of obtaining a great many mutations from a few plants. So far tobacco is most amenable to such treatment, and Nitsch is now trying to repeat this success with other species, so that he can offer the plant geneticists this new store of hereditary variation.

GEOTROPISM

Statolith Hypothesis Upheld

from our Plant Physiology Correspondent

A FRESH variation on an old experimental theme may have clinched the argument about the mechanism of perception of gravity in roots in favour of the starch statolith hypothesis. Tor-Henning Iversen of the University of Bergen eliminated statolith starch from the roots of cress seedlings by incubating them in a mixture of potent plant growth hormones, after which the roots did not respond to gravity (*Physiol. Plant.*, **22**, 1251; 1969).

Starch statoliths are large, mobile, starch-filled plastids found in many plant tissues which respond to gravity. The idea that the position and movement of these particles within the cells could indicate to the plant the direction and magnitude of the gravitational field derived from an analogy with invertebrate statocytes. These are hollow organs containing a dense, mobile particle which exerts pressure on particular sensory hairs according to the position of the animal.

The simplest test of the statolith concept in plants is to remove the statolith starch from the tissues and then observe changes in the response to gravity. This has proved difficult because statolith starch is most persistent. In 1966 Barbara Pickard and K. V. Thimann found that they could destarch tissues by incubating them at 30° C in a mixture of gibberellic acid and kinetin. When they used this procedure with corn coleoptiles—the cylindrical, geotropically sensitive sheaths which surround the primary leaves of grass seedlings—the growth was somewhat retarded, but nevertheless coleoptiles could still respond to gravity (*J. Gen. Physiol.*, **49**, 1065; 1966).

This evidence for geotropic responsiveness in a tissue devoid of statolith starch counted heavily against the statolith hypothesis. Earlier this year, however, Hertel, de la Fuente and Leopold observed a close correlation between the behaviour of starch particles in a mutant variety of corn and the geotropic responsiveness of the tissues (*Planta*, **88**, 204; 1969). Now Iversen has repeated Pickard and Thimann's experiment, but on roots, and has come to the opposite conclusion. The growing tips of roots are covered by the rather mucilaginous cells of the root cap. These cells, which seem to be essential for the root to perceive gravity, contain the starch statoliths. Iversen has eliminated these statoliths from the cap cells by growing cress seedlings in a mixture of gibberellic acid and kinetin at 35° C in darkness. In these conditions loss of starch, as judged by both light and electron microscopy, is complete after some thirty hours. The treated roots grew almost as well as untreated controls, but did not respond to gravity. It is very important that the growth of the root should not have been affected significantly. Geotropic curvatures are the result of differential growth of the upper and lower halves of the root; lack of geotropic responsiveness in a tissue with severely impaired growth would prove nothing. Perhaps the strongest point in Iversen's argument was the observation that starch re-formed in the roots when they were exposed to light, and that simultaneously geotropic sensitivity was restored.

ENTOMOLOGY

Flying Parasites

from a Correspondent

TAXONOMISTS may not be the only people to benefit from a recent study of a large family of wasp-like creatures. Dr M. W. R. de V. Graham's work of unravelling the relationships within the West European members of the largely parasitic family Pteromalidae was, apart from its obvious academic value, an essential prelude to any attempts to use parasitic insects in programmes of biological control.

The Chalcidoidea, to which this family belongs, is one of the groups of minute parasitic, or much more rarely vegetarian, Hymenoptera, or wasp-like creatures, which contain many species and are far from fully described and catalogued, even in Western Europe. The family Pteromalidae is one of the larger in the group and most workers have found that it presents great difficulties. Moreover, a special hazard has been left through the activities of workers in the early nineteenth century, particularly the British entomologist F. Walker, who described, extremely superficially, vast numbers of species, for example, 250 species of *Pteromalus* which in most cases nobody else has been able to recognize. One of Graham's most onerous tasks has been to find all these species, scattered through several collections and often poorly labelled, and to interpret them in modern terms—the rules of nomenclature unfortunately making it impossible to ignore them (*Bull. Brit. Mus., NH*, Entom. Sup., **16**; 1969).

Graham examined the type specimens of more than 600 species in the British Museum and of about 300 in other European museums. Even so, he has described eighty-seven new species and noted many others which he could not describe because information is still inadequate. All these species have been arranged in a modified classification with fifteen subfamilies and more than 200 genera. Keys have been provided for the identification of all the species and their hosts or habitats recorded wherever these are known.

There has been a great increase in the study of parasitic Hymenoptera since the Second World War which has been accelerated during the past few years. There is little doubt that dissatisfaction with the side effects of the use of insecticides turned attention to the possibilities of biological control with the aid of insect predators and parasites. But it soon became apparent that such a development was impossible unless all the insects were correctly identified, for very small specific differences in structure are often associated with widely different behaviour. The proper classification of small parasitic Hymenoptera became at once a matter of potential interest to agriculture. Many of these parasites play an important part in the population dynamics of insects and a better understanding of this subject will certainly be permanently useful. Moreover, even if no practical results stem from Graham's work, it will remain a very important addition to our knowledge of the West European fauna and a monument to his industry and taxonomic insight.