NOTES.

ON THE ORIGIN OF PARASITISM IN FUNGI[1].—Up to the present no definite explanation has been offered as to why a given parasitic Fungus is often only capable of infecting one particular species of plant. This, however, is well known to be the case, for although the spores of Fungus-parasites germinate freely on the surface of any plant when moist, infection only takes place when the spores germinate on the particular species of plant on which the Fungus is known to be parasitic. This apparently selective power on the part of the Fungus I consider to be due to chemotaxis.

An extensive series of experiments was conducted with various species of Fungi, including saprophytes, facultative parasites, and obligate parasites, and the results are given in tabulated form in the full paper. The chemotactic properties of substances occurring normally in cell-sap were alone tested; among such may be enumerated saccharose, glucose, asparagin, malic acid, oxalic acid, and pectase. In those instances where the specific substance, or combination of substances, in the cell-sap assumed to be chemotactic could not be procured, the expressed juice of the plant was used.

These experiments proved that saprophytes and facultative parasites are positively chemotactic to saccharose, and this substance alone is sufficient in most instances to enable the germ-tubes of facultative parasites to penetrate the tissues of a plant, unless prevented by the presence of a more potent negatively chemotactic or repellent substance in the cell-sap.

As an illustration, *Botrytis cinerea*, which attacks a greater number of different plants than any other known parasite, cannot infect apples, although saccharose is present, on account of the presence of malic acid, which is negatively chemotactic to the germ-tubes of *Botrytis*.

In the case of obligate parasites the cell-sap of the host-plant proved to be the most marked positive chemotactic agent. Malic acid is the specific substance that attracts the germ-tubes of *Monilia fructigena* into the tissues of young apples; whereas the enzyme pectase performs the same function for the germ-tubes of *Cercospora cucumis*, an obligate parasite on the cucumber.

Immune specimens of plants belonging to species that are attacked by some obligate parasite owe their immunity to the absence of the substance chemotactic to the parasite.

Purely saprophytic Fungi can be educated to become parasitic, by sowing the spores on living leaves that have been injected with a substance positively chemotactic to the germ-tubes of the Fungus experimented with. By a similar method of procedure, a parasitic Fungus can be induced to attack a different species of host-plant.

[1] Abstract, reprinted from the Proceedings of the Royal Society.

These experiments prove what has previously only been assumed, namely, that parasitism in Fungi is an acquired habit.

A series of experiments prove that infection of plants by Fungi occurs more especially during the night, or in dull, damp weather. This is due to the greater turgidity of the cells, and also to the presence of a larger amount of sugar and other chemotactic substances present in the cell-sap under those conditions.

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CULTURAL EXPERIMENTS WITH 'BIOLOGIC FORMS' OF THE ERYSIPHACEAE[1].—In the introductory remarks the author points out that through specialization of parasitism 'biologic forms' have been evolved in the Erysiphaceae which, both in their conidial (asexual) stage and ascigerous (sexual) stage, show specialized and restricted powers of infection. The powers of infection, characteristic of each 'biologic form,' are under normal conditions sharply defined and fixed, and hitherto the result of the experiments of numerous investigators—both in regard to the present group of Fungi and to the Uredineae, where the same specialization of parasitism occurs—has been the accumulation of evidence tending to emphasize the immutability of 'biologic forms.'

The second part of the paper gives the result of cultural experiments with 'biologic forms' of *Erysiphe Graminis* DC., carried out during the past summer in the Cambridge University Botanical Laboratory. It has been found that *under certain methods of culture, in which the vitality of the host-leaf is interfered with, the restricted powers of infection, characteristic of 'biologic forms,' break down.*

In the first method of culture adopted, the leaf, which was either attached to a growing plant, or removed and placed in a damp chamber, was injured by the removal of a minute piece of leaf-tissue. In this operation the epidermal cells on one surface, and all or most of the mesophyll tissue, were removed at the cut place, but the epidermal cells on the other surface (opposite the cut) were left uninjured. Conidia were sown on the cuticular surface of the uninjured epidermal cells over the cut. In a few experiments the conidia were sown on the internal tissues of the leaf exposed by the cut, and these gave the same results.

Using this method of culture, over fifty successful experiments, of which details are given, were made. In these the conidia of certain 'biologic forms' were induced to infect 'cut' leaves of host-species which are normally immune against their attacks.

The experiments proved that the range of infection of a 'biologic form' becomes increased when the vitality of a leaf is affected by injury, and also that species of plants 'immune' in nature can be artificially rendered susceptible.

Further experiments showed that *the conidia of the Fungus produced on a 'cut' leaf are able at once to infect fully uninjured leaves of the same host-species.*

In other experiments, a method suggested by Professor H. Marshall Ward with the object of avoiding lesion of the leaf, was adopted. Leaves were injured by touching the upper epidermis for a few seconds with a red-hot knife, and conidia were

[1] Abstract, reprinted from the Proceedings of the Royal Society.