





Контрольная на первом практикуме...

БОТАНИКА

В четырех томах

Том 4

В двух книгах

Книга 1

А.К.Тимонин, В.Р.Филин

Систематика высших растений

К.И. Мейер.
Практический курс
морфологии
археогониальных
растений. М, 1982

БОТАНИКА

В четырех томах

Том 4

В двух книгах

Книга 2

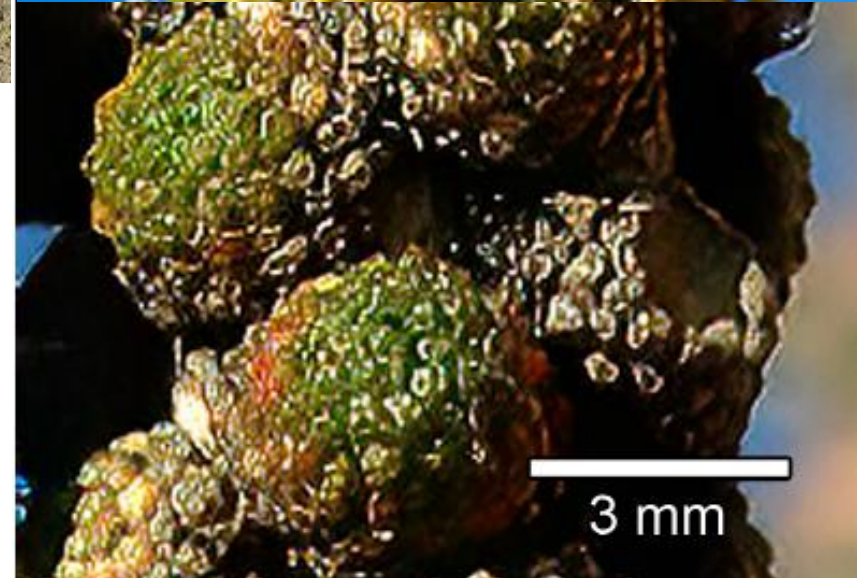
А.К.Тимонин, Д.Д.Соколов,
А.Б.Шипунов

Систематика высших растений









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Article

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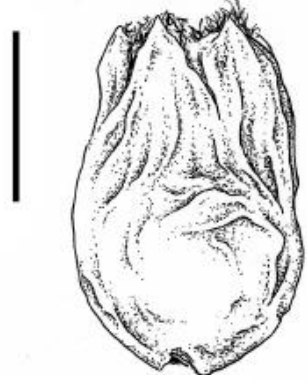
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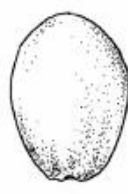
<https://doi.org/10.11646/phytotaxa.439.3.1>

From the frying pan: an unusual dwarf shrub from Namibia turns out to be a new brassicalean family

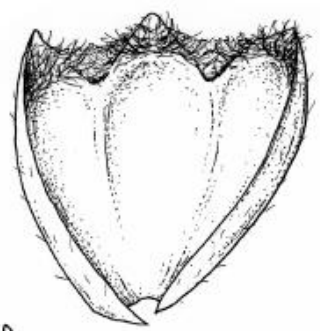
WESSEL SWANEPOEL^{1,2,6}, MARK W. CHASE^{3,4,7}, MAARTEN J.M. CHRISTENHUSZ^{3,4,8}, OLIVIER MAURIN^{3,9},
FÉLIX FOREST^{3,10} & ABRAHAM E. VAN WYK^{2,5,11*}



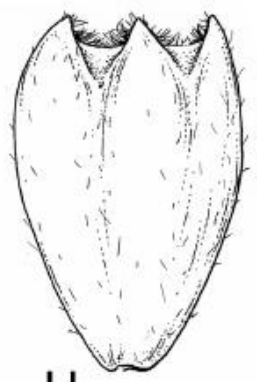
чашечка с плодом



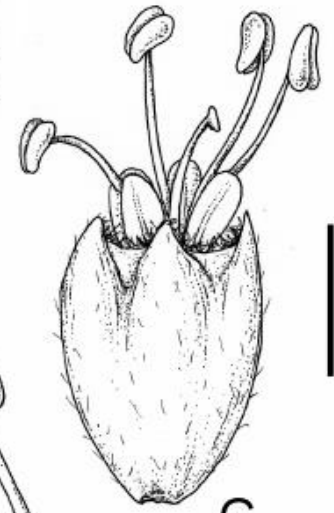
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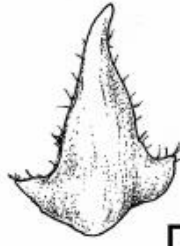
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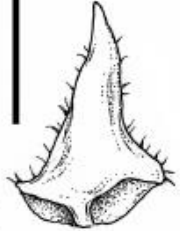
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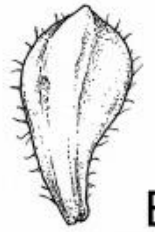
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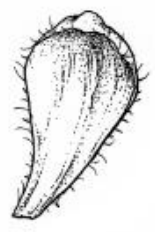
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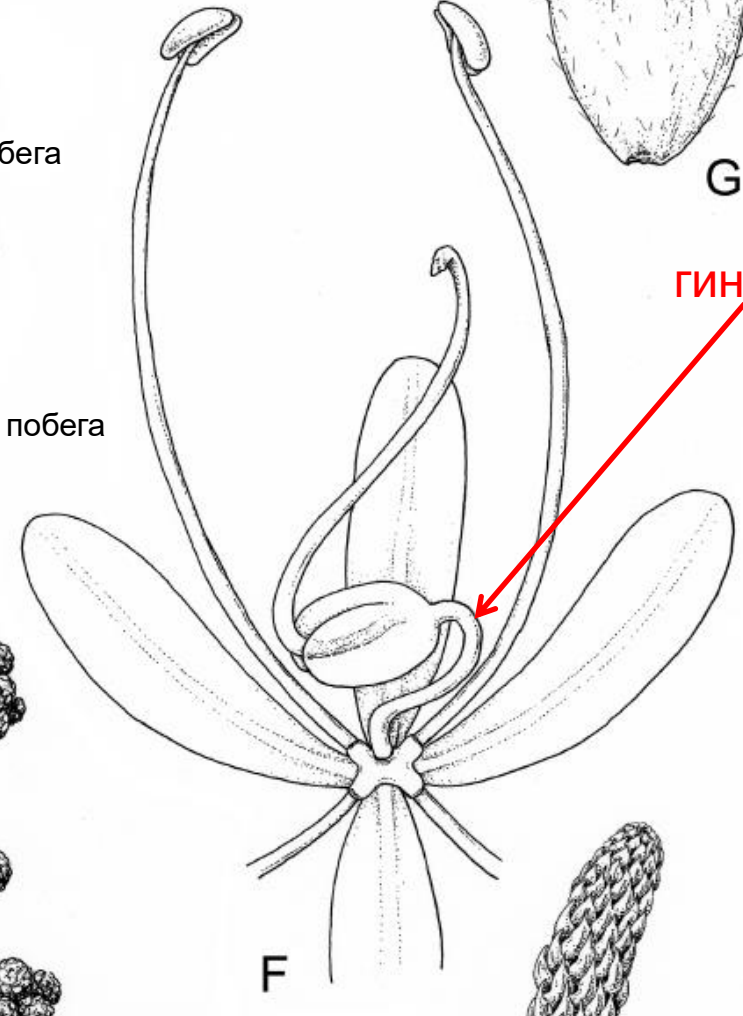
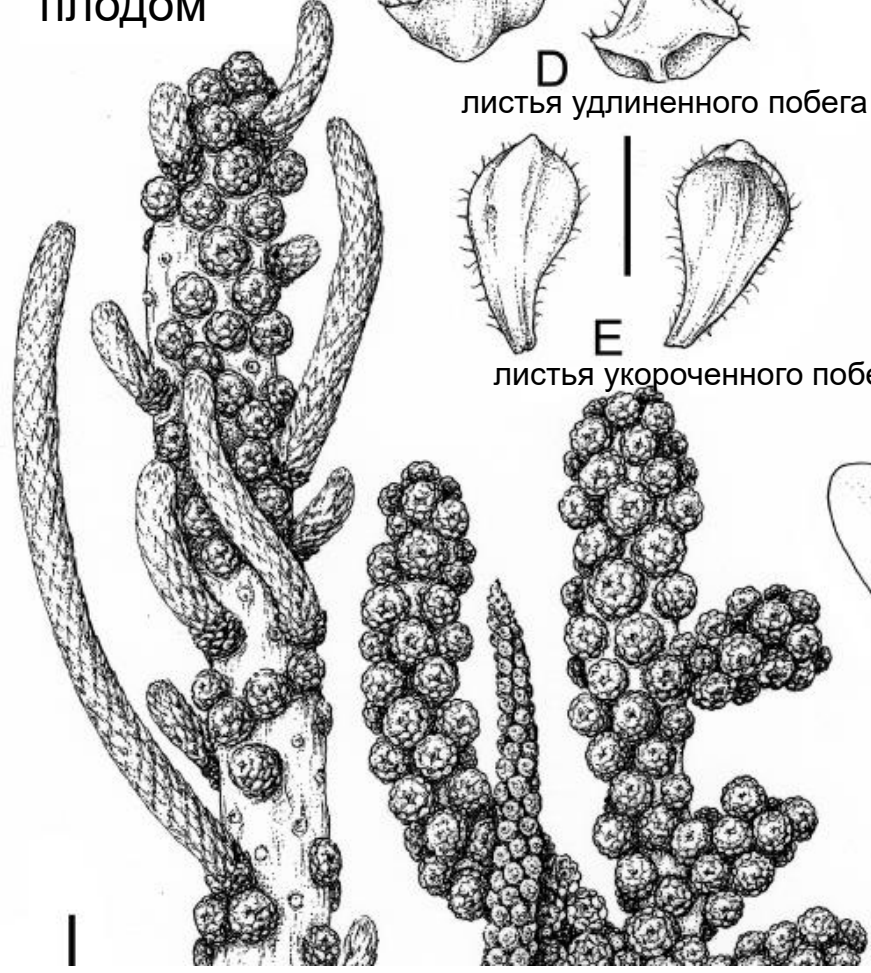
листья удлинённого побега



E

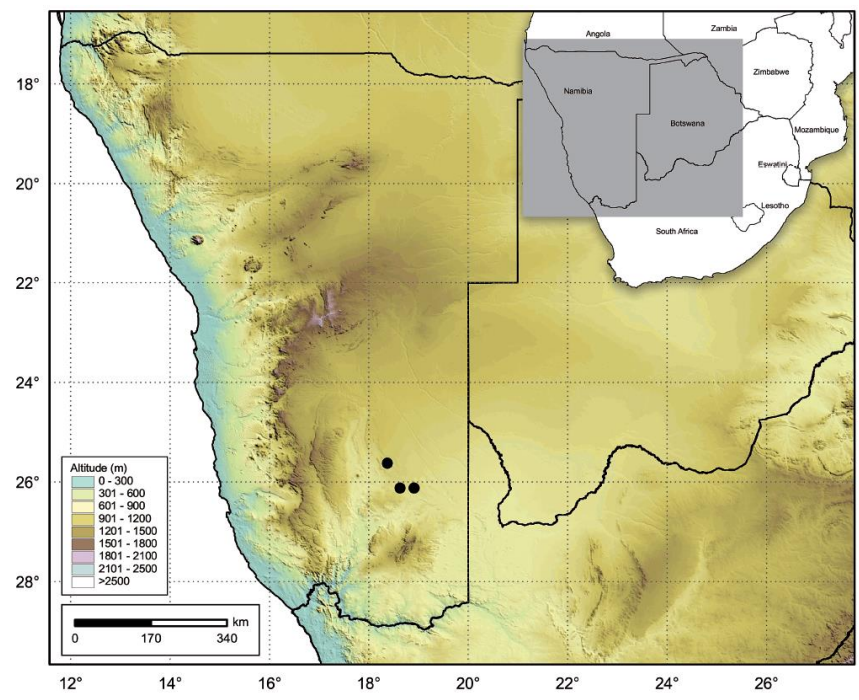
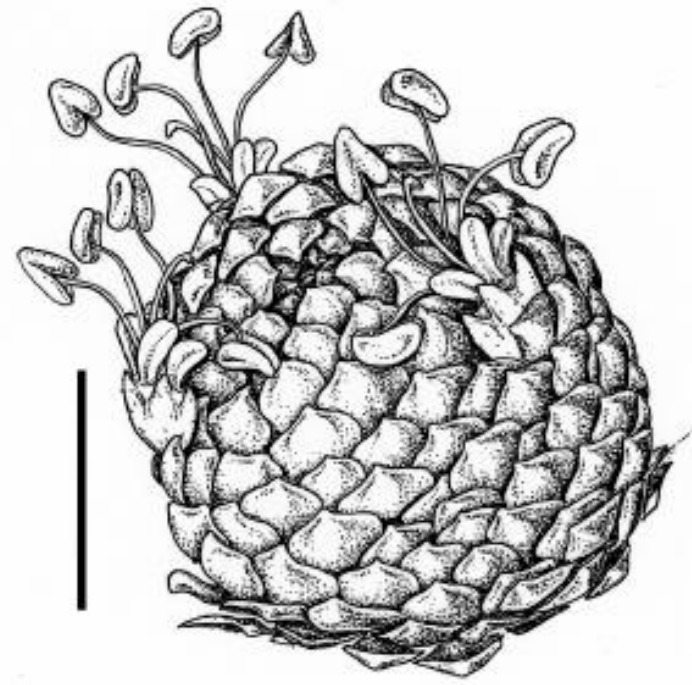


