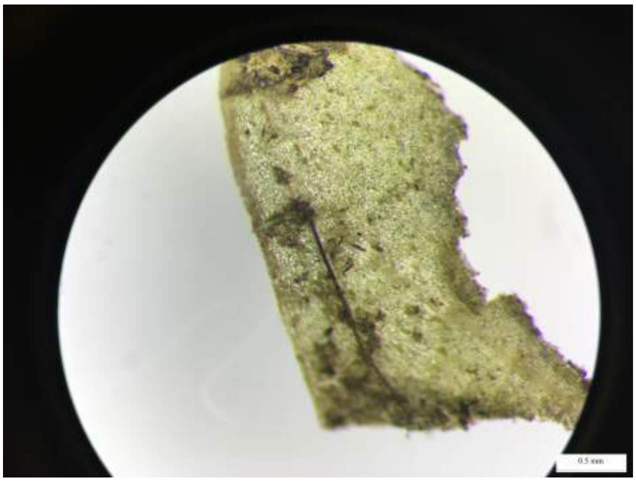


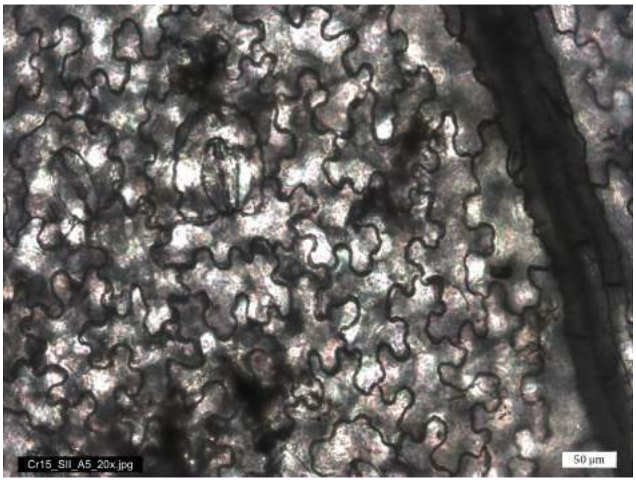


Fragment 28 (28_SII_A4_Cr15) → Inc_65

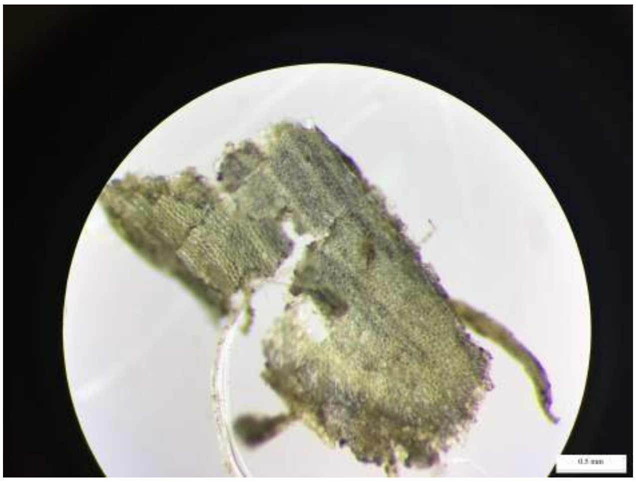


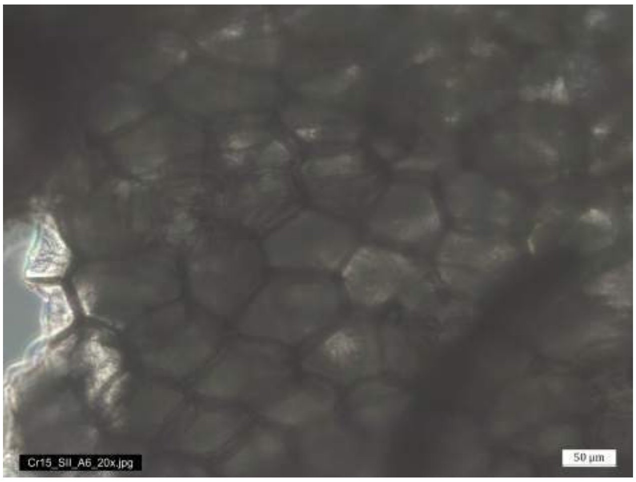
Fragment 29 (29_SII_A5_Cr15) → Inc_66



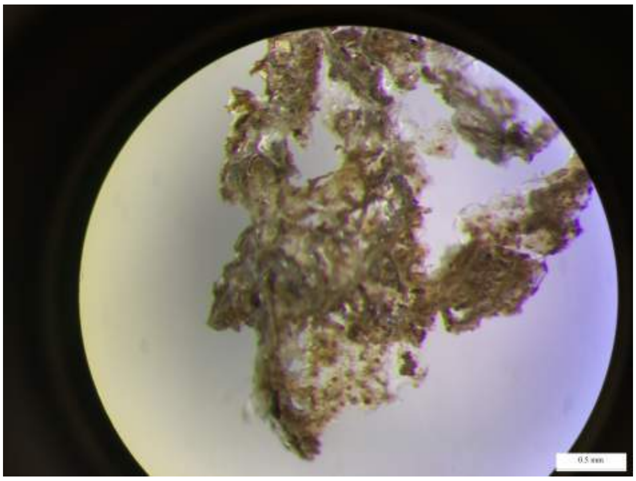


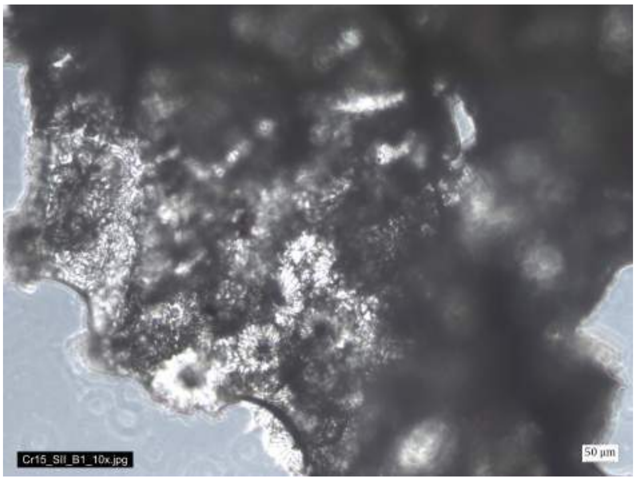
Fragment 30 (30_SII_A6_Cr15)



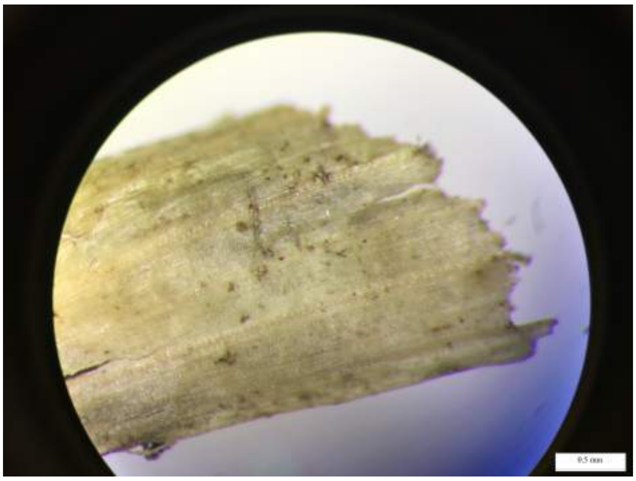
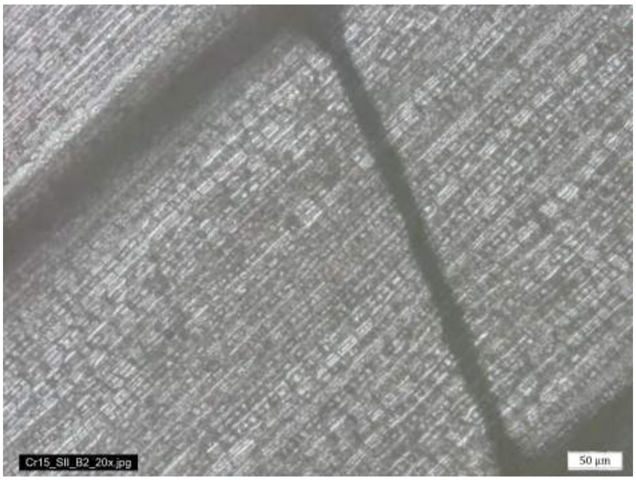


Fragment 31 (31_SII_B1_Cr15)

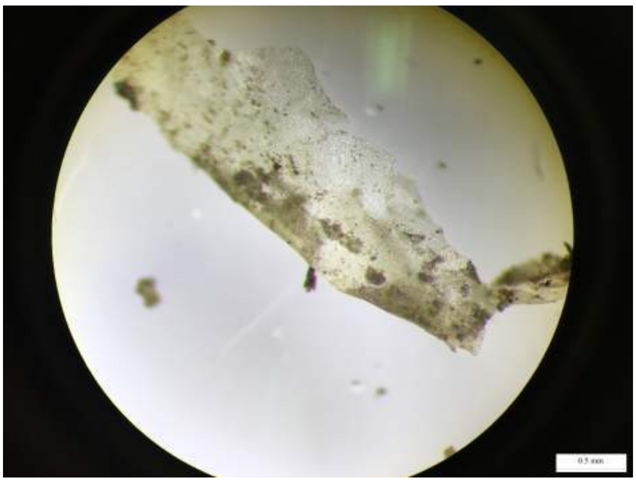
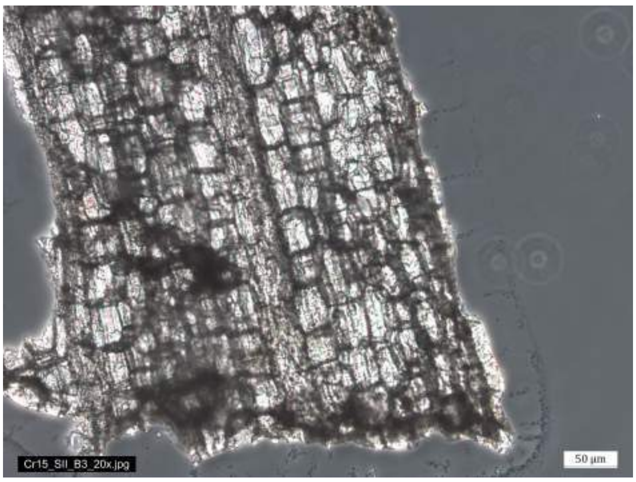




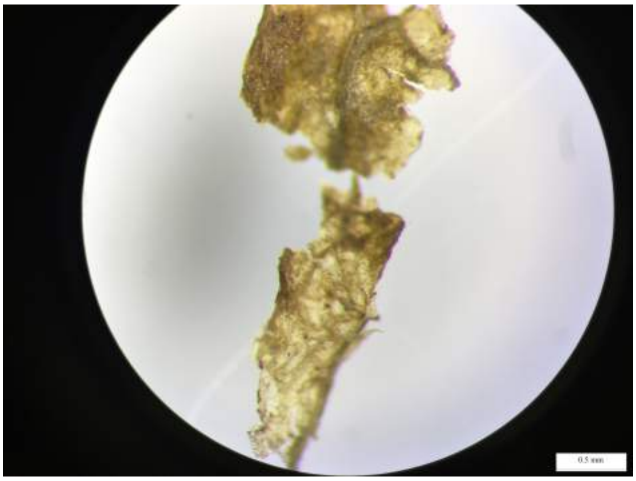
Fragment 32 (32_SII_B2_Cr15)

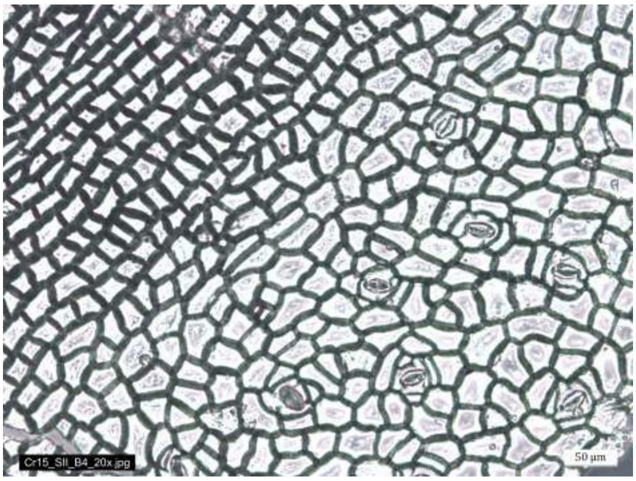



Fragment 33 (33_SII_B3_Cr15)

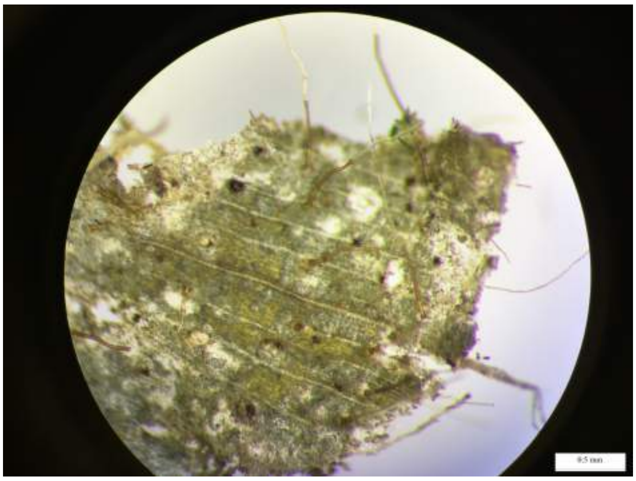



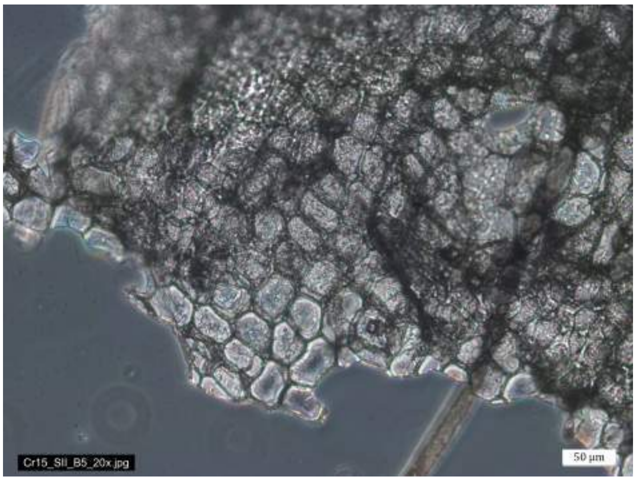
Fragment 34 (34_SII_B4_Cr15)



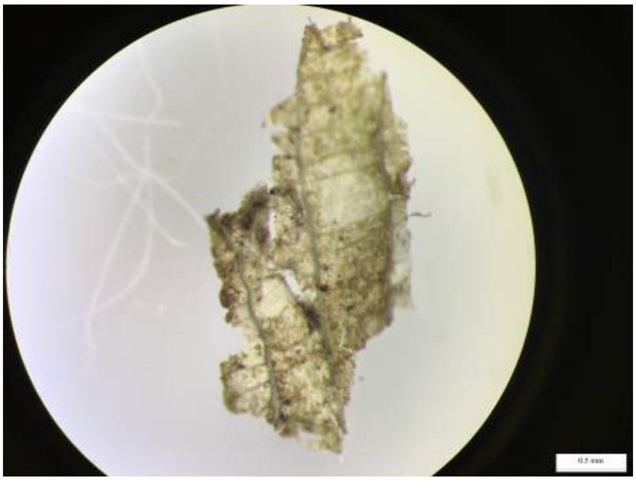


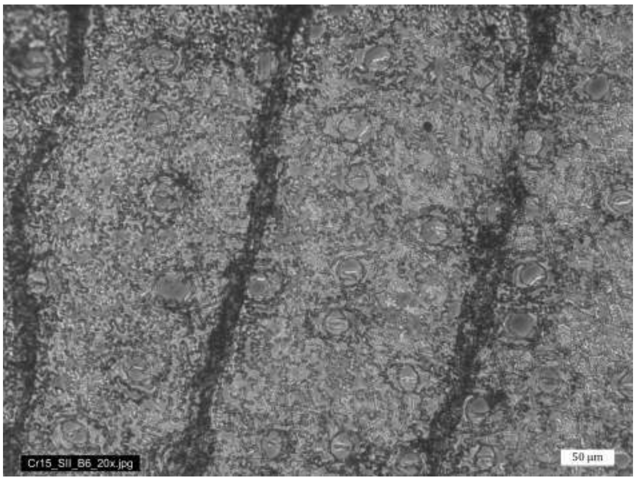
Fragment 35 (5_SII_B5_Cr15)



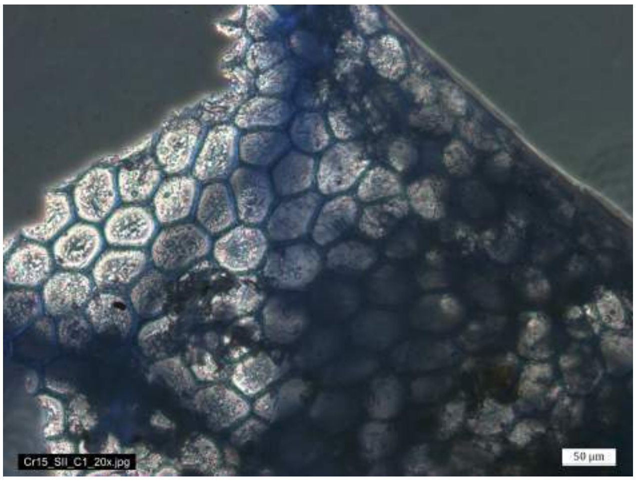


Fragment 36 (36_SII_B6_Cr15)

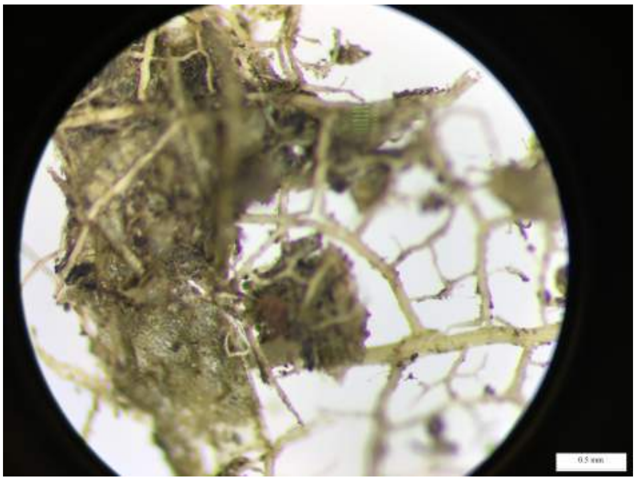


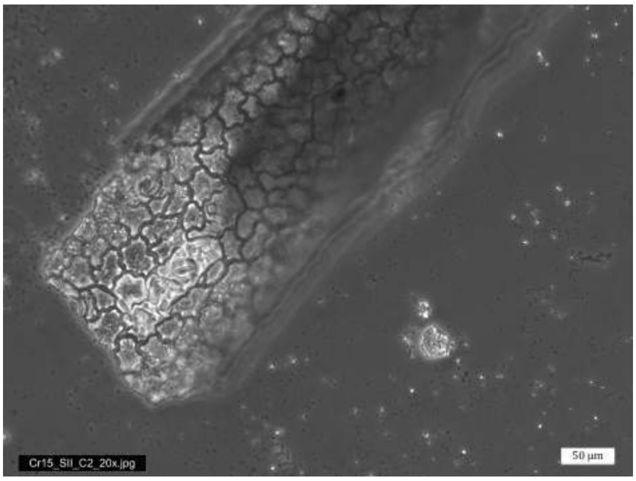


Fragment 37 (37_SII_C1_Cr15)

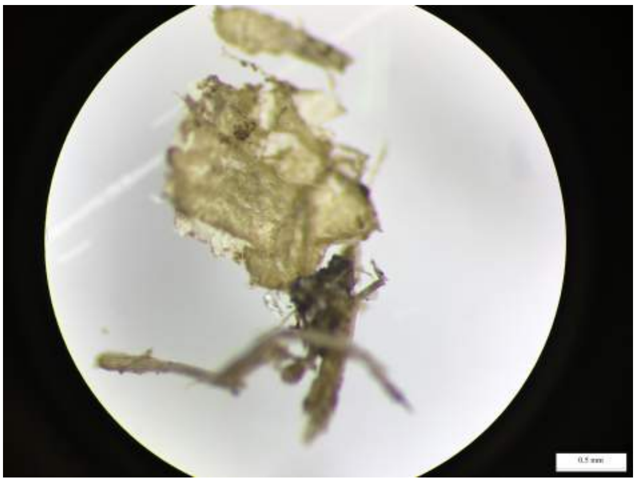


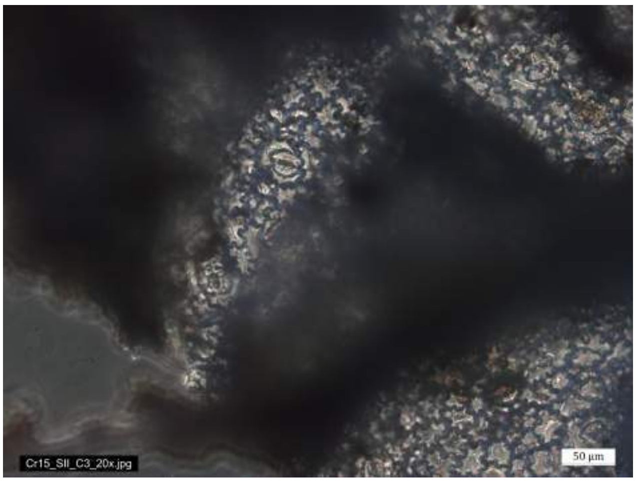
Fragment 38 (38_SII_C2_Cr15)



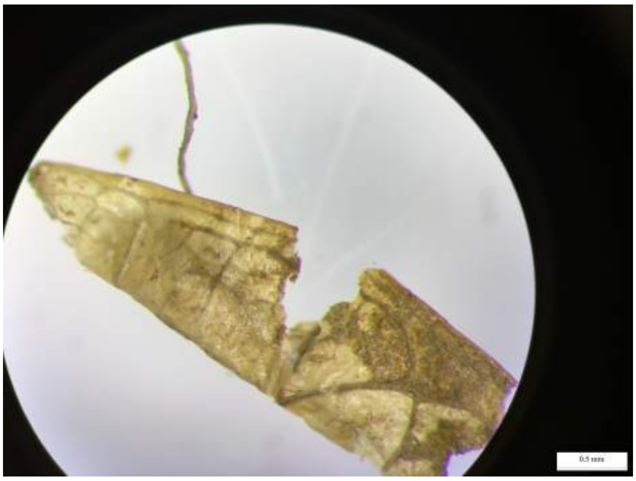


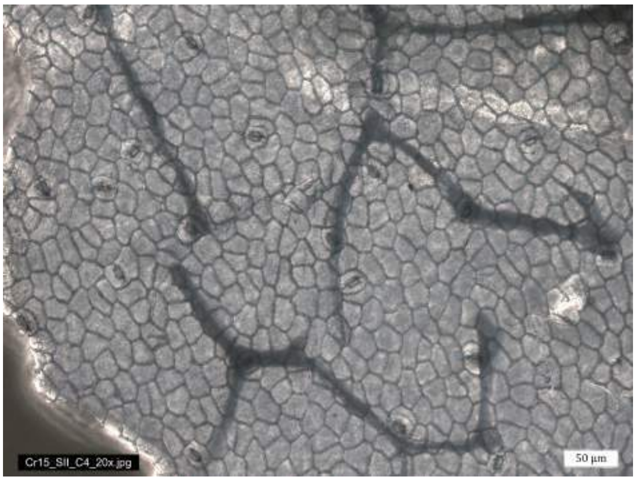
Fragment 39 (39_SII_C3_Cr15)



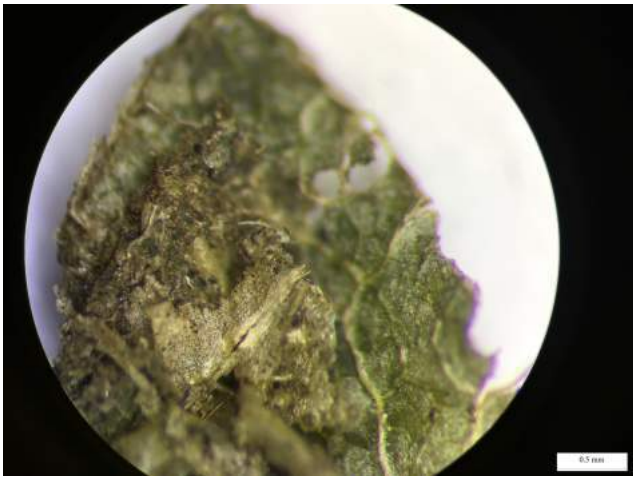


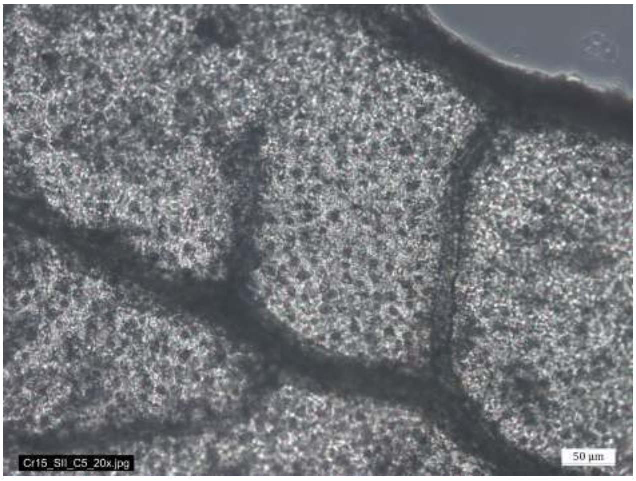
Fragment 40 (40_SII_C4_Cr15) → Inc_67



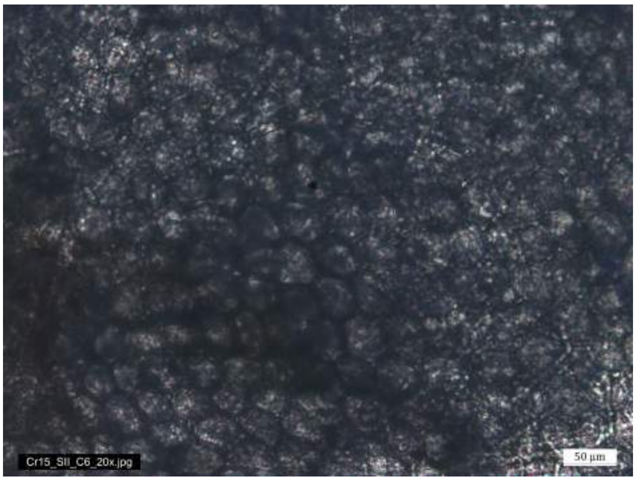


Fragment 41 (41_SII_C5_Cr15)

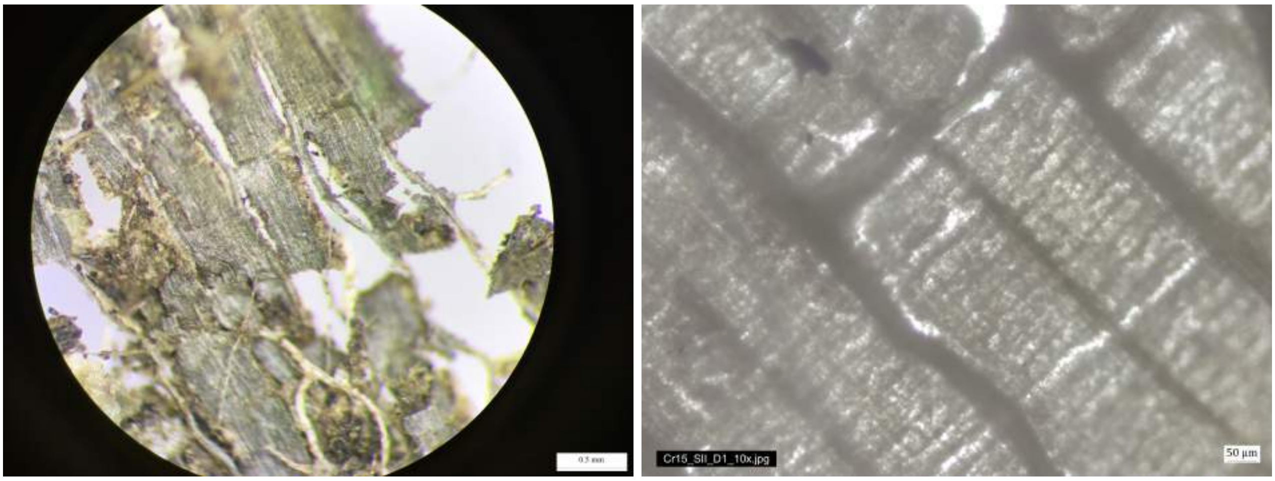




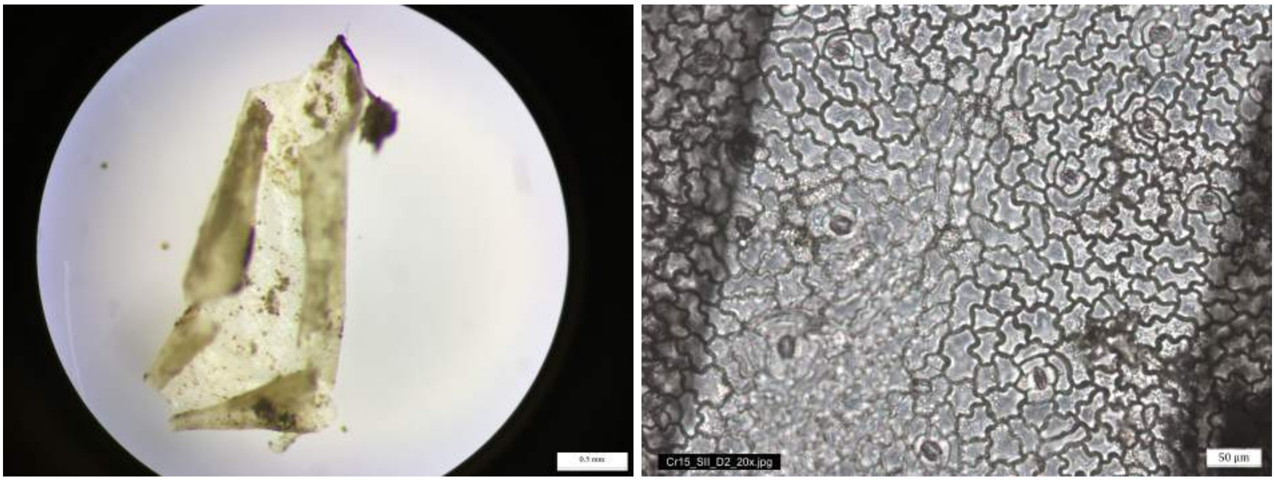
Fragment 42 (42_SII_C6_Cr15)



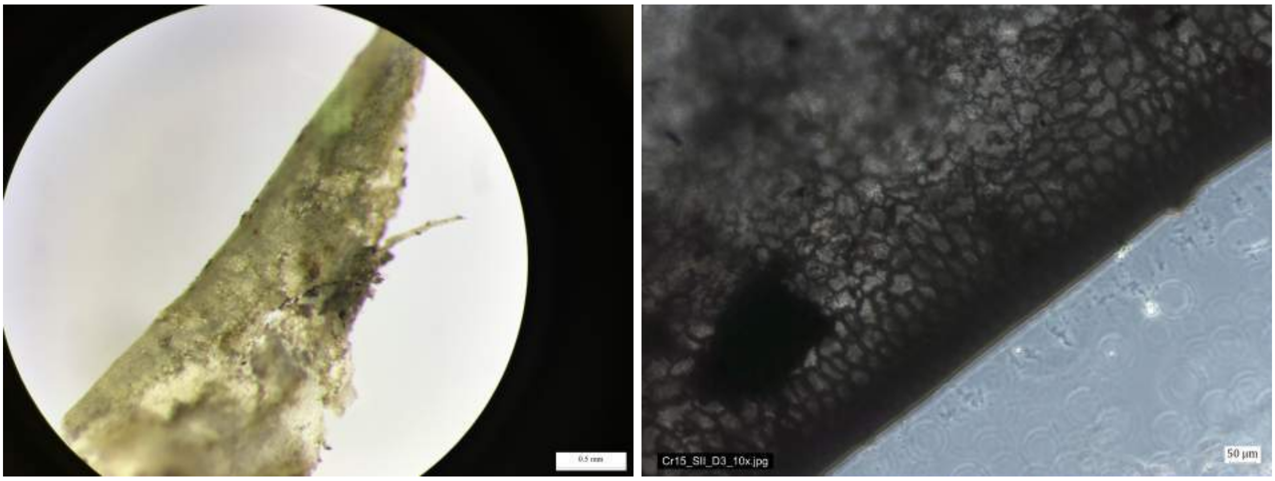
Fragment 43 (43_SII_D1_Cr15)



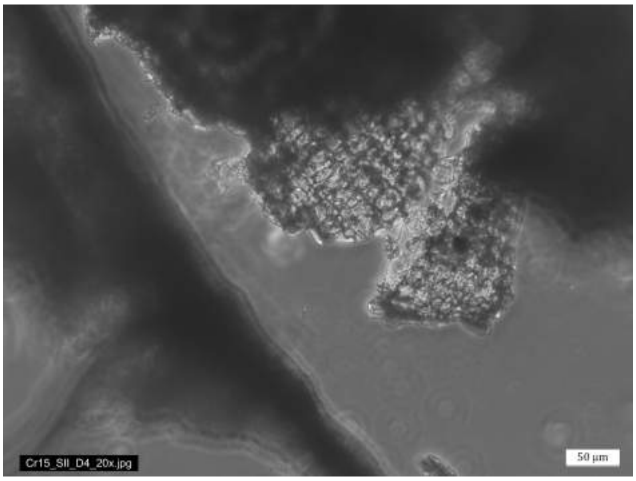
Fragment 44 (44_SII_D2_Cr15) → Inc_68



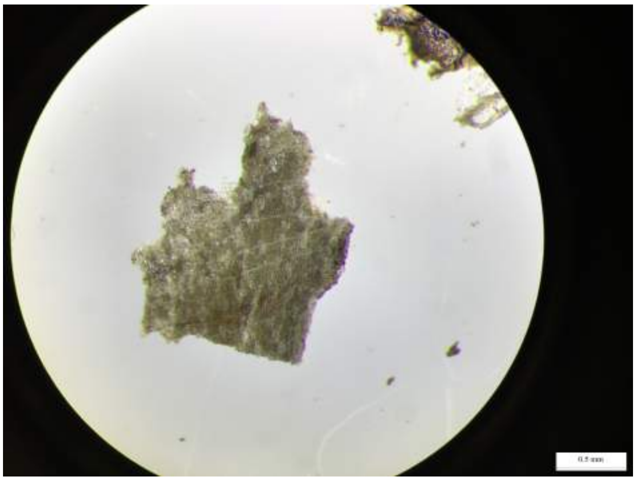
Fragment 45 (45_SII_D3_Cr15)

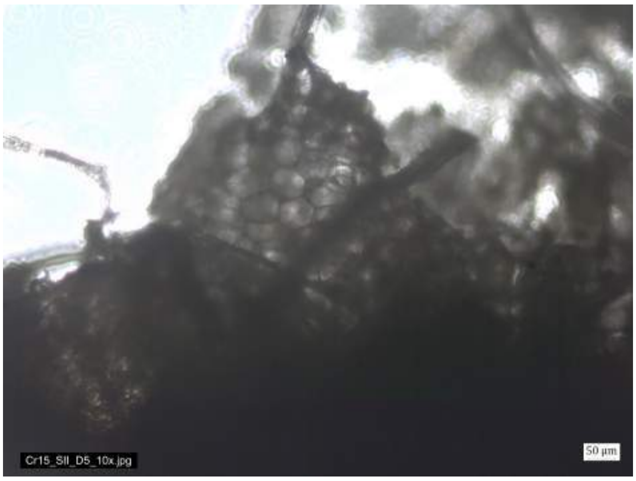


Fragment 46 (46_SII_D4_Cr15)

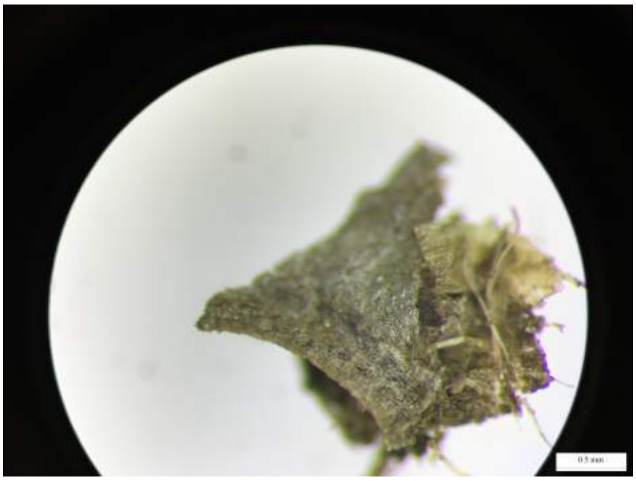


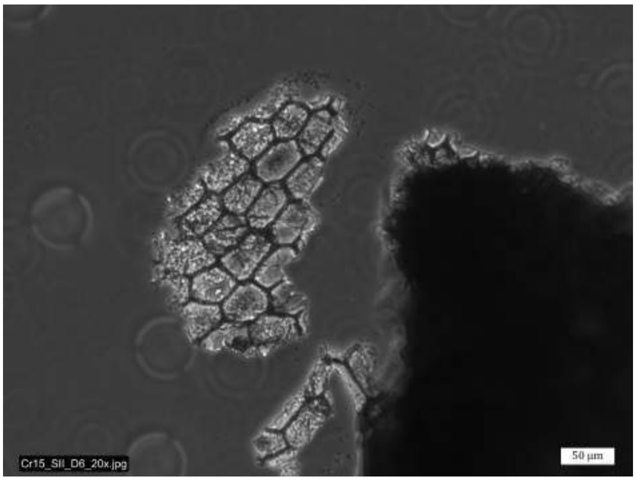
Fragment 47 (47_SII_D5_Cr15)





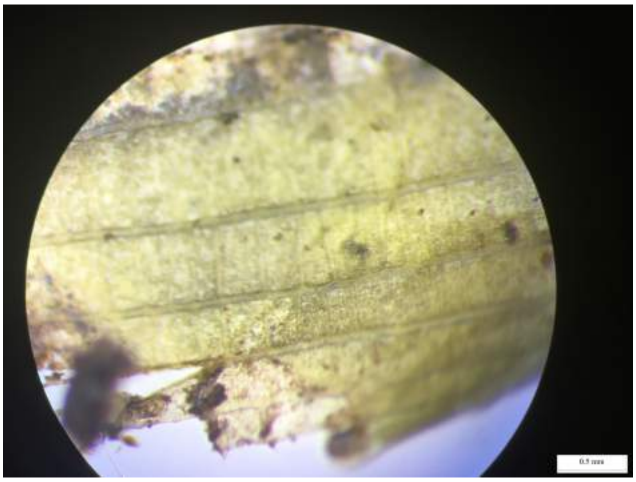
Fragment 48 (48_SII_D6_Cr15)

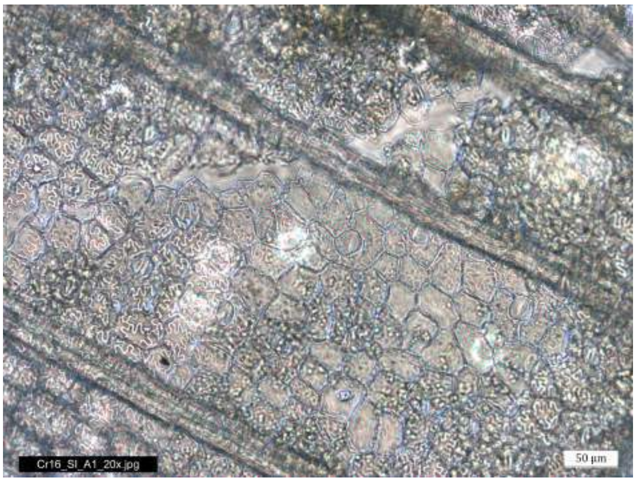




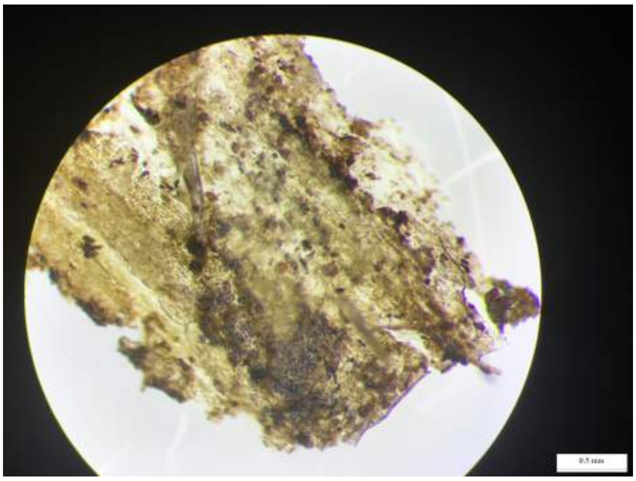
Fragments of the Faece 6

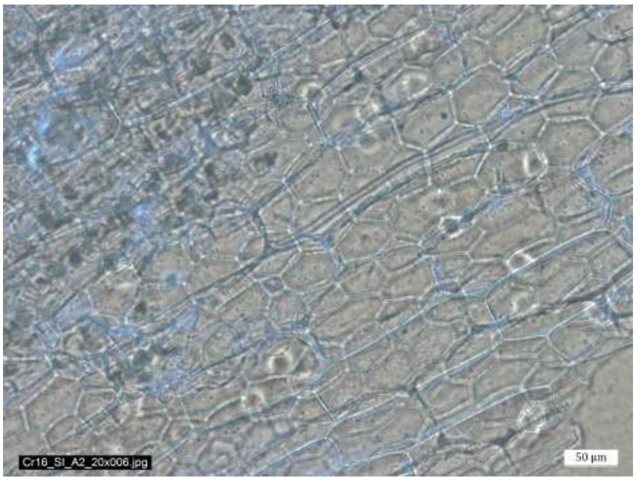
Fragment 1 (1_SI_A1_Cr16) → Inc_69



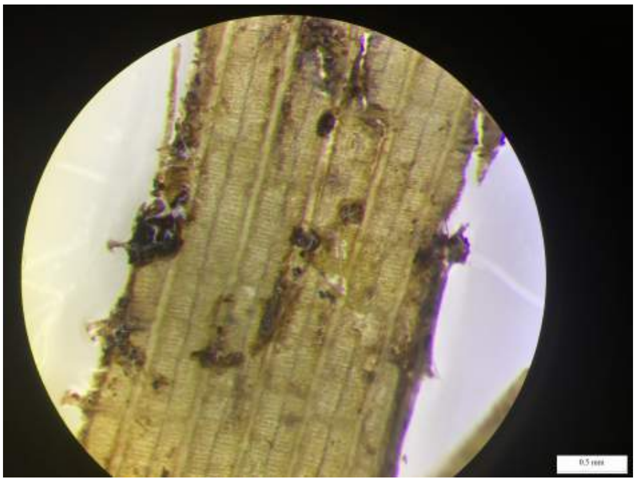


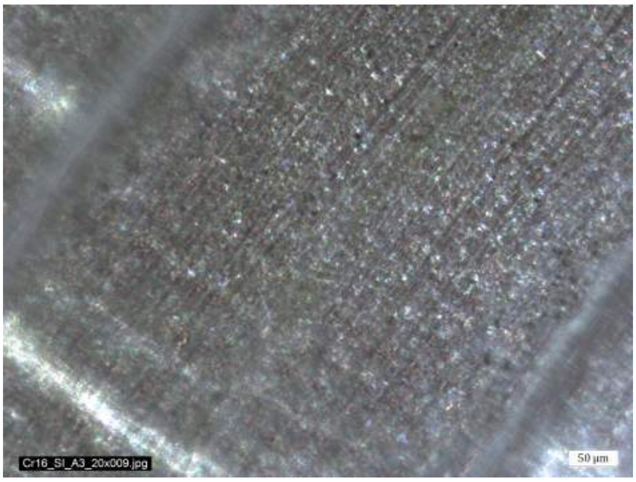
Fragment 2 (2_SI_A2_Cr16) → Inc_70



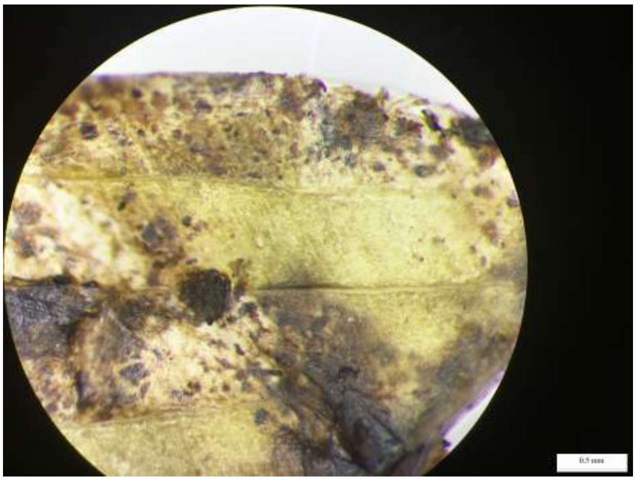


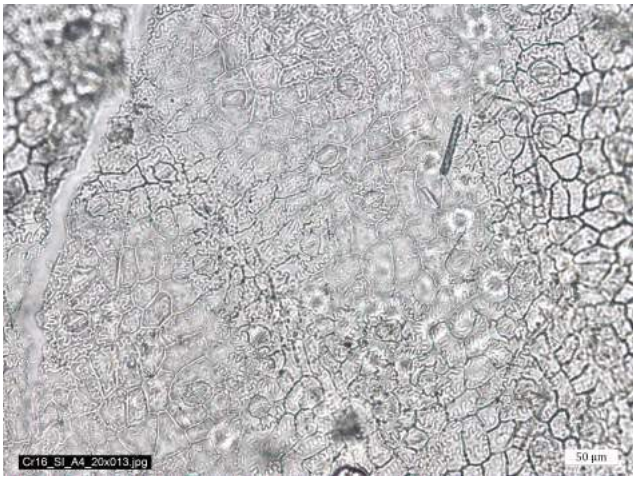
Fragment 3 (3_SI_A3_Cr16) → Inc_71



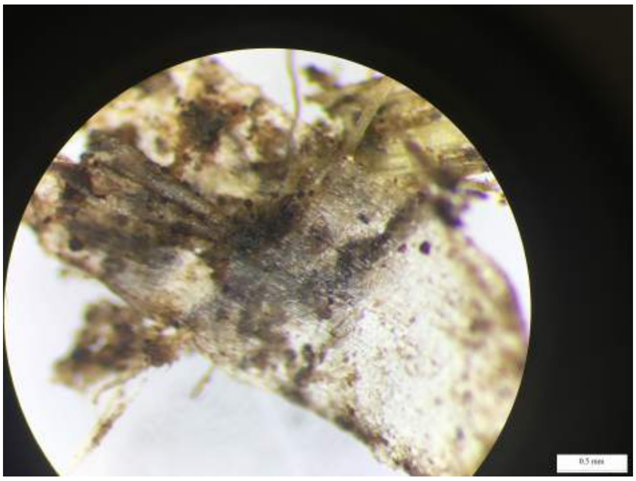


Fragment 4 (4_SI_A4_Cr16)

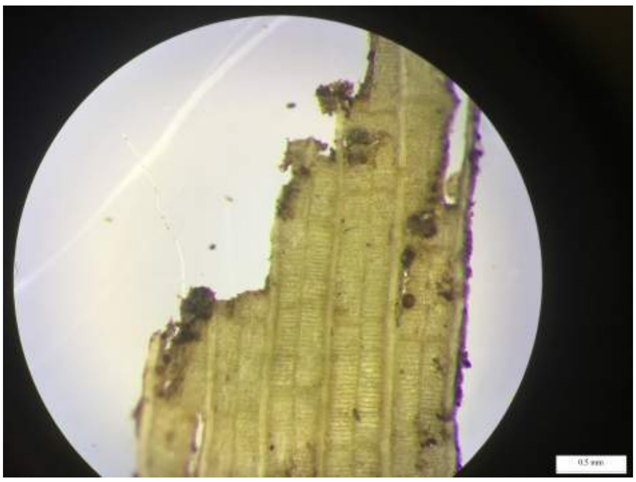


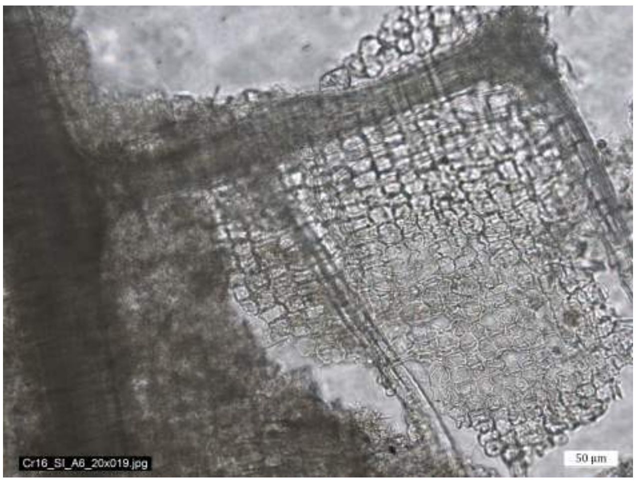


Fragment 5 (5_SI_A5_Cr16)

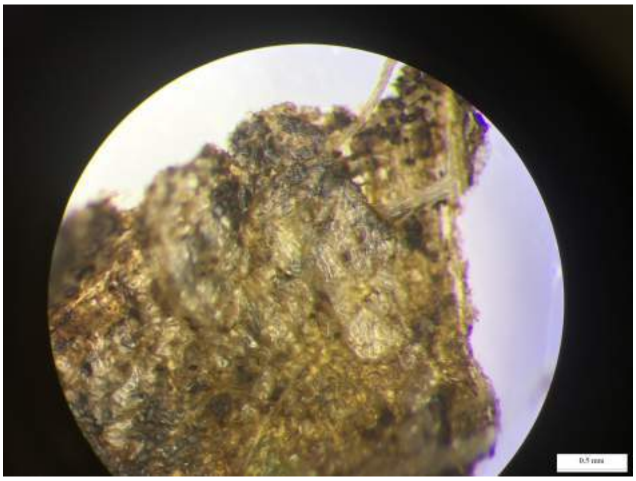


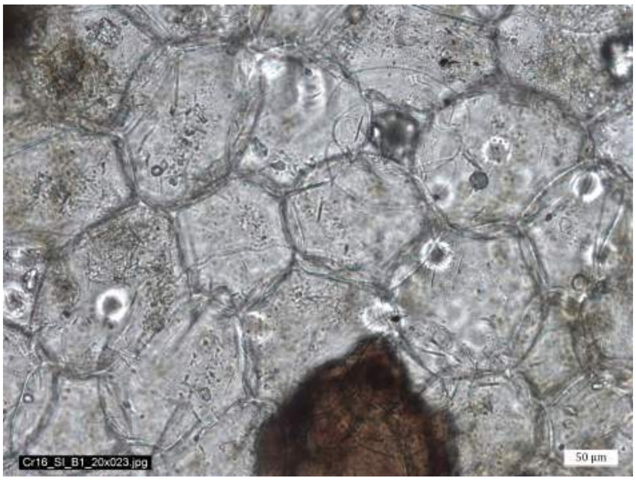
Fragment 6 (6_SI_A6_Cr16)



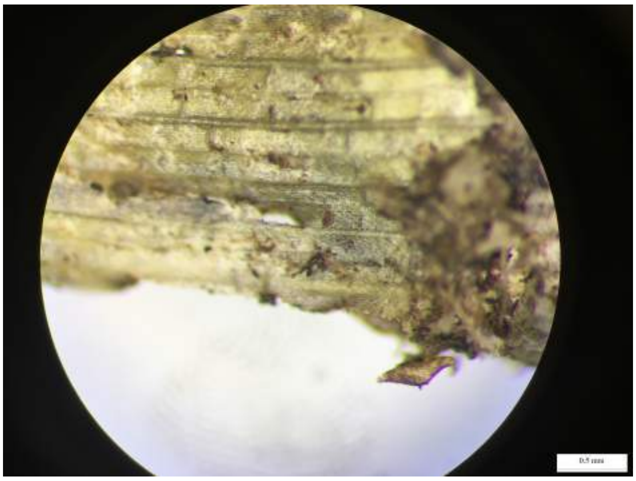


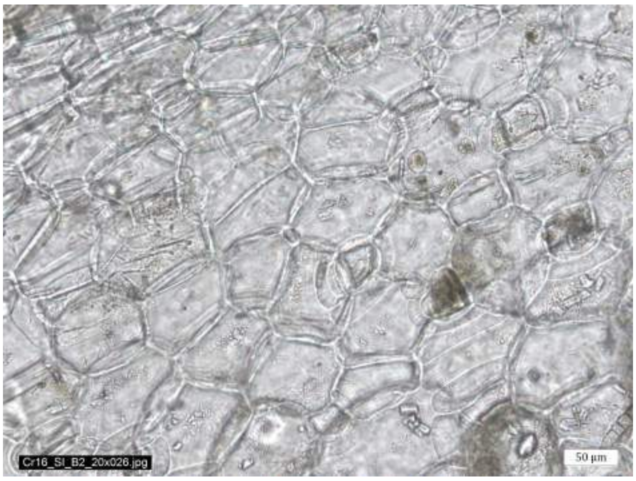
Fragment 7 (7_SI_B1_Cr16) → Inc_72



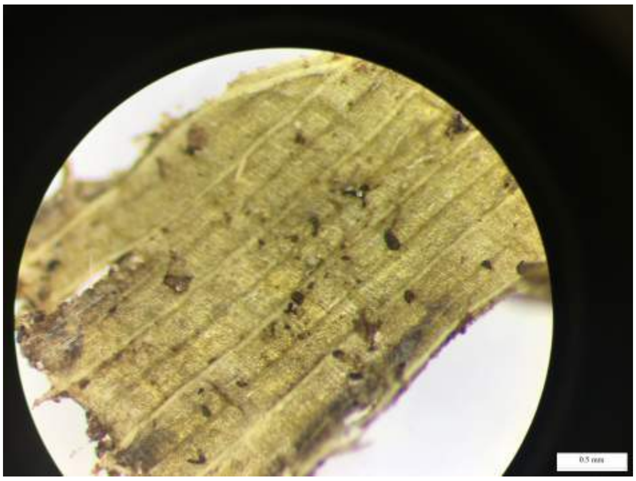


Fragment 8 (8_SI_B2_Cr16)

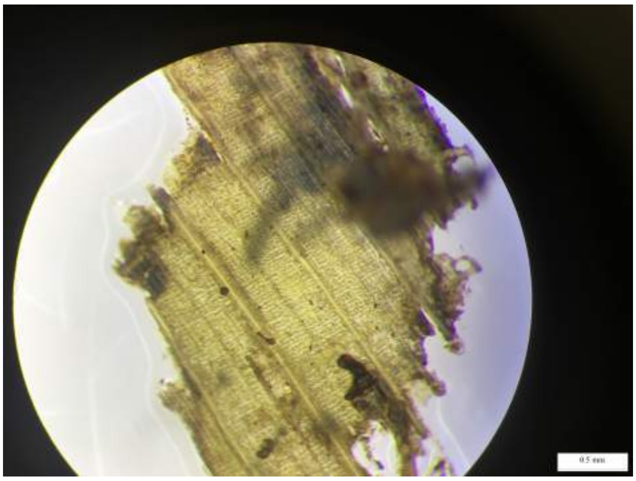


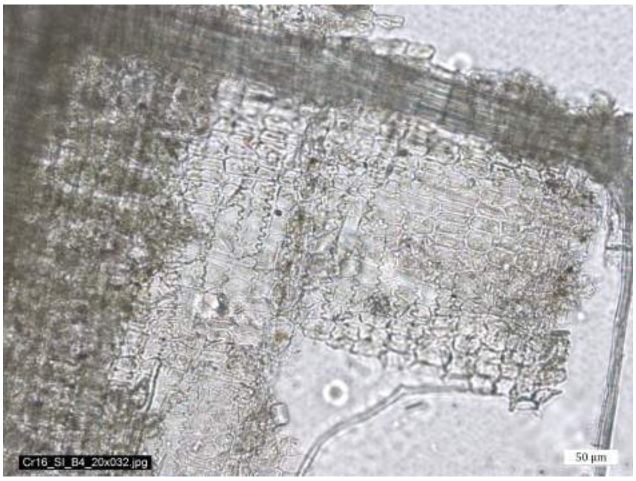


Fragment 9 (9_SI_B3_Cr16)

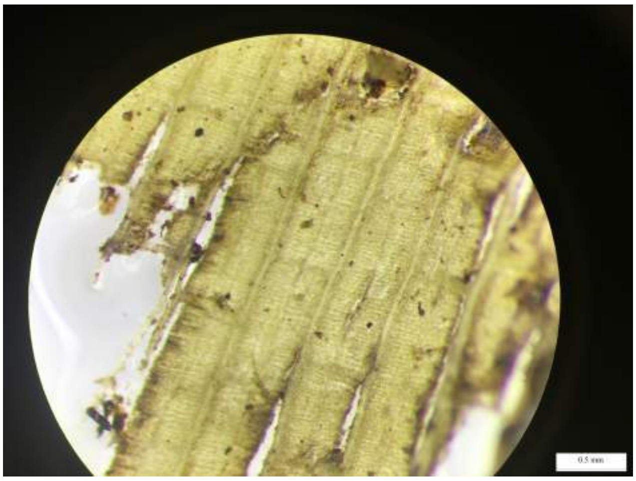


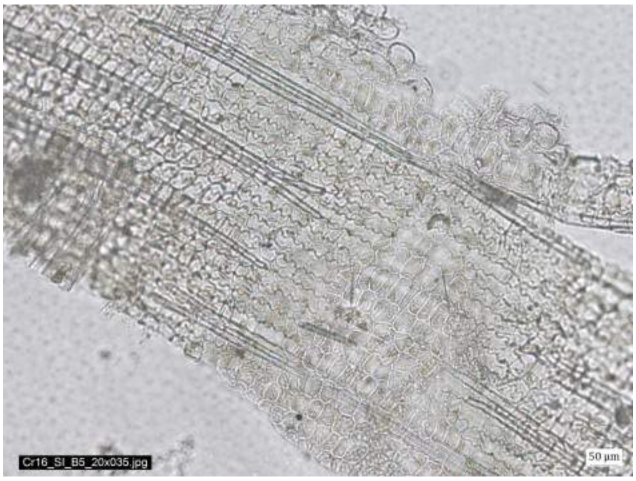
Fragment 10 (10_SI_B4_Cr16)



