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Western Yellow Pine Mistletoe

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free nitrogen; or they may be useful in some other way. In return the symbionts are benefited by receiving protection and nourishment.

The fifth part of the book deals with symbionts in relation to luminescence in animals. A considerable share of animal luminescence is, according to the author, due to the presence of symbiotic organisms. It is predicted that this will be a rich field for research in the future. Three forms are dealt with especially, namely, Coleoptera, Pyrosoma, and the Cephalopods. The literature dealing with light production in these forms is fully treated and the conclusion is drawn that the light-producing structures are symbionts which are housed in the cells of special organs, and that these symbionts are carried over from one generation to the next by way of the egg.

The sixth section deals with the mistakes of the symbiosis investigators and especially with the fanciful and unscientific work of Portier as published in various papers and summarized in his book "Les Symbiotes," 1918.

At the end there are nineteen pages of references to literature dealing with symbiosis and related subjects, and this list undoubtedly contains practically everything that had appeared up to 1921. The book is inspiring and instructive and must remain a classic in years to come for those interested in the subject of intracellular symbiosis.

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WESTERN YELLOW PINE MISTLETOE¹

This bulletin gives the results of studies over a period of twelve years on the effect of mistletoe *Razoumofskya cryptopoda* (Engelm.) Cov. on the growth and seed production of western yellow pine. The intensive part of these studies was carried on near the San Francisco mountains in northern Arizona. "The parasite is the most widely distributed and one of the most serious enemies of the western yellow pine." On southern slopes and near the lower limit of the distribution of the pine, areas occur where 75 to 90 per cent of all trees above six inches in diameter are infected.

The effects of the mistletoe on the bole of the tree are to retard the growth both in height and diameter. Witches brooms and increased thickness of limbs are more common on the infected trees than on the healthy ones. When infection occurs early in the life of trees, burls are frequently formed. The large amount of reserve food of the infected stems, their soft spongy nature, and their thicker inner bark attract porcupines and squirrels. Other effects of mistletoe infection are the production of a flow of resin, and shorter and more yellowish leaves. The life of the tree is shortened, small amounts of seed are produced by infected trees during generally heavy seed

¹Korstian, Clarence F., and W. H. Long, The Western Yellow Pine Mistletoe: Effect on Growth and Suggestions for Control. U. S. Department of Agriculture Bul. 1112. pp. 35. Dec. 21, 1922.

years, and at other times practically none, also the seed is of poorer quality. The merchantability of the timber is reduced both by an increase in the number of knots and by a weakening of the lumber.

The authors state that the most practical method of controlling mistletoe is to remove infected pines while cutting operations are in progress.

The bulletin presents a large amount of carefully collected data in a very clear manner, and fully demonstrates the seriousness of mistletoe infection in a region where forest productivity is retarded by numerous other unfavorable factors.

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