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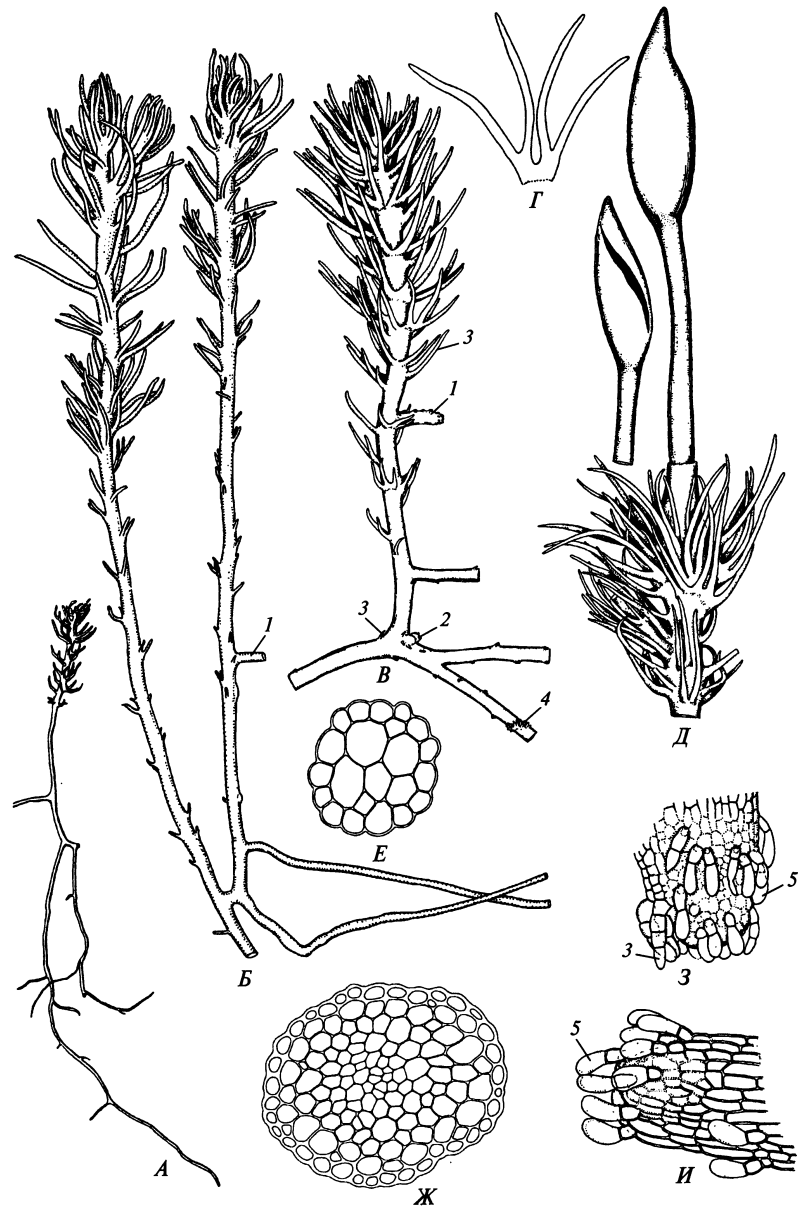


гинофор

F



(Тимонин, Филин, 2009)



A, B — побеги *T. lepidozoides*; *B, Г* — побег (*B*) и срединный лист (*Г*) *T. ceratophylla*; *Д* — вскрывшаяся коробочка (слева) и побег *T. ceratophylla* со зрелым спорогонием (справа); *Е, Ж* — поперечные срезы проксимальной части сегмента листа (*Е*) и стебля (*Ж*) *T. lepidozoides*; *З, И* — верхушки геотропной (*З*) и плагитропной (*И*) осей *T. ceratophylla*; *1* — интеркалярная ветвь; *2* — верхушка спящей ветви; *3* — лист; *4* — клювовидные слизевые волоски; *5* — булабовидный слизевой волосок

Род был описан в 1958 году. Его относили к печеночникам (а иногда даже сближали с плауновидными) до 1990, когда были найдены спорофиты

Такакия: 2 вида (тихоокеанское побережье Сев. Америки, Алеутские о-ва, Борнео, Гималаи)

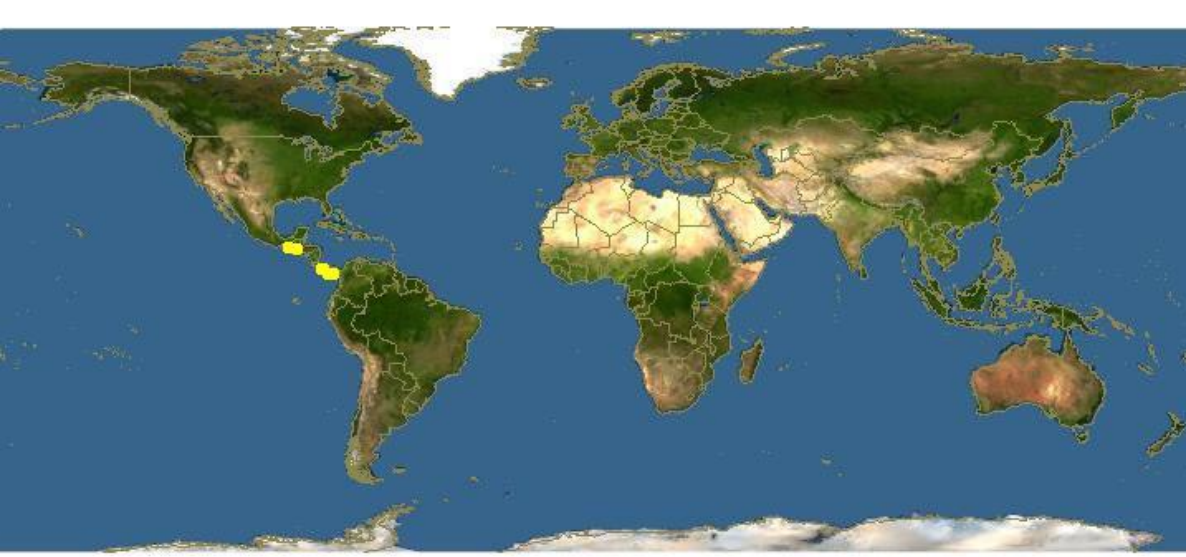
Takakia





Wollemia nobilis –
третий род семейства
Araucariaceae

Новый род, описан из
Австралии в 1994 г.

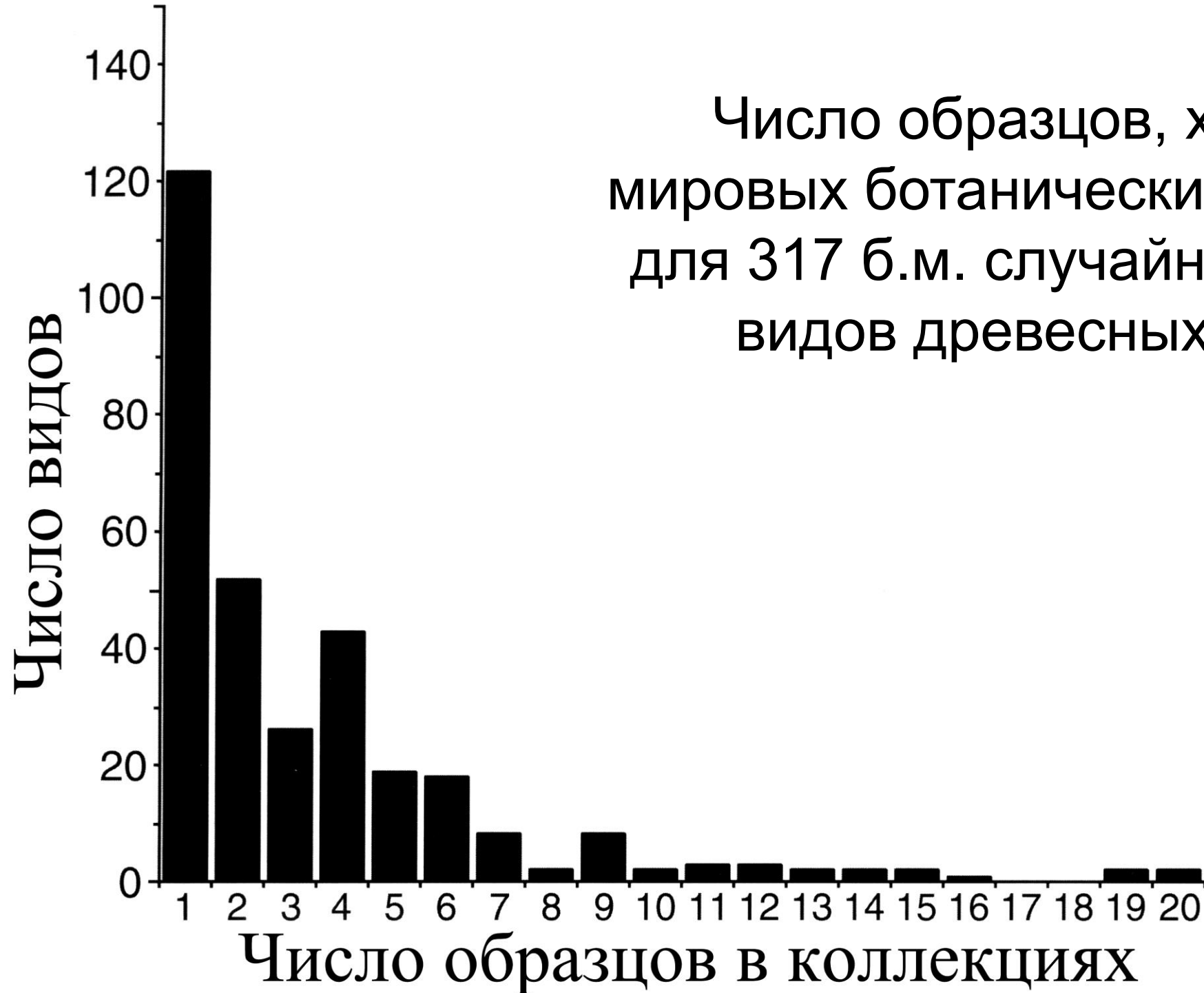


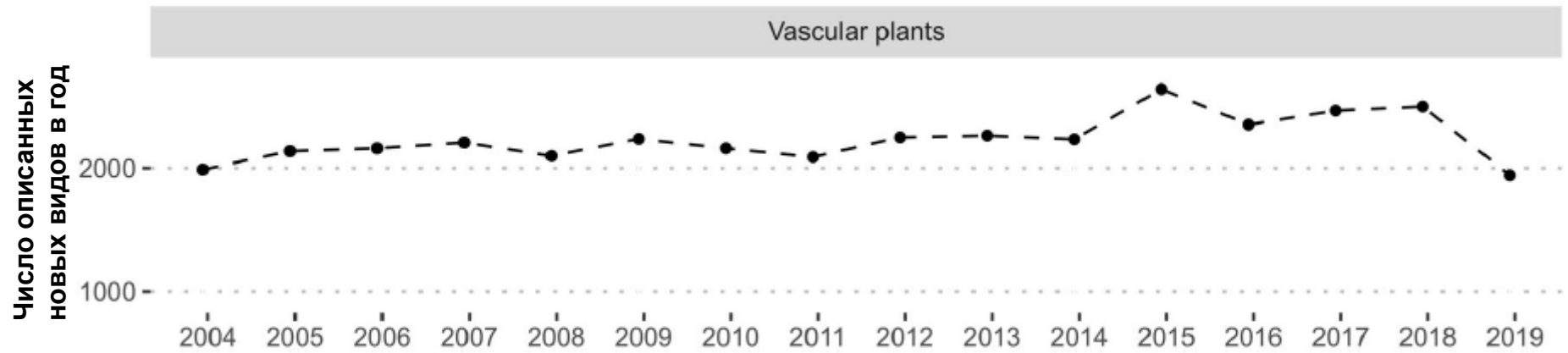
<http://www.plantsystematics.org>



Ticodendron
incognitum

Число образцов, хранящихся в мировых ботанических коллекциях, для 317 б.м. случайно выбранных видов древесных тропических растений





The five plant families with most new species published in 2019 (IPNI, 2020).

Family	Numbers of new species published in 2019
Orchidaceae	288
Rubiaceae	157
Compositae (Asteraceae)	100
Araceae	78
Leguminosae	71

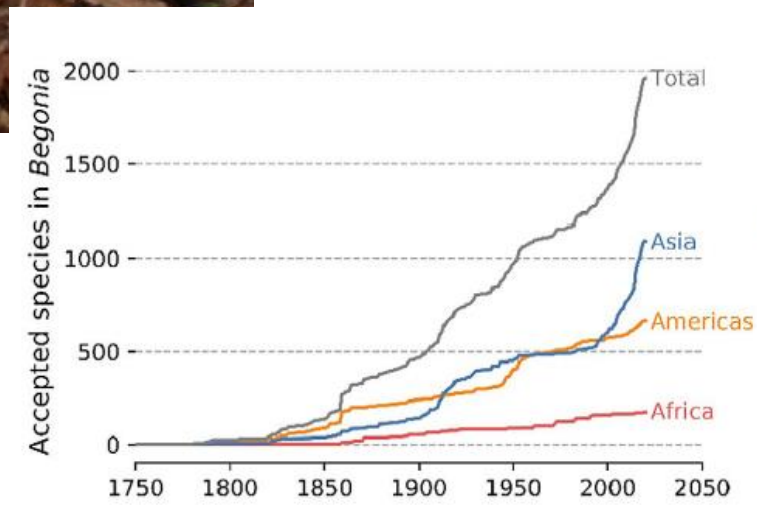
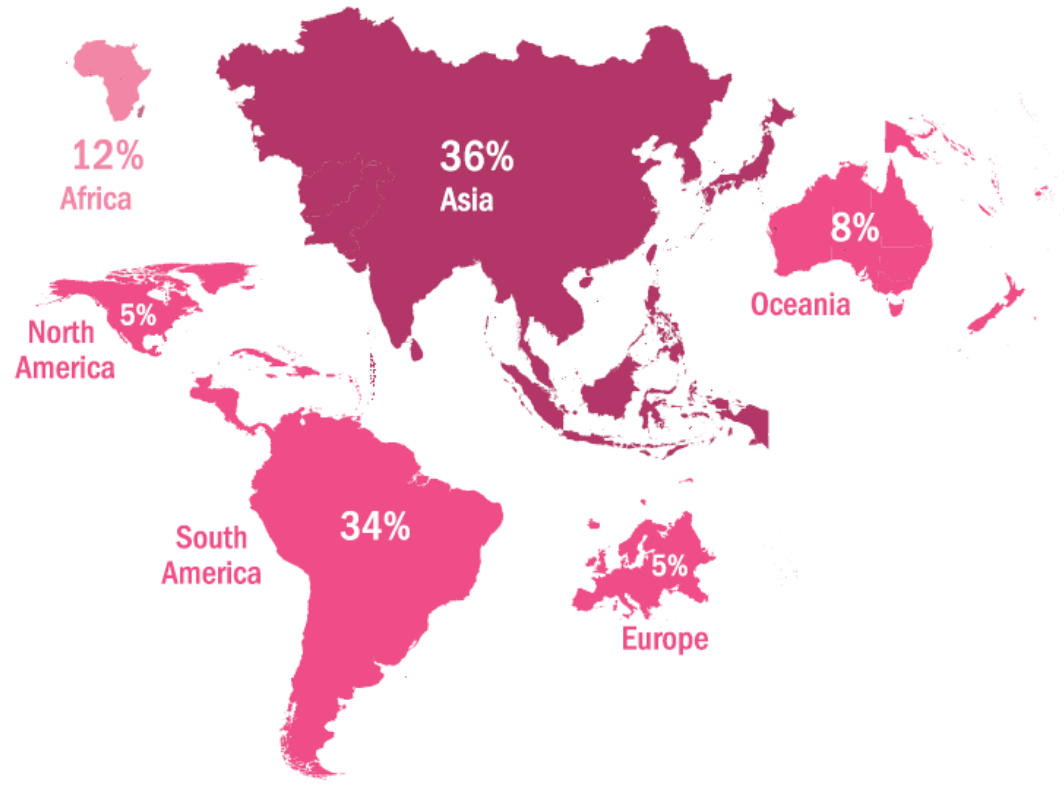
The top five vascular plant families in terms of numbers of accepted species (WCVP, 2020).

