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Vascular Inter-Relationships in some *Solanaceae* Members

J. J. SHAH, and J. D. PATEL

Department of Botany, Sardar Patel University,
Vallabh Vidyanagar, Gujarat, India

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Abstract. Vascular inter-relationships between axillary bud, axillant leaf and axis have been studied in fives pecies of the *Solanaceae*, *Lycopersicon lycopersicum* (L.) KARSTEN, *Cestrum nocturnum* L., *Cestrum diurnum* L., *Withania somnifera* (L.) DUNAL, and *Datura innoxia* MILL. The phyllotaxy is alternate and the node is unilacunar with one or more leaf trace strands. The bud traces arise either from the trace of the subtending leaf or of the strands flanking the leaf gap. The vascular relationship between the bud, axillant leaf and main axis is discussed.

The vascular relationship between the axillary or lateral buds (branches) and the primary vascular system of the axis is an interesting field of study where there is need of more information (EZELARAB and DORMER 1963; SHAH and UNNIKRISHNAN 1968). EZELARAB and DORMER (1963) have described five basic types of vascular connections between the bud and the axis in the family *Ranunculaceae*. ESAU (1953) defines the leaf trace as a vascular bundle connecting the vascular system of the leaf with the stem and lacuna or leaf gap as a parenchymatous region in the vascular system of the stem, located adaxially from the diverging leaf trace. According to the number of lacunae present in the axial vasculature, nodes are mainly classified into three main types: unilacunar, trilacunar and multilacunar (ESAU 1953).

The information regarding the nature of bud trace connection in members of the family *Solanaceae* is meagre. With a preliminary intention to collect some data on this aspect, we selected five species of the family *Solanaceae*, *Lycopersicon lycopersicum* (L.) KARSTEN, *Cestrum nocturnum* L., *Cestrum diurnum* L., *Withania somnifera* (L.) DUNAL and *Datura innoxia* MILL. All have alternate phyllotaxy.

Material and Methods

The young nodes and internodes, just below the vegetative shoot apex, were collected and fixed in Aceto: Alcohol (JENSEN 1962). After one day, the material was transferred to 25 to 30% aqueous NaOH solution and kept in an oven at 48—50 °. The translucent material was transferred to aqueous

chloral hydrate solution and kept for one to four days at room temperature (26—30 °). Cleared shoots were washed in water and stained with dilute safranin. Ten to 15 samples for each species were dissected and observed under binocular stereo-microscope. The vascular patterns were traced for 4 to 5 nodes and internodes.

Results

Cestrum nocturnum

The number of primary vascular strands is 13. Four strands *i.e.*, the leaf traces of the immediate nodes above, appear prominent (1, 4, 7, and 10 in Fig. 1). At the fifth node, the strands 12 and 13 originate from the leaf trace strand, 1.

The two bud traces arise from the smaller strands flanking the leaf gap (BT_1 and BT_2 in Fig. 1). The node is unilacunar with a single leaf trace.

Cestrum diurnum

The node is unilacunar with a single leaf trace. Strands 7 and 8 fuse to form a common strand (Fig. 2). It traverses up to four nodes to become a leaf

