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CYTOLOGICAL OBSERVATIONS IN THE GENUS PHASEOLUS L.

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ABSTRACT

Three species of the genus *Phaseolus* L. are reported upon.

1) *Phaseolus lathyroides* L. the name of which seems to be synonymous with *Ph. semi-erectus* L., has 2n = 22. This is in accordance with previous counts.
2) *Phaseolus hysterinus* Dur. has 2n = 22, but many cells in the inner cortical layer of the root are polysomatic.
3) Material of *Phaseolus sublobatus* Roxb., a species recently studied by DATTA & SEN, has been studied again: 2n = 22 and in a small number of seeds 2n = 44 could be reported, hence a case of spontaneous tetraploidy in *Phaseolus*.

Owing to the smallness of the chromosomes a complete analysis of the karyotype is nowhere attempted at and seems of dubious value for breeding work. At most can be stated that all three species in diploid condition show one large pair and one satellited pair of somewhat smaller chromosomes. These are present twice in the tetraploid.

Much has been published in the past forty years on chromosomes and chromosome numbers in the genus *Phaseolus*. As to chromosome number it seems to be sure that 11 is the base number: as to the chromosomes themselves, they are generally reported as small and recently DATTA and SEN (1963) claim to have been the first to publish an analysis of the complement when studying the karyotype in *Phaseolus sublobatus* Wall., more generally known as *Ph. sublobatus* Roxb.

In recent years I obtained some batches of *Phaseolus* seeds from various sources. Three of these were investigated and the results are reported here. The first were handed to me as *Phaseolus lathyroides* L. from the seed stores of the Regional Experiment Station Nrth. Nigeria at Shika. Here they were imported from Northern Rhodesia to try them out as a possible grazing component. It seems that the name is synonymous with *Ph. semi-erectus* L., according to Backer originating from tropical America and hence widespread in tropical regions in general. Backer reports it as a long-standing weed in grassland and way-side borders in Java. Our counts of roottip chromosomes tally with the reports of SENN (1938) and TURNER (1956), being 2 n = 22 (fig. 1). One pair of chromosomes excels the others clearly in length, whereas one other, smaller pair is satellited. Here are about 10 chromosomes which may be called small ones with median constrictions but considering the magnification (2000 ×) it seems virtually impossible to make a distinction between them.

A second batch of seeds I obtained from the Botanical Garden at Delft. They belong to *Phaseolus hysterinus* Dur. and data on the karyo-

type seem as yet not to have been given. However, also this species possesses 2 n = 22 chromosomes in its root tips (fig. 2). Also here one somewhat larger pair can be detected and one satellited pair of somewhat smaller dimensions. Really small chromosomes are obviously somewhat less, perhaps 6 in all, but here we meet with the same difficulty, the smallness of the chromosomes, which again, have