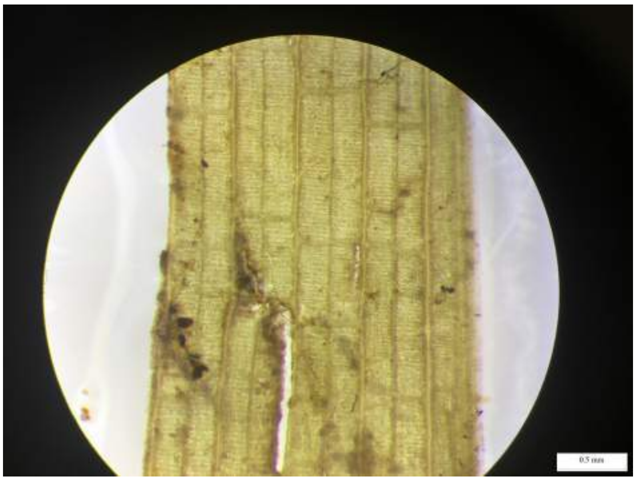


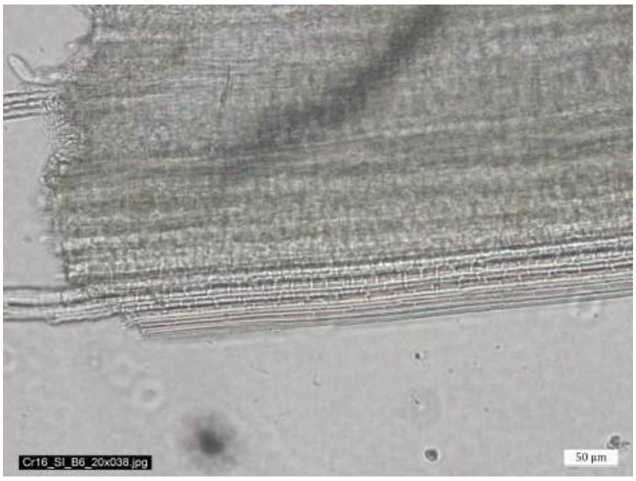
Fragment 11 (11_SI_B5_Cr16)



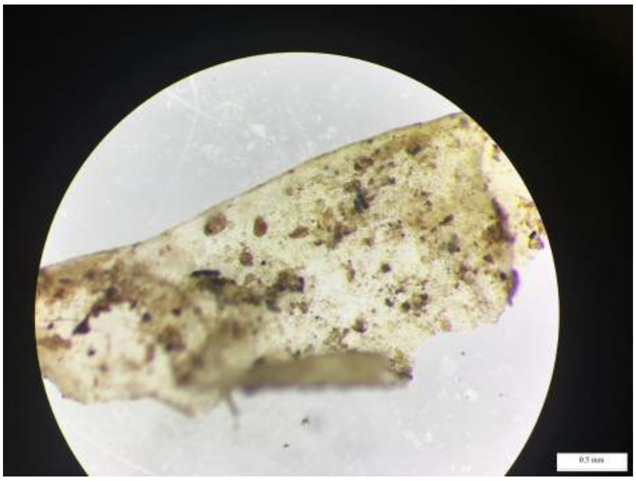


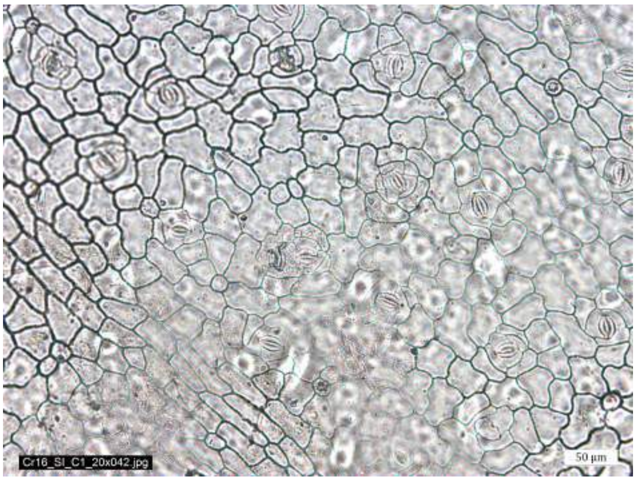
Fragment 12 (12_SI_B6_Cr16)



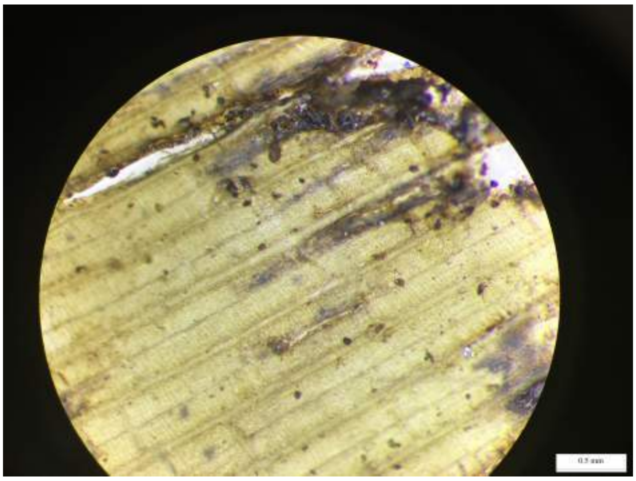


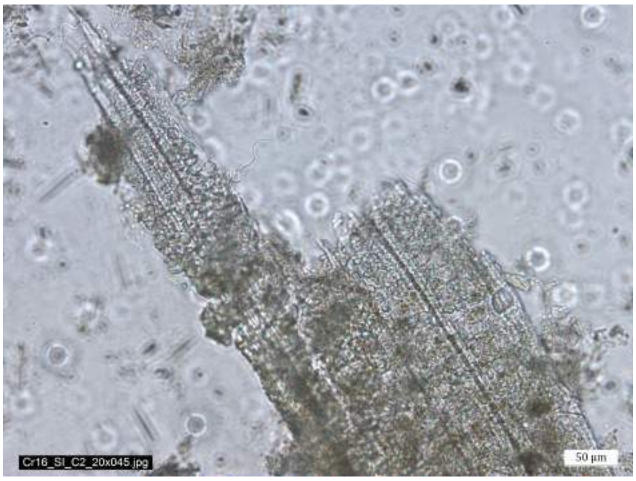
Fragment 13 (13_SI_C1_Cr16)



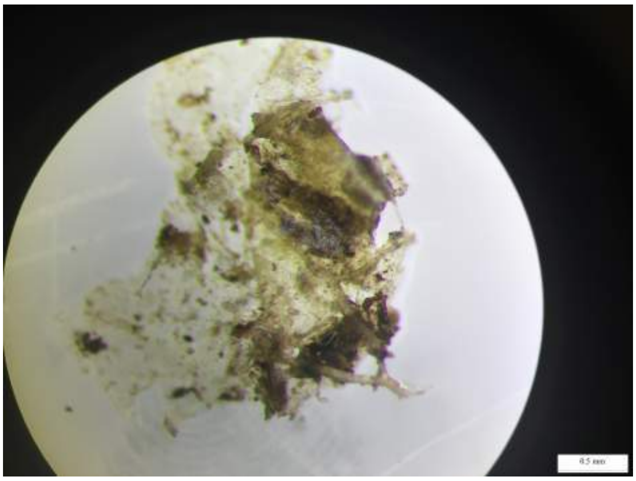


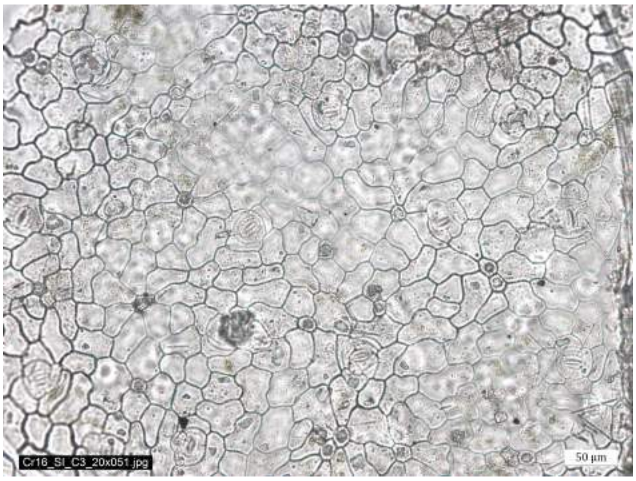
Fragment 14 (14_SI_C2_Cr16)



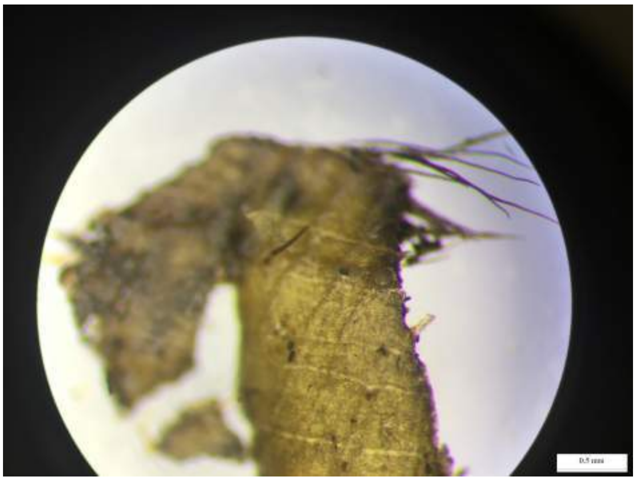


Fragment 15 (15_SI_C3_Cr16) → Inc_73

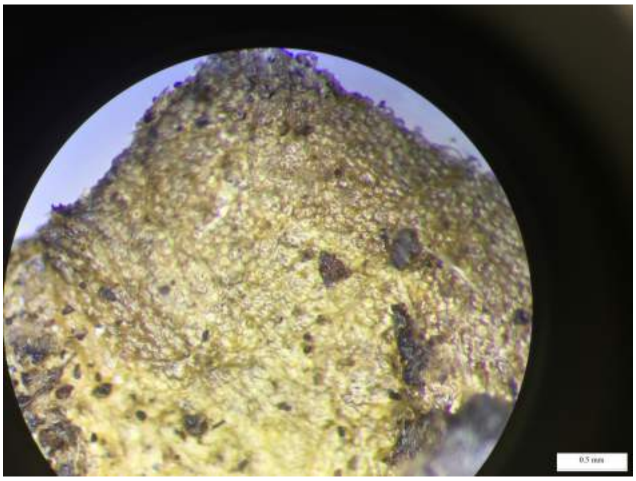


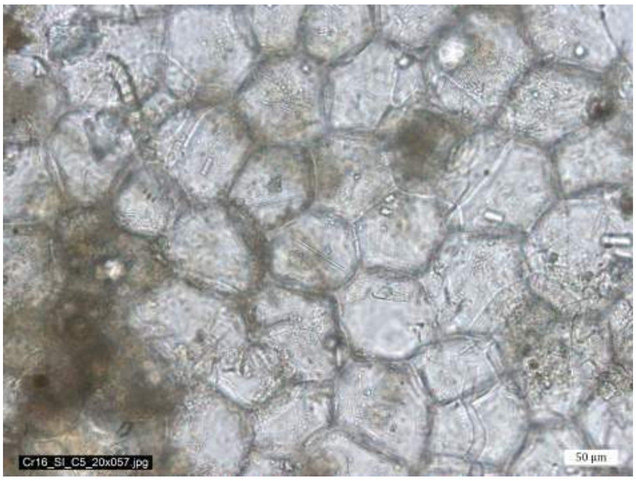


Fragment 16 (16_SI_C4_Cr16)

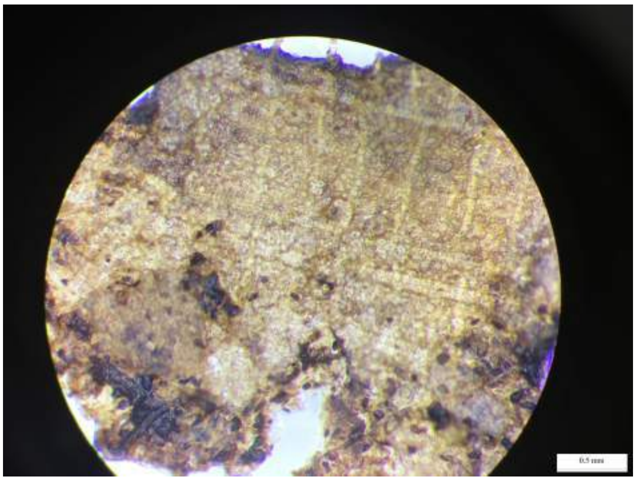


Fragment 17 (17_SI_C5_Cr16)

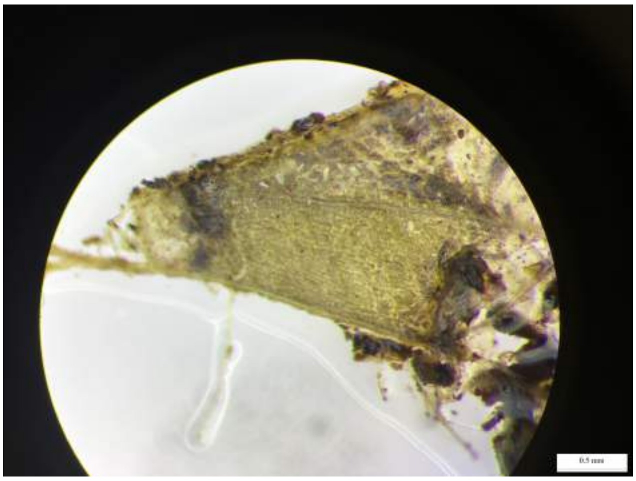


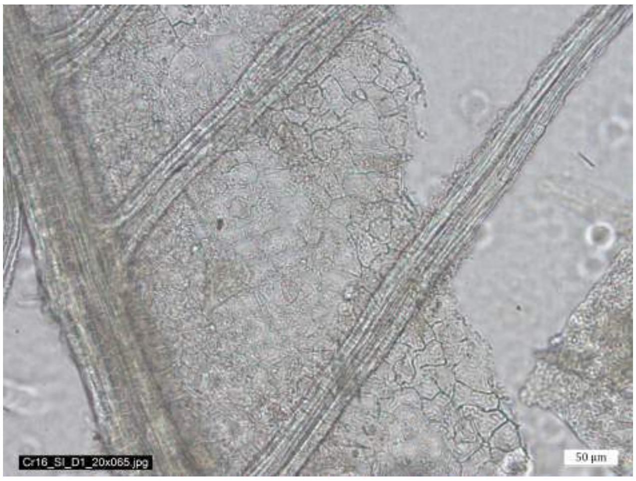


Fragment 18 (18_SI_C6_Cr16) → Inc_74

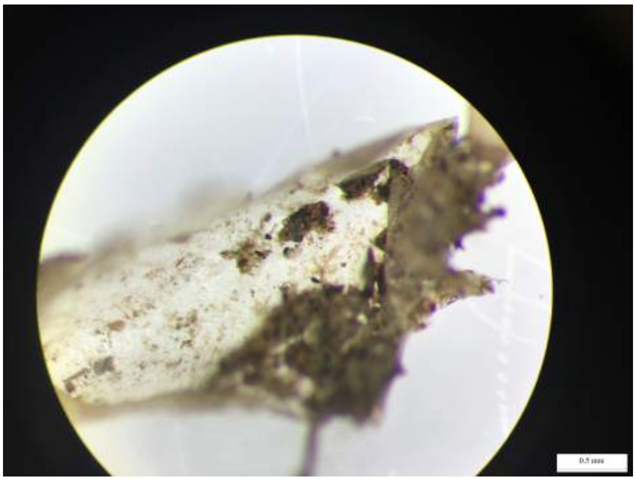


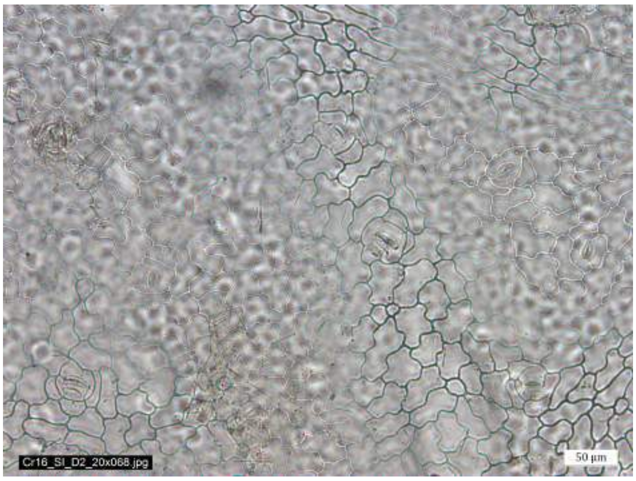
Fragment 19 (19_SI_D1_Cr16)



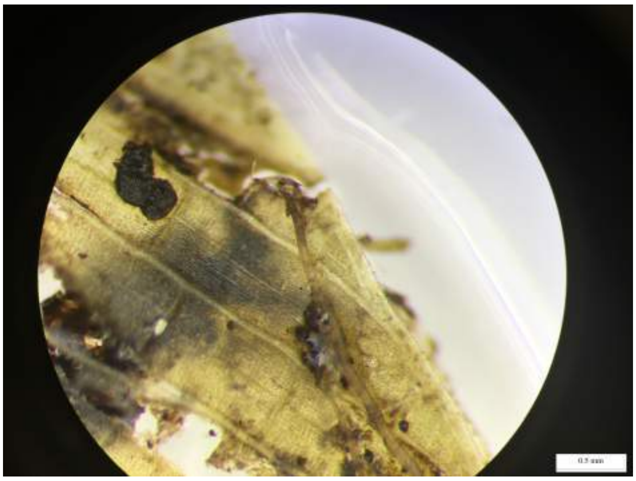


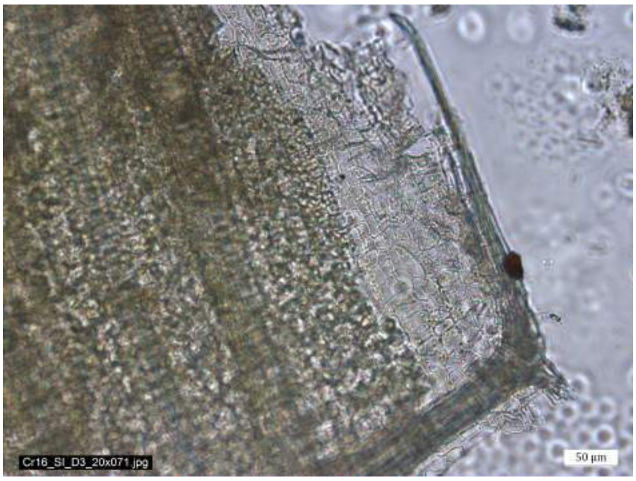
Fragment 20 (20_SI_D2_Cr16)



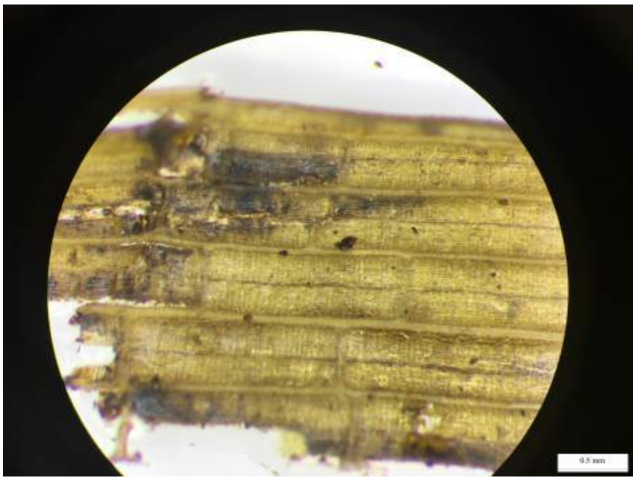
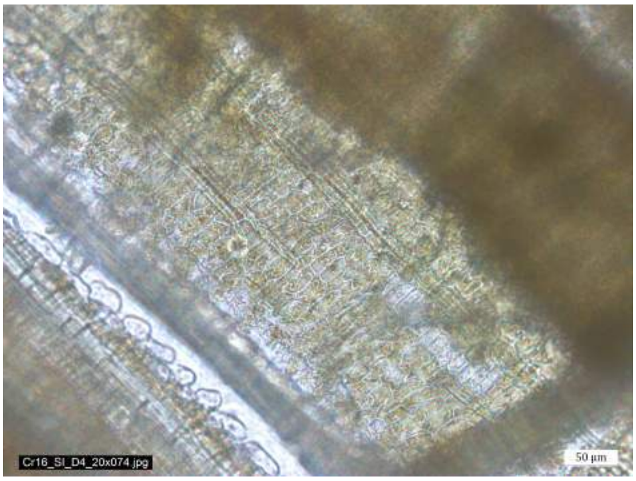


Fragment 21 (21_SI_D3_Cr16)

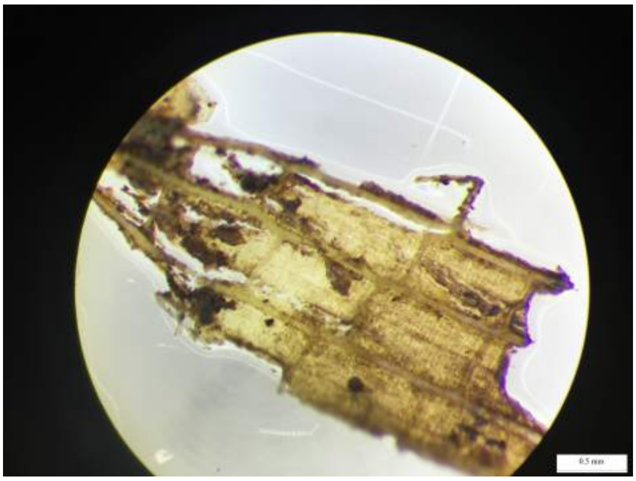
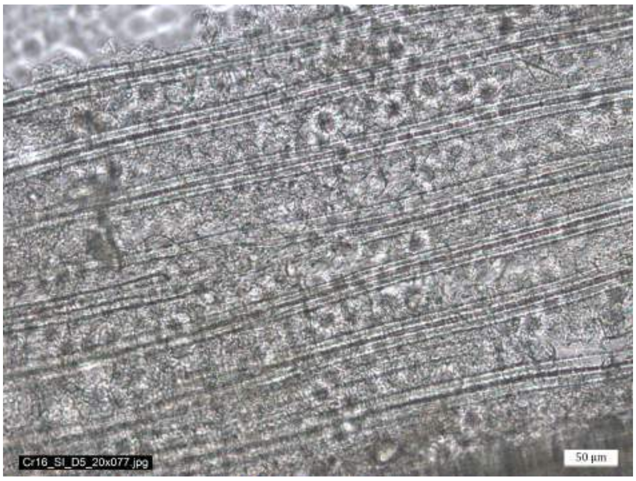




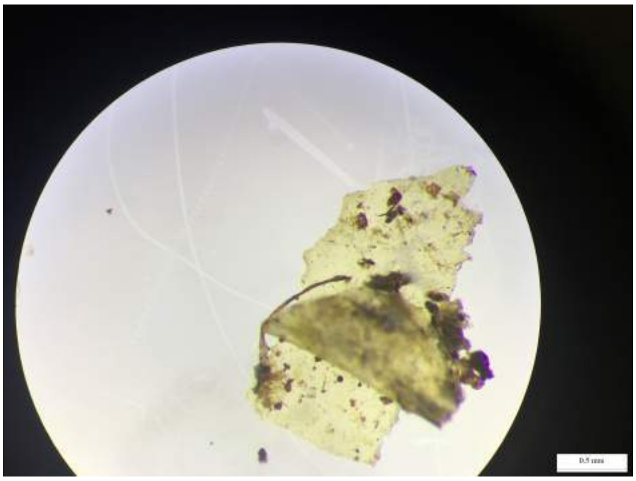
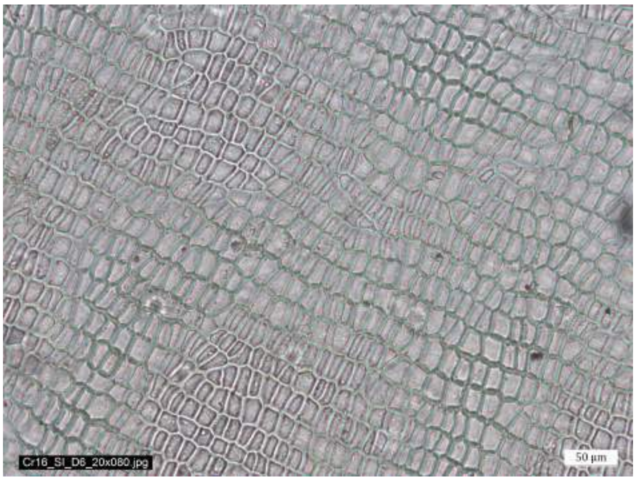
Fragment 22 (22_SI_D4_Cr16)

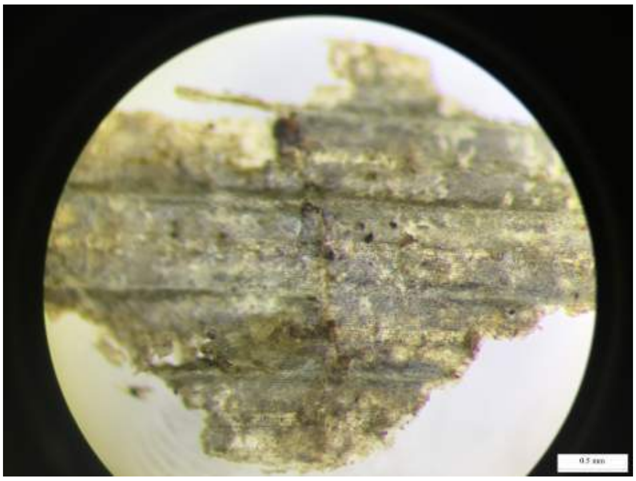
Fragment 23 (23_SI_D5_Cr)

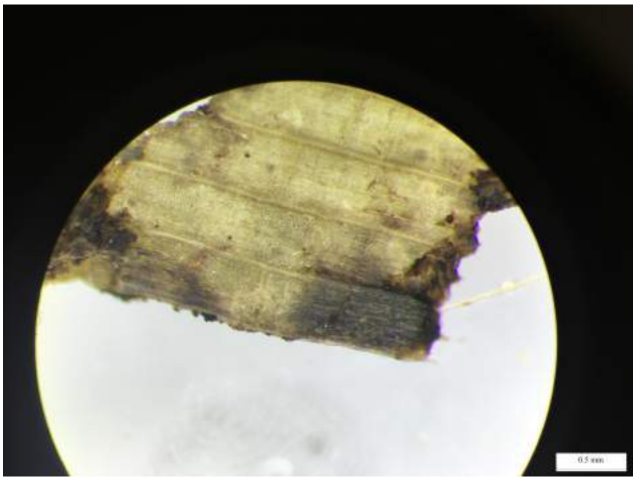
Fragment 24 (24_SI_D6_Cr16) → Inc_75

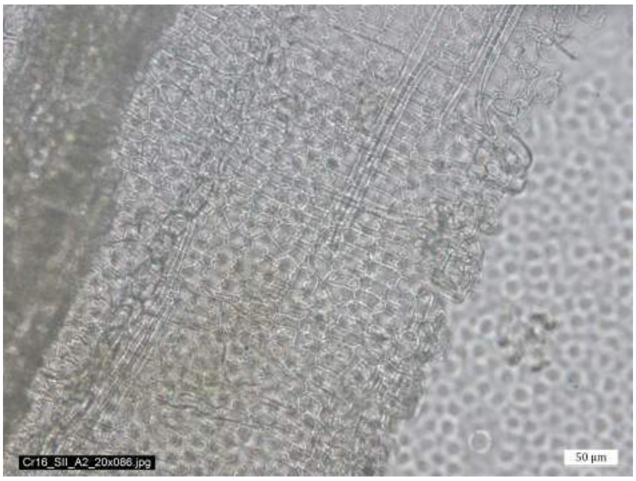



Fragment 25 (25_SII_A1_Cr16) → Inc_76

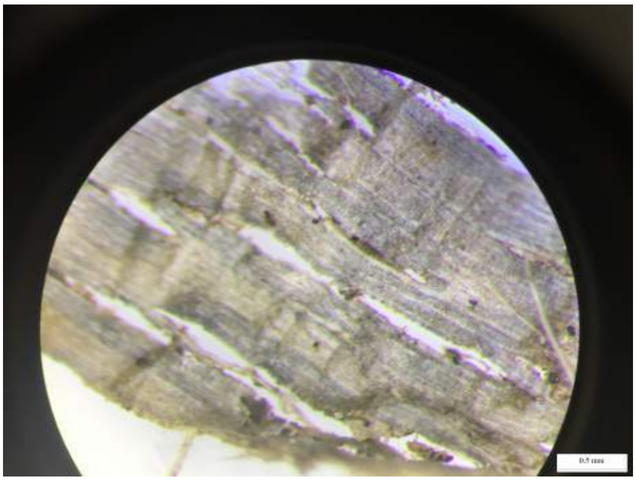


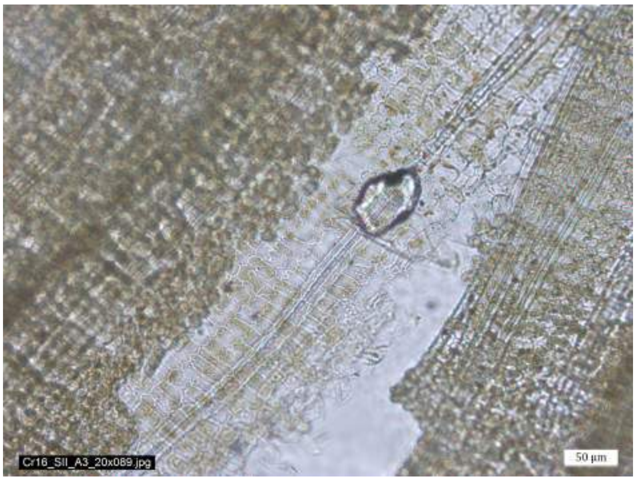
Fragment 26 (26_SII_A2_Cr16)



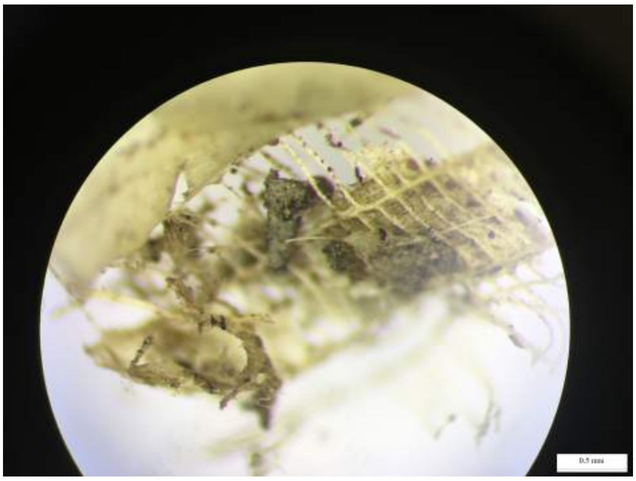


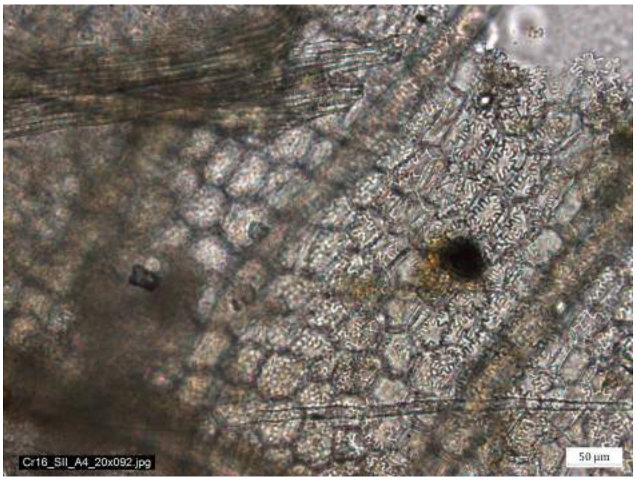
Fragment 27 (27_SII_A3_Cr)



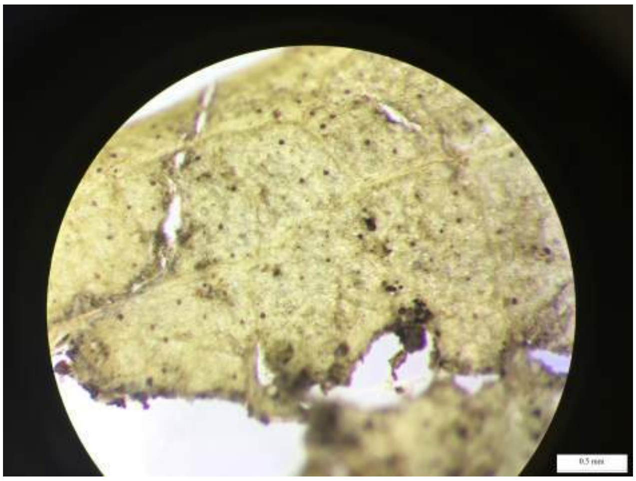


Fragment 28 (28_SII_A4_Cr16)

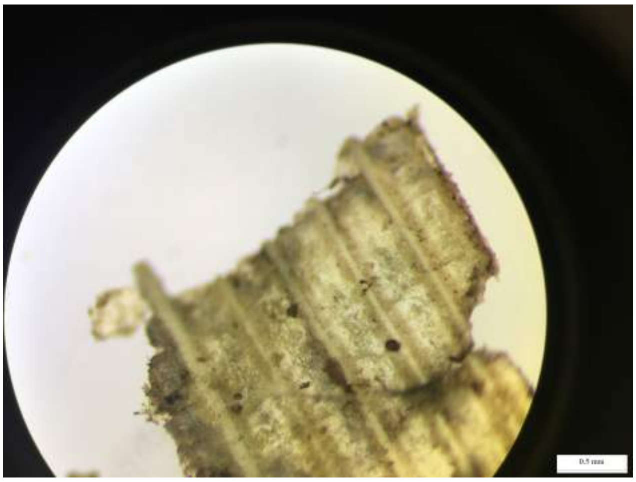




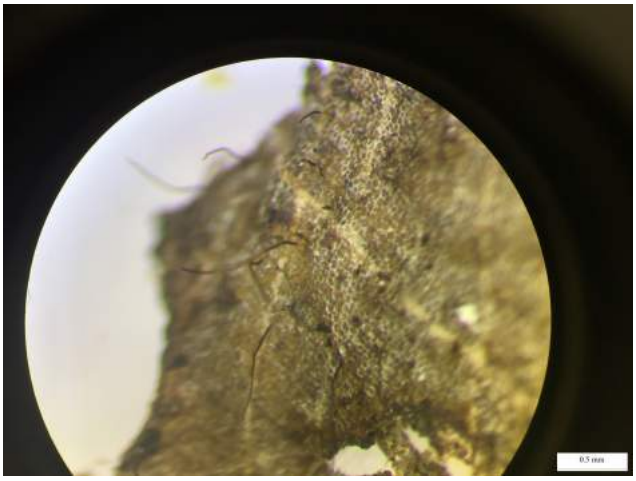
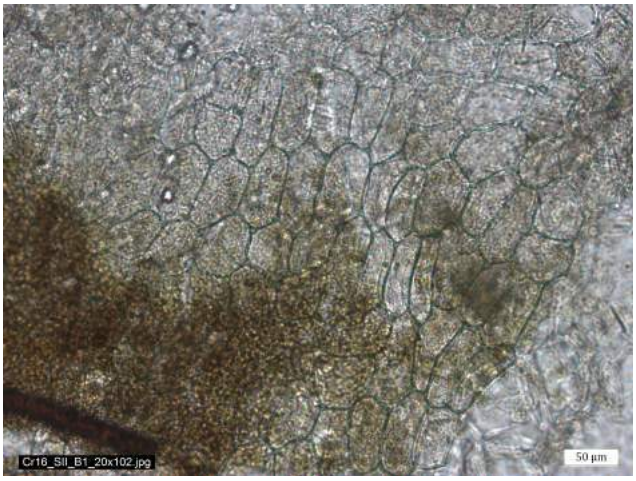
Fragment 29 (29_SII_A5_Cr16) → Inc_77



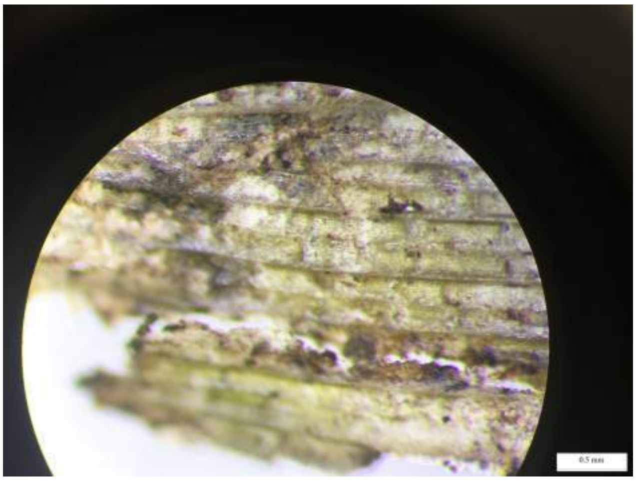
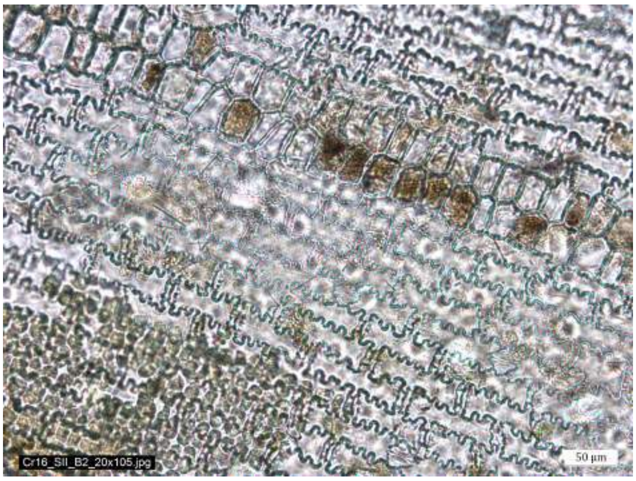
Fragment 30 (30_SII_A6_Cr16) → Inc_78



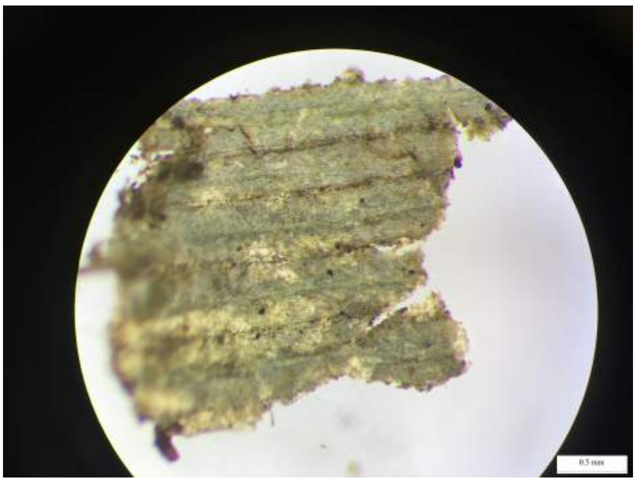
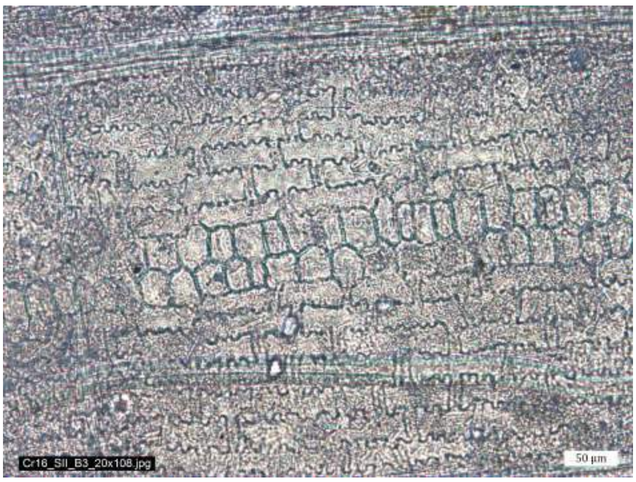
Fragment 31 (31_SII_B1_Cr16)

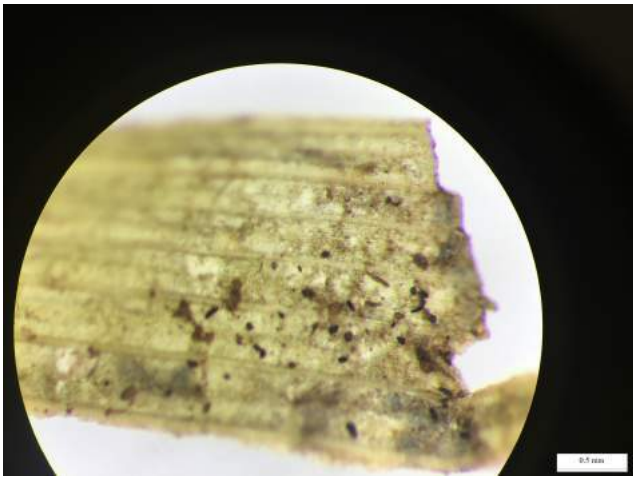
Fragment 32 (32_SII_B2_Cr16)

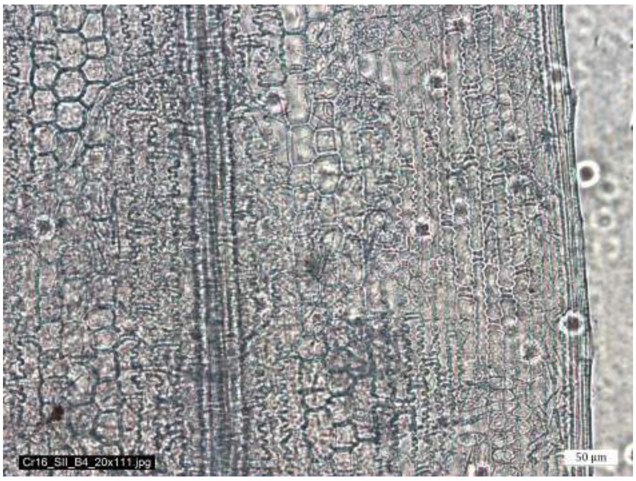



Fragment 33 (33_SII_B3_Cr16)

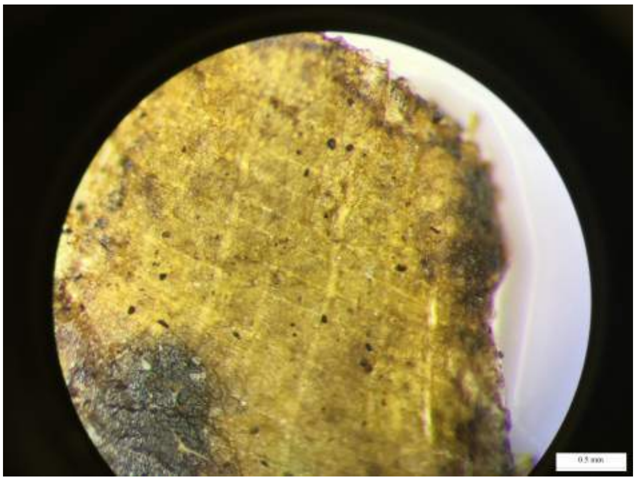



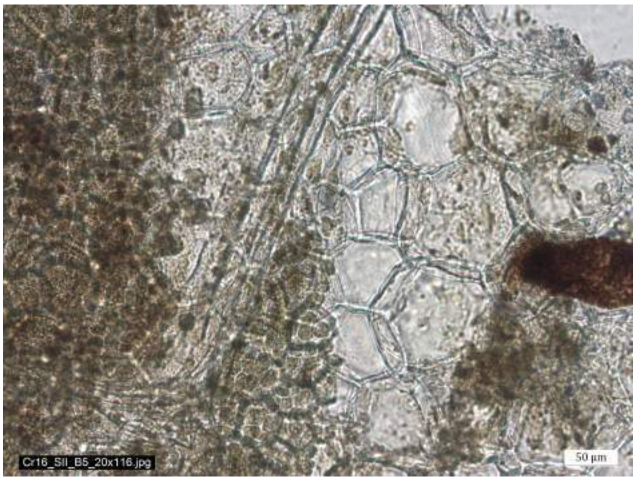
Fragment 34 (34_SII_B4_Cr16)



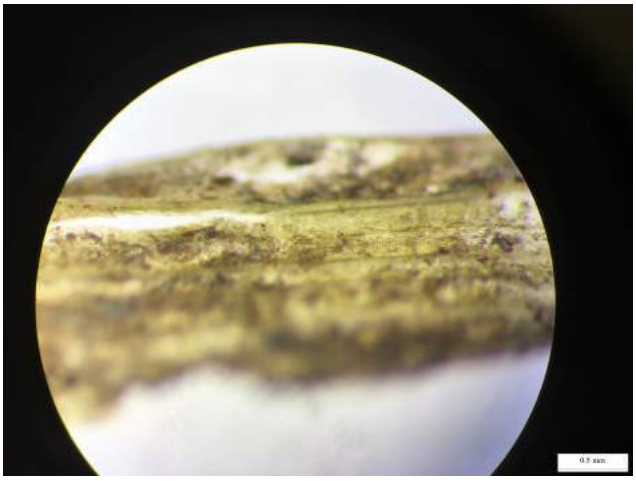


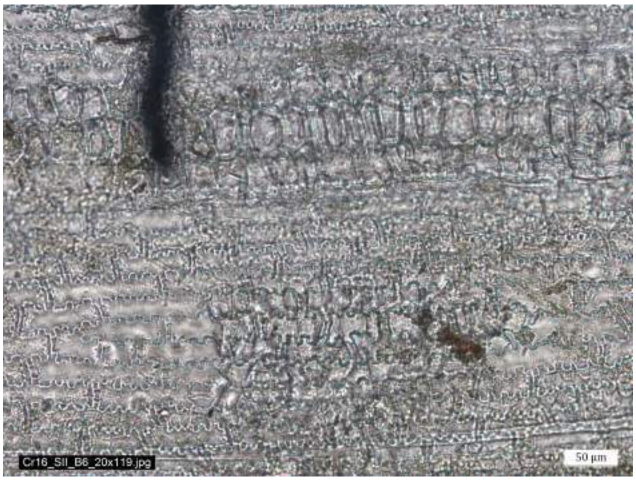
Fragment 35 (5_SII_B5_Cr16)



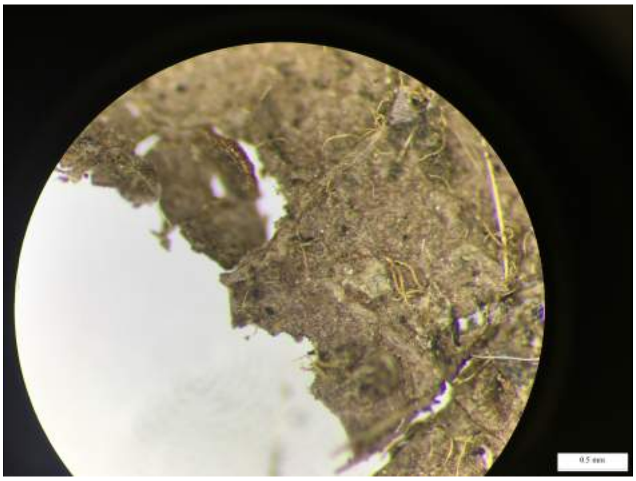


Fragment 36 (36_SII_B6_Cr16)



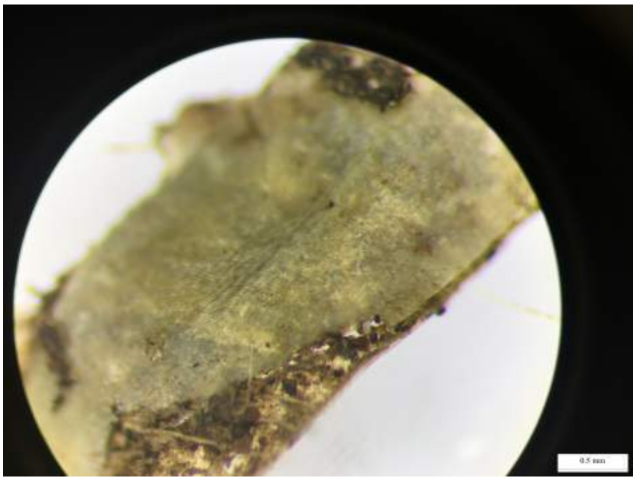


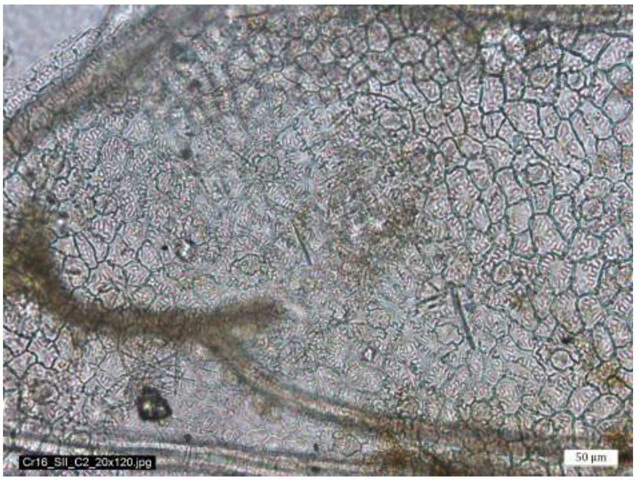
Fragment 37 (37_SII_C1_Cr16)



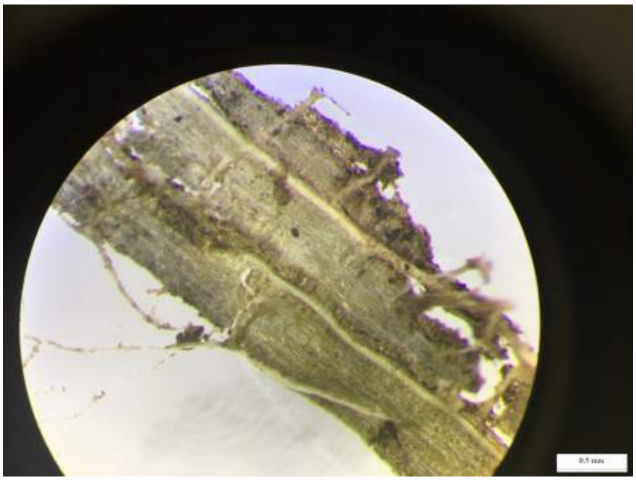
No references

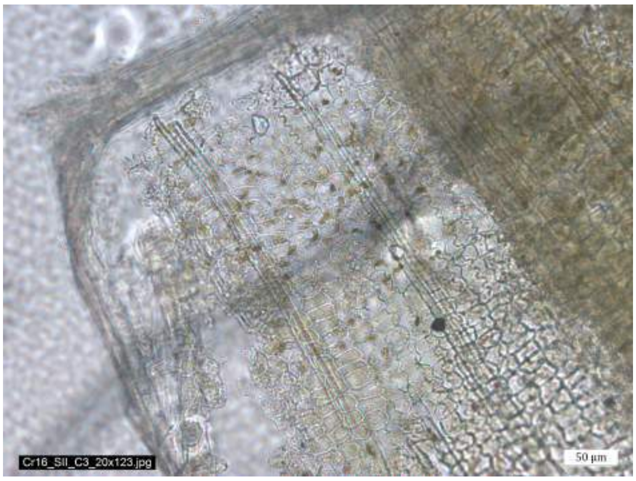
Fragment 38 (38_SII_C2_Cr16)



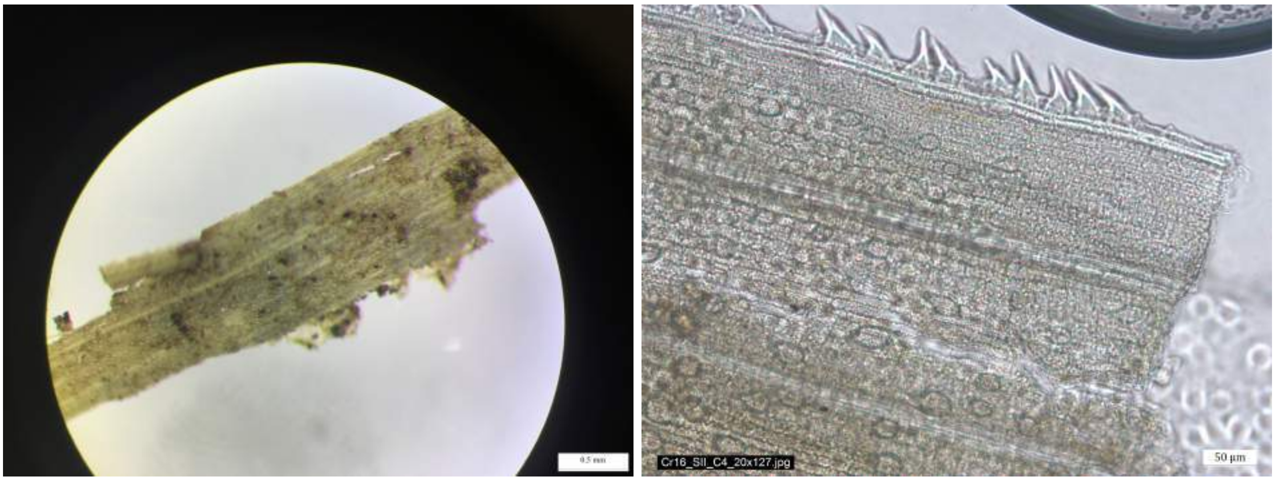


Fragment 39 (39_SII_C3_Cr16)

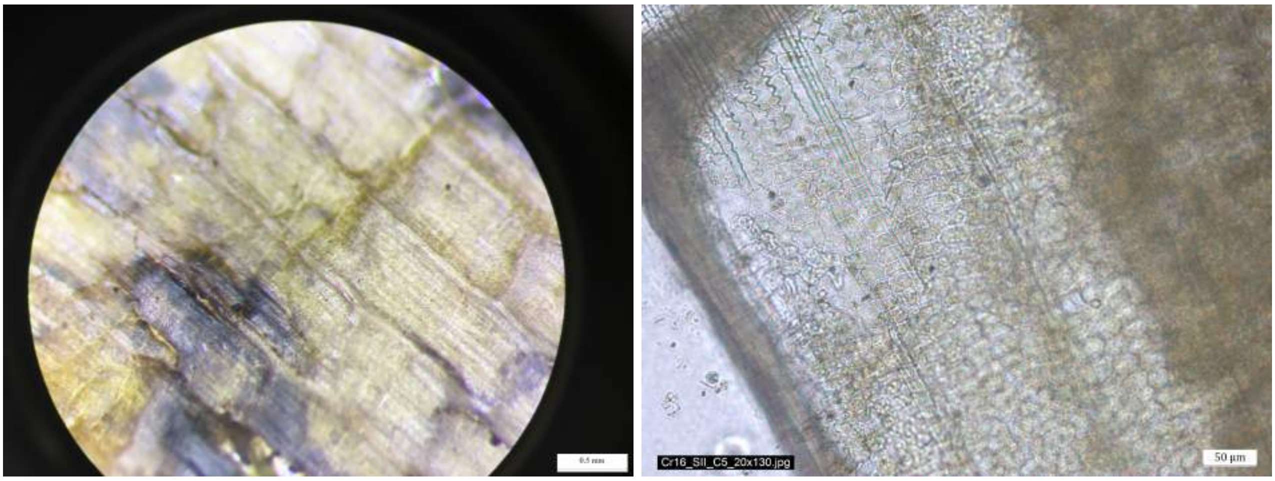




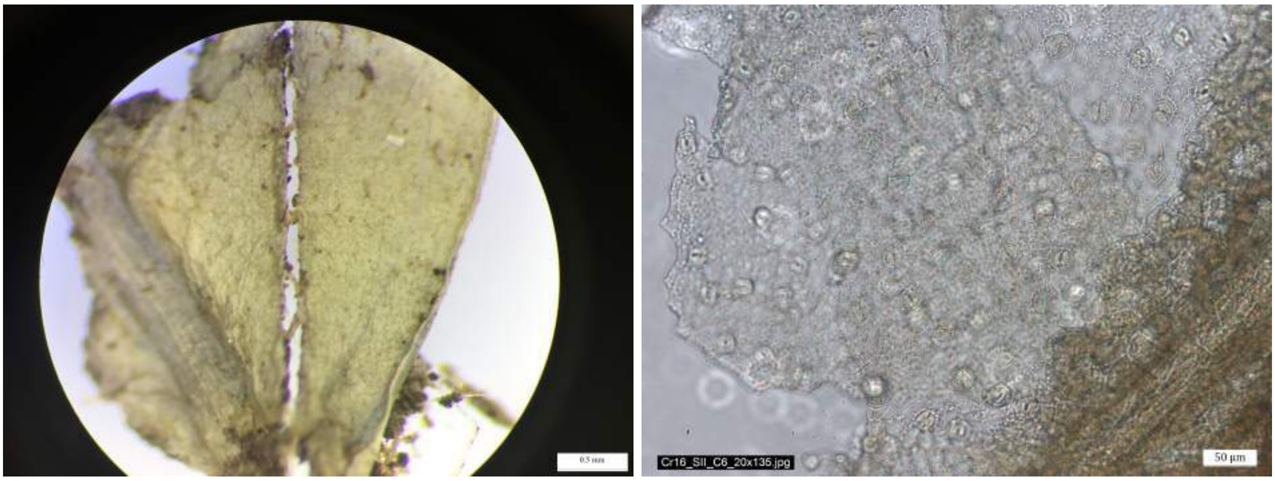
Fragment 40 (40_SII_C4_Cr16)



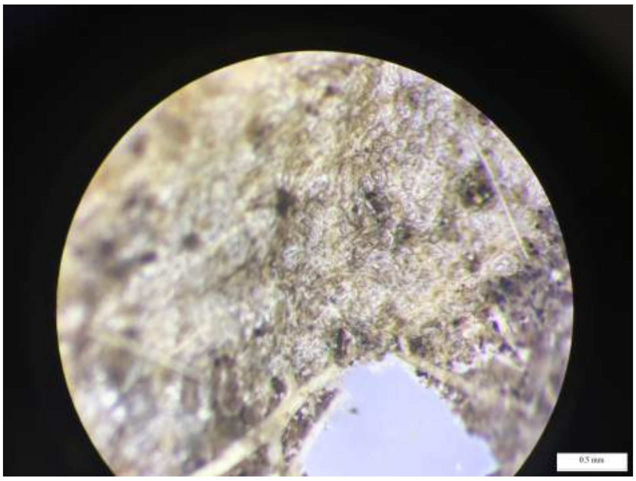
Fragment 41 (41_SII_C5_Cr16)