Family	Global totals species (rounded to nearest 1,000)
Compositae (Asteraceae)	32,000
Orchidaceae	30,000
Leguminosae (Fabaceae)	22,000
Rubiaceae	14,000
Gramineae (Poaceae)	12,000



Galanthus bursanus (Amaryllidaceae) from Turkey, discovered on Facebook. Photo: D.Zubkov;

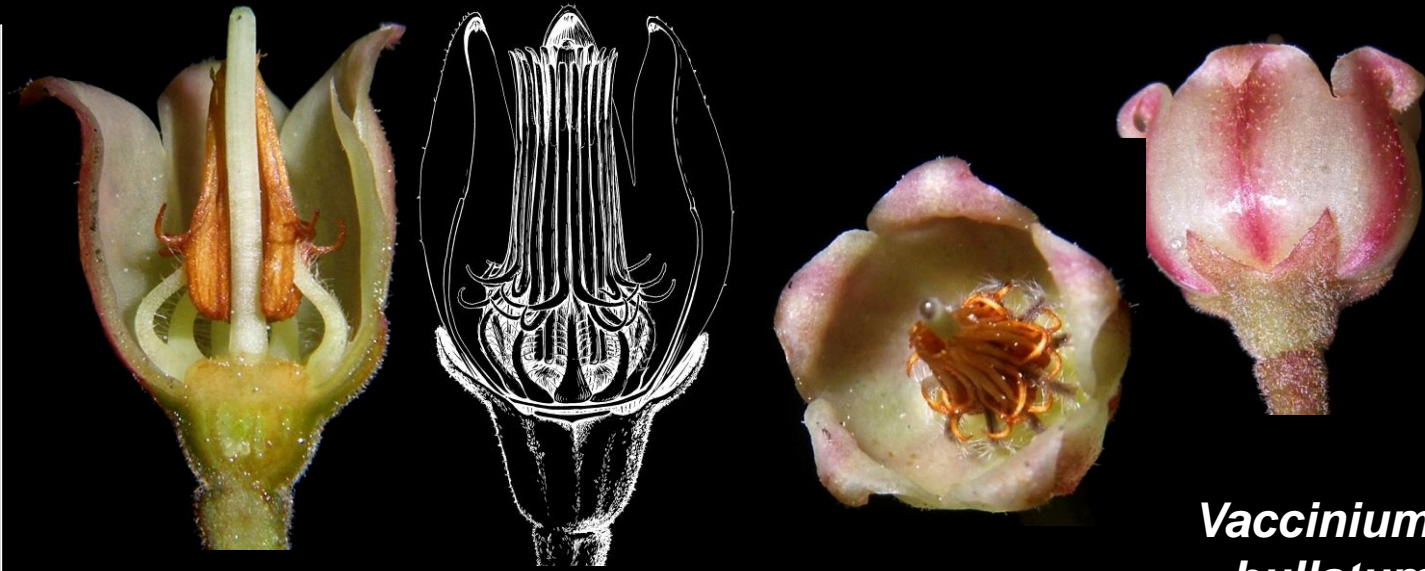
Plants



Vaccinium (Ericaceae): около 450 видов, большое разнообразие в горных районах тропиков



Vaccinium uliginosum - голубика



Vaccinium bullatum

Первое описание и изображение цветка
Пыльники склеены в трубку
Придатки пыльников диморфные,
перекрещиваются через один
(Nuraliev et al., 2020)



узкий ареал



Новые для науки **виды**, **подвиды** и **разновидности**, описанные сотрудниками и аспирантами кафедры высших растений за 1993-2018 гг. (значки – типовые местонахождения)



Biemannia longicheila Aver. & Nuraliev
(Orchidaceae). Вьетнам.



Tripleurospermum nathaliae A.Zernov (Asteraceae).
Краснодарский край, Россия.



Aspidistra xuansonsensis Vislobokov
(Asparagaceae). Вьетнам.



Symphytum x mosquense
S.R.Majorov & D.D.Sokoloff (Boraginaceae).
Москва.



Lotus stepposus Kramina
(Fabaceae). Украина.



Corbichonia exellii Sukhor.
(Lophiocarpaceae). Намибия.



Argostemma cordatum
Nuraliev (Rubiaceae).
Вьетнам.



Seychellaria barbata
Nuraliev & Cheek (Triuridaceae).
Мадагаскар.



Thismia mucronata Nuraliev
(Thismiaceae). Вьетнам.



Trithuria cowieana D.D.Sokoloff, Remizowa,
T.D.Macfarl. & Rudall (Hydatellaceae).
Австралия.



Shortia rotata Gaddy & Nuraliev
(Diapensiaceae). Вьетнам.



Arthrocnemum franzii Sukhor.
(Amaranthaceae). Кабо-Верде.



Strobilanthes barbigerata J.R.I.Wood, Nuraliev &
Scotland (Acanthaceae). Вьетнам.



*Aspidistra
elatior*

H.-J. TILLICH

A key for *Aspidistra* (Ruscaceae), including fifteen new species from Vietnam¹

With one Map and 3 Figures

Summary

Fifteen species and two subspecies of *Aspidistra* (Ruscaceae, Monocotyledons) from Vietnam new to science are described. This raises the number of known species to 76 and extends the genus area to South Vietnam at ca. 12° N. Additionally, a detailed new key is given to determine all recently known species in *Aspidistra*.

New species: *Aspidistra atroviolacea*, *A. bicolor*, *A. bogneri*, *A. carnosa*, *A. cornata*, *A. foliosa*, *A. geastrum*, *A. lateralis*, *A. lutea*, *A. marasmioides*, *A. opaca*, *A. petiolata*, *A. stricta*, *A. subrotata*, *A. superba*.

New subspecies: *Aspidistra arnautovii* sp. nova, subsp. *arnautovii*, *A. arnautovii* subsp. nova *catbaensis*, *A. subrotata* subsp. nova *crassinervis*.

New combinations: *Aspidistra dodecandra*, *A. glandulosa*.

Introduction

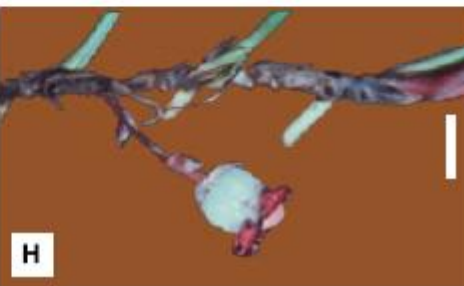
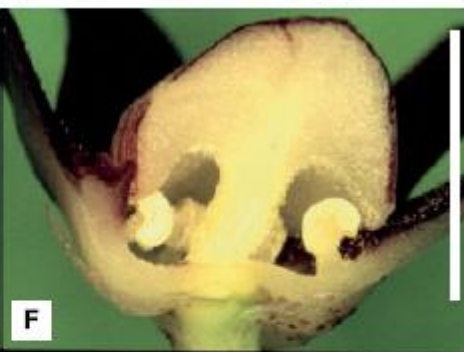
The family Ruscaceae has a Northern Hemisphere distribution with a center of diversity in South-Eastern Asia (following ANGIOSPERM PHYLOGENY GROUP 2003), the name Ruscaceae SPRENG. (1826) has priority over Convalariaceae HORAN. (1834). The genus *Aspidistra* is a typical South-East Asian element of that family. It was introduced by KER-GAWLER (1822) with *A. lurida* from China. During the following 150 years only ten more species were described (LINDLEY 1826; BLUME 1834; BAILLON 1894; STAPF 1903; HAYATA 1912, 1920; GAGNEPAIN 1934a, b; PEI 1939). Even CONRAN & TAMURA (1998) estimated only „about 11 spp“. A more realistic approach is given in the new English edition of the Flora of China in

Zusammenfassung

Ein Schlüssel für die Gattung *Aspidistra* (Ruscaceae) einschließlich 15 neue Arten aus Vietnam

Es werden 15 neue Arten und zwei neue Unterarten der Gattung *Aspidistra* (Ruscaceae, Monocotyledoneae) beschrieben. Damit erhöht sich die Zahl der bekannten Arten auf 76. Das Areal der Gattung reicht nun bis in das südliche Vietnam bei ca. 12° N. Zusätzlich wird ein neuer Bestimmungsschlüssel für alle derzeit bekannten Arten der Gattung vorgestellt.

distinguishing 49 species (LIANG & TAMURA 2000). Indeed, the number of known species has increased remarkably during the past two or three decades, and the increase in species number continues indicating that for a long period of time these understorey plants of warm-temperate to (sub-)tropical rain- and monsoon-forests have been widely overlooked (CHUN & HOW 1977; LANG 1978, 1981; ZHU & ZHANG 1981; CHEN & FANG 1982; LANG & ZHU 1982, 1984; WAN 1984a, b, 1985, 1987, 1989, 1989; HUANG 1986; WAN & HUANG 1987; LI 1988; PENG 1989; TAO 1992; FANG, YEN & ZENG 1993; LI, LONG & BOGNER 1998; LANG et al. 1999; FANG & YU 2002; HE 2002; LI & TANG 2002; TANG & LIU 2003; BOGNER & ARNAUTOV 2004; BRÄUCHLER & NGOC 2005; TILLICH 2006).

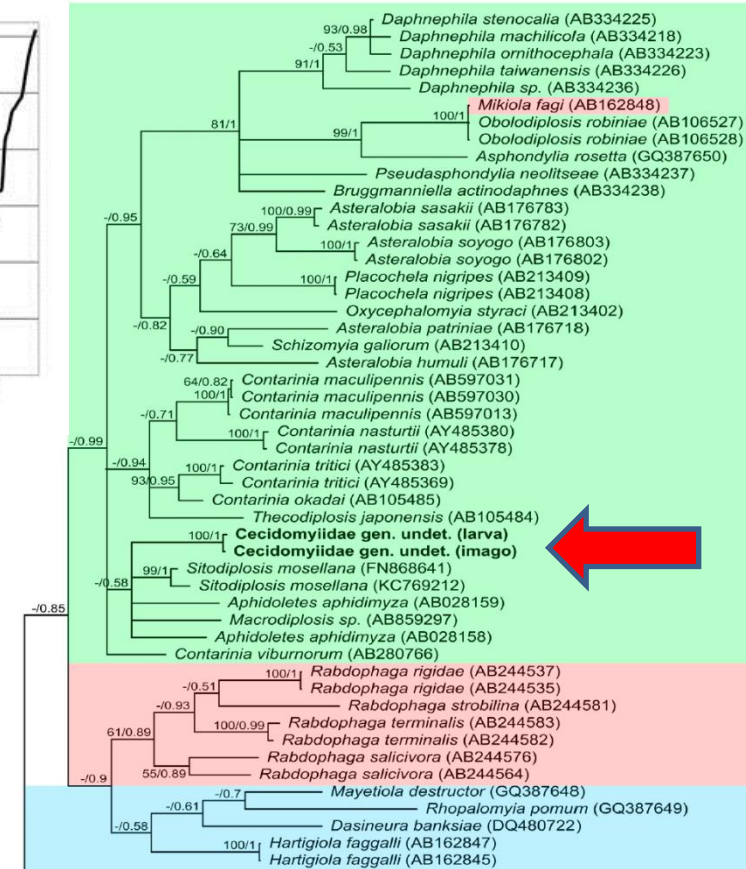
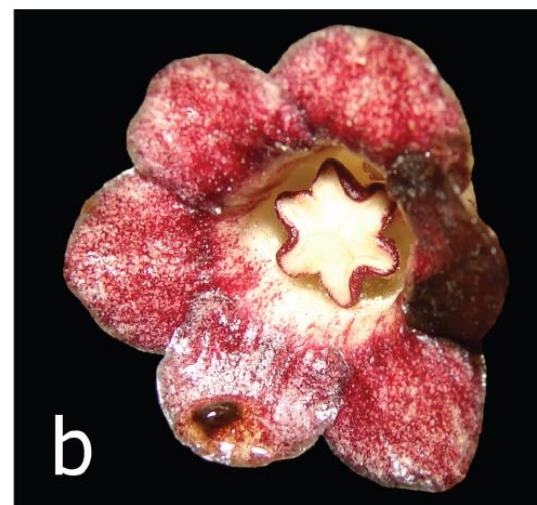
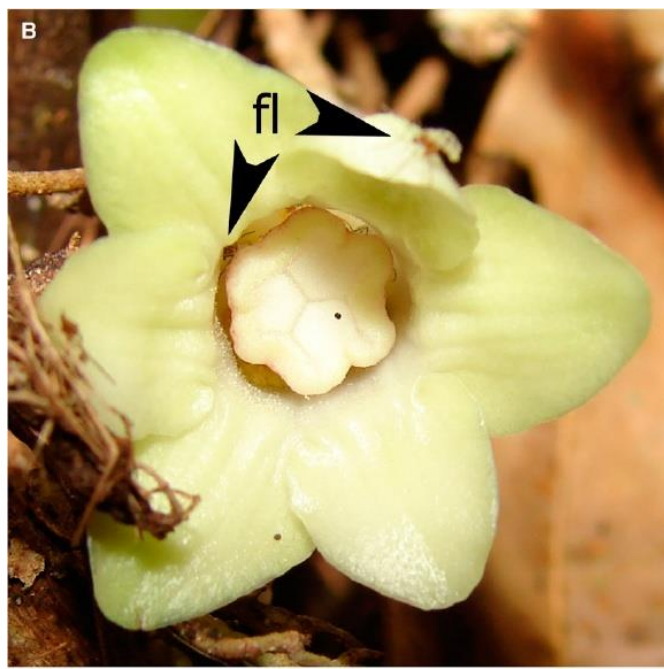
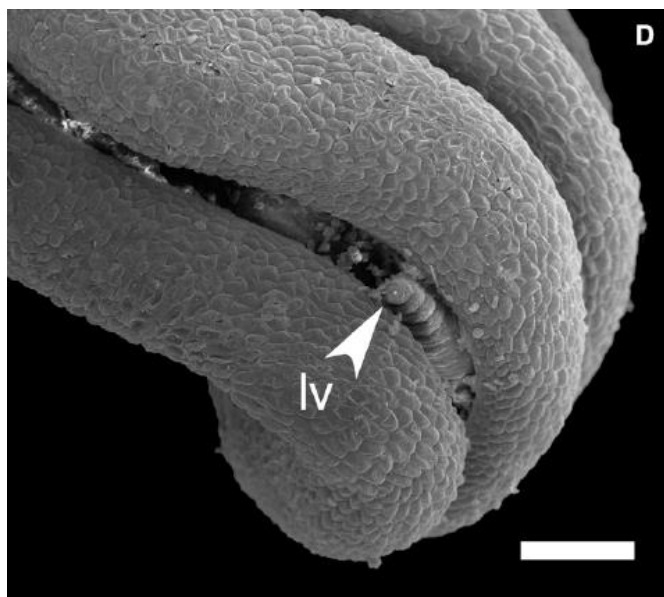
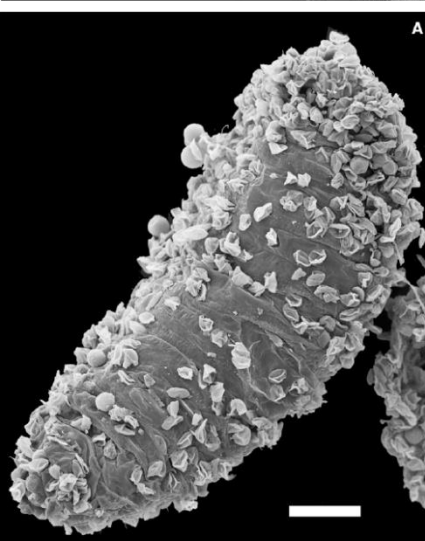
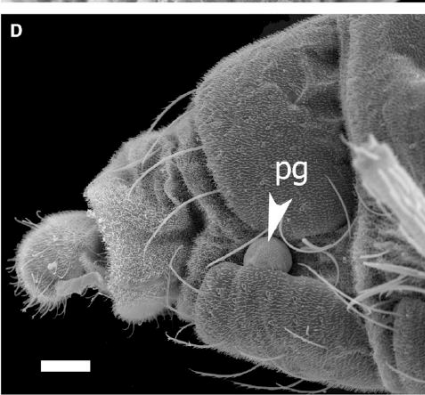
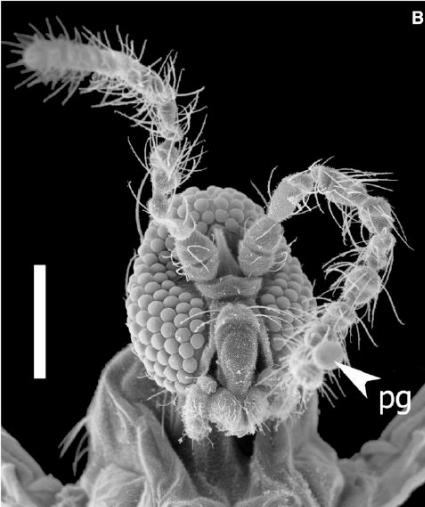


