

**CHROMOSOME CYTOLOGY AND RELATIONSHIP
OF THE LOWIACEAE**

by

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ABSTRACT

The chromosome number of *Orchidantha maxillarioides* is found to be $2n = 18$. The phylogeny of the SCITAMINEAE is discussed, and it is pointed out that the LOWIACEAE may be regarded as the most primitive representative of the order.

The family LOWIACEAE is a small and isolated group consisting of some few species of the only genus ORCHIDANTHA. Three of these species were treated by SCHUMANN (1904) and by WINKLER (1930) under the MUSACEAE, viz. *O. longiflora* (SCORTECH.) H. WINKEL, *O. maxillarioides* (RIDL.) K. SCHUM., and *O. borneensis* N.E. BROWN. Two more species were described by the present writer (LARSEN 1961), viz. *O. siamensis* K.L. and *O. laotica* K.L. The genus is restricted to the evergreen forests of Borneo, the Malay Peninsula, and Laos. With the exception of *O. maxillarioides* all species are known from the type locality only.

The cytology of this small family has not so far been studied, and it was with interest that the writer followed a plant in the greenhouses of the Botanic Garden, Copenhagen; this plant had been received from another European botanical garden as seeds of unknown origin under the name of ORCHIDANTHA sp. During the summer 1964 it flowered abundantly and could be determined to *O. maxillarioides*. As the plant was vigorous, several good root-tips were fixed in chrome-acetic formalin (MÜNTZING's modification of NAWASHIN's fluid). After fixation the material was dealt with according to the paraffin method and stained with Feulgen. The plant used for these studies is kept in the Botanic Garden, Copenhagen, and material is deposited in the herbarium of the Botanical Institute, Aarhus University (Herb. AAU).

The chromosome number and chromosome morphology could be studied in several good metaphase plates, and there was no difficulty in establishing the number to be $2n = 18$ (Fig. 1), the species is diploid with the basic number $x = 9$. It was also immediately striking that the chromosomes were remarkably large. There is no great shape differentiation among the members of the complement, most chromosomes are V-shaped with median-submedian kinetochore. The question then is whether it is possible to use this new knowledge to elucidate the systematic position of the family.



Fig. 1. Metaphase chromosomes from root tips of *Orchidanthia maxillarioides*.

Taken as a whole the order of the SCITAMINEAE is comparatively little studied by cytologists. The first and so far the only one who has taken up a comparative cytological study of the whole order is VENKATASUBBAN (1946). As his work is quoted over and over again it should be emphasized that today it is almost only of historical interest. In his introduction it is clearly mentioned that the material used originates from Botanical Gardens (mainly from the Botanical Garden, Peradenia, Ceylon), and that the identifications have not been checked by the author or by any specialist on the group, nor has any material used for the cytological studies been preserved as voucher specimens. This means that we may use the generic names and probably in all cases regard them as right, but the specific names undoubtedly in many cases are dubious. If, keeping this in mind, VENKATASUBBAN's results are compared with the present writer's own (mostly unpublished) data on the cytology of the order of the SCITAMINEAE, it is still possible to form a picture of the cytological pattern of the group. Such a very coarse characterization of the families in question is attempted below.

- CANNACEAE : $x = 9$. Chromosomes small.
- STRELITZIACEAE : $x = 7, 8, 11, 12$, and perhaps other numbers. Chromosomes small.
- MARANTACEAE : $x = 4 (?)$, 6, 9, 11, 12, and 13. Chromosomes small – medium-sized.
- ZINGIBERACEAE : $x = 9, 10, 11, 12, 16, 17$, and perhaps other numbers. Chromosomes medium-sized.
- MUSACEAE : $x = 9, 10, 11$. Chromosomes small–medium-sized.
- LOWIACEAE : $x = 9$. Chromosomes medium-sized; however, they are the largest known in the order.

At a first glance this may look rather confusing. It should be added that the most frequent basic number is 9, then follow 10, 11, and 12.

VENKATASUBBAN (loc. cit.) tries to construct an original basic number $x = 6$. This is, however, purely speculative as well as his postulated “polyphyletic” origin of the MARANTACEAE. Neither has this been considered in the three most weighty modern contributions to the system of the vascular plants, viz. those of HUTCHINSON (1959), TAKHTAJAN (1959) and by the author describing the group in ENGLER’s Syllabus (POTZTAL 1964). Let us look on the position of the family LOWIACEAE in the system of these authors.

HUTCHINSON has no comments on the family which he merely places between the STRELITZIACEAE and the ZINGIBERACEAE. He is undoubtedly under the influence of WINKLER’s treatment in Nat. Pflanzenfam., where it is regarded as a subfamily under the MUSACEAE.

TAKHTAJAN refers the LOWIACEAE to the primitive ZINGIBERALES (= SCITAMINEAE) with 5-6 stamens, these being the STRELITZIACEAE and the MUSACEAE, i.e. he has no new viewpoints to add.

POTZTAL places the family LOWIACEAE as an appendix to the SCITAMINEAE and considers it a family “bei der wohl mehr verwandtschaftliche Beziehungen zu den MARANTACEAE oder ZINGIBERACEAE als zu den MUSACEAE vorhanden sind. Jedoch bestehen Zweifel, ob sie überhaupt zu den SCITAMINEEN gehört”.

From the present cytological studies of *Orchidantha maxillarioides* it is evident that the LOWIACEAE naturally belongs to the order of the SCITAMINEAE on account of the basic number $x = 9$. As this is also strongly supported by the morphology there is no reason for the doubt advanced by POTZTAL. The basic number 9, which occurs so frequently among the SCITAMINEAE, and the diploid level may also be interpreted as primitive characters. There might be reason to regard 9 as the level from which the order has started its evolution.

If we turn to the geographical distribution of the LOWIACEAE, this gives us a picture of an old group, the present remains of which may represent the scattered stands of a paleoendemic group. It may not be accidental that we find this in tropical S.E. Asia as this is the richest evolution centre for the SCITAMINEAE.

The floral morphology of ORCHIDANTHA has already been discussed and illustrated by diagrams by the present writer (loc. cit.) and is not to be repeated here, only it should be emphasized that it represents a primitive stage within the SCITAMINEAE.

To sum up: the LOWIACEAE may be regarded as primitive for cytological, morphological, and distributional reasons, and it is very likely that this family is closely related to the ancestors of the SCITAMINEAE.

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