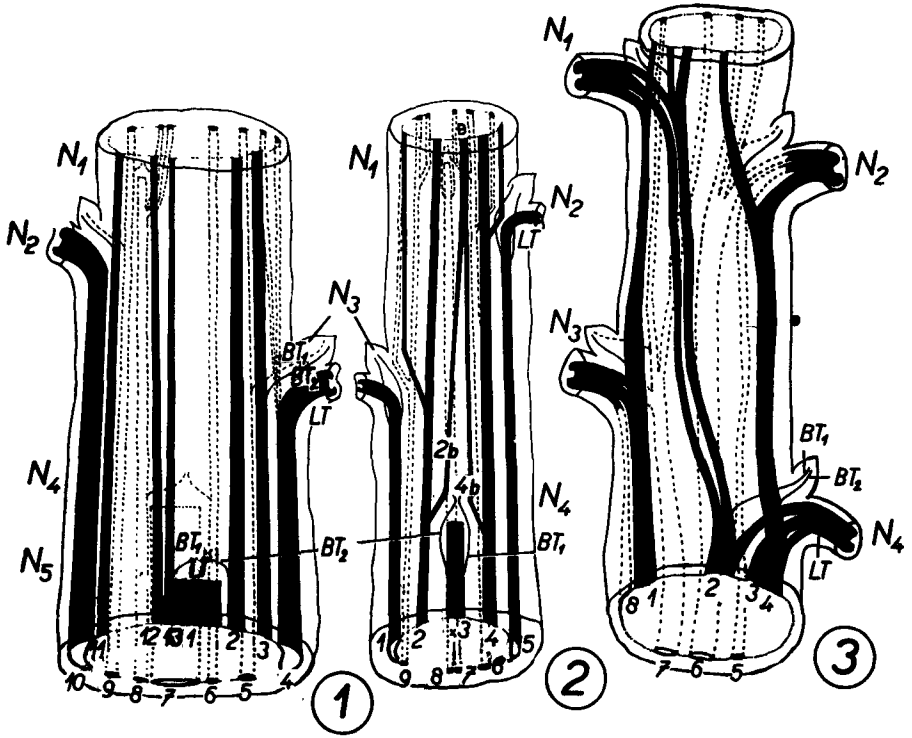

Fig. 1—3. Schematic representation of primary vasculature in *Solananceae* members. Fig. 1. *Cestrum nocturnum*; Fig. 2. *Cestrum diurnum*; Fig. 3. *Datura innoxia*.
2b, 4b, smaller strands; BT_1, BT_2, bud traces; LT, leaf trace; X, vascular strand; 1—13, primary vascular strands; N_1—N_5, one to five nodes.

trace. Strands 3, 1, 5, and X are conspicuous and they depart as leaf traces at the consecutive four nodes above (Fig. 2). Strands 2 and 4 give rise to narrow strands 2b and 4b which fuse to form a common strand B similar to that of a strand X. The two bud traces originate from the trace of the subtending leaf (Fig. 2).

Datura innoxia

Fig. 3 illustrates the axial vasculature. There are eight conspicuous primary vascular strands. The node is unilacunar with three trace condition. There are two basic patterns in which the three leaf trace strands originate. One occurs at every fourth node (N_1 and N_4) and the second, at successive two nodes (N_2 and N_3). The two bud traces originate from the vascular strands flanking the leaf gap. The bud trace arises from the vascular strand which arises from a strand having a common origin with the trace strand of the subtending leaf.

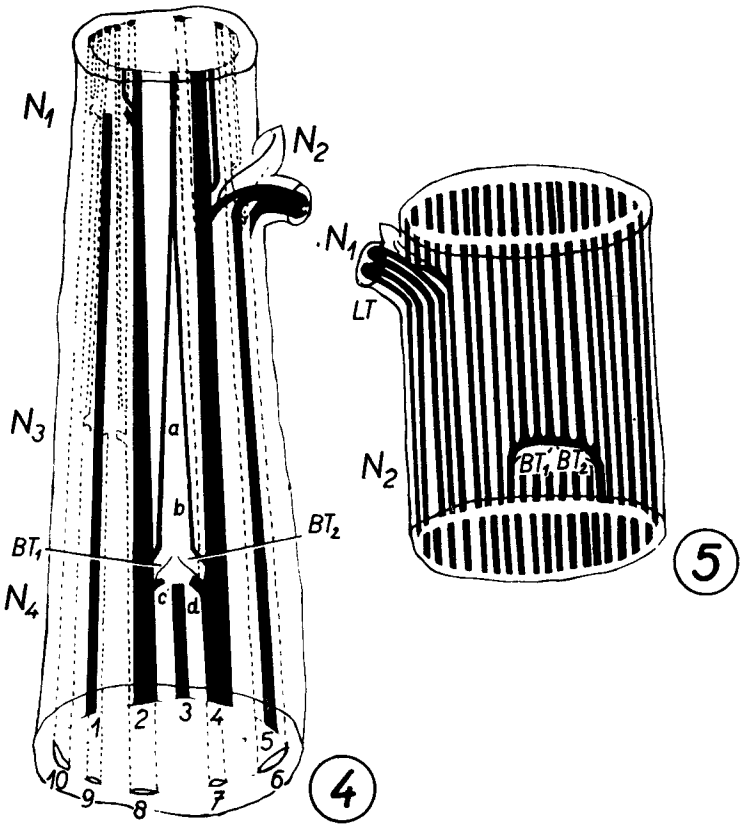

Fig. 4—5. Schematic representation of primary vasculature in Solanaceae members. Fig. 4. *Withania somnifera*; Fig. 5. *Lycopersicon lycopersicum*.
a, b, c, d smaller strands; BT_1, BT_2, bud traces; LT, leaf trace; 1—10, primary vascular strands: N_1—N_4, one to four nodes.

