

SHORT COMMUNICATION**MULTIPLE BUDS AND ADVENTITIOUS SHOOT FORMATION IN SUGARCANE****K. Chandran*, P. Mahesh and M. Nisha****Abstract**

Sugarcane, a complex polyploid propagated asexually through setts, generally has one bud at each node. Abnormal multiple buds are frequently observed in germplasm collection which are characterized by the presence of two or more buds at a single node. It is universally accepted that this trait is not genetically inherited. Yet another abnormality which yields multiple shoots at the nodes is adventitious shoot formation. Hormones or minor elements as the physiological cause, ontogenic modification, arresting of apical dominance and insect infestation are the plausible explanations for this phenomenon. In this communication, we report the presence of four independent buds in the progeny of a cross involving Co 62175 and appearance of adventitious shoots in some of the germplasm clones. The consistent occurrence of adventitious shoot formation in a limited number of clones even after 10 cycles of vegetative propagation indicated some relation to the genetic makeup of the clones.

Key words: *Sugarcane, germplasm, multiple buds, adventitious shoots*

Introduction

Sugarcane is a vegetatively propagated crop and the cut pieces of stem used for propagation are called setts. The setts from immature canes or immature top portions are reported to sprout better than mature bottom portions (Van Dillewijn 1952). At every node

the stem bears an axillary bud and the root band, where the root primordia are located. Generally a single bud is found to occur at every node. Buds are sometimes absent in the top portion and less frequently in the basal part. Barber (1918) reported cane altogether devoid of buds. Sugarcane seedlings without buds were also reported from The Philippines (Mercado 1928). The heritability of multiple bud formation was of a matter of inquisitiveness to the scientists considering its potential as planting material. Formation of double buds is the most frequently observed condition. Double buds may occur in the form of twin buds enclosed by a common bud scale (Jeswiet 1916 *cf* Van Dillewijn 1952) or they may be as a separate entity as observed in NCO 351 at field gene bank, SBIRC, Kannur. Zerban (1909) reported a stalk with each node bearing two buds diametrically opposite and that were alternately arranged at right angles in successive internodes. This kind of decussate arrangement was also reported from Hawaii (Lyon 1910; Martin 1932). Barber (1918) and Jeswiet (1916) reported the presence of double buds leading to the dichotomous splitting of the stem. The setts with multiple buds produce more primary tillers than the normal buds. Mercado (1928) reported that the multiple eyed condition reduced after the first propagation. Jeswiet (1916) reported that the triple buds were of common occurrence and even after four years of propagation the characteristics were found to persist in the clone. Four independent buds in a row were observed in a progeny of cross involving Co 62175 at the Regional Centre of Sugarcane Breeding Institute, Kannur (Fig. 1) and all of them germinated when planted in pots. In this rare occurrence, all other nodes showed only single buds. Raghavan (1951) reported the occurrence of two to four buds per node in a cane seedling. He studied the subsequent generation of the canes

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Fig. 1. Multiple buds in a seedling of cross involving Co62175

having the abnormality and found that this trait was not carried to their next generation and hence confirmed that it was not a genetically inherited trait. He attributed some physiological causes involving hormones or minor elements for this kind of abnormality. He also reported that only one out of the four buds germinated to produce shoots but our observation showed that all the four buds germinated in to shoots. The multiple bud formation is referred to as non-genetical by many authors, where as Jeswiet (1916) reported the appearance of this trait even after four cycles of vegetative propagation exhibiting some genotypic relationship. Thakur (1952) observed multiple buds in two hybrids, i.e. five buds in Pusa hybrid (X 4668) and 3-4 buds in Co 435 and cited ontogenic modification as an explanation for this phenomenon. He observed that when the apical dominance is halted due to any



Fig. 2. Adventitious shoots and normal bud in H 52-246

reason, the primary meristematic cells protrude out at more than one places, lower down the cane. This results in the development of multiple buds. The study of Sharma (1955) showed that many of the 69 canes from 24 varieties with multiple buds were injured by insects at the adjoining part, while some of them did not show any detectable damage. Some varieties had more number of canes with multiple buds indicating a varietal propensity towards such malformations.

