

identification of plants

trace amounts. Here is where the organic chemist aids the classical taxonomist by his ability to separate, identify and measure the quantity of each component.

After spending more than five years pioneering chemotaxonomy of North American conifers using gas chromatography, Dr. von Rudloff was invited to present his findings at the 1966 International Congress of Natural Products in Stockholm, Sweden. He reported that qualitative differences in terpene content appeared to exist between conifer families and that quantitative differences were apparent between species. Different families contained different terpene mixtures while species within the same family contained similar mixtures which differed from one species to another primarily in the amount of individual components. It thus appeared that each conifer species might have a characteristic chemical fingerprint and thus a basis was laid to put chemotaxonomy to the test.

The test came when Dr. von Rudloff analyzed terpene patterns in white spruce, black spruce and Rosendahl spruce, a recognized hybrid of the first

Michael Granat collects volatile leaf oils using a special steam distillation apparatus which permits quantitative recovery of oil from less than 10 grams to more than one kilogram of plant material.

two. When two species cross to breed a hybrid one would expect the hybrid's fingerprint to show a pattern reflecting the fingerprints of both parents but intermediate between the two. Expectations were confirmed.

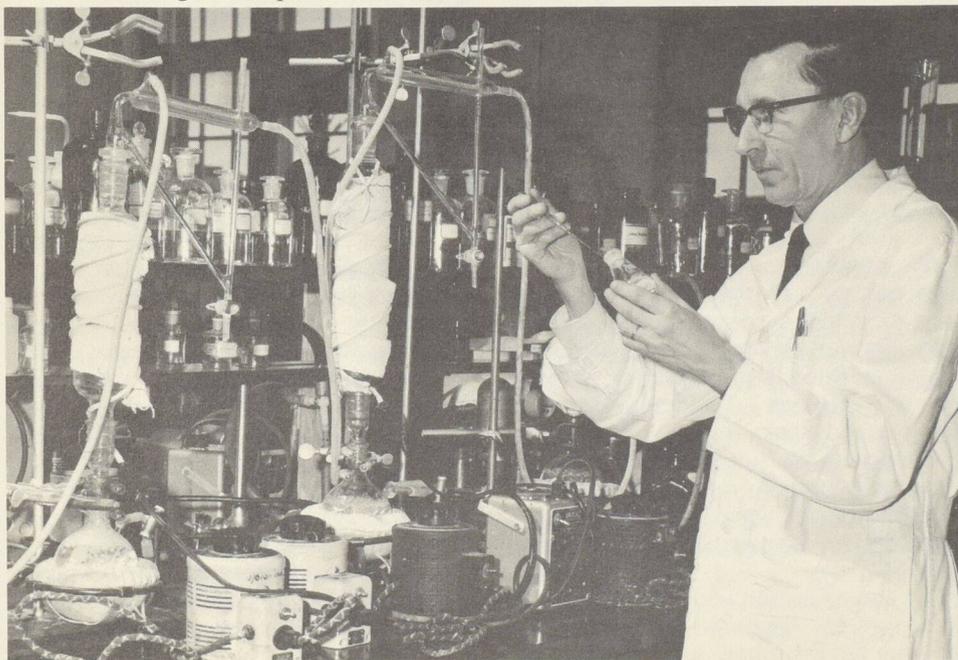
However, Dr. von Rudloff cautions: "The chemist would be lost without the guidance of a botanist. As Prof. Erdtman wisely advised, the new information a chemist may arrive at will only become meaningful if based on a sound botanical foundation."

The work with Rosendahl spruce supplied by Dr. M. Holst of the Petawawa Forest Research Station at Chalk River met this qualification, for the hybrid had already been morphologically well defined by botanists.

Citing an example of what could befall the chemist who departs from this basic guideline for chemotaxonomy, Dr. von Rudloff explains: "The sesquiterpene longifolene has been found to be a characteristic wood component of certain conifers, but it has recently also been found in a liverwort. Beware the chemist who states that this liverwort is therefore closely related to these conifers!"

So, working with the co-operation

Michael Granat recueille les essences émanant d'un distillateur spécial et permettant de les mesurer en partant d'échantillons de 10 à 1000 grammes de végétal.



of trained botanists, Dr. von Rudloff pressed on to the next stepping stone through a joint project with a group at the University of Texas in Austin. The Texas group had extended an invitation of co-operation after hearing Dr. von Rudloff's report in Stockholm in 1966 and the Canadian chemist willingly accepted the interest of a botanist, a taxonomist and an electrical engineer. (The engineer spent nine months devising a computer program to determine significant variations in terpene fingerprints while eliminating spurious results from data compiled from hundreds of chemical analyses.)

The Texas group sent him samples of local juniper and requested a chemotaxonomic analysis of the volatile oils. Each sample was coded so Dr. von Rudloff knew nothing about it except a number. His results showed two distinct fingerprints or terpene patterns indicating two separate species among the samples with no sign of hybridization in any samples. Unknown to him, classical taxonomy had attributed cross breeding between two species in question and hybridization of most trees was suspected. Because of Dr. von Rudloff's findings, Professor B. L. Turner, a well-known botanist (systematist) at the University of Texas, made a thorough morphological examination of each sample and uncovered an error in taxonomic classification. The variation in shape previously considered significant among junipers near Austin was due to environment rather than genetic cross breeding of two species. Chemotaxonomy helped correct the error. It also opened the door to a quantitative study on different populations of these juniper species. →