INTRODUCTORY.

I. General Remarks on Polyploidy and Sterility in *Musa*.

Polyploidy has been shown to be of common occurrence within the genus *Musa* by the extensive survey of chromosome numbers which Cheesman and Cheesman and Larter carried out and reported on in 1932 and 1935 respectively. It was evident from this work that the basic number in the subgenus *Eumusa* was x = 11; the seeded varieties were diploid 2n = 22, and the vast majority of the seedless edible varieties were triploid 2n = 33 - only a few were diploid.

Cheesman concluded from this common occurrence of triploidy in the edible bananas that their seedlessness was due primarily to their numerical hybridity. "It is now believed that the most important basic reason for sterility in bananas has been discovered, and that it lies in the fact that the majority of edible varieties are triploid plants" (Cheesman 1934).

In a recent (1942) paper Dodds has however shown that the significance of polyploidy in edible bananas is not as Cheesman suggests. He stresses the great significance of the fact that there are indeed diploid bananas, parthenocarpic and sterile, and he derives the implicit conclusion that triploidy (or any other polyploidy) is not an essential condition for sterile parthenocarps in *Eumusa*.

Dodds gives a full account in his paper of the cytology of five diploid parthenocarpic forms. He points out that all five are heterozygous. Structural hybridity was common, and present in varying degree from a single interchange to three interchanges and several inversions. One plant (type 20, Guindy) he considered to be in all probability an interspecific hybrid that had gone sterile and parthenocarpic.

An extremely important fact that is brought out in this work is that these cytological irregularities are not the prime cause of sterility in the parthenocarpic diploids. Pisang Lilan (type 32) illustrated this conclusion of Dodds most clearly. The only cytological abnormality in this case was a single interchange which commonly expressed itself at Metaphase 1 as a trivalent and univalent. Such an abnormality could theoretically account for a fifty percent decrease from the normal in the number of viable spores produced. This was indeed exactly the condition that was found in the male; only 4,500 pollen grains were produced from 2,250 PMC'S - which without loss should normally give 4 x 2,250 - 9,000.

On the female side however extensive pollination had shown the plant to be virtually one hundred percent sterile. At least half of this sterility cannot be accounted for cytologically.

Dodds then stresses:

1) That we have here a marked differential fertility between the sexes.

and 2) That the female-sterility of this parthenocarpic banana is not due to meiotic irregularity from either -

a) numerical hybridity (polyploidy)

or b) structural hybridity (dyscentric change).

Gross dyscentric change and its consequent meiotic irregularity was considered by this author to be a feature in edible bananas that had appeared after the incidence of parthenocarpy and sterility, and owed its existence to a lapse in the eliminating influence of the sexual process - was in fact an effect rather than a cause of sterility.

The same author, while he has dismissed polyploidy as the cause of sterility and seedlessness in edible forms, fails to demonstrate what is the significance of this common association of triploidy and parthenocarpy. He does nevertheless in a later paper on the whole scope of banana genetic systems, point out that there is one aspect of polyploidy in the edible forms that is in part understood and of considerable practical importance.

This feature is the tendency of triploids to give polyploid off-spring. Dodds has pointed out that where tetraploid seedlings appear in the progenies bred out of edible bananas, the most satisfactory step in banana breeding has been made if such tetraploids are, as seems probable, due to the formation of a restitution nucleus in the embryo sac mother cell of the edible female parent. For where edible varieties are triploid it is clear that successful meiosis in them will lead to a break-down of their essential complex triploid constitution which cannot be reconstructed. Clearly the inheritance of the intact triploid complex from a female parent is the best step that can be taken - or in Dodds' terms "primary" tetraploids and not "secondary" triploids are the desired type of plant in banana breeding.

Whatever may be the original significance of triploidy in parthenocarps we reserve for fuller discussion at the end of this paper;

suffice it to say here that there is now considerable ground for believing it is secondary to or consequent on parthenocarpy and not its cause.

However its present practical significance is in the role it plays in leading to meiotic failure.