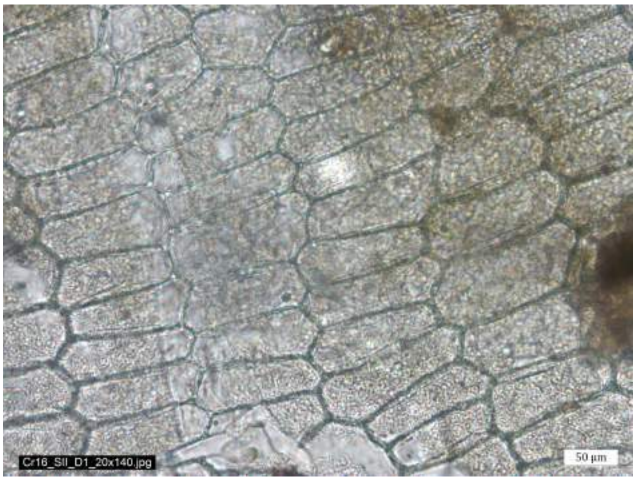


Fragment 42 (42_SII_C6_Cr16) → Inc_79

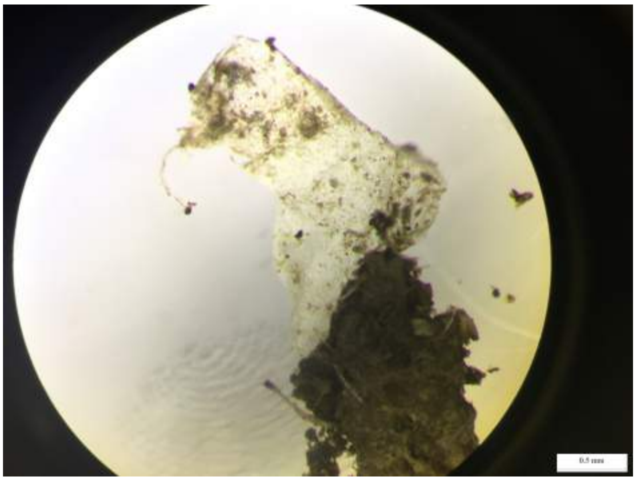


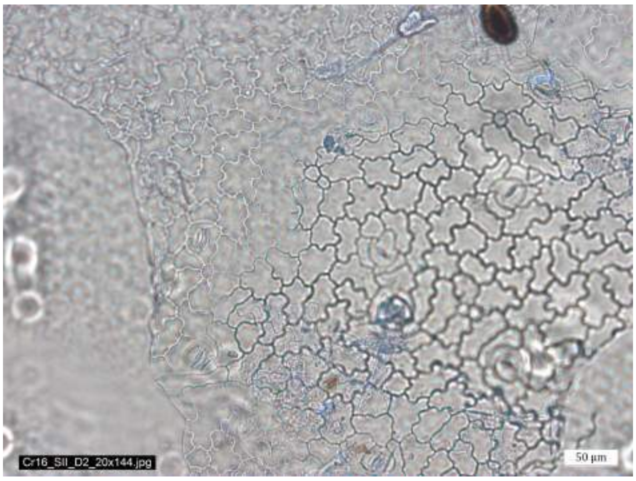
Fragment 43 (43_SII_D1_Cr16)



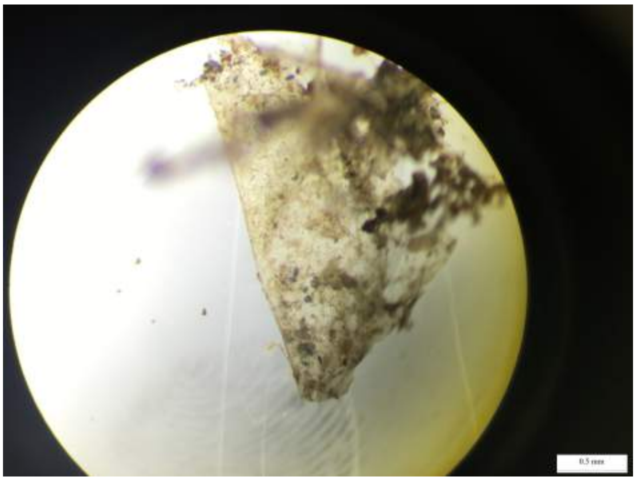


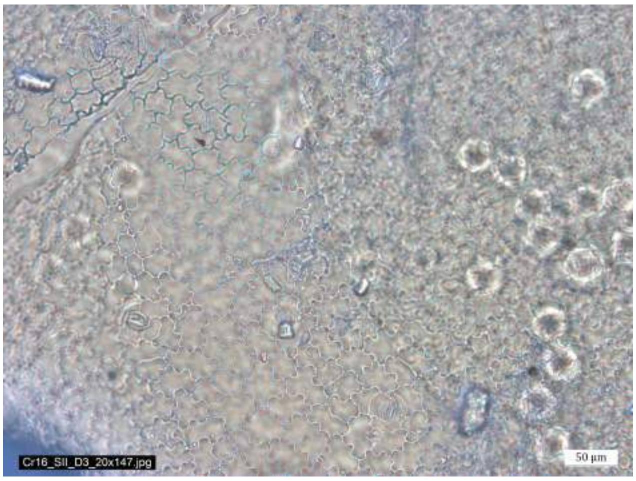
Fragment 44 (44_SII_D2_Cr16)



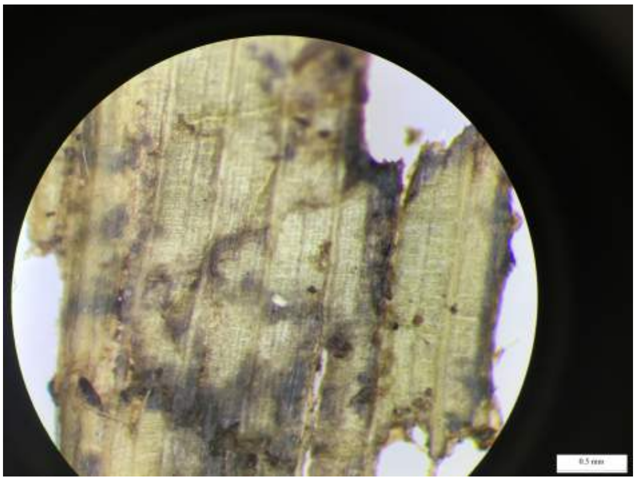


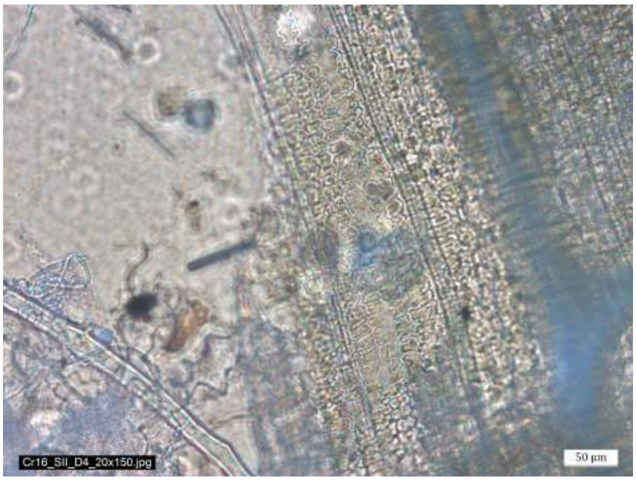
Fragment 45 (45_SII_D3_Cr16)



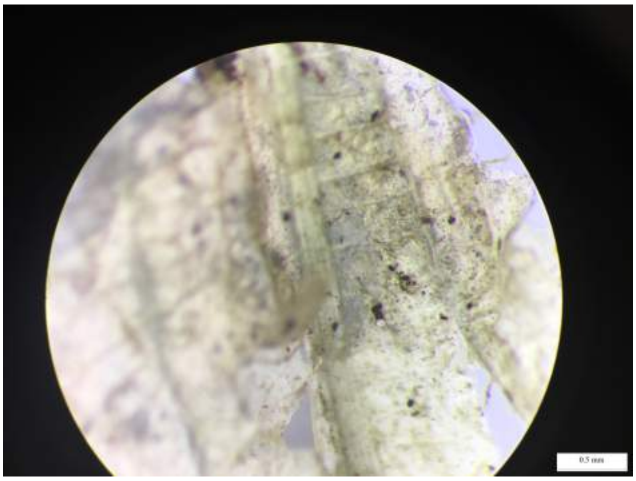


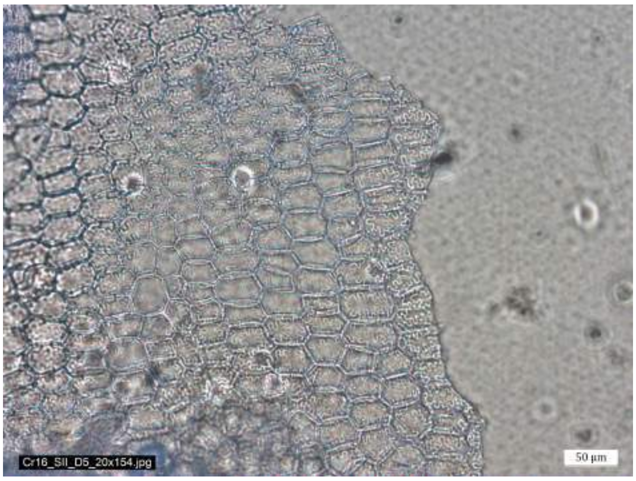
Fragment 46 (46_SII_D4_Cr16)



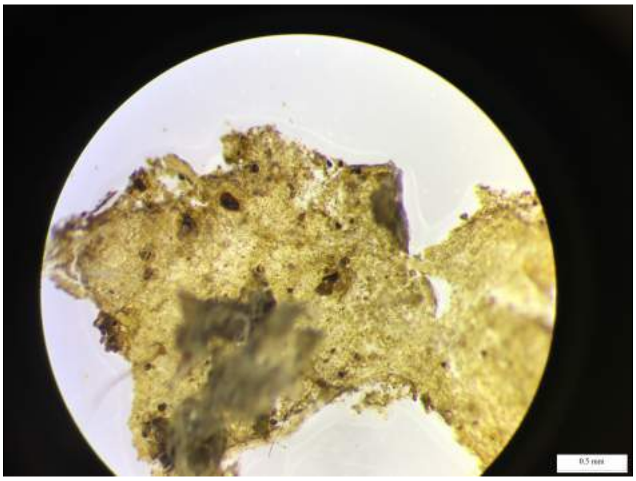


Fragment 47 (47_SII_D5_Cr16)



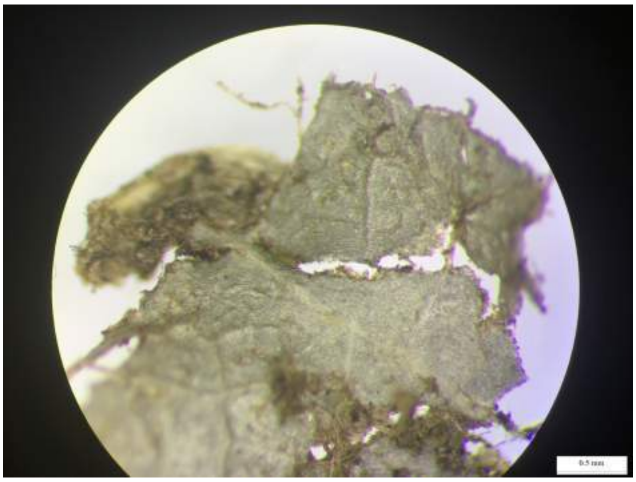


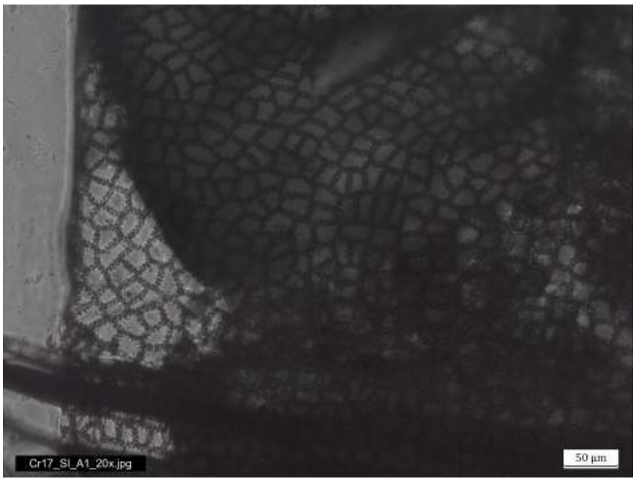
Fragment 48 (48_SII_D6_Cr16)



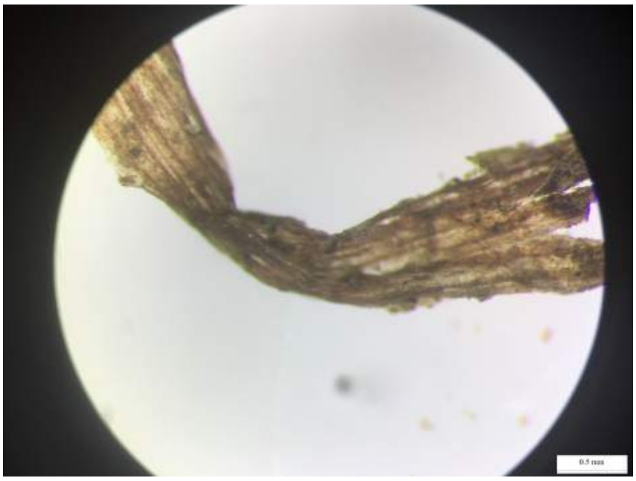
Fragments of the Faece 7

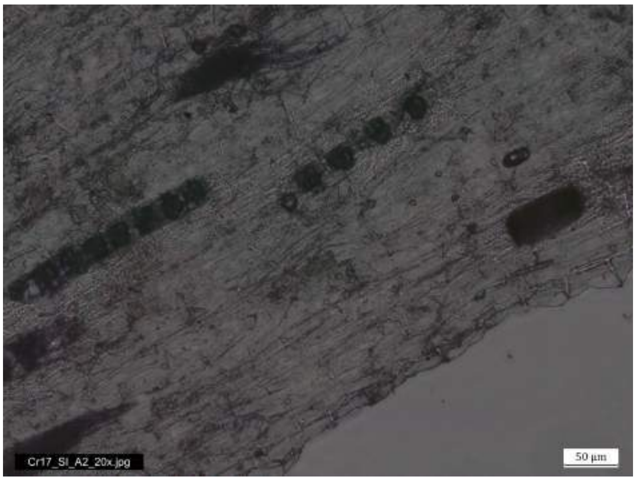
Fragment 1 (1_SI_A1_Cr17) → Inc_80



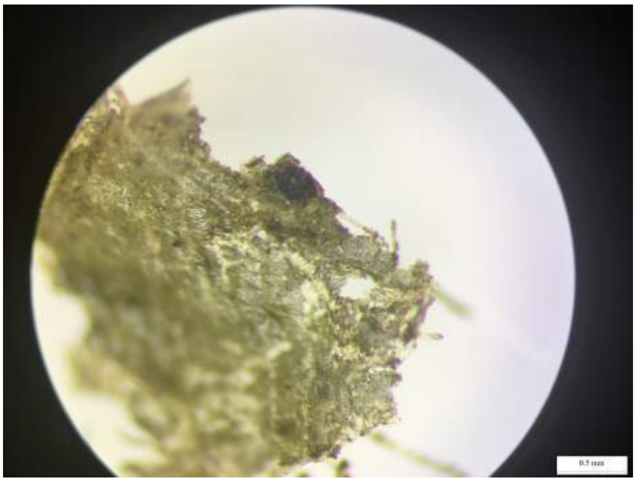


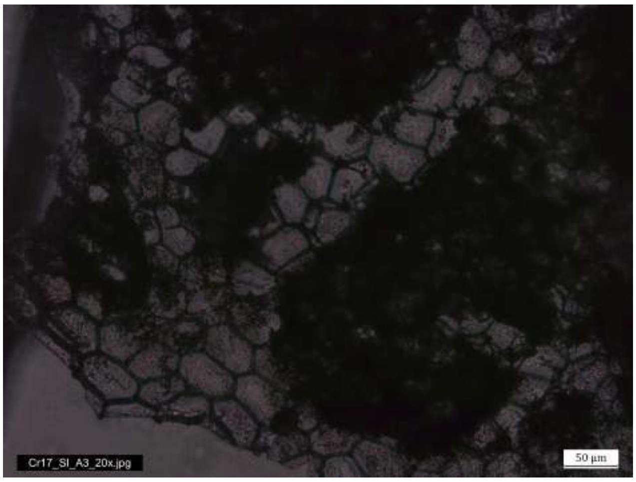
Fragment 2 (2_SI_A2_Cr17) → Inc_81



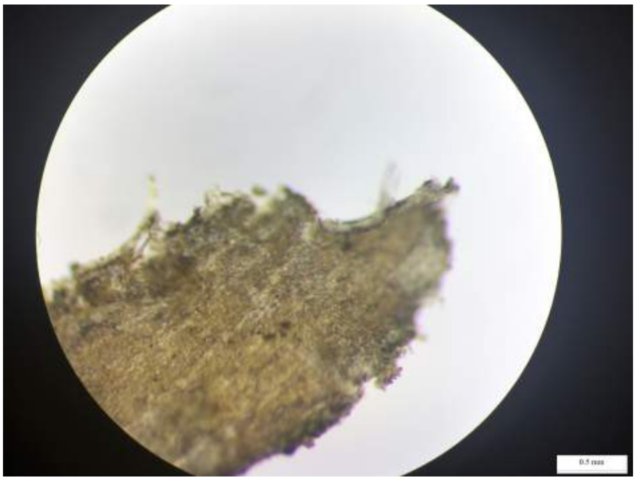


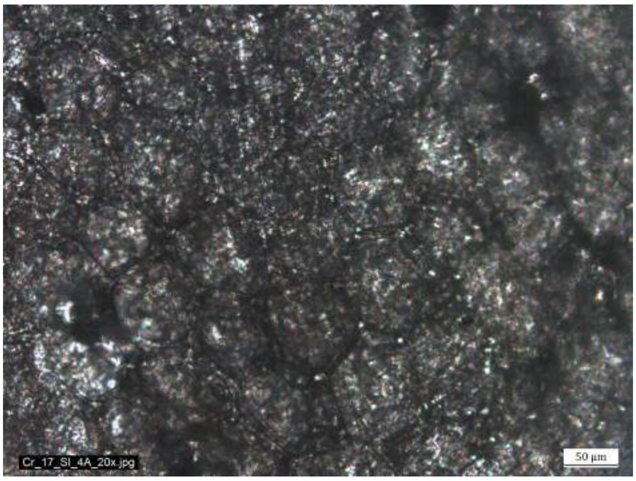
Fragment 3 (3_SI_A3_Cr17) → Inc_82



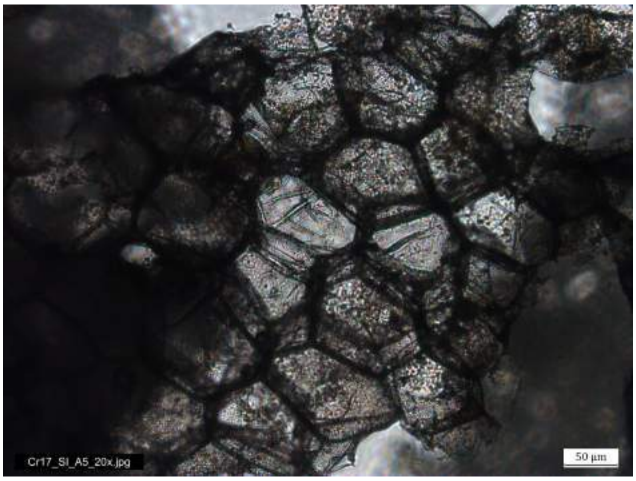


Fragment 4 (4_SI_A4_Cr17)

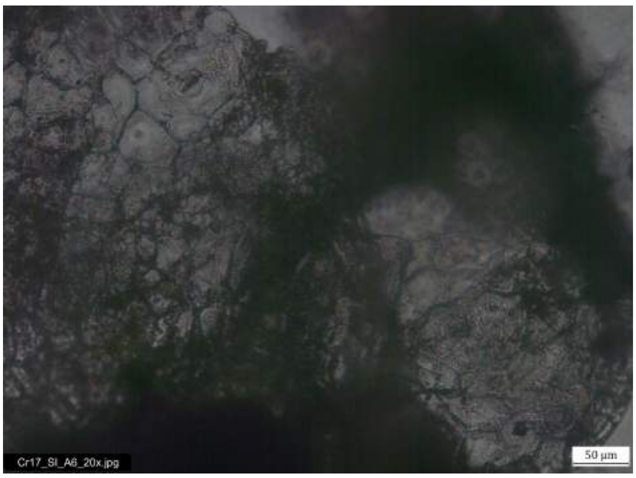




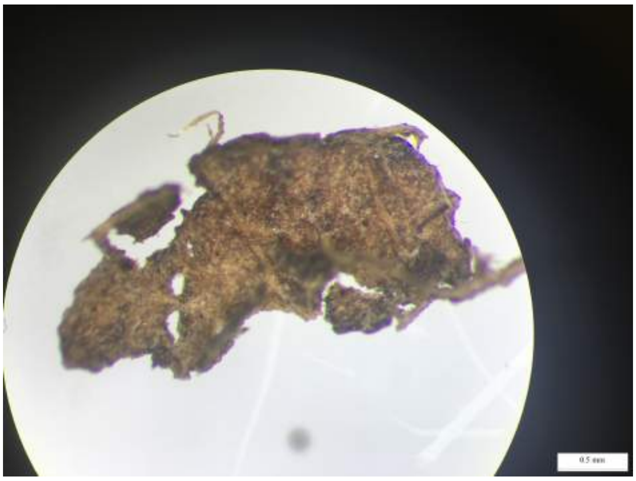
Fragment 5 (5_SI_A5_Cr17)

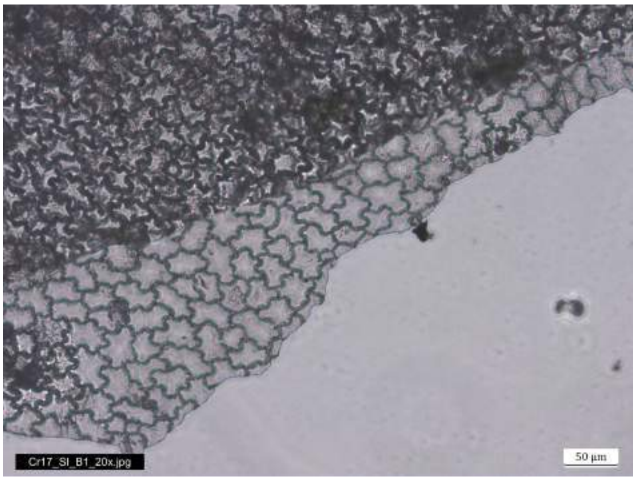


Fragment 6 (6_SI_A6_Cr17) → Inc_83

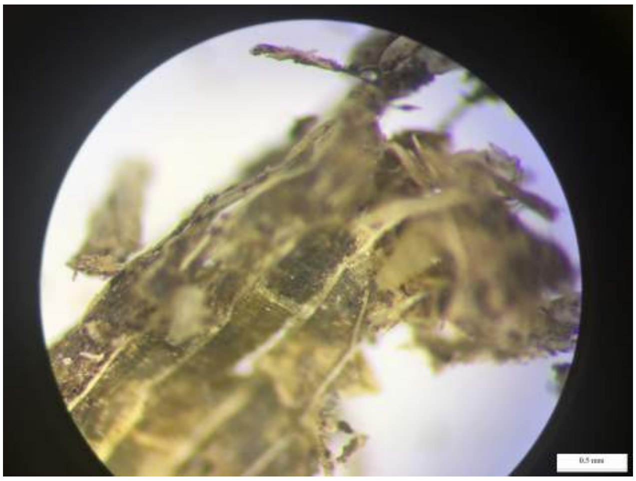


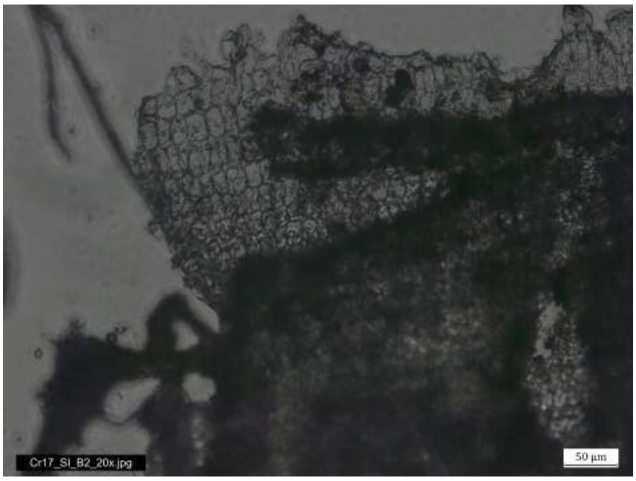
Fragment 7 (7_SI_B1_Cr17) → Inc_84



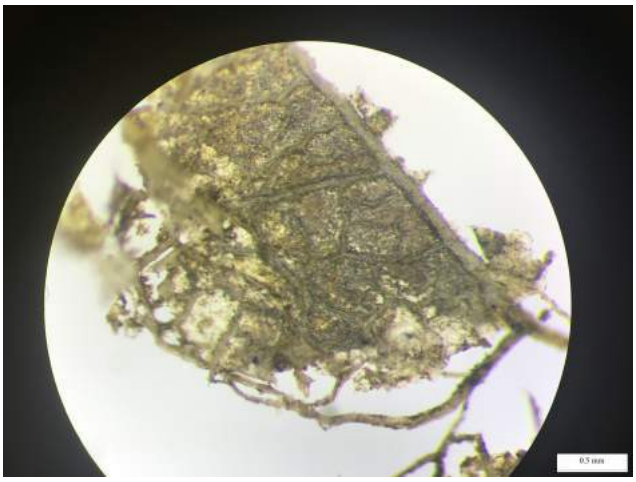


Fragment 8 (8_SI_B2_Cr17)

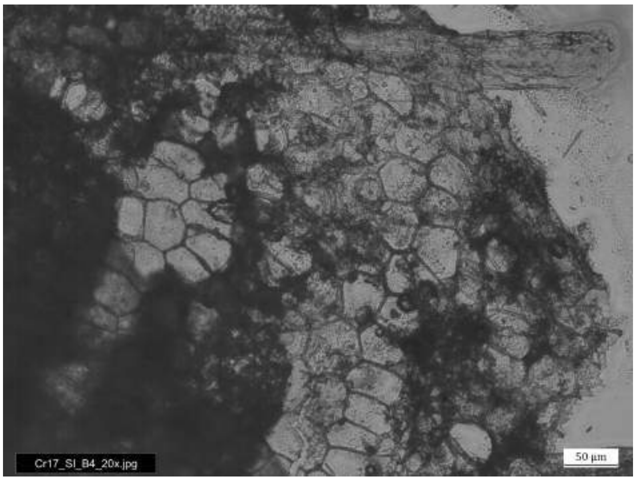




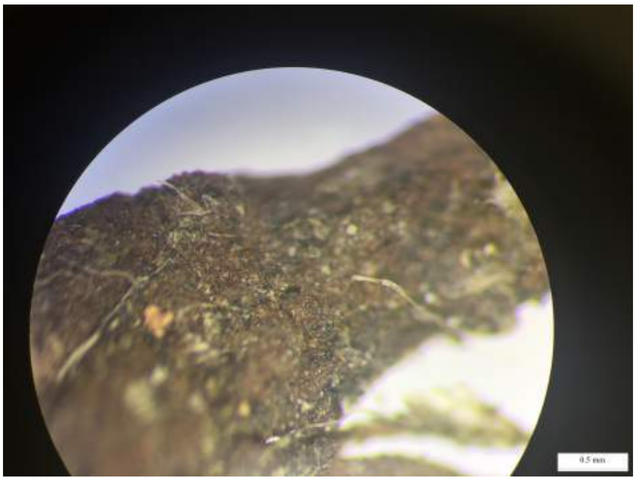
Fragment 9 (9_SI_B3_Cr17) → Inc_85



Fragment 10 (10_SI_B4_Cr17)

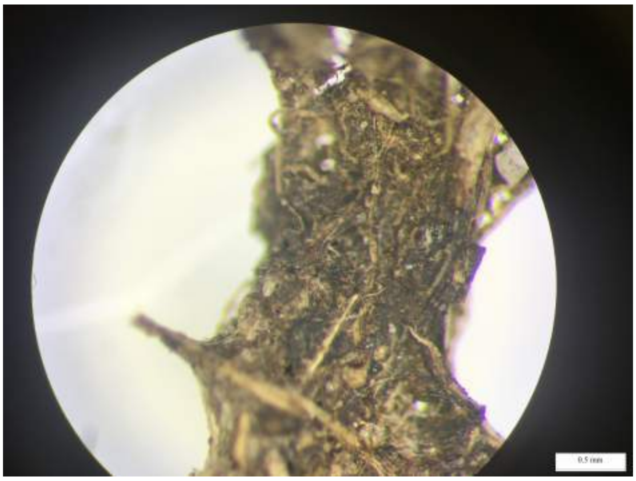


Fragment 11 (11_SI_B5_Cr17)

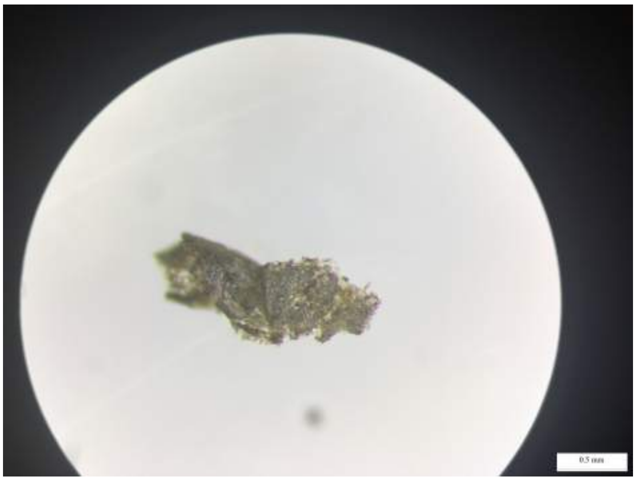


No references

Fragment 12 (12_SI_B6_Cr17)

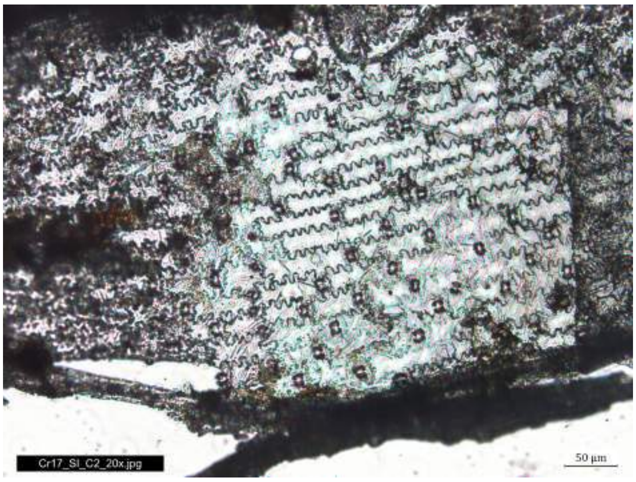


Fragment 13 (13_SI_C1_Cr17)

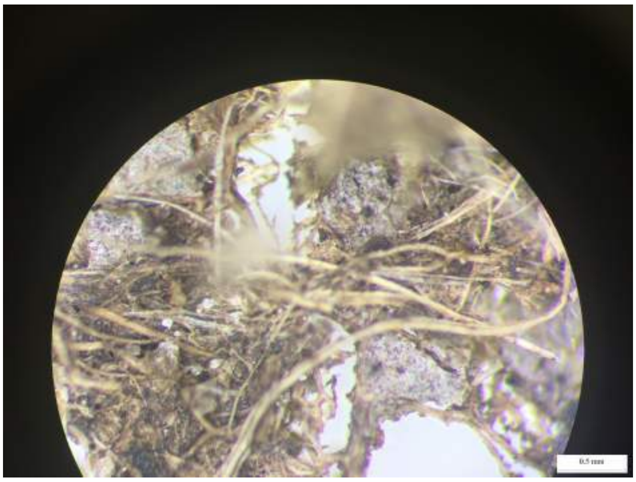


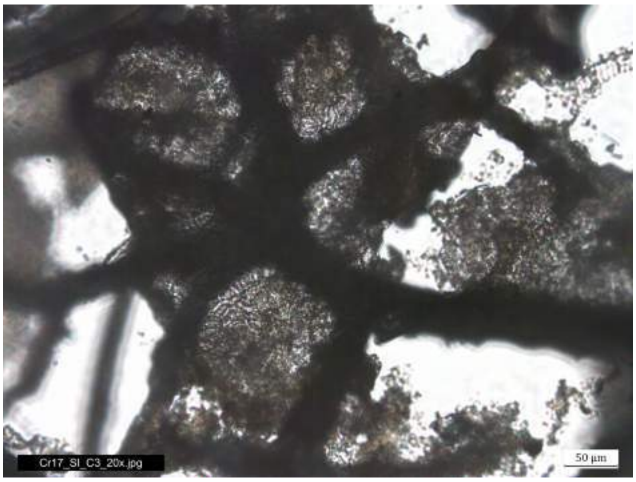
No references

Fragment 14 (14_SI_C2_Cr17) → Inc_86

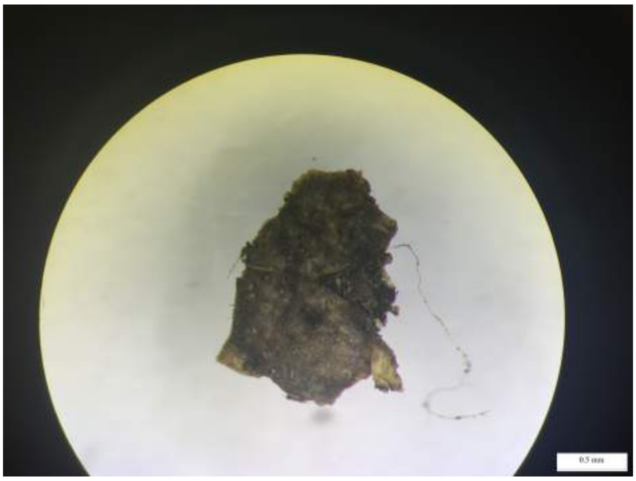


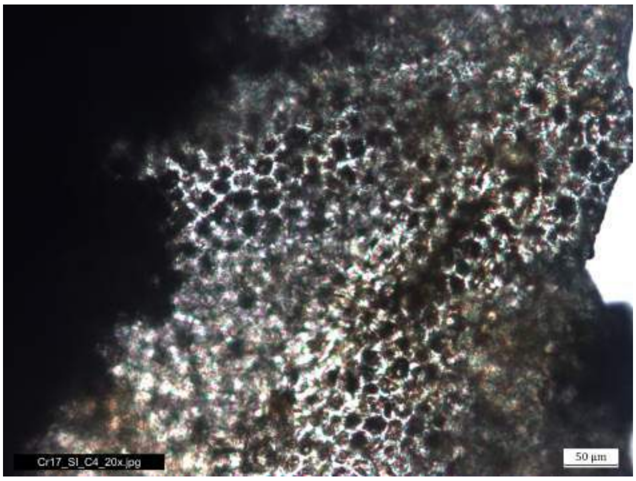
Fragment 15 (15_SI_C3_Cr17)



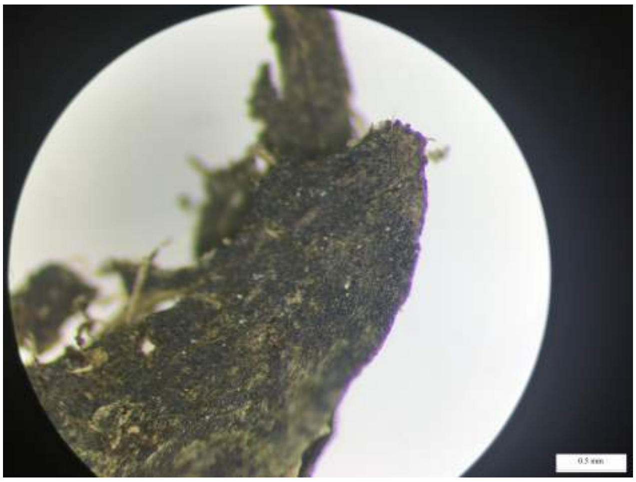


Fragment 16 (16_SII_C4_Cr17) → Inc_87



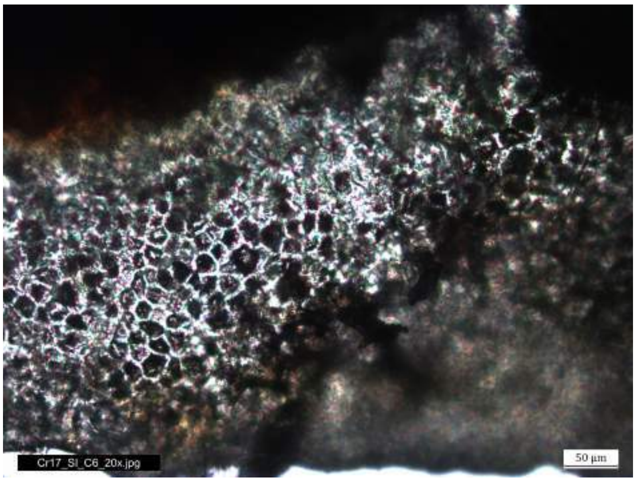


Fragment 17 (17_SI_C5_Cr17)

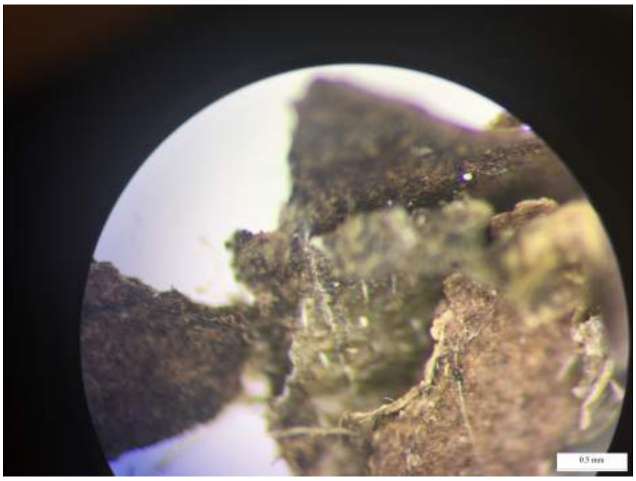


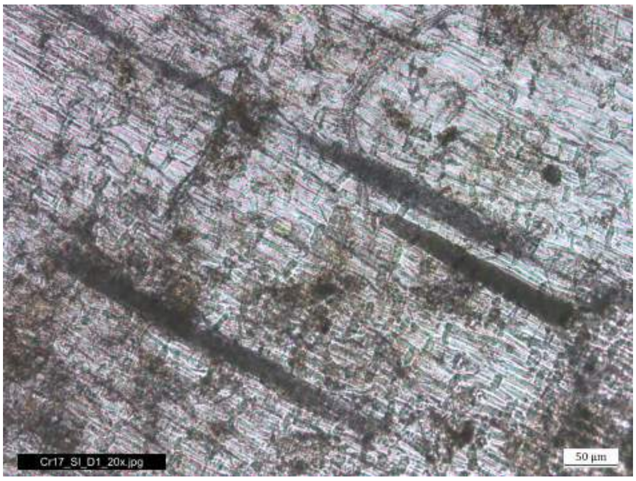
No references

Fragment 18 (18_SI_C6_Cr17)



Fragment 19 (19_SI_D1_Cr17)

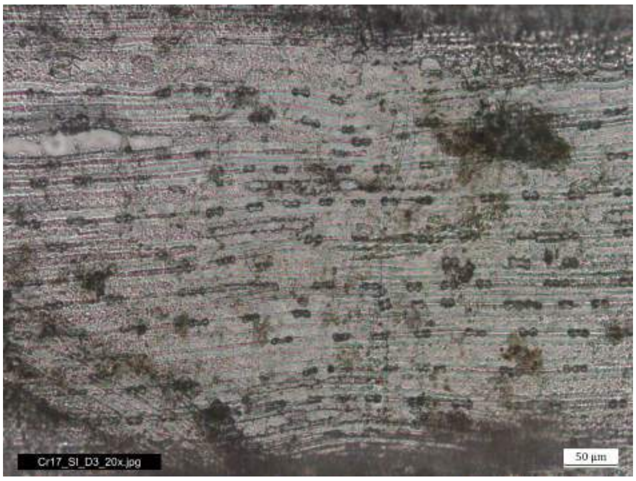




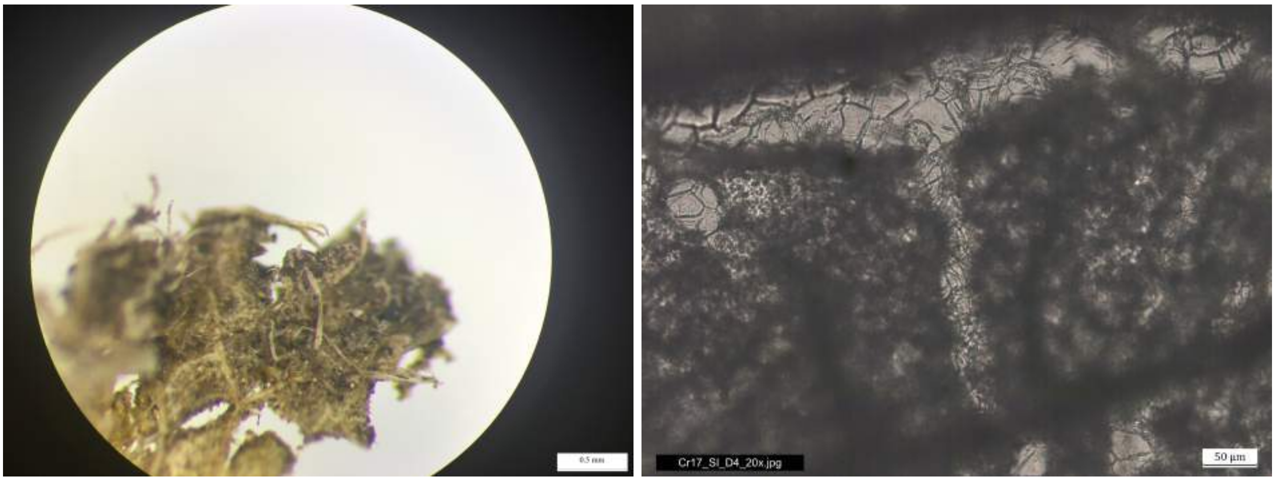
Fragment 20 (20_SI_D2_Cr17)

No references

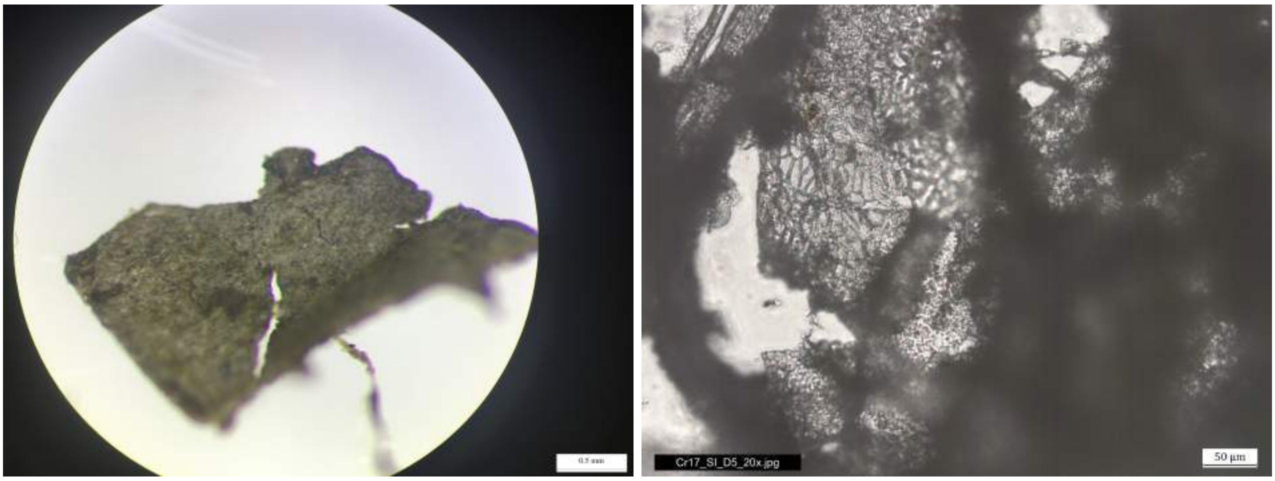
Fragment 21 (21_SI_D3_Cr17)



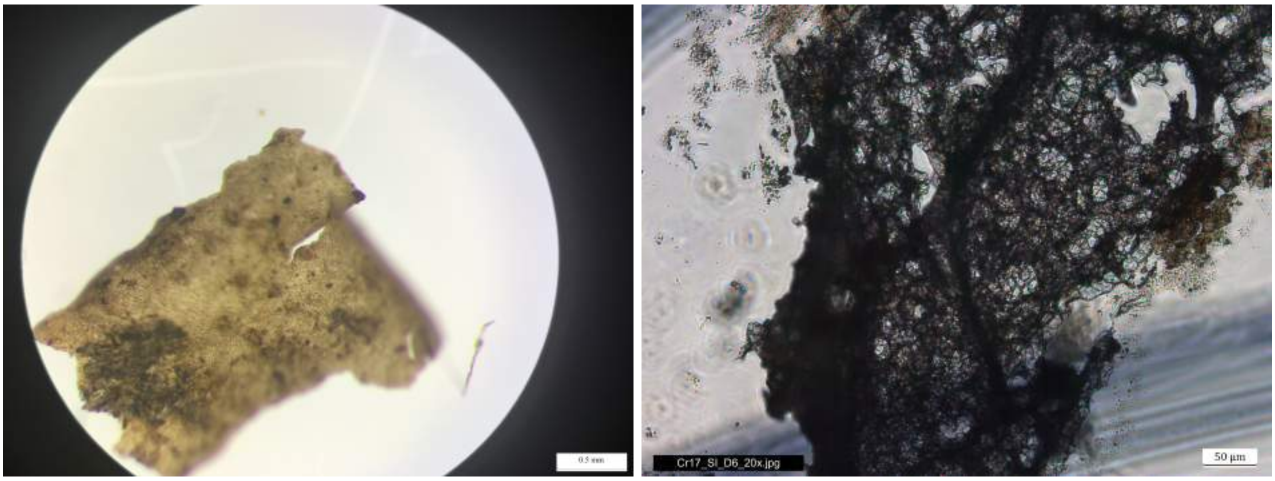
Fragment 22 (22_SI_D4_Cr17)



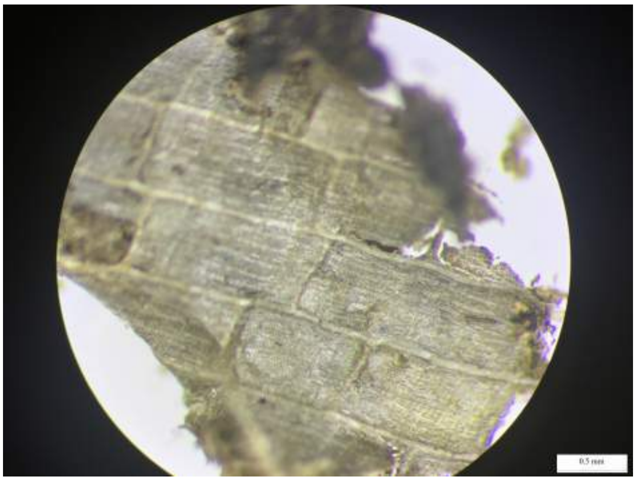
Fragment 23 (23_SI_D5_Cr) → Inc_88

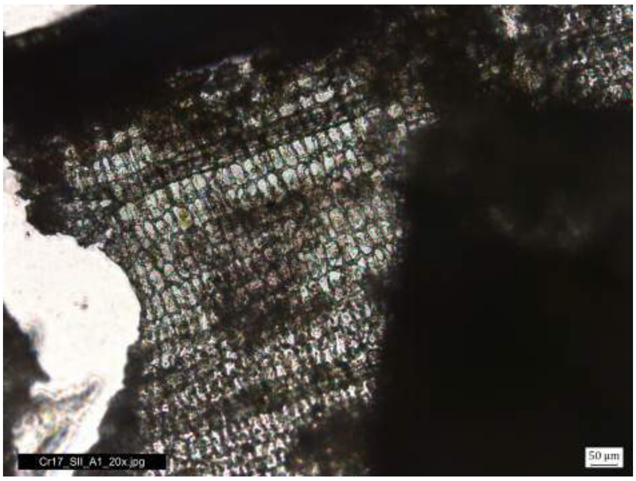


Fragment 24 (24_SI_D6_Cr17)

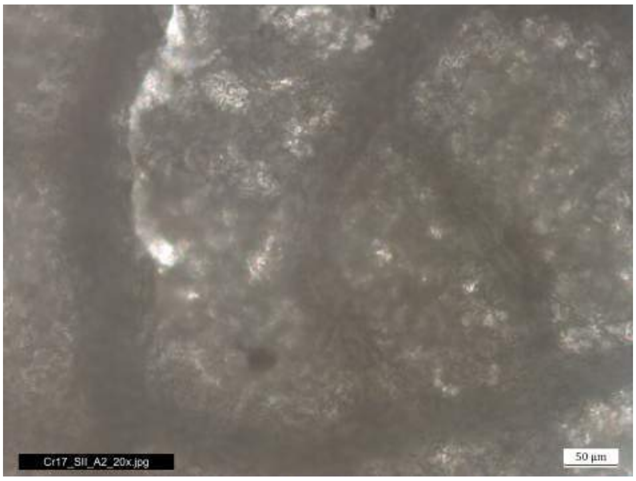


Fragment 25 (25_SII_A1_Cr17) → Inc_89

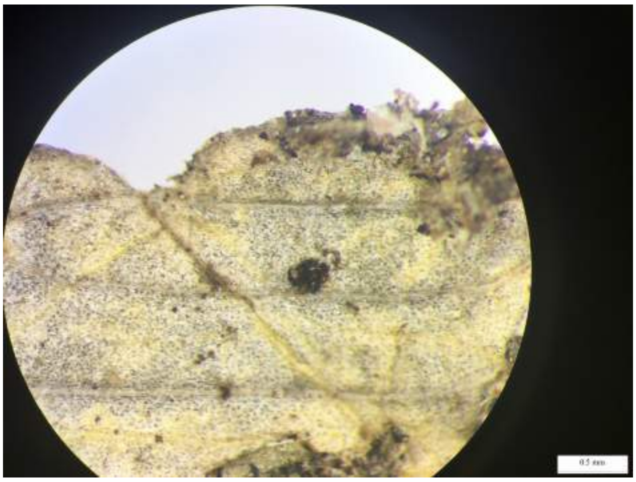


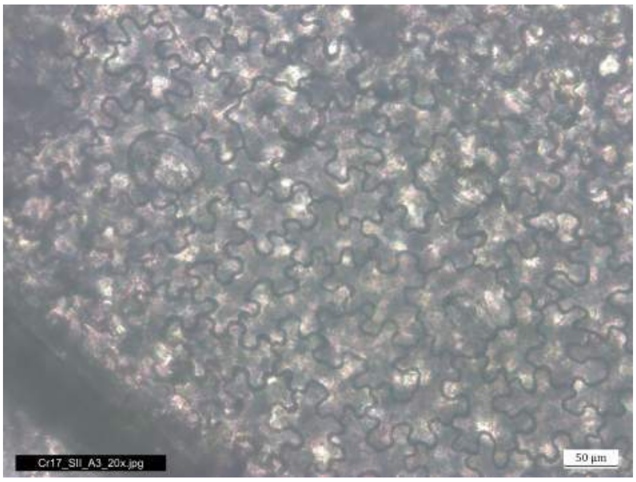


Fragment 26 (26_SII_A2_Cr17)

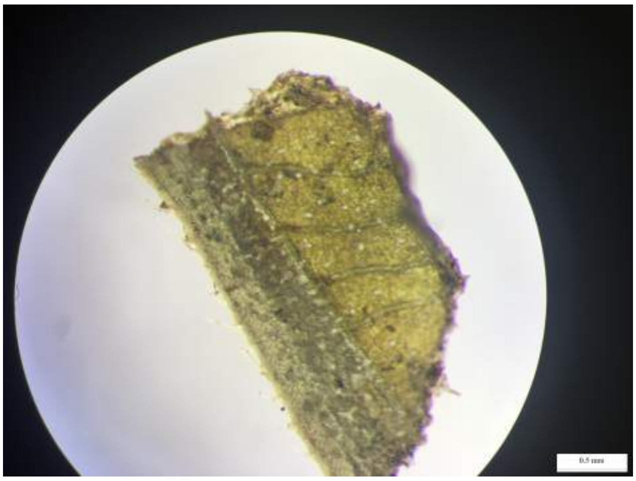


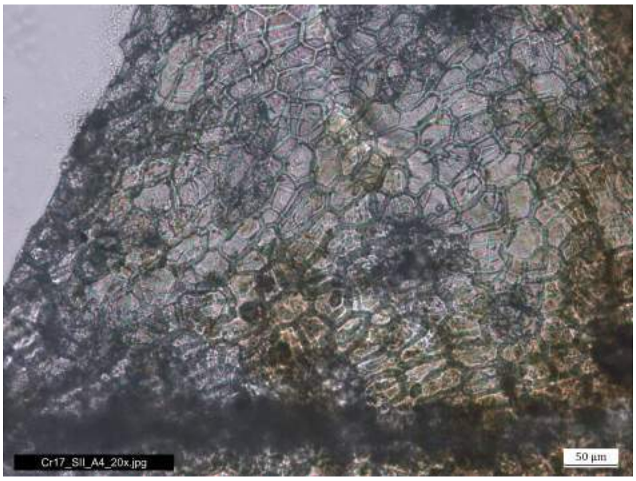
Fragment 27 (27_SII_A3_Cr) → Inc_90



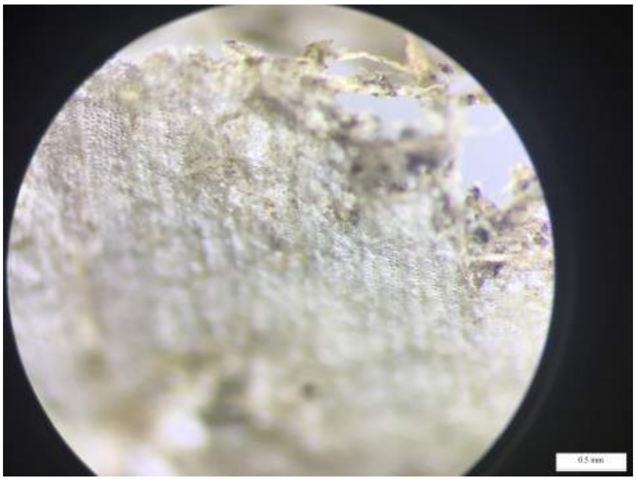


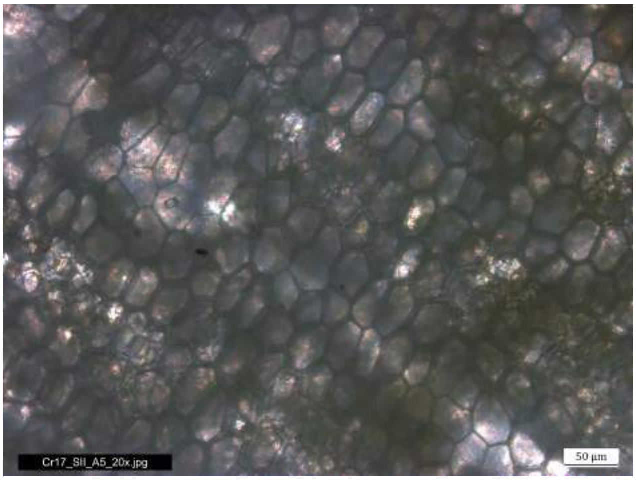
Fragment 28 (28_SII_A4_Cr17)



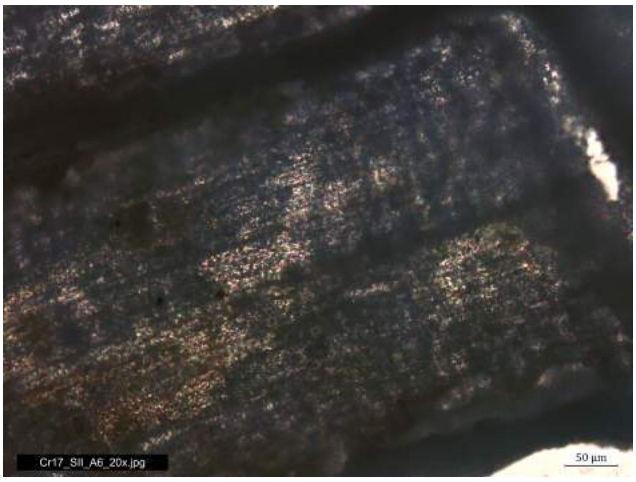


Fragment 29 (29_SII_A5_Cr17)

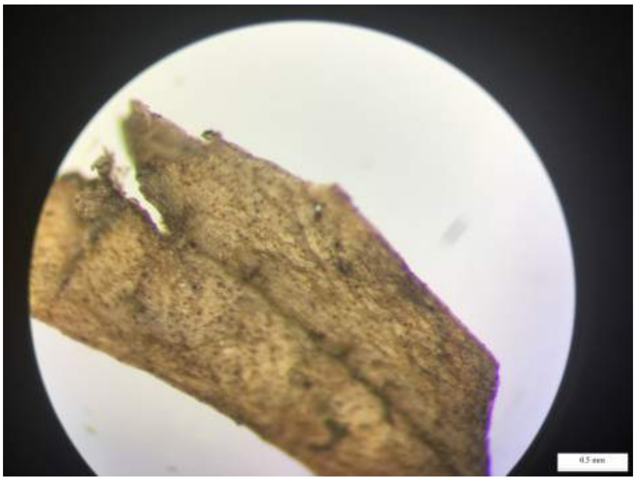


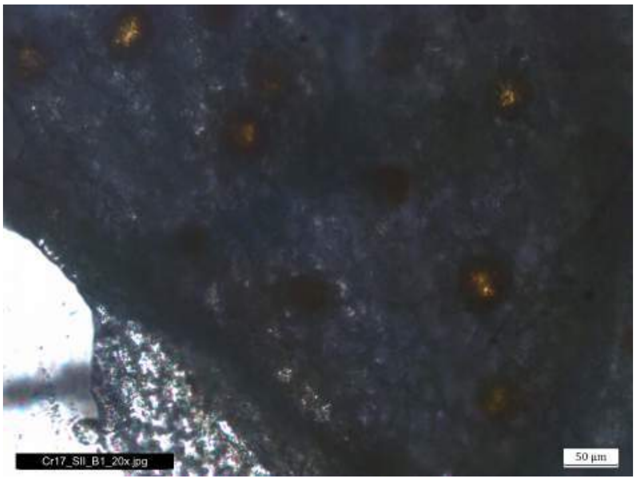


Fragment 30 (30_SII_A6_Cr17)

