5. IDENTIFYING COMMON MACROLICHENS TO GENUS

Target Audience

6th grade and up

Subject

Use regional dichotomous identification keys to identify common macro-lichens (foliose, fruticose, and squamulose *but not crustose lichens*) to the genus level.

Objectives

Students will

1. Learn specific morphological structures necessary to distinguish between some different genera of lichens.
2. Learn to use a dichotomous identification key in conjunction with a hand lens or magnifying glass.
3. Improve their observation skills and learn to distinguish subtle differences in color and morphology.

Time Needed

1. Teacher preparation time: One to two hours.
2. Classroom time: One to a lifetime of classroom hours, depending on desired level of proficiency.

Materials

1. Dissecting microscope or 10-20x hand lens with adequate light (lamp or well lit room), one per 1-3 students. Magnifying lenses can be used in lieu of the above, though they may not provide enough magnification to see all structures clearly.
2. Regionally appropriate lichen field guide, dichotomous key or identification guide (see Additional Resources at the end of this document for help locating an appropriate guide)

Activity

1. In front of the class, demonstrate how to properly use the hand lens by holding the hand lens close to the eye and moving the sample closer until it is in focus. Students can practice this by looking at their hands, pencils or appropriate object.

2. Teach vocabulary by using photographs and drawings in front of the class.
3. Describe how to use a dichotomous key with the sample key in this lesson.
4. Utilizing the skills of using a hand lens and dichotomous key, have each pair of students try to key 3 to 5 lichens in one class period.

Vocabulary

(Also Review vocabulary from Lesson Plan 1 "What is a Lichen?")

Note: Many lichen species and some lichen genera are only distinguishable from each other by means of chemical tests or light microscopy, especially crustose lichens. For that reason, crustose lichens and species level identifications are not included in this introductory lesson. Also, identifying most lichens to the species level requires a larger vocabulary than covered here so the goal of this lesson is to identify samples to genus.

Despite these taxonomic challenges, the majority of non-crustose lichens can be identified to genus using physical features visible to the naked eye or through a hand lens or strong magnifying glass. The following vocabulary list is a starting point for learning lichen terminology but it is important to use the more comprehensive glossaries in a lichen field guide or taxonomic key that accompanies this list (see "Additional Resources and References"). If a term is used in a key, it is expected that the students can look up the definition in the glossary of whatever guide is being used.

Asexual Reproductive structures

Specialized parts of the thallus that break off and are transported to a new surface by wind, water or animals. Each of these structures, as well as larger fragments of the thallus itself, can form a new lichen that is a genetic copy of its parent.

1. **Soredia** (singular **soredium**): "Lichen acne", lichen "dust" or small patches of eroded thallus that appear as little fuzzy eruptions or abraded sections of the thallus. Soredia can be variously shaped, from round to long and crack shaped and can be located on the surface of the thallus, the edges or both. They are pollen-sized balls of fungal hyphae and algal or cyanobacterial cells. Often they occur in discrete rounded or oblong structures, called **soralia** (singular **soralium**), which is a group or patch of soredia.
2. **Isidia** (singular **isidum**): Tiny projections of the lichen thallus, like miniature fingers or towers growing on the thallus. Compared to soredia they have a more organized internal structure, similar to the lichen thallus, and are 10-100 fold larger and heavier. Each isidium can break off and form a new lichen.
3. **Lobules*:*** Larger, flatter versions of isidia, appearing like flat flakes of the thallus that break off easily, often located on the edges of the thallus.

Sexual Reproductive Structures

Structures of the fungal partner that produce fungal spores. To form a new lichen, these spores must germinate and then reunite with a free-living alga or cyanobacteria):

1. **Apothecia**: Disk-shaped structures, sometimes with a rim that is the same color as the thallus. The central section of the disk is most often a different color from the thallus. There are other types of fungal reproductive structures but for simplicity, they have been omitted.

Teacher Preparation

This lesson builds upon Lesson Plans “What is a Lichen?”, “Drawing a Lichen” and “Collecting Lichens”. Please review the information covered in those previous lessons if this lesson seems like too much information.

To instruct students in this lesson, teachers must be familiar with the basic vocabulary for lichen morphology used in most identification guides or keys. The teacher must also be familiar with how to use a hand lens, dissecting microscope or whatever available low magnification device is available. Lastly, teachers must know how to use a dichotomous key.

How to correctly use a hand lens or magnifying glass

Holding the handlens in one hand, bring it to within a few inches of one eye. Using the other hand, bring the lichen into focus by moving it closer to the handlens until a clear image is seen. It will seem that lichen sample will be very close to the face but this is normal. Try to not move the handlens to get the object in focus, rather, try to move the object, as this allows for a stable field of view. As one moves the handlens away from the eye, the field of view gets smaller and details of the lichen become more obscured.

If using a dissecting microscope, see directions that accompany the device. Dissecting microscopes are low power (20x-70x) compared to light microscopes and allows the user to manipulate the object being viewed with the hands, tweezers and probes. An adequate light source is also necessary, either a lamp or a mirror that is positioned to illuminate the object being viewed.

How to use a dichotomous key

A dichotomous (two-way branching) key is a series of questions based on characters of the object that lead the reader to identity of the object, in this case, a lichen. Here is a general example. Imagine you were trying to use a dichotomous key to identify a pencil amongst other objects in a classroom.

1a Object square, flat, about the size of your head_____**book**
1b object smaller, not square_____**2**

2a Object flat, very thin and much broader in one direction_____**ruler**
2b Object not flat; object more or less round in cross section_____**3**

3a Contains black liquid that comes out from tip_____**pen**
3b Object not exuding black liquid from tip_____**pencil**

Question 1a doesn't fit the description of a pencil, so go to question 1b, which better accommodates a pencils appearance. So choose 1b, which directs the reader to questions 2. Queston 2a asks if the object is flat? No, a pencil is not flat, so go on to question 2b. The description of pencil better fits there so proceed to the next set of questions. Finally, questions 3 asks more specific questions about the objects, which allow you to distinguish between a pencil and pen. Notice how the questions become more specific as they progress. This process of elimination is exactly how a dichotomous key works for lichens or any group of organisms.

Set up lichen identification stations

Students can be paired together with one hand lens and field guide along with their collections (from Lesson Plan #2 "Collecting Lichens"). Students can then take turns looking at the lichen while the other reads the key.

Making Connections

Lichen identification is a prerequisite knowledge for most lichen studies. The more species a person a person can identify, the more able they able to make keen observations to continue honed.

Check for Understanding

Lichen Flash Cards

Each time a pair of students successfully identifies a lichen, have them record on 3"x5" cards the features they had to observe to navigate through the dichotomous key to arrive at the correct name of the lichen. Next to each feature or the most easily demonstrated feature, have the students draw a picture from their observations, of what the lichen and its structures look like. At the end of class, all the students can share their flash cards by making photocopies to hand out to each group. Some groups will have observed things in a different way for the same lichen, which will be a good source of discussion.

Journal entries

Drawing the lichens and making notes as the students proceed in identifying the samples is another good way for them to retain what they are learning. Also important is to have them record any questions and anomalies they notice.

Finding Lichen Keys for your Area

The Farlow Herbarium of Harvard University maintains and on-line guide to the literature for identifying North American Lichens including general lichen references, works for beginners, lichen keys online, and a lichen bibliography by genus. Start with this resource to find a key for your area and level of expertise.

http://www.huh.harvard.edu/collections/lichens/guide/index.html

See 'Additional Resources and References' page for more information.