

Report of the Nomenclature Workgroup from ISRR V, Reprise

Richard Zobel¹ and Yoav Waisel²

¹USDA-ARS Appalachian Farming Systems Research Center, 1224 Airport Rd, Beaver, WV 25813, USA.

²Tel Aviv University (retired)

Contact: Richard Zobel, rich.zobel@ars.usda.gov

ABSTRACT

The International Society for Root Research (ISRR) held a workshop on root nomenclature during the 5th Symposium at Clemson University, but the report has never been published. With the increasing emphasis on modeling root growth and development, it is appropriate to revisit that report. The report defined four types of root: Tap Root, Lateral Root, Basal Root, and Shoot Borne Root. To summarize the report: the tap root is the extended radicle or its replacement (in some species, e.g. maize (*Zea mays* (L.)), this can be a seminal root which replaces the radicle); a basal root is a root originating from the hypocotyl or mesocotyl (i.e. seminal roots other than the tap root); a shoot borne root is a root originating from shoot tissues (stem, petiole, leaf, etc.); and a lateral root is a root originating from another root. The rationale for these definitions as well as decisions on nomenclature for lateral roots of different orders, and definitions of "fine root" will be presented.

KEYWORDS: Nomenclature, Tap Root, Basal Root, Shoot Borne Root, Lateral Root

INTRODUCTION

Since man discovered plant roots, he has attempted to describe them to others by giving them descriptive names, by their site of origin (e.g. shoot borne; lateral; seminal), by their apparent morphological function (buttress; tap), their presumed physiological function (feeder), and anatomical site of origin (endogenous or lateral; exogenous or adventitious), just to name a few. There have been suggestions for common root nomenclature (see, for instance: Sutton and Tinus, 1983; Klepper, 1987; Zobel, 1989; Gregory, 2007), but there has, as of yet, been no commonly adopted nomenclature.

The International Society for Root Research decided to rectify a portion of this by holding a workshop on root nomenclature to come to a consensus on at least a portion of the roots in a root system. On During the Fifth International Society for Root Research Symposium, held at Clemson University (July 14 – 18, 1996), a workshop on root nomenclature was held (July 16, 1996). Ten international scientists attended this workshop and discussed two issues: 1) nomenclature for root measurement, and 2) nomenclature of root taxonomy. The conclusions from this workshop were published as a webpage for 5 years (<http://www.rhizo.ars.usda.gov/ISRR/nomenclature/>), until the web-server was shut down by a reorganization within the USDA-ARS. What follows is a version of that webpage:

WORKSHOP DECISIONS

After extended discussion on the subject of root measurement nomenclature, the general consensus was to rely on SI units and the requirements of the respective societies to which publications are submitted. It was felt that those interested in roots should, however, use root/shoot ratio, as opposed to shoot/root ratio. There was some discussion of the lack of real meaning of these ratios, and it was suggested that the allometric relationship be used (i.e. the log of root weight plotted against the log of total plant weight). On the subject of root diameters, the

consensus was to use Böhm's (1979) list of diameter classes (Table 1) as the most appropriate nomenclature for the present.

The bulk of the discussion centered on root taxonomic nomenclature.

1. Shoot borne roots - Dr. Kutschera, through Monike Sobotik, suggested that a term other than adventitious be used to identify shoot borne roots. In general the term adventitious refers to roots originating from non-meristem tissues, and such roots can originate from shoot or root tissues. The term "shoot borne" was chosen to describe all roots being derived from shoot tissues or organs.
2. Tap root - The first root to emerge from the seed and grow downwards is to be called the "tap root". This term to be applied to the radicle or its replacement roots, whether they are a seminal root or a lateral branch that take over the role of the tap root after damage to the original tap root.
3. Basal roots - After some discussion and a detailed description and review of the literature by Rich Zobel, the term "basal root" was chosen for roots originating from the hypocotyl (or mesocotyl, i.e. seminal roots).
4. Lateral roots - The term "lateral root" was accepted for any root branching from another root. To assist in describing the precise relationship of the lateral roots, branches off the three primary types of root should be called "first order laterals", branches from these first order laterals are then second order, etc. The full description of a specific first order lateral would be "tap root first order lateral" or "first order lateral of the tap root", or "first order basal root lateral", etc.

Figure 1 shows three of these root classes on both a dicotyledonous plant (soybean) and a monocotyledonous plant (wheat) grown hydroponically. Figure 2 shows shoot borne roots and their laterals on a perennial ryegrass plant excavated from a pot of soil.

