Table 1 *Segregation of the trilobate leaf gene in mungbean.*

Progeny of	Segregation pattern (No of plants) Normal	Mutant	Total	Ratio	*P*
Mutant-2 selfed	0	129	129	0:1	—
F_1's					
Normal x Mutant-2	0	79	79	0:1	—
Mutant-2 x normal	0	91	91	0:1	—
F_2	47	182	229	1:3	0.10
F_1 × Normal (test cross)	89	107	196	1:1	0.20
F_1s					
Mutant-1 × mutant-2	0	92	92	0:1	—
Mutant-2 × mutant-1	0	77	77	0:1	—
F_2(F_1 plants selfed)	25	279	304	1:15	0.20
F_1 × normal	35	85	120	1:3	0.20

Figures 1–3. Typical leaves of the trilobate mutant-1, **1.** normal, **2.** and mutant-2, **3.** plants.

plants with trilobate leaves were always pigmented. The mutant-2 like the earlier mutant-1 gave a monogenic inheritance for the trilobate leaf shape gene (table 1). The present communication reports the results of inheritance studies conducted in both the mutants.

Reciprocal crosses were attempted between the plants from two mutant stocks. For this, the unopened flower buds were emasculated in the evening, immediately sprayed with 50 ppm aqueous solution of kinetin to minimise flower shedding and were pollinated the next morning. The results obtained from various crosses are presented in table 1. The F_1 plants were further allowed to self-pollinate. The F_2 progeny gave a 15 trilobate: 1 normal segregation indicating that the character is controlled by two genes Tlb_1 and Tlb_2 and the two mutant plants were having genotypes $Tlb_1\ Tlb_1\ tlb_2^+\ tlb_2^+$ and $tlb_1^+\ tlb_1^+\ Tlb_2\ Tlb_2$, so that the plants possessing either Tlb_1 or Tlb_2 or both had trilobate leaves. In the test cross, F_1 × normal, a 3 trilobate: 1 normal ratio, typical of a test cross in duplicate gene inheritance, was obtained. The quality of the fit for these ratios was tested by a X-square test and the *P* values are given in table 1.

From the results, it can be concluded that the leaf shape (trilobate vs normal) in mungbean is governed by at least two genes Tlb_1 and Tlb_2.

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INHERITANCE OF TEN INDUCED MUTANTS IN OKRA (*ABELMOSCHUS ESCULENTUS* (LINN) MOENCH.)

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ABELMOSCHUS ESCULENTUS (Linn) Moench commonly known as okra or bhindi is an important vegetable crop of the tropical and sub-tropical regions. There are only a few reports on spontaneous and induced mutations in this crop[1–5]. In studies aimed to explore the possibilities of increasing genetic variability in okra, 35 true breeding mutants were isolated

