Table 1 *Effect of BAP and NAA on shoot-tip culture of Dolichos biflorus*

BAP (mg/l)	NAA (mg/l)	Growth response: Callus	Growth of shoot apex	Multiple shoots at nodal region	Rhizogenesis
—	—	—	+	—	++
—	2.0	++++	—	—	+
0.1	0.1	+	++	++	—
0.3	0.1	+	++++	++++	—
0.5	0.1	++	+++	+++	—
0.7	0.1	+++	++	++	—
1.0	0.1	++++	+	++	—
2.0	0.1	++++	—	—	—

—, No response; +, very poor; ++, poor; +++, good; ++++, excellent.

the base of shoot-tip explants failed to show any morphogenetic response in subcultures.

The present work indicates the regenerative potential of shoot tips, which can be exploited to get virus-free clones by micropropagation.

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HISTOGENESIS OF A MOTH GALL ON *TEPHROSIA PURPUREA* (L.) PERS. (FABACEAE)

P. JAYARAMAN

Department of Botany, Presidency College, Madras 600 005, India

THE stem galls, compared to the foliar galls, are usually simple in external form, but more complex internally. The higher level of structural complexity of the stem galls is due to involvement of more tissue types, especially, in certain cases, the vascular cambium, which is endowed with a high degree of histogenetic potential. Compared to the large number of stem galls so far recorded from India[1], only a few have been studied histologically[2,3]. The present paper deals with the histogenetic events in the formation of the stem gall on *Tephrosia purpurea* (L.) Pers. (Fabaceae) caused by a moth, *Dactylethra* *candida* (Staint)[3]. The growth of the gall involves bidirectional activity of a *de novo* meristem induced by the feeding activity of the moth.

The galls on *T. purpurea* occur mostly at the apices of young axes of axillary buds, sometimes of the main shoots, and rarely of the peduncle of the raceme. The number of galls per plant ranges from a few to more than twenty-five. Different developmental stages of the gall may be seen on a single plant. The mature galls are pyriform or flask-shaped (figure 1), greenish-pink or greenish-yellow, villous when young, glabrous or sparsely hairy at maturity. A fully grown gall, especially one from which the insect has escaped, is hollow, hard, and with a circular, fairly wide exit hole at the summit of the gall. Three or four consecutive internodes of a young shoot are involved in the formation of a gall and each gall measures approximately 1.2 cm in length and 8 mm in diameter. Malformed leaves persist on the gall (figure 1). The larval cavity is wide, single and axially oriented. The gall is somewhat circular in cross-sectional outline in contrast to the angular outline of normal stem (figures 3–5).

Examination of early stages of the gall indicates that the larva enters the young stem through the third or fourth internode of the shoot and reaches the pith, where it establishes a chamber by eating the

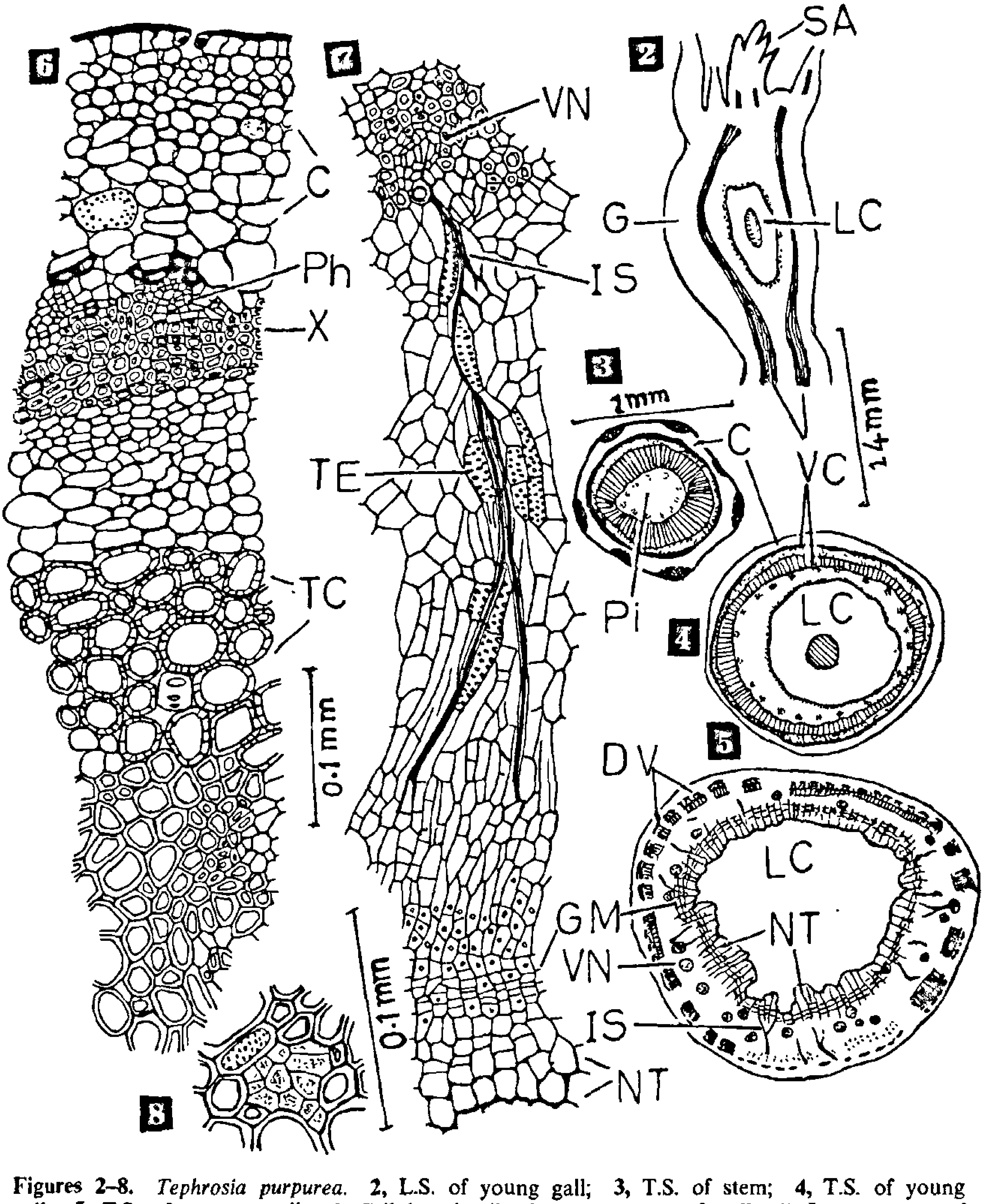
Figure 1. *Tephrosia purpurea.* A shoot bearing axillary bud galls, one of which shows a wide apical ostiole (os).

