EEOB 2210 Reading Review Name _____
Due Friday May 24, 2019 Credit: 10 pts. of Field Trip Assignment 2

HYMENOPHYLLACEAE. FILMY FERN FAMILY

Delicate ferns with slender creeping rootstock, leaves usually much divided, very thin, transparent. Sporangia marginal, on a receptacle borne at the apex of a vein in a funnel-shaped indusium, the receptacle exserted as a bristle. Chiefly tropical.

1. TRICHOMANES L.

Small creeping ferns with finely divided leaves. (Greek name for some fern.)

1. T. BOSCHIANUM Sturm (for R. B. van den Bosch, 1810-62), FILMY FERN.—Leaves including stipe 1-2 dm. long, 12-35 mm. wide, bipinnatifid. Dripping rocks, Kanawha State Forest, Kanawha County (*Mrs. Denison*), Stiltner, Wayne County (*Plymale & Gilbert*) (*Amer. Fern Journ.* 28: 122, 123. 1938; *Castanea* 3: 84. 1938; 4: 1. 1939) and Webster Springs, Webster County (*W. H. Gillespie*). This represents a northeastern extension of the range of this species. Resembles small forms of *Cystopteris fragilis*, but the thin leaves and terminal bristle-like receptacles make excellent diagnostic characters. The gametophyte will probably be found in deep shaded recesses of sandstone and quartzite rocks. In the Appalachians it is more common and widespread than the sporophyte, but it is overlooked because it resembles a filamentous alga (Cf. D. R. Farrar, "Gametophytes of four tropical fern genera reproducing independently of their sporophytes in the southern Appalachians." *Science* 155: 1266, 1267. 1967).

It is almost certain that the sterile "Appalachian gametophyte", doubtless the prothallial stage of VITTARIA LINEATA (L.) J. E. Smith (Vittariaceae), occurs in southeastern West Virginia, since it is fairly common at Mountain Lake, Giles County, Va. (*W. H. Wagner, Jr.* and *A. J. Sharp, Science* 142: 1482, 1484, cover, 1963; see also *Castanea* 31: 137, 138. 1966). It resembles a tiny branching, pale-green, translucent liverwort. The sporophyte of this tropical species has been found as far north as Georgia.

Doubtless? The excerpt above is from "Flora of West Virginia," by P. D. Strausbaugh and Earl L. Core Flora of West Virginia was originally published in four parts, beginning with part one in 1952 and ending with part four in 1964. A group of six botanists from West Virginia, Maryland, and North Carolina is updating the book for future publication.

You are hired to write the description of the Appalachian gametophyte for the new edition. After reading the 2016 AJB article, what will you write? How would it differ from the above?

“Unraveling the origin of the Appalachian gametophyte, *Vittaria appalachiana*”
By Jerald B. Pinson and Eric Schuettpelz.
2016. American Journal of Botany.

INTRODUCTION

Ferns represent a distinct lineage of plants characterized (along with lycophytes) in the following manner (compare and contrast the sporophyte and gametophyte phases):

Among fern species with long-lived gametophytes, perhaps none is as peculiar as *Vittaria appalachiana*. Set forth its common name and describe the manner ijn which it is so remarkable.

Fern gemmae are ***quite large quite small*** (circle one) in comparison to spores. Describe the consequence of that size difference in relation to dispersal.

Three possible agents of gemmae dispersal are the following:

a)

b)

c)

A 1995 publication by Kimmerer and Young is cited as evidence for one of the modes. What is that evidence?

The notion of limited dispersal capability in *V. applachiana* is also supported by consideration of a combination of the geologic history of area, and the current distribution of the plant. Explain this evidence and how it supports a particular time frame for its loss of the ability to produce mature, functioning sporophytes.

In an attempt to better understand the life history of *V.* applachiana Farrar did something involving “allozymes.” If perchance this is the year 2017 and therefore you have all the information known to humankind available at your fingertips, explain what allozymes are.

Allozyme-meister Farrar discovered the following:

a) something about population structure:

b) a trait generally considered to be indicative of a hybrid origin:

There goes Gastony, counting chromosomes! What did Gastony find, and what did it suggest?

This study aims to elucidate the evolutionary history of *V. appalachiana* using a combination of these two types of data:

a) _____, which is useful for determining the affinities of species that arose in a particular manner (named and explained):

b) _____, which is useful for determining the affinities of species that arose in different manner (named and explained):

MATERIALS AND METHODS (technical, OK to skip over)

RESULTS

Plastid phylogeny. Within *Vittaria* a split was resolved separating a clade (branch of the phylogenetic tree) including 3 species from a clade containing 3 other species, including our friend the Appalachian gametophyte. The samples of *V. applachiana* were all found to be "monophyletic" (i.e., all occurring as tips of one branch, thus derived from a common ancestor). The situation was different for *V. lineata* and *V. graminifolia*, however; describe the placement of those two ferns on the tree (in simpler language that the article did).

In the space below, sketch a much-simplified ("pruned") version of Figure 2. Omit 4 non-*Vittaria* ferns at the top (the "outgroup") and, for instances where all the tips of a branch are same species, just draw it once (compress it to a single branch). Your simplified tree should show the key points about the tree that are described verbally in this section

Nuclear Phylogeny. Bayesian analysis of the 56 recovered *DET1* alleles yielded a phylogenetic tree that was ***mostly consistent*** ***inconsistent*** (circle one) with the plastid tree.

DISCUSSION

Phylogeny of Vittaria. Previous analyses of vittarioid fern relationships included no more than one exemplar from any species of *Vittaria*. These dinky little analyses uncovered the following:

With the inclusion of multiple accessions from each of six *Vittaria* species, however, the authors found the following to be true about the two most widespread species!:

Did any of the tropical ferns show an especially close relationship to the Appalachian gametophyte? If so, which one?

Origin of the Appalachian gametophyte. Analysis of their:

a) PLASTID data set indicates the following (consistent with earlier studies):

b) NUCLEAR DATA set (somewhat surprisingly) suggest the following:

We are left with two alternative explanations for the origin and evolution of *V. appalachiana*. They depend upon something having to do with the chromosmes of *V. graminifolia*. How many are there in it, as compared with our Appalachian friend?

Two possibilities thus emerge, depending upon which is the closest relative, namely:

a) If the closest relatives of *V. applachiana* turn out to be _____, then the most likely explanation would be this:

b) If, however, the closest relatives of *V. applachiana* are _____, there would be a second most parsimonious explanation, this one:

Regardless of how the Applachian gametophyte originated, there are two reasons sufficient for the continued recognition of both *V. applachiana* and *V. graminifolia*, namely:

Reason 1 (having to do with reproductive mode):

Reason 2 (shown/highlighted by previous studies):L

Could the current populations of the Appalachian gametophyte be being sustained by long-distance dispersal from some tropical sporophyte source? Support your answer.

Based on the above, what is the most likely explanation for the wide range of *V. applachiana*? Support your answer. Thanks!

All the same, the work presented here does indicate that *V. applachiana*…

is NOT this:

…and instead points to an origin involving: