but there was a striking decline last year in damage to weeping willows by *Marssonina salicicola*, which causes leaf spot, shoot canker and dieback. *Cristulariella depraedans*, a fungus previously unrecorded by the commission, caused spectacular damage to sycamore leaves in the south last year.

Larger pests are the problem of the commission's mammal and bird experts. Last year saw the continuation of trials of chemical repellants to prevent severe browsing by roe deer. A Dutch repellant, 'Aaprotect', was sprayed onto the shoots of Norway spruce, and three months after the beginning of the trial about a third of the shoots had been damaged. This represents a marked reduction in the damage done by the deer, but the chances are that a slow accumulation of damage will reach economic proportions in one or two seasons where browsing is a severe hazard to young plantations.

PLANT ANATOMY

New Cells Described

by our Botany Correspondent

A NEW category of plant cells has been recognized after an extensive survey of living material and literature. Drs B. E. S. Gunning and J. S. Pate of Queen's University, Belfast, have suggested that cells with marked ingrowths on their walls, which give them a large ratio of surface to volume, have evolved to cope with the transfer of solutes across the cell membrane. For this reason the cells are called transfer cells (*Protoplasma*, **68**, 107; 1969).

In spite of considerable morphological variations, transfer cells, which are found throughout the higher plants, are always characterized by distinctive, irregular ingrowths of the cell walls. Gunning and Pate have defined five situations in which transfer cells are found, and each case involves transfer of solutes across the membrane. First, there is absorption from the external medium. The ability of the submerged leaves of water plants to absorb and accumulate ions has often been investigated, and there is clear evidence in several species of ingrowths on the outer faces of epidermal cells, which are not covered by a waxy cuticle. Gunning and Pate think that these epidermal transfer cells will be found to be widespread in aquatic plants, facilitating the uptake of solutes by the provision of a large area of cell membrane.

Transfer cells are also common when solutes have to pass to the external medium; for example, in the glands of insectivorous plants. And there are transfer cells in the outer layers of the haustoria of parasitic plants such as *Cuscuta*, dodder, which penetrate into the vascular system of the host to absorb food materials. A similar situation is the placental connexion between the sporophytic generations of mosses and ferns and the gametophytic generations on which they develop. Transfer cells of both generations are found adjacent to each other, and Gunning and Pate assume that this means that there is specialization related to both influx of solutes to the parasitic sporophyte and efflux from the host gametophyte.

When it comes to reproduction in the higher plants, it is common to find situations in which an increased surface area of membrane would enhance absorption from the surrounding nutritive cells to the developing parts of the plant. There is discontinuity of contact between, for example, developing pollen grains and the surrounding tapetum and between the embryo and the embryo sac. Transfer cells always seem to be there to facilitate the passage of nutrients from one to the other.

The final context in which transfer cells have been reported is the transport systems of plants. The cells may be associated predominantly with the xylem or the phloem (Fig. 1*a*) or with both (Fig. 1*b*). Evidently the cells pass solutes between the conducting elements of xylem and phloem, or between the cells of xylem and phloem themselves.

Speculating about the development of transfer cells, Gunning and Pate have pointed to evidence that some secretory cells do not form ingrowths until secretion begins; perhaps the specialization of the wall will be found to be synchronized with the onset of intensive transport of solutes. The frequent localization of ingrowths on the cell walls considered to be most active in transfer suggests that the interaction with neighbouring structures is a determining factor in development. But the mechanism of development of the ingrowths is still a mystery. They will provide botanists with some intriguing problems, and it will be interesting to see how eagerly the name transfer cell is greeted.

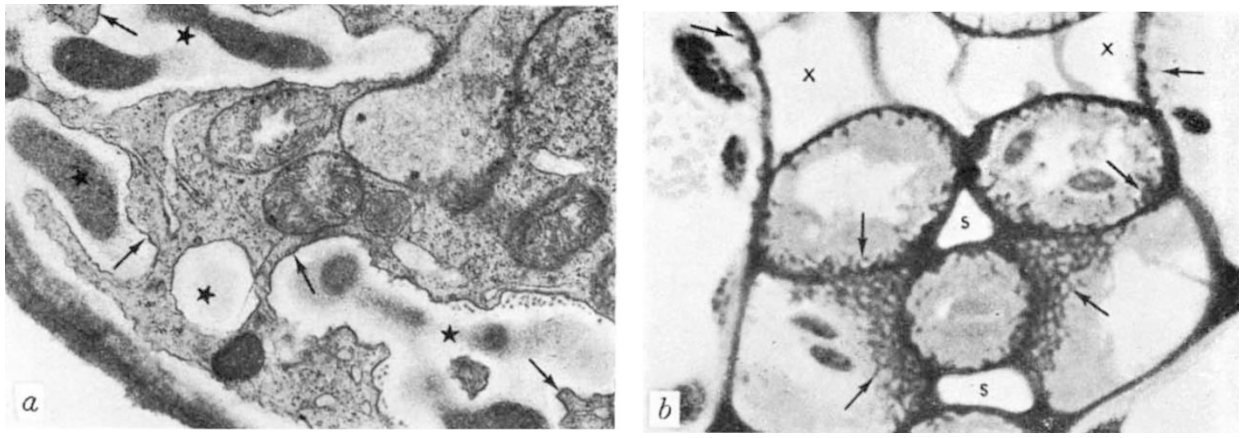

Fig. 1. (*a*) Electron micrograph showing the wall and membrane of transfer cells in phloem of *Vicia faba*. Stars mark the irregular ingrowths, which are associated with plasma membrane, arrowed (×20,000). (*b*) Photomicrograph of transfer cells surrounding sieve elements (s) and xylem (x) of *Anacyclus*. Some of the ingrowths of transfer cell walls are arrowed (×2,100).