Flowers and fruits in the genus Wolffiella (Lemnaceae) : Blüten und Früchte der Gattung Wolffiella

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Flowers and fruits in the genus *Wolffiella (Lemnaceae)*

Blüten und Früchte der Gattung *Wolffiella (Lemnaceae)*

by

Elias LANDOLT

The genus *Wolffiella* according to MONOD (1949) and LANDOLT (1980a) comprises 9 species. The genus *Wolffiella* was described by HEGELMAIER (1895). He separated it from the genus *Wolffia* because of the asymmetry of the fronds (tract of elongated cells shifted to the side of the median line of the lower wall of the pouch). Therefore he did not include *W. Welwitschii*, *W. hyalina* and *W. repanda*, all with symmetrical fronds, in the genus *Wolffiella*.

Later (1921), GOEBEL showed that this symmetry is not such an important characteristic as HEGELMAIER thought. HEGELMAIER only knew of flowers and fruits from the three species *W. Welwitschii*, *W. hyalina* and *W. repanda*, but not from *W. lingulata*, *W. oblonga*, *W. gladiata* and *W. denticulata*. Still later, in 1929, SAEGER wrote of these four latter species: "It would be of interest to know whether the sexual method of reproduction has been entirely replaced by the vegetative method, or whether fertile flowers might still be produced under appropriate conditions." In 1932,

HICKS commented after failing to bring *W. gladiata* (under the name *W. floridana*) to flower under experimental conditions: "The ability to produce flowers apparently has been so completely lost that they are never produced by plants in nature."

Since then, flowering fronds of all known species have been found in nature: *W. oblonga* (GIARDELLI 1935), *W. lingulata* (MASON 1938), *W. gladiata* (KURZ and CROWSON 1948 under the name of *W. floridana*), *W. denticulata* (MAUVE 1966, OBERMEIER-MAUVE 1966). Further publications on the flowering of *Wolffiella* concern *W. Welwitschii* (MONOD 1949), *W. hyalina* (JOVET-AST 1968) and *W. lingulata* (ESKUCHE and ROMERO FONSECA 1982). From the two newly described species of *Wolffiella* (LANDOLT 1980b), *W. rotunda* is represented in the type collection with flowering fronds, but fruits are not known. *W. neotropica*, known until 1983 from about a dozen collections, had never been found with flowers until recently. Also, under experimental conditions in our laboratory (26°C, 20000 Lux, 16 hours of light duration, 1/5 Hutner solution), *W. neotropica* did not develop mature flowers in the presence of EDDHA. One single flower was observed in a very early stage, but it did not develop further. In November 1983, I happened to discover a flowering and fruiting population of *W. neotropica* on a field trip near Rio de Janeiro, Brazil, in company of Mr. C. Farney.

All species of *Wolffiella* (vegetative and flowering fronds) are shown in fig. 1. In table 1, some characteristics of the flowers and fruits of all known species of *Wolffiella* are placed together. The data are taken partly from the literature and partly from my own observations, a description of the vegetative fronds is given in LANDOLT (1984). It is not certain which of the given quantitative characteristics cover the whole range of variations within the species and which are just segmentary. We know that some of the characteristics depend on non-specific genetic factors; others are subject to modifications. For example, the diameter of the pollen grain is related to the chromosome number (s. LANDOLT 1984). Length and width of fronds and number of stomata vary with climatic conditions and with the chemical composition of the water. Good species-specific characteristics seem to be: number of the flowers, length-width ratio, shape of flowering fronds, and number of stomata. The diameter of the pollen grain is not very species-specific, as far as we know. However, the small size