Arcitalitrus sylvaticus

Aspidistra
1998 – 11 ВИДОВ
2000 – 49 ВИДОВ
2005 – 80 ВИДОВ
2015 – 130 ВИДОВ
2017 – 145 ВИДОВ
2020 – 180 ВИДОВ

¹ Dedicated belatedly to Dr. hc. Josef Bogner on the occasion of his 65. birthday.

Новый вариант взаимодействия
опылителей и растений: личинки
опылителя развиваются в пыльниках
обоеполых цветков



American Journal of
Botany
Celebrating 100 years 1914–2014

American Journal of Botany 101(9): 1519–1531, 2014.

POLLINATION OF VIETNAMESE *ASPIDISTRA XUANSONENSIS*
(ASPARAGACEAE) BY FEMALE CECIDOMYIID FLIES: LARVAE
OF POLLINATOR FEED ON FERTILE POLLEN IN ANTHERS OF
ANTHETIC BISEXUAL FLOWERS¹

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Two new genera of Podostemaceae from northern Central Laos: saltational evolution and enigmatic morphology

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Abstract

Podostemaceae, the river-weeds, are characterized by remarkable differences between species and genera, which resulted from saltational evolution. This paper presents additional cases of such two genera, which are described here from the Phou Khao Khouay National Protected Area in northern Central Laos. Molecular phylogenetic data show that *Ctenobryum mangkonense* (gen. & sp. nov.) is sister to *Hydrodiscus koyamae*, while *Laosia ramosa* (gen. & sp. nov.) is isolated from all Asian genera of subfamily Podostemoideae. *Ctenobryum mangkonense* is distinct from *Hydrodiscus koyamae* in the crustose roots (versus rootless in the latter), scattered flowers on the root (versus alternate on the shoot), and pectinate bracts (versus simple, sheath-like). *Laosia ramosa* is distinct from all the genera in the columnar, endogenously branched axes and single style-stigma complex. The axis is an enigmatic organ with combined characteristics of root, stem and leaf, pending further study. Laos, together with Thailand, is a center of diversity of the Southeast and East Asian Podostemoideae. The three monotypic genera, i.e., *Ctenobryum*, *Hydrodiscus* and *Laosia*, occur in neighboring and closely similar aquatic habitats within the Area. The new taxa are formally described.

Keywords *Ctenobryum* · Enigma · *Laosia* · *matK* phylogeny · New genera · Saltational evolution

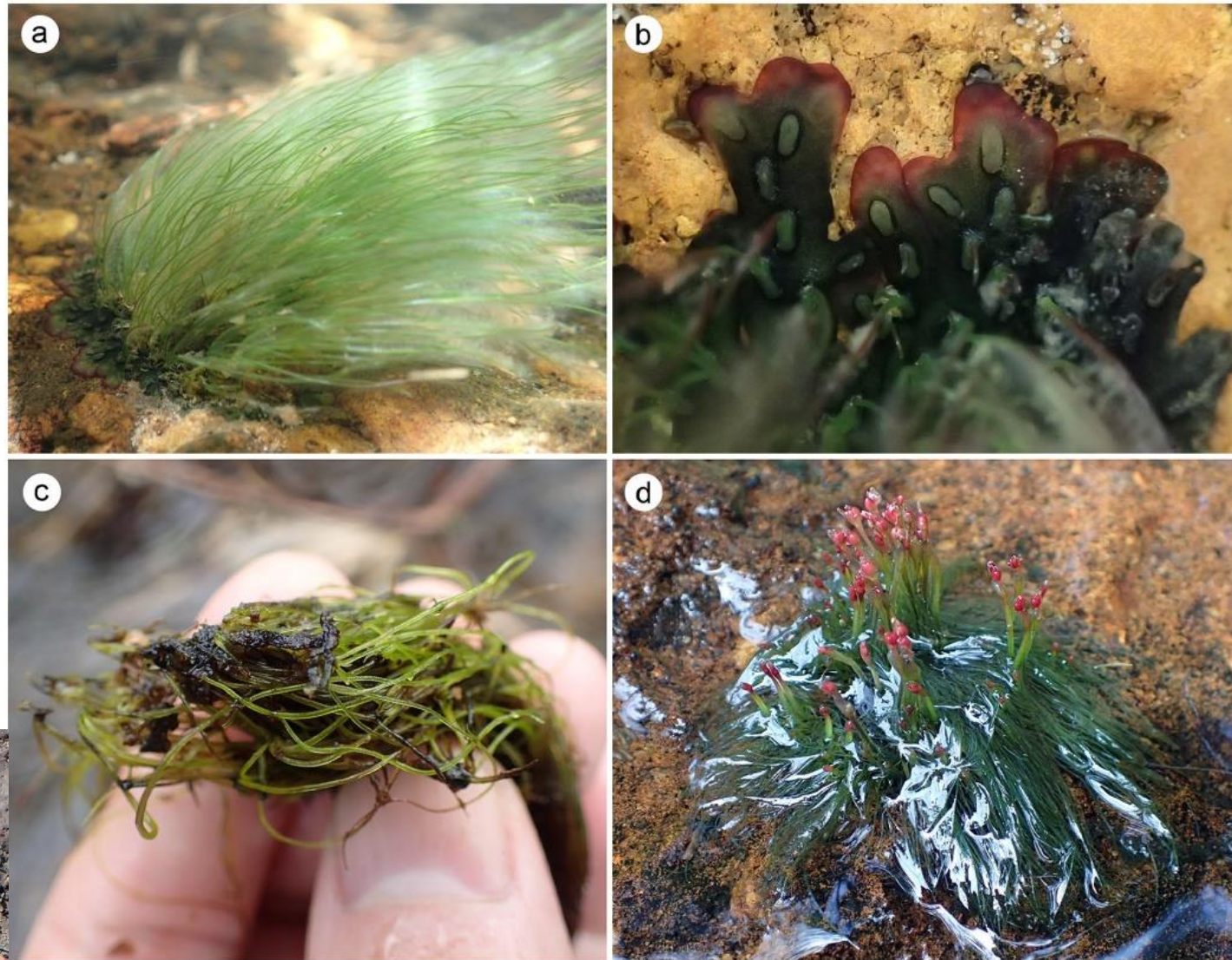


Fig. 3 *Laosia ramosa* in natural habitat. **a** Floating axes branched from roots adhering on rock surface (under water). **b** Lobed, ribbon-like roots. Bulges where axes will arise are seen on root surface (under water). **c** Columnar axes (green) branched from root (black, in upper center). **d** Semi-submerged, floriferous plant. **e** Flower with single stamen and ovary with single stigma. **f** Fruits. **g** Dried roots with fruits. Scars of floriferous branches in depressions on root

Acknowledgements We thank M. Nuraliev for providing information and images of *Laosia ramosa*, P. Werukamkul for help on the field trip, and Y. Hirayama for technical assistance for the phylogenetic analysis.

Fig. 7 *Ctenobryum mangkon-ense*: LPK-04. **a** Crustose root with flowering shoots scattered on dorsal surface.

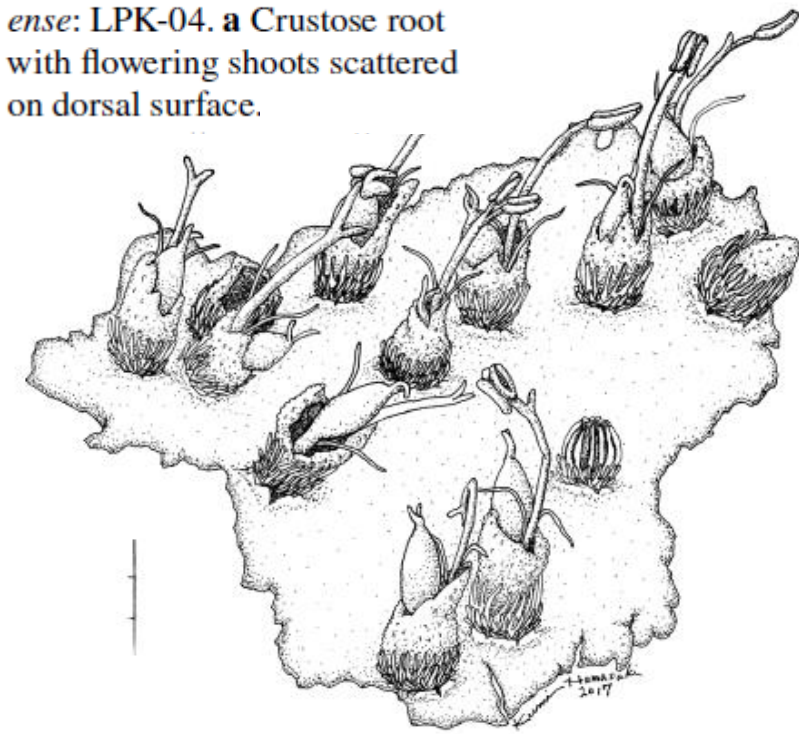


Fig. 3 *Laosia ramosa* in natural habitat. **a** Floating axes branched from roots adhering on rock surface (under water). **b** Lobed, ribbon-like roots. Bulges where axes will arise are seen on root surface (under water). **c** Columnar axes (green) branched from root (black, in upper center). **d** Semi-submerged, floriferous plant. **e** Flower with single stamen and ovary with single stigma. **f** Fruits. **g** Dried roots with fruits. Scars of floriferous branches in depressions on root

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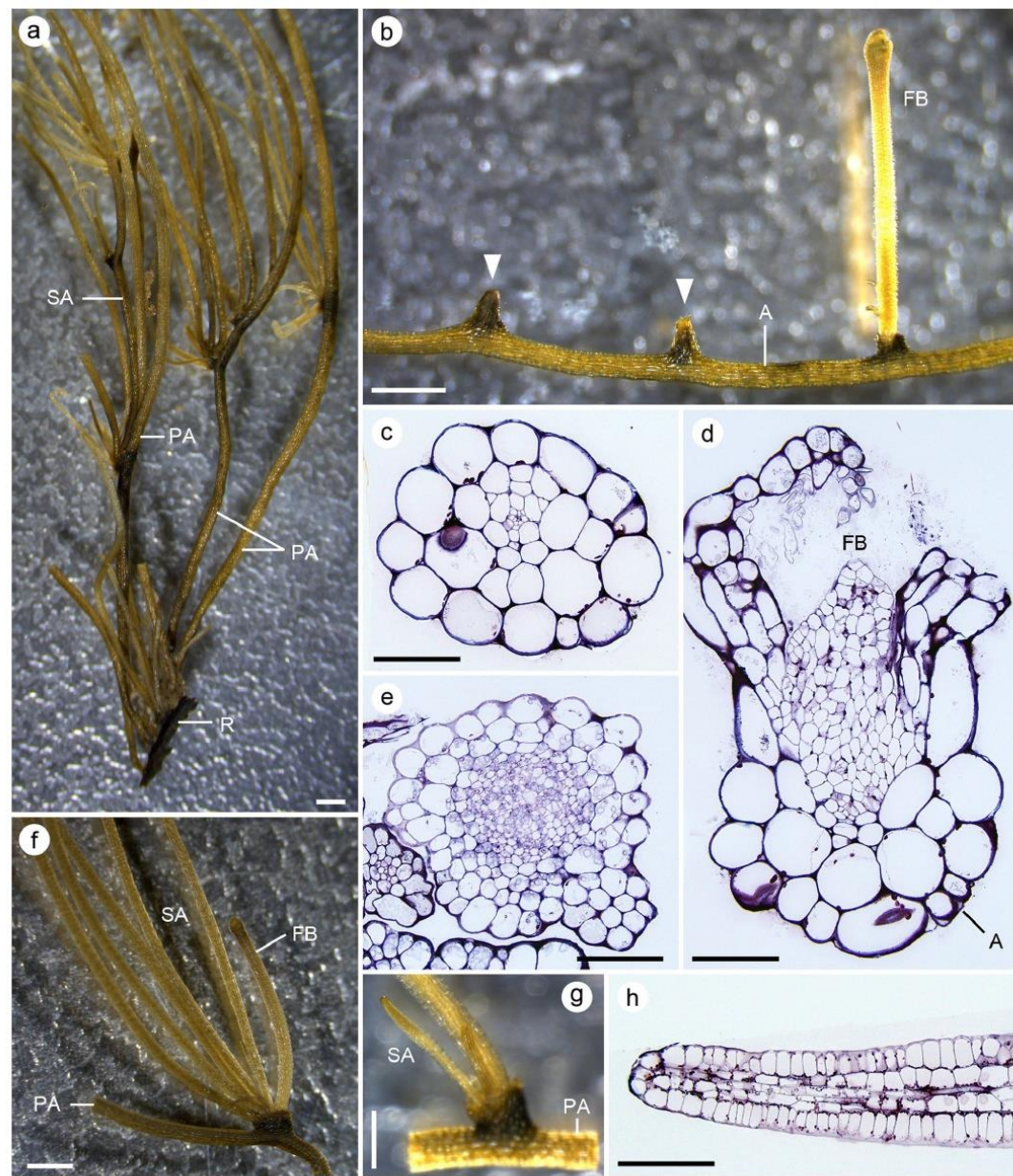


