

hyaline, oval, $2.8-8.5 \times 2.7-5.5 \mu$, rounded at both the ends (Figs. 2 and 3).

The identity of culture was confirmed by CMI, Kew, Surrey, England, and was deposited under IMI. 2450004.

Phoma jolyana Pirozy and Morg. has been reported to cause leaf spot disease in *Citrus aurantifolia*¹ and pre-harvest rot of Banana fruits² in India. But its occurrence on *Bilbergia nutans* is a new record.

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ABNORMAL STOMATA IN THE BULB-SCALES OF *ALLIUM CEPA* L.

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FOSTER¹ has mentioned the presence of "abortive" or "abnormal" stomata on the epidermis of the bulb-scales of onion, but no details are given. Scott *et al.*² have categorically stated that "no stomata are present" in the epidermis of the bulb-scale. In view of the contradictory observations, it was thought worthwhile to re-examine the epidermis of the bulb-scales of onion.

The epidermis from the adaxial as well as abaxial surfaces of the local variety of onion were separated and mounted and examined in safranin glycerine jelly.

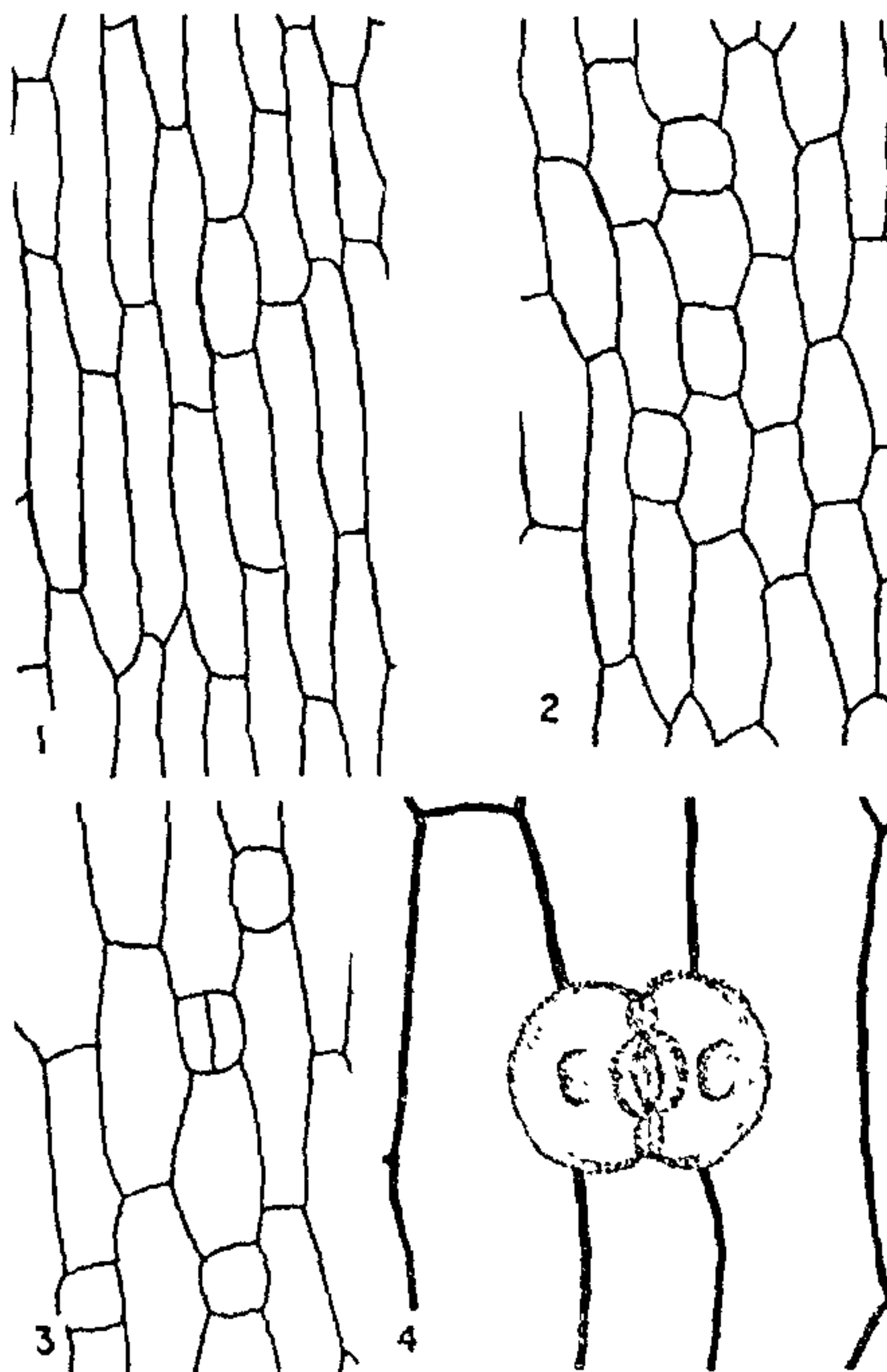
The cells on both the epidermal surfaces (Fig. 1) are longitudinally elongated and regularly arranged. They are about $250 \times 50 \mu$ in size and show simple pits in their walls. Those of the abaxial surface are somewhat smaller and narrower. The following types of aberrant stomata were noticed.