cells around itself (figures 2 and 4). The initial responses of the cells bordering the larval chamber are somewhat similar to the process of wound healing, and involve dilation of cells. Outer to this zone, a few layers of cells become meristematic. The cells of this meristem divide, mostly in the periclinal plane and occasionally in the anticlinal plane as well. Though this meristem is aetiologically a wound meristem, by the bidirectional activity and additive mode of growth, it simulates cork cambium or vascular cambium (figures 5 and 7). The centripetal derivatives of the meristem differentiate into large thin-walled cells serving as a nutritive source to the larva. The centrifugal derivatives actually contribute to the growth of the gall and form a broad zone. As the cells of this zone mature, they develop fairly thick walls with simple pits (figure 6). At several loci of this zone groups of cells differentiate into amphivasal type of vascular nodules in which a few phloem elements are ensheathed by tracheary elements of isodiametric shape (figure 8). These elements resemble the neighbouring parenchyma cells, because the ground parenchyma cells differentiate directly and metaplastically into xylem elements.

As soon as larval activity begins in the third or fourth internodal portion, the apical meristem of the affected shoot shows retarded growth, and internodal elongation is also reduced considerably, leading to condensation of the shoot system. The leaf primordia also do not attain the full stature of normal leaves (figure 1).

The vascular cambium of the axis ceases its activity soon after the onset of cecidogenesis. The vascular tissues formed up to then occur in the form of a narrow cylinder. Due to intrusion of the proliferating gall parenchyma, the vascular cylinder is cleaved into discontinuous sectors (figure 5). The xylem tissue has reduced dimensions of the elements and a low frequency of vessels compared to those of normal xylem tissue.

During growth of the gall, narrow radial strands of vascular elements differentiate from the parenchyma cells derived from the gall meristem. Each such strand evidently starts from the phloem elements of the amphivasal nodule or from the secondary phloem of the vascular cylinder (figures 5 and 7). They are simple or sometimes branched, and run into the nutritive tissue zone ending just outside the larval chamber. The central core of the strand contains cells with dark, amorphous substance and the ensheathing cells are short, pitted xylem elements (figure 7). Since these strands evidently



Figures 2–8. *Tephrosia purpurea.* **2,** L.S. of young gall; **3,** T.S. of stem; **4,** T.S. of young gall; **5,** T.S. of mature gall; **6,** Cellular detail of outer sector of gall; **7,** Inner sector of gall; **8,** Amphivasal nodule with central phloem surrounded by xylem. C, Cortex; DV, divided vascular cylinder; G, gall; GM, gall meristem; IS, irrigating strand; LC, larval chamber; NT, nutritive tissue; Pi, pith; Ph, phloem; SA, shoot apex; TC, thick-walled cells; TE, tracheary elements; VC, vascular cylinder; VN, vascular nodule; X, xylem.

drain off nutrients from the vascular tissues into the nutritive zone of the gall, they are referred to as irrigating strands (*fais ceux d'irrigation*) in cecidological literature[4]. After the larva develops into an adult moth, it escapes by biting a circular hole at the apex of the gall (figure 1). After the exit of the insect, the gall cavity may be occupied by ants, fungal mycelium, or other insects for shelter.