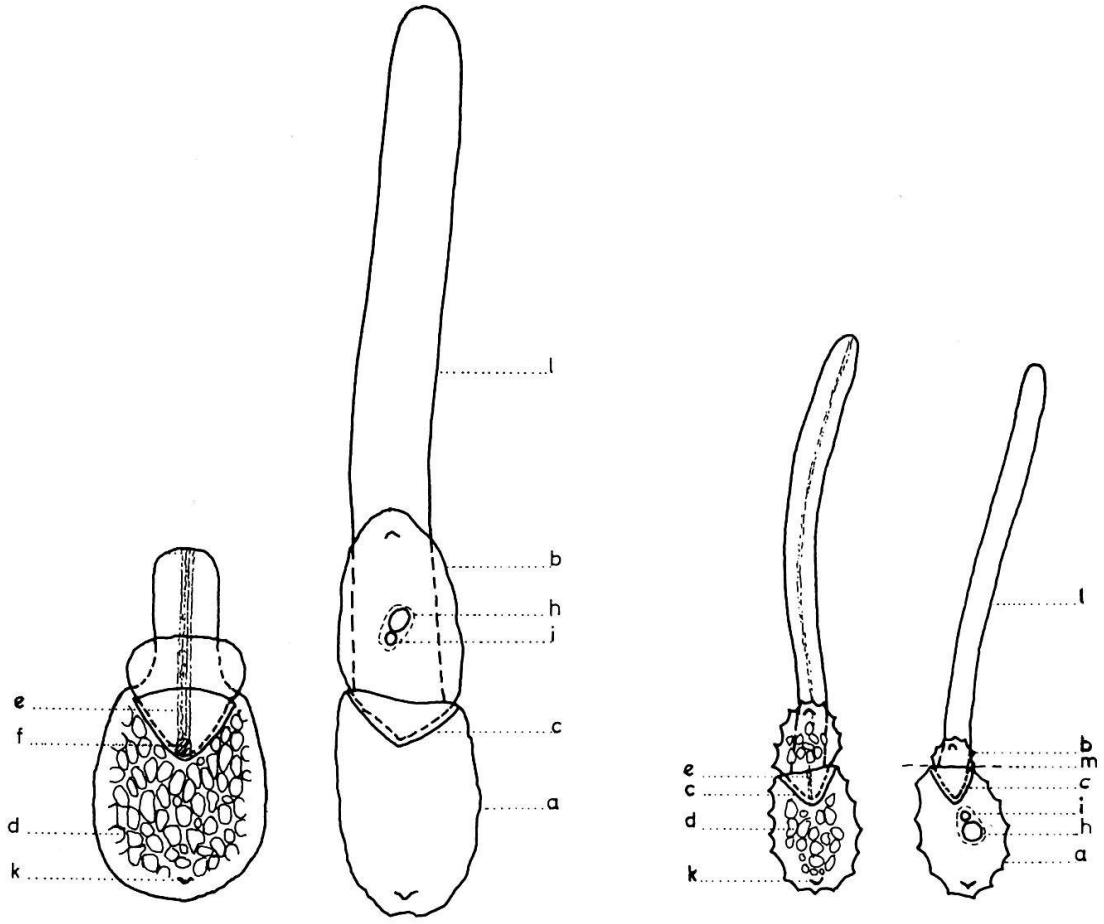
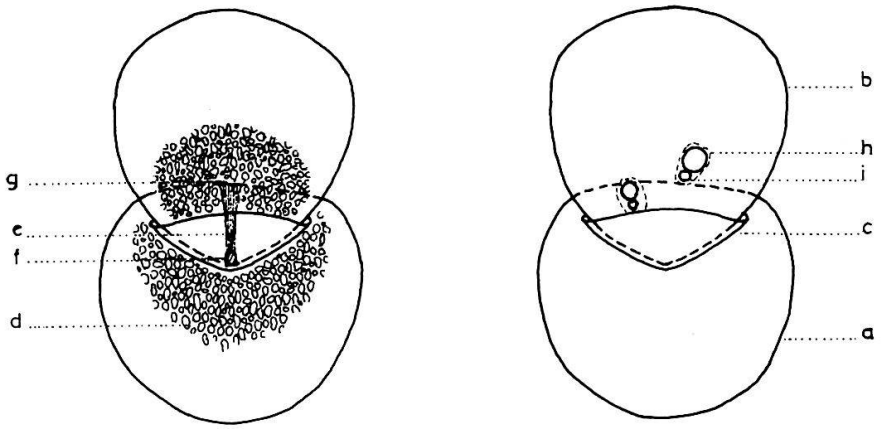