Fig. 4 Axes of *Laosia ramosa*. **a** Branched axes borne on flattened root showing that primary axes arise from root and secondary axes arise from primary ones. **b** Two branch buds (arrowheads) and floriferous branch (=flower bud comprising spathe and elongate pedicel) from parental axis. Note flower buds occur on same side of axis. **c** Cross section of columnar axis with thin provascular cells. **d** Cross section of axis with endogenous bud (in longitudinal section).

e Cross section of pedicel. **f** Endogenous flower bud and axes (secondary axes) from parental axis (primary axis). **g** Endogenous lateral branches (short axes) subtended by turned-up ruptured projection of axis. **h** Longitudinal section of short axis. A axis, FB flower bud, PA primary/parental axis, R root (flattened), SA secondary axis. Scale bars **a, b, f** 1 mm; **c-e, h** 100 μ m; **g** 500 μ m

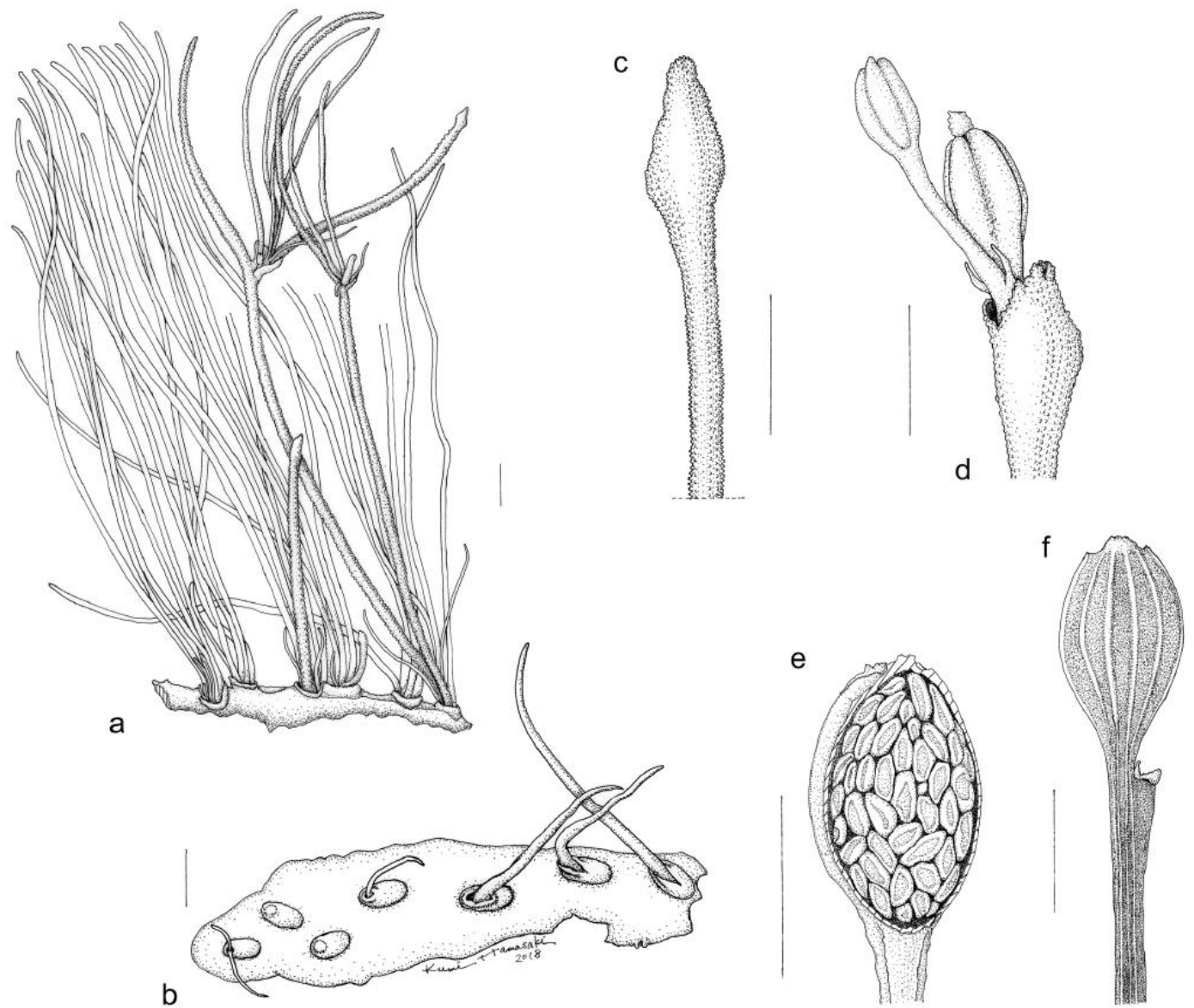


Fig. 8 *Laosia ramosa*: **a** LPK-206, **b** LPK-201, **c-f** LPK-05. **a** Branched columnar axes, some of which are floriferous, branched from ribbon-like root. **b** Ribbon-like root with axis-buds on dorsal surface. **c** Spathe. **d** Flower extruded from spathe, with two

tepals, single stamen and ovary with single stigma. **e** Seeds on placenta in capsule. Valve of capsule is removed. **f** Stalked, ribbed capsule. Scale bars 1 mm

Vladimariales ordo nov. (Gymnospermae) from the Middle Jurassic Deposits of the Mikhailovskii Rudnik Locality (Kursk Region, European Russia)

N. V. Gordenko

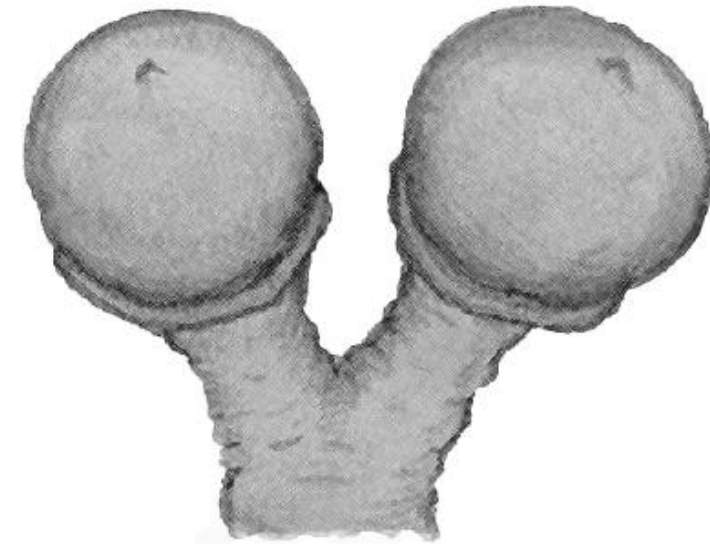
Borissiak Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya ul. 123, Moscow, 117997 Russia
e-mail: gordynat@mail.ru

Received: July 14, 2009

Abstract—Composite seed-bearing capsules (formed by fusion of eight radially arranged elementary capsules), assigned to a new monotypic order Vladimariales ordo nov., were found in the Upper Bathonian deposits of the Mikhailovskii rudnik locality (Zheleznogorsk town, Kursk Region). In its morphology, the new order demonstrates valuable, phylogenetically conditioned similarity to Peltaspermales and Umkomasiales, but it is evolutionarily more advanced than these latter. A base of the composite capsule is supported by a collar on a stalk, which in external appearance is not different from collar of Ginkgo L., but has stalk, vascularized in a different way (its conducting tissue consisted of eight radially arranged collateral vascular bundles; each vascular bundle correspond to one of eight fused elementary capsules, each of which contain a solitary seed). Capsules and seeds are inverted relative to the collar; as a result, collar protects micropilar tips of seeds. The presence of collar and whole aspect of the new plant composite capsules give them the significant superficial similarity with seed-bearing organs of modern Ginkgo. Mature composite capsule in Vladimariales ordo nov. dehisced along the lines of fusion of elementary capsules, forming the composite capsule, and scattered seeds; opened composite capsule detached from axis. The significance of the new order for gymnosperm phylogeny is discussed.

Key words: Middle Jurassic, Bathonian, gymnosperms, Ginkgoopsida, morphology, anatomy, systematics.

DOI: 10.1134/S0031030110100060

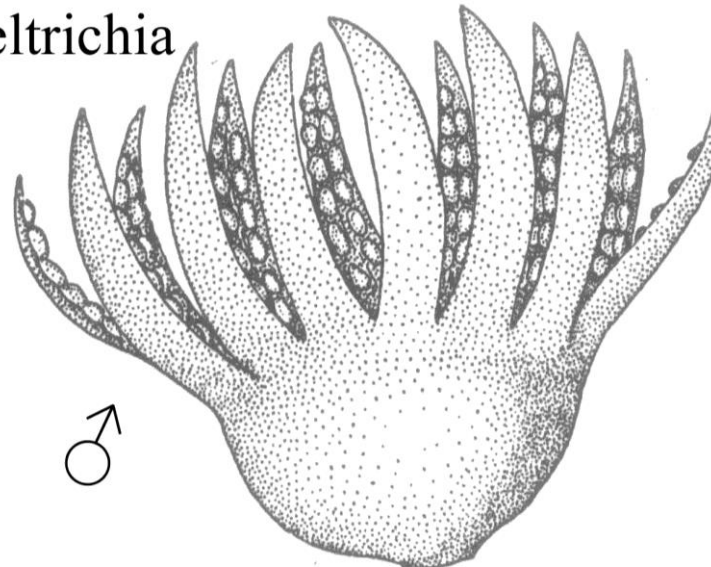


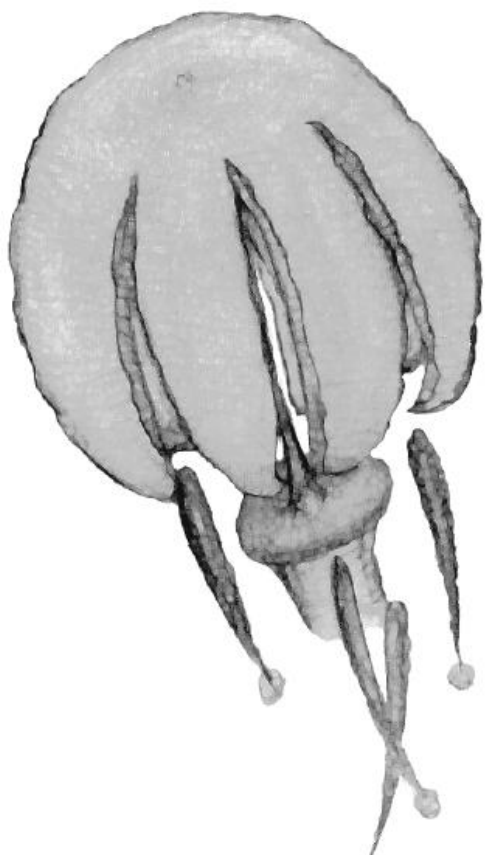
Reconstructed premature composite capsules of *Vladimaria octopartita*



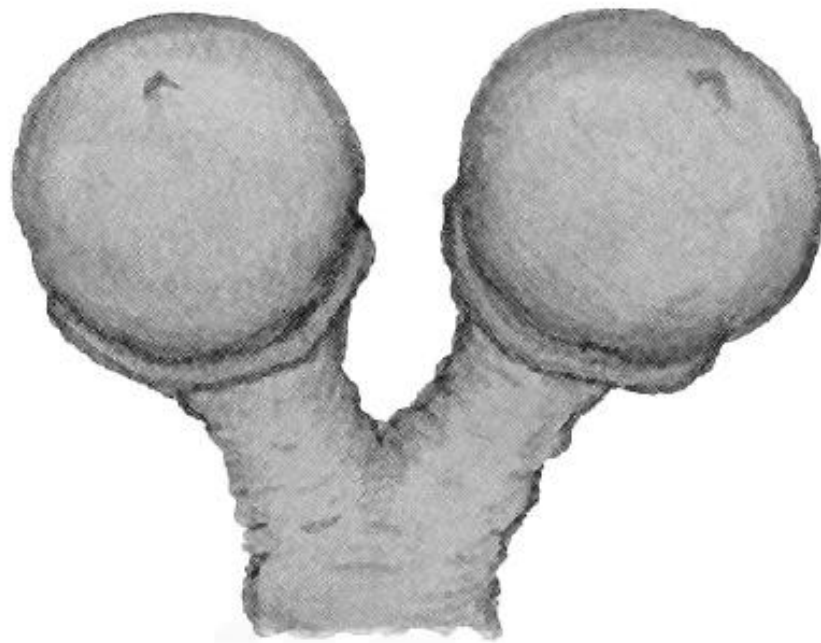
Czekanowskiales. He regarded the corystosperms (umkomasians) as a family within the order Peltaspermales. In recent years, they are often regarded as a separate order—Umkomasiales (Anderson and Anderson, 2003; Taylor et al., 2006; Taylor and Taylor, 2009). I also believe that umkomasians are an independent order. Meyen included all listed orders to comprehensive classis Ginkgoopsida, erected for plants with bilaterally symmetrical seeds without secondary integument (Meyen, 1984, 1987). He derived the Caytoniales, Ginkgoales, and Czekanowskiales directly from Peltaspermales with their umbrella-shaped seed-bearing organs, through the family Angaropeltidaceae (a new name of Cardiolepidaceae, established by Meyen, 1977). The Peltaspermales (I exclude of them umkomasians), evidently, appeared already in the Carboniferous (Kerp et al., 2001; Naugolnykh, 2007), still demonstrated diversity in the Triassic, but completely disappeared to the beginning of Jurassic. According to Meyen, the Ginkgoales and Czekanowskiales are united by close affinity to Peltaspermales. The vast majority of foreign scientists at present

