This technique is particularly useful if large numbers of intact, viable embryos are needed, free from contamination, for use in physiological and other experimental work.

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Phylogeny of the Genus *Aniba* Aubl.—A Comparative Morphological and Chemical Observation

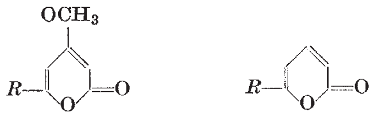
Evolutionary progress in the plant kingdom is usually evaluated on a structural basis; only a few attempts have been made to utilize chemical facts in phylogenetic reasoning. The concomitant changes in the morphology and chemistry of *Eucalyptus*[1] and *Callitris*[2] species were studied by Baker and Smith. McNair correlated the evolutionary status of plant families with the chemistry of their constituents[3,4].

We believe that observations of this kind could be extended in the light of our present knowledge of biosynthetic pathways and present an example which shows the results that can be expected from efforts of this kind.

A number of α-pyrones are known to occur in several species of the plant genus *Aniba* Aubl. (family Lauraceae). Chemically, these can be divided into two groups, according to the presence or absence of a methoxyl group at carbon atom 4 of the pyrone ring. (Table 1).

Table 1

Group *A* Group *B*



R	Group *A* compounds	Group *B* compounds
Phenyl	4-methoxyphenylcoumalin (5)	phenylcoumalin (8)
Piperonyl	4-methoxyparacotoin (6)	paracotoin (8)
β-Styryl	5,6-dehydrokavain (7)	
β-Pyridyl	anibine	

Figures in brackets are reference numbers.

Compounds of the group *A* type have been encountered in *Aniba rosaeodora* Ducke, *A. Duckei* Kostermans and *A. firmula* (Nees *et* Mart.) Mez, whereas type *B* is represented in *A. coto* (Rusby) Kostermans and *A. pseudocoto* (Rusby) Kostermans. We have recently suggested that this distinction may possibly have a phylogenetic significance[5].

Acetic acid units are admittedly the biosynthetic building blocks of polyketomethylene chains and their cyclization products. Experiments with isotopically labelled acetate support this theory and many examples are known of natural compounds with the oxygen atoms in the required positions. The above group *A* compounds are typical examples. We have therefore suggested that in the group *B* type the oxygen function at carbon atom 4 has been lost, assigning to those species which produce such substances a more recent origin in the evolutionary history of the genus. (Birch and Donovan[9] had already included phenylcoumalin among the compounds originated through the linkage of acetate units.)

In order to verify the validity of this assumption on conventional morphological grounds, a comparative analysis of the floral verticils of the known species of *Aniba* has been undertaken, based on the classical phylogenetic concept of gradual reduction and suppression of whorls in the evolution from primitive to the more recent forms. Since in *Aniba* perigonium and gynæcium show practically no variability, observations were concentrated on the andrœcium.

Table 2. Phylogenetic Development in the Genus *Aniba* Aubl. Based on the Gradual Reduction and Suppression of Verticils in the Andrœcium

Type 1
(10 species)
Verticils I, II and III fertile
(verticil III flanked by glands)
Verticil IV staminode (present or not)

↙ ↘

Type 2*a*
(19 species)
Verticils I, II and III fertile
(verticil III flanked by glands)
Verticil IV absent

Type 2*b*
(1 species)
Verticils I and II fertile
Verticils III and IV staminode
(verticil III flanked by glands,
verticil IV (present or not)

↘ ↙

Type 3
(2 species)
Verticils I and II fertile
Verticil III staminode (flanked by glands)
Verticil IV absent

In Table 2 it is shown how in *Aniba* the andrœcium, starting from a primitive type 1 with three fertile and one sterile verticils, developed through two parallel suppressive and reductive routes (types 2*a* and 2*b*) to type 3, with only two fertile and one sterile verticils.

In this scheme, *A. rosaeodora*, *A. duckei* and *A. firmula* (the species known to contain type *A* compounds) fall into class 1. *A. coto* and *A. pseudocoto* are to be placed in class 2*a*, the latter species representing already a transition form to class 3, since the minute lateral locules of the anthers of the inner whorl of fertile stamens (III) already indicate a tendency toward the staminode condition (as is also found in class 2*b*).

In this way it appears that the morphological and chemical evidence support each other. Not only is the chemical reasoning in accordance with the structural criterion, but even lends to it a new and significant basis, since the biosynthetic pathway clearly shows the only possible direction in which evolution could have taken place.

Financial aid from the Conselho Nacional de Pesquisas is gratefully acknowledged. This communication is one of a series on the chemistry of rosewood[5], we should like to dedicate it to the memory of the late Adolfo Ducke.

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