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BY

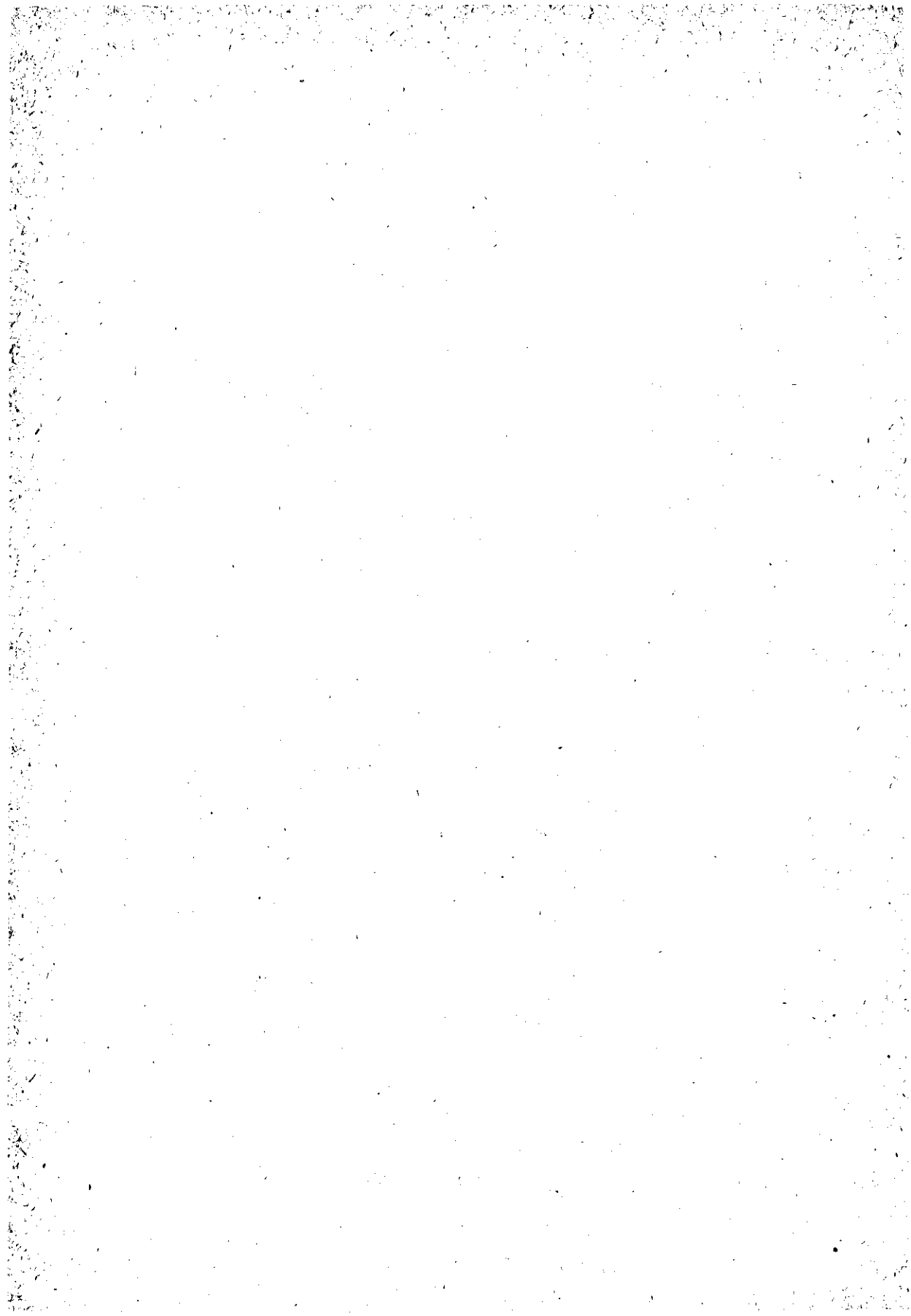
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WOOD ANATOMY AND SYSTEMATIC POSITION OF *ROPOUREA* *GUIANENSIS* AUBL.

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INTRODUCTION

Three years ago Dr HAROLD N. MOLDENKE from the New York Botanical garden requested the second author to supply him with material of *Ropourea guianensis* AUBL., presuming this plant from French Guiana being also native to Surinam.