Weltrichia

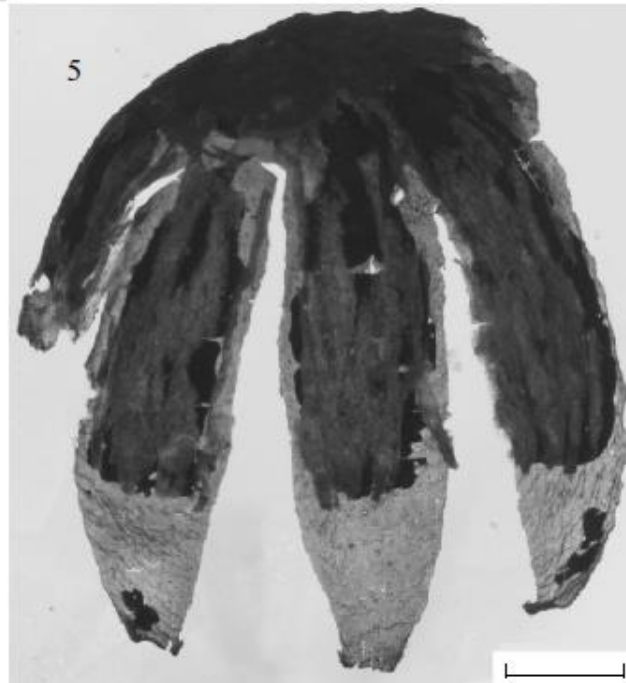
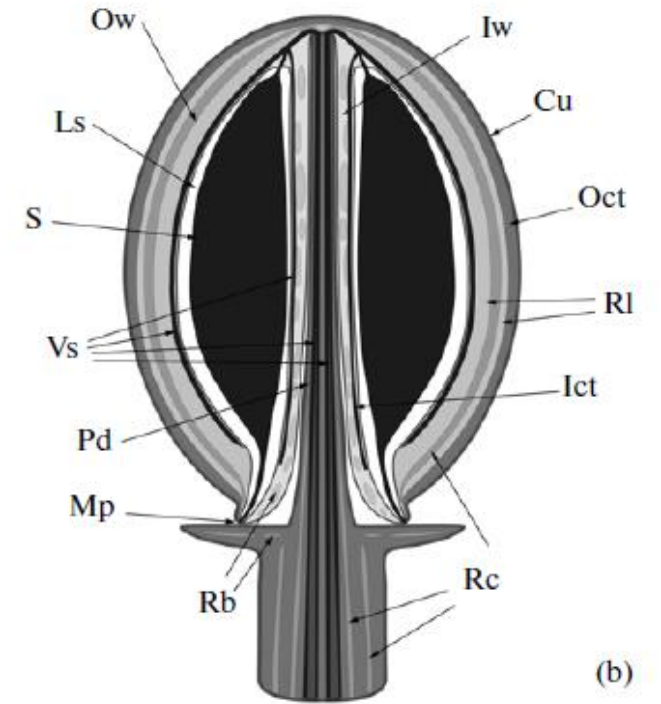
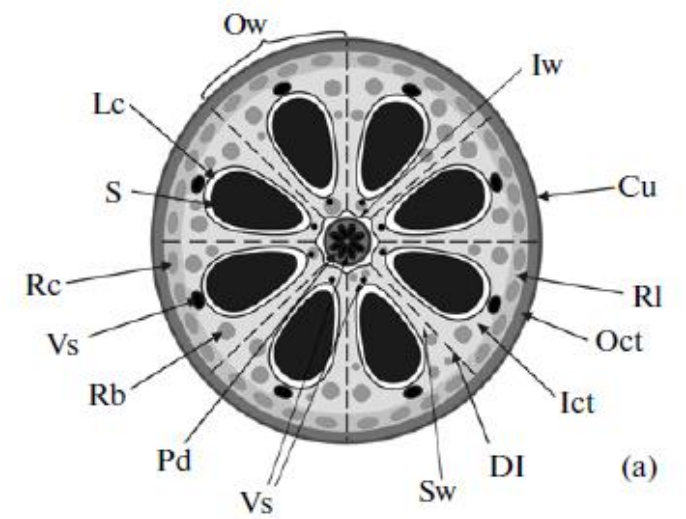




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Reconstructed premature composite capsules of *Vladimaria octopartita*.



**Vladimariales ordo nov. (Gymnospermae)
from the Middle Jurassic Deposits
of the Mikhailovskii Rudnik Locality
(Kursk Region, European Russia)**

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Received: July 14, 2009

Abstract—Composite seed-bearing capsules (formed by fusion of eight radially arranged elementary capsules), assigned to a new monotypic order Vladimariales ordo nov., were found in the Upper Bathonian deposits of the Mikhailovskii rudnik locality (Zheleznogorsk town, Kursk Region). In its morphology, the new order demonstrates valuable, phylogenetically conditioned similarity to Peltaspermales and Umkomales, but it is evolutionarily more advanced than these latter. A base of the composite capsule is supported by a collar on a stalk, which in external appearance is not different from collar of *Ginkgo* L., but has stalk, vascularized in a different way (its conducting tissue consisted of eight radially arranged collateral vascular bundles; each vascular bundle correspond to one of eight fused elementary capsules, each of which contain a solitary seed). Capsules and seeds are inverted relative to the collar; as a result, collar protects micropylar tips of seeds. The presence of collar and whole aspect of the new plant composite capsules give them the significant superficial similarity with seed-bearing organs of modern *Ginkgo*. Mature composite capsule in Vladimariales ordo nov. dehisced along the lines of fusion of elementary capsules, forming the composite capsule, and scattered seeds; opened composite capsule detached from axis. The significance of the new order for gymnosperm phylogeny is discussed.

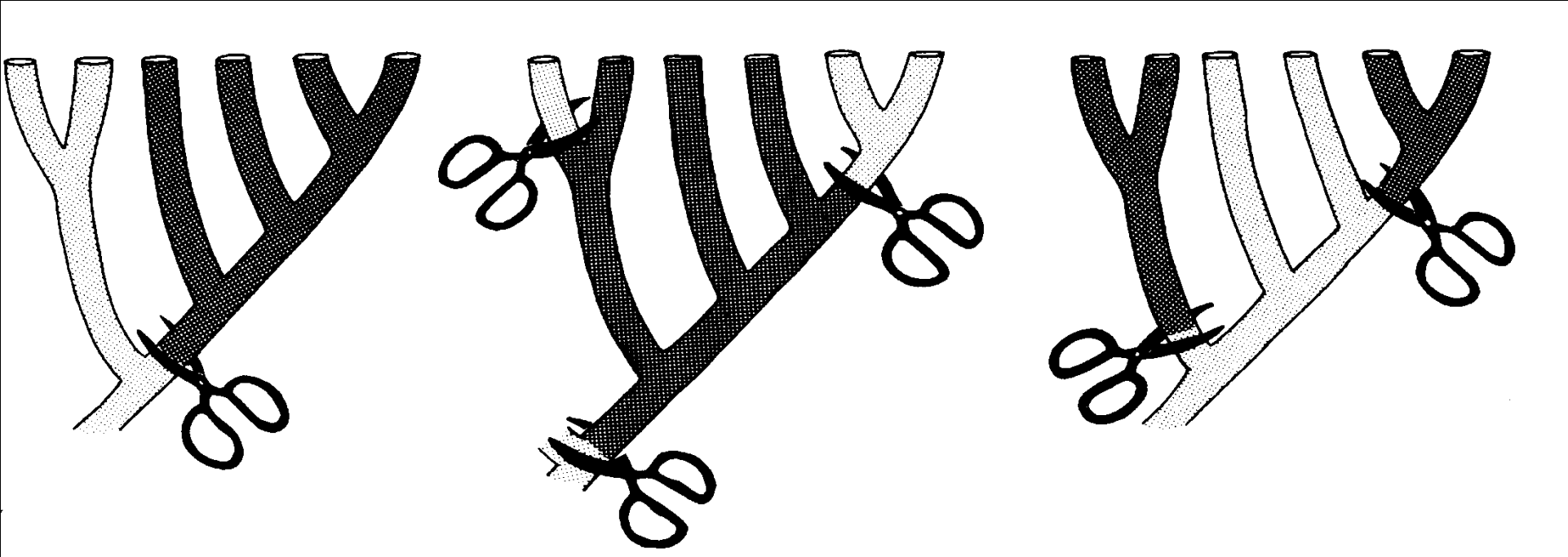
Типы систем живых организмов

- **Искусственные** — произвольный выбор небольшого числа признаков как основы системы
- **Естественные** — анализ большого числа признаков и выделение самых значимых как результат работы систематика; попытка отразить в системе «естественно присущий природе порядок» (который мог пониматься, например, как план творения).
- **Эволюционные** — система должна отражать представления об эволюции
- **Кладистические** — система должна однозначно следовать из представлений об эволюции. Два аспекта — переход от филогенетического дерева к системе и технические алгоритмы построения деревьев.

Старое понимание терминов

Монофилия

Полифилия



Монофилия

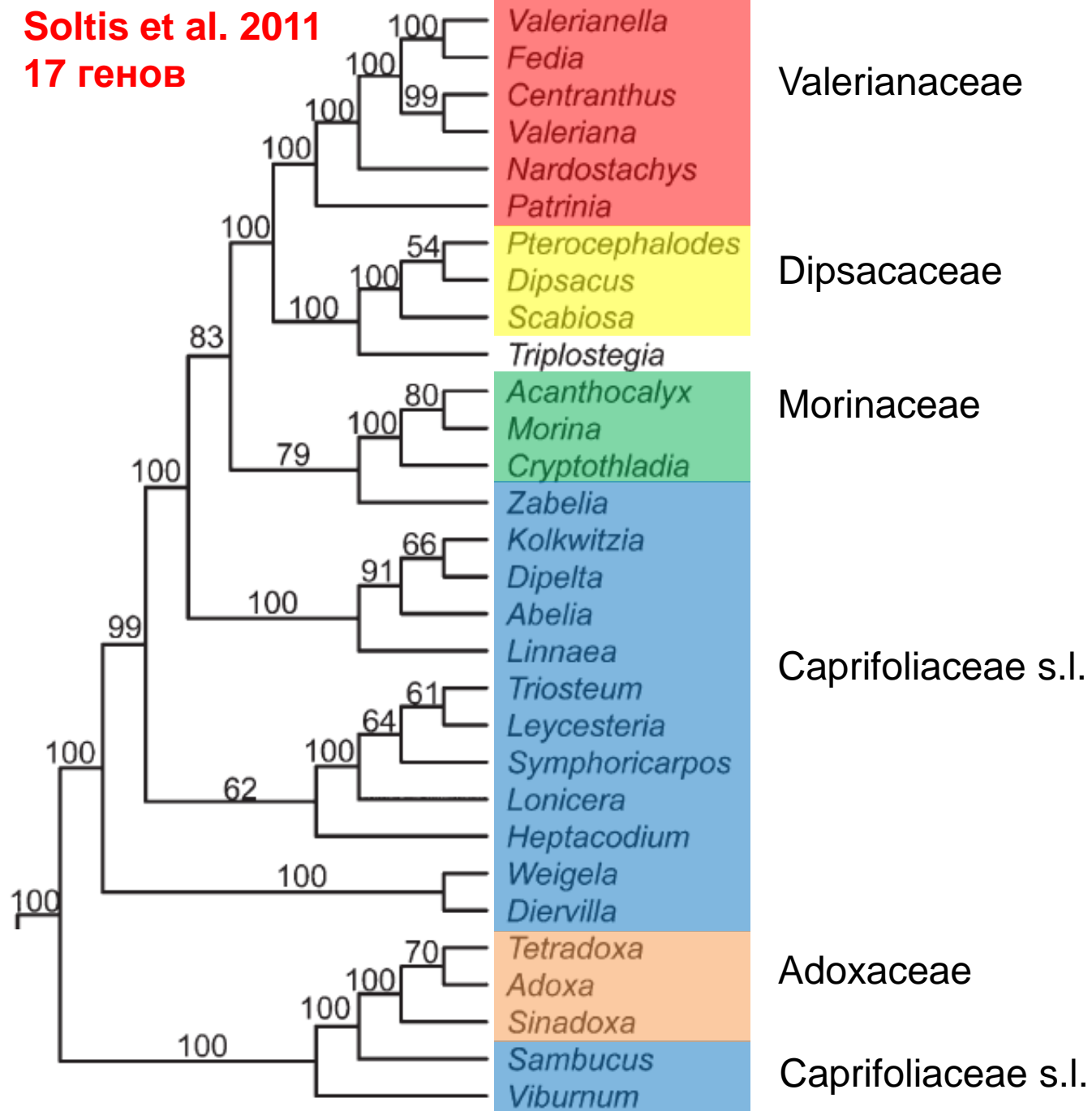
Парафилия

Полифилия

«не-монофилия»