LITERATURE CITED

- Böhm, W. 1979. *Methods of Studying Root Systems*. Springer-Verlag. Berlin. p. 188.
- Gregory, P.J. 2006. *Plant Roots; Growth, activity and interaction with soils*. Blackwell. Oxford. pp. 318.
- Klepper, B. 1987. Origin, branching and distribution of root systems. p. 103. IN: Eds. Gregory, P.J. Lake, J.V. and D.A. Rose. *Root Development and Function*. Cambridge University Press. Cambridge.
- Sutton, R.F., and R.W. Tinus. 1983. *Root and Root System Terminology*. Forest Science Monograph 24. Society of American of Foresters. Bethesda. pp 137.
- Zobel, R.W. 1989. Root growth and development. p. 61. IN: eds: Keister, D.L. and P.B. Cregan. *The Rhizosphere and Plant Growth*. Beltsville Symposium 14. Kluwer. Dordrecht.

Table 1 Böhm's root classification by diameter (mm).

Very Fine	Fine	Small	Medium	Large	Very Large
$x < 0.5$	$0.5 < x < 2.0$	$2 < x < 5$	$5 < x < 10$	$10 < x < 20$	$x > 20$

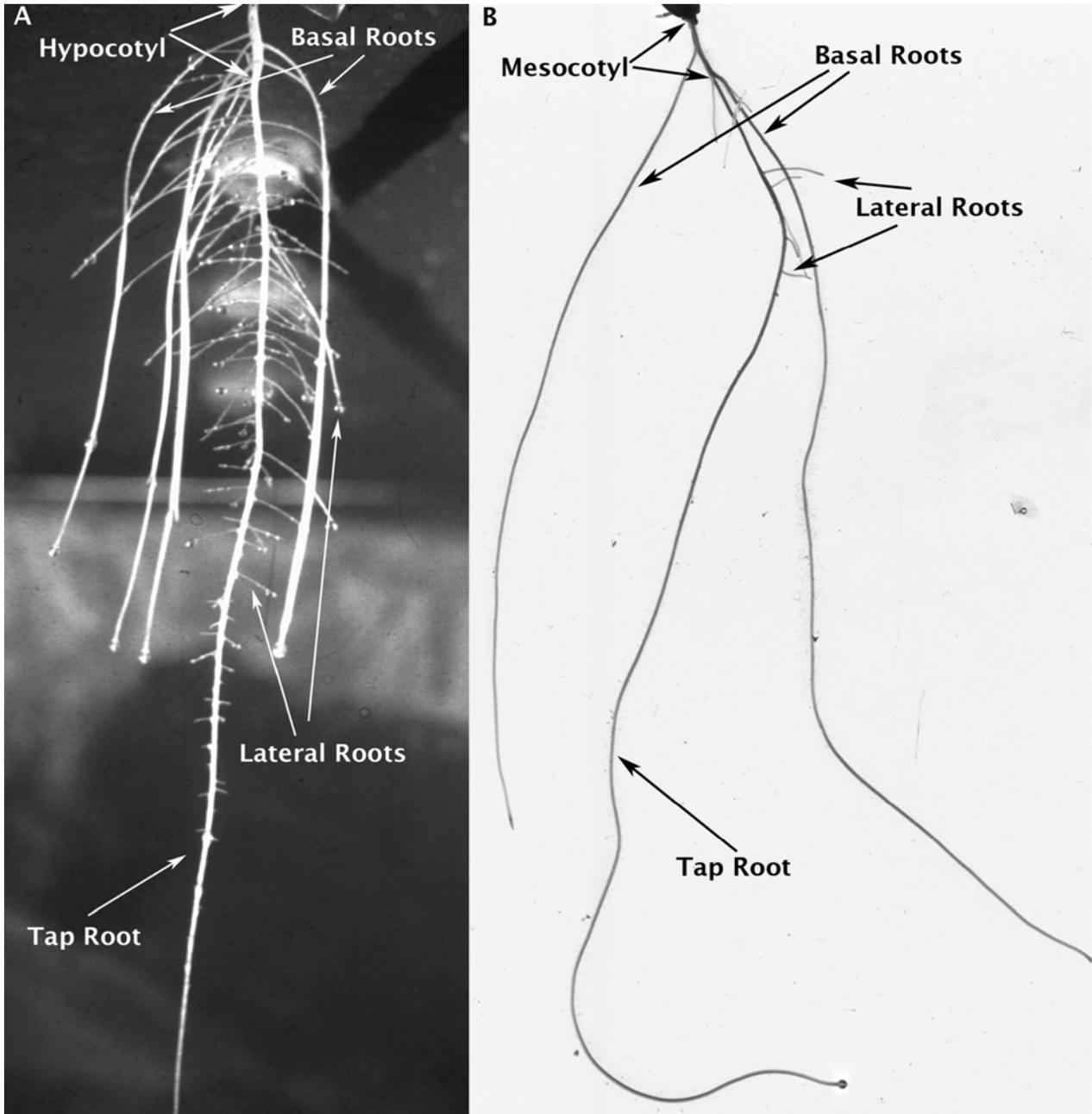


Figure 1. Demonstration of Tap, Basal, and Lateral roots in monocot and dicot seedlings. Image A is a soybean seedling (cv. Corsoy), and image B is a wheat seedling (cv. Scout). Plants were grown in hydroponic conditions.

