

### The Origin of Cultivated Tobacco.

THE cytogenetic investigations during the last few years supplied evidences for the origin of *Nicotiana tabacum* L. (cigarette and cigar tobacco) and of *Nicotiana rustica* L. (pipe tobacco, Makhorka). Both species represent allopolyploid hybrids, the former being an amphidiploid of *Nicotiana sylvestris* and *Nicotiana tomentosiformis* (syn. *Rusbyi*) or a form of the tomentosa group, while the latter being an amphidiploid of *N. paniculata* and *N. undulata*. *N. tabacum* and *N. rustica* have 48 chromosomes in the somatic cells, while *N. sylvestris*, *N. tomentosiformis*, *N. paniculata* and *N. undulata* have 24 chromosomes in the somatic cells.

The arguments for the above statements are :

1. *For N. tabacum.*—*N. tabacum* haploids have most frequently 24 univalent chromosomes during the first meiotic division, though one or two bivalents also occur. The same chromosome behaviour often occurs in the  $F_1$  hybrids *N. sylvestris*  $\times$  *N. tomentosiformis*.<sup>1</sup> In the hybrids *N. tabacum*  $\times$  *N. sylvestris* 12 chromosomes of *N. tabacum* conjugate with the chromosomes of *sylvestris*. The same mode of conjugation was found in the hybrid *N. tabacum*  $\times$  *N. tomentosiformis*, i.e., 12 bivalents and 12 univalents. The production of triple hybrids with 24 bivalents in crossing *N. tabacum* with the  $F_1$  (*sylvestris*  $\times$  *tomentosiformis*), i.e., a fully fertile triple hybrid having all three complete genomes of the component species supplied the evidence that 12 *tabacum* chromosomes are homologous with the chromosomes of *sylvestris* while the other 12 are homologous with those of *tomentosiformis*. The production of the amphidiploid *sylvestris-tomentosiformis*, however, represented the final solution of the problem. The amphidiploid *sylvestris-tomentosiformis* has 48 somatic chromosomes. It produces fully fertile hybrids with *N. tabacum*, and has morphological characters the varieties of *N. tabacum* have.

2. *For N. rustica.*—*N. rustica* haploid has usually 24 univalent chromosomes and rarely bivalents are formed, while in the hybrid *paniculata*  $\times$  *undulata* non, or several bivalents are formed.  $F_1$  hybrids *N. rustica*  $\times$  *N. paniculata* and *N. rustica*  $\times$  *N. undulata* form usually 12 bivalents and 12 univalents during the first meiosis (occasionally trivalents are formed too, but this is in agreement with the former data). Trigenomal triple hybrid *N. rustica*  $\times$  *paniculata*  $\times$  *un-*

*dulata* (having complete genomes from all these three species, i.e., 48 chromosomes) should be fertile as well as the amphidiploid *undulata-paniculata*. The hybrids between *rustica* and the amphidiploid *paniculata-undulata* should be fertile too. This phylogenetic problem has such a direction of development. It is outlined here very roughly and will be given elsewhere in detail.

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### Cleistogamy in Sorghum.

CLEISTOGAMY occurs in many grasses. In wild species of *Hordeum* (Barley) cleistogamic forms have been noted. In cereals the occurrence of cleistogamy is very rare. The economic disabilities attendant on seed production under cleistogamic conditions militate against the common occurrence of cleistogamy in cereals; the more so in the case of sorghum in which the grains are naked and develop beyond the glume. In the wide collection of sorghums under study at the Millets Breeding Station, Coimbatore, two races, one Indian and another African, have been met with in which the flowers are cleistogamous. These races belong to the botanical group *Sorghum papyrascens*, Stapf., the very group in which erratic flowering,<sup>1</sup> vivipary,<sup>2</sup> and chlorophyll deficiencies<sup>3</sup> have been recorded. The long papery glumes and the degenerate lodicules have already been noted to be responsible for the erratic flowering.<sup>1</sup> In the cleistogamous forms, the earheads never give such evidences of flowering as the presence of stray emerged anthers and odd protruding stigmas. Such pedicelled spikelets as were antheriferous remained unopened. In spite of this the chaffy-looking heads did give a few viable grains. An examination was made of the cleistogamic forms in comparison with chasmogamic ones among the *papyrascens* group of sorghums. The following tabular statement brings out the points of contrast.

The cause of the cleistogamy will be evident from the accompanying table. In the cleistogamic forms the involucreal glumes are big. The lower floral glume is very wide and clasps the upper floral glume (lemma) tightly. This clasp coupled with the degenerated scaly lodicules results in cleistogamy.