Ropourea is a small tree of the dense jungle of the Guianas only reaching a height of 4-6 m and has been described by AUBLET (1), but the affinity of the genus is still uncertain. LANJOUW and UITTEN (9) found a specimen in a herbarium of AUBLET in the possession of Mr DENAIFFE in Carignan, France. This specimen only consists of a branch with 4 large leaves. The material has been collected to all probability (9, 10) by AUBLET himself during his stay in French Guiana from 1762-1764. Beyond their statement: „Cette plante doit être étudiée”, LANJOUW and UITTEN apparently did not take a particular interest in the plant themselves, but only stated its presence in what probably is a Type collection (10).

The description and illustrations by AUBLET are incomplete and do not permit to check the botanical identity of the plant. Since the second author never saw the plant himself, before he got the letter of Dr MOLDENKE, he showed the plate in AUBLET's book to an old Indian, BAPTIST, from the tribe of the Arowaks, during many years a plantcollector of the Agricultural Experiment Station in Paramaribo and asked him whether as to his knowledge such a plant existed in Surinam. The plate shows a branch with verticillate leaves of different number at the nodes („Tout autour de chaque noeud sortent des feuilles dont le nombre varie”). According to AUBLET's description and plate 78 the leaves are compound and pinnate with 6-12 leaflets. The flowers are numerous, sessile in the leaves axils and slightly above the nodes and bear 5 stamens. The fruit is a berry about the size of an egg, yellow and hairy, quadriloculate, every loculus containing one seed imbedded in an edible, sweet, yellow, pulpy substance. For a more detailed description see AUBLET (1).

BAPTIST, trained in the knowledge of forest plants as were his parents and ancestors from hundreds and hundreds of years of jungle life, recognised *Ropourea* from the illustration and called it by its Arowak name jawale wassilikodo which means „opossum testicles”. It is a small tree, 4-6 m in height, growing deep in

the interior of the Saramacca district, as well as elsewhere in Surinam and in French Guiana.

BAPTIST went and came back from the interior bringing with him some short fragments of stems with bark, some of them with roots, and fruits with seeds. The thickest stems are 4–5 cm in diameter at the base: they bear simple leaves and are cauliflorous. As far as can be judged from the picture jawale wassilikodo is exactly the same plant as *Ropourea*. The leaves (leaflets according to AUBLET) are alternate, but *simple* and without stipelles. What is called thorns („petites épines au dessus de chaque foliole”) by AUBLET are merely the axillary buds of the leaves. What AUBLET calls a compound leaf with thorns in the axils of the leaflets really is a shoot with simple leaves and axillary buds.

4 Times BAPTIST brought plants 1–2 feet in height and also stumps to Paramaribo, which were planted in the nursery of our experimental garden. The first set arrived in May 1945, the second in 1946. From these only 10 small, tiny plants survived. So far they only produced a few leaves and only one has 3 lateral branches with 2–4 leaves. Medio 1947 BAPTIST sent 18 stumps, 2–3 cm in thickness and 40 cm in length. Only 3 survived and formed strong branches with 2–3 lateral shoots and 10–14 leaves. 8 Further stumps were received in February 1948, some of them 4 cm in thickness. It may be expected, that only the 3rd or 4th shoot-whirl produces flowers, so the first flowers will not appear before the next 2 or 3 years.

From a floral-morphological point of view the problem *Ropourea* can not be solved conclusively before the plants flower. All facts available, however, the enlarging persistent calyx, morphology of fruit and seed and the characteristics already enumerated, if not quite sufficient for determination, yet suggested the family of the *Ebenaceae* to the second author.

During the first author's recent stay in Paramaribo the second author called her attention to the problem and asked her to try and see if an investigation of the anatomy of the wood might prove a clue to the taxonomic position of jawale wassilikodo (= *Ropourea*). Although wood anatomy has already proved its value in taxonomic problems, we could not be sure about this beforehand, because wood descriptions hitherto have been made nearly always from specimens supplied from mature trunk wood. The wood of the elder growth rings may sometimes differ widely from the younger ones. If, however, identification based upon wood characters would also bring out the *Ebenaceae*, it would be a strong indication of the correctness of the second author's suggestion based upon the few morphological facts available.

Now indeed identification based on characters visible with the handlens and on minute features both lead up to this family. The first author did not come into knowledge of full particulars concerning the morphological facts cited above before the identification was completed.