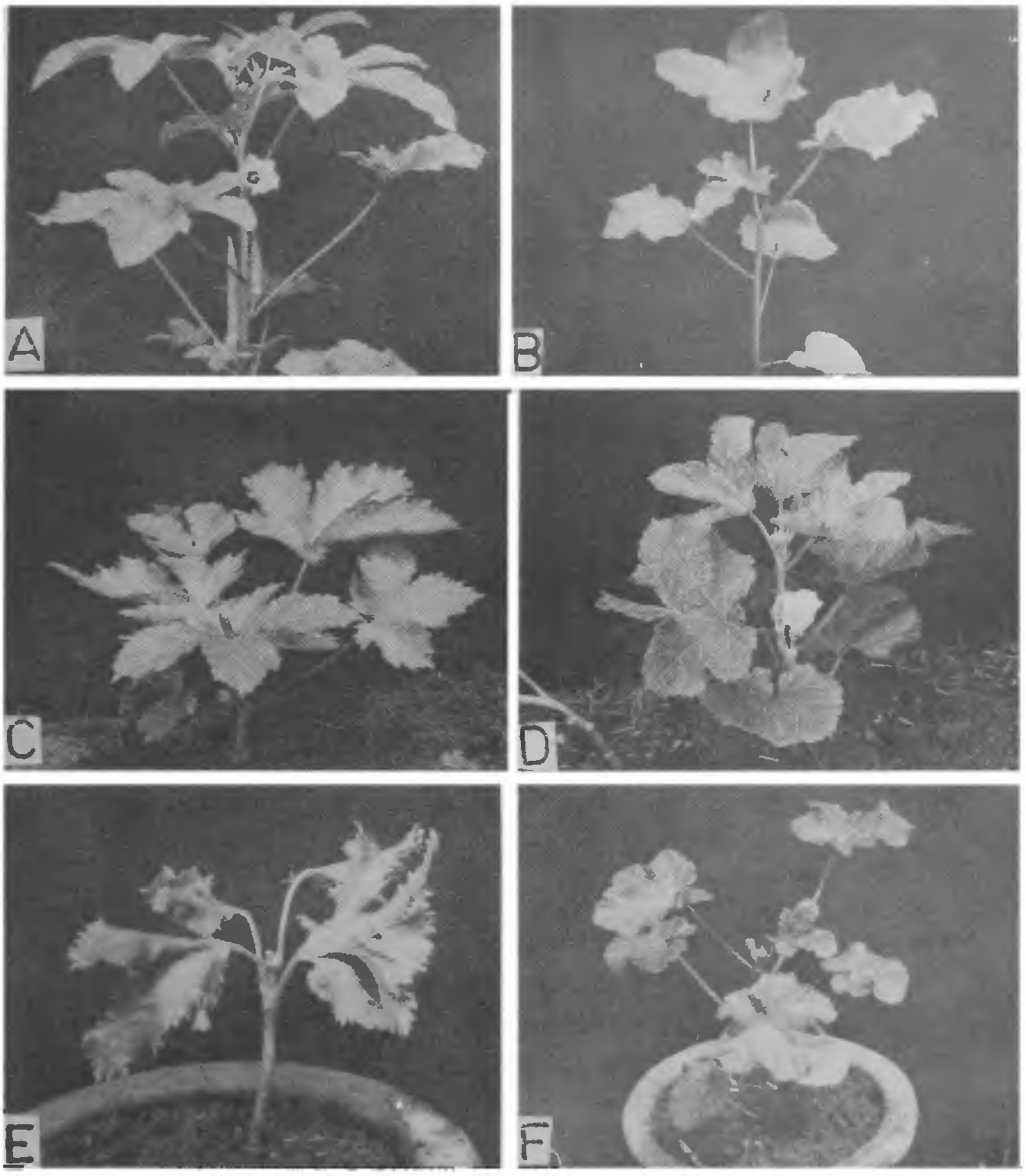
following gamma ray, fast neutron or ethyl methanesulphonate (EMS) treatments of seeds. The inheritance of ten mutants is presented in this paper.

Pusa Sawani (PS), a widely grown cultivar in India was used in this study. Individual fruits were harvested separately from the M_1 plants and the M_2 generation was grown as single fruit or single plant progenies[6]. The mutants isolated could be identified on the basis of their growth habit, leaf colour, shape, serrations, plant height and other morphological characters. The gene symbols and the salient features of the ten mutants included in this study are reported (table 1). Five of the mutants are shown in figure 1. In the M_4 generation, six of the true breeding mutants were reciprocally crossed to the parent. In addition, the inheritance of a drooping and a dwarf mutant was studied from the segregation ratios of the normal and mutant plants in the progeny of heterozygous sister plants.

The phenotype of the F_1 plants in all the crosses was like the parent *Pusa Sawani*. In the F_2, PS and the mutant phenotypes in all the crosses segregated in a 3 : 1 ratio (table 2) indicating that all the mutants were monogenic recessives. In diploid plants, most of the induced mutations are recessive and show monogenic recessive inheritance[7–9]. In addition, three drooping mutants were observed among 112 M_2 plants from two progenies. The mutant is characterised by its drooping, deeply serrate, trifoliate leaves (figure 1E). This mutant is slow growing, rarely produces flowers and does not set seeds. It was maintained by growing the heterozygous sister plants which segregated into normal and mutant plants in a 3 : 1 ratio (table 3). It is inferred that the mutant phenotype is governed by a pair of recessive alleles. A very short, dwarf mutant (plant height 32.5 ± 3.4 cm compared to 76.0 ± 3.6 cm of PS) was obtained in the M_3 generation from EMS treatment. Twelve such plants were observed alongwith 73 normal plants in that progeny. This mutant