Fig. 1. Vegetative and flowering fronds of *Wolffiella* species. x8 (flowering fronds of *W. gladiata* after KURZ and CROWSON 1948, of *W. denticulata* after MAUVE 1966)

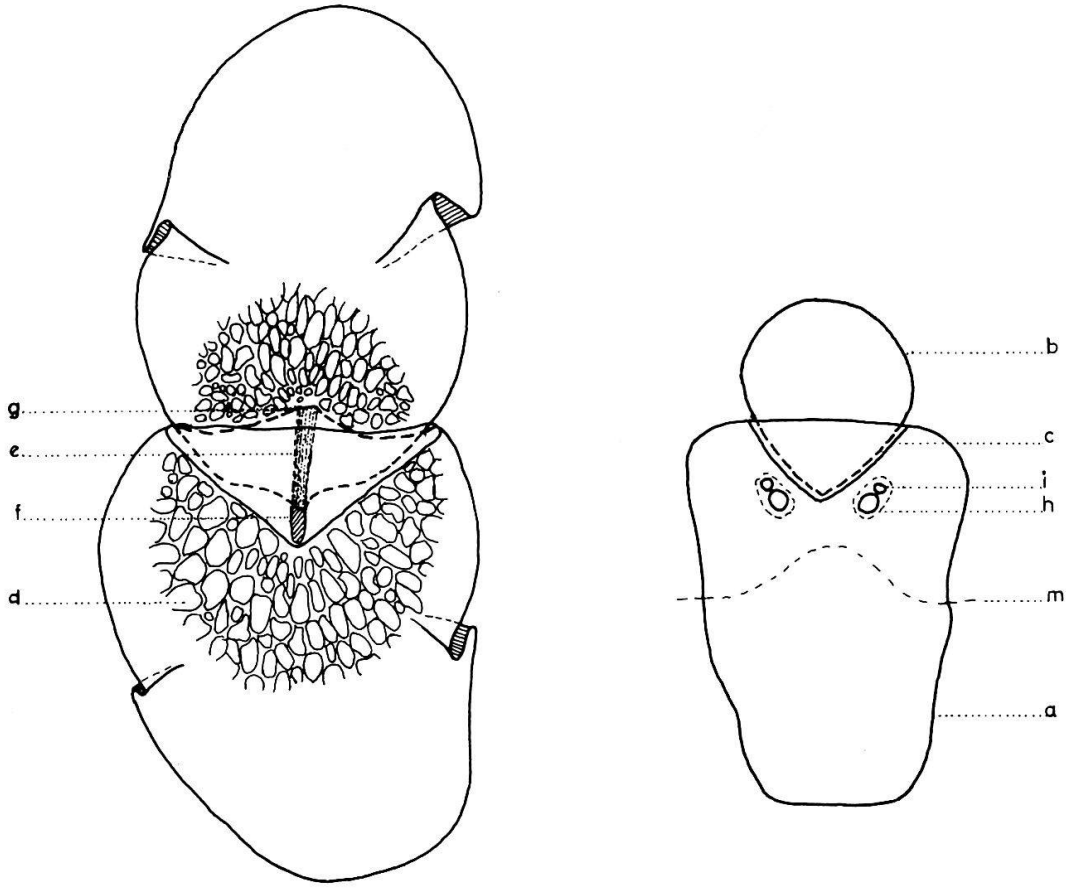
Vegetative und blühende Glieder der Wolffiella-Arten

a mother frond
b daughter frond
c pouch
d area with air spaces
e track of elongated cells ending in the attaching point of the mother frond
f rest of the stipe of the first daughter frond (already disconnected)
g attaching point
h anther
i stigma
k papule
l appendage of the lower wall of the pouch (bent downwards)
m water level: the appendange of *W. hyalina* and *W. repanda* and the distal part of the flowering fronds of *W. Welwitschii, W. lingulata, W. oblonga* and *W. gladiata* are submerged.