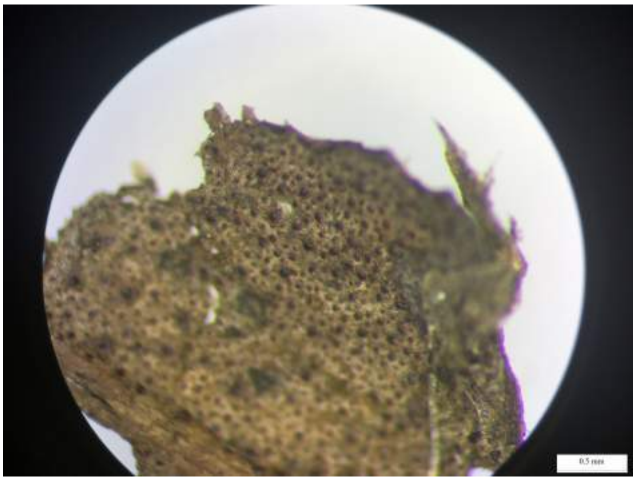


Fragment 31 (31_SII_B1_Cr17)



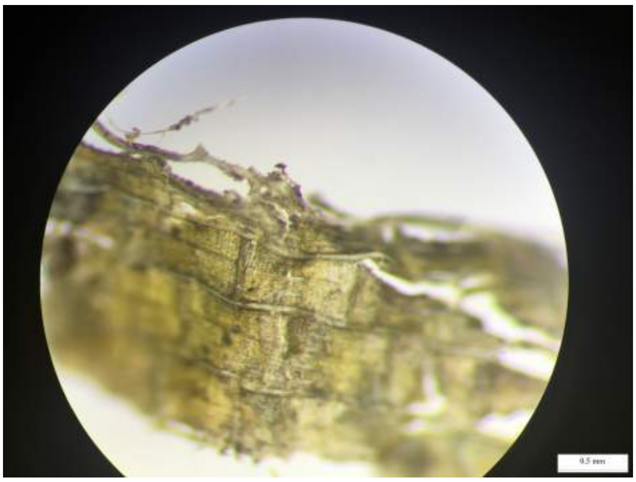


Fragment 32 (32_SII_B2_Cr17)



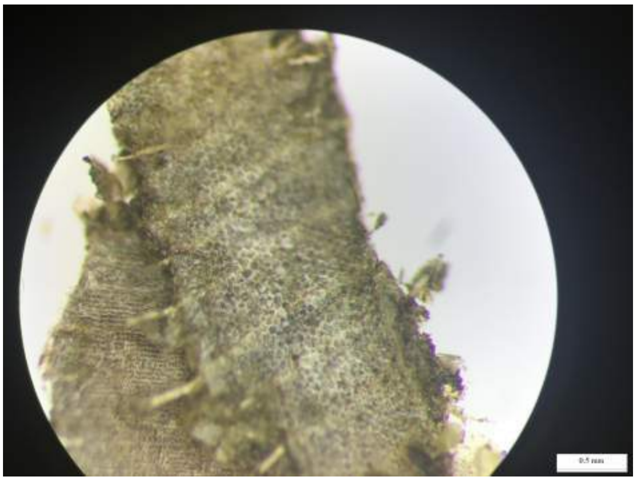
No references

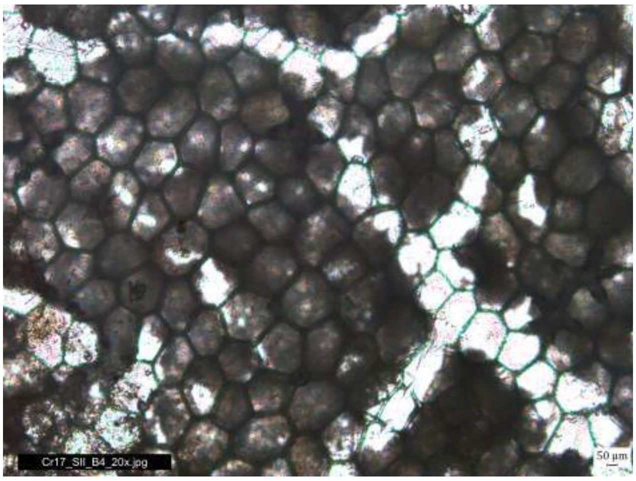
Fragment 33 (33_SII_B3_Cr17)



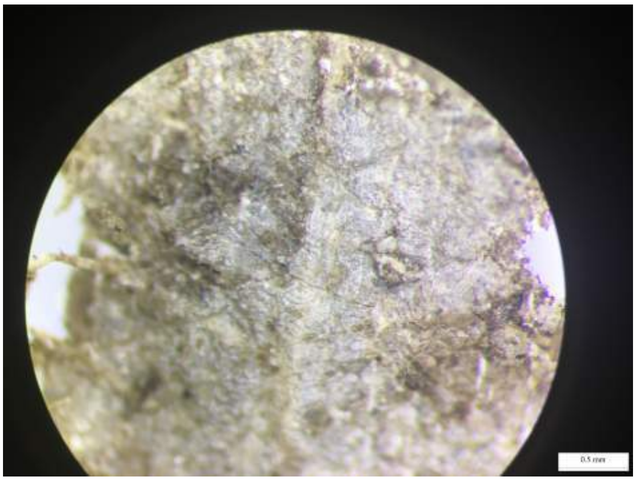
No references

Fragment 34 (34_SII_B4_Cr17)



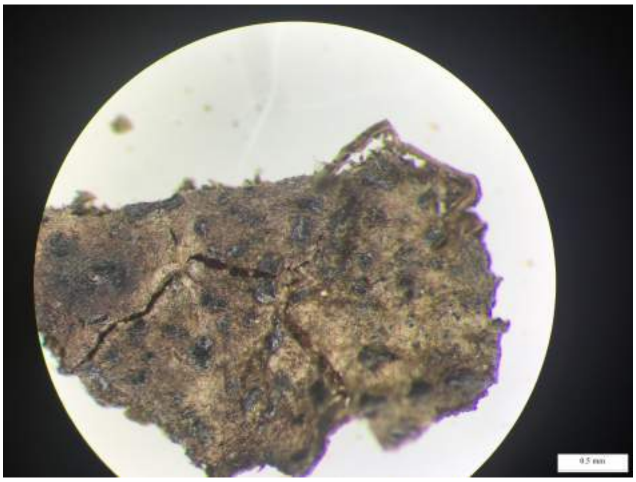


Fragment 35 (5_SII_B5_Cr17)



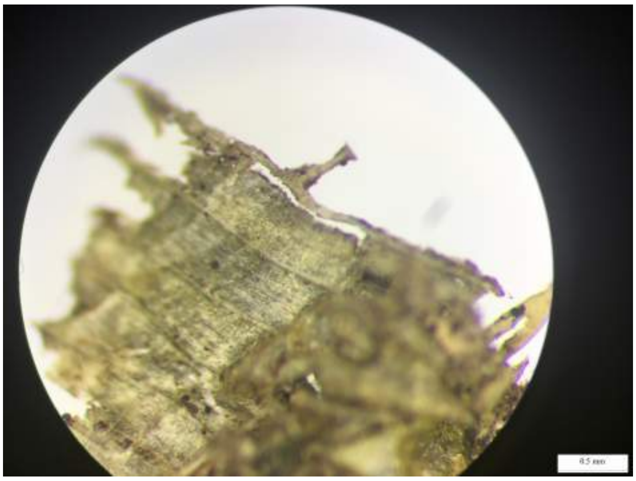
No references

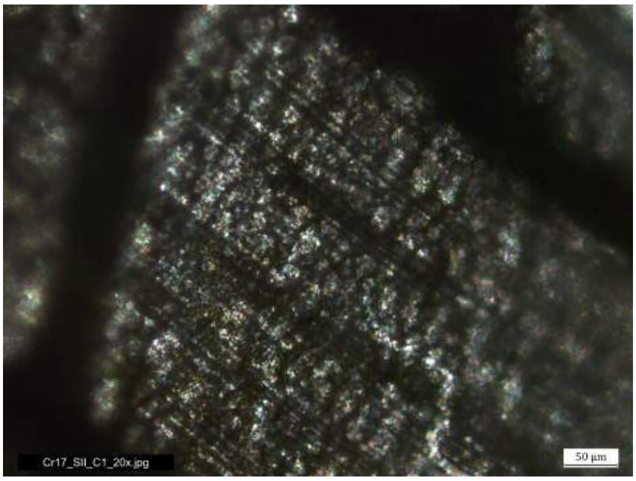
Fragment 36 (36_SII_B6_Cr17)



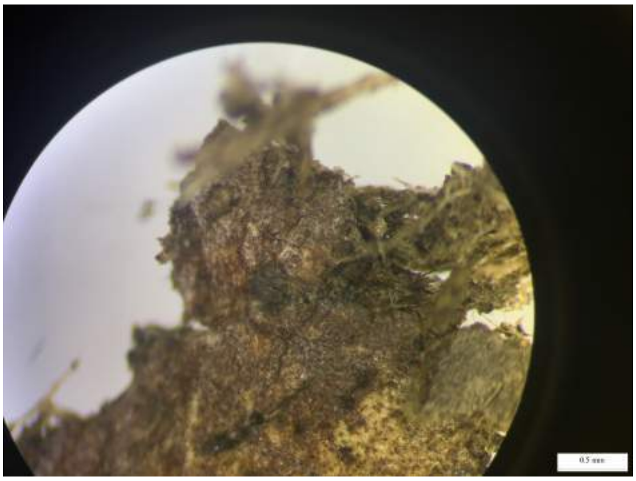
No references

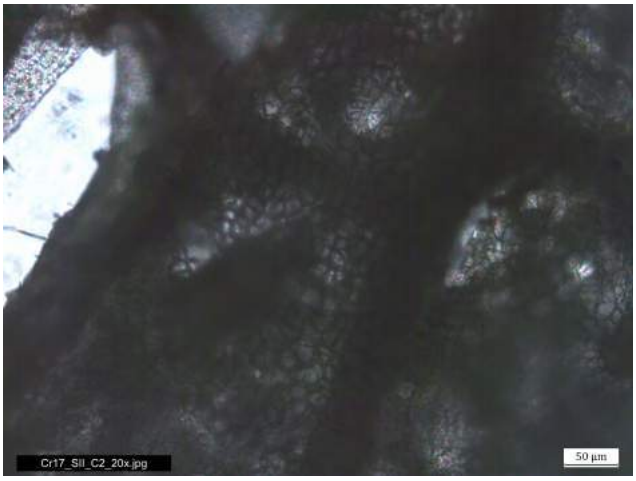
Fragment 37 (37_SII_C1_Cr17)



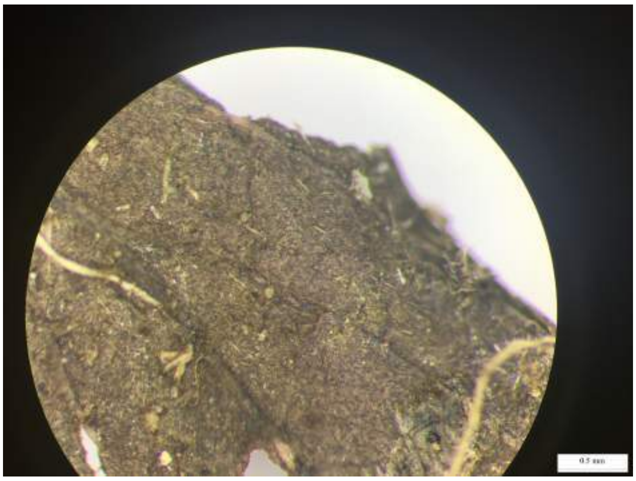


Fragment 38 (38_SII_C2_Cr17)

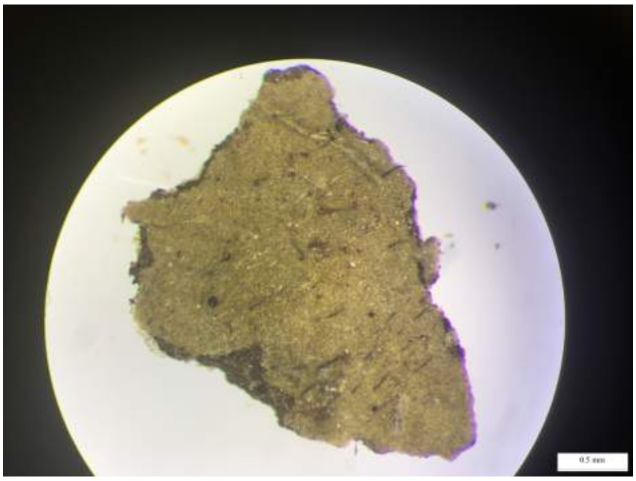


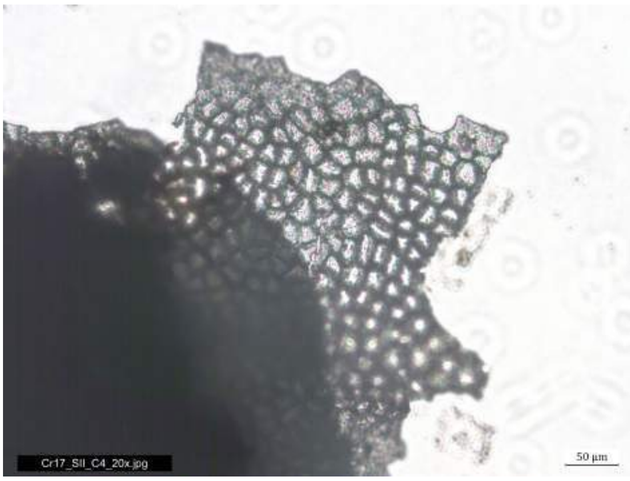


Fragment 39 (39_SII_C3_Cr17)

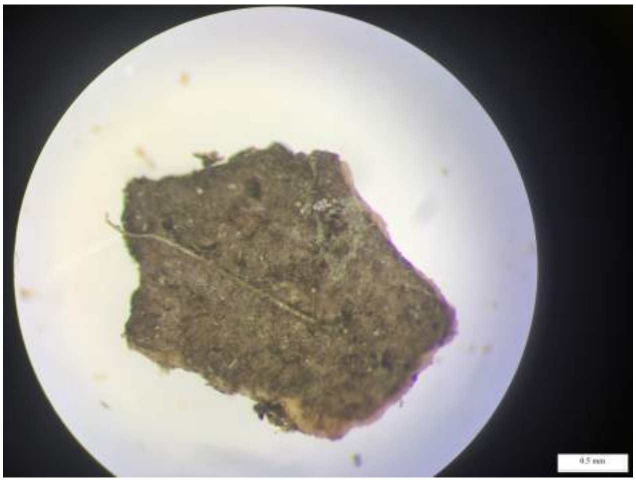


Fragment 40 (40_SII_C4_Cr17) → Inc_91



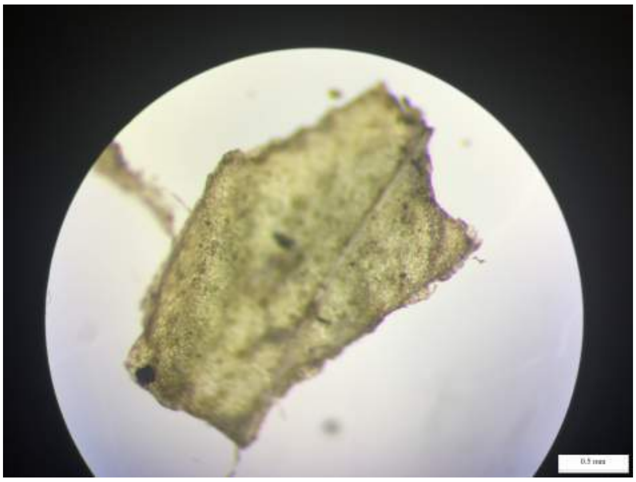


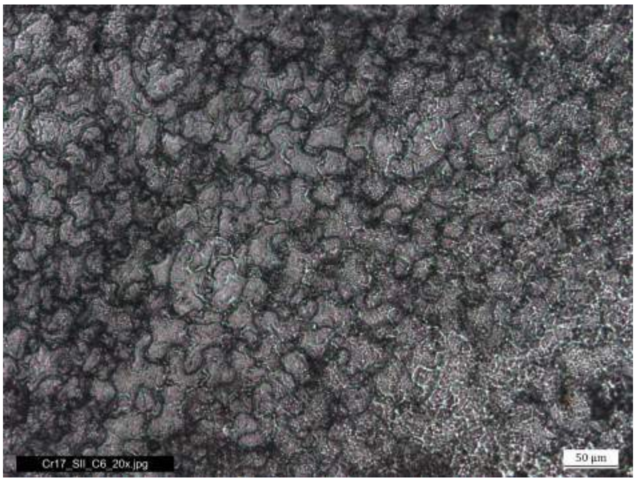
Fragment 41 (41_SII_C5_Cr17)



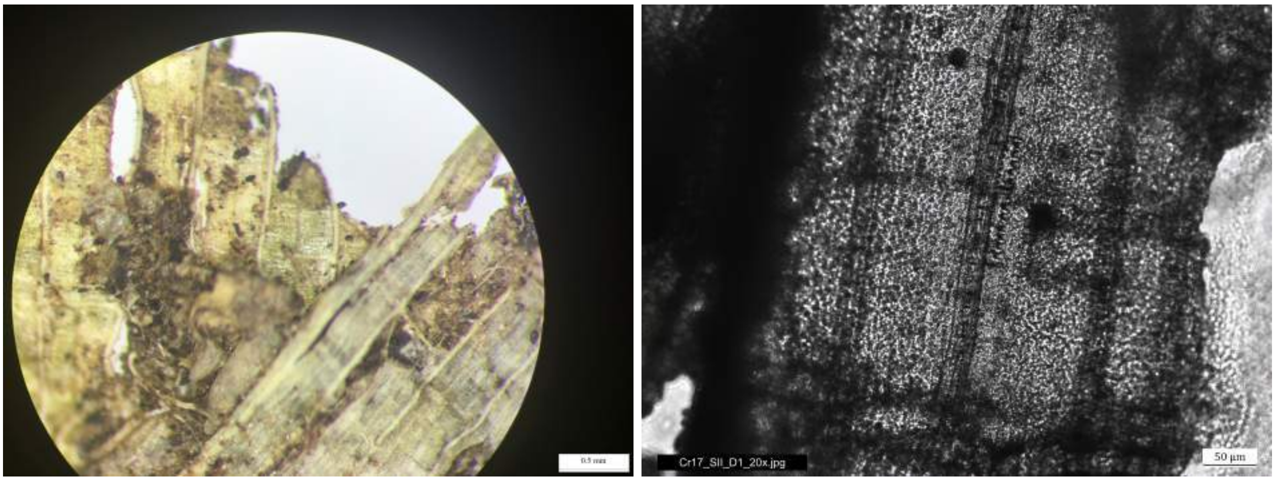
No references

Fragment 42 (42_SII_C6_Cr17)

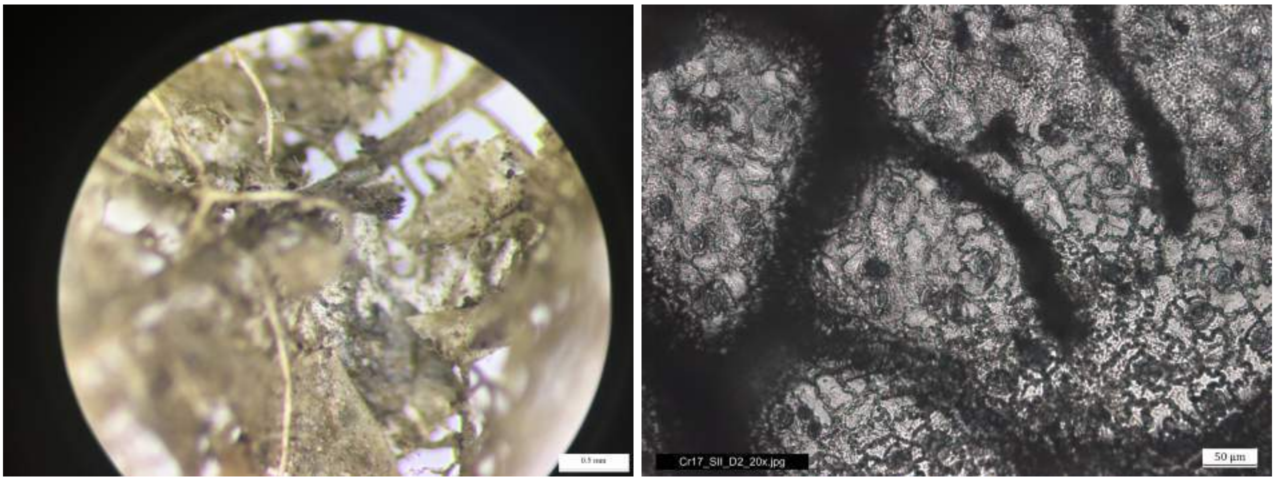




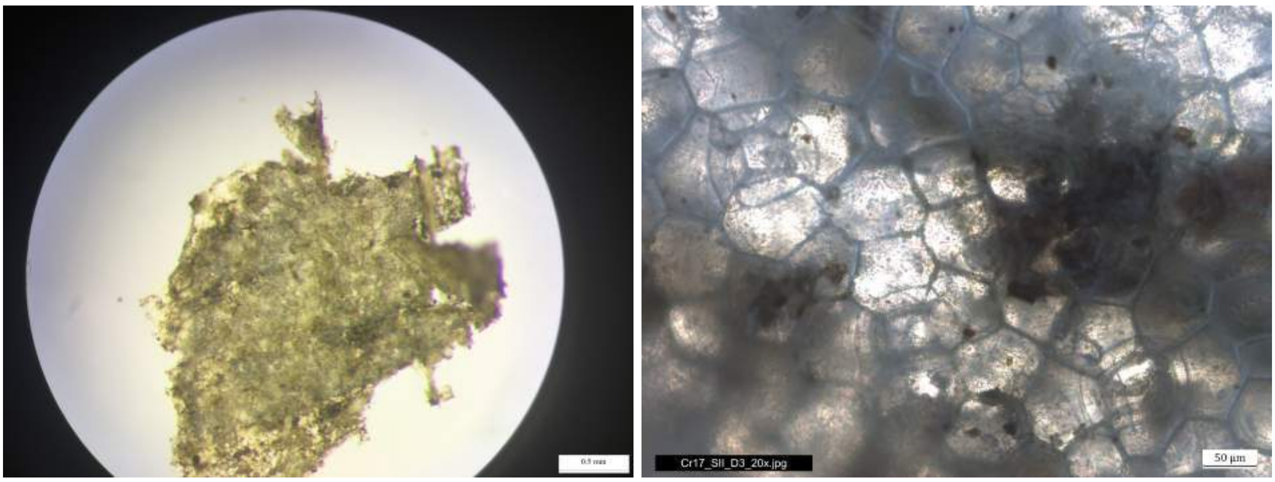
Fragment 43 (43_SII_D1_Cr17)



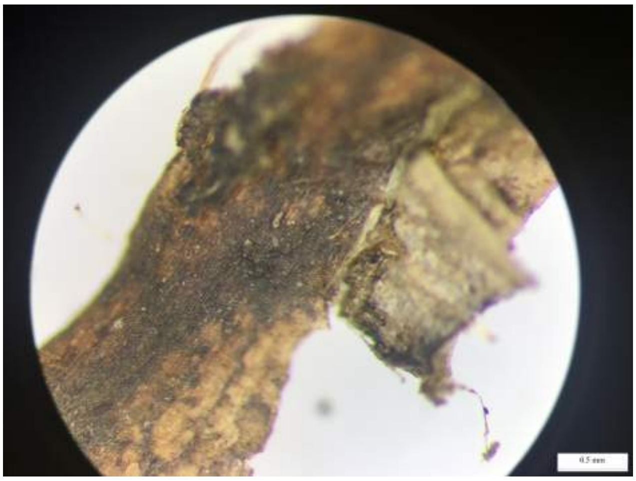
Fragment 44 (44_SII_D2_Cr17)

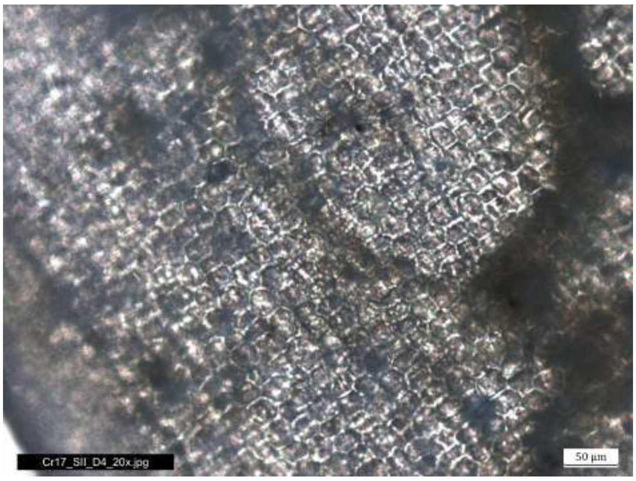


Fragment 45 (45_SII_D3_Cr17)

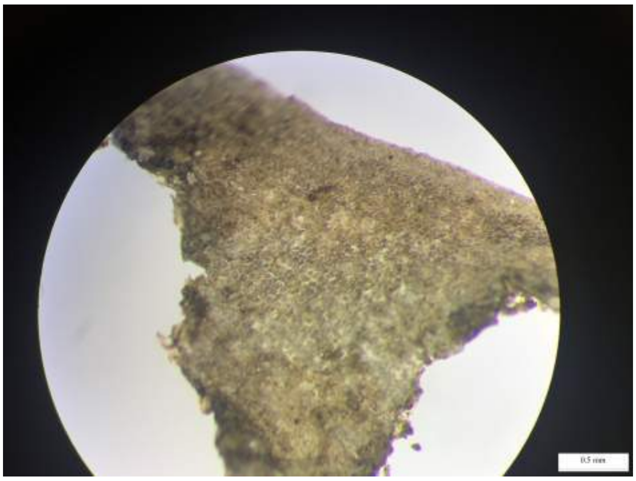


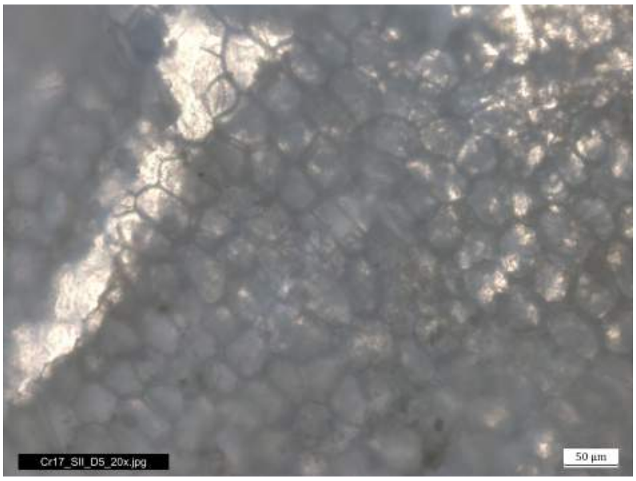
Fragment 46 (46_SII_D4_Cr17) → Inc_92



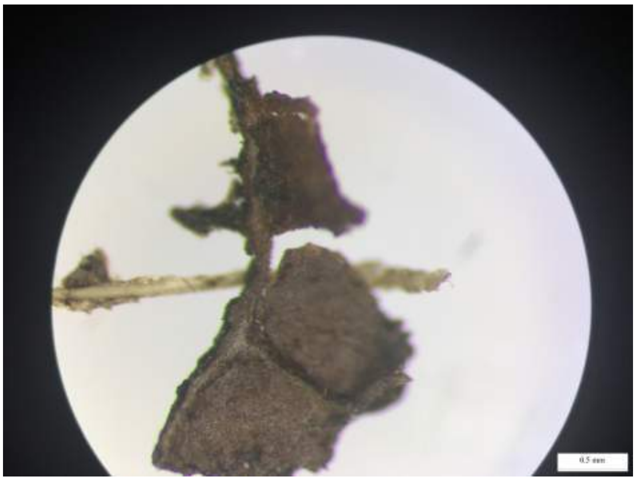


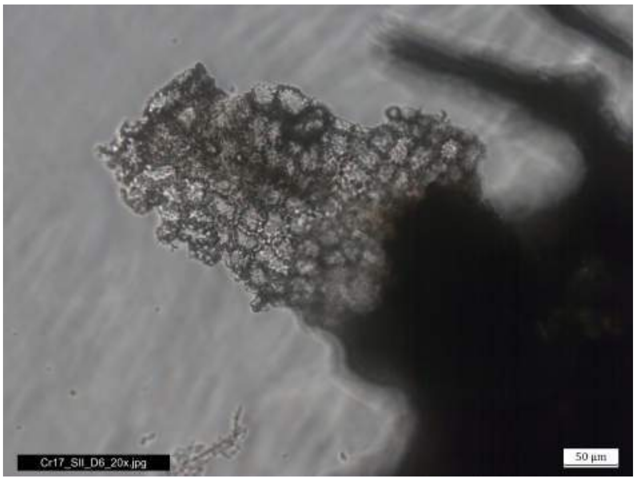
Fragment 47 (47_SII_D5_Cr17)





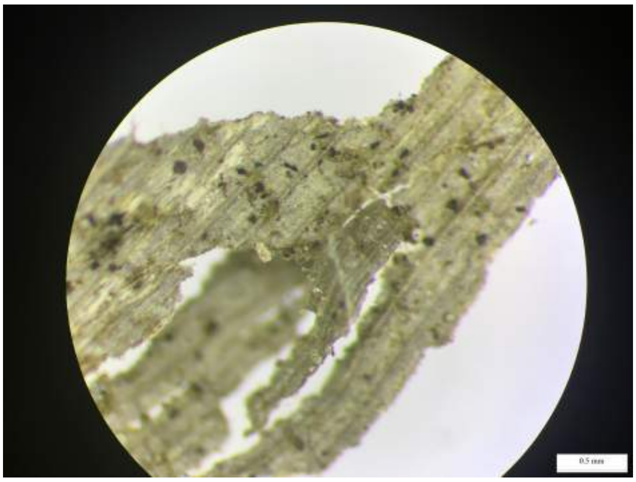
Fragment 48 (48_SII_D6_Cr17)



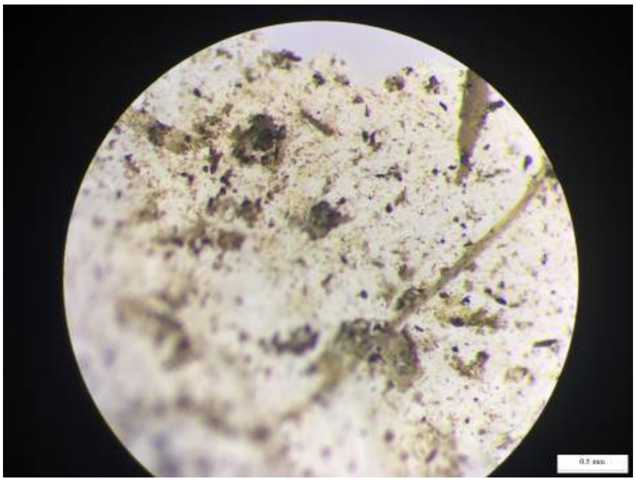


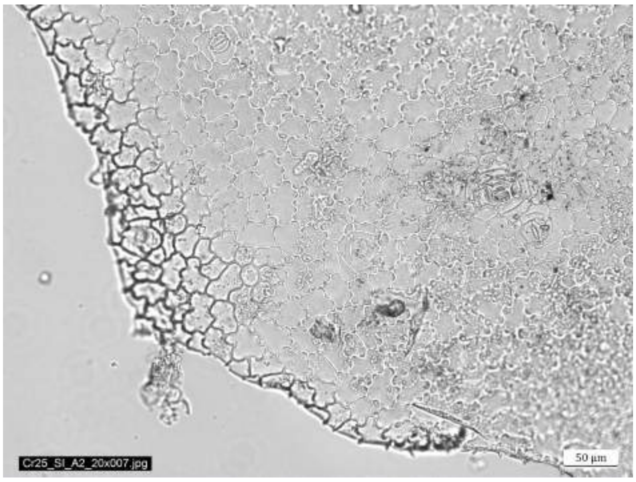
Fragments of the Faece 8

Fragment 1 (1_SI_A1_Cr25)

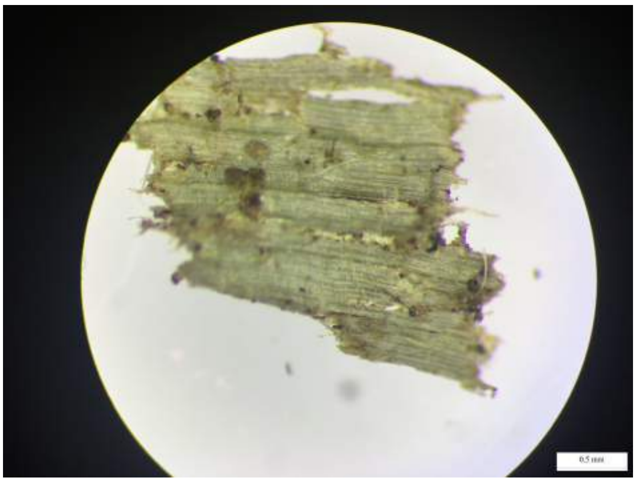


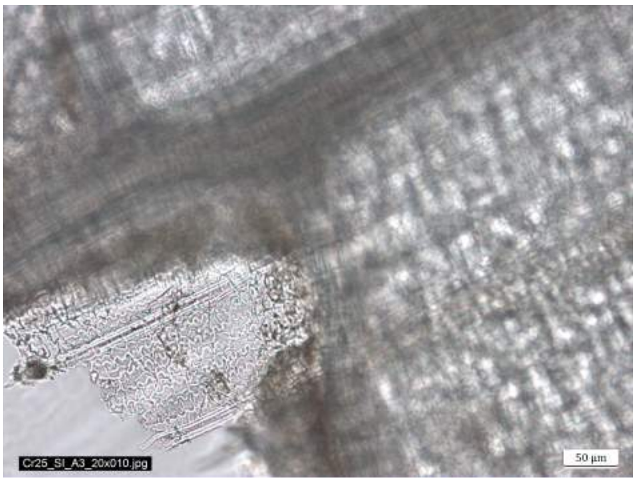
Fragment 2 (2_SI_A2_Cr25)



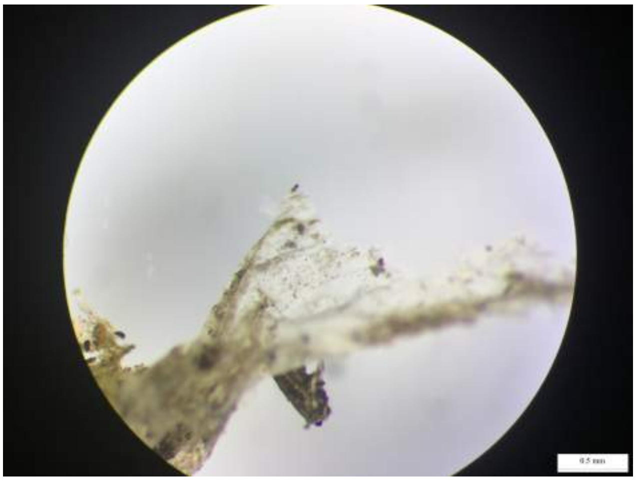
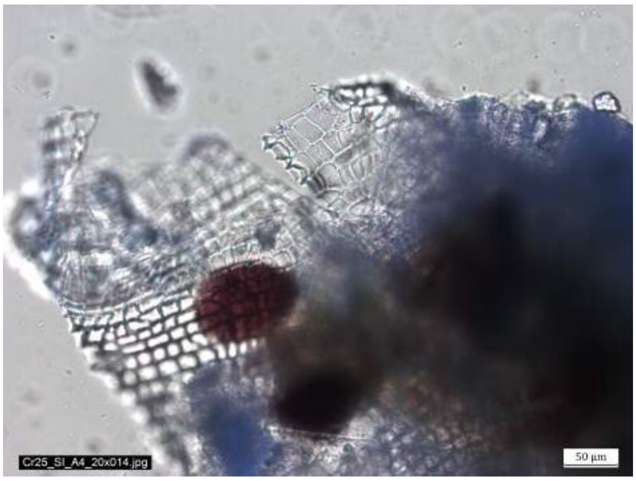


Fragment 3 (3_SI_A3_Cr25)

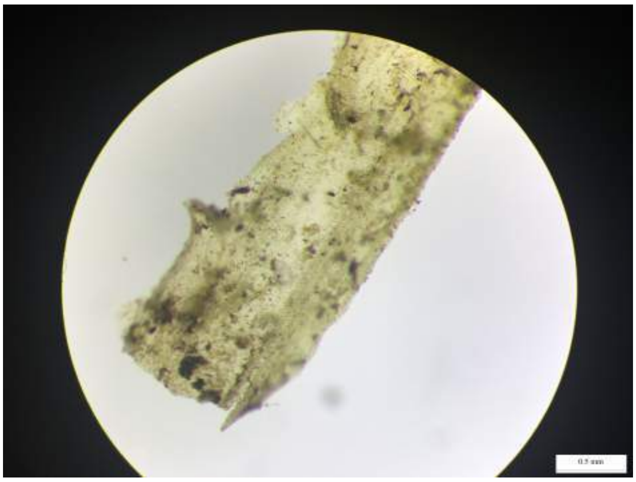
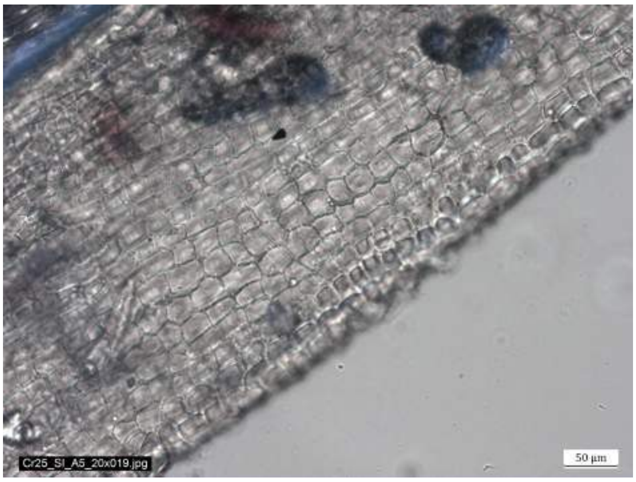




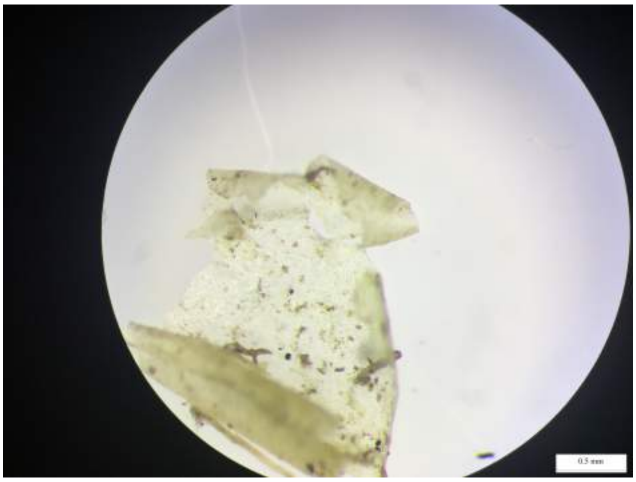
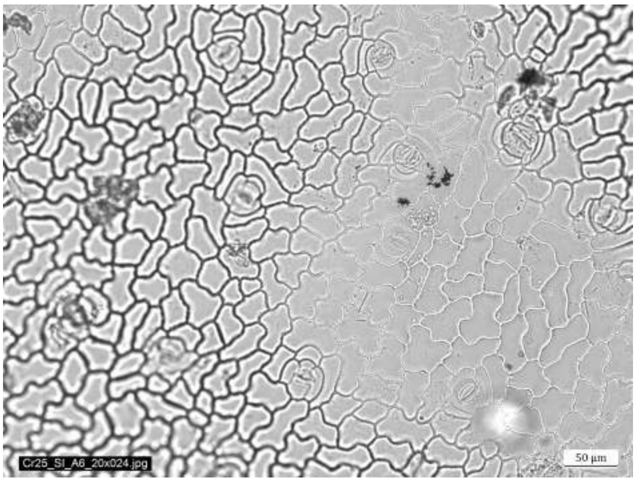
Fragment 4 (4_SI_A4_Cr25) → Inc_93

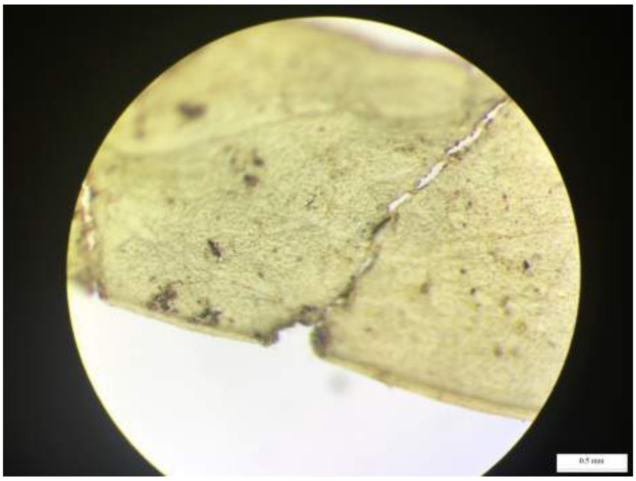
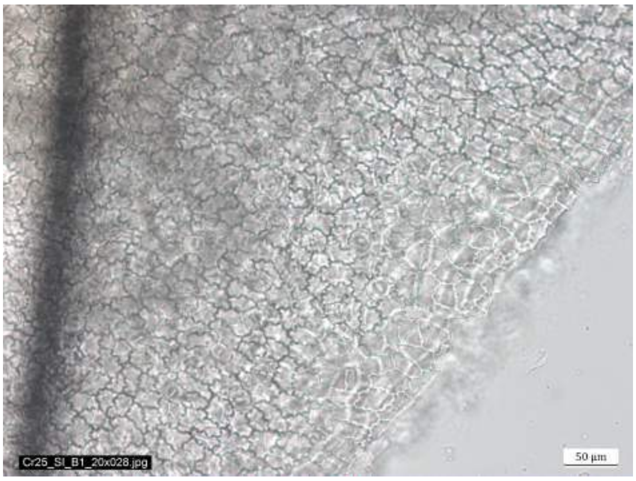
Fragment 5 (5_SI_A5_Cr25) → Inc_94

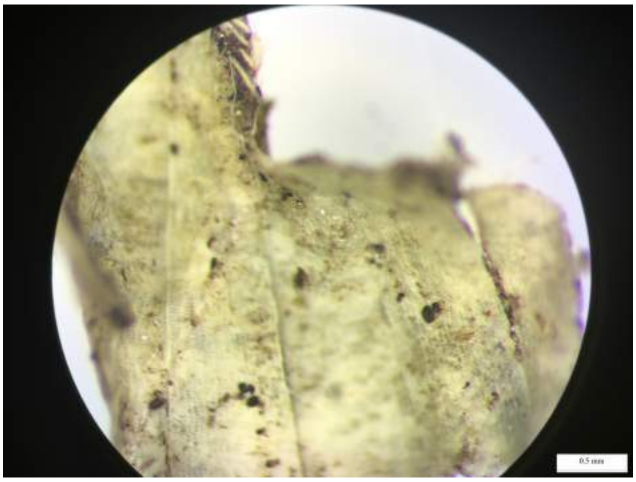
Fragment 6 (6_SI_A6_Cr25) → Inc_95

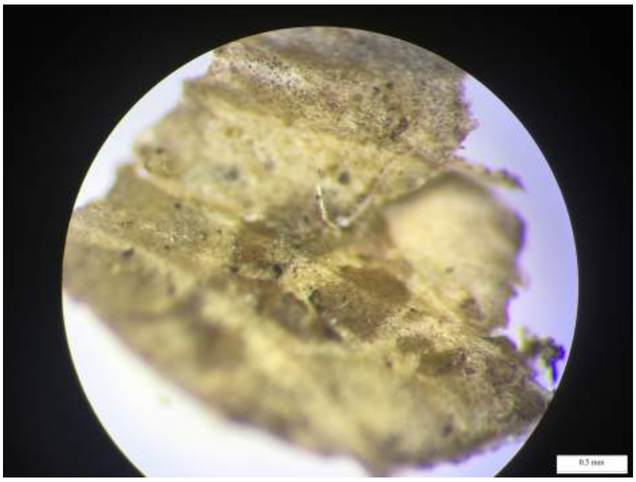
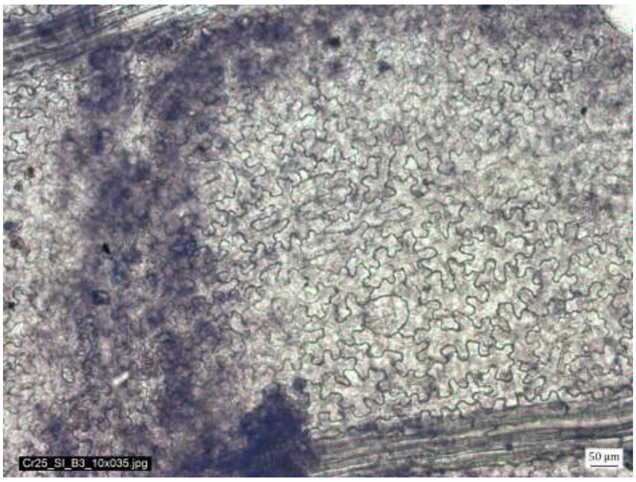
Fragment 7 (7_SI_B1_Cr25) → Inc_96

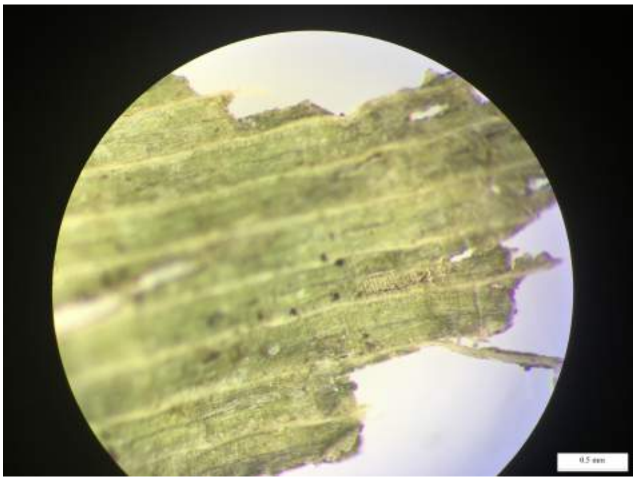
Fragment 8 (8_SI_B2_Cr25) → Inc_97



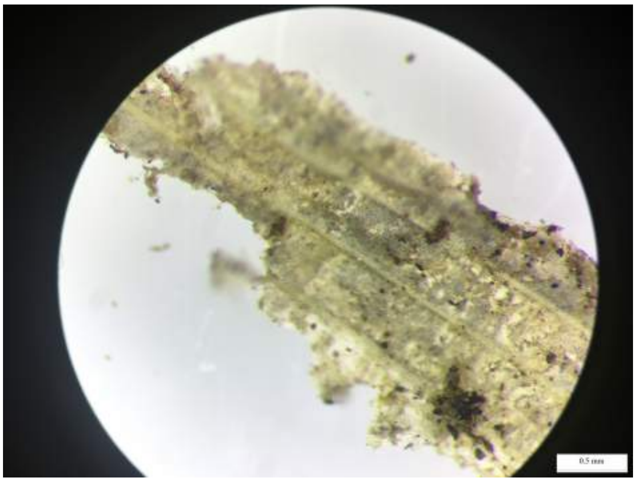

Fragment 9 (9_SI_B3_Cr25) → Inc_98

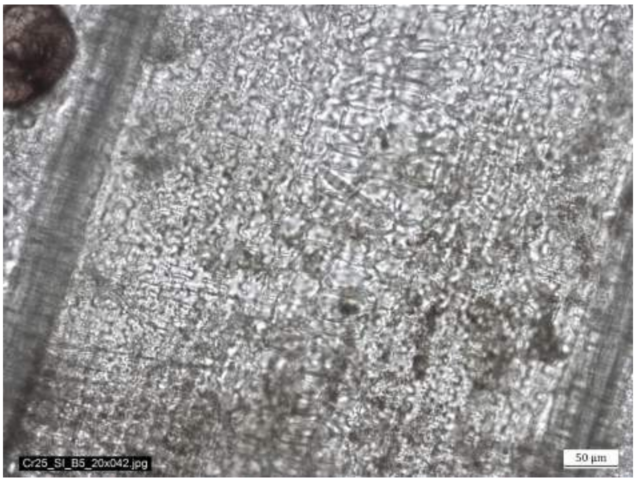



Fragment 10 (10_SI_B4_Cr25) → Inc_99

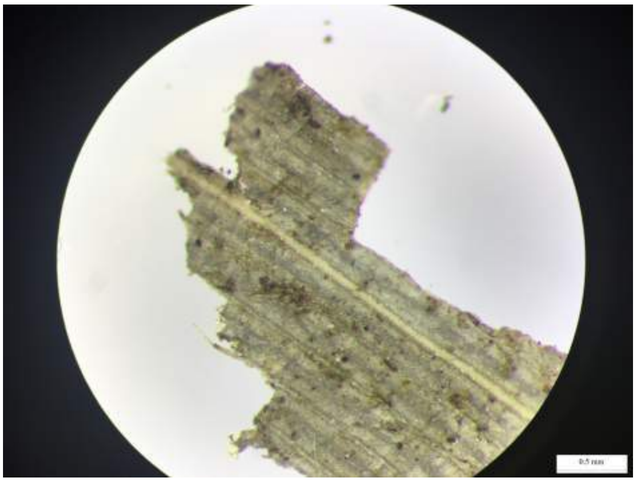


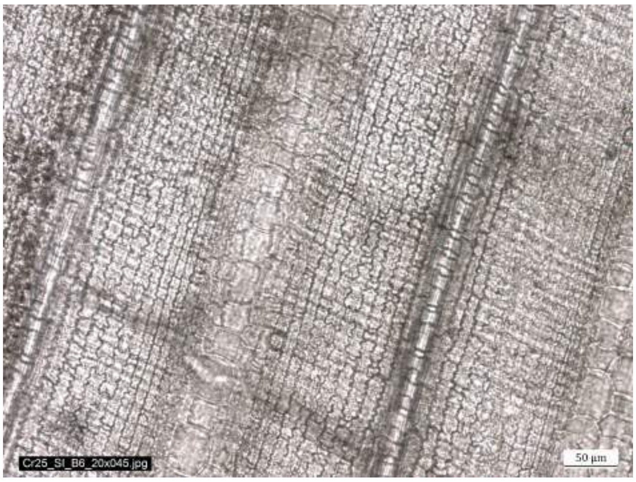
Fragment 11 (11_SI_B5_Cr25) → Inc_100



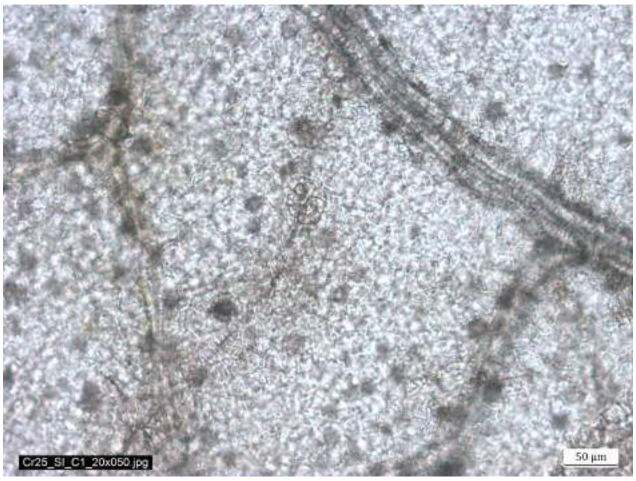


Fragment 12 (12_SI_B6_Cr25)

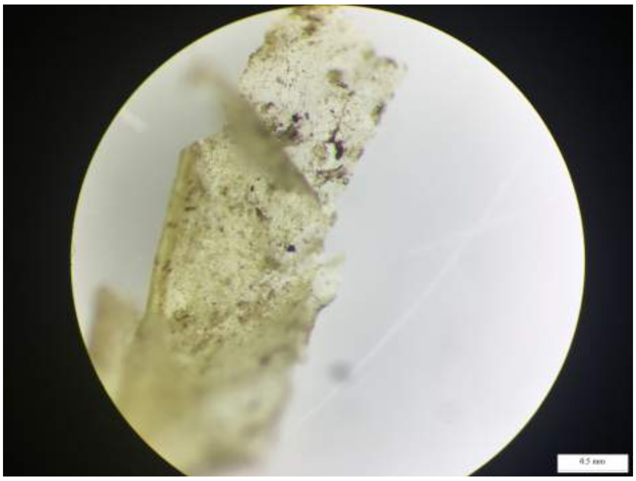
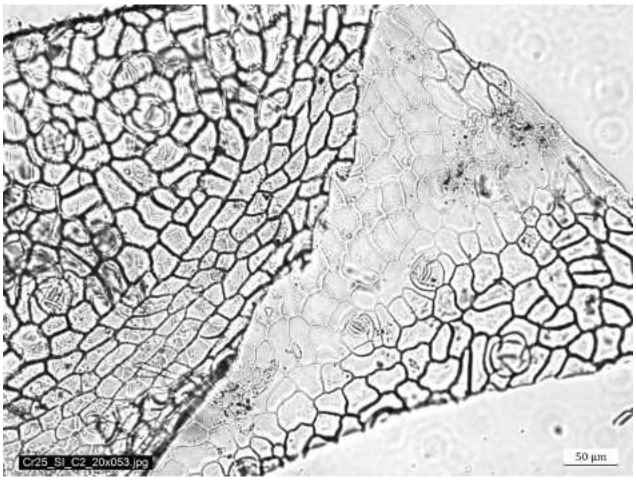




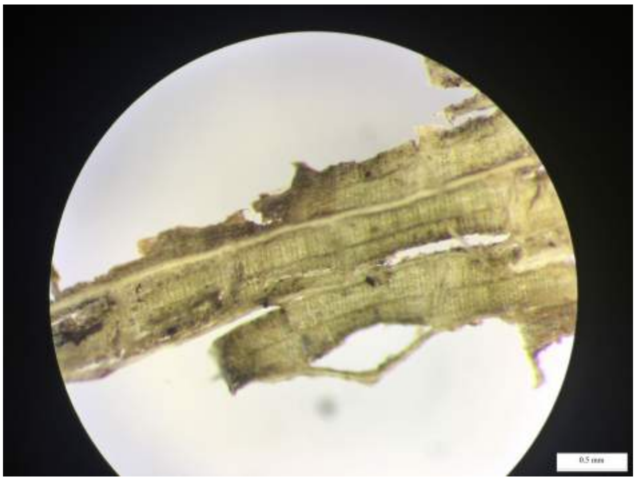
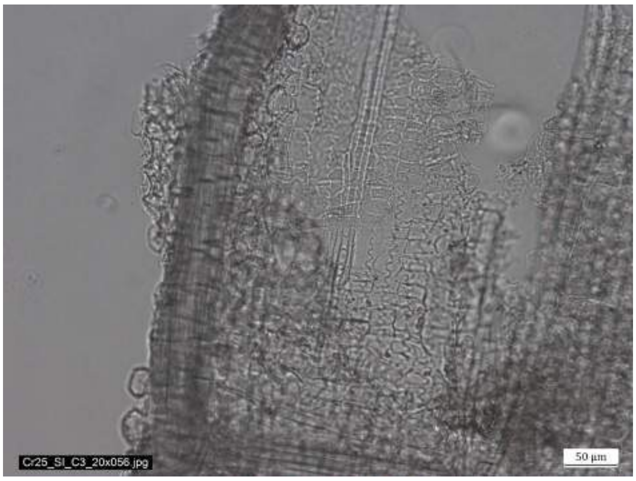
Fragment 13 (13_SI_C1_Cr25) → Inc_101

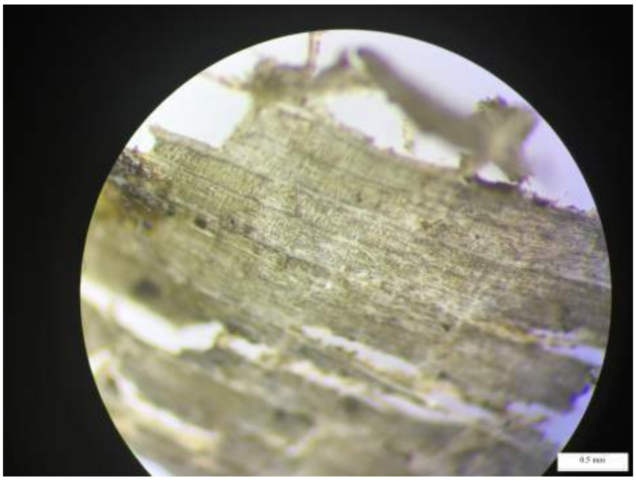
Fragment 14 (14_SI_C2_Cr25)

Fragment 15 (15_SI_C3_Cr25)

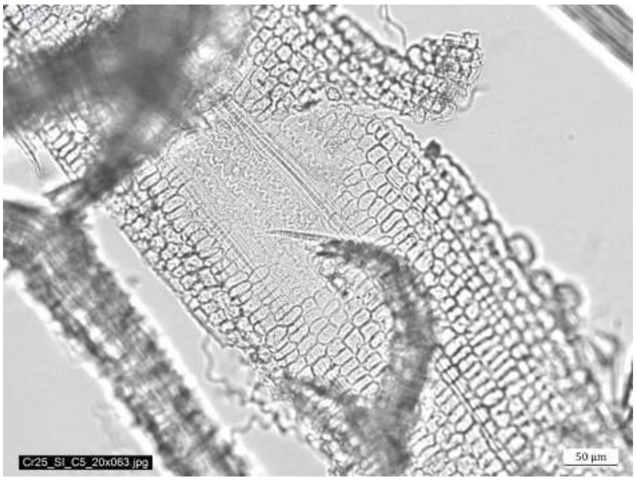



Fragment 16 (16_SI_C4_Cr25)