*Sorghum papyrascens*, Stapf. *Spikelet Measurements (Average of 12).*

	Chasmogamic form mm.		Cleistogamic form mm.	
	L.	B.	L.	B.
Lower Involucral glume .. .. .	7.0	4.0 (5.5 spread out)	9.5	4.5 (6.0 spread out)
Upper Involucral glume .. .. .	6.7	3.6 (5.0 spread out)	9.5	3.5 (5.5 spread out)
Lower Floral glume .. .. .	5.0	3.0 (4.0 spread out)	5.5	2.7 (4.2 spread out)
Upper Floral glume .. .. .	4.5	3.5	4.5	3.5
Anthers .. .. .	4.2	1.2	3.5	1.0
Filamental length .. .. .	6.0 to 10.0		4.0 to 6.0	(coiled)
Lodicules .. .. .	2.3	1.5 × 1.0 (thickness)	1.1	0.6 × 0.4 (thickness)

Examinations made on spikelets at various hours of the night showed that between 3 and 5 a.m. there is a feeble endeavour on the part of the two involucral glumes to open out a bit, only to close up enclosing the clasped floral glumes with the anthers and ovary inside them. The smallness in the size of the anthers and the shortness in the length of the filaments (which become coiled) is noteworthy. In a dissected flower the anthers are stuck up against the stigmatic feathers and pollinate them after dehiscence (Fig. 1). In the spikelets in which the grains

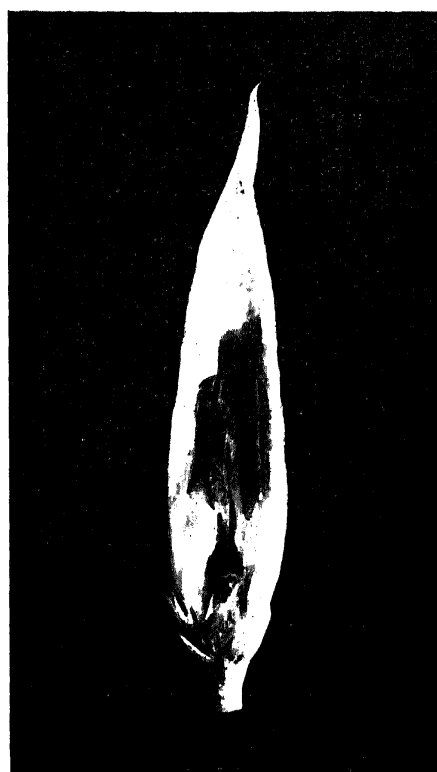


Fig. 1.

set, the shrivelled stigmas, anthers and filaments stuck up between the developed grain and the triangular niche above it, are easily noticeable (Fig. 2).

Earheads in which this cleistogamy occurred were analysed and compared with

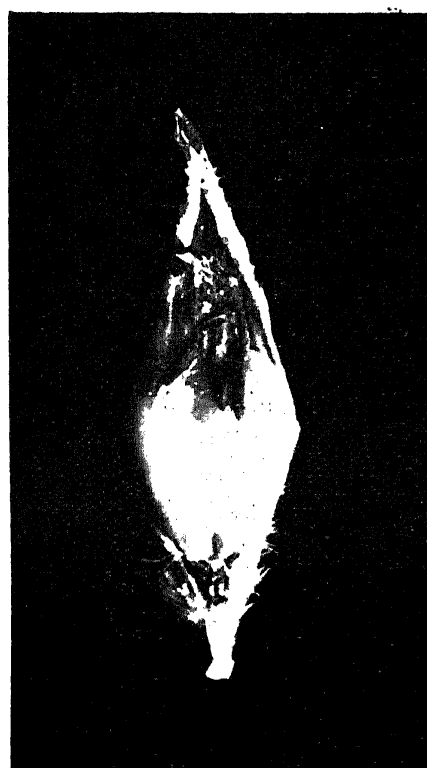


Fig. 2.

related chasmogamic lines and the following table brings out the points of contrast between the two.

*Sorghum papyrascens*, Stapf.

*Earhead Analysis (Average of 6 Heads)*

Percentage of—	Chasmogamic heads	Cleistogamic heads
1. Fertile sessile spikelets ..	59	50
2. Ill-developed seeds ( $\frac{1}{3}$ weight of normal) ..	5	19
3. Viviparous seeds ..	9	15
4. Antheriferous pedicelled spikelets ..	0	17

In cleistogamic heads the relatively poorer seed setting is evident. The accentuated vivipary is noteworthy. Above all the remarkable activation under this abnormality of as many as 17 per cent. of the usually abortive pedicelled spikelets into antheriferous ones,<sup>4</sup> throws interesting evidence on the probability of these pedicelled spikelets having once had perfect flowers.

