NRC chemists develop new tool for Identification of plants

Michael Granat prélève une petite branche de cyprès jaune dans la serre du LRP pour trouver, avec le Dr von Rudloff, à quelle époque de l'année la composition des essences reste constante.

Analyses of conifers growing in the PRL greenhouse enabled Dr. Ernst von Rudloff to determine the dormant period during which composition of volatile leaf oils remains constant. Here Michael Granat snips off a twig of yellow cedar for analysis.

"That which we call a rose by any other name would smell as sweet," said the poet.

"That may be fine for you," said the scientist, "but for my business we'll have to do better than that."

And so about 200 years ago scientists began systematically naming plants by families, species and varieties according to related physical characteristics or morphology. The idea was basically sound but the task was formidable.

For two centuries specialists depended upon myriads of painstakingly astute observations and agreement among themselves to establish internationally recognized names for plants. Biologists, biochemists, horticulturalists and amateur gardeners all benefit from this monumental accomplishment without contributing any more effort than looking up the desired name in a published reference. Finally, in the 1960's some promise of assistance was offered to lighten the load of plant taxonomists.

Today 350,000 plants are classified by botanists who specialize in morphological identification. The majority of taxonomical assignments are clear-cut but enough areas of uncertainty remain to warrant a helping hand. The first real advance since the well-trained eye is in the form of independent chemical analysis. It is called chemotaxonomy or the chemosystematic study of plants, and the National Research Council of Canada is helping to pioneer the new approach.

Dr. Ernst von Rudloff, an organic chemist at the Prairie Regional Laboratory in Saskatoon, has spent much of the last decade helping to develop this new method of analysis. He explains that chemotaxonomy is the study of characteristic chemical compounds in plants with an effort being made to correlate plant species by the type of compounds they accumulate. It is based on the assumption that plant constituents are just as much subject to genetic control as are the morphological characters. In other words, physically related plants may produce related patterns of chemical compounds. Analyses of these compounds should strengthen long-standing taxonomical classifications and may clarify cases in which morphological characters are too indistinct for classical taxonomists to make satisfactory indentifications.

"An early pioneer of chemotaxonomy is Prof. H. Erdtman of the Royal Institute of Technology in Stockholm, Sweden," says Dr. von Rudloff whose own interest in the field was sparked by a visit to Prof. Erdtman's laboratory in 1958. "His studies of a qualitative nature on wood extractives during the 1950's permitted chemotaxonomic conclusions within genera or sub-genera. We have been able to complement his early work by providing some of the first attempts to arrive at quantitative data. This has led to a distinction between species of the same genus and in favorable cases allows conclusions within the same species or even within populations."

Apart from the academic value of such an approach, strong practical overtones are beginning to manifest themselves.

NRC's contribution in the new field has concentrated on terpenes, a group of chemical compounds which accumulate as volatile oils in a wide variety of plants. Eucalyptus, camphor and mint oils as well as turpentines are well-known mixtures of plant terpenes. The evergreens or conifers produce such oils and Dr. von Rudloff's quantitative work on the chemotaxonomy of Canadian conifers has provided a glimpse of how valuable this new tool may prove to be.

The volatile oils are analyzed by a gas chromatograph. This highly sensitive analytical instrument separates the different components of the oil and registers them in sequence as peaks on a recorder chart. The peak areas are proportional to the amount of individual components. This is no simple analysis, however, as the volatile oil from one tree may contain up to 100 different components, some in →