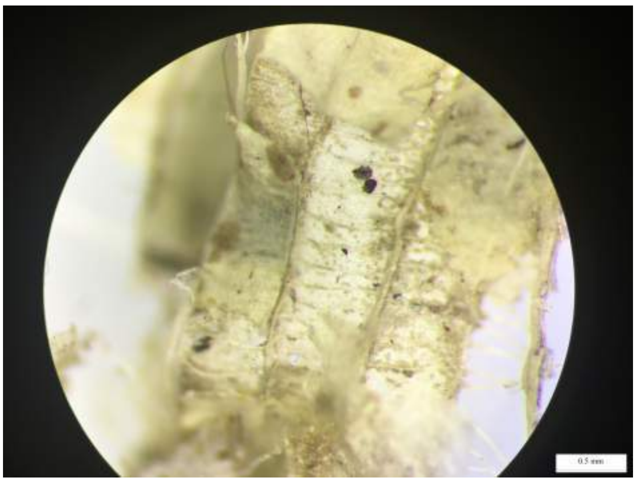


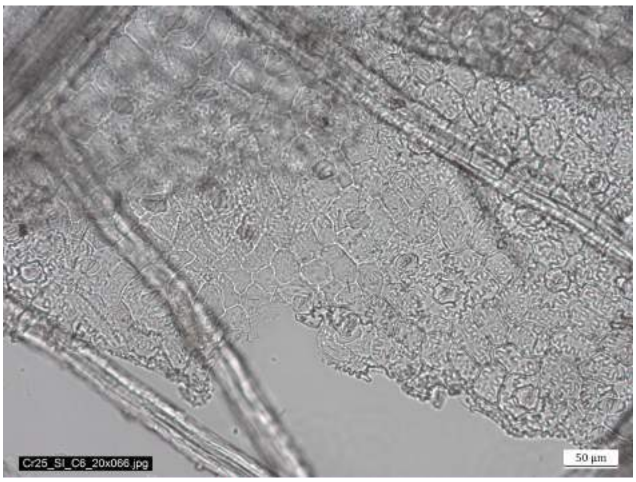
Fragment 17 (17_SI_C5_Cr25)

No references

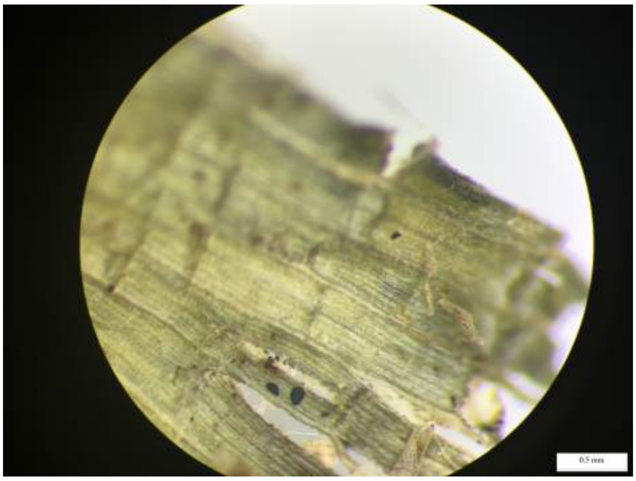


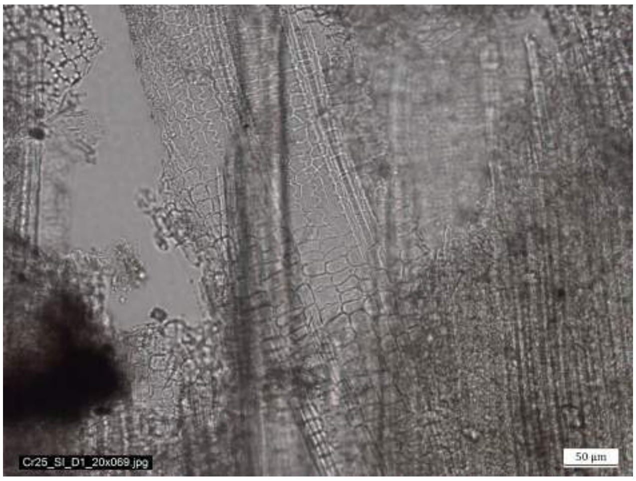
Fragment 18 (18_SI_C6_Cr25) → **Inc_102**



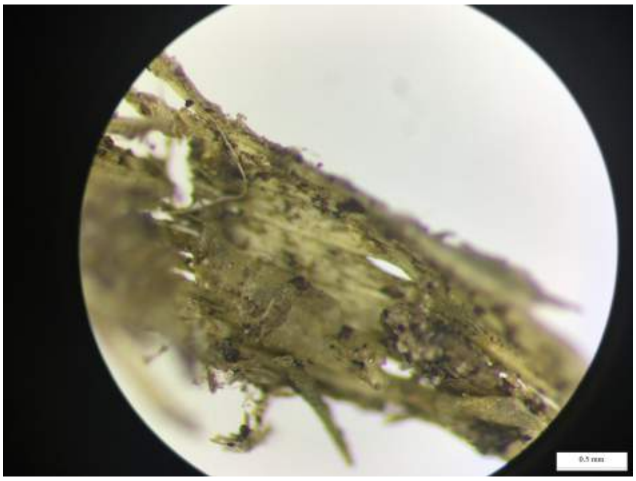


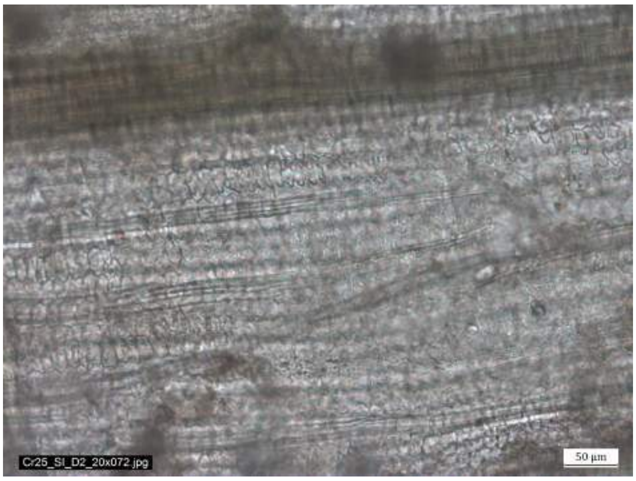
Fragment 19 (19_SI_D1_Cr25)



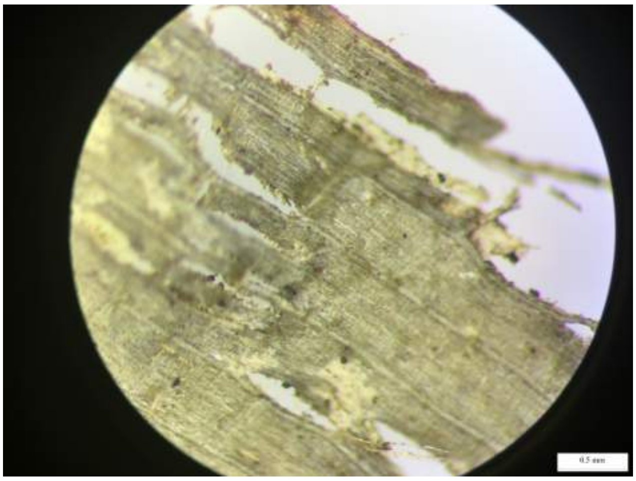


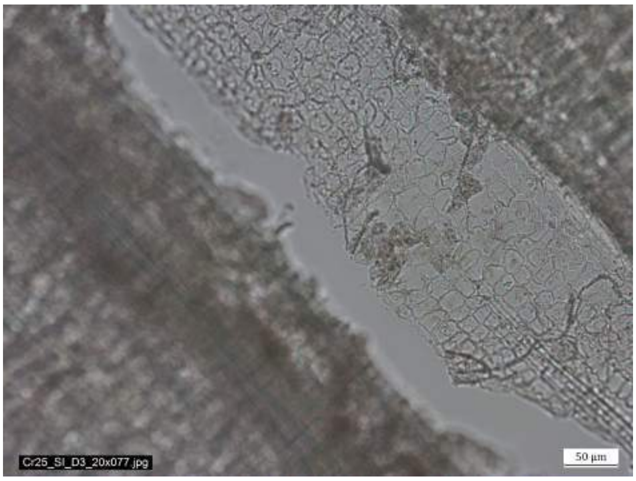
Fragment 20 (20_SI_D2_Cr25)



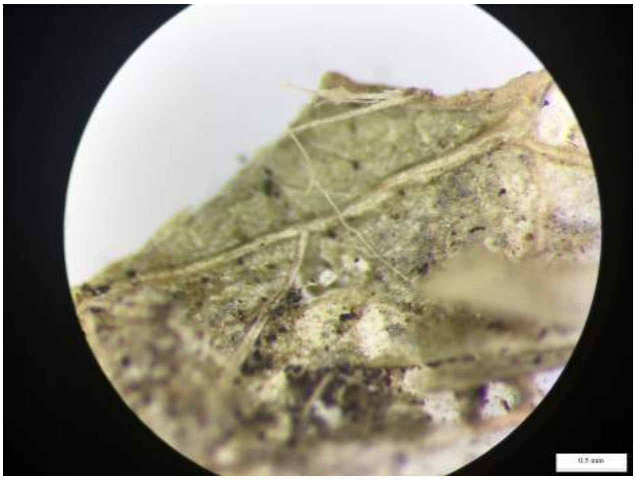


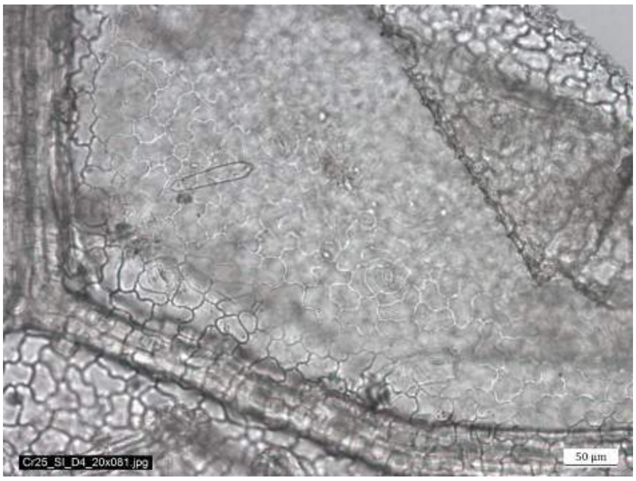
Fragment 21 (21_SI_D3_Cr25)



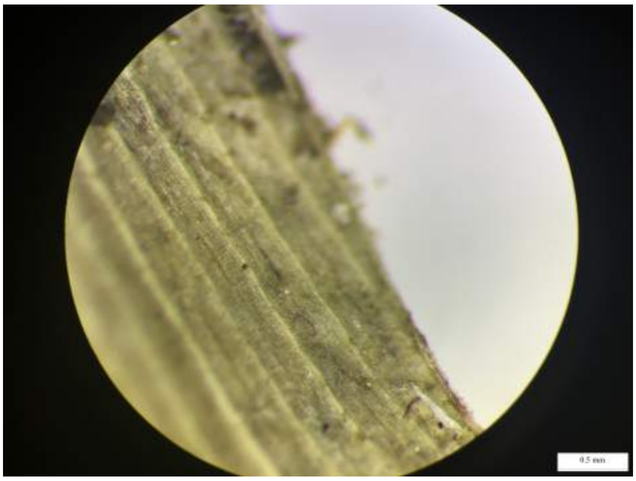


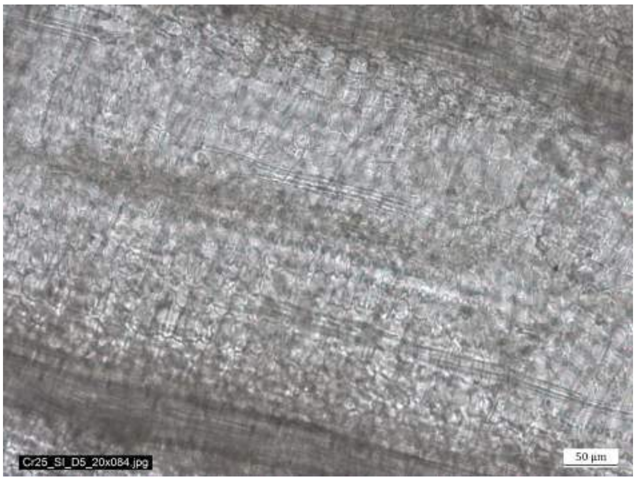
Fragment 22 (22_SI_D4_Cr25)



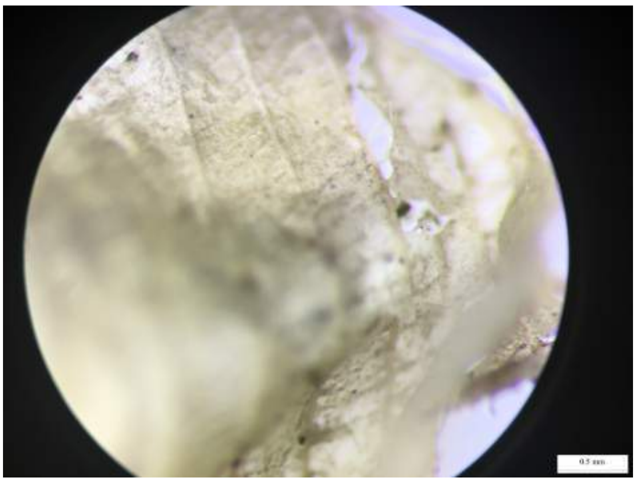


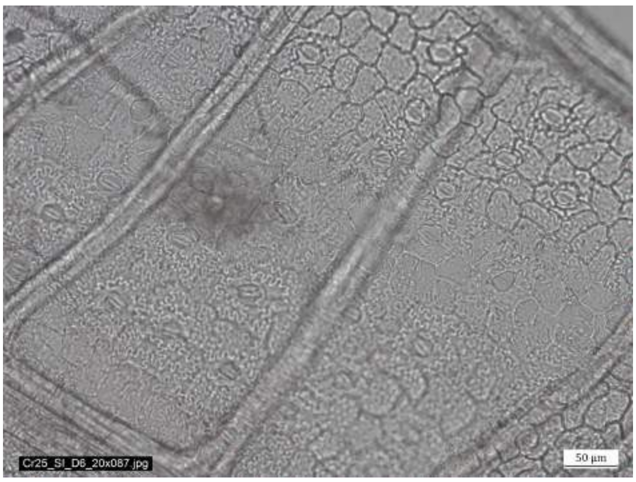
Fragment 23 (23_SI_D5_Cr)



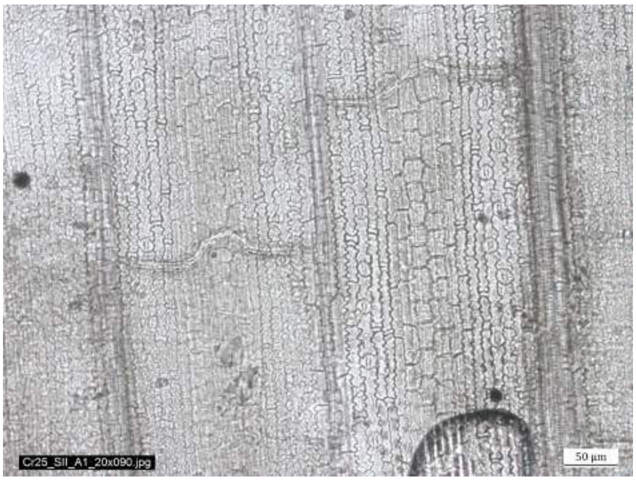


Fragment 24 (24_SI_D6_Cr25)

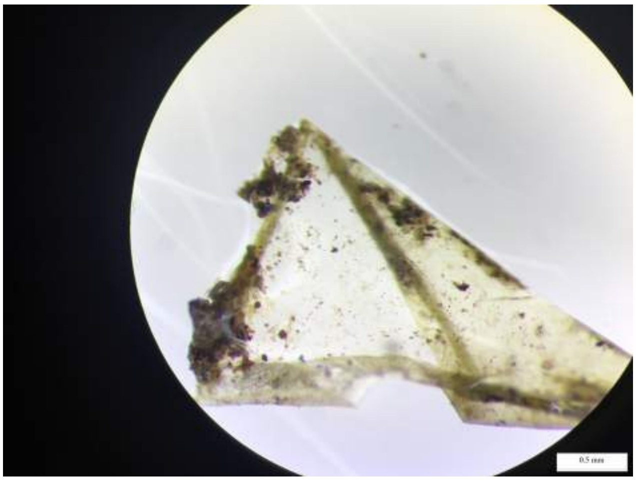


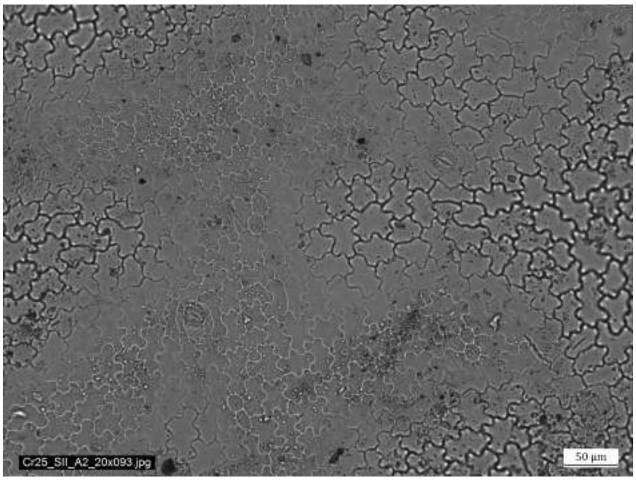


Fragment 25 (25_SII_A1_Cr25)

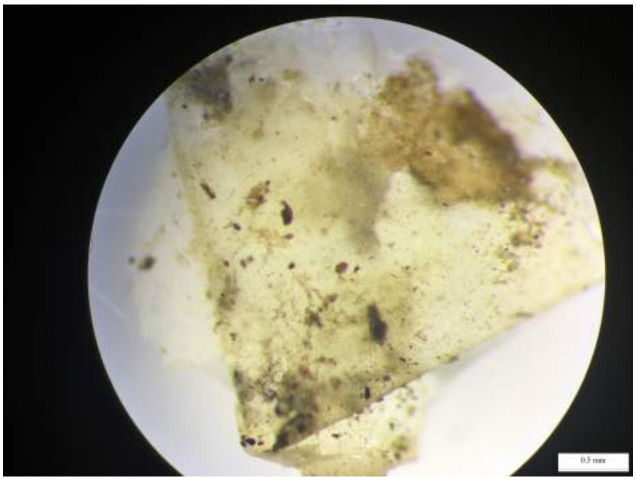


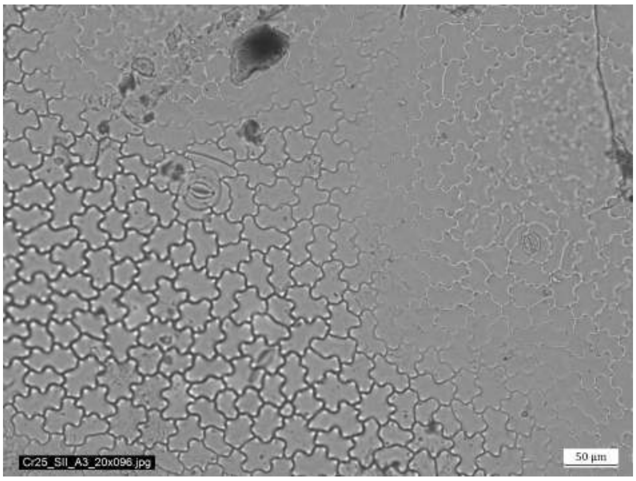
Fragment 26 (26_SII_A2_Cr25) → Inc_103



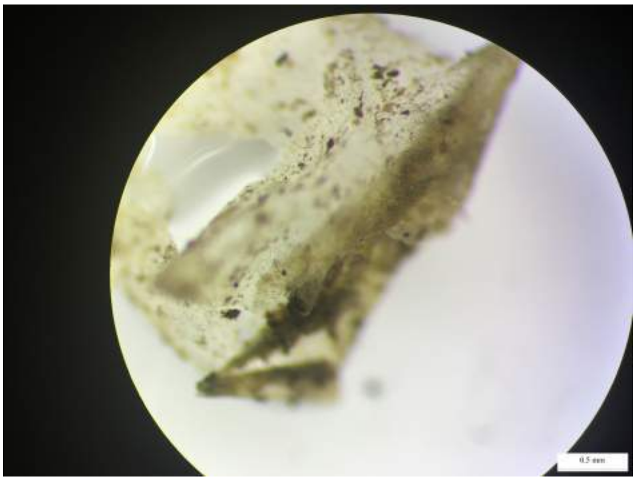


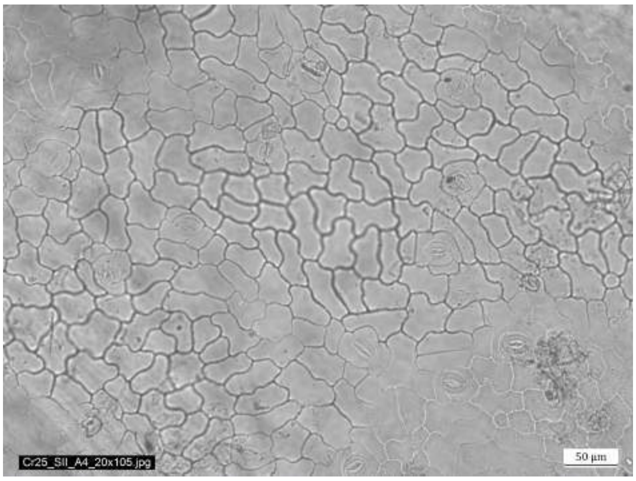
Fragment 27 (27_SII_A3_Cr)



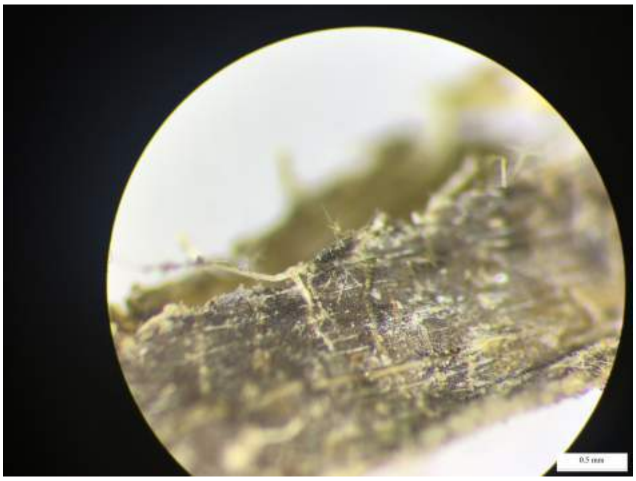


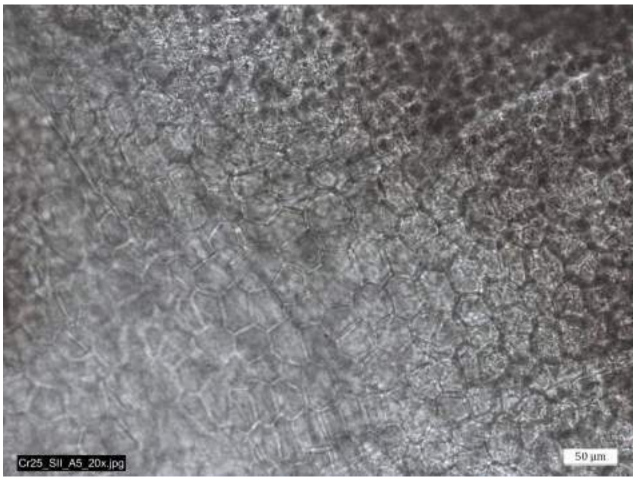
Fragment 28 (28_SII_A4_Cr25) → Inc_104



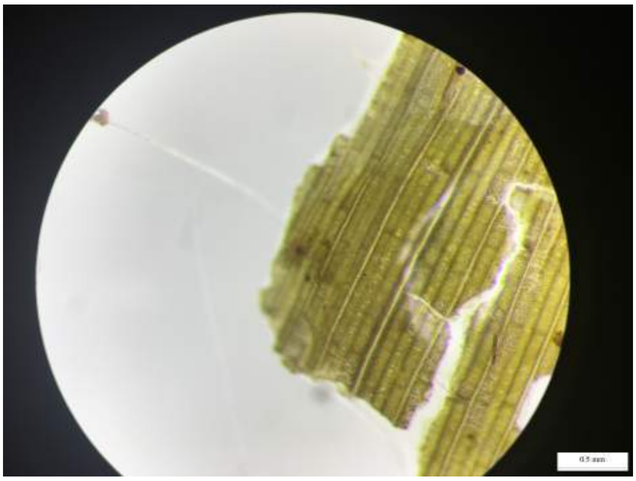


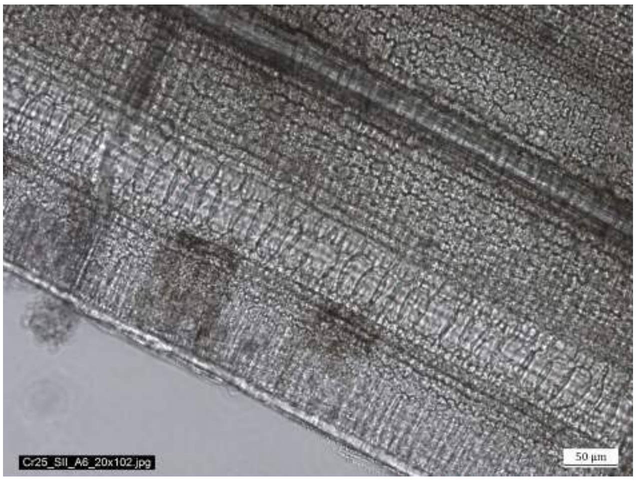
Fragment 29 (29_SII_A5_Cr25)



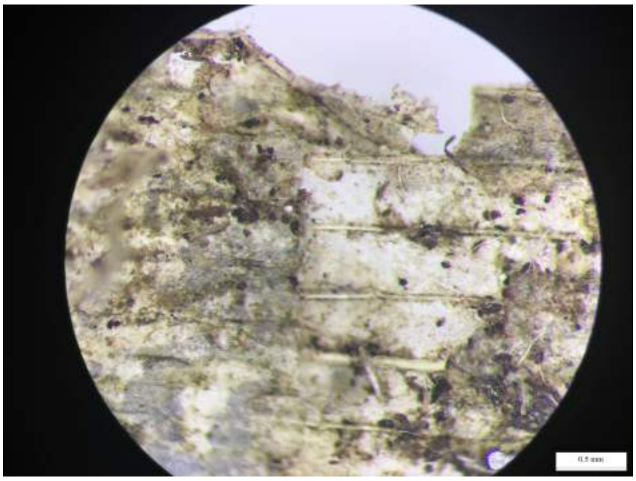


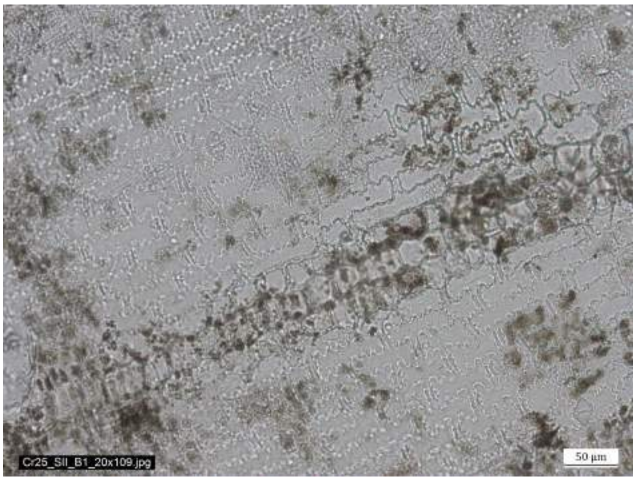
Fragment 30 (30_SII_A6_Cr25)



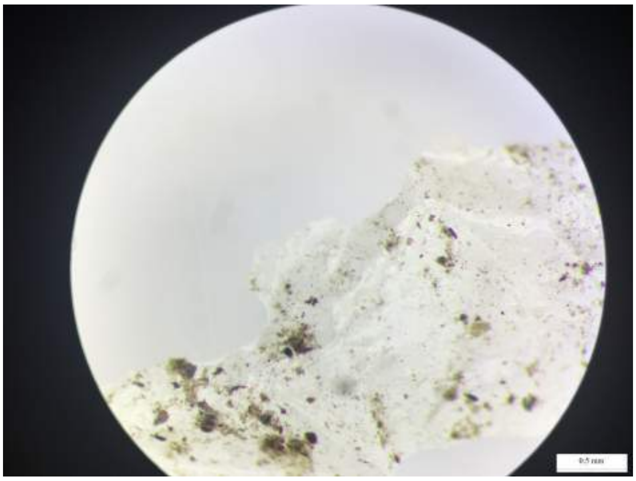


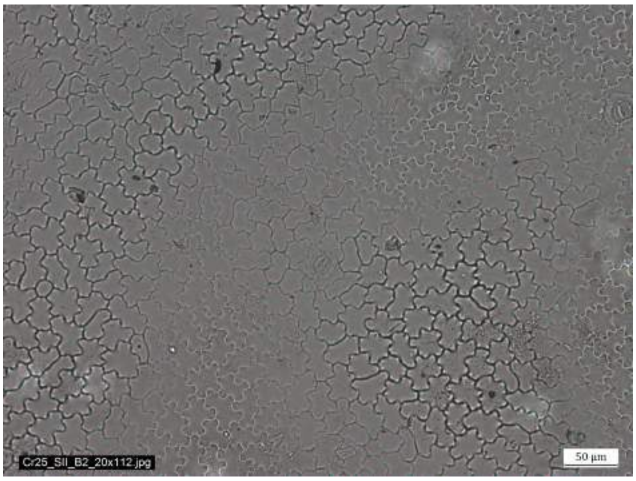
Fragment 31 (31_SII_B1_Cr25)



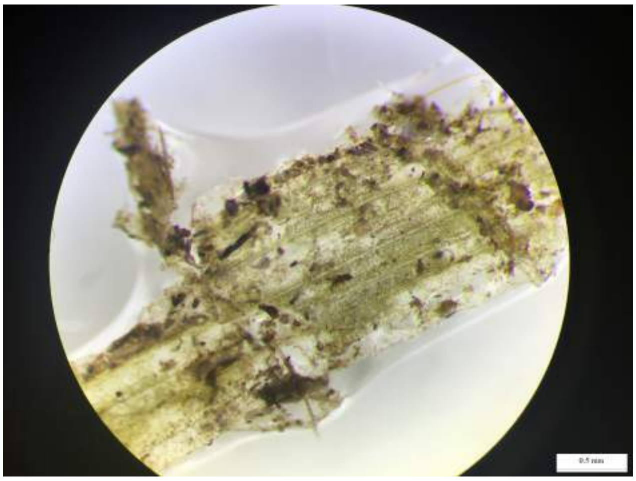


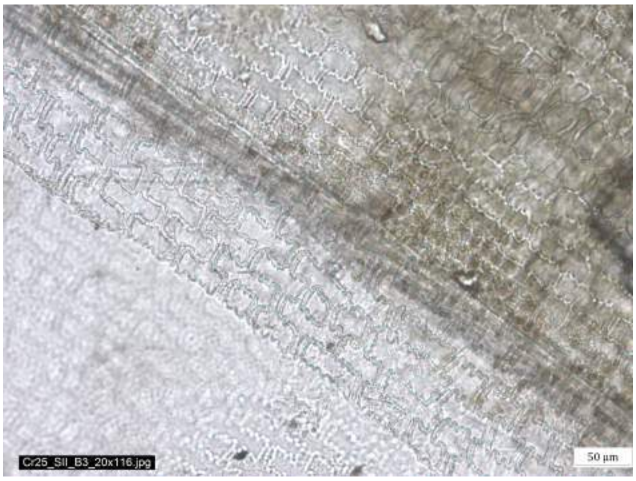
Fragment 32 (32_SII_B2_Cr25)



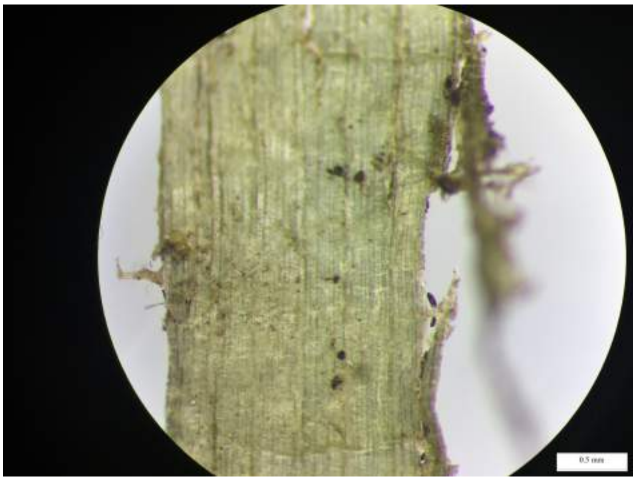


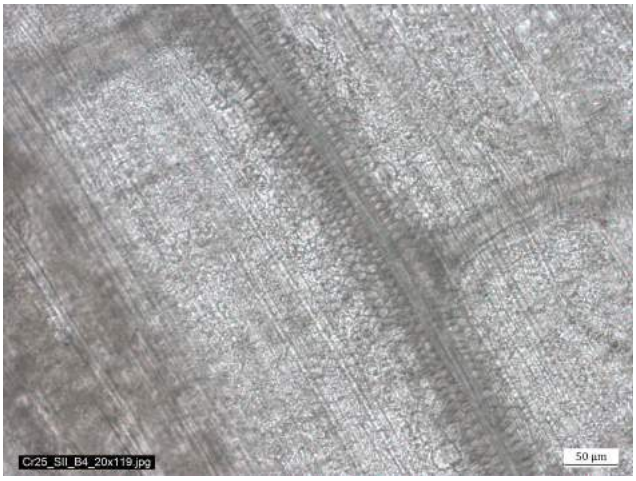
Fragment 33 (33_SII_B3_Cr25)



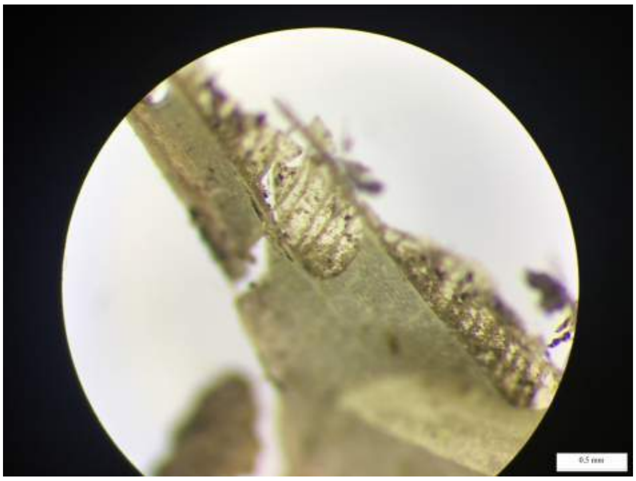


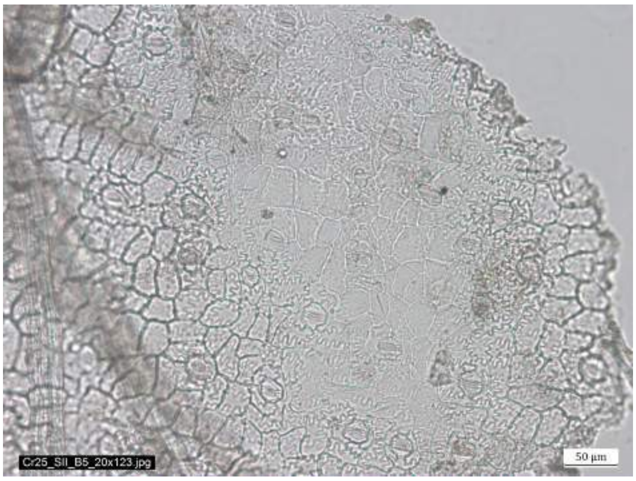
Fragment 34 (34_SII_B4_Cr25)



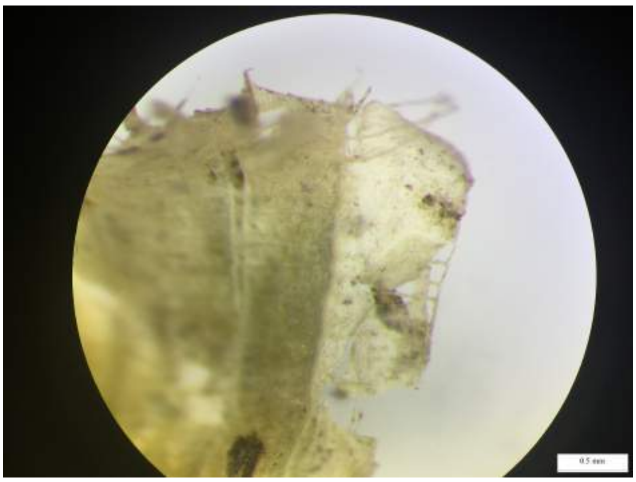


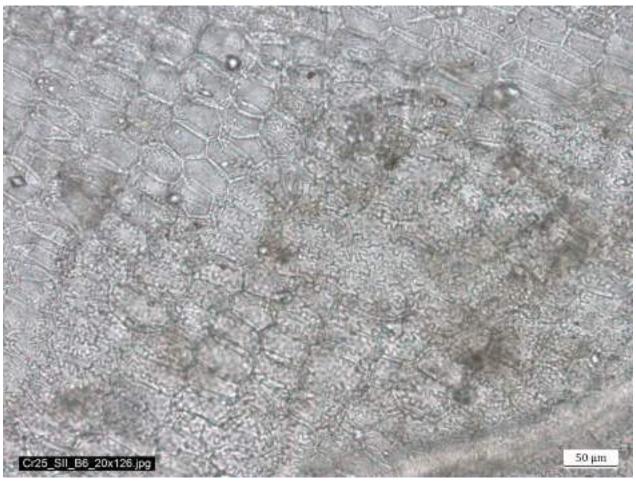
Fragment 35 (5_SII_B5_Cr25)



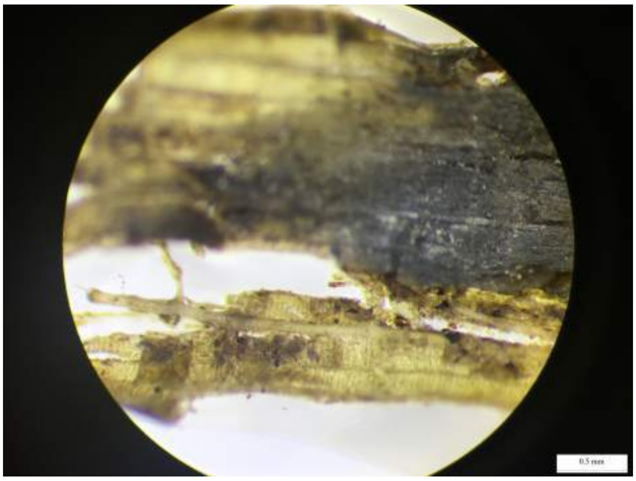


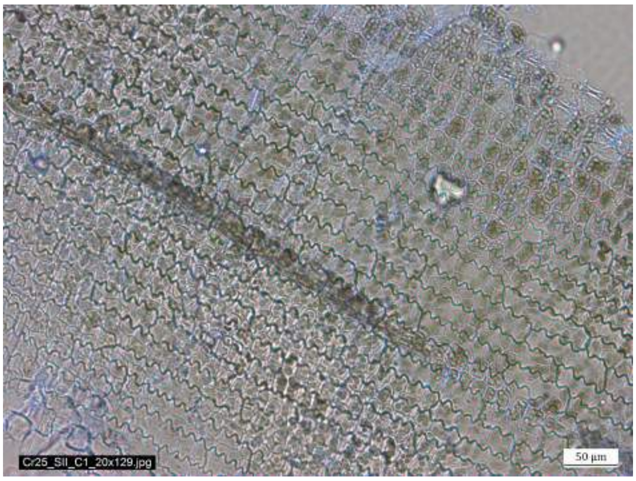
Fragment 36 (36_SII_B6_Cr25)



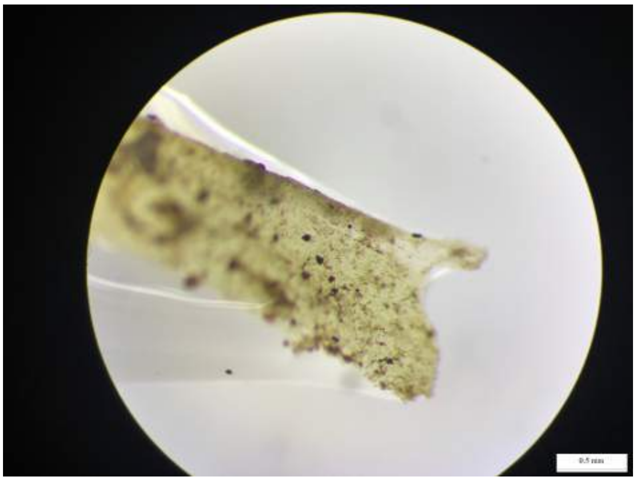


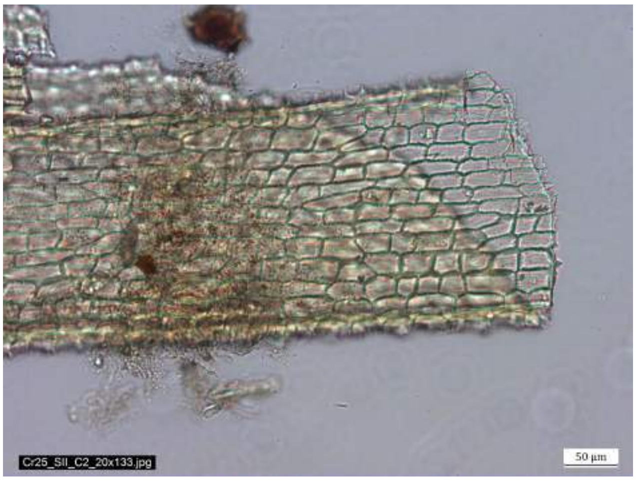
Fragment 37 (37_SII_C1_Cr25)



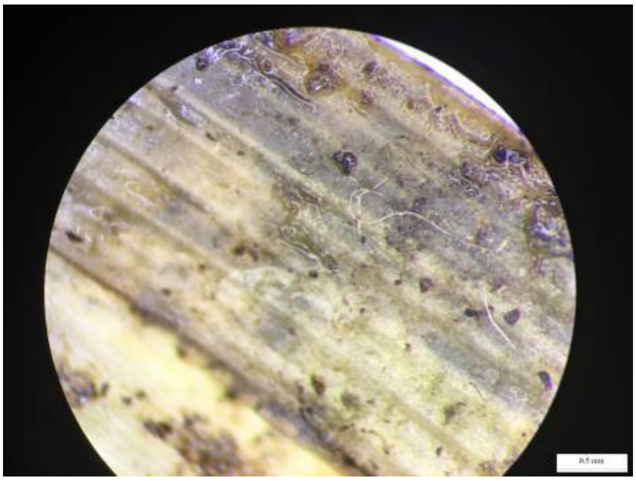


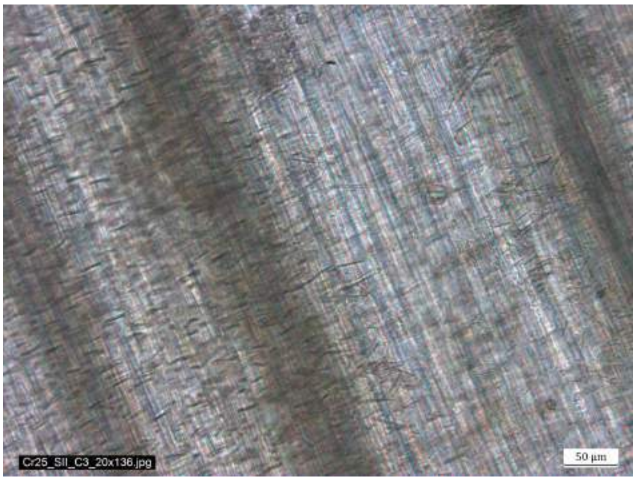
Fragment 38 (38_SII_C2_Cr25)



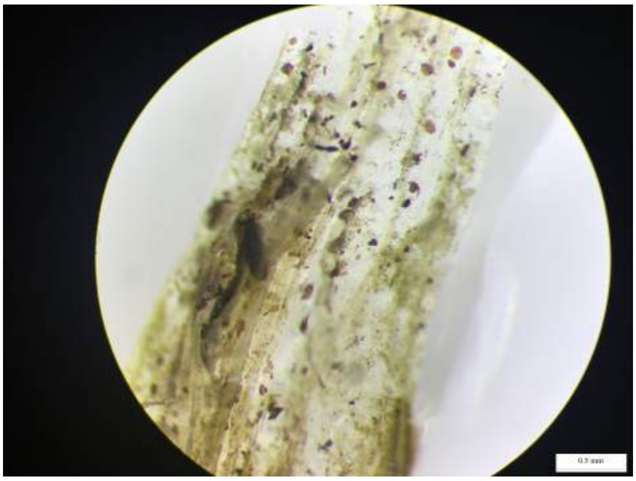
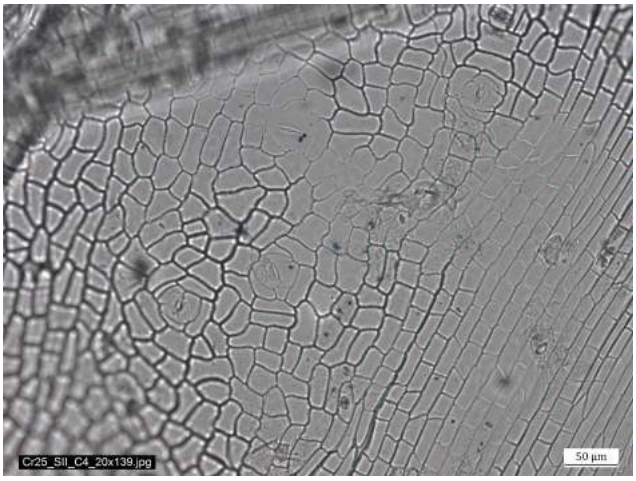


Fragment 39 (39_SII_C3_Cr25)

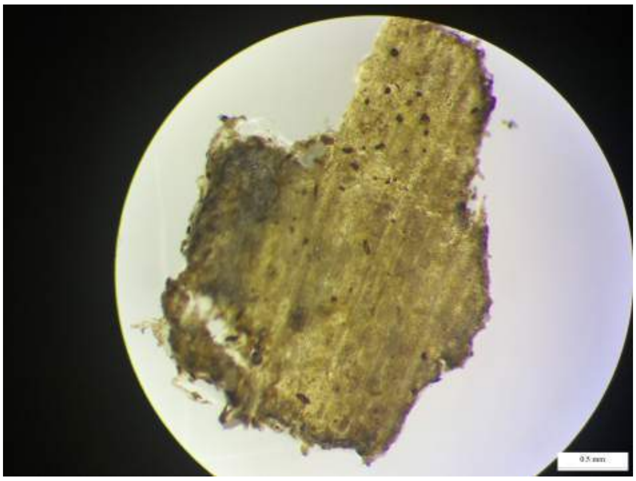
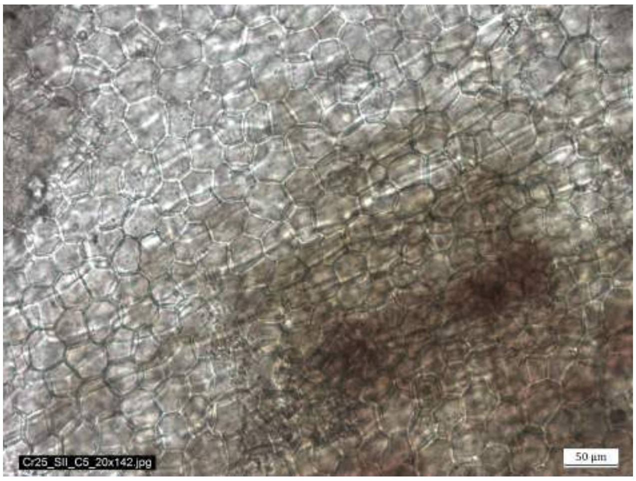




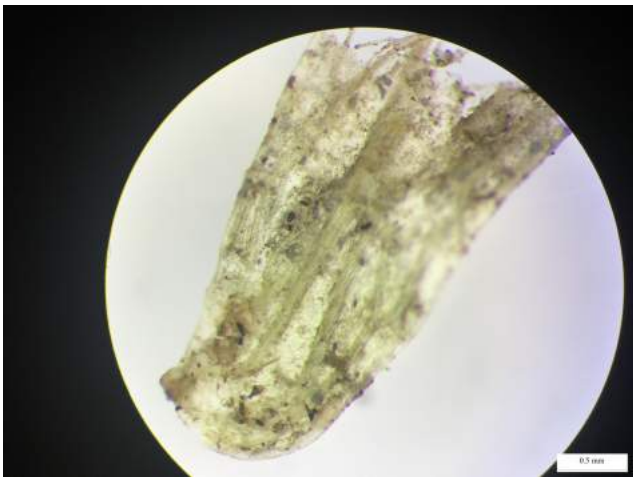
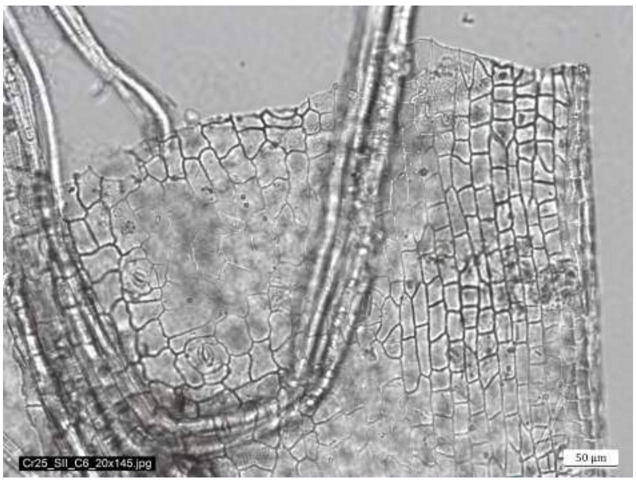
Fragment 40 (40_SII_C4_Cr25)

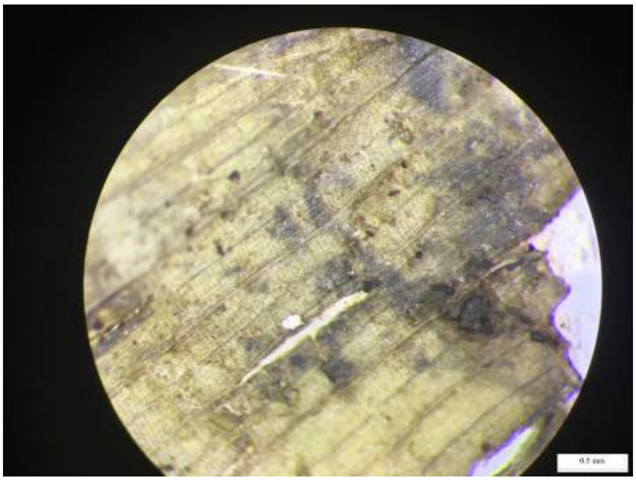
Fragment 41 (41_SII_C5_Cr25)

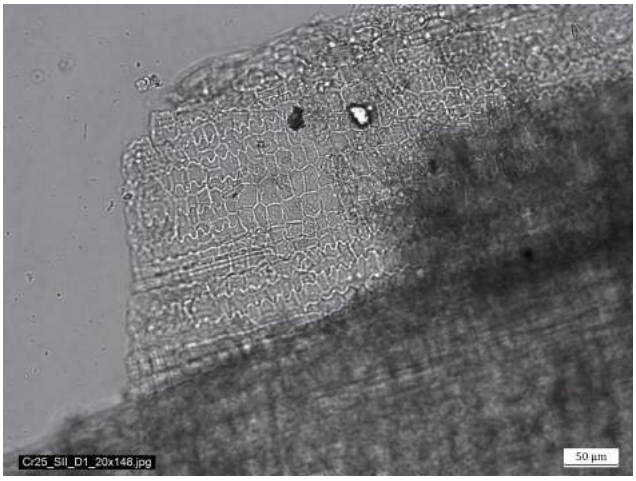



Fragment 42 (42_SII_C6_Cr25)

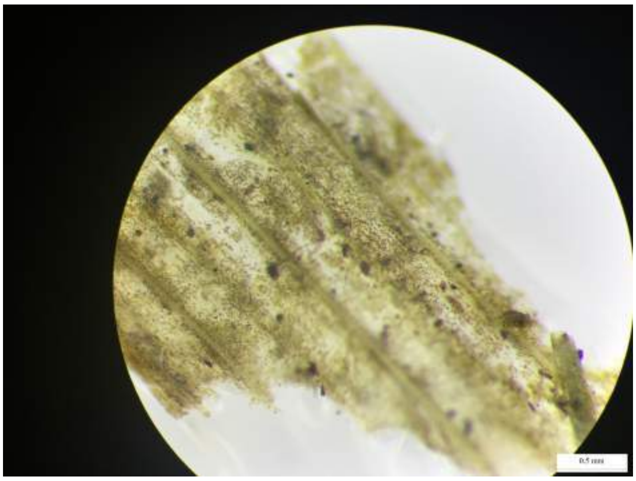



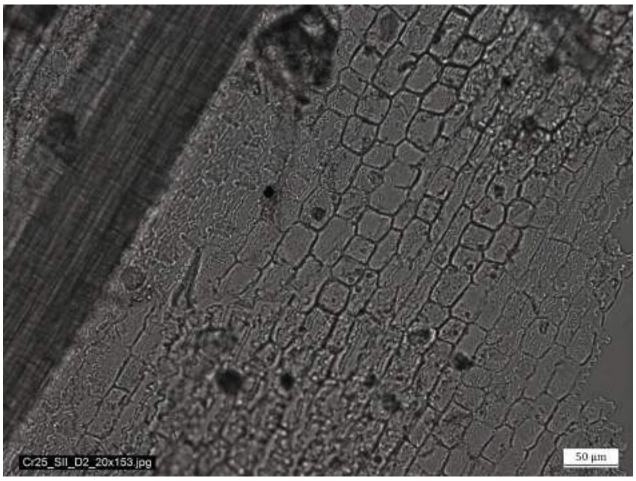
Fragment 43 (43_SII_D1_Cr25)



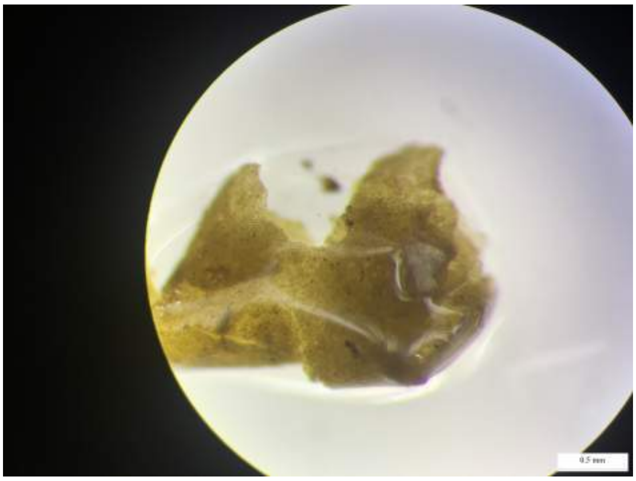


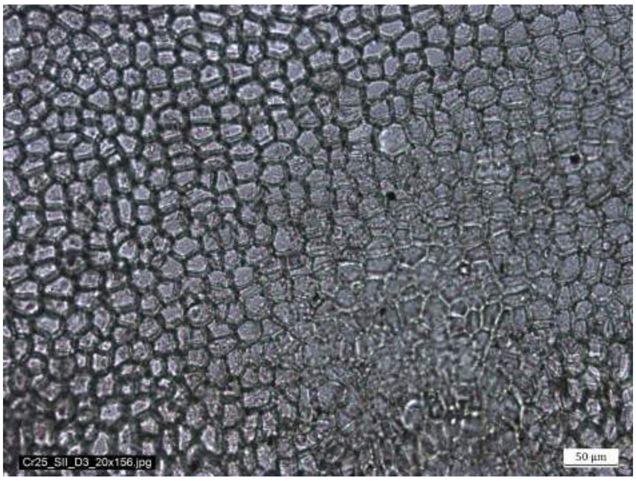
Fragment 44 (44_SII_D2_Cr25)



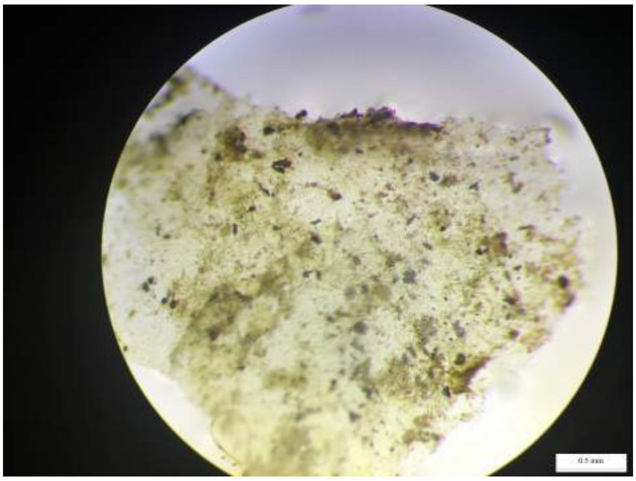


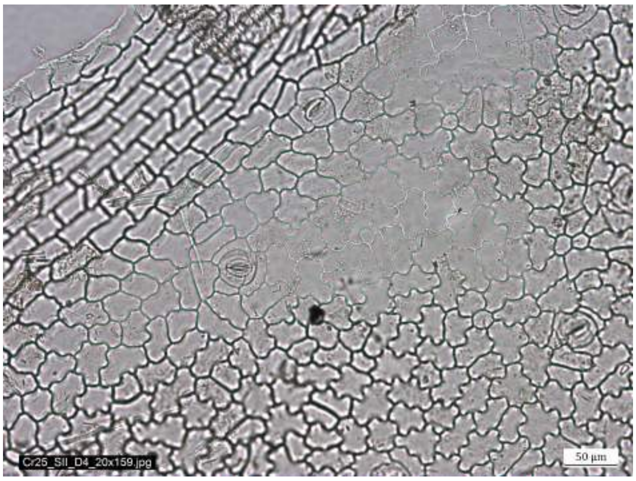
Fragment 45 (45_SII_D3_Cr25) → Inc_105



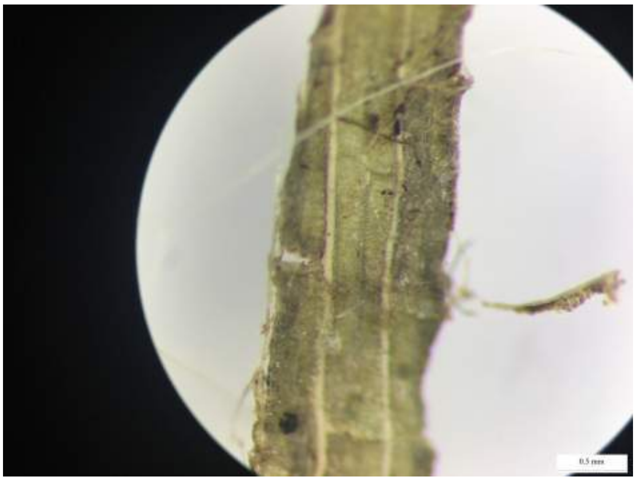


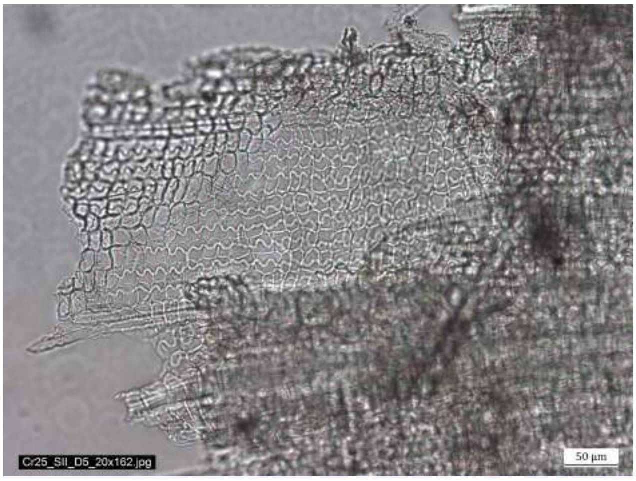
Fragment 46 (46_SII_D4_Cr25) → Inc_106



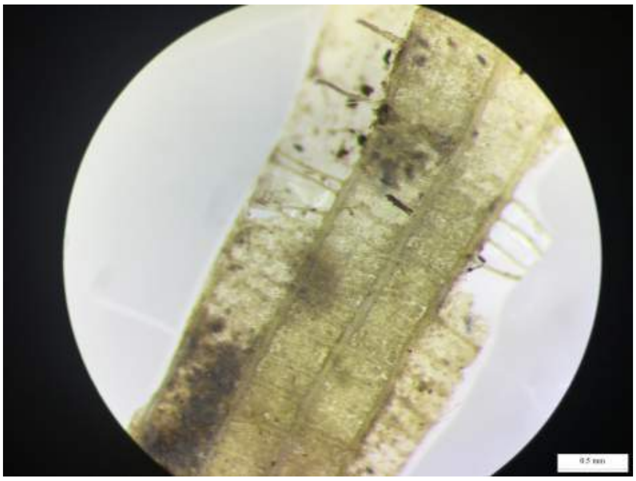


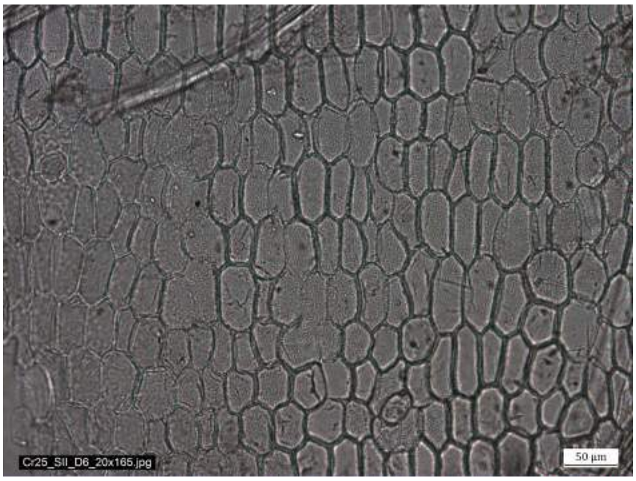
Fragment 47 (47_SII_D5_Cr25)





