

ON THE DEFINITIONS OF THE FOUR TYPES OF MONOCHASIA

by

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In his Blüthendiagramme, the work which can never be sufficiently praised, Eichler gives a set of definitions of the four types of monochasia, with explanations of them, all of the highest value.

I should therefore have had no reason to treat the topic here, if the study of the inflorescence of the *Plumbaginaceae* (6) had not furnished some observations which might give further information on a point which hitherto had remained doubtful.

Before the introduction of the new types, the fan and the sickle, by Buchenau in 1865 (3), the botanists only used to distinguish between the cincinnus and the screw, following in this respect the example of Schimper of 1834 (1). The cincinnus was defined as having a constant antidromy in the successive cormus individuals, the screw as consisting of a number of homodromous members.

It is true that in the splendid paper by the Bravais brothers (2) a third group was indicated; they not only distinguished the "cyme unipare scorpioide" with antidromous "petioles" and the "cyme unipare hélicoïde" with homodromous "pétioles", but incidentally they mentioned the existence of a third group, that of the "cymes distiques", with distichous "pétioles".

The last group, of which they knew very few instances from nature, was not treated under a separate heading, and has not been adopted by later botanists. Yet it included the later types of Buchenau, and their instances were: *Moraea Sinensis* (Iridaceae) with a fan, described as a „cyme uninodale distique" and the genus *Statice*, of which indeed some species have a sickle, described as „cyme binodale unipare distique".

We may therefore say that between 1834 and 1865 there were only two types of monochasia, characterized by their floral spiral direction.

In the definitions of sickle and fan by Buchenau the spiral direction no longer played a rôle, it being the prophyll position

that gave the characteristic; an adaxial fertile prophyll determining the fan and an abaxial position the sickle. These conceptions of Buchenau, being much better elaborated than that of the „cyme distique”, were universally adopted and indeed they formed a great improvement in the theory of monochasia.

Yet there was one decided disadvantage: the four definitions did not form a logically consistent system, as the spiral direction and the prophyll position are quite independent factors. For instance, if we should meet with a monochasium with abaxial fertile prophylls and homodromous flowers it would belong equally well to the category of the sickle as to that of the screw.

It is therefore no wonder when we meet with a modification of the definitions in Eichler's Blüthendiagramme (4, I, p. 39) in which cincinnus and screw are distinguished by their lateral prophylls. Eichler characterized the cincinnus by the fact that the successive cormus generations are placed alternately on the left and the right side of their parent axis, whereas in the screw all generations fall on the same left or right side.

In this way the whole set of definitions becomes a logical one, and without any doubt this modification is a further great improvement. Yet we must be aware of the fact that the definition of cincinnus and screw has been impoverished by the loss of a most valuable character. For the zigzag of the cincinnus is the direct consequence of the antidromy of the successive members, and the helix of the screw is in the same way the consequence of their homodromy.

Later morphologists, copying Eichler's definitions, did not even mention the different spiral direction relation (Pax, 5, Velenovsky, 7) and doubtless many modern botanists ignore the fact, which necessarily precludes them from a real understanding of the two monochasia types in question.

Eichler was the more inclined to replace the spiral direction as a basis of distinction by the lateral or median prophyll position, as he thought that at least for the cincinnus the spiral direction was no absolutely reliable character, since in *Canna* we meet with two-flowered cincinni with homodromous flowers.

Here we may remark that the homodromy of the two flowers of the *Canna* cincinnus is strictly limited to the floral parts proper; the position of the bracteoles is such as it should be in a cincinnus and the Bravais' consequently mention *Canna* (2, p. 206) with perfect justice as a „cyme uninodale scorpioide” with antidromous petioles. This curious clash seems to be due to the fact that the floral spiral in the first flower is emprosthodromous and in the

second opisthodromous. But in any case the whole *Canna* plant presents so many curious, fixed but unexplained spiral conditions, that the homodromy of the floral parts of the two flowers in this reduced cincinnus cannot present a serious argument against the importance of the spiral direction in all other cincinni and screws.

When we therefore are inclined to reinsert the spiral direction in the definitions of cincinnus and screw, the question naturally arises as to the spiral direction in fan and sickle.

The Bravais' evaded the question by ranging the latter under the inflorescences with "pétioles distiques" i.e. with median prophylls. But as the higher phyllomes, the floral parts, are not distichous, the question remains how the spiral in these parts may run.

Buchenaу settled the question in a rather easy way by declaring that the law of anti- or homodromy did not exist here, as all the subtending bracts fall in a single plane by their distichous arrangement (3, p. 429). If this opinion really should be substantiated, we should have a haphazard distribution of right and left spirals in the flowers.

Eichler took quite another view on the matter, as he supposed that the cincinnus should be more especially akin to the sickle into which it could be converted by a shift of the fertile prophylls to the front side, and that the screw should be in the same way akin to the fan into which it could be converted by a shift of the fertile prophyll to the back side. As a demonstration of this view he gave two diagrams of transitional stages (4, I, fig. 20). He writes further (p. 40): „Ob jedoch bei Sichelwuchs, entsprechend der Wickel, eine gesetzmässige Antidromie der Blüten statt findet, und Homodromie bei Fächer, ist mir nicht bekannt geworden; die Blüten zeigten in den beobachteten Fällen keine Merkmale, aus welchen sich ihre Spiralwindung hätte beurtheilen lassen und an den Deckblättern ist es, bei deren medianen Stellung, natürlich auch nicht zu constatiren”.

Against this view I might remark that there is no a priori reason why in a cincinnus the fertile prophylls should be shifted to the front side rather than to the back side and in a screw reversely; theoretically both cincinnus and screw change into sickles by a shift of the fertile prophylls to the front side and both change into fans by a shift to the back side. The only question is: what occurs in nature, and about this Eichler gave no evidence.

So we are still at a loss about the spiral direction in fan and sickle. Presumably we might expect a haphazard distribution in

radially symmetrical fans and sickles, where the prophylls are median from the very first.

Antidromy might be expected in dorsiventral fans and sickles and in such ones which originally properly were cincinni but where the fertile prophylls were shifted into a median position during the developmental stages.

Finally, homodromy should be expected in such cases where a screw is converted by a similar shift into a fan or a sickle.

Now of all plants, the *Plumbaginaceae* with their frequent shifts of the prophylls should furnish suitable material for answering some of these questions.

And indeed my observations, though not instituted with such an aim, show some light here, as they contain two cases of the kind alluded to, that of the *Statice Suworowi* glomerule and that of the *Armeria glomus*. The first is the case of a cincinnus which is converted into a sickle in this and some other particular species. It is therefore according to Eichler's expectation. Whether the antidromy of the cincinnus is retained in the sickle or not is unknown; a developmental study of the calyx might perhaps furnish the means to answer this question.

In the *Armeria glomus* we have a screw which is converted into a sickle, contrary to Eichler's expectation. In this case it is absolutely clear that the original homodromy of the screw has been retained with great accuracy.

From the above facts and considerations I might conclude with the following set of definitions.

1a. Prophylls and daughter axes not median, but lateral or intermediate in position.

2a. Lateral axes antidromous to their parent axes and consequently forming a zigzag. Cincinnus.

2b. Lateral axes homodromous with their parent axes and consequently forming a helix. Screw.

1b. Prophylls and daughter axes in a median position.

2a. Fertile prophylls adaxial. Fan. N. B. About the direction of the floral spirals no observations have been made as yet.

2b. Fertile prophylls abaxial. Sickle. N. B. About the direction of the floral spirals very few observations have been made as yet. Homodromy occurs in the *Armeria glomus*.

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