Кладистическое понимание терминов

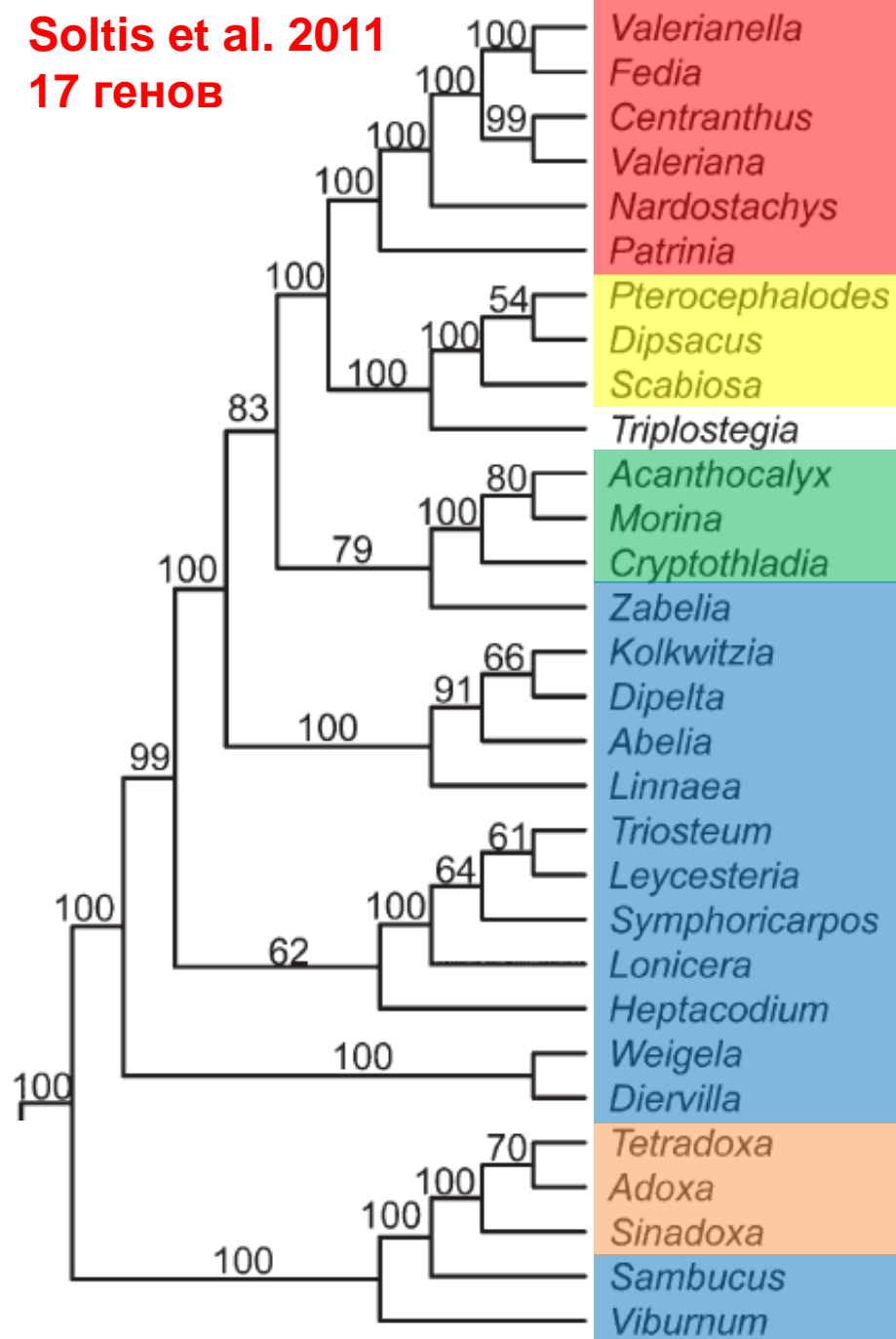
Soltis et al. 2011
17 генов



Порядок Dipsacales

Традиционно
выделяемые
семейства

Soltis et al. 2011
17 генов



Valerianaceae

Dipsacaceae

Morinaceae

Linnaeaceae

Caprifoliaceae

Diervillaceae

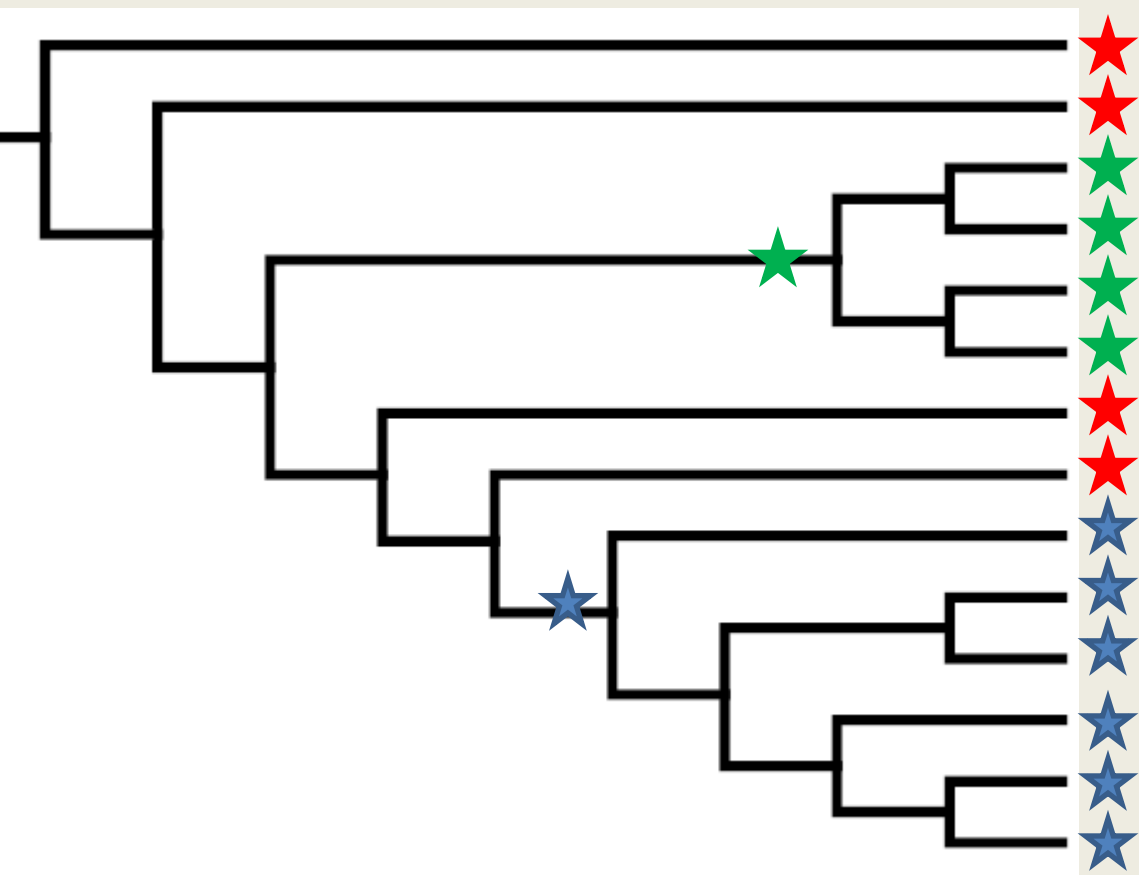
Adoxaceae

Порядок
Dipsacales

Семейства по
системе
Stevens (2007,
APWEB)

Кладизм, или «филогенетическая систематика»

- W. Hennig (1950, 1966) – основатель кладизма
- монофилия – парафилия – полифилия
- признаки – состояния признаков
- апоморфные и плезиоморфные состояния признаков
- синапоморфии и симплезиоморфии
- использование внешней группы
- принцип максимальной экономии (парсимонии)

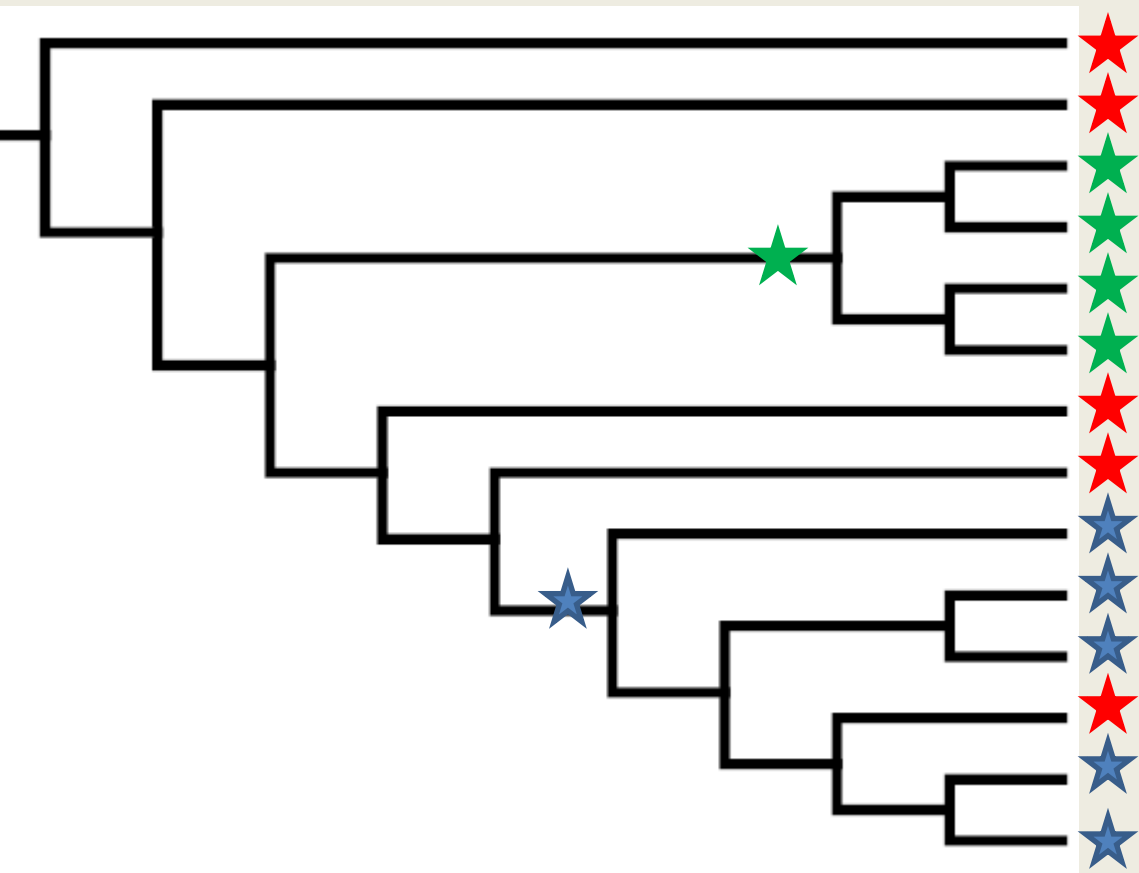


Родство определяют только по апоморфиям!!!

Самое простое предположение, что они возникли у общего предка группы и именно поэтому характерны для его потомков (т.к. унаследованы от этого предка).

Апоморфия – производное состояние признака

Плезиоморфия – исходное состояние признака



Родство определяют только по апоморфиям!!!

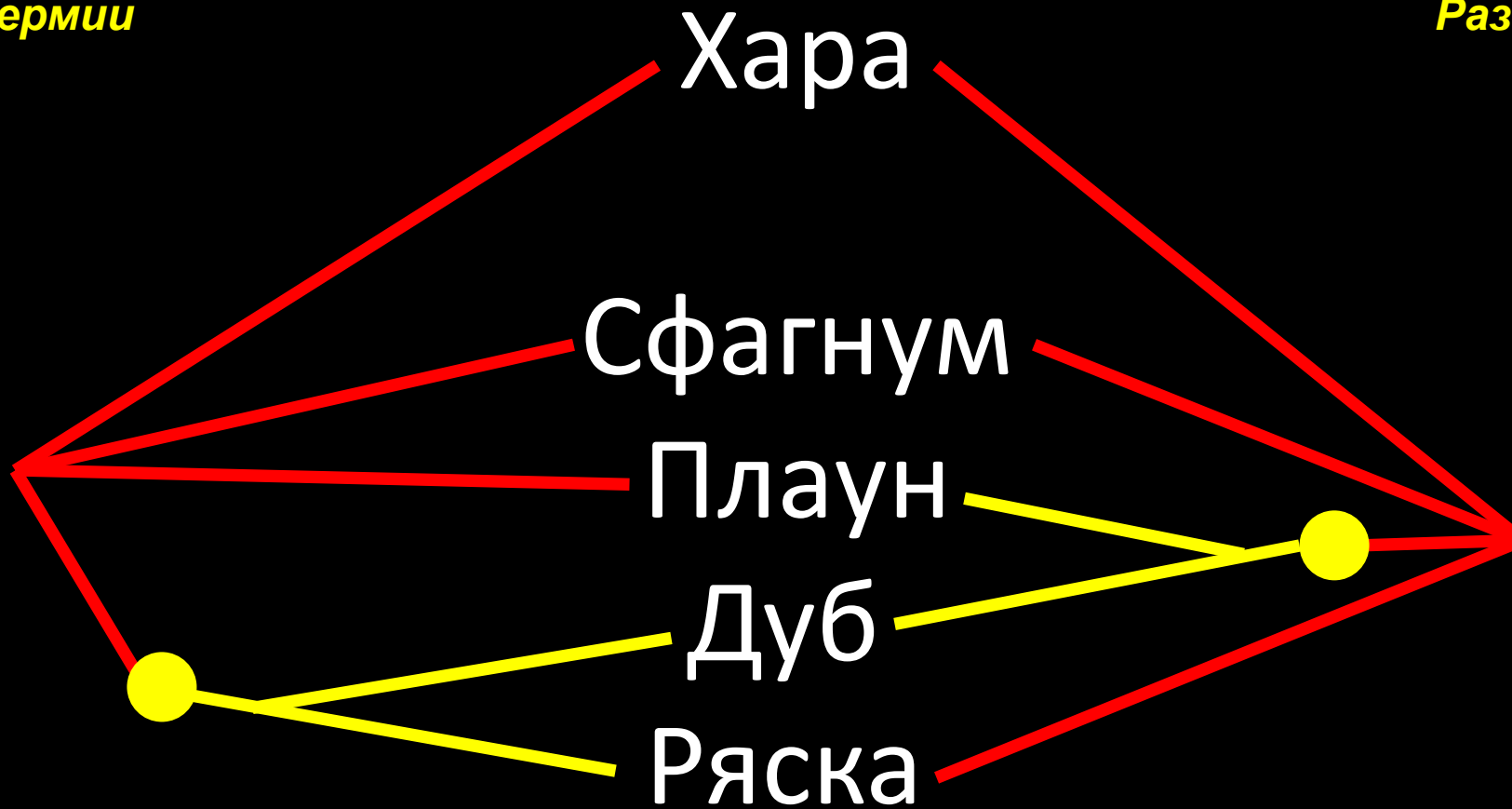
Самое простое предположение, что они возникли у общего предка группы и именно поэтому характерны для его потомков (т.к. унаследованы от этого предка).

