**Speciation in *Xanthoanthe*** **(Dendrogrammaceae)**

Name: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** Section: **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

In this exercise, you will take a closer look at a hypothetical genus of yellow-flowered plants that exhibits a pattern of evolution common to many plant groups. The processes that produced this pattern include ecological differentiation but also hybridization and polyploidization (sympatric speciation). You will use information about the currently recognized species of this genus to figure out their relationships and how these processes led to the observed pattern of diversity.

The genus *Xanthoanthe* (Dendrogrammaceae), characterized by its yellow flowers with notched petals and blue berries, occurs only on the island of San Andrés. This island is 125 miles long and 50 miles wide, and runs east-west. The western end of the island is mountainous, with a few peaks reaching altitudes of 3500 m. Several endemic groups of higher plants and insects are found on the island—*Xanthoanthe* is one of these and it is restricted to the mountainous part.

Basing their taxa on herbarium collections over the years, researchers have described seven species, of which *Xanthoanthe grandicalyx* is by far the most abundant and best known. Some of the presumed species are very rare and local. Recently, field work made it possible to investigate the chromosomes of most of the described taxa, as well as to gather new data on the respective habitats in which the plants occur. In addition, certain experimental hybridizations have been performed.

As a result of the new information, you are asked to synthesize the data and to figure out speciation events in the group. Work these out using Dendrogrammaceae cards 7, 8, 11, 16, 20, and 21 and the information given on the next page. Express them diagrammatically on the last page of this exercise as a network (your TA will give you an idea of how to do this). Include chromosome numbers (e.g., 2n = 14), genome number designations (e.g., diploid, tetraploid) and processes you think might have been involved. Also indicate whether you think that all seven of the currently recognized species should be retained as species, if you were to do a new classification.

**The solution to this problem will be easier if you organize your data to start with. Fill in the table and then using the cards, group the taxa that are similar morphologically and ecologically. Do not try to work with all of the taxa at once—stick instead to bite-sized pieces. And keep in mind that extinctions may have occurred.**

Following you will find information for each of the taxa, a worksheet (table) that will help you organize the information, and a blank sheet for you to diagram the relationships. You may work in groups, but each person must turn in his or her own exercise.

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**Species Diversity in** ***XANTHOANTHE***

*X. abortiva* (#21): Rare and limited to upland swamp or pond edges; decumbent herb; leaves sparsely pubescent; calyx about 2/3 the length of the corolla; fruits wrinkled, not producing mature seeds; pollen abortive; plant sterile but reproducing by occasional vegetative runners to form clones; chromosomes 2*n* = 22, not pairing normally at meiotic metaphase.

*X. alba* (not pictured): Only two plants ever discovered, these in association with *X. grandicalyx* (#11), which it resembles in all respects except for its white flower color. (Lack of material made it impossible to determine chromosome number or conduct breeding experiments.)

*X. flava* (#20): Common in upland forests, occasionally along forest edges; erect, single-stemmed herb; leaves glabrous; calyx about 1/6 the length of the corolla; pollen fertile; chromosomes 2*n* = 14.

*X. grandicalyx* (#11): Extremely abundant in upland meadows; two-stemmed herb; leaves densely pubescent; calyx about 5/6 the length of the corolla; pollen fertile; chromosomes 2*n* = 14.

*X. multicaulis* (#16): Common, but limited to swamp/pond edges; decumbent herb closely resembling *X. abortiva* (#21), including the sparsely pubescent leaves; calyx about 2/3 the length of the corolla; pollen fertile but larger than in the other species; fruits of normal size with normal seeds; chromosomes 2*n* = 44 and pairing normally; plant sexually reproductive but also propagating by occasional runners.

*X. repens* (#8) Very distinct plant, common at the edges of upland swamps and open ponds; creeping, stoloniferous herb; leaves glabrous; calyx about equaling the corolla in length; pollen fertile; chromosomes 2*n* = 16.

*X. serrata* (#7): Common along upland forest edges; erect, two-stemmed herb; leaves moderately pubescent; calyx about ½ the length of the corolla; pollen fertile; chromosomes 2*n* = 28. Experimental hybrids with *X. grandicalyx* (#11) show chromosome pairing as follows: 7 pairs + 7 singles.

***Xanthoanthe* Worksheet Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Habitat | Abundance | Habit | Leafpubescence | Calyx length/corolla | Flower color | Chromosome # and ploidy | Reproduction/Fertility | Meiotic behavior |
| **X. abortiva (#21)** |  |  |  |  |  |  |  |  |  |
| **X. alba** |  |  |  |  |  |  |  |  |  |
| **X. flava (#20)** |  |  |  |  |  |  |  |  |  |
| **X.** **grandicalyx****(#11)** |  |  |  |  |  |  |  |  |  |
| **X. multicaulis****(#16)** |  |  |  |  |  |  |  |  |  |
| **X. repens (#8)** |  |  |  |  |  |  |  |  |  |
| **X. serrata (#7)** |  |  |  |  |  |  |  |  |  |

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***Xanthoanthe*:** Evolutionary relationships and speciation\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Provide a network showing the hypothesized relationships among the taxa of *Xanthoanthe*, indicating chromosome numbers and ploidy levels for each species and also likely processes involved (e.g., hybridization, polyploidy) where appropriate. Keep in mind that you may need to hypothesize an intermediate taxon that is now extinct to work out all of the steps.