Table 1 *The salient features of ten okra mutants and the proposed gene symbols*

Mutant (1)	Gene symbols proposed (2)	Mutagenic treatment (3)	Characters (4)
chlorina	*ch*	20–90 krad γ-rays 2–4 krad F.N. 1% EMS	Seedlings slender fast growing; leaves light green with conspicuous veins (figure 1B)
virescent	*vr*	20–90 Krad γ-rays	Young leaves pale green turning green during maturity; leaf margins more serrated compared to parent.
dark green	*dg*	20 Krad γ-rays	Slender plant; stem, leaves and fruits dark green; petiols shorter than in parent.
pale leaf	*pl*	"	Plants with more bushy habit and stiff stem; leaves pale green throughout.
short bushy	*sb*	30 Krad "	Short bushy habit; full grown plants short in height with more hairy stem and leaves; petiols short (figure 1D).
subdariffa	*sd*	" "	Identified at first true leaf stage with long, acute, serrate leaf; subsequent leaves 3-lobed; resembles *Hibiscus subdariffa* during early vegetative period; in full grown plants, leaves trilobed, very long with serrate margins; flowers with narrow petals; fruit more than 5-angled (figure 1C).
trilobed	*trl*	" "	Slender plants with trilobed leaves; lobing very shallow; slow growing.
wavy leaf	*wvl*	40 Krad γ-rays	Leaves wavy and twisted towards the end of vegetative growth.
drooping	*dp*	20 Krad "	Sterile mutant with drooping habit; leaves drooping, trifoliate and deeply serrate (figure 1E).
dwarf	*dw*	1% EMS	Semi-sterile, very short and late; leaves dark green, short 3–5 lobed; flowers small; fruit almost globular (figure 1F).
pusa sawani (parent)			Leaves 3–5 lobed; flowers yellow with purple spot at the base of the petals on bothsides; fruits 5-ridged, dark green (figure 1A).



Figures 1, A–F. Parent and mutants in okra. **A.** *Pusa sawani* (parent); **B.** chlorina; **C.** subdariffa; **D.** short bushy; **E.** drooping; **F.** dwarf.

Table 2 *Segregation in the F_2 of crosses between the mutants and the parent Pusa Sawani (PS)*

Cross	F_2 Normal	F_2 Mutant	X^2 (3:1)	p	Heterogeneity x^2
(1)	(2)	(3)	(4)	(5)	(6)
Virescent × PS	280	104	0 882	0 3–0.5	
PS × Virscent	72	35	3.392	0 05–0.1	
Total	352	139	2.868		1 406 p = 0.2–0 3
Dark green × PS	399	127	0.205	0.5–0.7	
PS × Dark green	255	87	0.035	0.5–0.7	
Total	654	214	0 055		0.185 p = 0.5–0.7
Pale leaf × PS	383	151	3 059	0.05–0.1	
PS × Pale leaf	281	126	7.705	0 001–0 01	
Total	664	277	9.881		0 883 p = 0.3–0.5
Short bushy × PS	403	159	3.248	0.05–0.1	
PS × Short bushy	192	53	1.481	0.2 –0.3	
Total	595	212	0.801		3 928 p = 0.02–0.05
Subdarıffa × PS	180	57	0.113	0.7–0.8	
PS × Subdarıffa	289	80	2.168	0.1–0.2	
Total	469	137	1 850		0.431 p = 0.5–0.7
Wavy × PS	82	38	2.844	0.05–0.1	
PS × Wavy	70	21	0.180	0.5 –0.7	
Total	152	59	0.988		2.036 p = 0.1–0.2
PS × Chlorına	137	54	1.090	0.3–0.5	
PS × Trilobed	260	74	1 441	0.2–0.3	

Table 3 *Segregation of the drooping and dwarf mutants*

	Phenotype Normal	Phenotype Mutant	X^2 (3:1)	p	Coefficient of contingency
Drooping mutant					
M_3	74	14	3.88	0.05–0.1	
M_4	217	59	1.93	0 1–0.2	
M_5	127	43	0.008	0.9–0.95	
M_6	470	136	2.12	0.1–0 2	
Total	888	252	5 095	0.1–0.2	0.083
Dwarf mutant					
M_3	73	12	5.37	0.02–0.05	
M_4	1930	584	2.10	0.1–0.2	
Total	2003	596	5 93	0.01–0.02	0.054

was also late in flowering and did not produce any seeds, though in subsequent generations, the segregants produced few viable seeds. The segregation data of the normal sister plants in the subsequent generations (table 3) suggests that this mutant is governed by a pair of recessive alleles.

Following the rules of the International Committee on Genetic Nomenclature[10], appropriate gene symbols were suggested for these ten mutants. Though the mutants described have been named on the basis of the most prominent morphological alteration, they show variation in several other characters also. These mutants are new additions to the existing variability in this crop and are useful for genetic studies.

26 June 1984; Revised 17 May 1985

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ZONATE LEAF BLIGHT—A NEW DISEASE OF FINGER MILLET

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INDAF varieties of finger millet/*Eleusine coracana* (Linn) Gaertn released by the University of Agricultural Sciences, Bangalore have been found to be infected with a new fungal disease at the Regional Coconut Research Station, Arsikere.

The infection was noticed on 80-day old plants and the infected plants remained pale, stunted and later blighted. Freshly infected leaves showed minute light brown to dark brown, oblong spots surrounded by light yellow margin. Individual lesions were 1–1 8 cm in length and 0.5–1 cm in breadth. When such lesions coalesced the blighted portions measured 7–10 cm in length. Later, the blighted areas turned to light grey with light brown to brown wavy bands, which gave a characteristic zonation (figure 1). Coalescence of several lesions resulted in blighting of a large part of the leaf blade and finally affected leaves dried leaving the faint zonations on the affected areas. Hence, the disease has been named "zonate leaf blight".