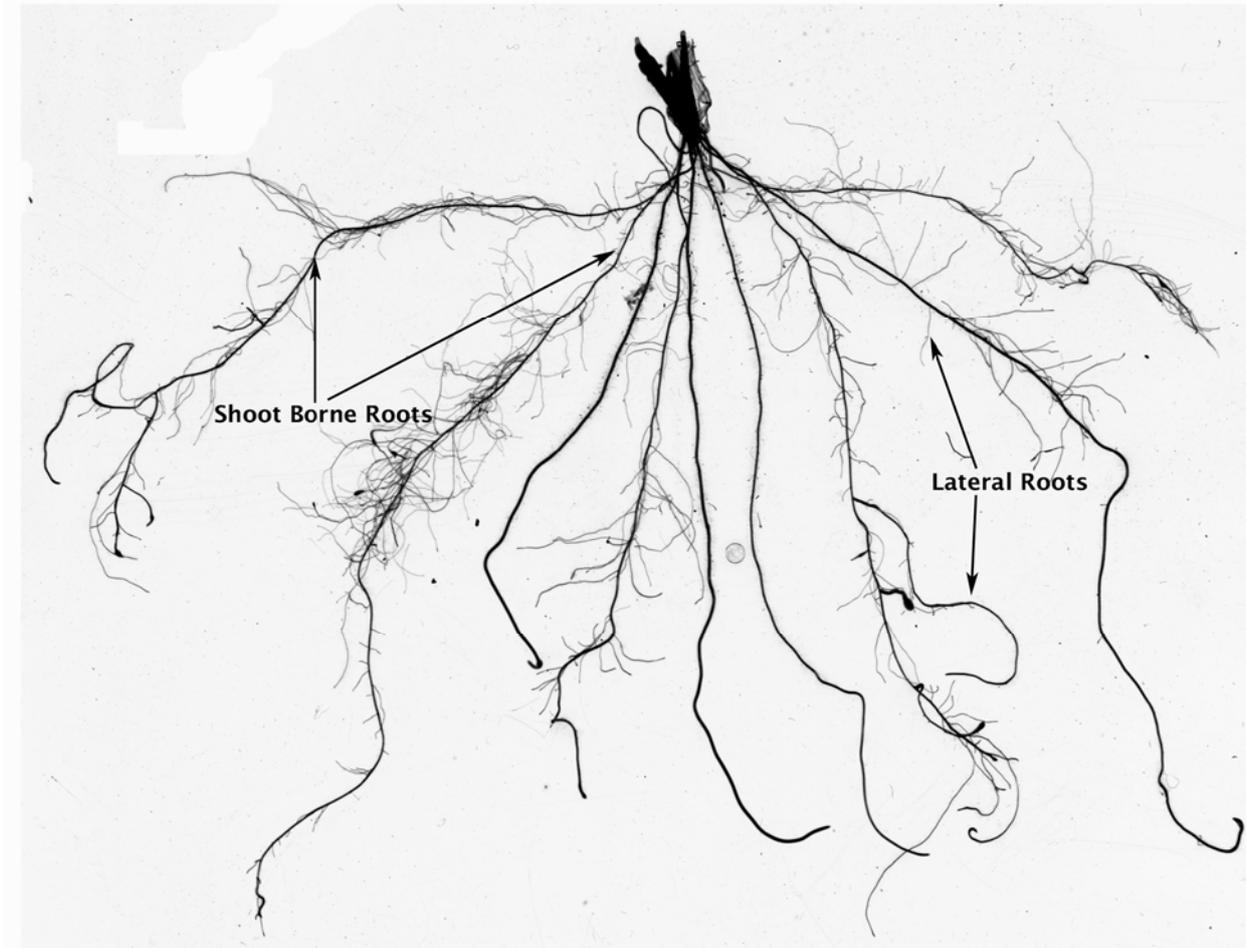


Figure 2. Ryegrass (cv. BG34) plant root system excavated from soil at the 5-tiller stage of development. Shoot borne and lateral roots are shown. Younger shoot borne roots are just developing lateral roots.