mediate, in comparison with the parents, in almost all details, namely, shape of leaf-pitcher and lid, colouring, size and shape of flower (though the flower of the hybrid is inclined to be larger and more showy than the parent), and size and shape of the petals. The intermediate relation also extends to microscopic details, such as character of cells of the epidermis, number of stomata, and characters of the internal tissues.

Dr. H. W. Youngken has studied the comparative morphology, taxonomy, and distribution of the Myricaceæ (bog-myrtles) of the eastern United States. The author finds that the infesting organism in the characteristic root-tubercles is an Actinomyces, and he has also observed it in the cells of the fruit-wall; after the fall and decay of the fruit it will again make its way into the soil and infect roots of other Myricas. Coccus-like forms, believed to be involution forms of the infesting Actinomyces, were found in the pitted wood-vessels, and apparently indicate the pathway taken by the parasite in order to reach the fruit-wall.

Miss Margaret Henderson describes the results of a comparative study of the structure and saprophytism of the Pyrolaceæ and Monotropaceæ in relation to the Ericaceæ (heaths). The author suggests that the two former families differ from the Ericaceæ only in their gradually increasing saprophytism and in those characters which go hand-in-hand with this, namely, loss of green colouring matter, reduction from shrubs to herbs, reduction of leaves to scales, increase in the number of seeds, and the reduction in their size and in the number of cells of the endosperm and embryo. Similar degradation changes occur in the orchid and gentian families, and the author therefore supports the view which would regard the Pyrolaceæ and Monotropaceæ, not as distinct families, but as representing subfamilies of the Ericaceæ.

The Claude Process for Ammonia Synthesis.

IN the issue of the *Revue scientifique* for May 28 M. Georges Claude gives an interesting account of his process for the synthesis of ammonia, depending on the use of pressures approaching 1000 atmospheres. The work of compression of a gas at constant temperature varies as the logarithm of the pressure, so that if the work of compression from 1 to 200 atm. is 2·3, that from 1 to 1000 atm. will be only 3, or at most 3·5, if the diminution of compressibility at high pressures is taken into account. At high pressures, however, the percentage of ammonia in equilibrium with hydrogen and nitrogen will be greatly increased. Claude announced in 1917 that his experiments indicated that the yield could be increased from about 13 per cent. at 200 atm. to more than 40 per cent. at 1000 atm., the temperature being the same in both cases. A production of 6 grams of ammonia per gram of catalyst an hour, as compared with 0·5 grams in the Badische process, is attained. Whereas it is necessary at 200 atm., employed by the Badische Co., to circulate the gas several times over the catalyst, and to separate the ammonia after each circulation, it is sufficient to circulate only three or four times at 1000 atm. The volume of the apparatus required for the same production is only about one-tenth that required at 200 atm. pressure. The main source of difficulty in working at high pressures is the evolution of heat, which is 25 to 50 times greater than in working at 200 atm. The difficulty is then, not to conserve the heat of reaction to make the process autothermic, as is the case in the Badische method, but to eliminate this heat. The Claude apparatus has been operated with success at La Grande Paroisse with a unit producing 1·25 metric tons of ammonia per day, and a larger unit, for 5 tons per day, with a compressor dealing with 700 cu. m. of gas per day, has recently been put into operation with success.

The percentage of ammonia after passing the catalyst is about 25 at 1000 atm., as compared with about 6 at 200 atm. The partial pressure is therefore 250 atm., as compared with about 12 atm. at 200 atm. total pressure. The vapour tension of liquid ammonia at atmospheric temperature being from 7 to 8 atm., it will be seen that this is negligible in the gas obtained by the Claude process, but most appreciable with the gas obtained by the Badische process. It is sufficient, in Claude's apparatus, to pass the gas through coils immersed in cooling water in order to separate practically all the ammonia, and the residual gas, after separation of liquefied ammonia, is sent directly, without further compression, to a second catalyst chamber. Three or four catalyst chambers suffice to convert the gas into ammonia. In the Badische process, on the contrary, it is necessary to wash out the ammonia with water under pressure, requiring a complicated apparatus and expenditure of work to bring the gas again to 200 atm. after mixing with fresh gas, and 15 catalyst chambers are required. It is also necessary to use heat to separate the ammonia gas from the solution so obtained, whereas in Claude's process the liquefied ammonia is merely allowed to evaporate, producing cold which can be utilised.

The Claude process, which offers great possibilities in the synthesis of ammonia and in the utilisation of atmospheric nitrogen, is to be installed in England. The patent rights have been acquired by the Cumberland Coal and Chemicals Co., who are to erect a works in the centre of the coke-oven district in Cumberland.

Field-work of the Smithsonian Institution.

THE Smithsonian Institution has just issued its annual Exploration Pamphlet, describing and illustrating its scientific field-work throughout the world during 1920. Twenty-three separate expeditions were in the field carrying on researches in geology, palæontology, zoology, botany, astrophysics, anthropology, archæology, and ethnology, and the regions visited included the Canadian Rockies, fourteen States of the United States, Haiti, Jamaica, four countries of South America, Africa from the Cape to Cairo, China, Japan, Korea, Manchuria, Mongolia, Australia, and the Hawaian Islands. The pamphlet serves as a preliminary announcement of the results obtained, though many of the expeditions will be more fully described later in the various series of publications under the direction of the Smithsonian Institution.

Dr. C. D. Walcott, secretary of the Smithsonian Institution, continued his geological work in the Cambrian rocks of the Canadian Rocky Mountains in the region north-east of Banff, Alberta. The work was hindered considerably during July and August by forest fires and by continuous stormy weather in September, but the particular questions involved in the season's research were settled satisfactorily, and some