

NEW OR UNUSUAL RECORDS

Shoot apex fasciation in *Sesamum indicum* associated with mycoplasma-like organisms

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Shoot apex fasciation was observed in sesame crops in central Iraq. The symptoms included flattening of the shoot apex, shortened internodes, and intense proliferation of leaf and flower buds. Mycoplasma-like organisms were detected by electron microscopy in sieve elements of fasciated plants but not in normal plants. Plants sown in July showed less fasciation than plants sown in June or May. Almost no fasciation occurred on plants grown inside insect-proof cages, irrespective of their origin from seed of fasciated or normal plants. Insect-borne and not seed-borne transmission is therefore suggested.

INTRODUCTION

Sesame (*Sesamum indicum*) is an annual crop grown extensively for food and oil in Iraq. Total production has reached 36 000 t annually (Rizk & Ali, 1981). The crop is often attacked by diseases, such as charcoal rot (*Macrophomina phaseolina*), wilt (*Fusarium* sp.) and phyllody (mycoplasma-like organisms) (Mustafa, 1974). Shoot apex fasciation has not previously been reported on sesame. In other species, some plant breeders believe that symptoms of this type result from mutagenic treatment (Ibrahim *et al.*, 1982).

The objective of this study was to establish the nature of shoot apex fasciation in sesame and to study the effects of sowing date and insects on its incidence.

MATERIALS AND METHODS

Plants with and without shoot apex fasciation symptoms were observed in commercial fields of sesame (cv. Local) at Qadisiya, Babylon and Baghdad provinces.

Small pieces of stem tissue (2-3 mm³) collected at the end of the growing season (August 1987) were fixed with 30 g/l glutaraldehyde in 0.025 M phosphate buffer, pH 6.8, and kept overnight at 5°C. After several washings with phosphate buffer, samples were post-fixed in 20 g/l osmium tetroxide in the same buffer for 2 h at room temperature. After four to five washings with phosphate buffer, the fixed tissue was dehydrated in a graded acetone series. The samples were

embedded over several days in a low-viscosity resin (Spurr, 1969). Sections were cut with a diamond knife, at silver-grey interference colour, stained with 10 g/l aqueous uranyl acetate and with lead citrate and viewed in a Philips EM 200 electron microscope at 60 or 80 kV.

Field experiments were laid out in 1986 and 1987 to examine the cultivar Q13.1.A.(C) and its three mutants derived by irradiation, Q16.1.A.(K), Q1.1.B.(L) and Q1.2.A.(M). The mutants and their parent were randomized in five replicate blocks, each 5 × 5 m. Seeds were sown in the first week of May. Fasciated and normal plants were counted regularly during the growing season.

Another experiment was conducted in a different field during 1987. The treatments comprised three sowing dates of seed collected from both partially fasciated and normal plants of sesame mutant Q16.1.A.(K) the previous season. Seeds from each source was sown on 1 May (D1), 1 June (D2) and 1 July (D3) in six replicate plots, each of four lines, 5 m long (125 seeds per line). Fasciated and normal plants were counted at maturity (4 months after sowing).

In another field experiment in 1987, seeds collected the previous season from partially fasciated and normal plants of sesame mutant Q16.1.A.(K) were sown in plots, each of two lines 2 m long (50 seeds per line) on the three sowing dates mentioned above (D1, D2, D3). Half the plots were covered with insect-proof cages (2 m long × 1 m wide × 2 m high). There were four