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OCCURRENCE OF THE NEW SPECIES *AZOSPIRILLUM HALOPRAEFERENS* IN ASSOCIATION WITH RICE ROOTS

A. BALASUBRAMANIAN and S. R. PRABHU
Department of Agricultural Microbiology, Agricultural College and Research Institute, Madurai 625 104, India

BACTERIA of the genus *Azospirillum* are widely distributed in the rhizosphere of tropical and subtropical grasses[1]. Association of *Azospirillum* with the roots of rice plants has been reported[2]. It is generally accepted that *Azospirillum* can enhance the growth of the plant[3]. Initially two species of *Azospirillum*, viz. *A. lipoferum* and *A. brasilense* were reported[4], to which a third species, *A. amazonense*, was added[5]. A fourth species, *A. halopraeferens*, which is characteristic for its high salt (3% NaCl) tolerance, has been reported[6]. The occurrence of a variant of *A. halopraeferens* associated with rice roots is reported here.

Roots of a local rice variety were collected from a rice soil of pH 8.0. Root bits (0.5 cm) from the washed root system were inoculated in nitrogen-free semi-solid malate medium[7]. Undulating subsurface pellicle formed on incubation was purified by three serial transfers into fresh semisolid medium. Each transfer was made at 48 h.

The isolate was gram-negative, highly motile and vibrioid. It can grow and fix nitrogen in presence of 5% NaCl in the N-free semisolid malate medium, but it is not obligately halophilic. The characteristics of *A. halopraeferens* listed by Reinhold *et al.*[6], except DNA base composition, were compared with our isolate (table 1). Photomigrographs of our isolate, *A. lipoferum* and *A. brasilense* are shown in figure 1.

Based on the observations, it is concluded that our isolate is a nutritional variant of *A. halopraeferens* reported by Reinhold *et al.*[6] This variant has been deposited in the culture bank of the Department of Agricultural Microbiology, Tamil Nadu Agricultural University.

With the occurrence of large areas of saline soils in the country and saline irrigation water, this highly

Table 1 *Characters of A. halopraeferens and present isolate*

Character	*A. halopraeferens*	Our isolate
Salt tolerance (NaCl)	3%	5%
Utilization of glucose	−	+
Utilization of sucrose	−	+
Acidification of peptone-based glucose broth	−	+

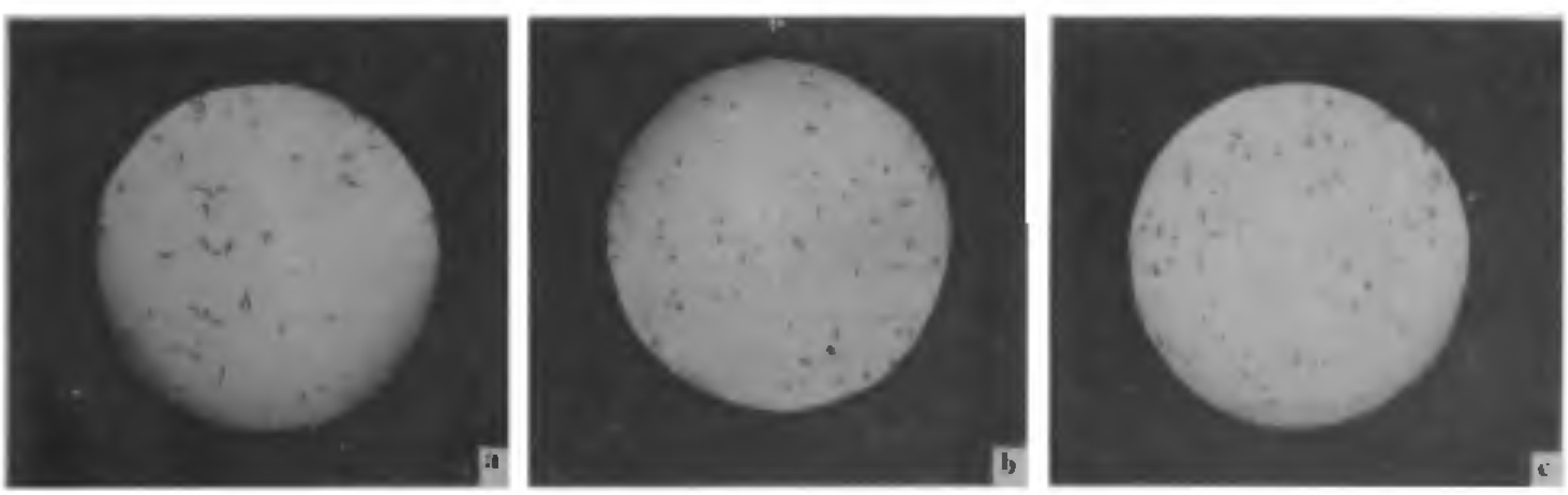

Figure 1. Photomicrographs of; **a**, *Azospirillum brasilense*; **b**, *A. lipoferum*; **c**, *A. halopraeferens*.