Obviously, the reason is lack of suitable landmarks which can differentiate between chromosomes. Centromeres, heterochromatic knobs, and the chromomere pattern, which so well characterize pachytene chromosomes are of little value as chromosome markers in metaphase 1 and subsequent stages.

The significant observation that neocentric activity is induced at knob sites in the presence of abnormal chromosome 10 (Rhoades, 1952) appears to provide a clue to overcome this difficulty. If all knobs, irrespective of their position in specific chromosomes are capable of inducing detectable neocentric activity, it may be possible to know the number of knobs present in the genome by counting the number of neocentromeres. On this assumption, if specific chromosomes are suitably marked with varying number of knobs, it should be possible to identify particular chromosomes at metaphase I as well as metaphase II.

Before trying to use neocentromeres as meiotic metaphase markers in the manner now suggested, it is necessary to test the assumption made above that all knob sites show detectable neocentric activity in the presence of abnormal chromosome 10. At least two important aspects of this problem can be recognized. (1) Under some conditions, there may be competition between knob sites, particularly if knobs of different sizes and/or physiological states are present in the same chromosome or chromosomal arm. (2) It is important to know the extent of variability in neocentric activity at any knob position due to intrinsic and external factors. Sites showing constancy in behavior should be useful as markers.

Even assuming constancy in neocentric expression and absence of any competition, not more than 3-4 chromosomes out of the ten present in the maize genome can be identified at metaphase I or II, since the same number of knobs cannot be employed to distinguish more than one chromosome of the complement. Further, if more than two knobs and hence neocentromeres are used to mark a chromosome, difficulty may be encountered due to overlapping or crowding of the chromosomal fibers at the neocentromeres.

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2. <u>A note on the possible use of neocentric activity as an additional trait for characterizing knob sites and maize races.</u>

The heterochromatic knobs, whenever present in maize races, are valuable aids for the characterization and identification of maize races. Usually observations are taken on the position and the size of the knob. Maize cytologists have tried to evaluate the activity of knob-forming positions

by grading the knobs accrding to their size. However, it has been felt that 'such an evaluation is not entirely satisfactory due to the personal element that is involved' (Longley and Kato, 1965: Chromosome Morphology of Certain Races of Maize in Latin America). Besides the subjective difficulty in grading, an important defect may arise in case there is no correlation between size and activity. In fact, it may be visualized that two knobs of exactly the same size may possess different physiological activity and similarly, the total activity of knobs in one race may be entirely different from that of a second race, having the same number of knobs in exactly the same positions in corresponding chromosomes. From these considerations it appears necessary to measure some form of physiological activity, which may be independent of size and can be easily estimated with a fair degree of precision. Thus an additional trait would be provided for characterizing these chromosome markers and consequently the maize races.

The neocentric activity, elicited by the abnormal chromosome 10, and possibly other abnormal chromosomes like Ab. 2 and Ab. 9, reported recently by Longley and Kato (1965) may be considered as one kind of physiological activity at a knob site. For the purely taxonomic purpose of delineating maize races, it would not matter whether and to what extent this activity is a property of the site itself or the result of interaction of the site with the rest of the chromosomal material besides the inducer, i.e. the extra heterochromatic piece in the abnormal chromosome.

Since the method of estimation is important, one must look for the stage of meiosis where this estimation can be undertaken with ease and accuracy. Metaphase II appears to be the right stage for such analysis, since precocious activity at the neocentromeres results in sufficient stretching of the chromatids, so as to permit easy measurement without the risk of the personal element. The total length of the stretched chromatid segments can be taken as a measure of the degree of neocentric activity. For estimating the total knob activity within the meiocyte, the following procedure may be adopted. The maize race to be studied may be crossed with a standard homozygous line, carrying abnormal 10, but few knobs. From the total activity of this hybrid material, half of the activity in the standard line may be deducted, and next this difference may be multiplied by two. The logic of this procedure is fairly simple. By suitably marking the chromosomes with varying number of knobs, it should be possible to identify specific chromosomes as discussed earlier and thus the activity at particular knob sites can possibly be estimated.

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