Cell and Tissue Development in One and Two Year Old Culms of *Arundo donax L.*

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Previous *Arundo donax* research investigated clarinet reeds selected by professional clarinetists from the woodwind reed market. Cell and tissue characteristics compared between usable and non-usable reeds showed the eight significantly important characteristics were growth related while one was directly related to position within the culm internode.

One year old Arundo culms were collected from growth bins of Christy Woods Greenhouse at Ball State University. Culm sections, measuring approximately one inch, were cut, treated, and processed for sectioning and examination. The material contained thin walled cells and tissues of young plant material. Secondary walls were absent from parenchyma cells and tissues. Fiber cells and vascular bundle tissues were at an early stage of growth development. Meristematic cells were abundant.

Two year old California grown Arundo culms that had been harvested and cured in preparation for the manufacture of clarinet reeds were marked with identifying codes and processed for sectioning. Cross section pieces were removed from each internode at three locations and labeled as to culm position, culm quadrant, and culm internode. Culm positions were: (a) bud end of the internode, (b) middle of the internode, and (c) directly below the bud area of the upper internode. Culm quadrants were: (1) the quarter of stem with bud origination centered, (2) ninety degrees clockwise from quadrant one, (3) one hundred eighty degrees clockwise from quadrant one, and (4) two hundred seventy degrees clockwise from one. Culm internodes were numbered starting from the ground (one) and progressing up the culm in numerical sequence to the plume.

Example identifying code: 4 C II 6 a 3 (4 = culm; C = California Arundo; II = number of growth years; 6 = internode; a = culm position within internode; 3 = quadrant within internode).

Microscope slides of selected cross sections were prepared with chemical treatment, embedded in paraplast for sectioning, microscopically examined, and photographed. Information found was compared with the results of prior Arundo studies of material submitted by professional clarinetists. A list of comparative results follows as listed:

Meristematic Cells/Tissues

California Arundo (2 year) — meristematic cells found: in areas from center culm edge towards center; within the middle area of the culm walls; and next to epidermis and toward center of the culm walls.

Clarinet Reed Arundo — no meristematic cells founds.

Cell and Tissue Growth Development

California Arundo (2 year) — parenchyma: uneven sizes and unsymmetrical; absence of secondary walls and intercellular spaces within parenchyma; thin fiber cell walls and incomplete fiber rings around vascular bundles; thin walled cells between the band of fiber and epidermis; and irregular thicknesses in the band of fiber.

Clarinet Reed Arundo — parenchyma: uniform and symmetrical; secondary walls and intercellular spaces within parenchyma; thick and well formed fiber cell walls within fiber ring surrounding vascular bundles; thick walled cells between the band of fiber and epidermis; and regularity of thicknesses in the band of fiber.

Irregularity of Cell Size/Placement

California Arundo (2 years) — stress movement shown in parenchyma by atypical cell shapes suggesting a flow of uneven tensions within the culm; large, thin walled parenchyma interpersed with one row of smaller and thicker walled parenchyma between epidermis and the band of fiber; incompletely formed fiber ring around vascular bundles; and mitosis of vascular bundles throughout culm.

Clarinet Reed Arundo — typical cell shapes without stress deformities; cells are approximately equal in size in the area between epidermis and the band of fiber, with at least two rows of small thick walled cells next to the epidermis; vascular bundles with completely formed fiber rings; and no mitosis of vascular bundles.

Conclusions and Recommendations

1. Clarinet reed blanks should be cut from the Arundo culm with the blade tip oriented toward the center (position b).

2. Clarinet reed blanks cut from position (c), quadrant 3 contain undesirable cell and tissue formation — gnarling and twisting of vascular bundles as well as irregular growth patterns in cells/tissues.

3. The incompleteness in growth development as indicated by the internal cell and tissue structures of two year old California Arundo implies an acceleration of disintegration of the material which suggests unstableness as well as a short period of usefulness for use as clarinet reeds.

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