1. *Arrested stomata*: These occur intermixed between the elongated cells on both the epidermal surfaces in the form of short (about $80 \times 50 \mu$), somewhat rounded cells (Fig. 2). Some of these are divided into two by a wall parallel to the long axis (Fig. 3). The arrested structures are more common on the

scales towards the outside of the bulb obviously because they are exposed to the outer atmosphere and light, whereas, the deeper unexposed layers lack such stomata.

2. *Apparently nonfunctional stomata*: Small stomata (about $55 \times 59 \mu$) with the pore walls, strongly thickened and almost obliterating the pore, are also present. These stomata also have polar lamellae and the epidermal wall of the guard cells is thickened (Fig. 4).

Onion bulb-scales form ideal material for the study of stomatal abnormalities. Morphologically they are leaves and presence of stomata could be expected but as they function as storage organs, the stomata are modified and non-functional. In the present study, two different types of abnormalities were noticed. Different types of aberrant stomata have recently been reviewed in detail by Farooqui³ but even she has not mentioned the non-functional stomata as described here.



FIGS. 1-4. *Allium cepa*—Abaxial epidermis of bulb-scale. Fig. 1. Ordinary epidermal cells from inner scale ($\times 340$). Fig. 2. Arrested stomata ($\times 340$). Fig. 3. Arrested stomata, one showing division into guard cells ($\times 340$). Fig. 4. Apparently non-functional stoma with thickened walls ($\times 820$).

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Arrested stomata were first described by Dehnel⁴ as persistent stomatal initials. Pant and Kidwai⁵ called them arrested stomata and suggested that they represented developmental stages of stomata incorporated into the mature leaf. Nowhere in literature have they been described from organs where normal stomata are themselves virtually absent. In the bulb-scales of onion, this may be due to the modification of the leaf consequent to its specialized function of storage.

It is interesting that stomata which would otherwise be considered "abnormal" on other plant organs are of normal occurrence here whereas normal stomata have not been observed.

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SPINACH LEAF CURL

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A LEAF curl disease of spinach (*Spinacea oleracea* L.) was observed during October 1978 and 1979 in a kitchen garden at Delhi. About 5% of the plants were found affected with the disease. Two diseased plants were transplanted in 8 inch pots in an insect-proof glass