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<sup>1</sup> *Jour. Indian Bot. Soc.*, 1936, 15, 139-142.

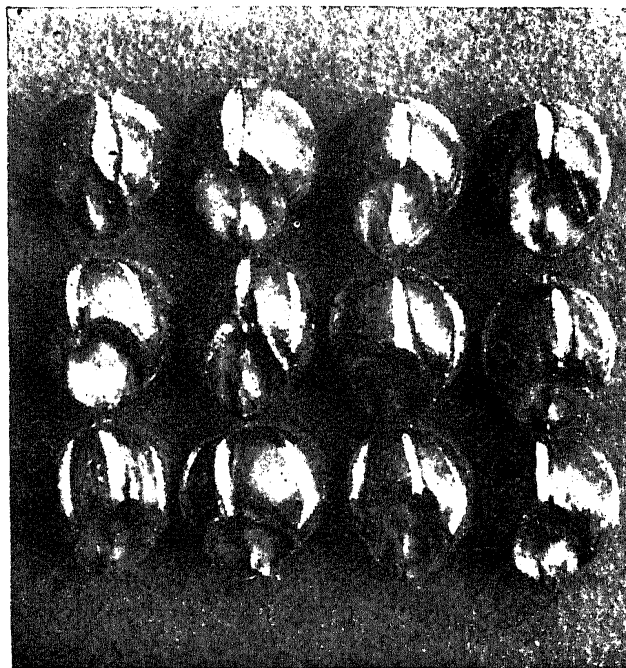
<sup>2</sup> *Curr. Sci.*, 1935, 3, 617.

<sup>3</sup> *Indian Jour. Agr. Sci.*, 1932, 2, 266.

<sup>4</sup> *Indian Jour. Agr. Sci.*, 1931, 1, 452.

### Cracked Grains in Sorghum.

IN Gramineæ, the rôle of the pericarp in the protection of the endosperm and the embryo is obvious. Any disturbance to this pericarp is deleterious to the seed. In Maize, Zapparoli<sup>1</sup> records the occurrence and inheritance of broken grains. In the grain sorghum which develops its naked grains outside the glumes, the importance of a sound and whole pericarp is obvious. At the Millets Breeding Station, Coimbatore, cracked grains in sorghum have been met with in half a dozen African races. They occurred in *Sorghum caffrorum*, Beauv., *S. caudatum*, Stapf., *S. rotundulum*, Stapf., and *S. guineense*, Stapf. In two races the cracking occurred in practically every grain of the earhead and in the others was found to be anything from 20 per cent. upward. Seasonal variations affected the degrees of expression. The cracked grains show best in the dough stage. Cracking commences with a longitudinal slit in the pericarp which deepens into a regular cleft with the rapid development of the grain, exposing the markedly noticeable white starch in the cleft. In purple pigmented varieties, these rents in the pericarp stimulate the usual run of pigment which gets deposited at the edges of the cleft and colours up the cracked areas. Cracking commences in the grains at the top of the panicle and covers the whole of it, in about a week's time. The cracks are very noticeable in round plumpy grains. They may be one, two, or three in number (see photo). They are disposed



Cracked Grains in Sorghum.

towards the embryo side of the grain and run roughly along the watermark lines clearly observable in some varieties. Cracking has so far been noted only in chalky grains<sup>2</sup> with a comparatively soft endosperm. In the flattish grains of *S. guineense* capped as they are with a partly corneous endosperm, the cracking is very irregular and erratic in disposition. In every one of these races, the markedly bold grain (big relatively to the grain size usually associated with the respective varieties), was a noticeable feature. In the earheads in which there were both cracked and uncracked grains, the average weight of cracked grains was about 6 to 7 per cent. more than the uncracked ones. Selections taken for cracking have bred true. The behaviour of this character in inheritance in crosses with normal grains is under study.

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<sup>1</sup> *Jour. Herd.*, 1925, 16, 259-262.

<sup>2</sup> *Indian Jour. Agr. Sci.*, 1934, 4, 96-99.

### Chromosome Numbers in Cymbopogon Species (continued).

IN a previous communication,<sup>1</sup> the chromosome numbers of five species were recorded. The numbers of the remaining South Indian