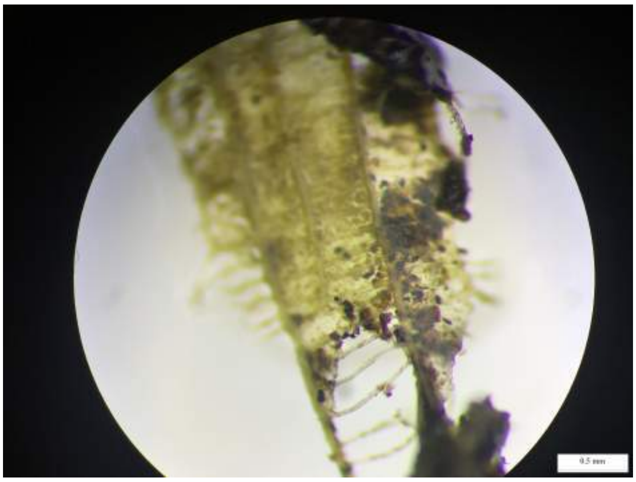
Fragment 48 (48_SII_D6_Cr25)



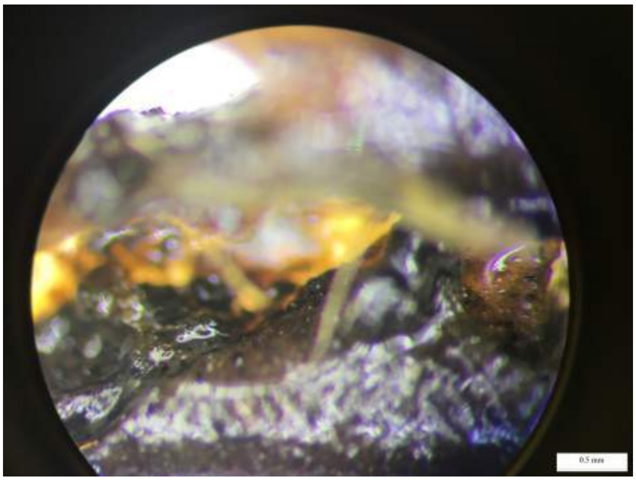


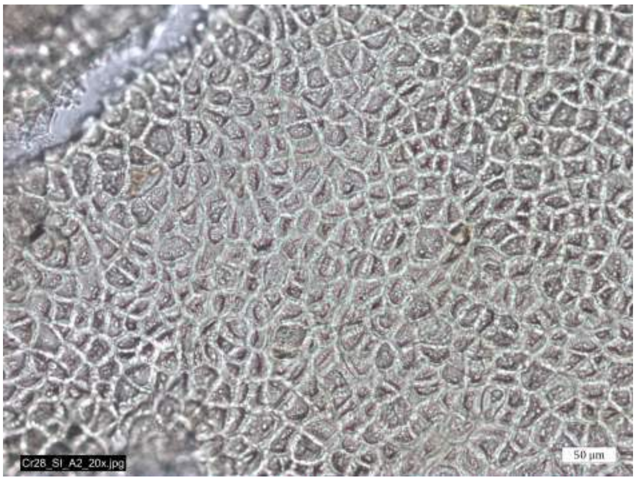
Fragments of the Faece 9

Fragment 1 (1_SI_A1_Cr28) → Inc_107

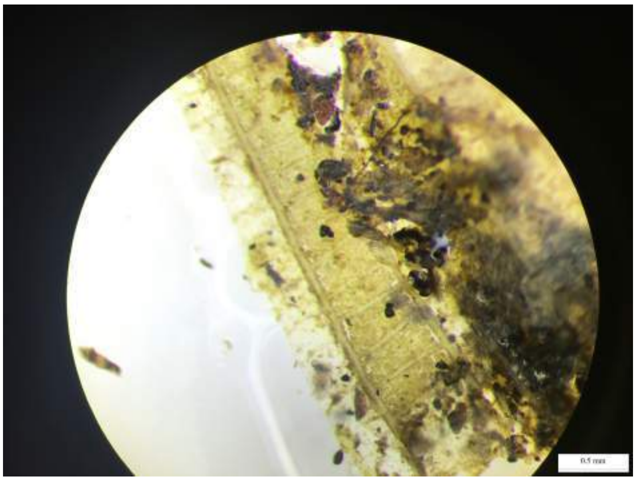


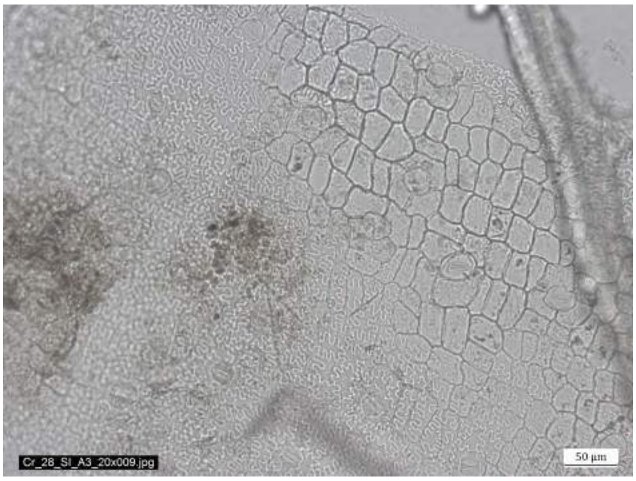
Fragment 2 (2_SI_A2_Cr28) → Inc_108



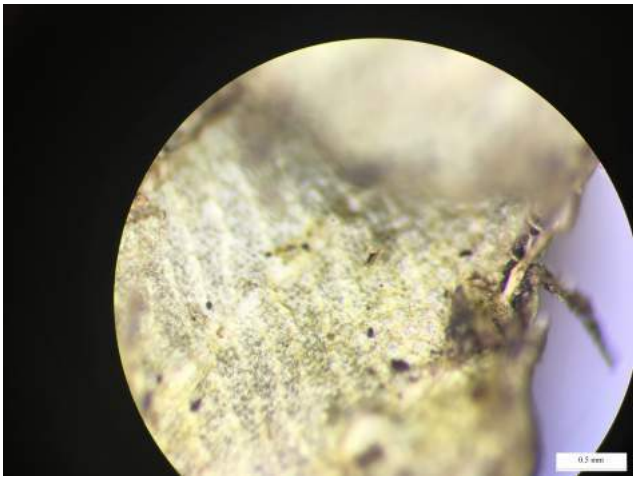


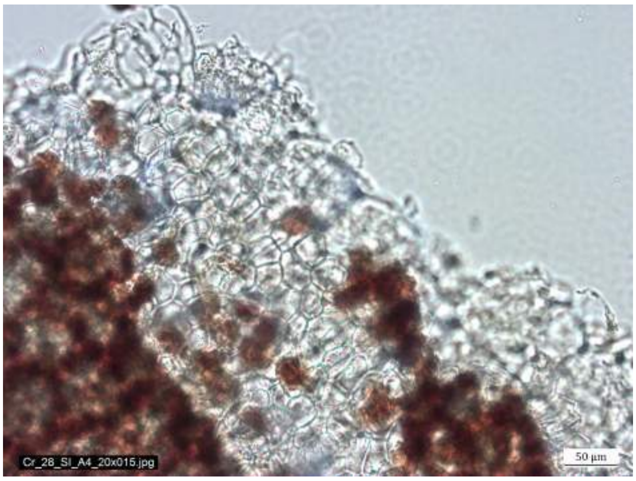
Fragment 3 (3_SI_A3_Cr28)



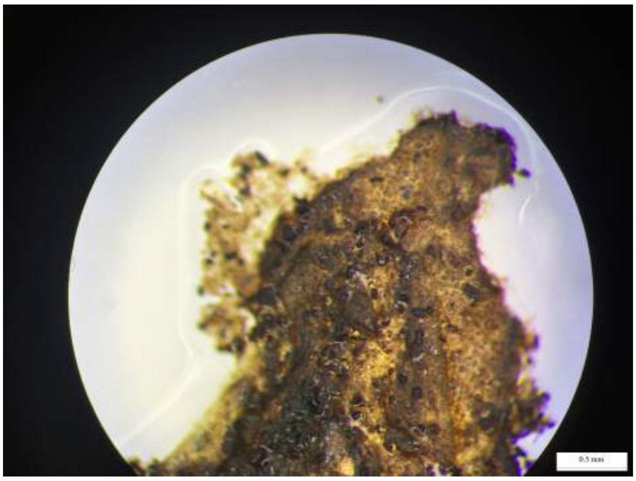


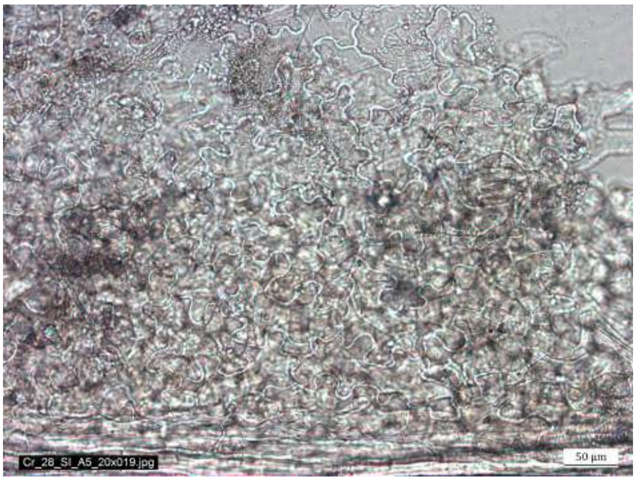
Fragment 4 (4_SI_A4_Cr28)



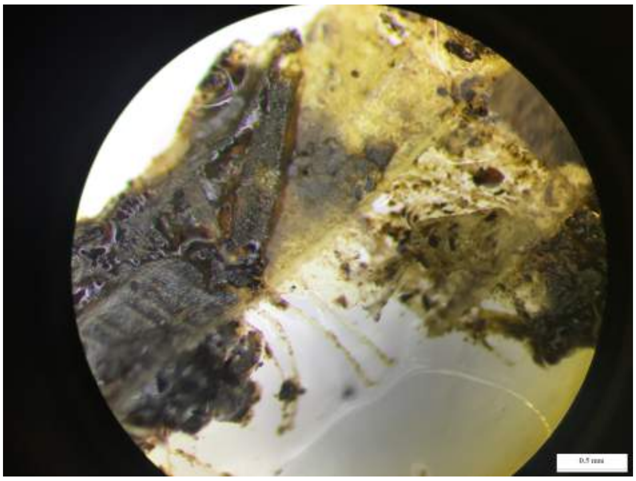


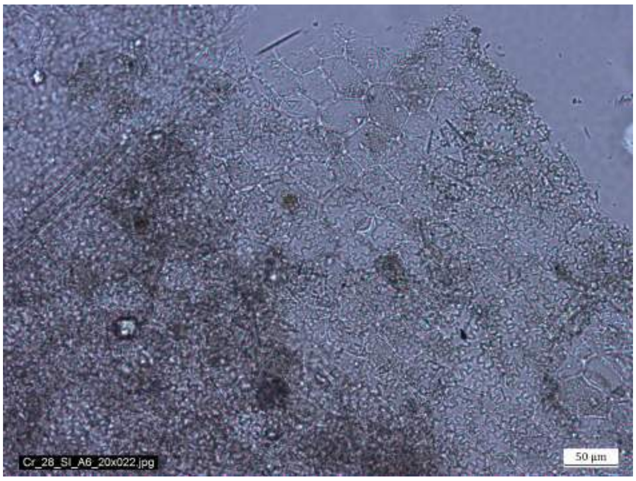
Fragment 5 (5_SI_A5_Cr28) → Inc_109



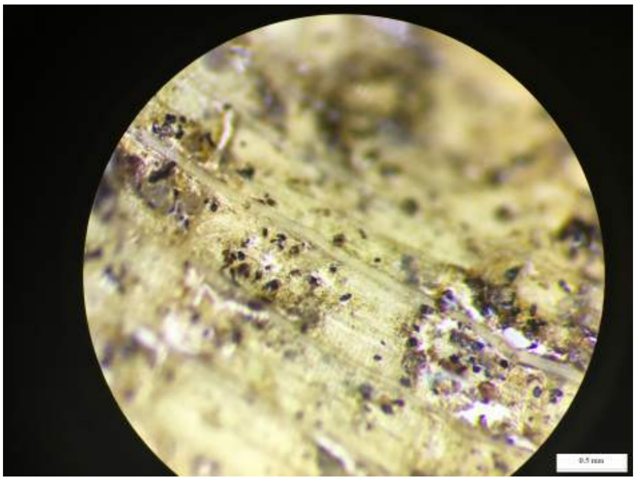


Fragment 6 (6_SI_A6_Cr28)

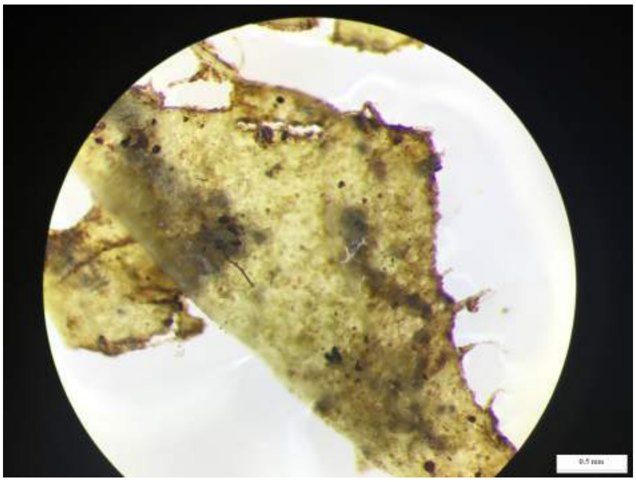


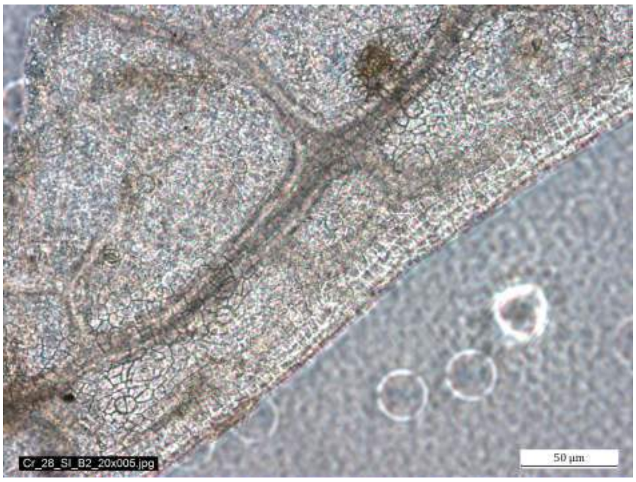


Fragment 7 (7_SI_B1_Cr28) → Inc_110

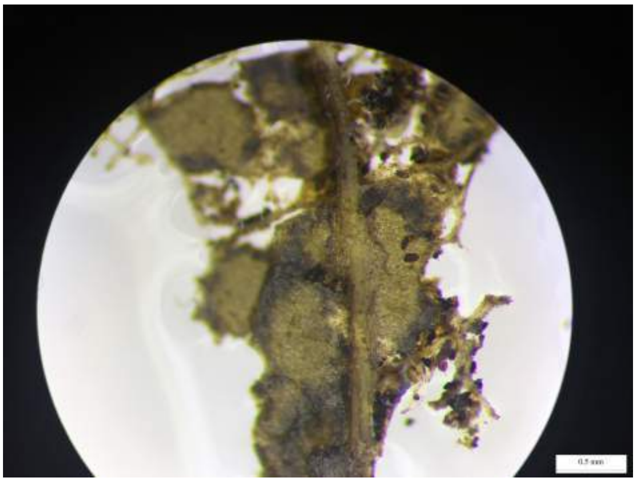


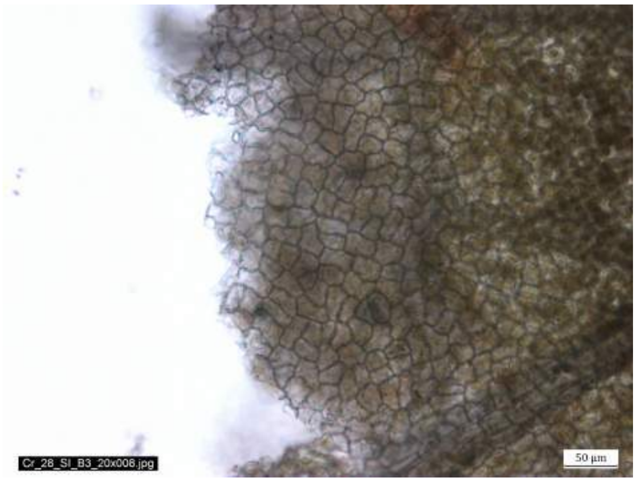
Fragment 8 (8_SI_B2_Cr28) → Inc_111



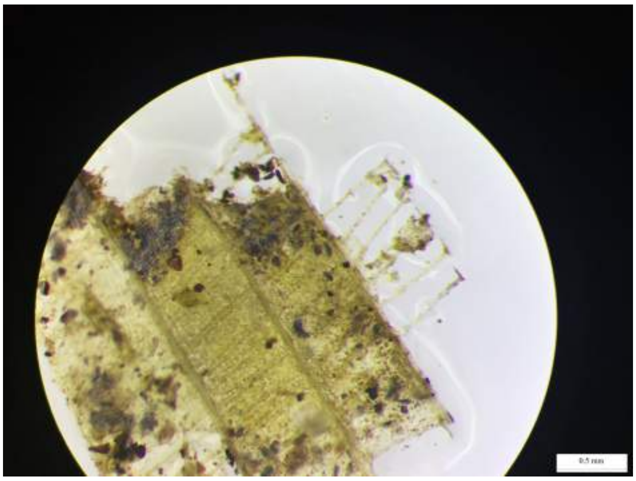


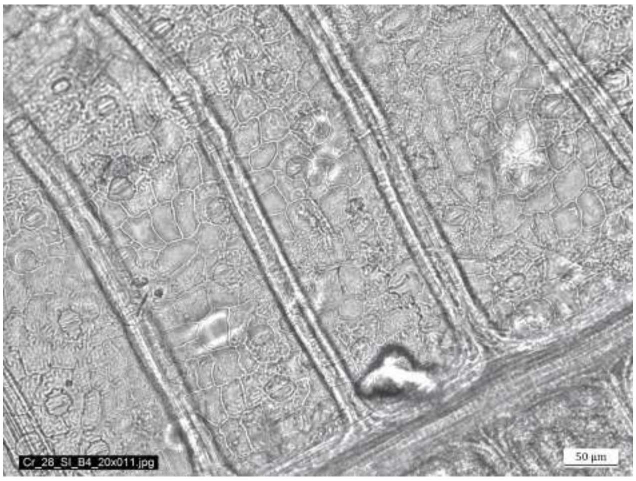
Fragment 9 (9_SI_B3_Cr28)



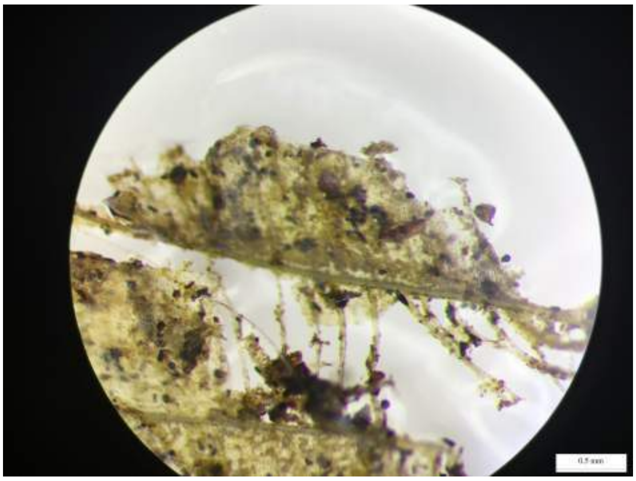


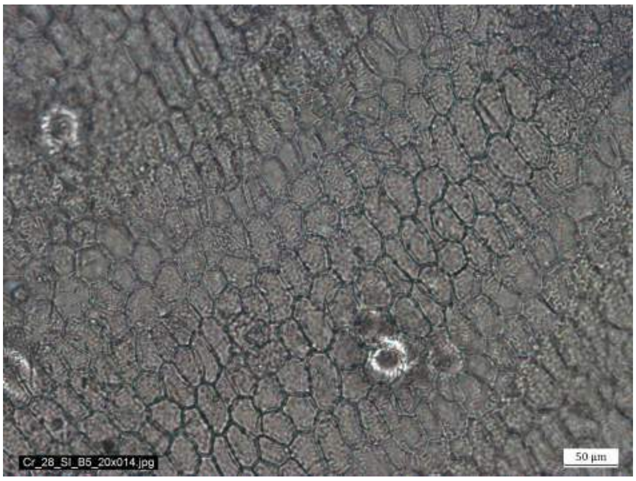
Fragment 10 (10_SI_B4_Cr28)



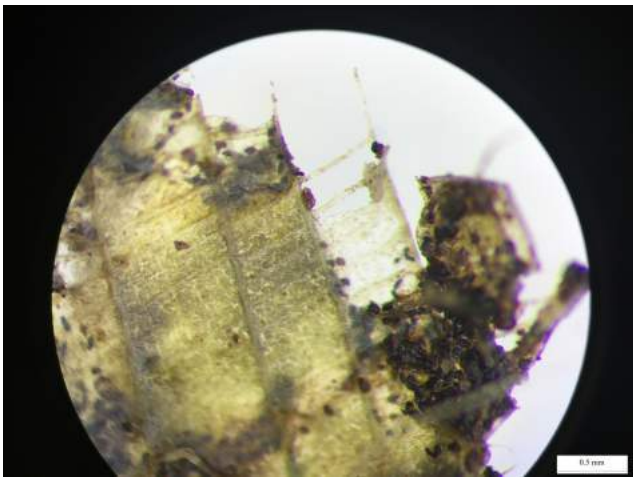


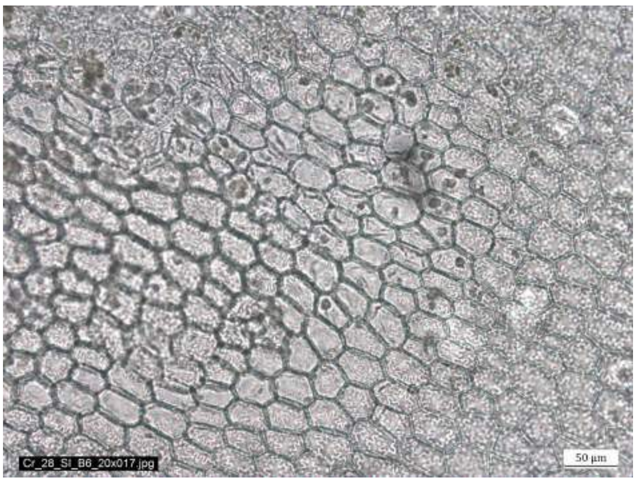
Fragment 11 (11_SI_B5_Cr28)



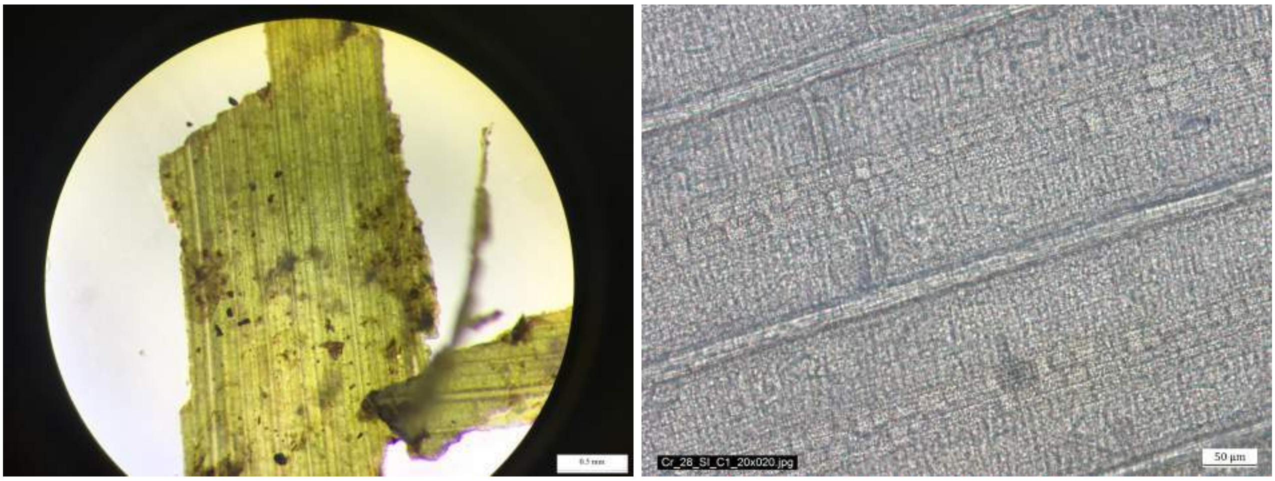


Fragment 12 (12_SI_B6_Cr28)

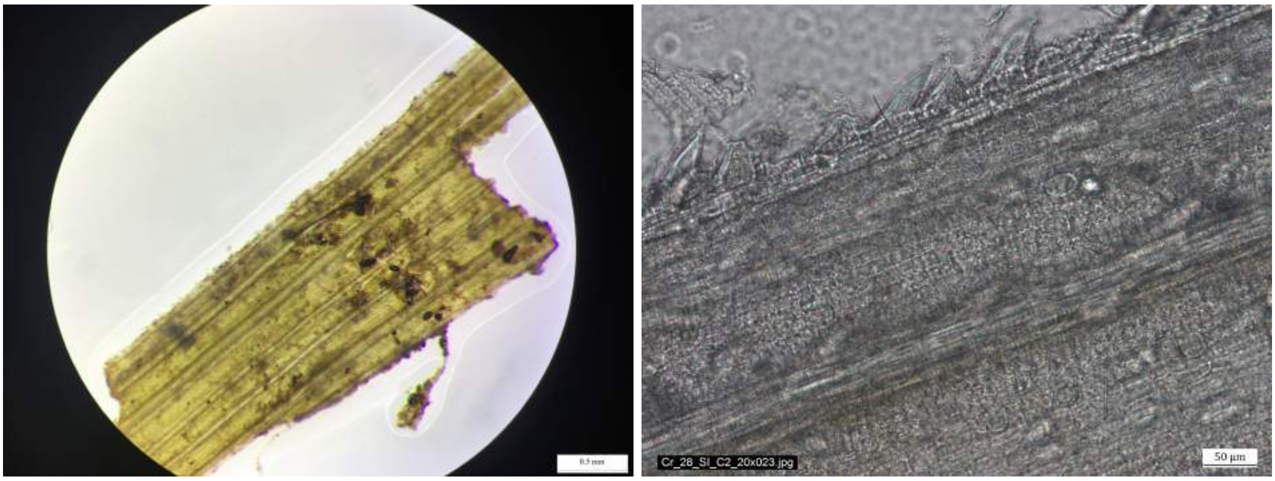




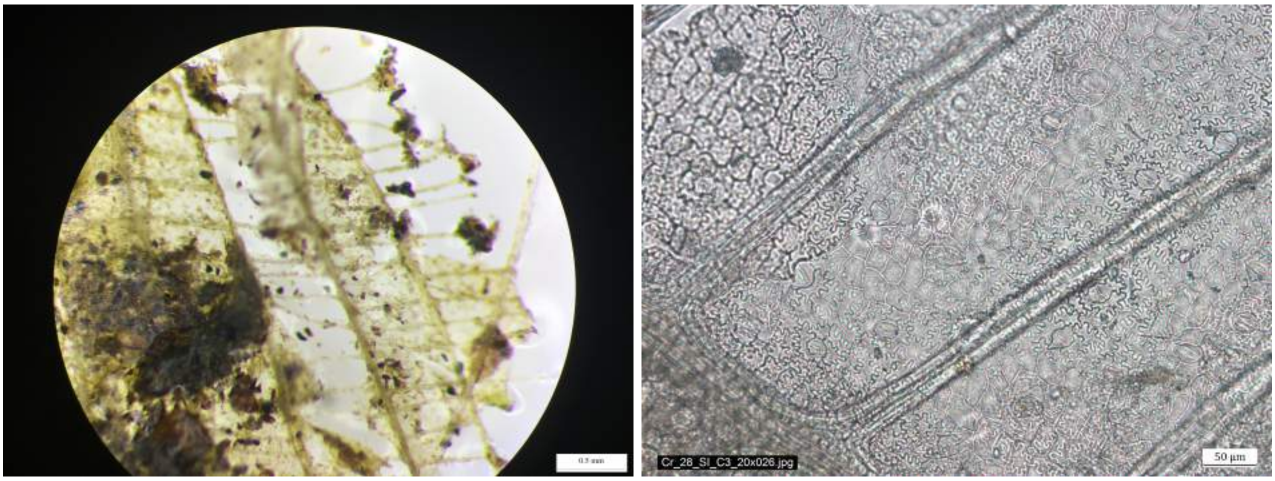
Fragment 13 (13_SI_C1_Cr28) → Inc_112



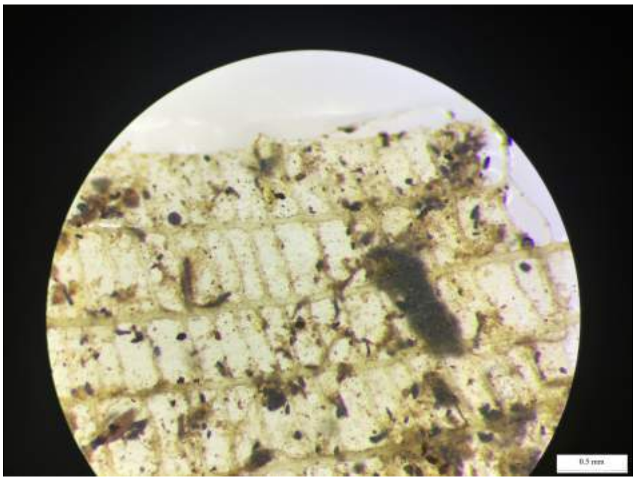
Fragment 14 (14_SI_C2_Cr28)

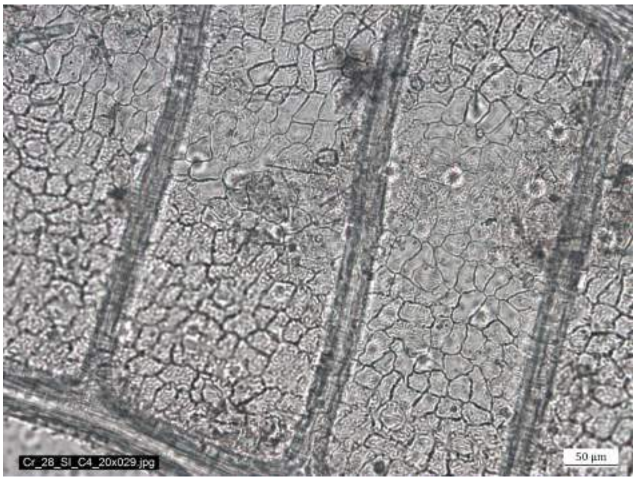


Fragment 15 (15_SI_C3_Cr28)

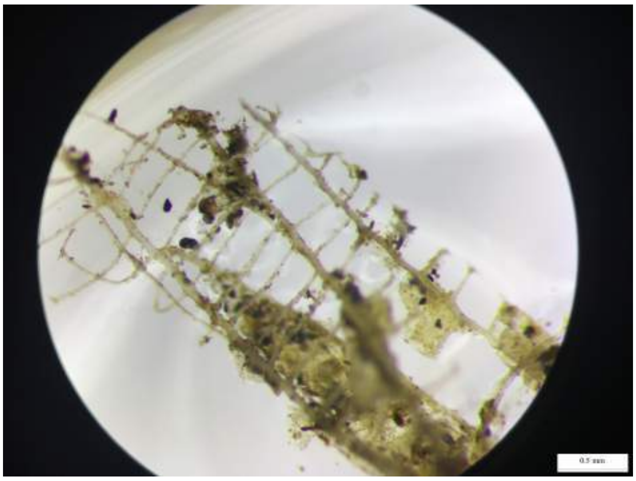


Fragment 16 (16_SI_C4_Cr28)

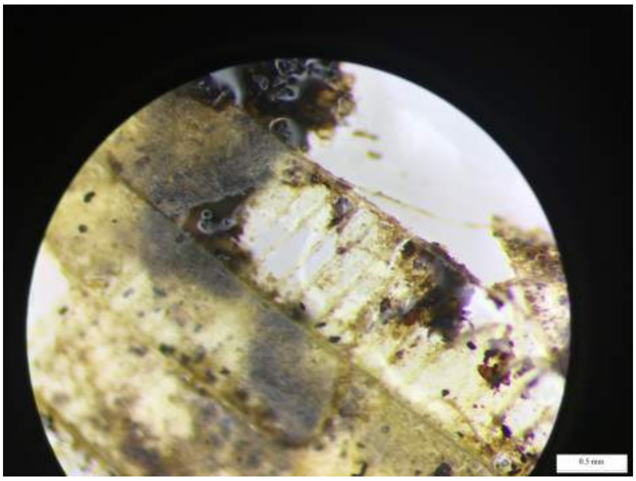


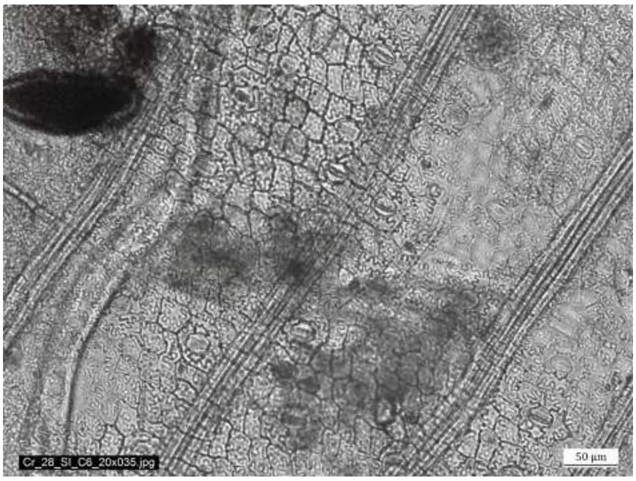


Fragment 17 (17_SI_C5_Cr28)

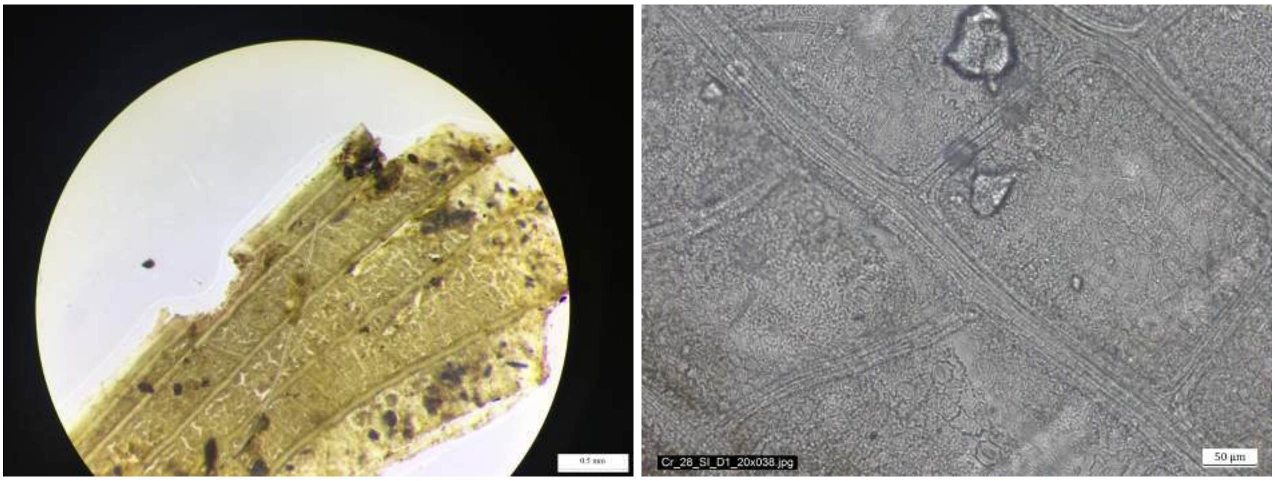


Fragment 18 (18_SI_C6_Cr28)

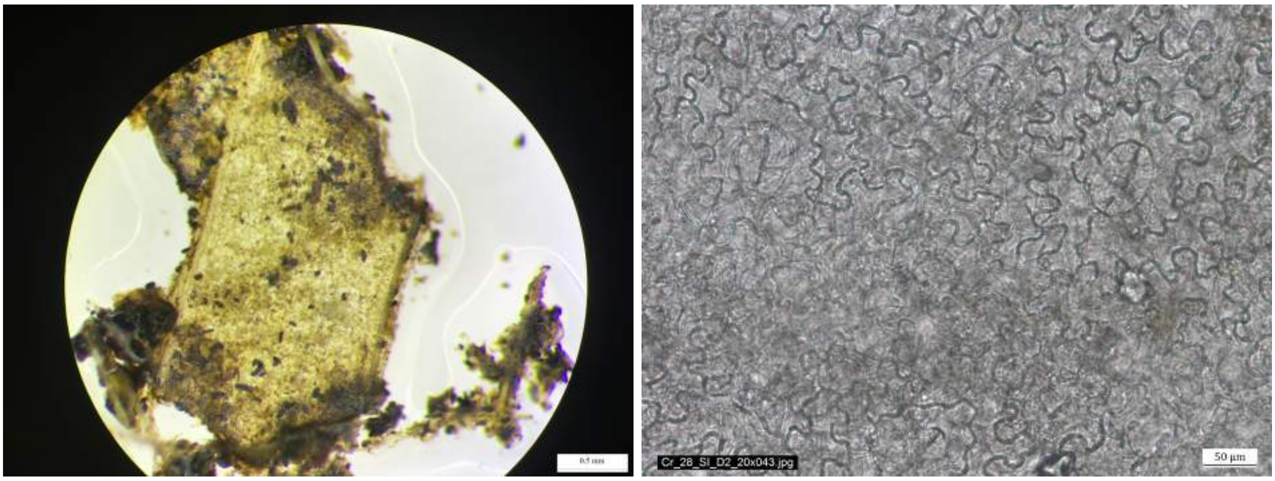




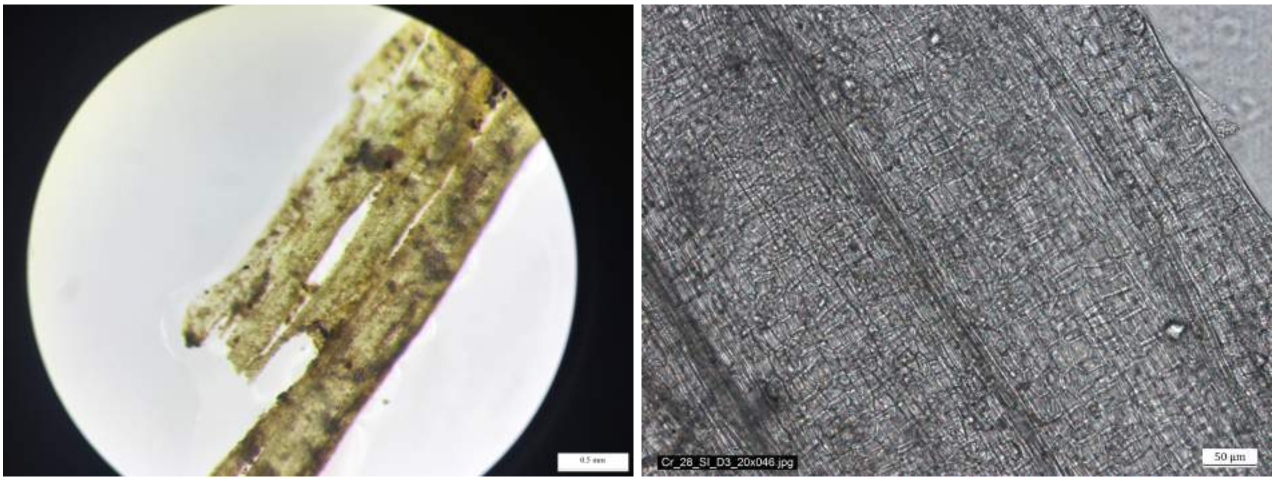
Fragment 19 (19_SI_D1_Cr28)



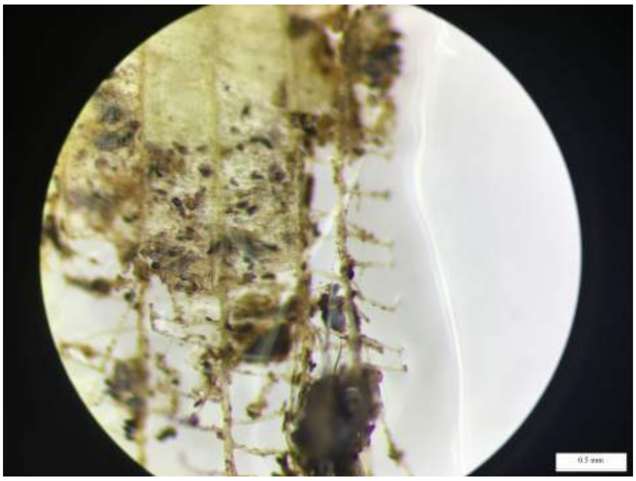
Fragment 20 (20_SI_D2_Cr28) → Inc_113

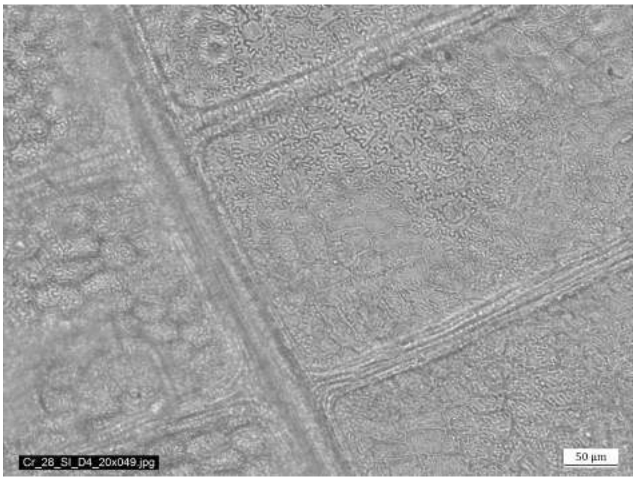


Fragment 21 (21_SI_D3_Cr28)

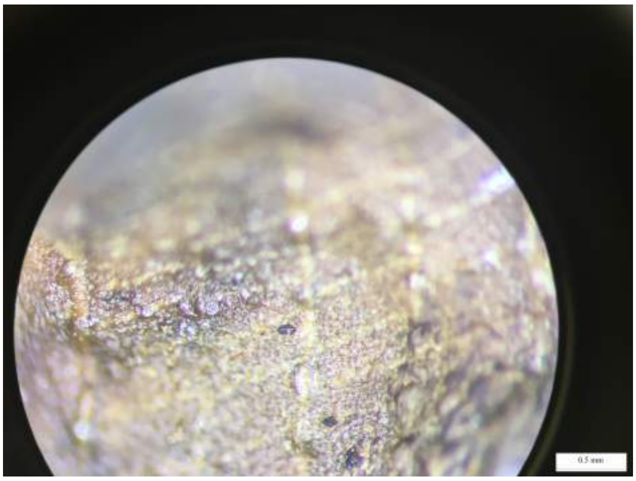


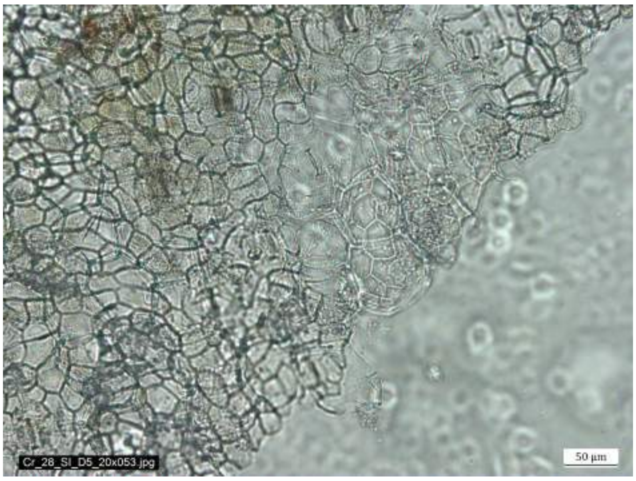
Fragment 22 (22_SI_D4_Cr28)



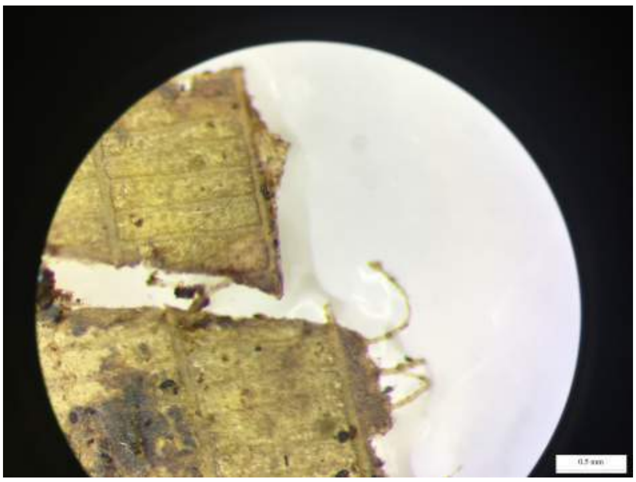


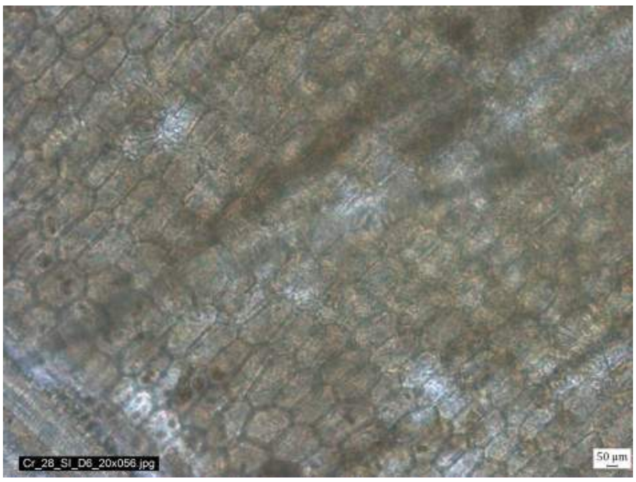
Fragment 23 (23_SI_D5_Cr)



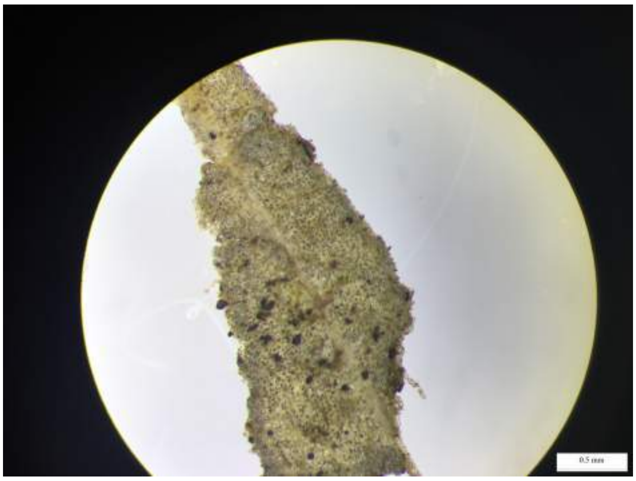


Fragment 24 (24_SI_D6_Cr28)



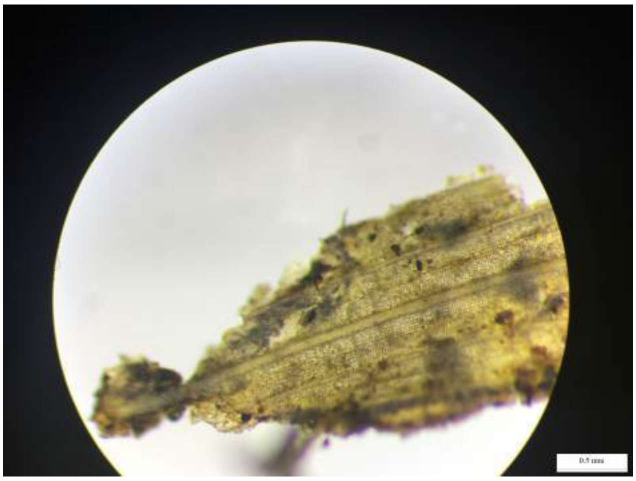


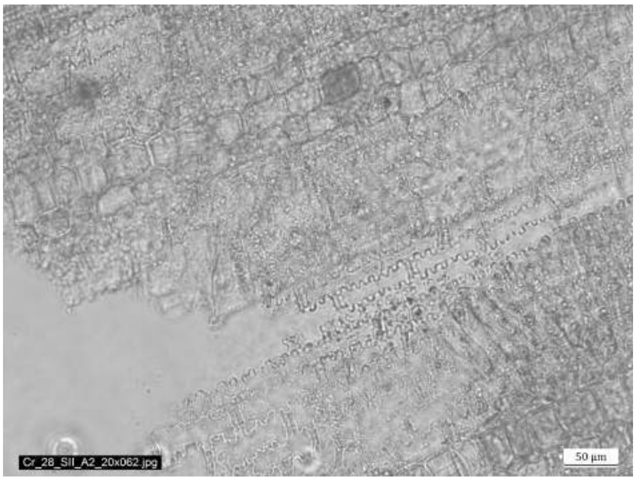
Fragment 25 (25_SII_A1_Cr28)



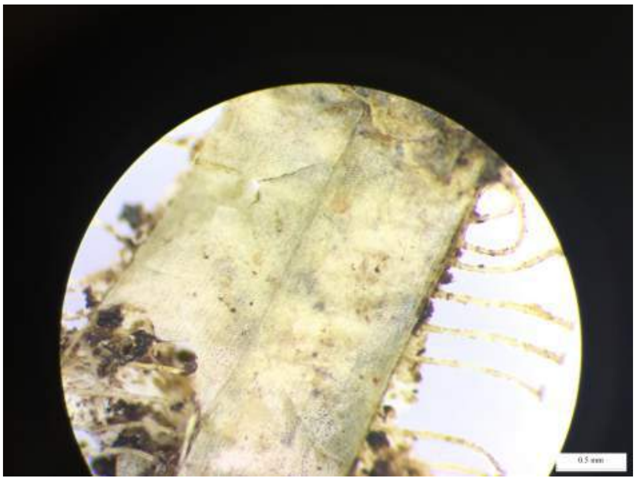
No references

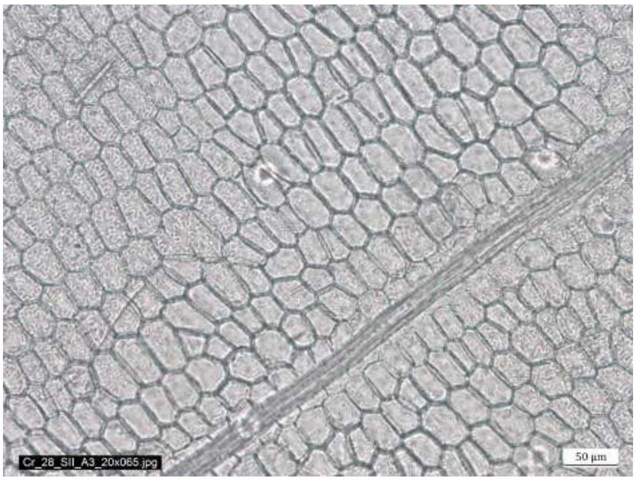
Fragment 26 (26_SII_A2_Cr28)



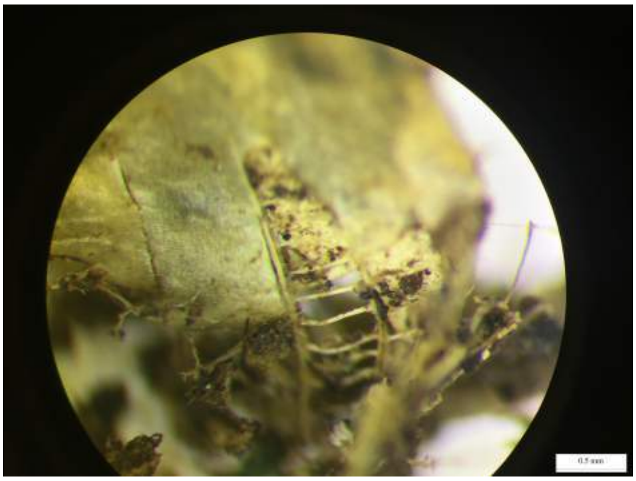


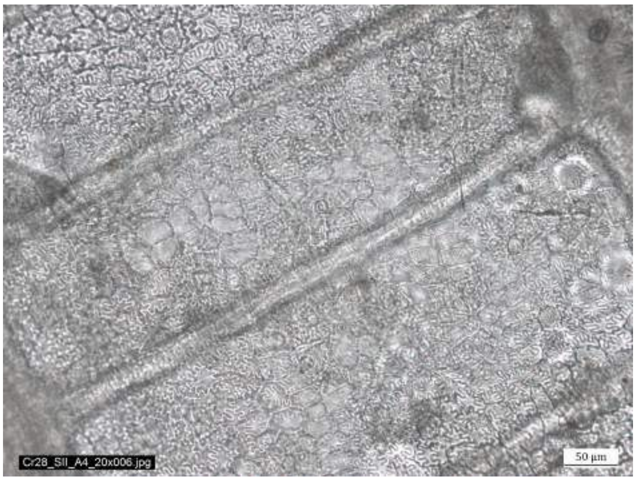
Fragment 27 (27_SII_A3_Cr)



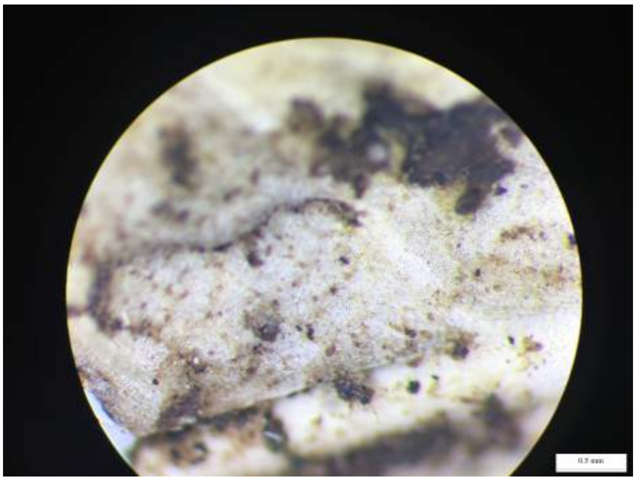


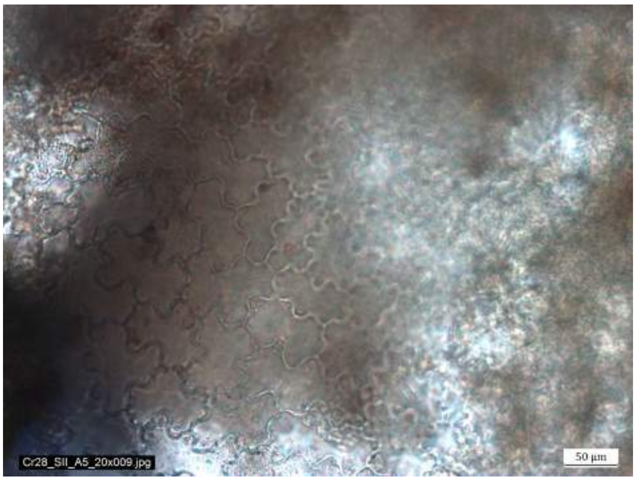
Fragment 28 (28_SII_A4_Cr28)