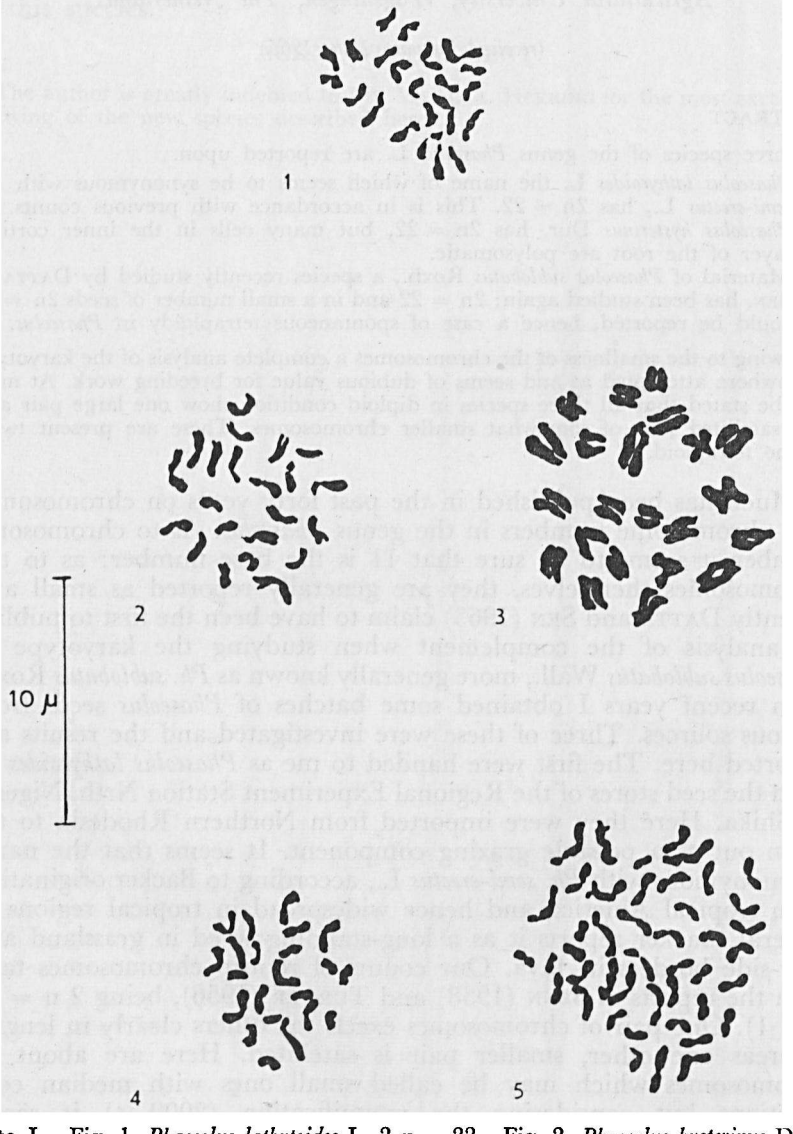

Plate I. Fig. 1. *Phaseolus lathytoides* L. 2 n = 22. Fig. 2. *Phaseolus hysterinus* Dur. 2 n = 22. Fig. 3. *Phaseolus hysterinus* Dur. Polysomatic inner cortical root cell. Fig. 4. *Phaseolus sublobatus* Roxb. 2 n = 22. Fig. 5. *Phaseolus sublobatus* Roxb. tetraploid seedling 2 n = 44.

to be represented via camera lucida at a magnification of 2000 times. In *Ph. hysterinus*, however, there is another feature worth reporting. The inner cortical cell layer which is next to the endodermis has larger cells containing polysomatic chromosomes. Fig. 3 shows the configuration of the metaphase plate with 22 doubled chromosomes. The phenomenon of polysomaty is widespread in the *Leguminosae*, e.g. very common in the genera *Cassia* and *Mimosa*, but I am not aware that it has been reported as yet in the genus *Phaseolus*.

The third species to be discussed here is *Phaseolus sublobatus* Roxb. quoted in the beginning of this article as having been studied recently by DATTA & SEN (1963). Our laboratory got a sample of about two ounces in 1958 from the AVROS Experiment Station at Medan, Sumatra (Indonesia). According to its staff, this plant appeared to be a very suitable ground cover in the oilpalm plantations. A further advantage is the edibility of the seeds. A number of seeds were germinated and the first roottip studies revealed tetraploidy (2 n = 44), whereas the other ones were diploid (Figs. 4, 5).

This result asked for further examination: the entire batch of seeds was scrutinized and yielded four seeds which were somewhat larger than the others. Thereupon 20 seeds, including the larger ones were planted in 1959. Roottip examination confirmed the expectation: the four larger seeds gave plants which were tetraploid, and the remaining 16 ones were diploid. In the vegetative stage the tetraploid plants were slightly more robust, their leaves somewhat thicker and the nervature somewhat more pronounced.

Whereas, however, flowering of the diploid plants met with no difficulties in our illumination controlled greenhouse, it appeared impossible to induce flowering in the tetraploid ones, notwithstanding the fact that they were kept over to a second year.

As from 1960 it was impossible to obtain further batches of seeds from Indonesia, we had to leave open the investigation of the reduction division, and did not yet publish these preliminary results.

After having seen the recent results published by DATTA & SEN, we considered it to be, perhaps, useful, to confirm their findings as to chromosome number and to make a note of this evidently spontaneous tetraploidy.

It may be stressed that in this case of tetraploidy there cannot exist confusion with the phenomenon seen in *Ph. hysterinus*. Tetraploidy in this case involves all the cell layers of the root tip and the characteristically polysomatic pairing of somewhat thickened chromosomes does not exist here.

As to the chromosome features themselves in this species, I would like to make the following remarks. When comparing the figure given by DATTA & SEN with the figure given here (Fig. 4), it is obvious that the method of fixing and staining (in our case Navashin fixative, cutting and staining with crystal violet) does not impair the comparability of the results.

Taking into consideration the magnification of 2000 times in both cases which is necessary to make a drawing of these partly extremely

small chromosomes, we must come to the conclusion that identification of some of the largest chromosomes is possible on account of their shape and constriction. In the case of *Ph. sublobatus* we may be able to identify four decidedly larger chromosomes; one pair with median and one pair with submedian constriction, the latter one satellited. The rest of the chromosomes become smaller, but in such a gradual way that we cannot aim at identification. The same holds true for the tetraploids, where four satellited chromosomes may be discerned.

Classification into groups differing in 0.1 μ magnitude seems rather useless. This has been the reason why in our previous studies in the genus *Indigofera* where we were confronted with similar dimensions, we tried to compare the total length of the chromosome set: mathematical treatment showed that even then the variation obtained in a number of plates caused an overlapping, mainly owing to the magnitude of the smaller and smallest chromosomes. In recent investigations in the genus *Vigna* which will be published before long, we met with the same difficulties: occasionally certain features of the karyotype in these genera may be considered as useful for cyto-taxonomical work, but as finer distinctions for breeding purposes they are unreliable.

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