two irradiations is too short to allow intermediate biochemical reaction to go to completion, the far-red irradiation will "switch off" photomorphogenic processes which had been "turned on" by the red irradiation.

Filaments of *Mougeotia* are made up of cylindrical cells each of which contains a single large flat plate-like chloroplast. The light-induced movement of this chloroplast is a response to light absorbed by the cytoplasm and not by the chloroplast itself. Movement induced by red light can be cancelled by a subsequent treatment with far-red light, indicating that phytochrome is the photoreceptor. In 1961, Bock and Haupt demonstrated that the phytochrome molecules are situated in the outermost portion of the cytoplasm and are probably associated with the plasmalemma, the membrane which limits the protoplast (*Planta*, **57**, 518). Haupt, working with G. Mortel and I. Winkelnkemper, has convincing evidence that phytochrome molecules in *Mougeotia* undergo a shift in the axis of absorption of light after conversion from Pr to Pfr—that is, a shift in the axis of dichroism (*Planta*, **88**, 183; 1969). This is the first direct evidence for such a shift, although it had been suspected for some time on the basis of polarotropic and phototropic evidence (for example, Etzold, *Planta*, **64**, 254; 1965, and Haupt, *Z. Pflanzenphysiol.*, **58**, 331; 1968).

A Zeiss microspectrophotometer was used to irradiate small portions of the cell with microbeams of polarized light. The behaviour of the chloroplast was used as an indication of the form of the phytochrome. This is possible because the edge of the chloroplast moves so as to avoid that part of the cell where the concentration of Pfr molecules is greatest; only a small part of the chloroplast moves in response to irradiation of a small area of the cell. After all the phytochrome in the cell had been established as Pfr by an initial saturating irradiation with far-red light, a part of the edge of the cell was irradiated with a microbeam of polarized red light. Movement of the chloroplast occurred only when the plane of vibration of the light was parallel to the long axis of the cell, indicating that the Pr form of the molecule is oriented parallel to the surface of the cell. The orientation of the Pfr form was revealed by following an inducing red irradiation with polarized far-red light. Chloroplast movement was cancelled only when the plane of vibration of the light was at right angles to the long axis of the cell. This indicates that the dichroic axis of the Pfr form of phytochrome is perpendicular rather than parallel to the surface of the cell.

It has been thought for some time that conversion of Pr to Pfr involves a conformational change in the molecule, but the significance of the shift of the axis of dichroism is not yet clear. The way in which phytochrome influences the movement of the chloroplast, or may play a part in the control of membrane permeability, similarly awaits further investigation and clarification.

TROPICAL FRUIT

For Exotic Tastes

from our Botany Correspondent

LOVERS of oranges and grapefruit may soon be able to add to their delight by eating the Puerto Rican

chironja, which combines the best qualities of both. Since its discovery in 1956 the chironja—the name is a combination of the Puerto Rican words for grapefruit and orange—has proved successful in marketing trials and seems to have a good commercial future.

Delegates to the conference on tropical and sub-tropical fruits, held in London from September 15 to 19, learnt that C. G. Morosco (Agricultural Experiment Station, Rio Piedras) found chironja trees growing wild while searching for promising new oranges in the Puerto Rican mountains. Local farmers told him that the glossy yellow fruit of these trees was so delicious that they had kept it all for themselves.

The new fruit is as easy to peel as a tangerine, although its rind is 5–8 mm thick. The easily separated segments, seven to fifteen in all, contain as much juice as two medium sized Valencia oranges. But the juice has none of the acid qualities of the orange, nor the bitterness of the grapefruit.

Ten years of field experiments have shown that the chironja can be propagated by seed, without reverting to the characters of orange or grapefruit. If it is a hybrid of these two, the chironja long ago became stabilized to breed true. Cytological investigations have not answered this question so far, and the origin of the new fruit remains a mystery. Fruit selected for marketing trials in 1957 and 1964 sold very quickly at high prices, and it has since been canned successfully. Perhaps it will not be long before Puerto Rican chironjas are arriving at Covent Garden market.

After 4,000 years of cultivation, mangoes too can soon be expected to appear more extensively in Europe and the United States. G. S. Puri (Liverpool Regional College of Technology) said that this relative of cashew nuts, pepper and poison ivy could become as important to the developing countries of the British Commonwealth as tea, coffee and rubber. Mangoes have the useful quality of being usable when raw, for chutney and pickle, when half ripe, for jam and candy, or when ripe as a luxury fruit. There is no problem in transporting the raw and half-ripe fruits; they can be shipped in the cooler part of the hold. But ripe mangoes are perishable and will remain a rare commodity until packaging problems are solved.

Airfreighted mangoes are now arriving safely in Europe from South Africa, where, according to L. Hobson (Letaba, North Transvaal), aggressive marketing should be able to make mangoes dominant in the exotic fruit trade. Israel has also taken up mango growing, and S. Gazit (Hebrew University, Rehovot) described how the toxicity of calcareous soils has been overcome by applying chelates to remove the excess calcium.

PHOTOSYNTHESIS

Ferredoxin Reduced

from our Plant Physiology Correspondent

LAST year, Yocum, Kyle and Gross reported that disrupted spinach chloroplasts prepared by sonication could be separated by sucrose density gradient centrifugation into two fractions with activities corresponding to photosystem I or photosystem II of the photosynthetic light reaction (*Proc. Intern. Cong. Photosynthesis*, 1968, in the press). A yellow substance was isolated which they called "lipoidal factor". The substance was