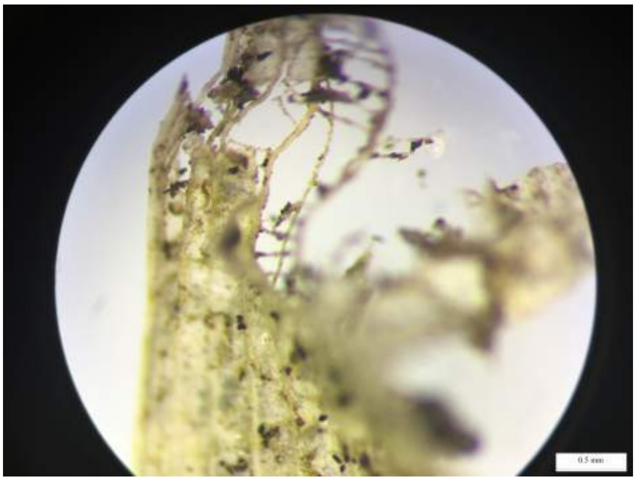


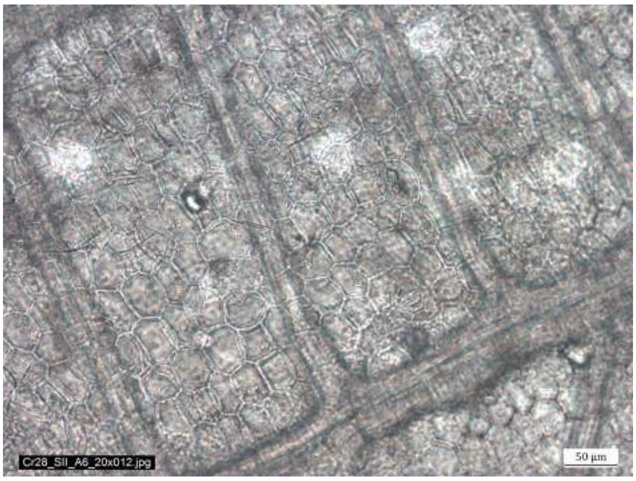
Fragment 29 (29_SII_A5_Cr28) → Inc_114



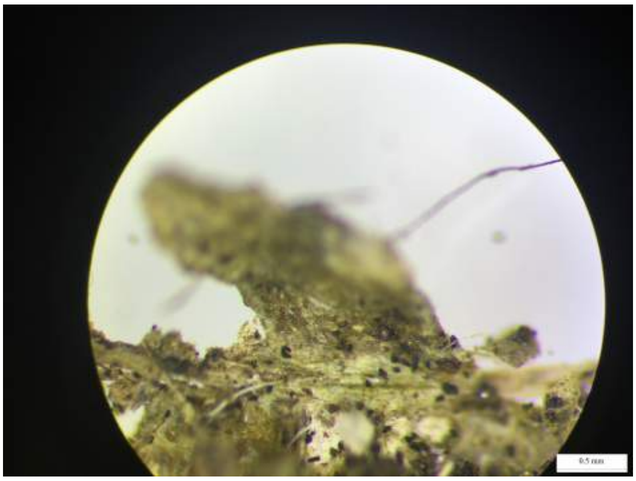


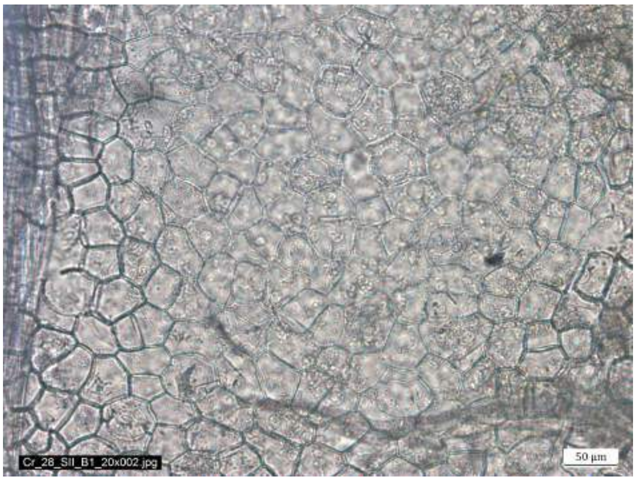
Fragment 30 (30_SII_A6_Cr28)



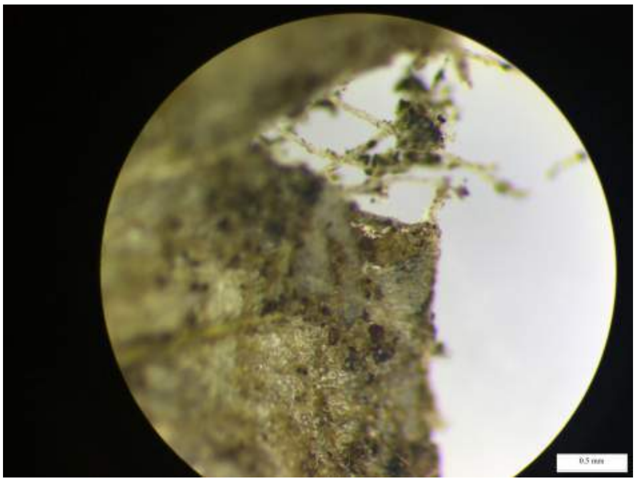


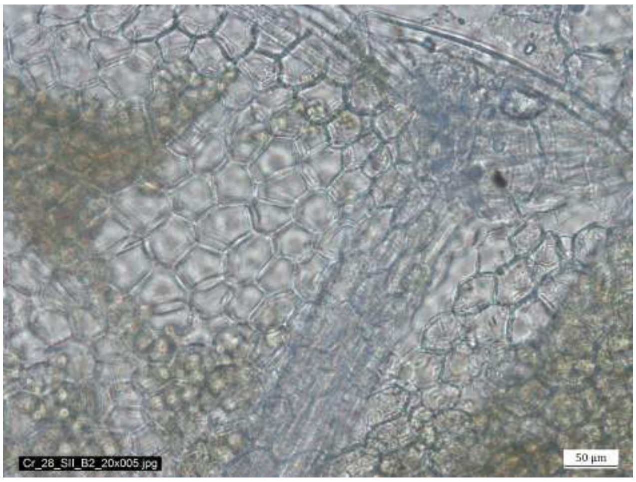
Fragment 31 (31_SII_B1_Cr28) → Inc_115



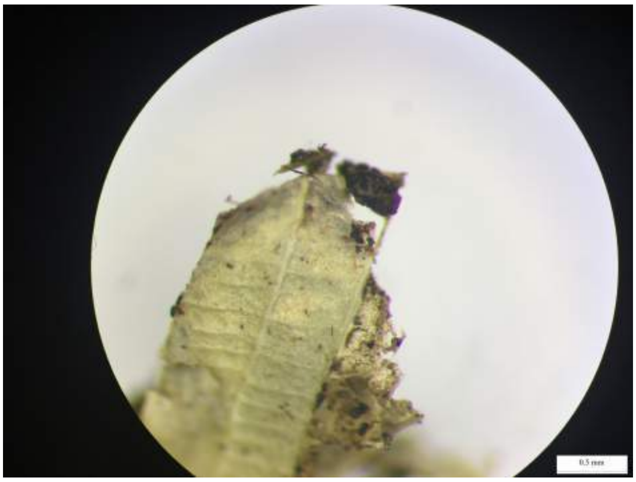


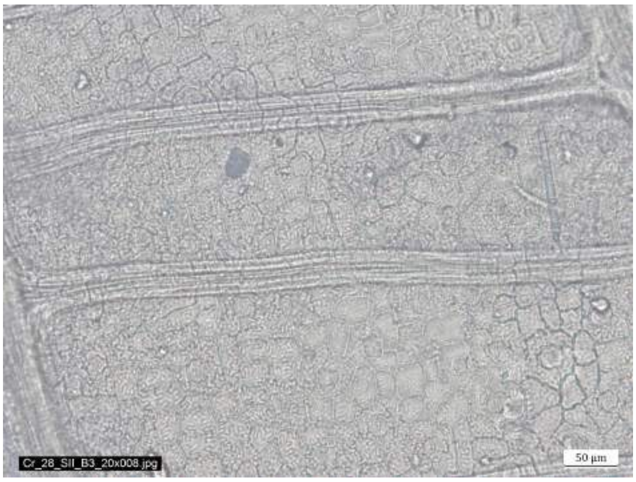
Fragment 32 (32_SII_B2_Cr28) → Inc_116



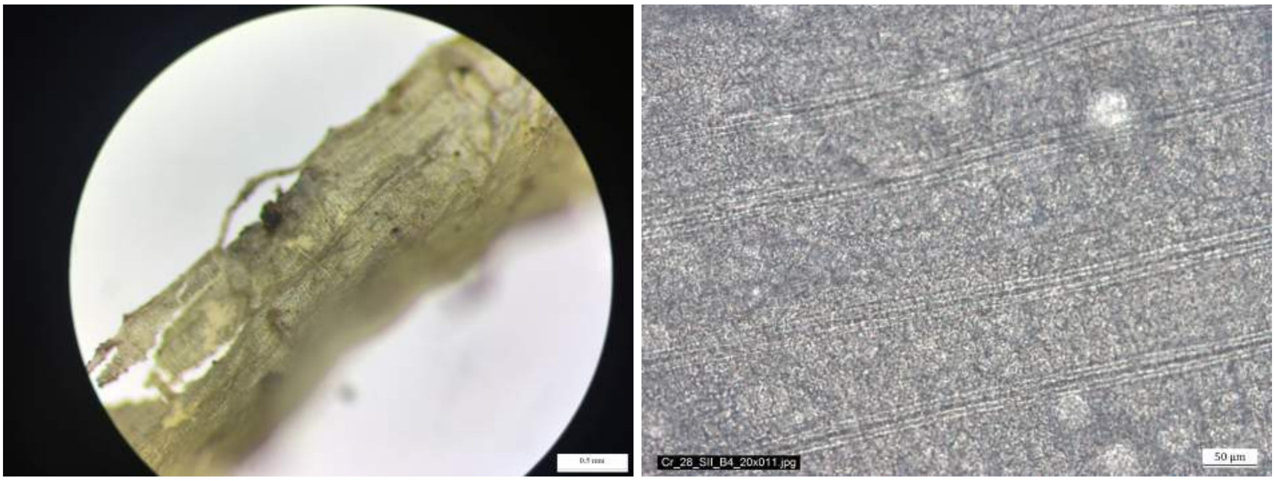


Fragment 33 (33_SII_B3_Cr28)

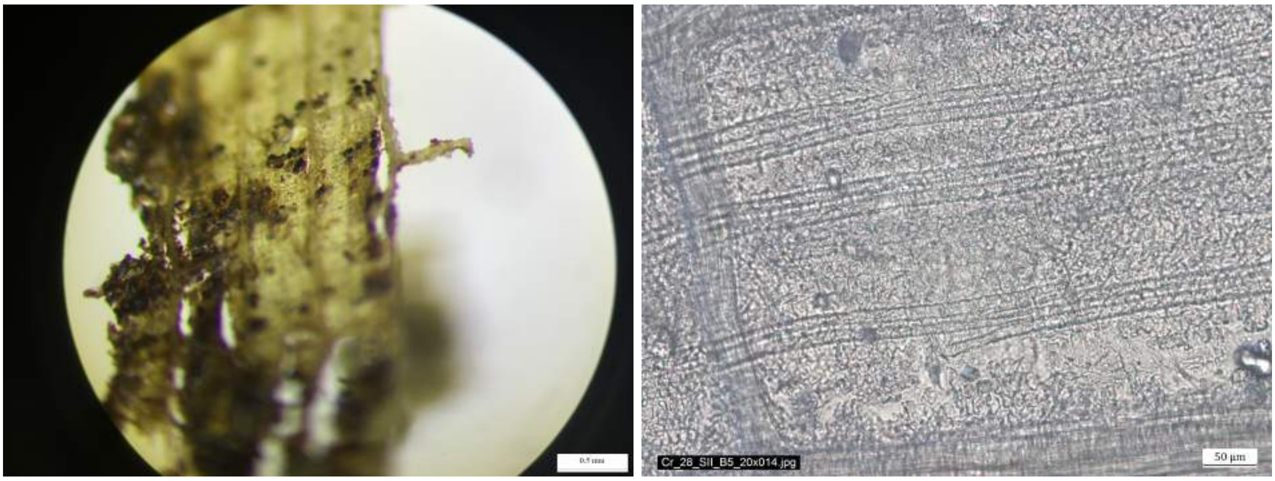




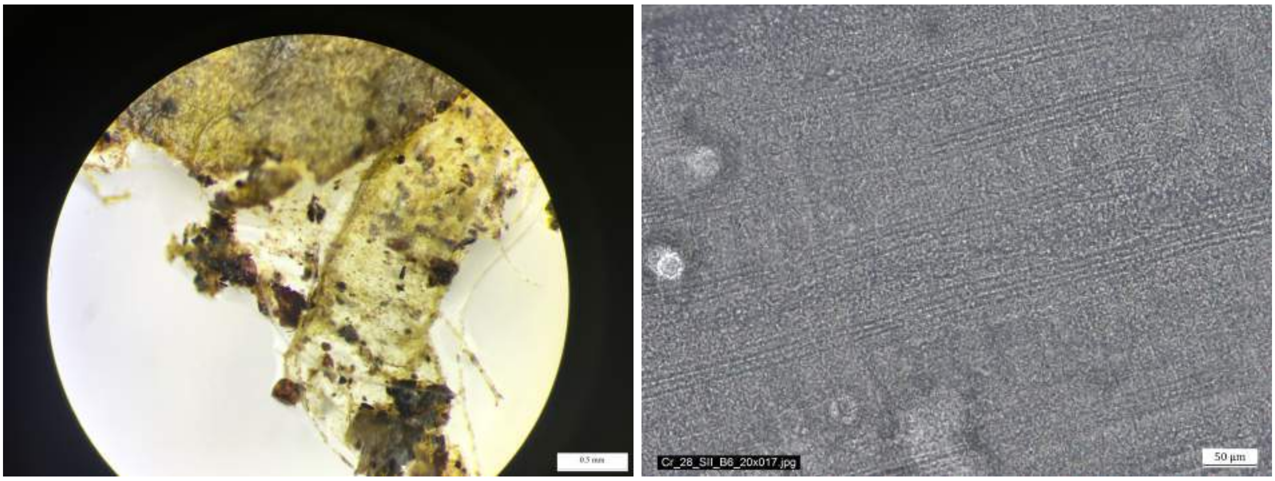
Fragment 34 (34_SII_B4_Cr28) → Inc_117



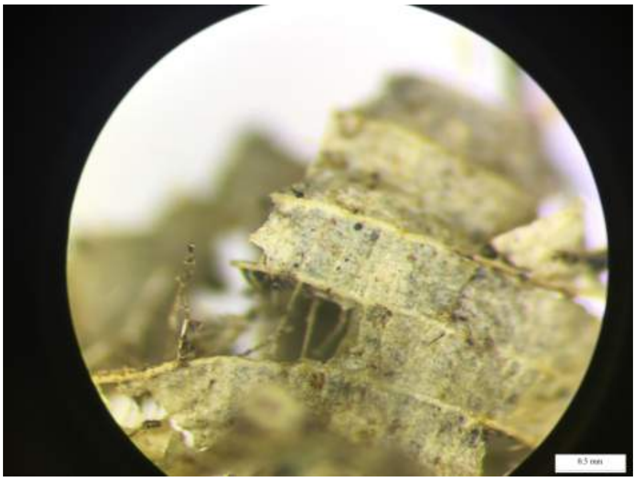
Fragment 35 (5_SII_B5_Cr28)



Fragment 36 (36_SII_B6_Cr28)

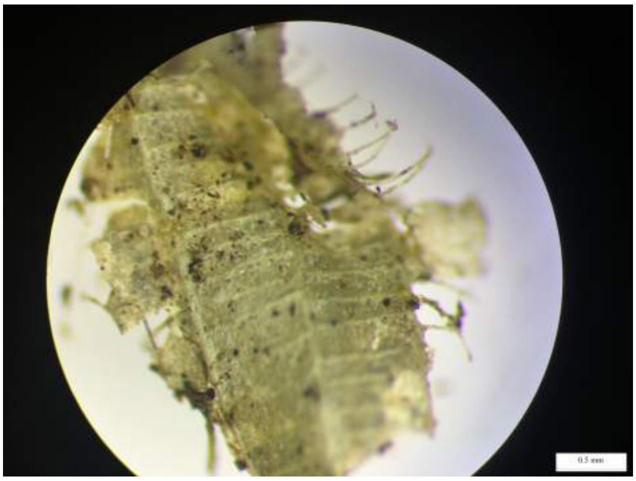


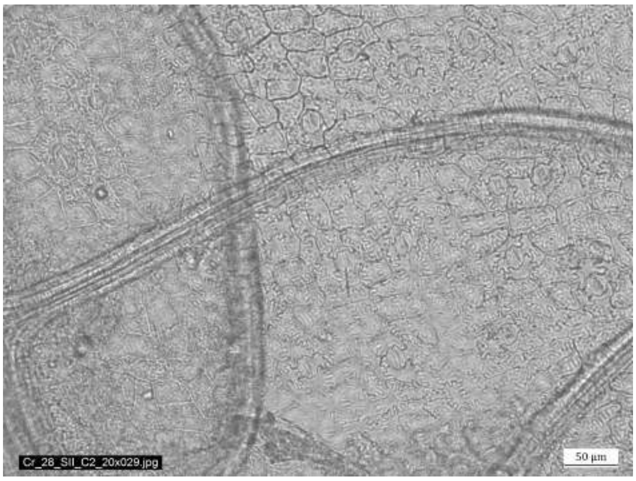
Fragment 37 (37_SII_C1_Cr28)



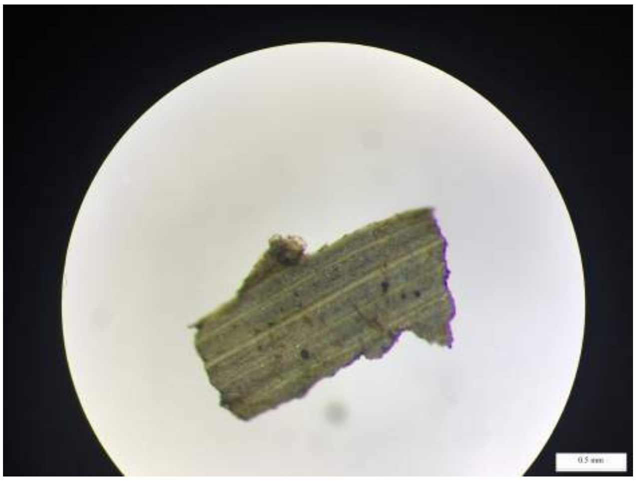
No references

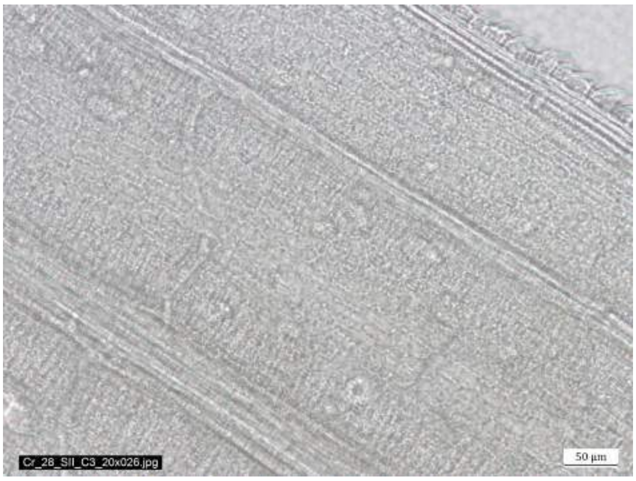
Fragment 38 (38_SII_C2_Cr28)



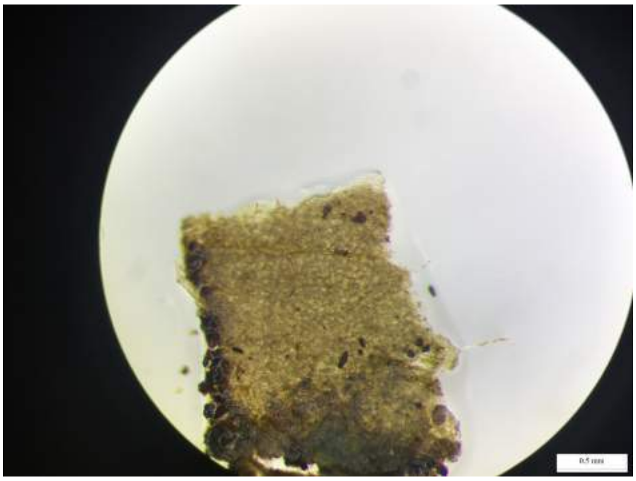


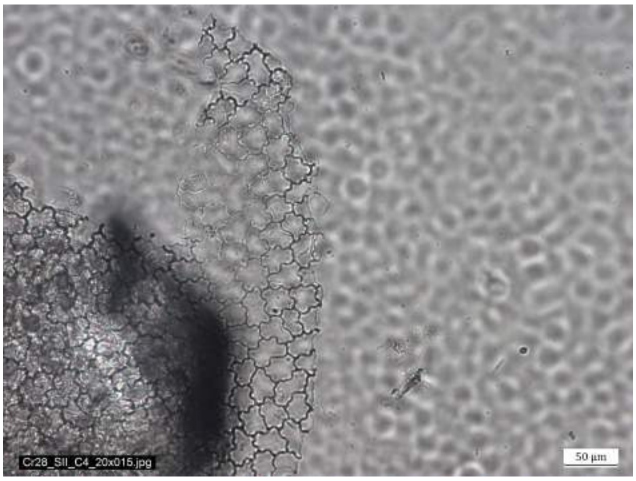
Fragment 39 (39_SII_C3_Cr28)



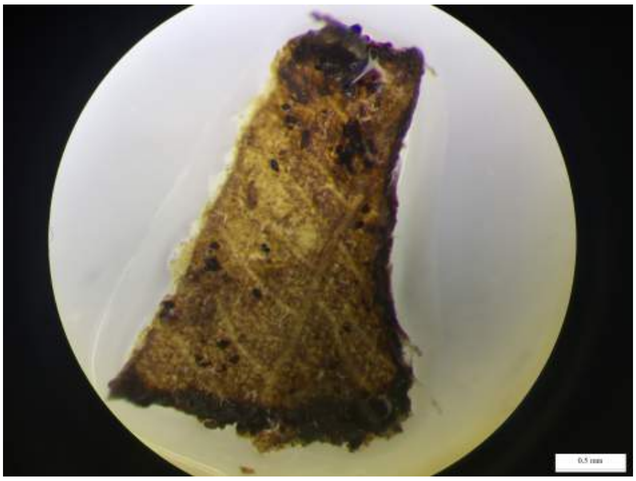


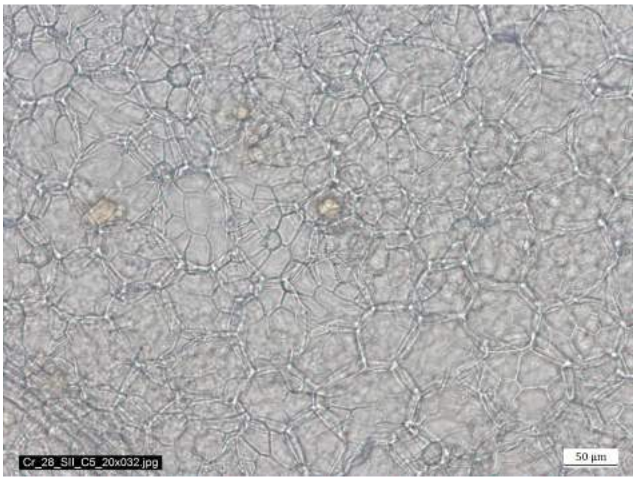
Fragment 40 (40_SII_C4_Cr28) → Inc_118



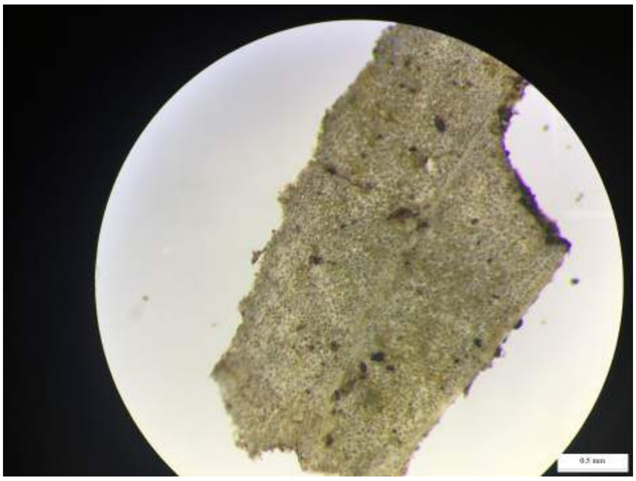


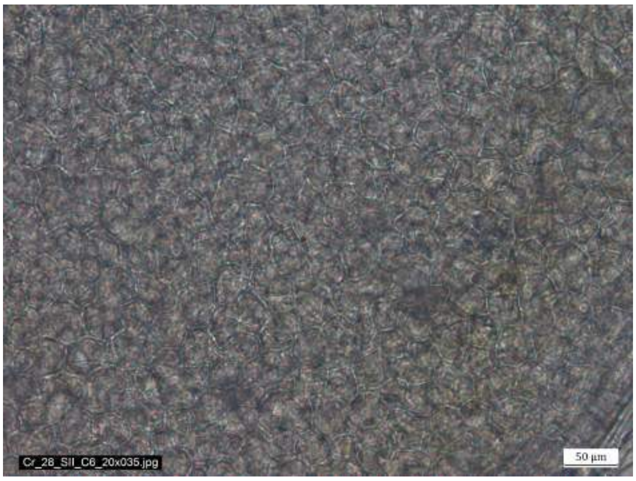
Fragment 41 (41_SII_C5_Cr28)



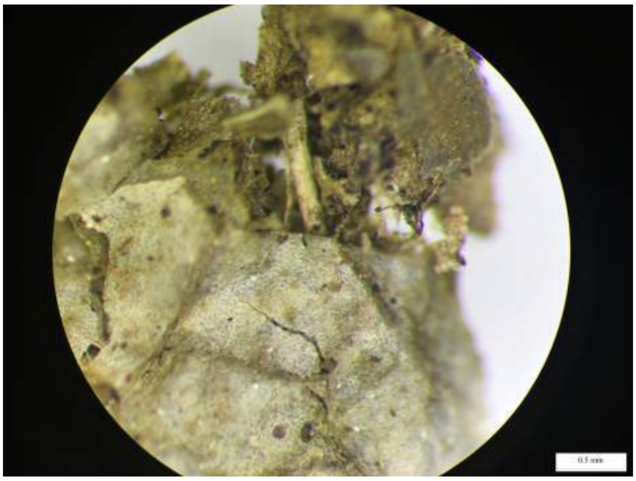
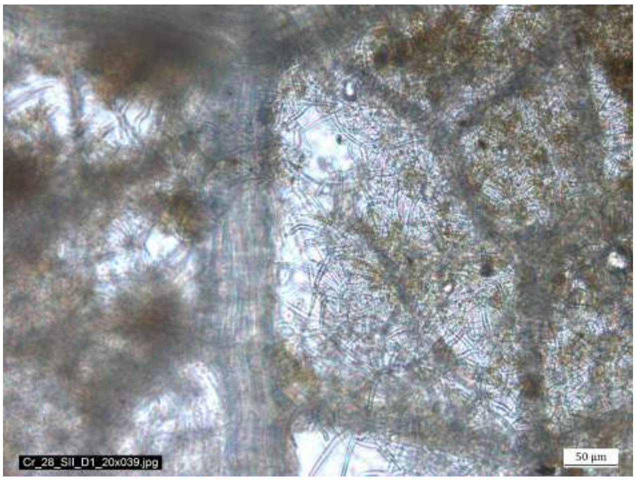


Fragment 42 (42_SII_C6_Cr28)

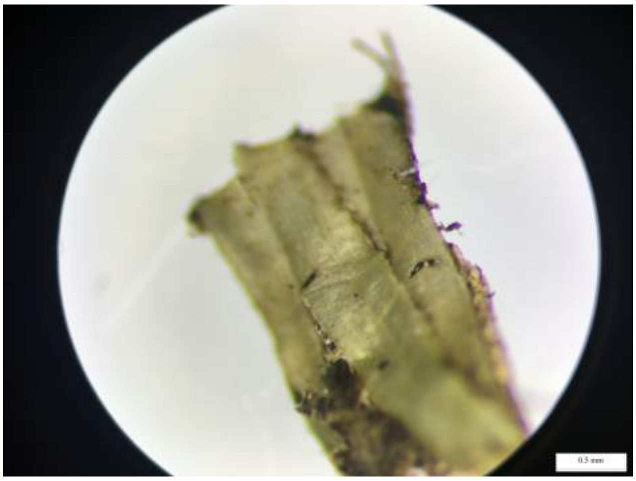
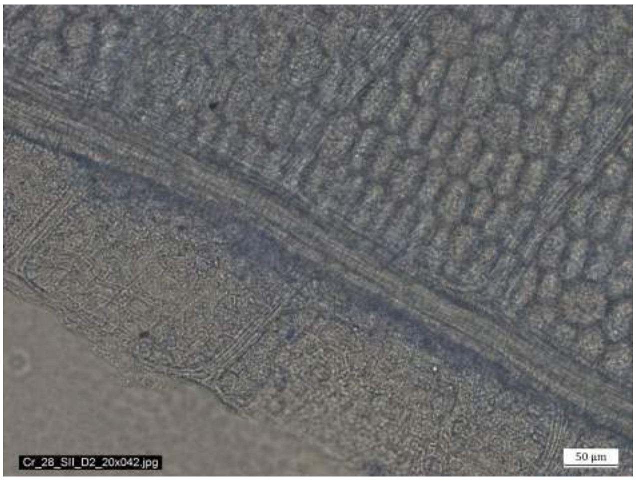




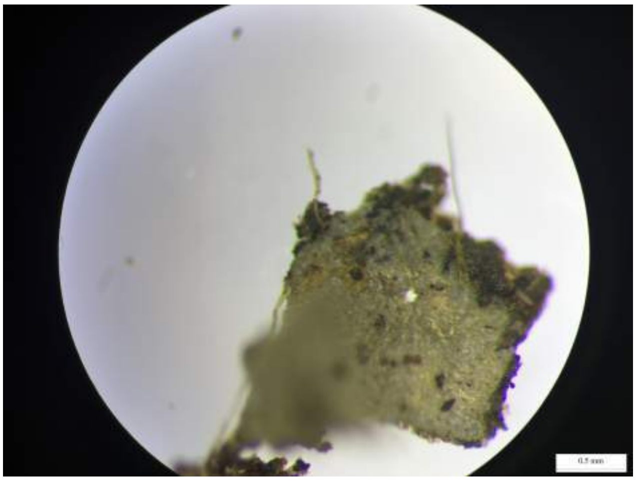
Fragment 43 (43_SII_D1_Cr28)

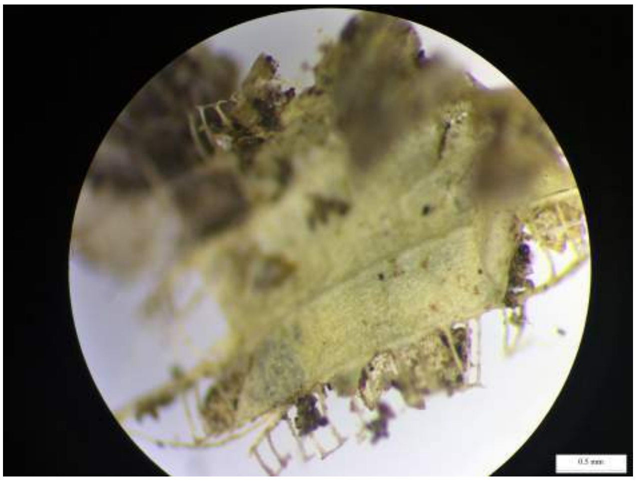
Fragment 44 (44_SII_D2_Cr28)

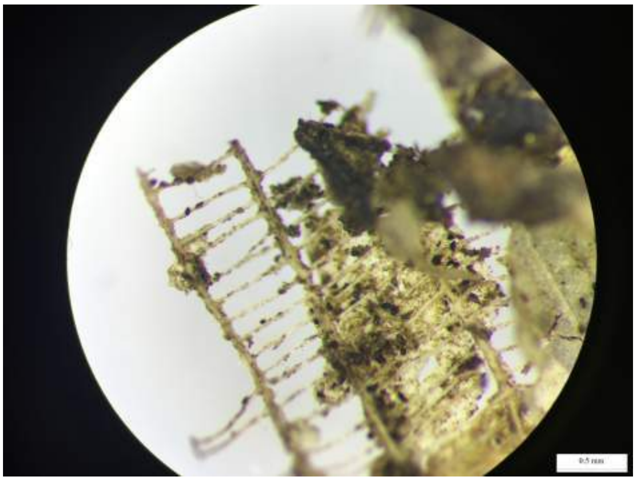
Fragment 45 (45_SII_D3_Cr28)

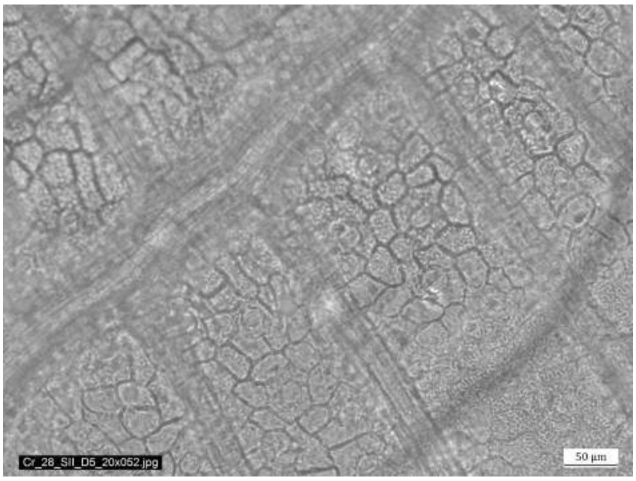



Fragment 46 (46_SII_D4_Cr28)

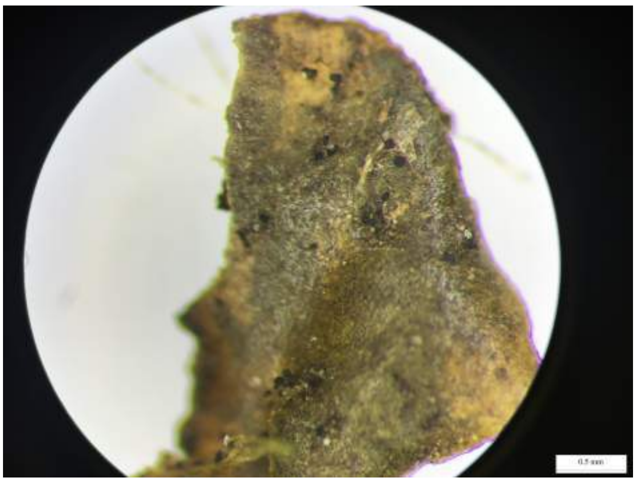


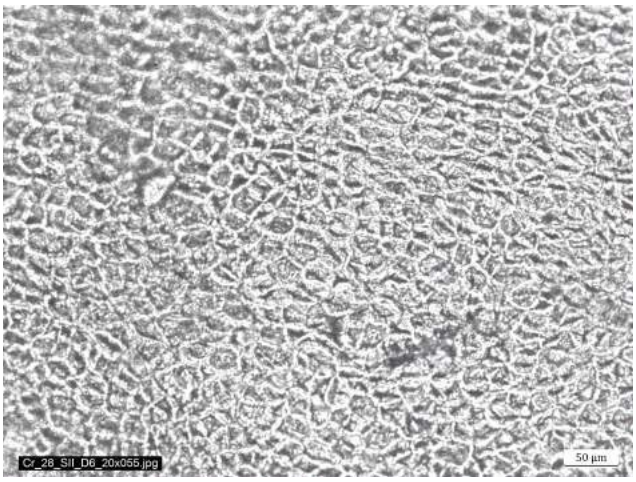
Fragment 47 (47_SII_D5_Cr28)





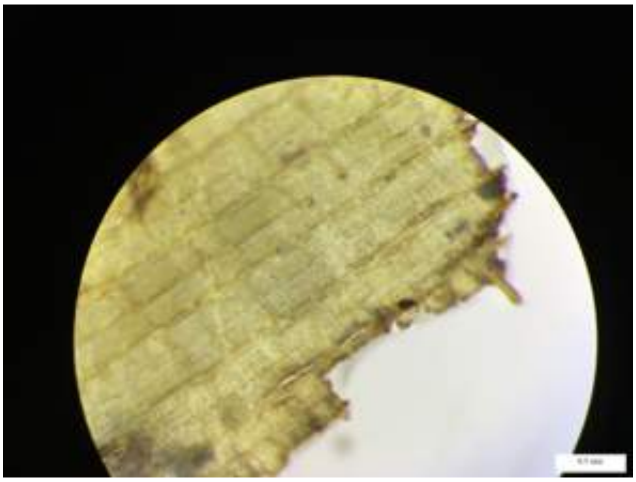
Fragment 48 (48_SII_D6_Cr28)



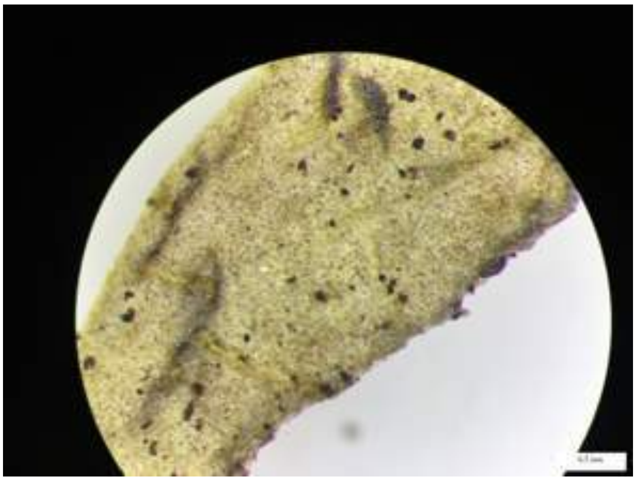
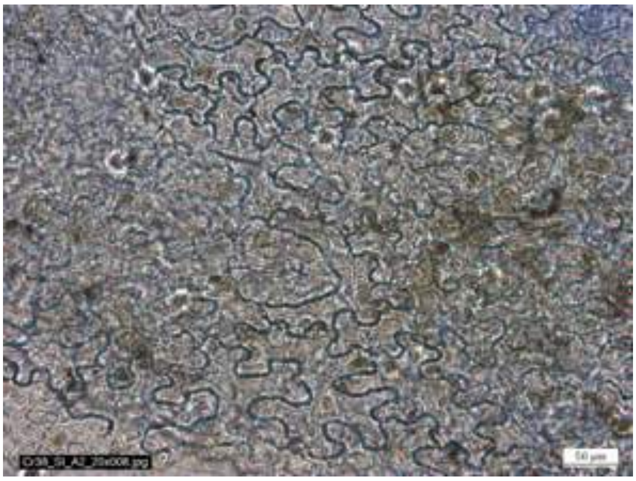


Fragments of the Faece 10

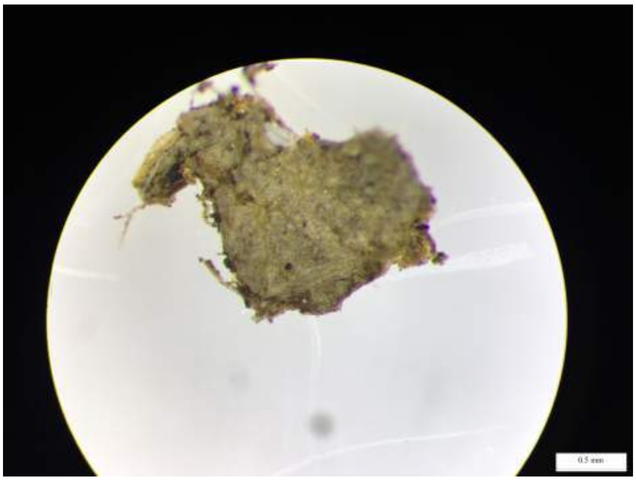
Fragment 1 (1_SI_A1_Cr38) → Inc_119



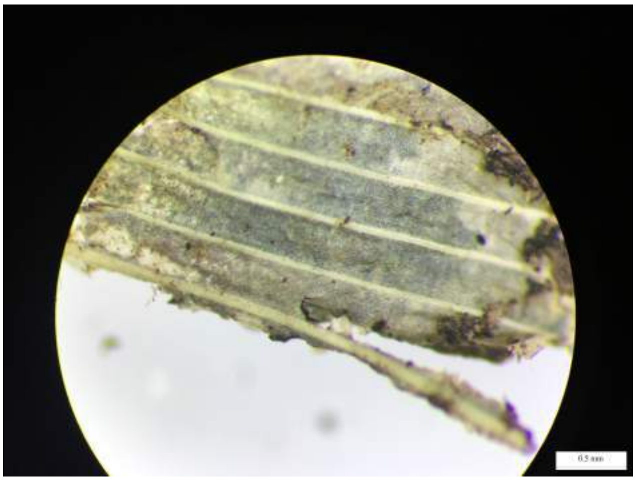

Fragment 2 (2_SI_A2_Cr38) → Inc_120

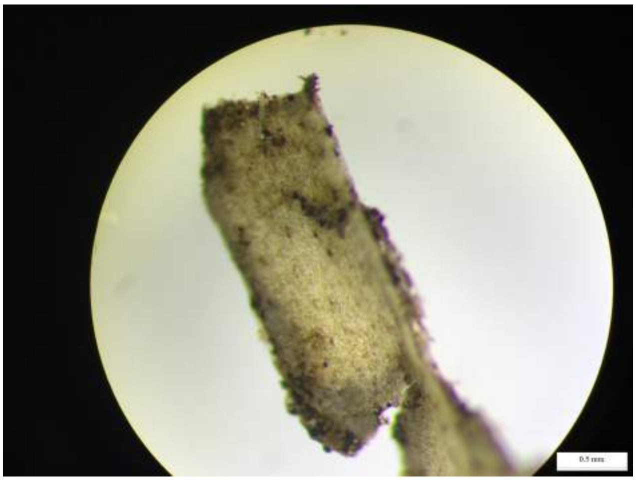
Fragment 3 (3_SI_A3_Cr38)

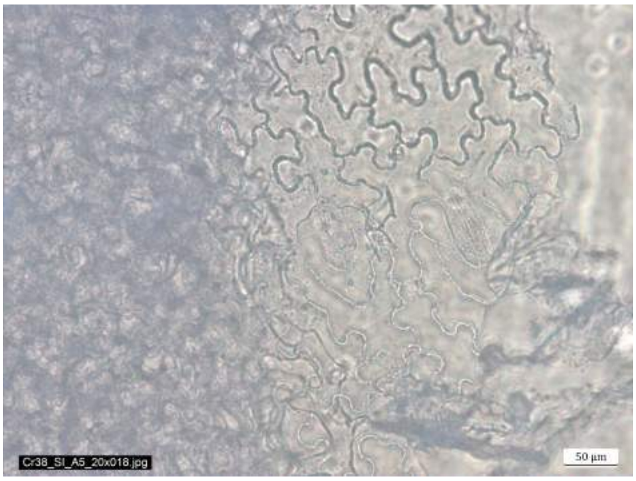



Fragment 4 (4_SI_A4_Cr38) → Inc_121

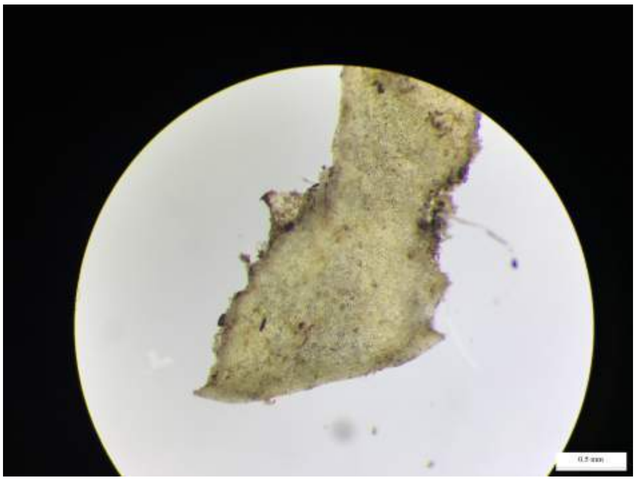


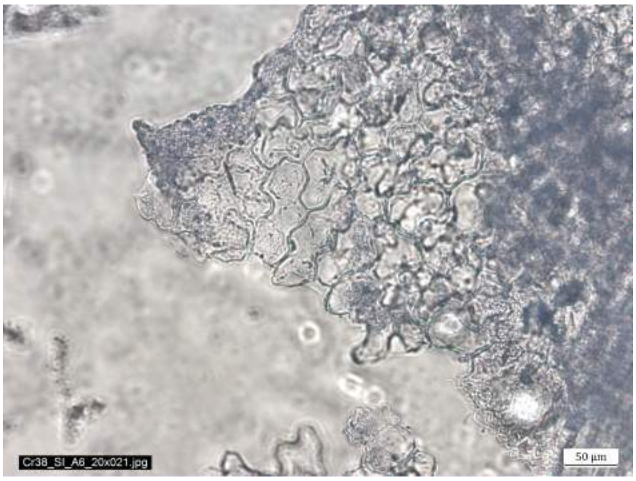
Fragment 5 (5_SI_A5_Cr38)



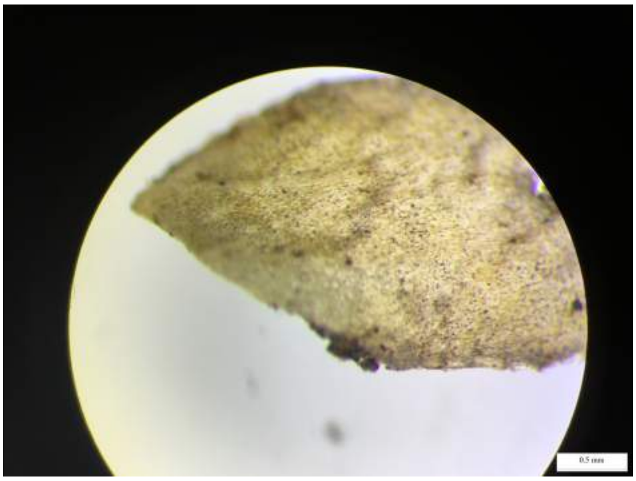


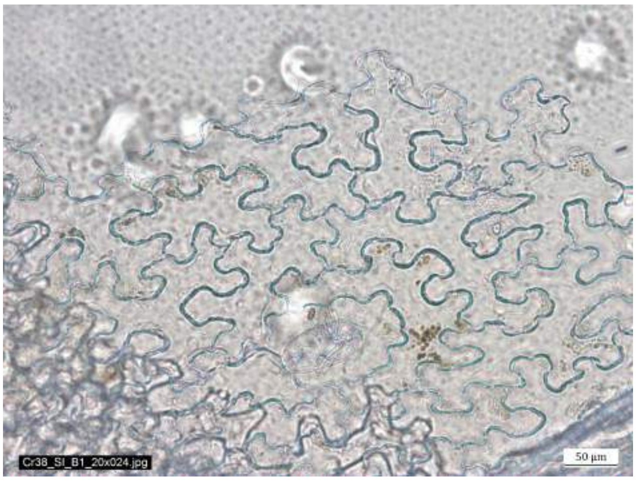
Fragment 6 (6_SI_A6_Cr38)



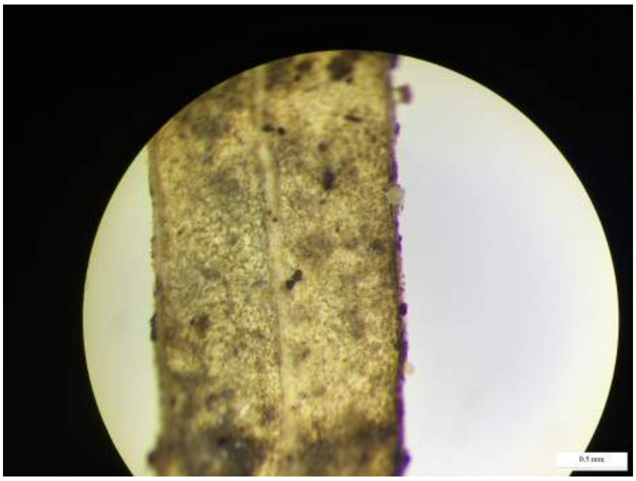


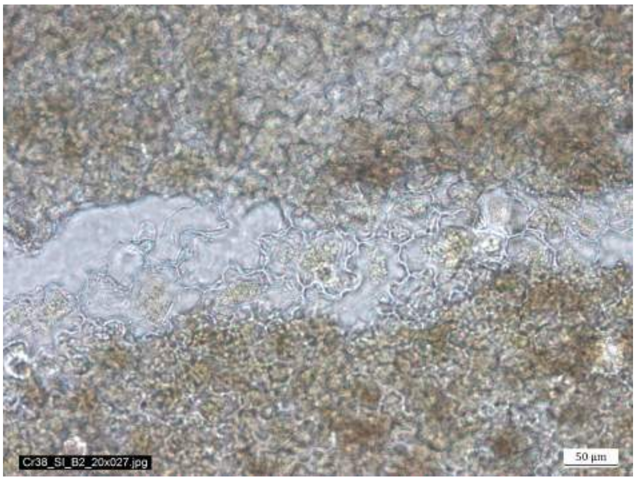
Fragment 7 (7_SI_B1_Cr38)



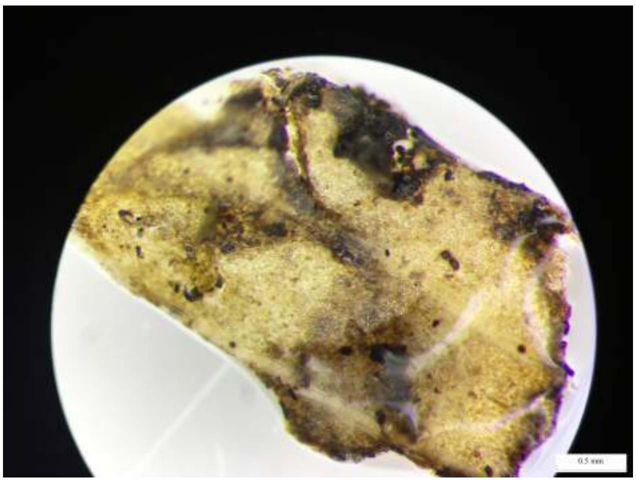


Fragment 8 (8_SI_B2_Cr38)

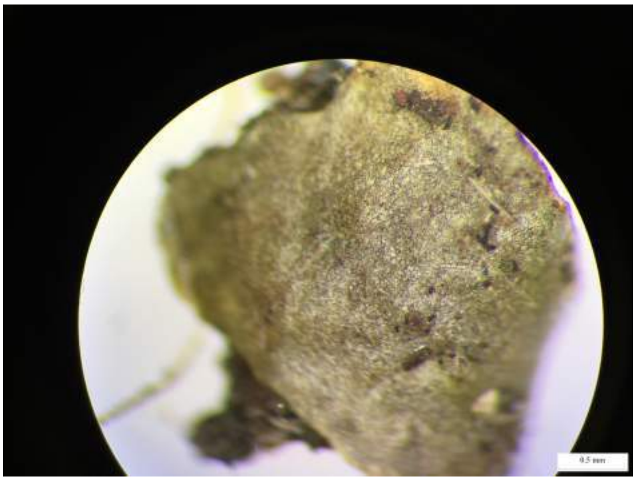




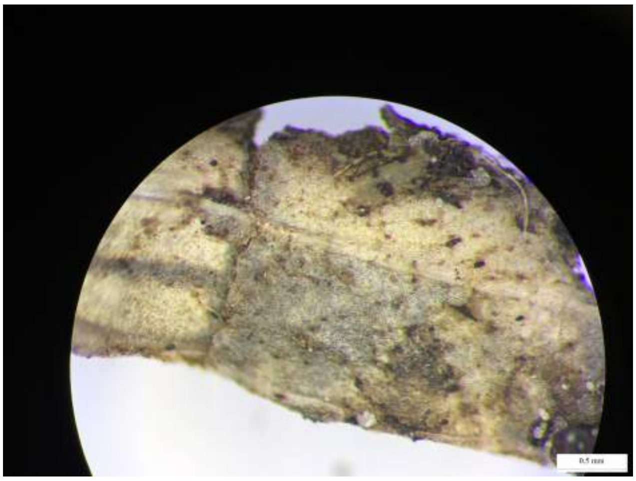
Fragment 9 (9_SI_B3_Cr38)

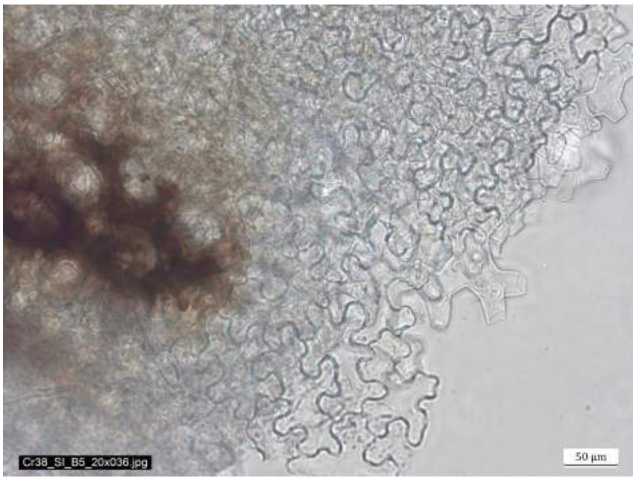


Fragment 10 (10_SI_B4_Cr38) → Inc_122

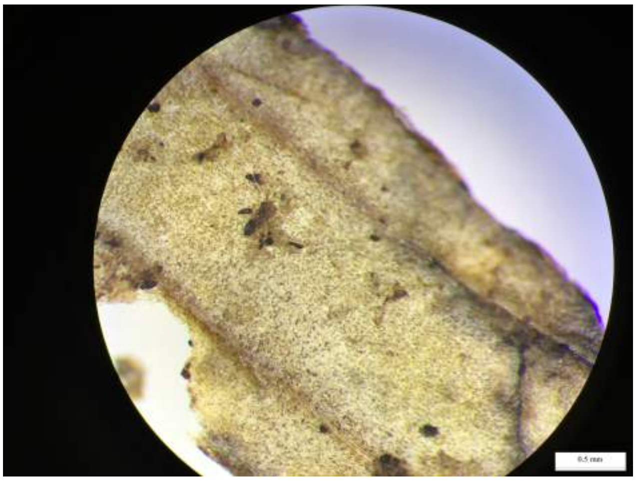


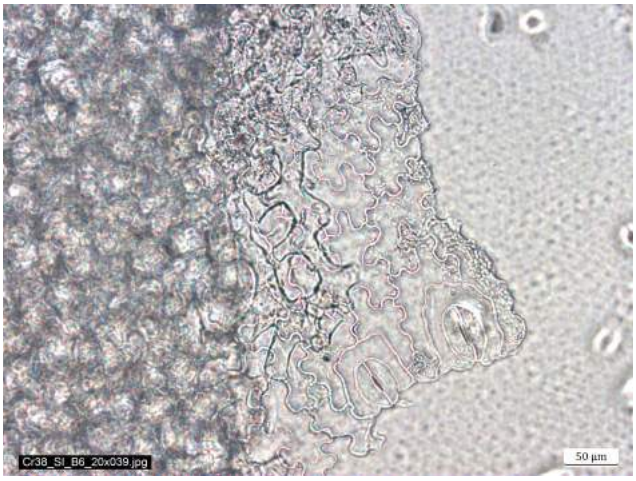
Fragment 11 (11_SI_B5_Cr38)



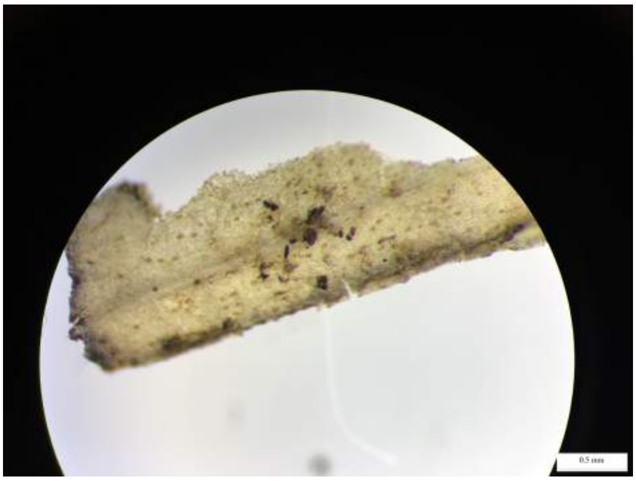


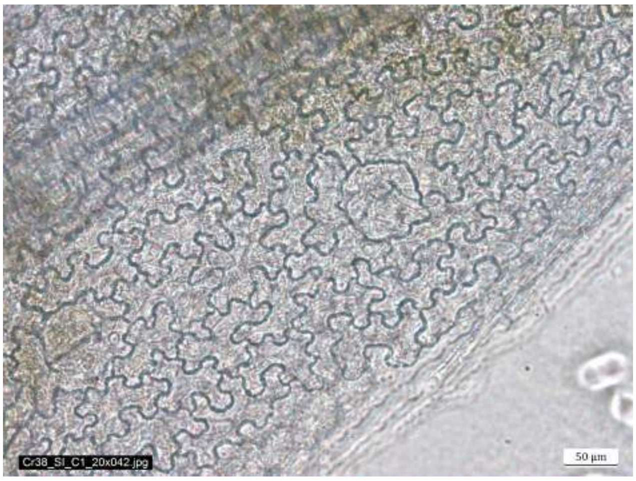
Fragment 12 (12_SI_B6_Cr38)



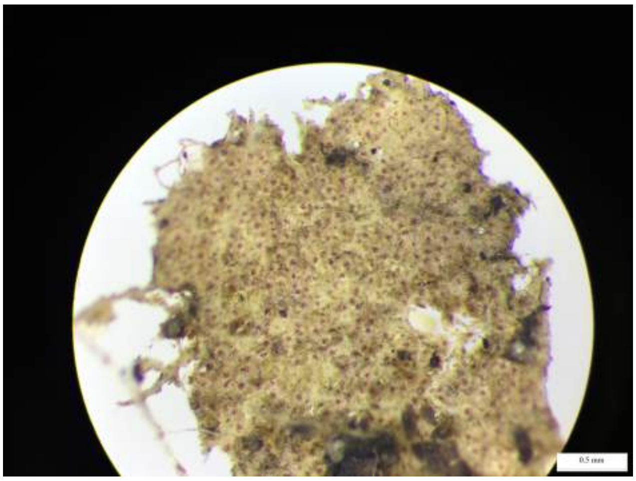


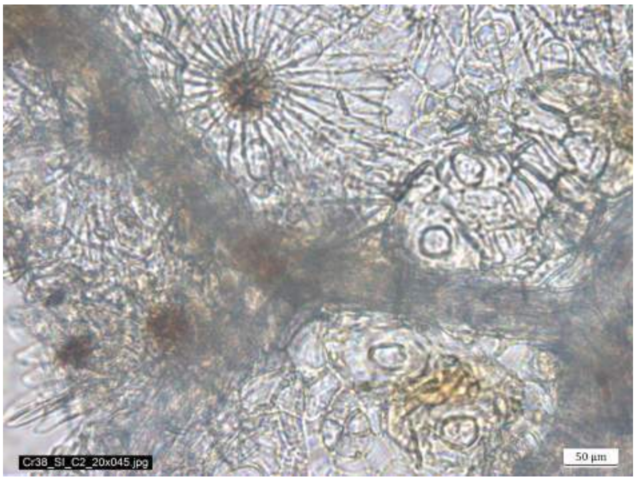
Fragment 13 (13_SI_C1_Cr38)