Withania somnifera

The number of primary vascular strands in the axis is 10 (Fig. 4). The node is unilacunar with three leaf trace strands. At N_4 the two bud traces (BT_1 and BT_2) arise from these strands (2 and 4) which also give rise to the lateral trace strands (c and d_1) of the subtending leaf (Fig. 4). The median trace strand of the leaf is independent and is formed by the fusion of two small strands (as a and b in Fig. 4). These smaller strands (a and b) arise as branches of the vascular strands which also give rise to the lateral leaf trace strands and bud traces at the node below.

Lycopersicon lycopersicum

There are many small vascular strands which form a ring of primary vasculature (Fig. 5). The limits of the vascular strands are difficult to distinguish; hence a continuous vascular ring is observed.The node is unilacunar with three or more leaf trace strands. The strands flanking the leaf gap fuse together. Many smaller strands arise from them.

The bud traces arise from the strands flanking the leaf gap.

Discussion

There are two axillary bud or branch traces in many dicotyledons. But one or more bud traces are also reported (ESAU 1965, EZELARAB and DORMER 1963, POULOSE 1968).

EZELARAB and DORMER (1963) suggest five patterns or conditions of the bud trace connection with the axial vasculature in the family *Ranunculaceae*. *Cestrum nocturnum*, *Datura innoxia* and *Lycopersicon lycopersicum* show unilacunar node. The normal condition of the bud trace connection is typified for a trilacunar node in the family *Ranunculaceae*. *Cestrum diurnum* shows Berberis condition. *Withania somnifera* does not fit into any of the categories of EZELARAB and DORMER (1963).

The relative plane of origin of the bud traces and of the leaf traces entering the region of insertion of the subtending leaf shows three conditions. The bud traces arise above the leaf trace as in *Datura innoxia*; below as in *Cestrum diurnum* or at the same level as in *Lycopersicon lycopersicum*, *Cestrum nocturnum* and *Withania somnifera*.

In *Syzygium cumini* (UNNIKRISHNAN 1967), *Clerodendrum splendens* (POULOSE 1968) and *Euphorbia tirucalli* (Thulasy 1968), the bud traces arise from the strands flanking the leaf gap. These strands do not divide at the node. In our studies, *Cestrum nocturnum* and *Datura innoxia* show similar condition. However these plants show varying nodal conditions.

In *Ocimum americanum* (UNNIKRISHNAN 1967), *Amaranthus tricolor*, *Thunbergia erecta* (POULOSE 1968), the bud traces arise from the strands flanking the leaf gap. But these strands branch at the node. The branches arise away from the leaf gap. We have not come across this type of condition.

In *Cuminum cyminum*, *Clerodendrum phlomidis*, *Mentha spicata*, (UNNIKRISHNAN 1967), *Leucas aspera*, *Anisomeles ovata* (SHAH and UNNIKRISHNAN 1968), *Clerodendrum inerme* (POULOSE 1968), the bud traces arise from the

strands of the subtending leaf. The strands flanking the leaf gap have branches oriented towards the side of the leaf gap. *Cestrum diurnum* and *Withania somnifera* show similar condition.

From the present study we conclude that the insertion of two axillary bud traces or branch traces is of two types. One arises from the traces of the axillant leaf trace, and the other arises from the strand flanking the gap of the axillant leaf.

The origin of the branch trace from the trace of the subtending leaf appears to be correlated with the branching of the flanking strands towards the leaf gap. This conclusion is based upon our studies in a large number of plants investigated in our laboratory. But we should mention that *Ipomoea carica* and *Ipomoea quamoclit* (THULASY 1968) do not confirm our observation.

The origin of the bud traces from the strands flanking the leaf gap appears to be correlated with either absence of branching of these strands or their branching oriented away from the subtending leaf.

Nodal condition do not affect the nature of bud trace connection with the axial vasculature.

Acknowledgement

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J. J. SHAH, J. D. PATEL, Botanický ústav, Sardar Patel University, Vallabh Vidyanagar, Gujarat, Indie: **Vzájemné vztahy cévních svazků u některých *Solanaceí*.** — Biol .Plant. **11** : 329 až 333, 1969.

Vztah mezi cévními svazky úžlabních pupenů podpůrného listu a hlavní osy byl studován u pěti *Solanaceí: Lycopersicon lycopersicum* (L.) KARSTEN, *Cestrum nocturnum* L., *Cestrum diurnum* L., *Withania somnifera* (L.) DUNAL a *Datura innoxia* MILL. Cévní svazky pupene vznikají buď z cévních svazků podpůrného listu nebo ze svazků osních, lakunárních. Je diskutována příbuznost cévních svazků pupene, podpůrného listu a osy.