There are not many keys apt to be used in the identification. Only those dealing with an amount of species and genera large enough to guarantee as much as possible for the present that the family of the unknown species is covered also, will do. Fully up to this purpose only are a still unpublished key by L. G. DEN BERGER (5) based on hand lens features and the key by JANSSONIUS (8) on microscopical characters, to a minor degree those by RECORD (16, 17).

Before discussing the result of comparing our wood with the four keys, a description of the structure as seen by the hand lens and with the microscope will be given below. We did not attempt to give full details, but only those that prove of value in the identification of wood specimens.

HAND LENS FEATURES

Growth rings inconspicuous, now and then indicated by a more or less poreless band.

No *ripple marks*, nor other *storied structure*; no *gum* or other *ducts*.

Wood glossy, especially the younger part of the stem and especially on radial face.

Colour light-yellow till brownish pink, the older parts darker, sometimes greyish, locally black.

Pores as often solitary as in radial rows of 2 or 3 and rarely 4, average number 10 per sq. mm (8 or sometimes 6-16), very small, with simple perforations, two or three pores near to the centre of the wood filled with a black substance in the neighbourhood of pith flecks.

Wood parenchyma metatracheal, paratracheal and diffuse. The metatracheal parenchyma in very small, short, broken lines, joining only a small number of rays, locally forming a reticulate pattern with the rays, 16-19 lines per mm. Paratracheal parenchyma perhaps everywhere in a sheath of one cell present but scarcely visible to a 16 × magnifying lens. Diffuse parenchyma everywhere in the fibrous tissue.

Rays very fine (see 3), not yet 30 μ wide, 12-19 per mm, of two kinds, and homogeneous and heterogeneous (terminology in accordance with JANSSONIUS, see MOLL and JANSSONIUS (12) vol IV p. 403 and REINDERS-GOUWENTAK (20), rather than with RECORD and CHATAWAY (15) or with the „GLOSSARY” (6). The first kind consisting of upright or square cells, less abundant than the second kind. The latter ones usually showing three tiers, the marginal tiers varying from 1 to more than 3 cells in height, the tier consisting of procumbent cells often higher than the upright tiers.

Medullary spots locally encountered near the centre of the wood, as black lines visible to the naked eye and to the hand lens.

Determination based on these characters with DEN BERGER's key (5) leads up to EBENACEAE (see Discussion).

MICROSCOPICAL STRUCTURE

Only those characters are given where the hand lens failed to provide evidence or was erroneous as compared with the microscopical anatomy. We have not aimed at giving a fully detailed description; only those features which may be of diagnostic value are given.

Growth rings not very distinct and only locally more or less delineated by short radial dimension of late wood elements.

Pores with simple perforations, the plates very oblique with a large perforation rim, bounded more often on one side upon ray cells, than on no side, rarely on both sides, for the rest upon parenchyma and libriform fibres, for the most part upon parenchyma.

Libriform fibers in distinct radial rows, with small bordered pits on radial walls (characteristics of libriform after JANSSONIUS (7) and REINDERS (18, 19)).

Wood parenchyma: topography the same as described above. The metatracheal lines one cell wide, separated by 1-7, mostly by 3 libriform fibers, in short irregular rows, joining mostly 2 or 3 rays, rarely more, at the utmost 9. Radial dimension larger than that of the fibers. The cells of both metatracheal and diffuse parenchyma in the same radial row with libriform fibers. Paratracheal paren-

chyma mostly in a sheath of one, also two, rarely up to 4 cells where the pores or pore multiples do not bound upon ray cells or libriform fibers. Nearly all parenchyma cells filled with starch. Non-paratracheal parenchyma-strands with more than 3 septs. Diffuse parenchyma everywhere in and between the metatracheal lines. Often diffuse or metatracheal parenchyma strands with many septs, each small cell bearing a large simple crystal.

Rays of two kinds. For definition of kinds of rays see JANSSONIUS (8; 12 vol IV, p. 403) and REINDERS-GOUWENTAK (20). Rays of first kind one-seriate, rarely locally in one cell 2-seriate, composed of upright cells only, 1-11 cells high and sometimes even higher; rays of second kind more abundant than those of first kind, heterogeneous and homogeneous. The heterogeneous rays composed of 3 or 5, rarely 7 tiers, one-seriate, also in the procumbent parts, in the latter parts occasionally two-seriate, and rarely in more than one cell in the same ray. The upright tiers 0-17, mostly 1, also 2 or 3 and rarely over 6 cells high; the procumbent tiers 1-10 cells, mostly 2 or 3 cells, also 4 or 5, but rarely over 5 cells high. The homogeneous rays very scarce, composed of a middle part of procumbent cells and an upper and lower part of upright cells, the latter parts perhaps never more than one cell high. Ray cells often contain starch.