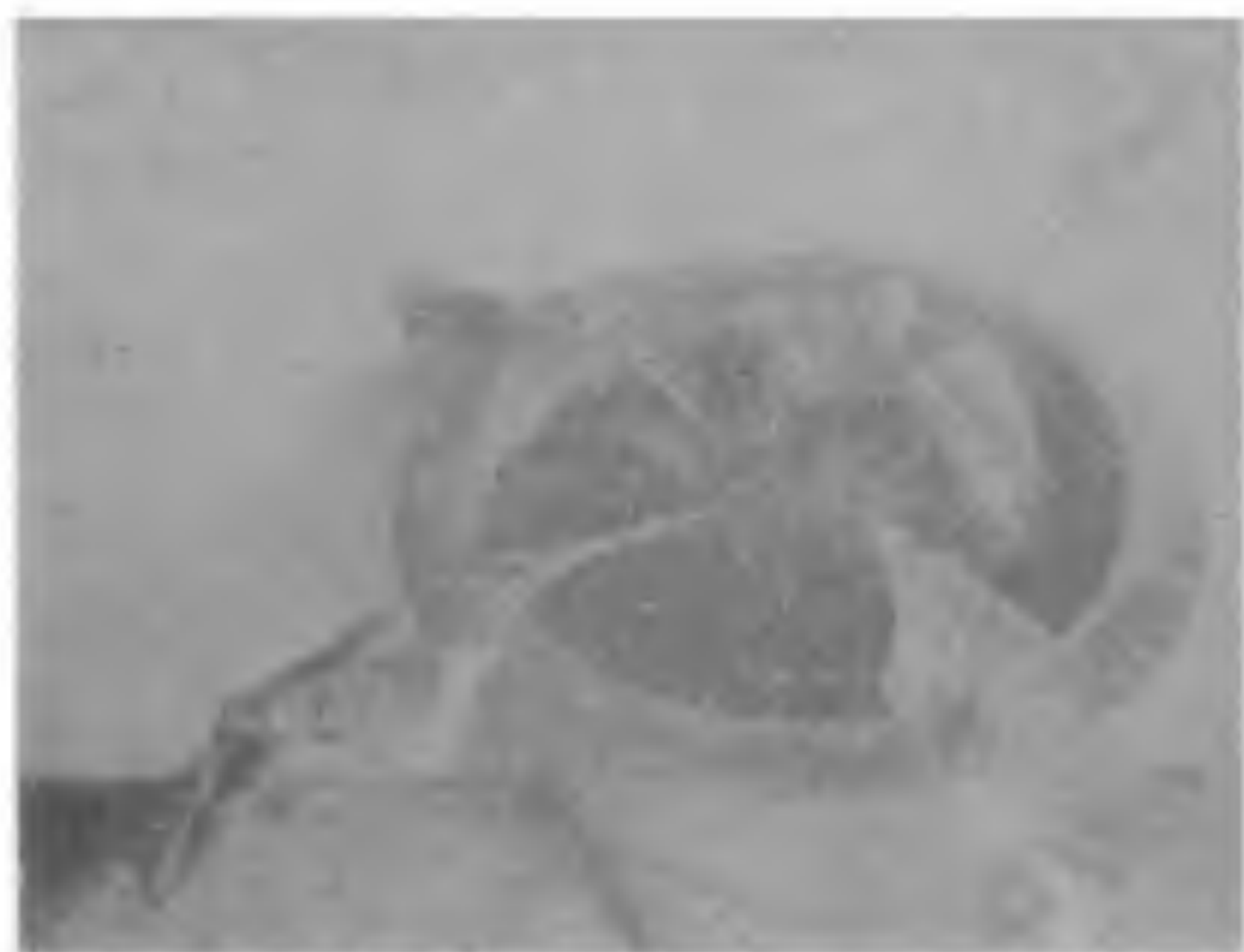


FIG. 1. Spinach leaf curl.

house after spraying with 0.05% rogor (Fig. 1). The disease is characterised by severe curling or rolling of the leaves with vein thickenings or the presence of long leafy enations on the veins on under-surface (Fig. 2). The plants are sparsely foliated and the leaves become thick and leathery.

As the symptoms were suggestive of white fly (*Bemisia tabaci* Gen.) transmitted viruses, transmission tests were conducted using healthy clones of *B. tabaci* maintained in the insectary and the disease was successfully transmitted to healthy spinach and tobacco seedlings raised in the glass house. The disease, however, could not be transmitted by mechanical sap inoculations using 600 mesh carborundum powder.

The insect transmission tests were conducted using microcages, feeding the white flies for 24 hours on diseased spinach leaves and then transferring them to leaves of healthy spinach and tobacco for an infection feeding of 24 hours. The insects were killed with 0.05% rogor after the infection feeding. The symptoms of leaf curl with enations appeared after 20-25 days.

The failure of the virus to be transmitted by mechanical sap inoculation and the successful transmission to tobacco with white flies producing characteristic symptoms of leaf curl with enations suggested that



FIG. 2. Spinach leaf showing enations on the under surface.