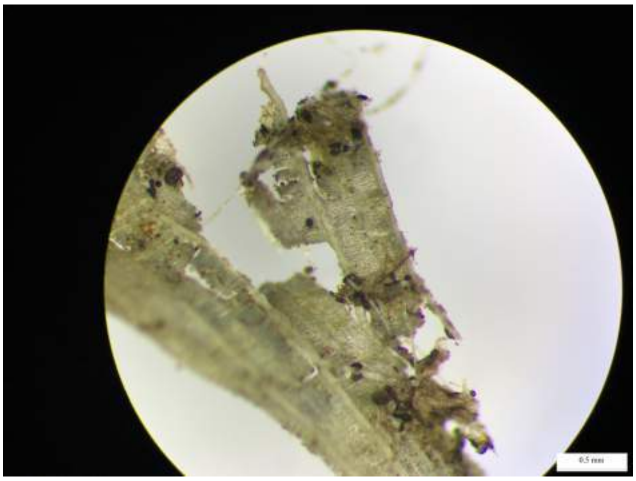


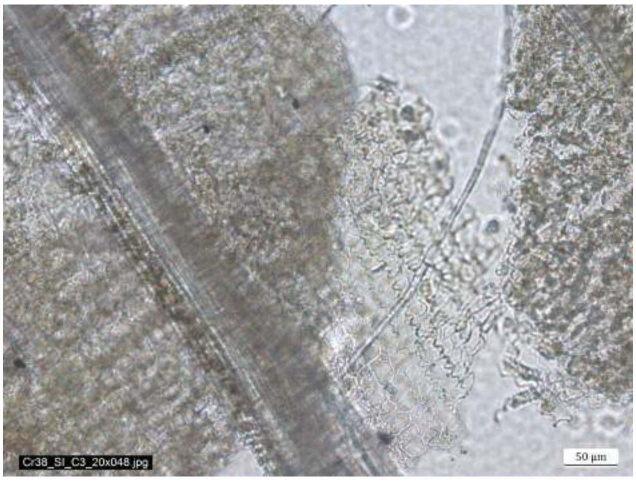
Fragment 14 (14_SI_C2_Cr38) → Inc_123



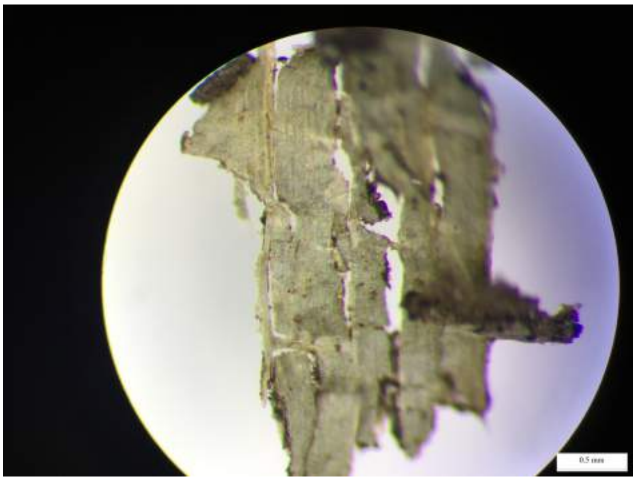


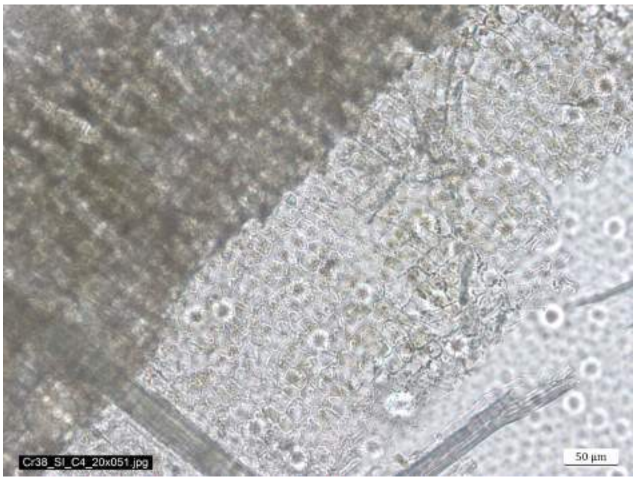
Fragment 15 (15_SI_C3_Cr38)



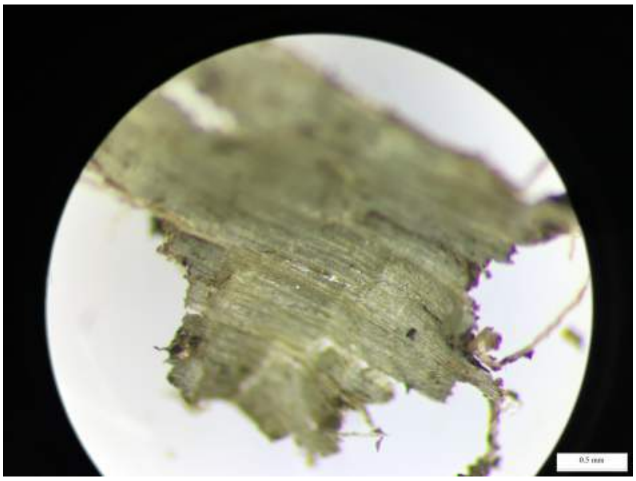


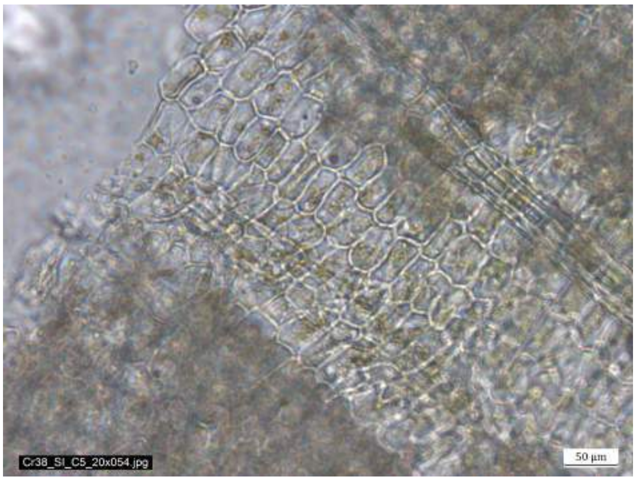
Fragment 16 (16_SI_C4_Cr38)



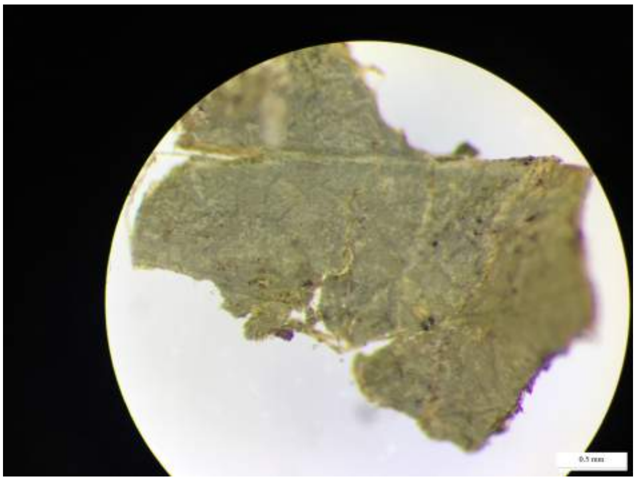


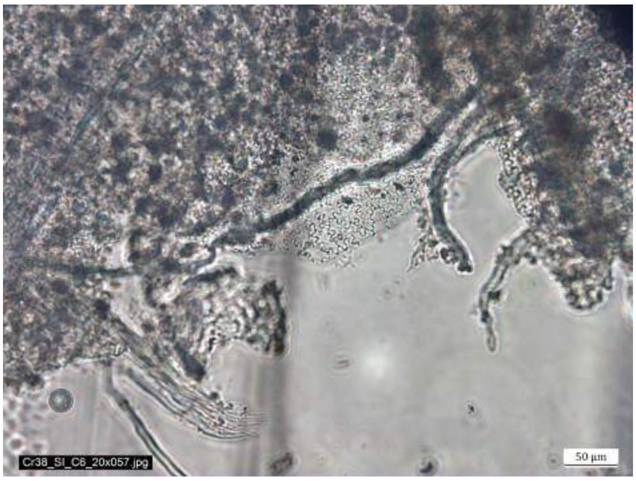
Fragment 17 (17_SI_C5_Cr38)



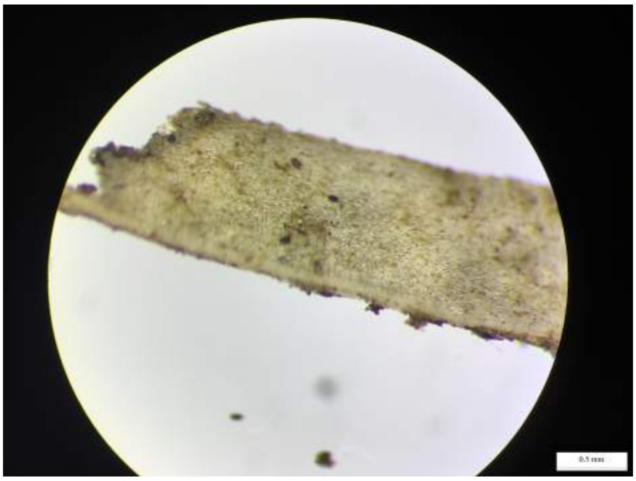


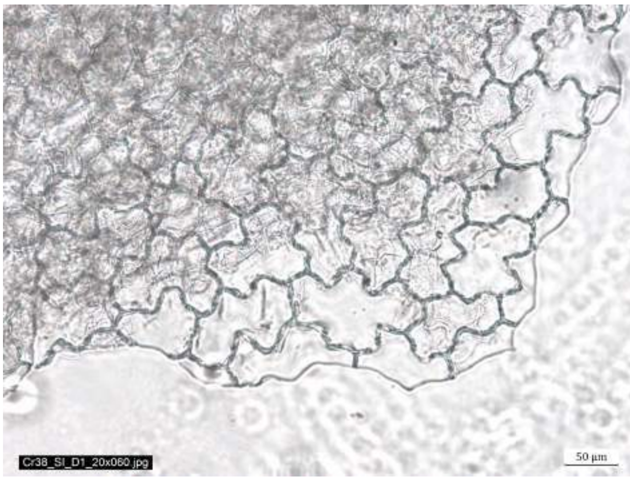
Fragment 18 (18_SI_C6_Cr38)



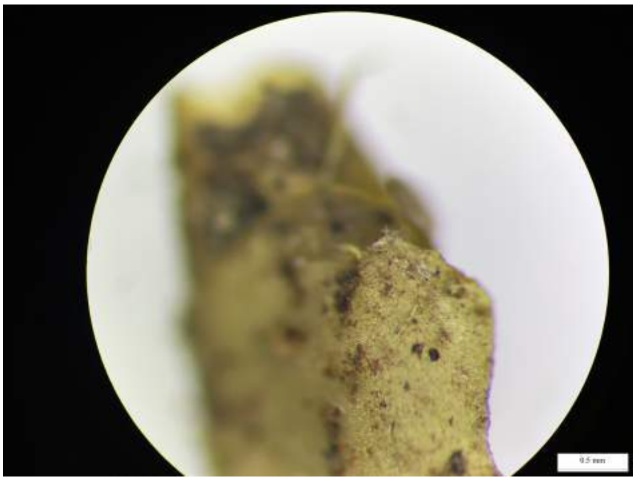


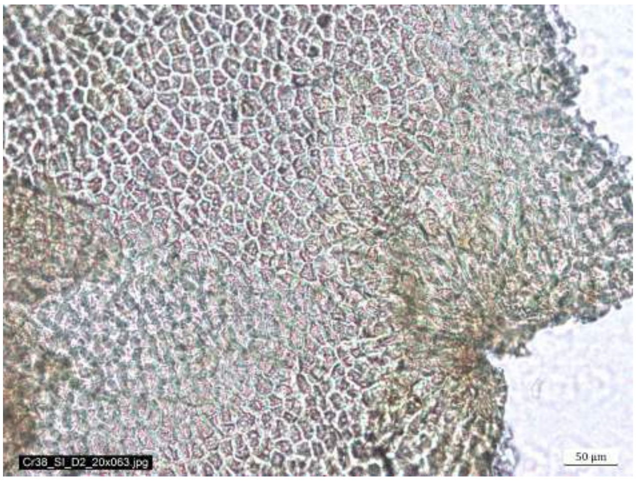
Fragment 19 (19_SI_D1_Cr38)



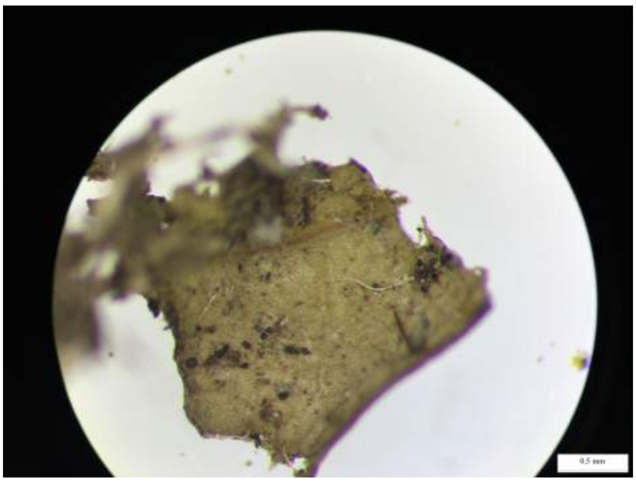


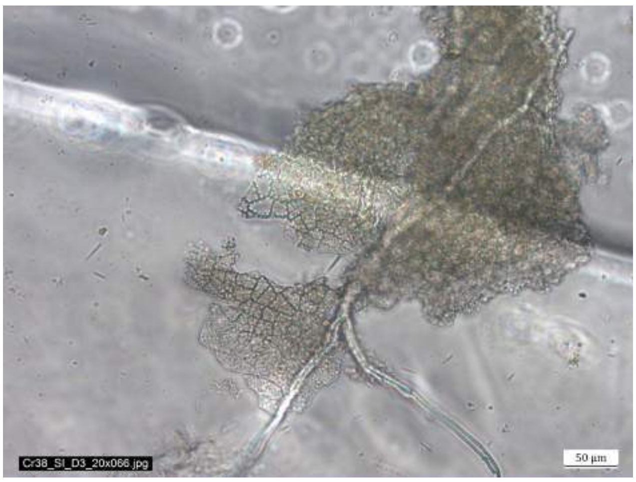
Fragment 20 (20_SI_D2_Cr38)



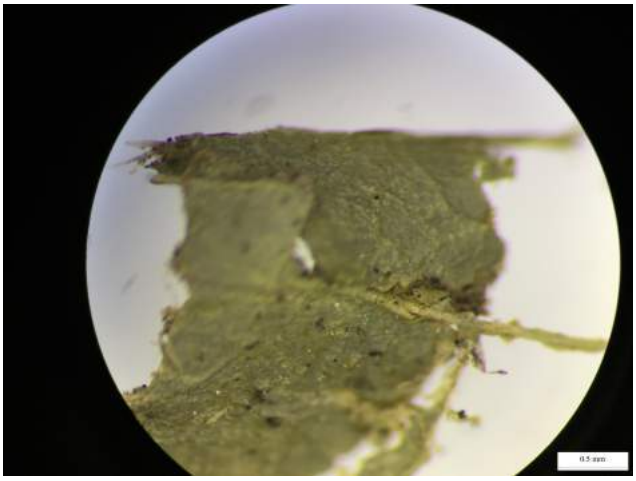


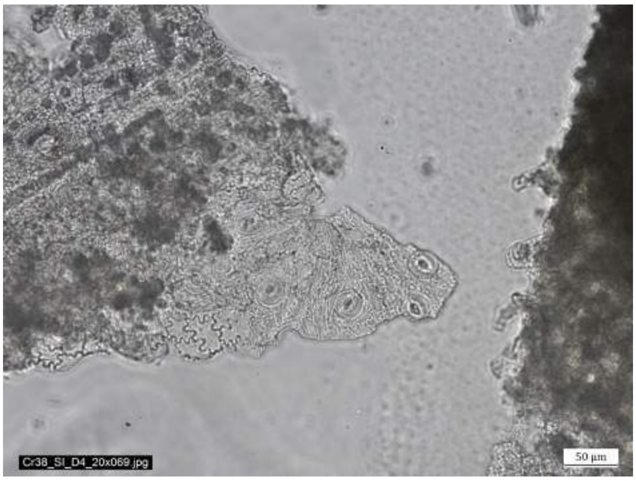
Fragment 21 (21_SI_D3_Cr38)



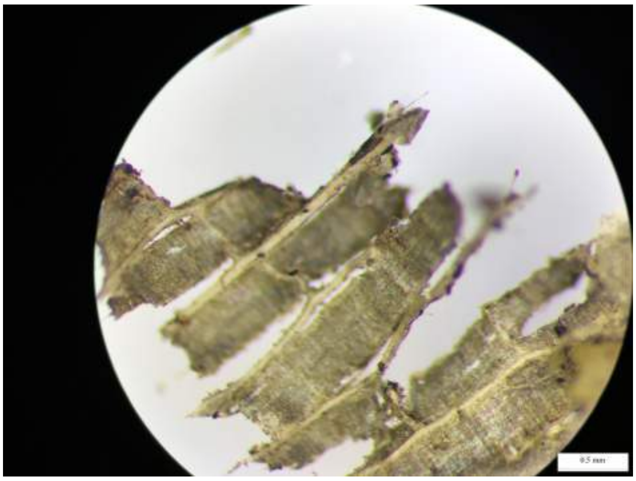


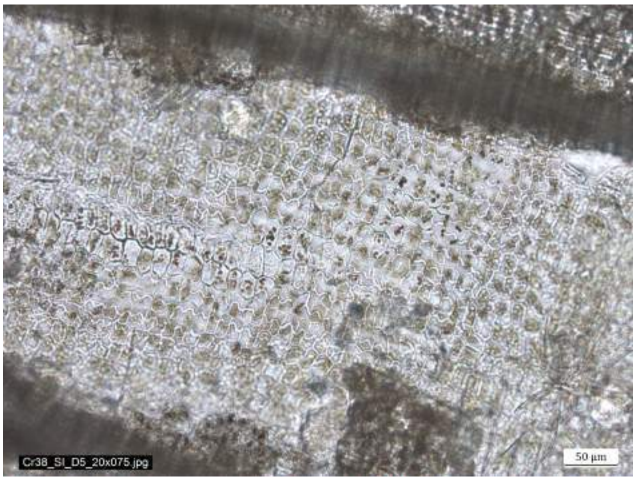
Fragment 22 (22_SI_D4_Cr38)



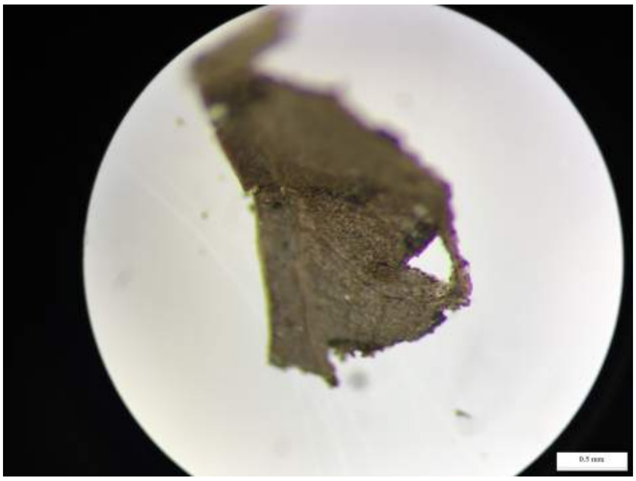


Fragment 23 (23_SI_D5_Cr)

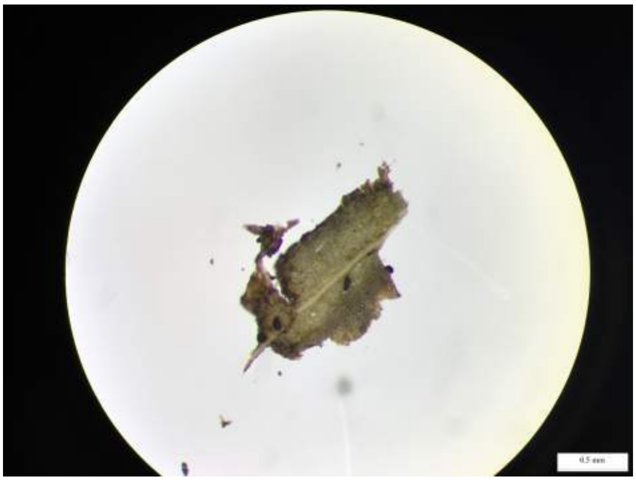


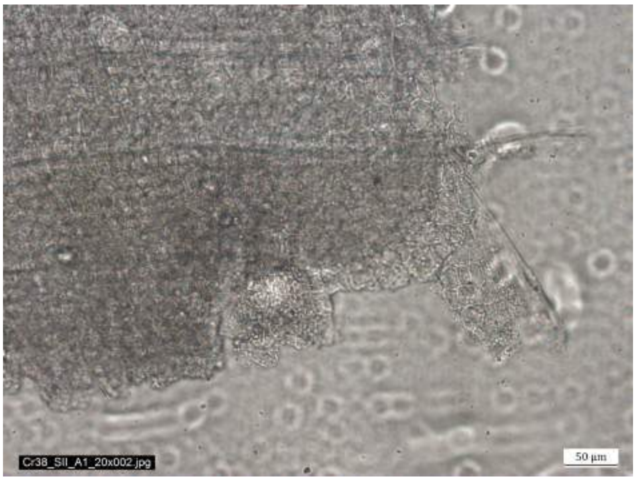


Fragment 24 (24_SI_D6_Cr38) → Inc_124

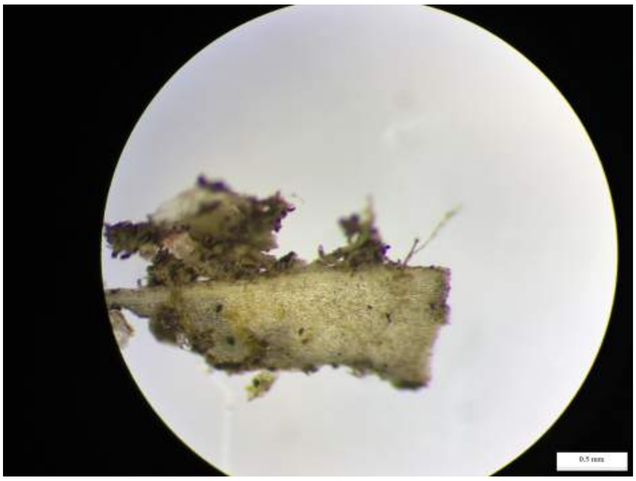


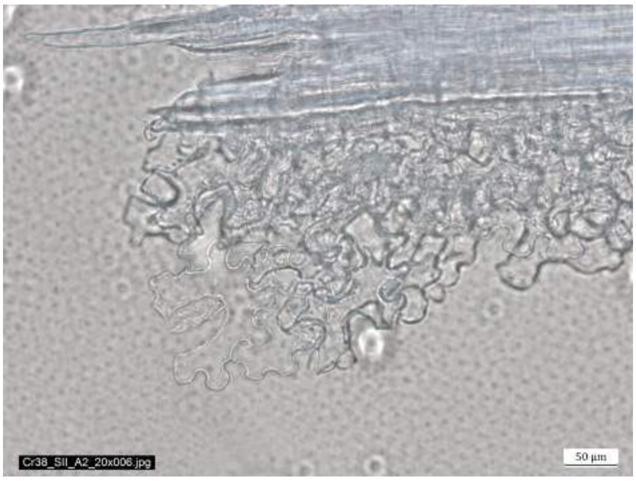
Fragment 25 (25_SII_A1_Cr38)





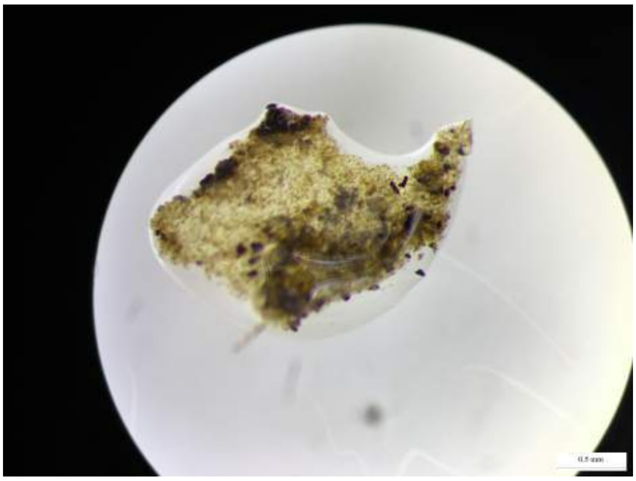
Fragment 26 (26_SII_A2_Cr38)



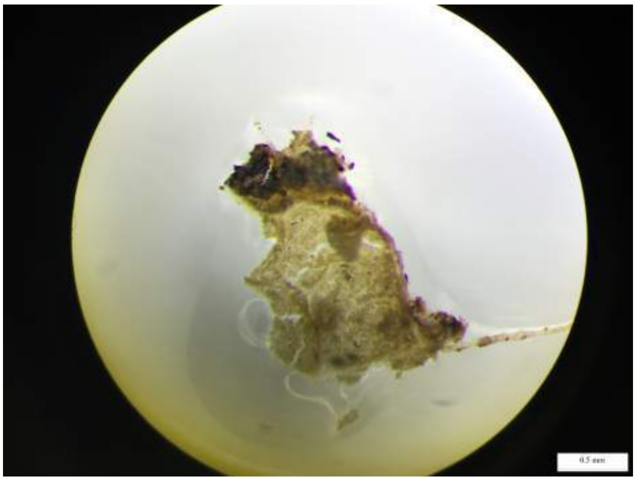


Fragment 27 (27_SII_A3_Cr) → Inc_125

Fragment 28 (28_SII_A4_Cr38)

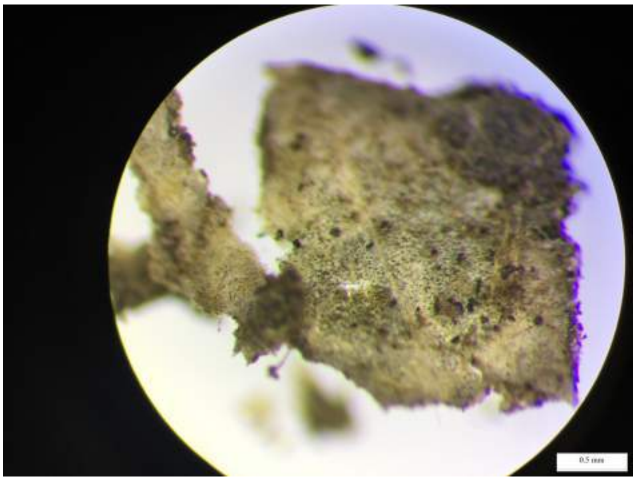


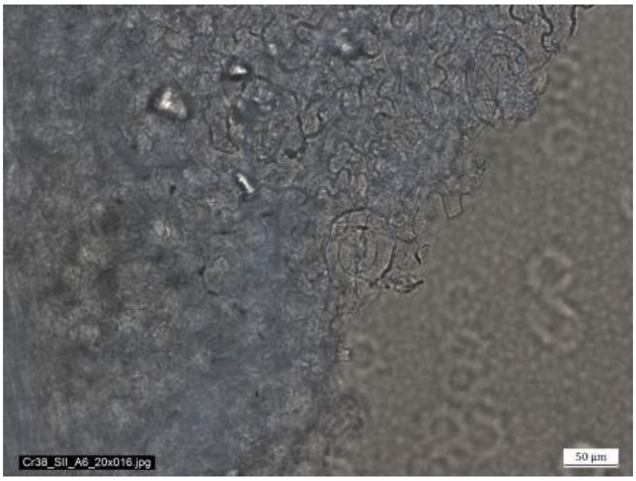
Fragment 29 (29_SII_A5_Cr38)



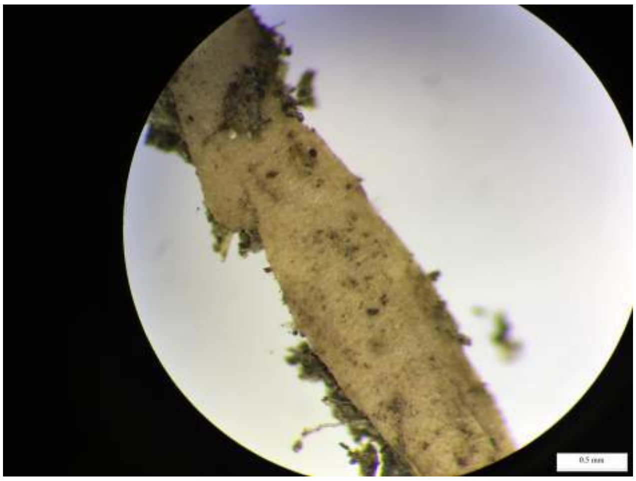
No references

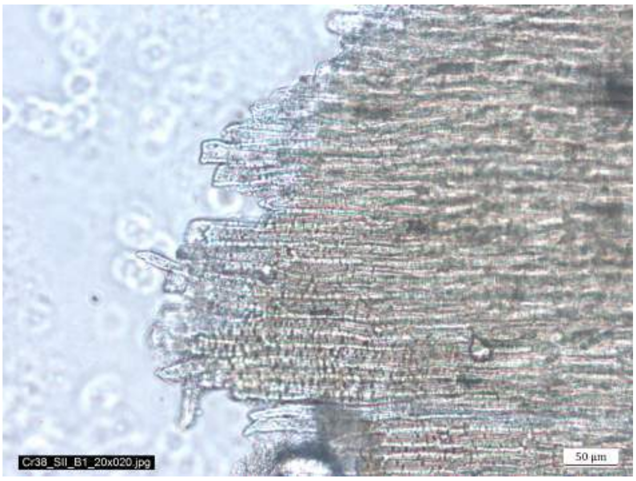
Fragment 30 (30_SII_A6_Cr38)



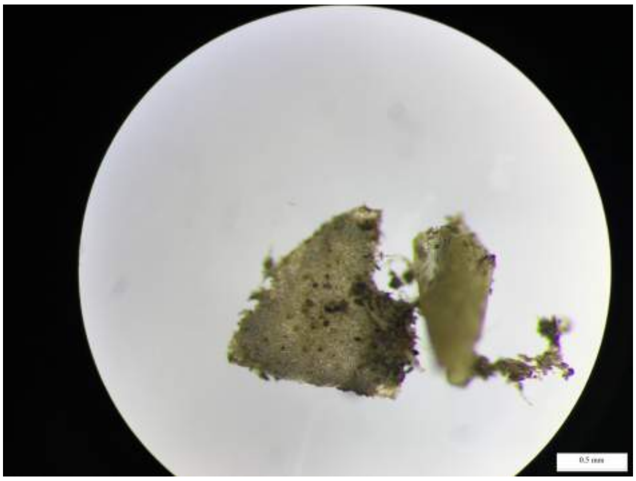


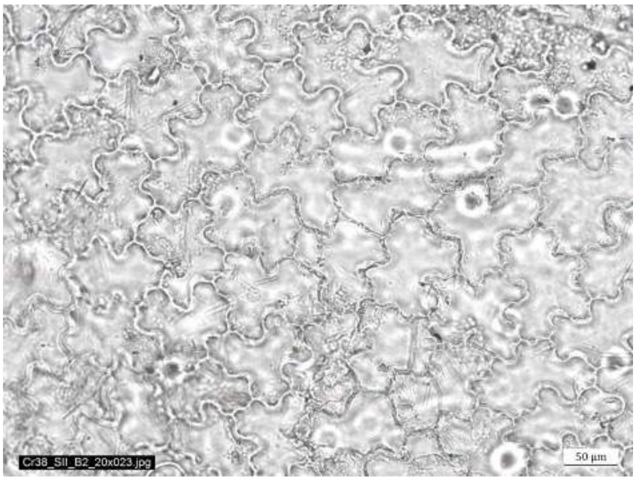
Fragment 31 (31_SII_B1_Cr38) → Inc_126





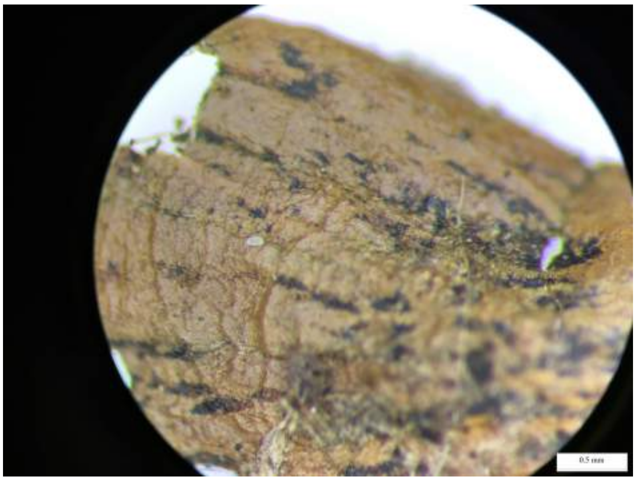
Fragment 32 (32_SII_B2_Cr38)

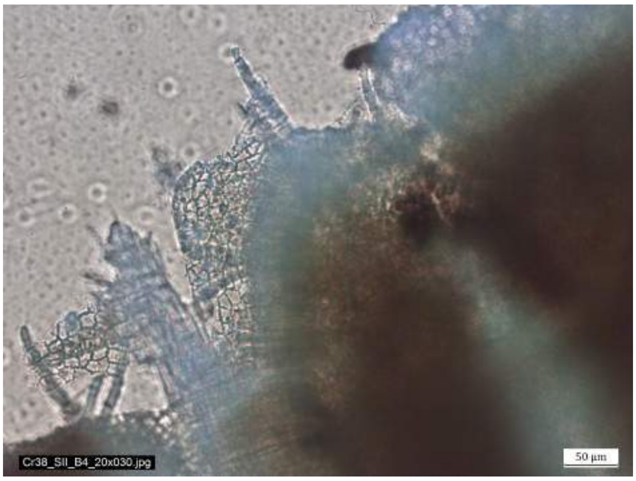




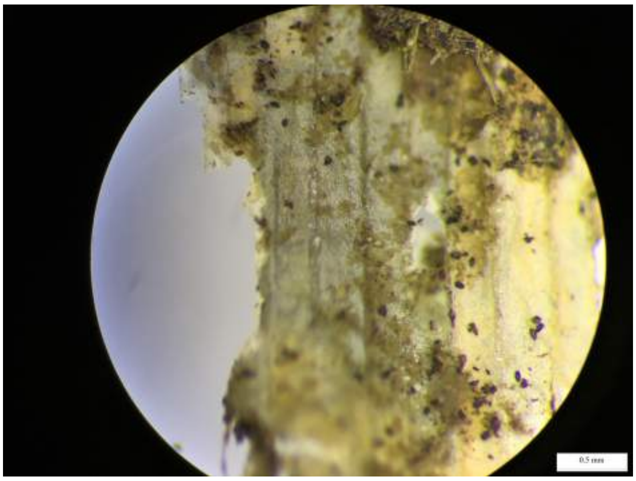
Fragment 33 (33_SII_B3_Cr38)

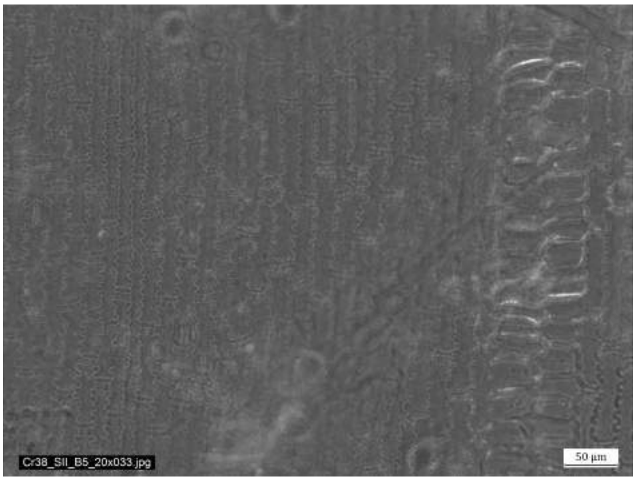
Fragment 34 (34_SII_B4_Cr38)



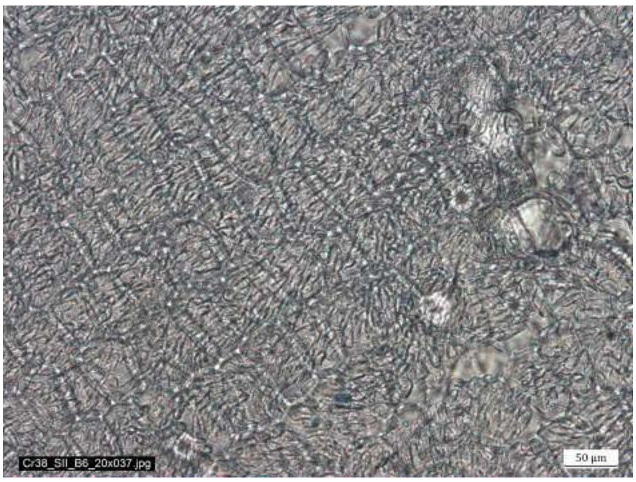


Fragment 35 (5_SII_B5_Cr38)

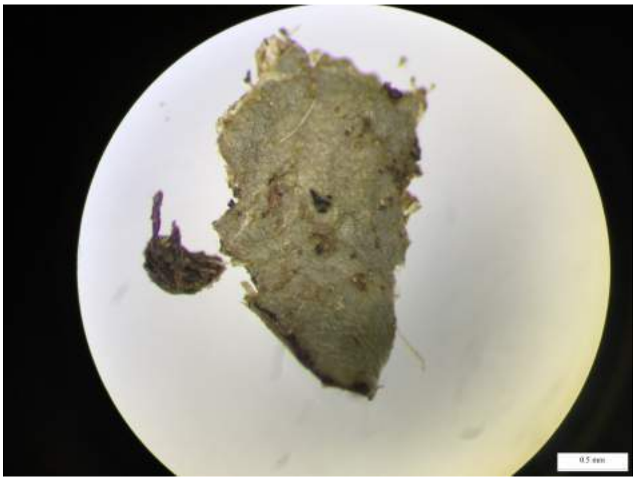
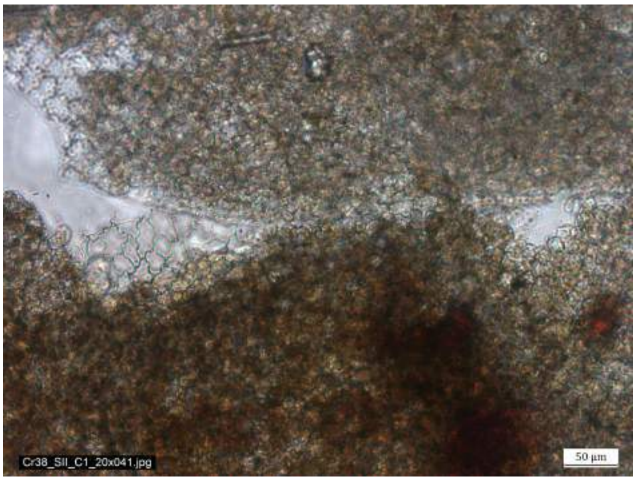




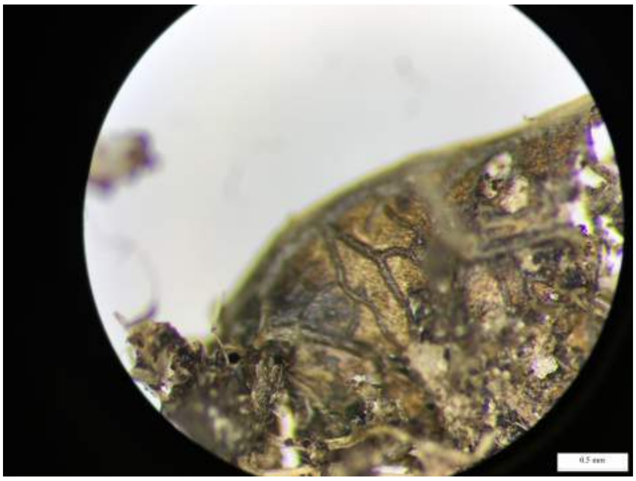
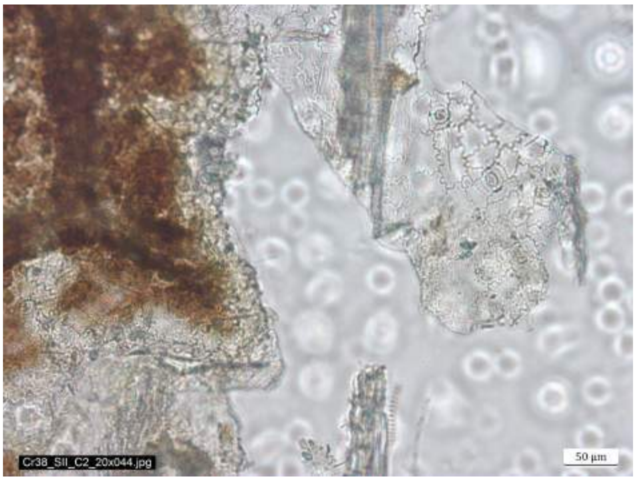
Fragment 36 (36_SII_B6_Cr38) → Inc_127



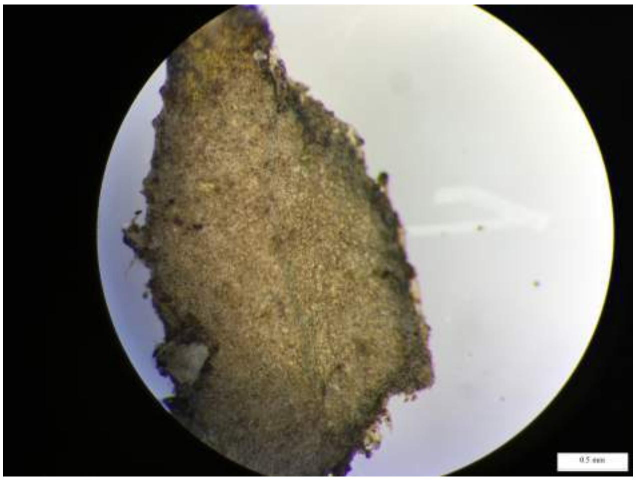
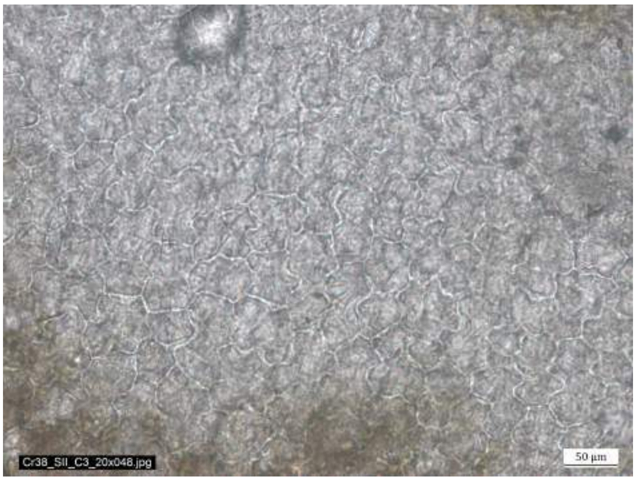
Fragment 37 (37_SII_C1_Cr38)

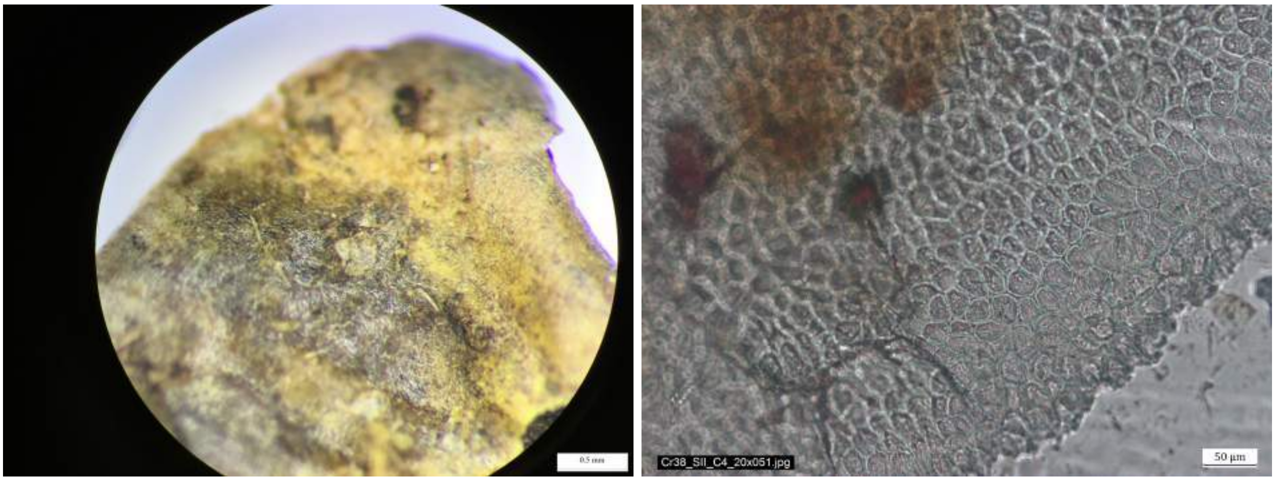
Fragment 38 (38_SII_C2_Cr38)

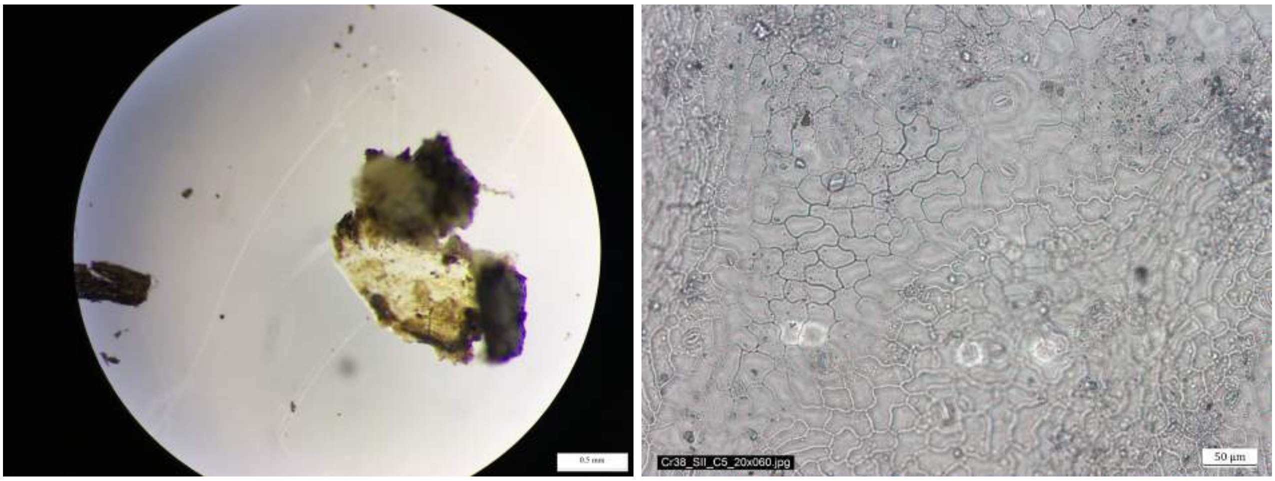
Fragment 39 (39_SII_C3_Cr38)

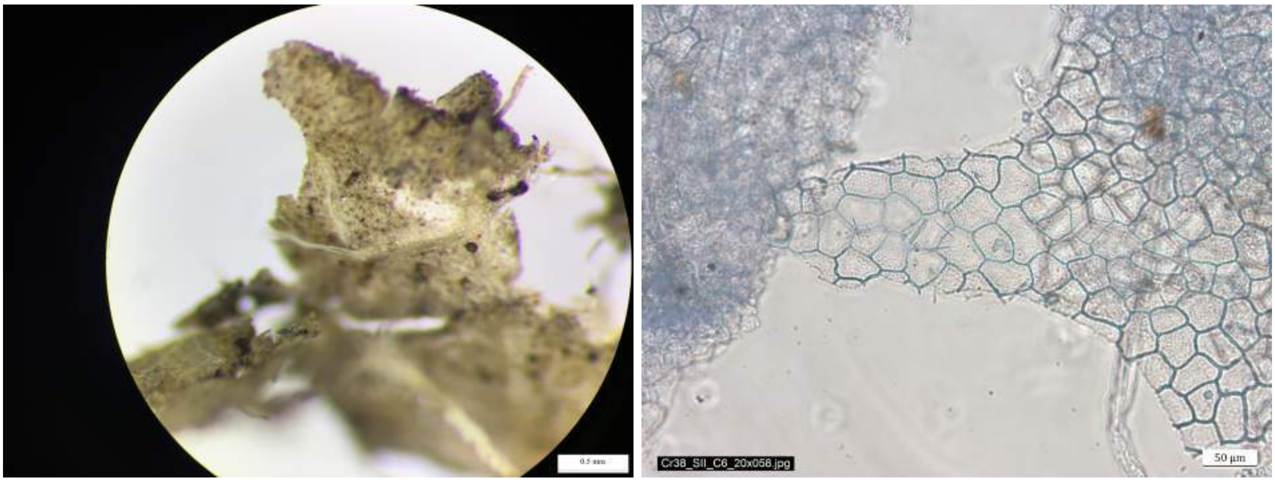
Fragment 40 (40_SII_C4_Cr38)



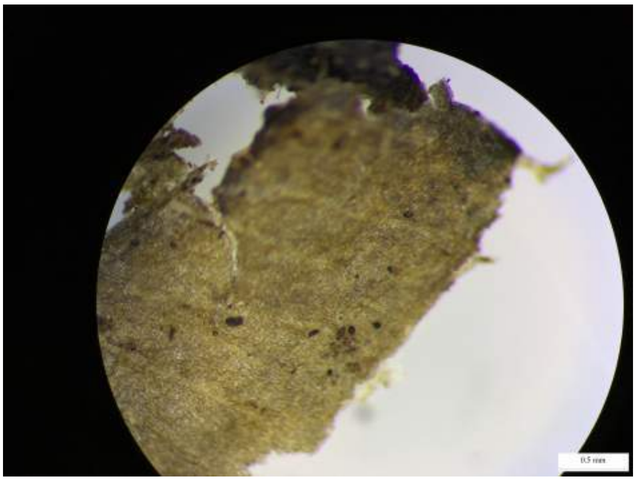
Fragment 41 (41_SII_C5_Cr38) → Inc_128

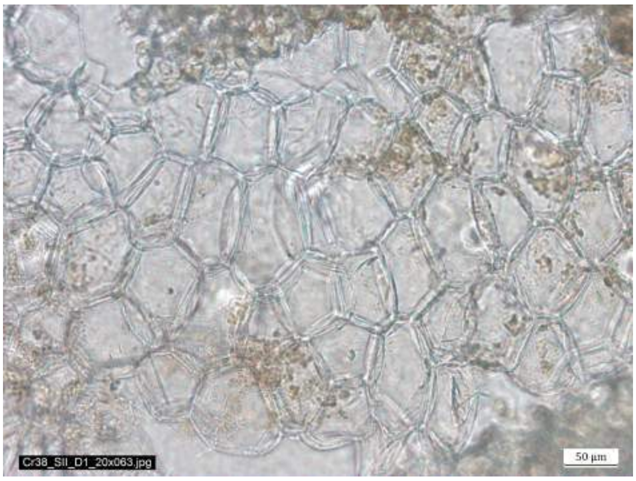


Fragment 42 (42_SII_C6_Cr38) → Inc_129

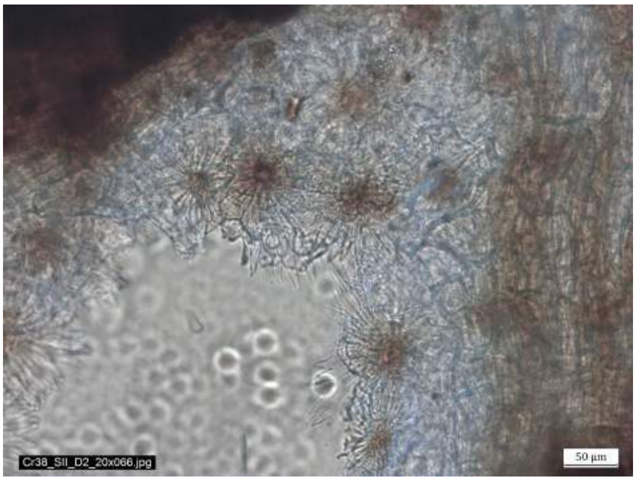


Fragment 43 (43_SII_D1_Cr38)

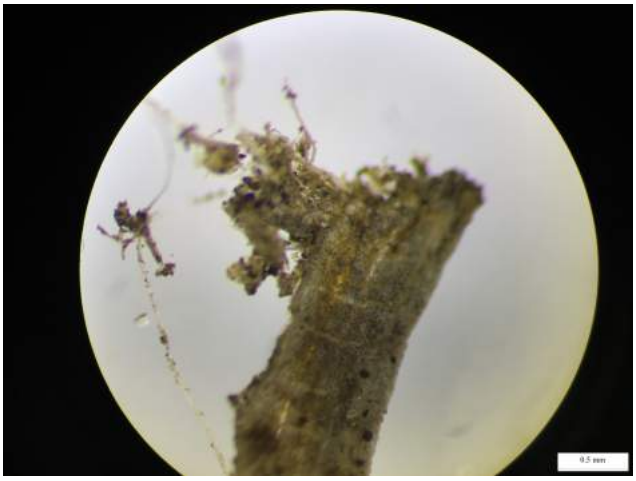


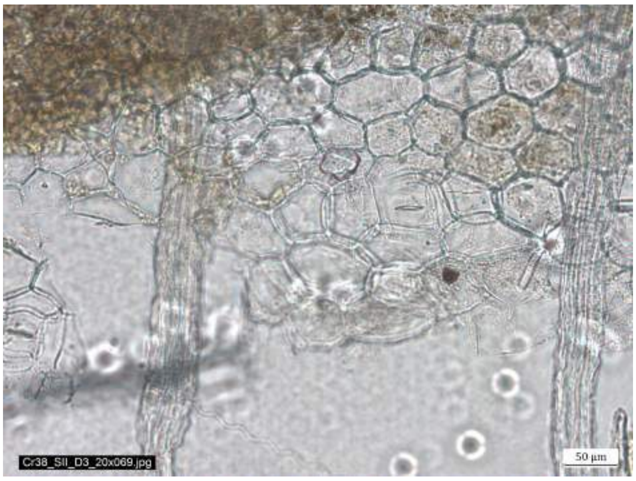


Fragment 44 (44_SII_D2_Cr38)

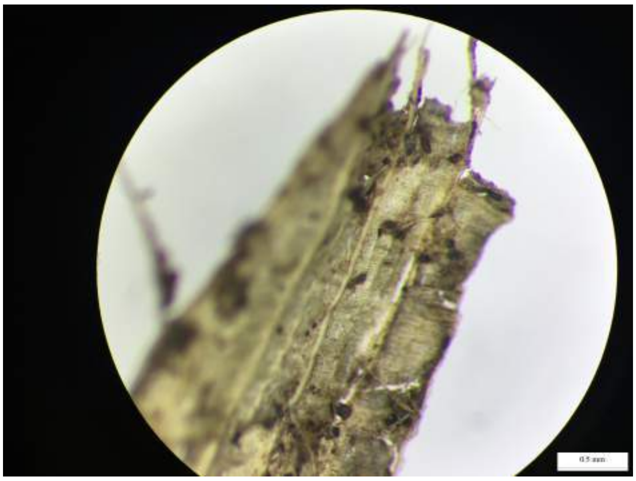


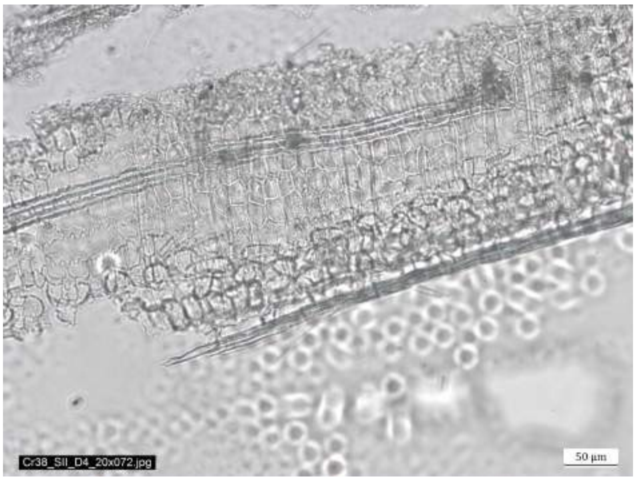
Fragment 45 (45_SII_D3_Cr38) → Inc_130



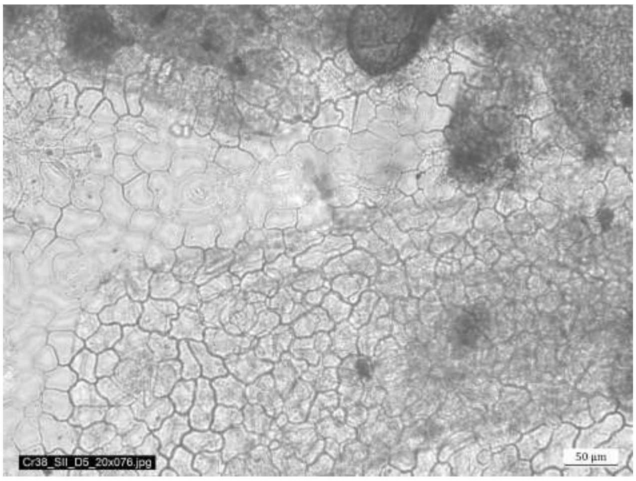


Fragment 46 (46_SII_D4_Cr38)





Fragment 47 (47_SII_D5_Cr38)



Fragment 48 (48_SII_D6_Cr38)