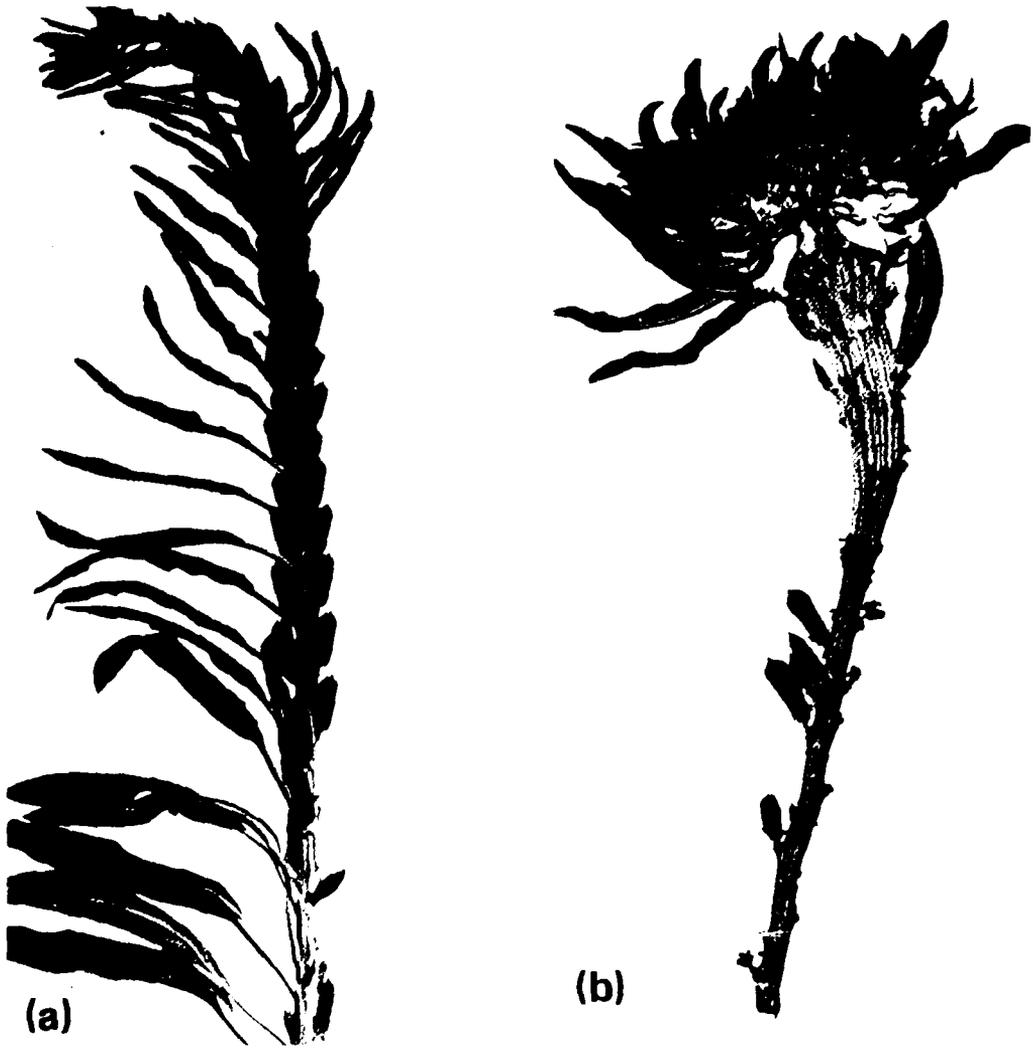


Fig. 1. Mature plants of *Sesamum indicum*: (a) healthy; (b) with shoot apex fasciation disease.

replicates. At the end of the growing season, the cages were removed and counts were made of plant survival and incidence of fasciation.

RESULTS AND DISCUSSION

The disorder was characterized in the fruiting stage by the flattening of the shoot apex, shortening of the internodes, and intense proliferation of leaf and flower buds. Flowers of affected plants appeared normal in shape but rather small and aggregated as clusters at the apex (Fig. 1b). The disorder is designated shoot apex fasciation. Such symptoms have apparently not previously been reported in sesame. Similar symptoms have also been observed in Iraq on *Jasminum* sp., *Sesbania* sp. and *Vicia faba*. Symptoms of phyllody, pre-

viously described by Vasudeva & Sahambi (1955), were occasionally observed on sesame plants showing fasciation. The incidence of fasciation reached 10% in some fields. These symptoms are markedly different from those previously reported for phyllody in sesame (Vasudeva & Sahambi, 1955; Choopanya, 1973). In phyllody the distinguishing symptom is flower virescence while in shoot apex fasciation it is the flattening of the stem.

