

## THE INFLUENCE OF THE APIDÆ UPON THE GEOGRAPHICAL DISTRIBUTION OF CERTAIN FLORAL TYPES.

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The reciprocal relations of flowers and insects form a subject which has attracted many workers since Darwin and others showed the importance of this phase of biology. In the whole field of adaptation we have no better materials than those afforded by the morphology of flowers and insects considered in their relation to each other. The field has been most exploited by botanists, but some entomologists have also made valuable contributions to the literature of this subject, and their assistance has always been necessary for the identification of visitors observed.

Ecology, the phase of biology which considers the animal or plant in its relation to its environmental conditions, has been much pursued of recent years. One of the oldest phases, and one which at the present time, it seems to me, is not receiving the attention which it should, is that concerned with the mutual adaptations of flowers and insects.

The researches of Darwin early showed the importance of the classic studies of Koelreuter, Sprengel and Knight, and other workers immediately seized his ideas and proceeded to verify and elaborate them by observation, experiment and comparison. The tracing of the development of the various conceptions concerning the relations of flowers and insects during this most important period in the history of biology is a most fascinating exercise, but one which is quite out of place in this paper. Here we are concerned only with the problem of the influence of the insects upon the geographical distribution of the flora, and we shall make no attempt to go back beyond the classic work of Hermann Müller on Alpine flowers and their fertilization by insects.

The basis of the floral theory of Müller, as developed in the third portion of his *Alpenblumen*, is the proposition of the beneficial effect of crossing; so often as the progeny of cross-fertilization comes into competition for existence with the offspring of self-fertilization, it wins in the contest; only when the struggle for existence is absent may self-fertilization suffice for long-continued propagation. The supporting evidence for this thesis is two-fold: the direct proof of the extensive cultural experiments of Darwin and the indirect evidence yielded by the organization of flowers themselves.

While the importance of cross-fertilization has doubtless been overestimated by many writers, it hardly need be stated in this place that at the present time no argument need be advanced in its support. Admitting

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