Adventitious shoot formation is yet another abnormality which yields more shoots at nodes. It is a mimic of *in vitro* rapid multiplication under natural conditions without any supply of growth regulators. Adventitious shoot formation is very frequently observed in germplasm collection. Even after 10 cycles of propagation this character was conserved in some clones (H 52-246 and PT 46-1003B). The other clones that showed the development of adventitious shoots are POJ 2747, CP 57-27, Co 529, Co 989, WL 07-756, WL 07-752 and WL 07-835. The adventitious shoots were always found initiated away from the normal buds and grew on either side to partially or fully encircle the nodes; the normal buds were also found active at the node (Fig. 2). Even three or four nodes in the same cane were found to show adventitious shoot formation (Fig. 3). The separated shoots/shoot clumps could be rooted by planting in moist potting mixture maintaining adequate moisture.



Fig. 3. Adventitious shoots in PT 46-1003B

The first report of the adventitious shoot formation was by Kamerling in 1900 (*cf* Van Dillewijn 1952) as a malformation. Subsequently many reports from Hawaii (Lyon 1913, 1926, 1927; Martin 1932, 1938a) described similar malformations. Scientists were more curious about this abnormality as they speculated it as a symptom of a new disease (Faris 1929). Martin (1938a) proved that the multiple shoot formation is not a disease, by inoculating the extract from galls into a healthy stem. The second view was that the galls are formed as a result of insect feeding on the stalk (Martin 1938b). The macerated leaf hoppers extract when inoculated to the stem resulted in the formation of gall which later produced adventitious shoots. Similar results were obtained by injecting growth regulating substances and the same substance when applied to leaves produced galls and roots. The adventitious shoots produced thus differ from each other and from the mother cane (Anonymous 1944 *cf* Van Dillewijn 1952). Khan *et al.* (1956) observed nodal galls in three of the

four varieties developed as a result of the attack of a microlepidopterous moth. Sharma (1953) studied the development of leafy shoots from the apex of six varieties of sugarcane and concluded that it was the result of a series of interactions with environmental and physiological process within the cane.

The present report on the occurrence of adventitious shoot formation, consistently in a limited number of clones even after 10 cycles of vegetative propagation, indicated some relation to the genetic makeup of the clones. The pedigree of the clones showing this abnormality revealed that in most of the cases the POJ series clones, *viz.* POJ 100, POJ 2725, POJ 2628 or POJ 2878 were involved in their parentage (Table 1). Probably these clones are most vulnerable to insect attack leading to the development of galls that proliferate in to shoots, as the apical dominance is halted.

Table 1. Pedigree of the clones showing adventitious shoot formation

| Sl. No. | Clone | Parentage |
|---------|------------|---|
| 1 | H52-246 | Not Available |
| 2 | EPC 37-247 | Not Available |
| 3 | PT 1003B | POJ 2725 {POJ 2364(POJ 100x Kassoer) x EK28 (EK2 (Lahaina x FIJI) x POJ 100)} X Sinocalamus |
| 4 | POJ 2747 | Lahaina x POJ 2628 |
| 5 | CP57-27 | Not Available |
| 6 | Co 529 | Co 213 (POJ 213x Kansar) X Co 508 {Co 214 x Co 214 ((Striped mauritius x (Sareetha x <i>S. spontaneum</i>))} |
| 7 | Co 989 | Co 475 X SG 63/32 (POJ 2725 x Imperata) |
| 8 | WL 07-756 | WL 04-95 X Co 96011 {Co 62175(Co 951 x Co 419 (POJ 2878 x Co 290)) x Co 1148} |
| 9 | WL 07-752 | WL 04-95 X Co 96011 {Co 62175(Co 951 x Co 419 (POJ 2878 x Co 290)) x Co 1148} |
| 10 | WL 07-835 | WL 04-95 X Co 96011 {Co 62175(Co 951 x Co 419 (POJ 2878 x Co 290)) x Co 1148} |

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