Expanded Application of Dendrochronology Collections: Collect and Save Exudates

Author(s): Jorge A. Santiago-Blay, Joseph B. Lambert, and Pearce Paul Creasman
Source: Tree-Ring Research, 67(1):67-68. 2011.
Published By: Tree-Ring Society
DOI: 10.3959/2010-7.1
URL: http://www.bioone.org/doi/full/10.3959/2010-7.1

TREE-RING RESEARCH, *Vol. 67(1), 2011, pp. 67–68*

SCIENTIFIC ADVISORY

EXPANDED APPLICATION OF DENDROCHRONOLOGY COLLECTIONS: COLLECT AND SAVE EXUDATES

JORGE A. SANTIAGO-BLAY[1]*, JOSEPH B. LAMBERT[2,3], and PEARCE PAUL CREASMAN[4]*

[1]Department of Paleobiology, MRC-121, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013-7012, USA

[2]Department of Chemistry, Trinity University, San Antonio, TX 78212, USA

[3]Department of Chemistry, Northwestern University, Evanston, IL 60208, USA

[4]Laboratory of Tree-Ring Research, University of Arizona, Tucson, AZ 85721-0058, USA

The ever-growing collections of dendrochronologists and the laboratories in which they work present numerous opportunities for research, as demonstrated within the pages of *Tree Ring Research*. The nature of tree-ring studies, especially chronology building, often calls for the collection of a large volume of specimens and long-term curation (see Stokes and Smiley 1968; Baillie 1982). For a variety of reasons, most such specimens appear to be used only for the application for which they were initially collected. However, there are many opportunities to expand the utility of dendrochronology collections (*e.g.* Eckstein and Schweingruber 2009; Haneca *et al.* 2009); one such example is presented here.

Plant exudates, including resins, gums, gum resins, and kinos, are ubiquitous in the plant kingdom and have had numerous uses in human civilization (*e.g.* adhesives, foods and beverages, medicines, jewelry). These materials are often found on dendrochronology tools, particularly in increment borers, or drill bits, and on specimens retained in tree-ring laboratories worldwide. During the preparation process for many dendrochronological applications, exudates are discarded. Such materials can be, and have been, put to scientific use.

Numerous techniques for the chemical analyses of plant exudates have been applied for over a century, each with advantages and disadvantages (Lambert *et al.* 2008). For instance, although gas chromatography followed by mass spectrometry (GC/MS) can identify individual molecules even at very low concentrations, the technique does not characterize the bulk of the sample. Molecular identification by GC/MS can depend on solubility, chromatographic separation, thermal properties during pyrolytic procedures, and other factors. However, nuclear magnetic resonance spectroscopy (NMR) of the unprocessed solid provides direct characterization of the bulk exudate. In recognition of this utility, for more than a decade a worldwide NMR chemical library of plant exudates has been in development (see Lambert *et al.* (2009) for an example of the plant family Fabaceae or Leguminosae).

By using NMR, it has been possible to characterize hundreds of exudate-producing plants (mostly trees) in numerous families of vascular plants (Lambert *et al.*, in press). Importantly, NMR does not alter the chemical makeup of the sample, allowing the analyzed material to serve as unadulterated voucher specimens. Many readers of this journal will be familiar with at least one such exudate, a resin, whose fossilized form, amber, is a highly coveted material used in jewelry for thousands of years, and it preserves organisms exquisitely (*e.g.* Beck 2003; Santiago-Blay and Lambert 2007).

This research is important because NMR patterns, particularly for resins, can reveal the botanical provenance of the exudate sample at the family and, in some cases, genus level. Such

*Corresponding authors: BLAYJ@si.edu; pcreasman@ltrr.arizona.edu

research can complement efforts to reconstruct ancient forests and sometimes reveals interesting taxonomic patterns (Lambert *et al.* 2009). With a sufficiently large database, it is possible to identify the likely botanical provenance of archaeological specimens. Related research regarding other resin forms, such as tar and pitch, has proven exceptionally useful in reconstructing cultural practices related to shipbuilding, preparation of transport amphorae, and sourcing of a variety of archaeological materials (*e.g.* Loewen 2005; Carlson 2003).

Dendrochronologists can contribute to this project with little effort and no impediment to their own work or specimens. Collecting bulk exudates is simple. Typically, a minimum of 100 mg (or about the size of the eraser on a new pencil) is needed. Carefully collect the exudate or scrape it from the surface of the tree/specimen, and place the sample in a plastic zippered bag or in a small envelope (Santiago-Blay and Lambert 2010a, 2010b). Add standard collection data (at least: date or range if known, location collected, botanical identification, whether collected live, remnant, or archaeological) with pencil on paper to accompany the specimen. Do not write directly on the specimens. Samples should not be exposed to solvents, glues or lubricants in the field or lab (*e.g.* WD-40®, Elmers®, *etc.*).

Specimens can be forwarded to either Jorge Santiago-Blay or Pearce Paul Creasman. All contributions will be greatly appreciated and appropriately acknowledged. If recognition of a permitting or supporting institution or funding agency is desired, please include such data on the label.

REFERENCES CITED

Baillie, M. G. L., 1982. *Tree-Ring Dating and Archaeology*. The University of Chicago Press, Chicago.

Beck, C. W., 2003. *Amber in Archaeology: Proceedings of the Fourth International Conference of Amber in Archaeology, Talsi 2001*. Institute of the History of Latvia, Riga.

Carlson, D. N., 2003. The Classical Greek shipwreck at Tektaş Burnu, Turkey. *American Journal of Archaeology* 107(4): 581–600.

Eckstein, D., and F. Schweingruber, 2009. Dendrochronologia–A mirror for 25 years of tree-ring research and a sensor for promising topics. *Dendrochronologia* 27(1):7–13.

Haneca, K., K. Čufar, and H. Beeckman, 2009. Oaks, tree-rings and wooden cultural heritage: A review of the main characteristics and applications of oak dendrochronology in Europe. *Journal of Archaeological Science* 36:1–11.

Lambert, J. B., J. A. Santiago-Blay, and K. B. Anderson, 2008. Chemical signatures of fossilized resins and recent plant exudates, Mini review. *Angewandte Chemie (International Edition)* 47:9608–9616.

Lambert, J. B., E. R. Heckenbach, A. E. Hurtley, Y. Wu, and J. A. Santiago-Blay, 2009. Nuclear magnetic resonance spectroscopic characterization of legume exudates. *Journal of Natural Products* 72:1028–1035.

Lambert, J. B., E. A. Heckenbach, Y. Wu, and J. A. Santiago-Blay, in press. Characterization of plant exudates by principal component and cluster analysis with nuclear magnetic resonance variables. *Journal of Natural Products*.

Loewen, B., 2005. Resinous paying materials in the French Atlantic, AD 1500–1800. History, technology, substances. *International Journal of Nautical Archaeology* 34(2):238–252.

Santiago-Blay, J. A., and J. B. Lambert, 2007. Amber's botanical origins uncovered. *American Scientist* 95:150–157.

Santiago-Blay, J. A., and J. B. Lambert, 2010a. Legumes and their exudates. *Aridus (Bulletin of the Desert Legume Program of the Boyce Thompson Southwestern Arboretum and the University of Arizona)* 22(1):1 (cover), 4, 6.

Santiago-Blay, J. A., and J. B. Lambert, 2010b. Desert plants and their exudates. *Desert Plants* 26(1):1 (cover), 3–8.

Stokes, M. A., and T. L. Smiley, 1968. *An Introduction to Tree-Ring Dating*. University of Chicago Press, Chicago.

Received 10 September 2010; accepted 20 October 2010.