Electron microscopy revealed numerous mycoplasma-like organisms (MLOs) in the sieve elements of fasciated plants (Fig. 2a), but not in normal plants, suggesting that this syndrome is caused by MLOs. These MLOs varied in shape and size; their ultrastructure appeared similar to

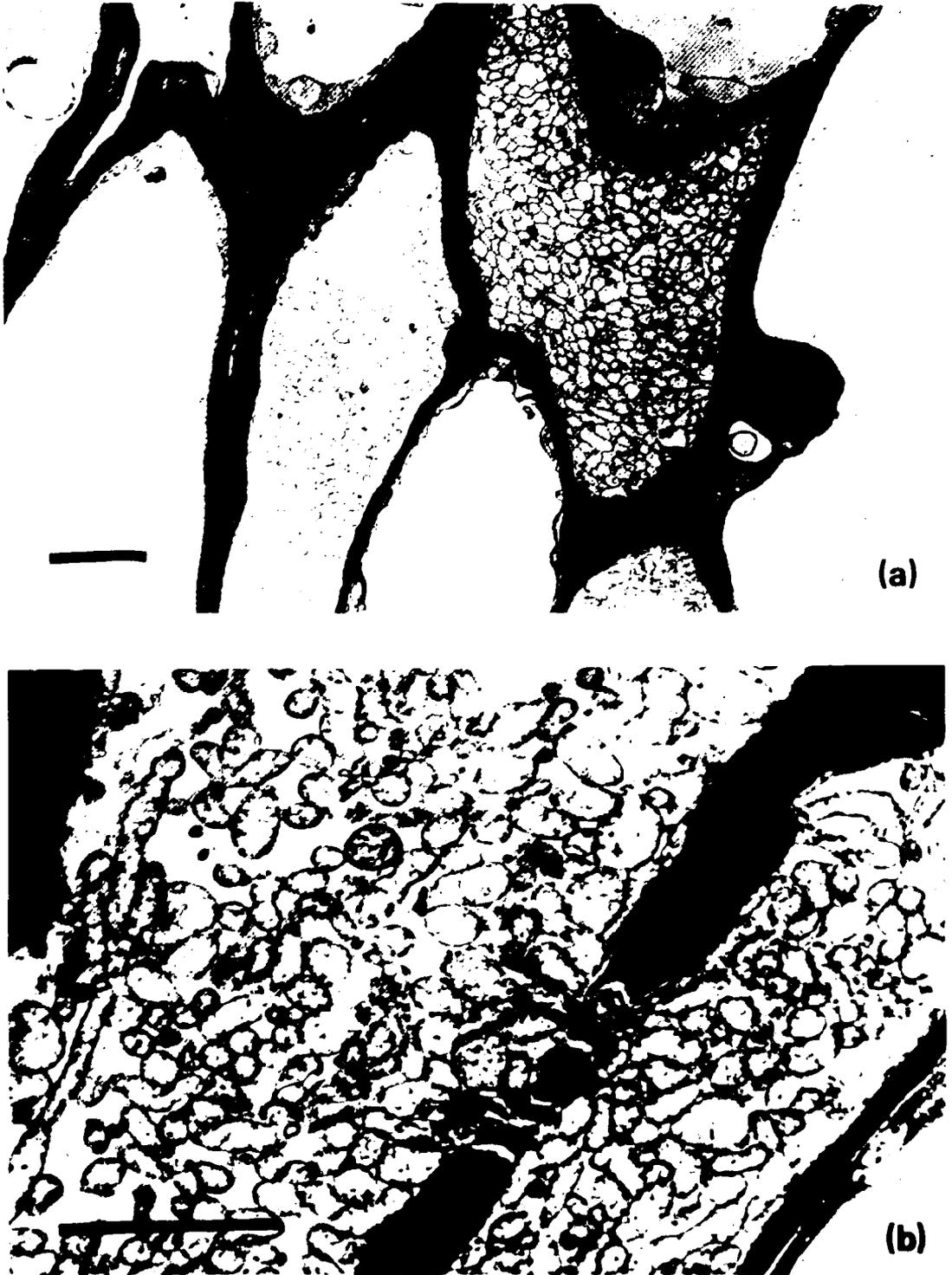


Fig. 2. (a) Mycoplasma-like organisms (MLOs) in sieve elements of phloem tissue of *Sesamum indicum* plants with shoot apex fasciation disease, bar = 2 μm . (b) MLOs passing through sieve plates; bar = 2 μm .