Black substance locally present in pores, wood parenchyma and rays, and rarely in fibers also.

Determination based on these characters brings out the EBENACEAE (see Discussion).

SOME REMARKS ABOUT THE BARK

MOELLER (11) describes the bark of two species of the *Ebenaceae*. There is a strong resemblance to the bark of *Ropourea*, especially on account of the presence of the vertical rows of the large fusiform stone cells near the cambium with many very fine pit canals which are closely surrounded by crystal fibers. *Ropourea* lacks phloem fibers, so do the species described by MOELLER. There is, however, a difference in the structure of the primary tissue. *Diospyros Lotus* and *D. virginiana* according to MOELLER have no sklerosis whatever. In the pericycle of *Ropourea* the dilatation gaps in the sklerenchyma fiber ring have been filled up with isodiametric stone cells of different dimensions; practically no fibers are found. In the cortex too some stone cells have been formed evidently by contact with those of the pericycle.

Radial dimension of the bark 600 à 700 μ .

DISCUSSION

DADSWELL and RECORD (4) write: „The identification of an unknown wood is a process of segregation and elimination. The correct determination of a specimen requires consideration of every possibility residing in more than 3000 genera of over 230 families. This involves a comprehensive systematic study of all the woods of the world, a task well begun but still far from completion”.

If, however, a key comprises many species and many genera from a large number of families and, if, moreover, it has entries to families as well as to genera or species, there is a chance of its comprising a set of family features sufficient to identify the family where an unknown wood fits in, even if this wood was not taken into consideration while constructing the key. The keys by DEN BERGER (5) and by JANSSONIUS (8) mentioned above are up to this purpose.

Consequently a key only leading up to few genera or to few species can not be used for our purpose, since only features concerning a special representative of a certain family are used. This holds true for the key by BROWN and PANSKIN (2) dealing with many species of many families but with only one species of the *Ebenaceae* and this a species with storied structure. The storied structure is used in the segregation, but only few species of the *Ebenaceae* bear this feature (14); jawale wassilikodo lacks it.

In the keys by RECORD (16, 17), built upon the Yale collection only one genus of the *Ebenaceae* (*Diospyros*) has been listed. Determination with these keys, however, leads up to this representative, thus supporting our result.

The key by PFEIFFER (13), although being the only one dealing with Surinam woods, can not be used for our purpose, because it lacks families which are not to be precluded beforehand. The *Ebenaceae* are not listed. Still we used this key tentatively for orientation purposes, to make sure that jawale wassilikodo did not belong to a family restricted to the south american tropics and was therefore not listed in keys constructed for tropical woods of the Old World.

The woods of a certain group of *Euphorbiaceae* and those of the *Ebenaceae* are somewhat alike in general structure. They differ in minor details. In group 23 of DEN BERGER's key the choice is between *Ebenaceae* and *Euphorbiaceae*. *Ebenaceae*, if the heartwood is black or with black streaks or if occasionally black patches are present and pores in these black patches are filled with a black substance along the walls or in the lumen; *Euphorbiaceae*, if the wood is without black patches or black streaks and without black substance in the pores or elsewhere. Procumbent part of larger rays in *Ebenaceae* is not lower than the upright part.

Now in our wood on radial face the higher tiers of rays are always those whose cells are procumbent. Black substance is locally present in pores, wood parenchyma and rays and rarely in fibers also. The black substance in the *Ebenaceae* is present in the heartwood. All wood in our specimen is sapwood since virtually all ray cells and parenchyma cells are filled with starch, but the tendency to form black substance is already present.

Thus from hand lens characters we may conclude to elimination of the *Euphorbiaceae* and call *Ropourea* a representative of the *Ebenaceae*.

Identification on minute characters by the use of the key by JANSSONIUS, also brings out *Ebenaceae*. This family is reached at nr 461 along the nrs 1, 5, 6, 11, 12, 104, 149, 155, 216, 320, 345, 346, 351, 414, 427, 431, 433, 452, 459, 460, 461. At nr 461 the *Euphorbiaceae* are eliminated because the rays of the first kind are less abundant than those of second kind.