d,e,f are not marked in flowering fronds

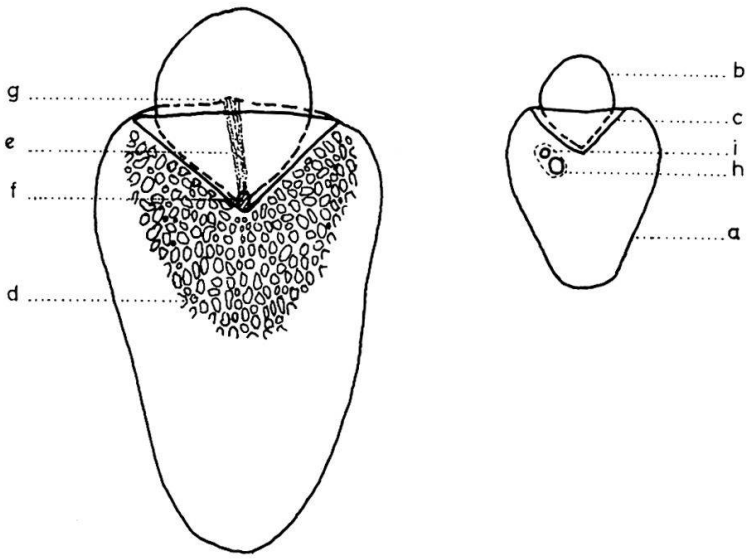


W. rotunda

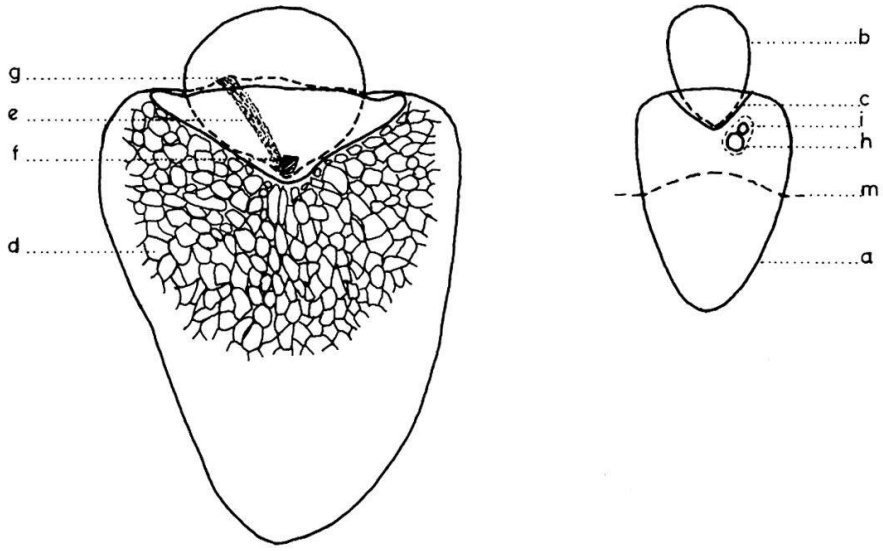


W. Welwitschii

Fig. 1 (continued)