Repeated tissue *isolates* on acidified potato dextrose agar yielded a pure culture of *Drechslera* sp. A week-old sporulating culture was successfully used to produce artificial infection on healthy plants. The characteristic lesions were noticed on the leaves within 72 hr of inoculation.

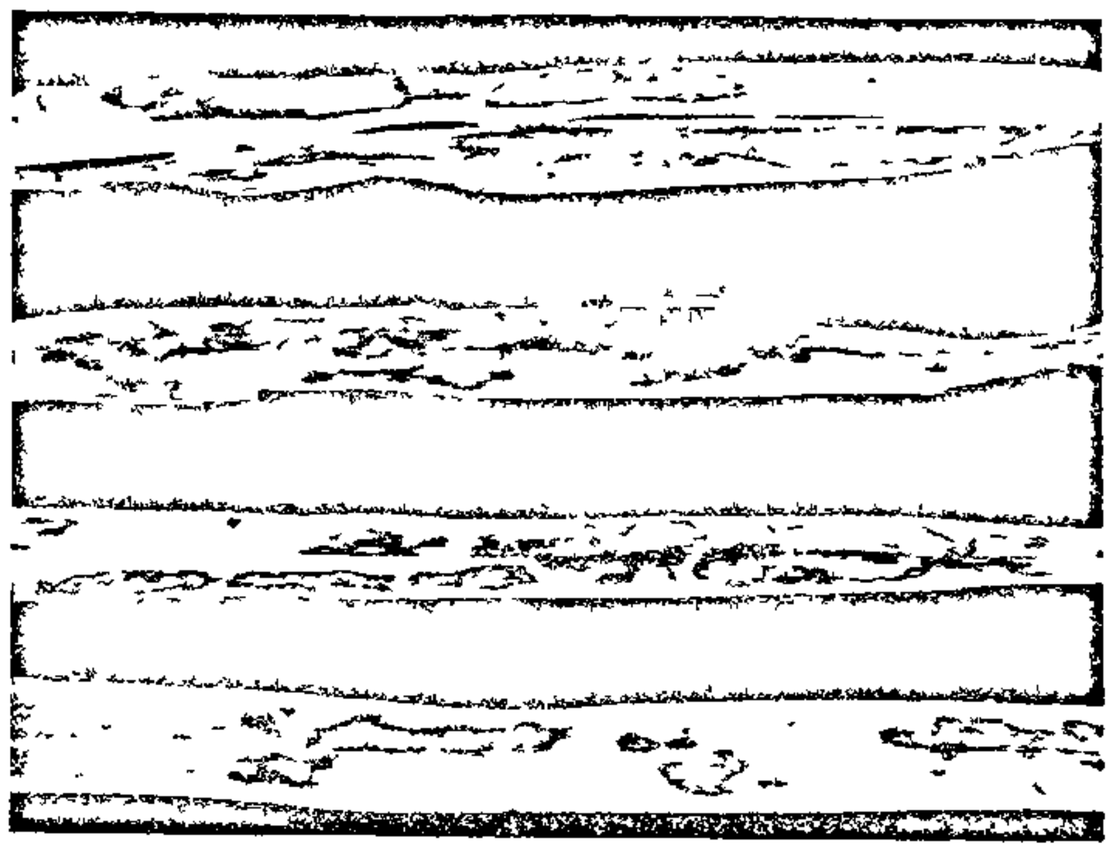

Figure 1. Zonate leaf blight of ragi.

The fungus exhibited light grey to olivaceous mycelial mat with scanty sporulations on PDA. Conidiophores were solitary, occasionally in small groups, straight, geniculate, pale to light brown, and measured 125–200 μm × 4–6 μm. Conidia were straight to slightly curved, fusiform, light brown to golden brown, smooth and measured 45–95 × 8–16 μm with 5–10 pseudosepta. Fungus also produced abundant chlamydospores when kept on PDA for more than 20 days.

Based on the morphological characters, the fungus has been identified as *Drechslera setariae* (Sawada) Subram & Jain. The culture has been deposited at CMI, Kew, Surrey, England 234254 a. *D. setariae* has been recorded on seeds[1] and plants[2] of *Setaria italica* Beauv. However, the pathogen was not recorded so far on finger millet in India. Thus, it constitutes a first record from India as one of the hosts for *D. setariae* and a new disease on finger millet.

The authors are grateful to Dr. E. Punithalingam, Commonwealth Mycological Institute, Kew, Surrey, England for confirming the identification of the pathogen.

14 February 1985; Revised 22 May 1985

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