So the structure of the wood of *Ropourea* indicates this species to be a representative of the *Ebenaceae*. Classification upon wood anatomical characters has not yet reached the perfection of morphological classification. Thus if we should conclude only from a wood-anatomical standpoint, we would not be able to choose between the *Ebenaceae* or a new family to be created for *Ropourea* alone. But since morphological evidence leads to the *Ebenaceae* as well, the correctness of determination on wood anatomical characters is strongly supported.

We wish to acknowledge the help of BAPTIST, the old Arowak-Indian whose skill and knowledge enabled us to get hold of AUBLET's *Ropourea* in order to reveal its systematic position as far as possible.

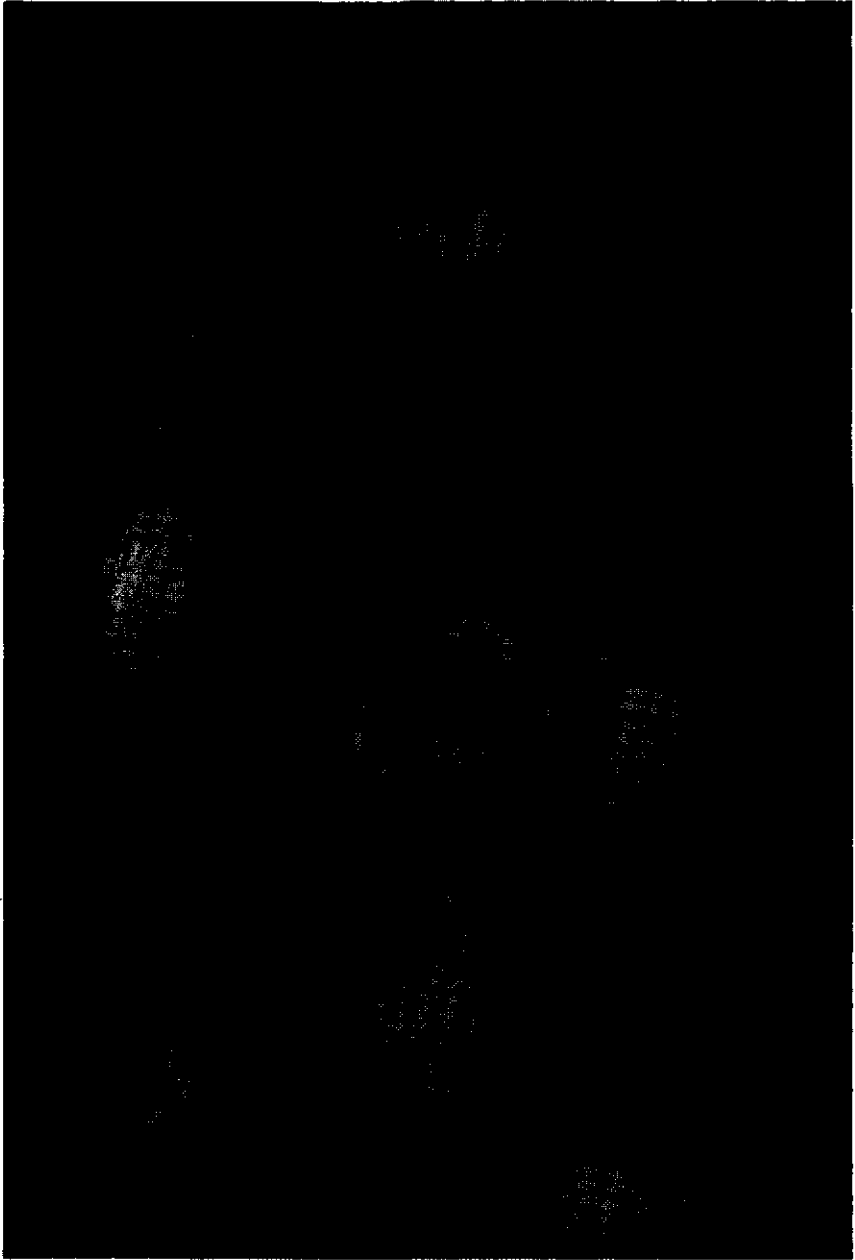
SUMMARY

Ropourea guianensis AUBL. most probably is a representative of the *Ebenaceae*. The anatomy of its wood and bark, the morphology of its leaves, fruit and seed are demonstrating it.

The text by AUBLET wants a correction. The so called thorns are buds: the leaves are simple.

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