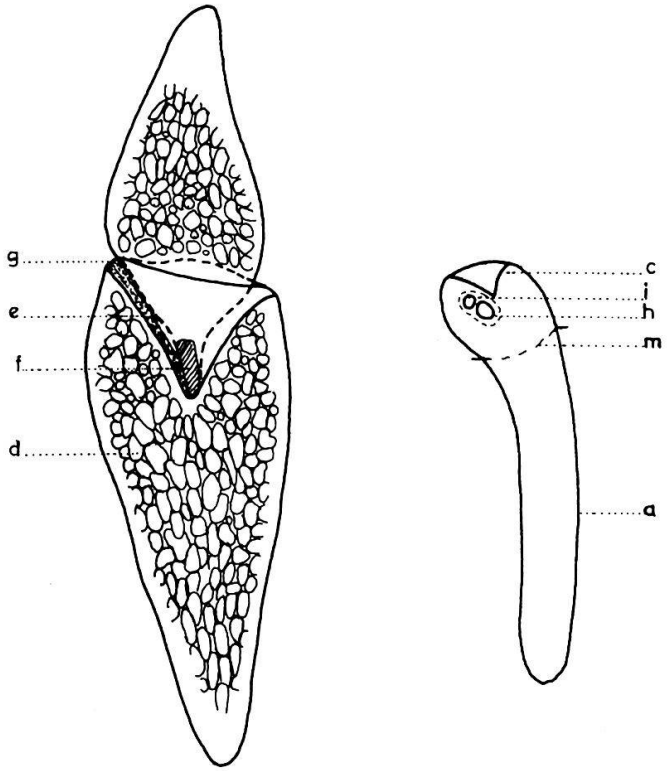


W. neotropica

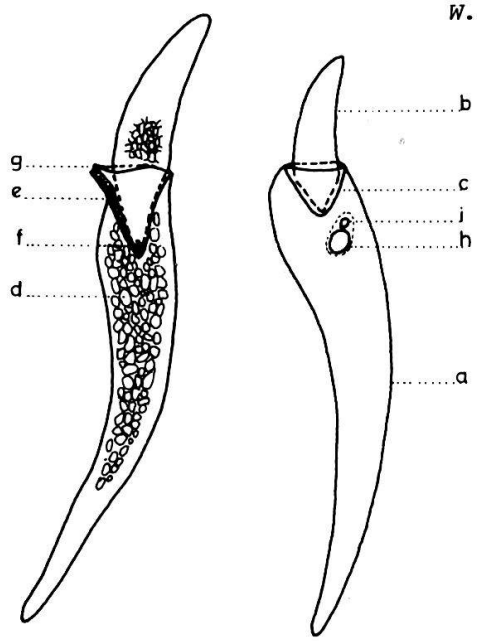


W. lingulata

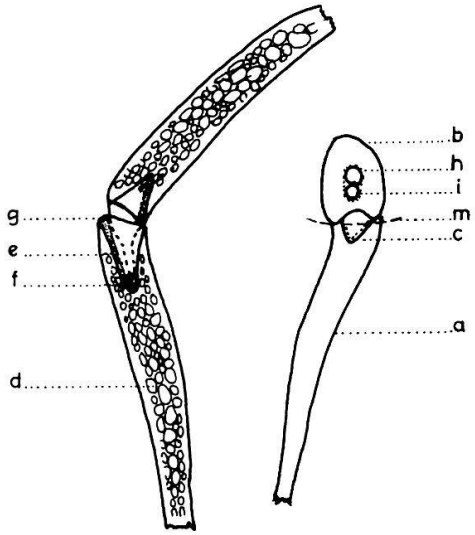
Fig. 1 (continued)



W. oblonga



W. gladiata



W. denticulata

Fig. 1 (continued)

Thanks are due to Ms. A. Hegi who made the drawings.