Table 1. Mean incidence of fasciation on three induced sesame mutants and their parent line, throughout two successive seasons

Sesame line	Incidence of fasciation (%)					
	1986			1987		
	15 Jul.	15 Aug.	15 Sep.	15 Jul.	15 Aug.	15 Sep.
Q16.1.A.(K)	0.7	1.1	8.5A	0.8	2.6	12.2A
Q1.1.B.(L)	0.3	0.6	0.7B	0.0	1.4	4.9C
Q1.2.A.(M)	0.0	0.0	4.4AB	0.2	1.1	5.1C
Q13.1.A.(C)	0.0	0.9	5.7A	0.4	1.1	8.2B

Values with a common letter within a column are not significantly different according to Duncan's Multiple Range Test ($P=0.05$).

Table 2. Effect of sowing date and insect-proof cages on mean incidence of fasciation, in sesame mutant Q16.1.A.(K) during 1987

Sowing date	Incidence of fasciation (%) ^a			
	Non-caged plants		Caged plants	
	Seeds from fasciated plants	Seeds from normal plants	Seeds from fasciated plants	Seeds from normal plants
(D1) 1 May	51.7A	47.2A	0.5	0.0
(D2) 1 June	28.0B	24.7B	0.0	0.0
(D3) 1 July	12.0C	8.6C	0.0	0.0

^a Data for four months after sowing.

Values with a common letter within a column are not significantly different according to Duncan's Multiple Range Test ($P=0.05$).

that of previously reported MLOs associated with disease symptoms in various crop plants (Choopanya, 1973; Hibben *et al.*, 1986). MLOs were observed passing through the sieve plates of affected plants (Fig. 2b). No virus particles were observed.

The induced mutant Q16.1.A.(K) was more susceptible to fasciation than the other mutants or their unirradiated parent (Table 1). Symptoms were first seen at the beginning of July, 2 months after sowing, and increased towards maturation. These results agreed with those previously reported for phyllody in the same mutants of sesame (Tamimi, 1988).

Incidence of fasciation was greatly reduced by delayed sowing (Table 2), confirming the belief of local farmers that early sowing (in May) increases the effects of disease and insect pests.

Plants grown inside the insect-proof cages were almost entirely free from the shoot apex fasciation, irrespective of their origin from seed of fasciated or normal plants (Table 2). No insects were found on the caged plants. A vector has not been identified. However, species of Diptera, Hemiptera, Homoptera and Lepidoptera have been identified on sesame crops in central Iraq, namely *Antigastra catalaunalis*, *Balchutha hortensis*, *Bemisia tabaci*, *Melanogromyza azawii*, *Neoa-*

liturus haematocephs, *Orosius albicinctus*, and *Sogatella vibix* (Al-Rubaei, 1985). Infestation with these insects was reported to be very high during May and June (33–45%).

It is suggested that this newly described disease is caused by MLOs, and that transmission is probably insect-borne and not seed-borne. To reduce the incidence of shoot apex fasciation in sesame crops in central Iraq, late sowing (in July) is recommended.

REFERENCES

- Al-Rubaei H.M. (1985) Sesame insects in the middle of Iraq. *MSc Thesis*, University of Baghdad.
- Choopanya D. (1973) Mycoplasma-like bodies associated with sesame phyllody in Thailand. *Phytopathology* **63**, 1536–1537.
- Hibbon C.R., Lewis C.A. & Castello J.D. (1986) Mycoplasma-like organisms, cause of lilac witches-broom. *Plant Disease* **70**, 343–345.
- Ibrahim I.F., Kadhum L.J. & Mahmood A.H. (1982) Effect of seed exposure to some physical and chemical mutagens on the (M1) generation plants of *Cucumis sativus* L. *Journal of Agriculture and Water Resources Research* **1**, 5–22.
- Mustafa F.H. (1974) List of plant diseases in Iraq. *Ministry of Agriculture. Bulletin No. 74*, 27pp.
- Rizk T.Y. & Ali H.A. (1981) *Sugar and Oil Crops*, pp. 40–72. Mosul University Press, Iraq.
- Spurr A.R. (1969) A low viscosity, epoxy resin embedding medium for electron microscopy. *Journal of Ultrastructural Research* **26**, 31–43.
- Tamimi K.M. (1988) Evaluation of induced sesame mutants to phyllody disease in Iraq. *Arab Journal of Plant Protection* **6**, 40–44.
- Vasudeva R.S. & Sahambi H.S. (1955) Phyllody in sesamum (*Sesamum orientale* L.) *Indian Phytopathology* **8**, 124–129.

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