Table 1. Flowering and fruiting characteristics of the species of *Wolffiella*

Blüten- und Fruchtmerkmale der Wolffiella-Arten

Wolffiella	*hyalina*	*repanda*	*rotunda*	*Welwitschii*	*lingulata*	*oblonga*	*gladiata*	*denticulata*	*neotropica*
vegetative fronds									
length in mm	1.0-3.0	0.5-1.8	1.0-3.0	3.0-7.0	3.0-9.0	1.2-7.5	3.0-9.0	2.0-7.0	2.0-8.0
width in mm	0.8-2.0	0.4-1.2	1.0-3.0	2.5-5.0	0.5-5.0	0.4-2.5	0.25-0.8	0.3-0.8	1.5-5.5
length/width	1⅓-1 2/3	1⅓-1 2/3	4/5-1⅕	1¼-2	1¼-4	3-8	4-20	6-20	1¼-2½
number of stomata	> 60	> 60	> 60	0-12	0-10	0-10	0-6	0-5	20-35
flowering fronds									
length in mm	1.5-2.5	1.0-1.6	1.0-3.0	4.0-6.5	3.0-5.0[2]	2.8-3.5	2.5-6.5	0.5-1.0	1.0-3.5
width in mm	0.8-1.4	0.7-1.0	1.0-3.0	2.0-3.5	1.2-2.0	0.8-1.2	0.6-0.8	0.8-1.4	0.7-1.5
length/width	1½-2	1½-2	4/5-1⅕	1½-2	2-3	3-4	4-8	1⅓-1 2/3	1⅓-3
number of stomata	> 60	> 60	> 60	0-12	0-10	0-8	4-18	?	20-35
number of flowers	1	1	1-2	2	1	1	1	1	1
diameter of pollen grain in µm	19-23[1], 28[7], 20[7]	19-21[1]	?	18-19[6] 17-18[1]	20-23[2]	11-15[3]	15-20[4]	?	16-18
seeds									
length in mm	0.38[1]	0.32[1]	?	0.45[1]	0.41-0.44[2]	0.35-0.40	0.3-0.4[4]	?	0.30-0.36
thickness in mm	0.28[1]	0.24[1]	?	0.30[1]	0.29[2]	0.25-0.29	0.18-0.25[4]	?	0.21-0.24
frequency of flowering	rather frequent	rather frequent	?	rather frequent	occasionally	occasionally	rare	rare	?
fruiting	not rare	?	?	not rare	rather rare	rather rare	very rare	very rare	?

data from: 1 HEGELMAIER (1868, 1895), 2 MASON (1938), 3 GIARDELLI (1935), 4 KURZ and CROWSON (1948), 5 MAUVE (1966), 6 MONOD (1949), 7 JOVET-AST (1968). Own mesurements without number.
? no exact information

of the pollen diameter of *W. oblonga* (according to GIARDELLI 1935) is very striking. The surface of the pollen grain is muriculate (with very small tuberances) and nearly identical within the subfamily of *Wolffioideae*. The value of the seed size is uncertain. It seems that the largest fruits belong to *W. Welwitschii* and *W. lingulata*. In comparison with the genus *Wolffia*, in which the seeds are nearly spherical and the length-thickness ratio 1 to 1.2, the seeds in *Wolffiella* are ellipsoidical (length-thickness ratio 1.3 to 1.7).

Regarding the habitat of vegetative and flowering fronds, the genus *Wolffiella* may be divided into three groups:

1. Vegetative and flowering fronds floating on the surface of the water and similar in appearance, with many stomata: *W. hyalina, W. repanda, W. rotunda.*

2. Vegetative and flowering fronds floating below the water surface, with the base of the flowering frond reaching the water surface; not very different in shape (flowering fronds shorter and somewhat narrower in large-fronded species or wider in narrow-fronded species); with very few stomata located laterally at the base of the frond: *W. Welwitschii, W. lingulata, W. oblonga, W. gladiata.*

3. Vegetative fronds generally floating below the water, with flowering fronds floating on the surface of the water; flowering fronds much shorter, with many stomata: *W. neotropica, W. denticulata.*

Summary

Flowering and fruiting fronds of *W. neotropica* were found for the first time near Rio de Janeiro (Brazil). The flower and fruit characteristics of all *Wolffiella* species are compared (cf. table 1).

Zusammenfassung

In der Nähe von Rio de Janeiro (Brasilien) wurden blühende und fruchtende *W. neotropica* entdeckt. Blüten- und Fruchtmerkmale von allen *Wolffiella*-Arten werden miteinander verglichen (Tab. 1).

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