Апоморфия – производное состояние признака

Плезиоморфия – исходное состояние признака

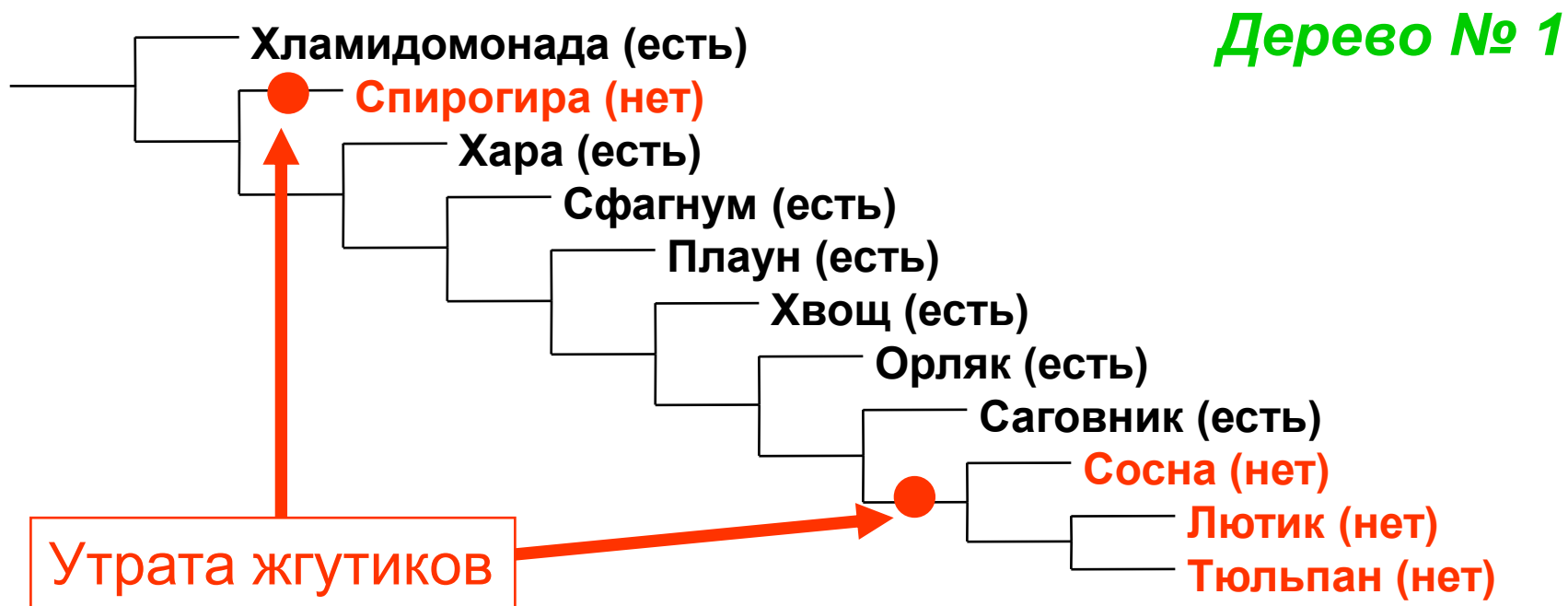
Мужские гаметы
Сперматозоиды
Спермии

Ксилема
Отсутствует
Развита



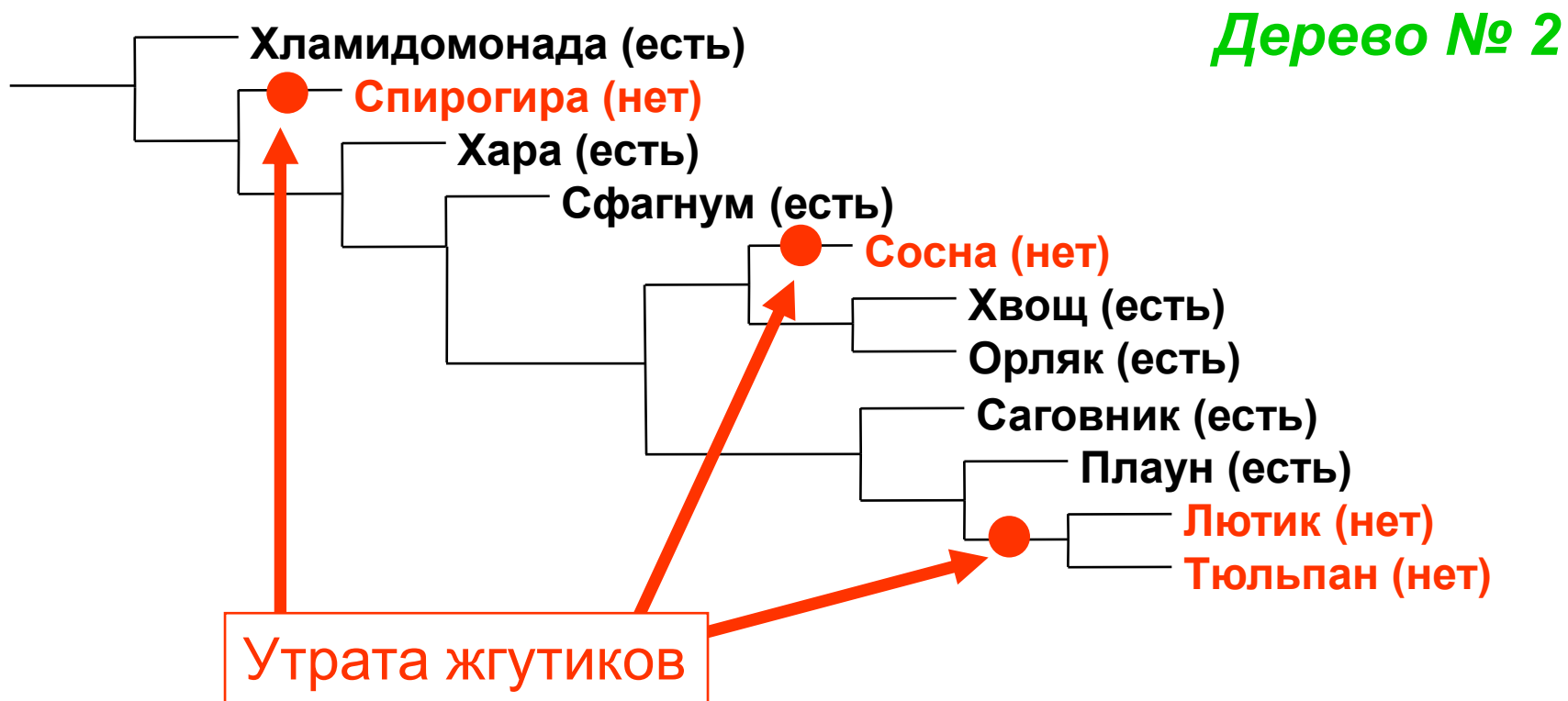
Конфликт признаков: в этом массиве данных две синапоморфии, но не может быть так, что обе они – истинные. Хотя бы одна из них должна быть ложной. Принцип максимальной экономии – один из подходов для принятия решений том, какие из синапоморфий – истинные, а какие – ложные.

Признак № 1: способность образовывать жгутики (есть/нет)



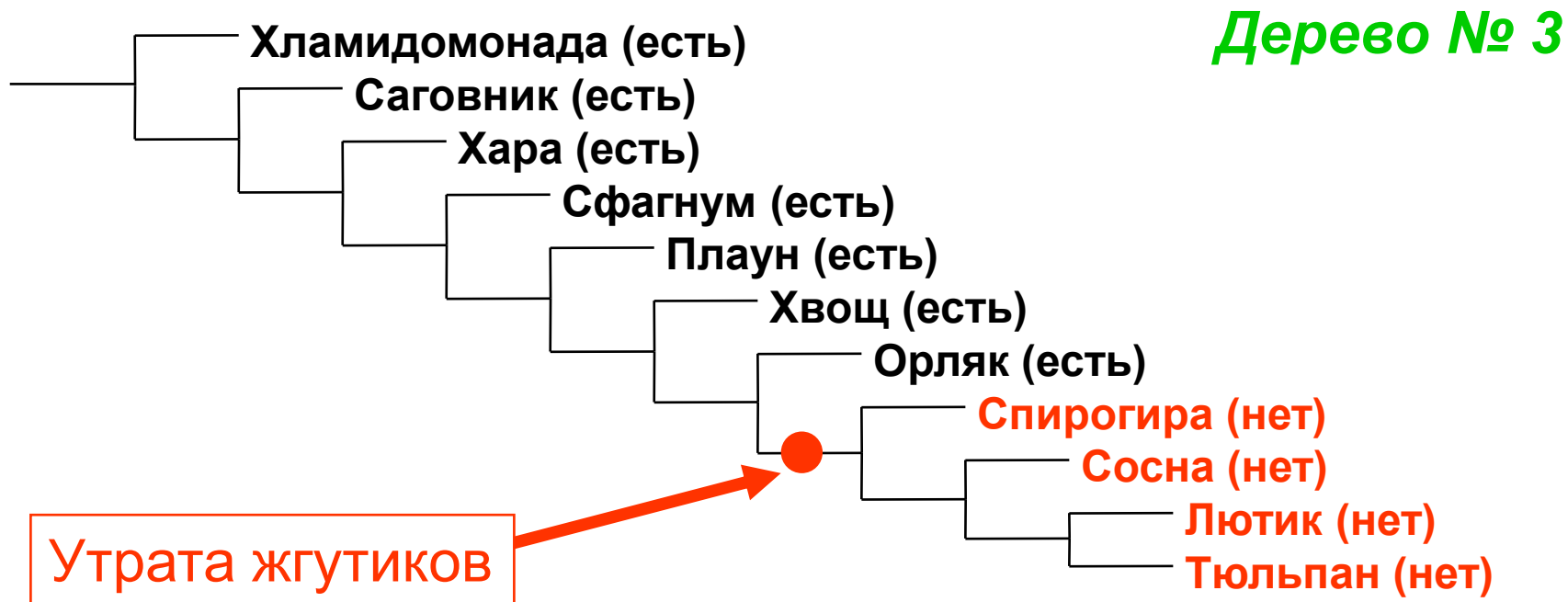
Длина дерева № 1 по признаку № 1 = 2 шага

Признак № 1: способность образовывать жгутики (есть/нет)



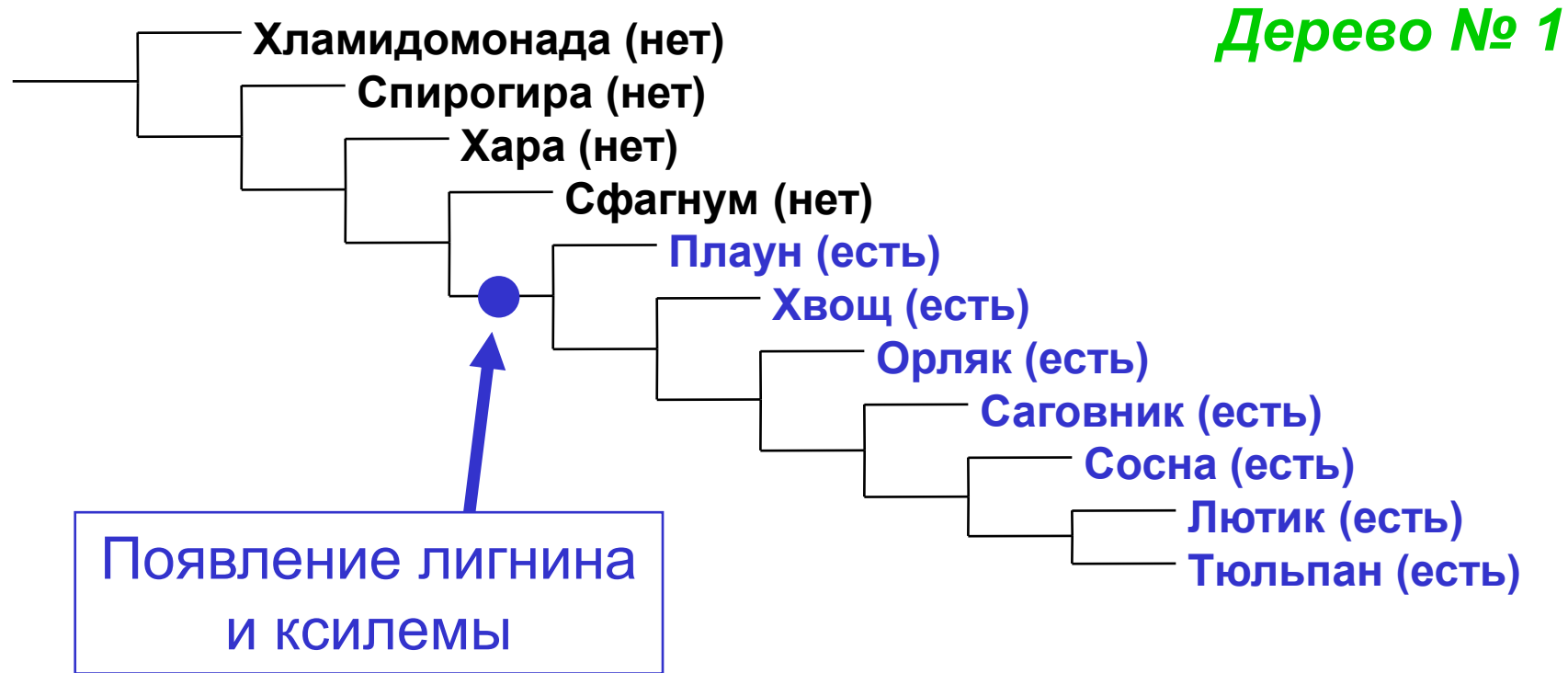
Длина дерева № 2 по признаку № 1 = 3 шага

Признак № 1: способность образовывать жгутики (есть/нет)



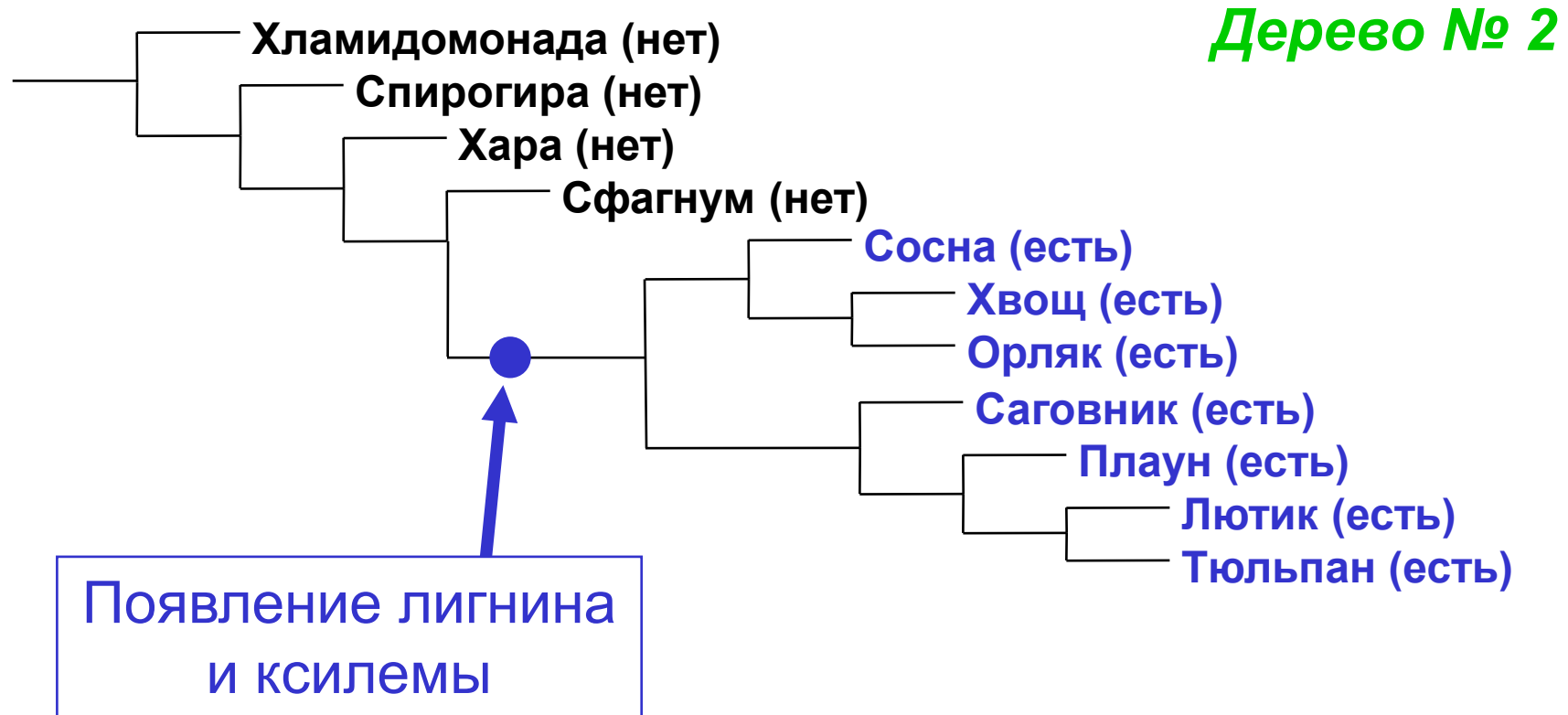
Длина дерева № 3 по признаку № 1 = 1 шаг

Признак № 2: способность к биосинтезу лигнина и наличие проводящих элементов ксилемы (нет/есть)



Длина дерева № 1 по признаку № 2 = 1 шаг

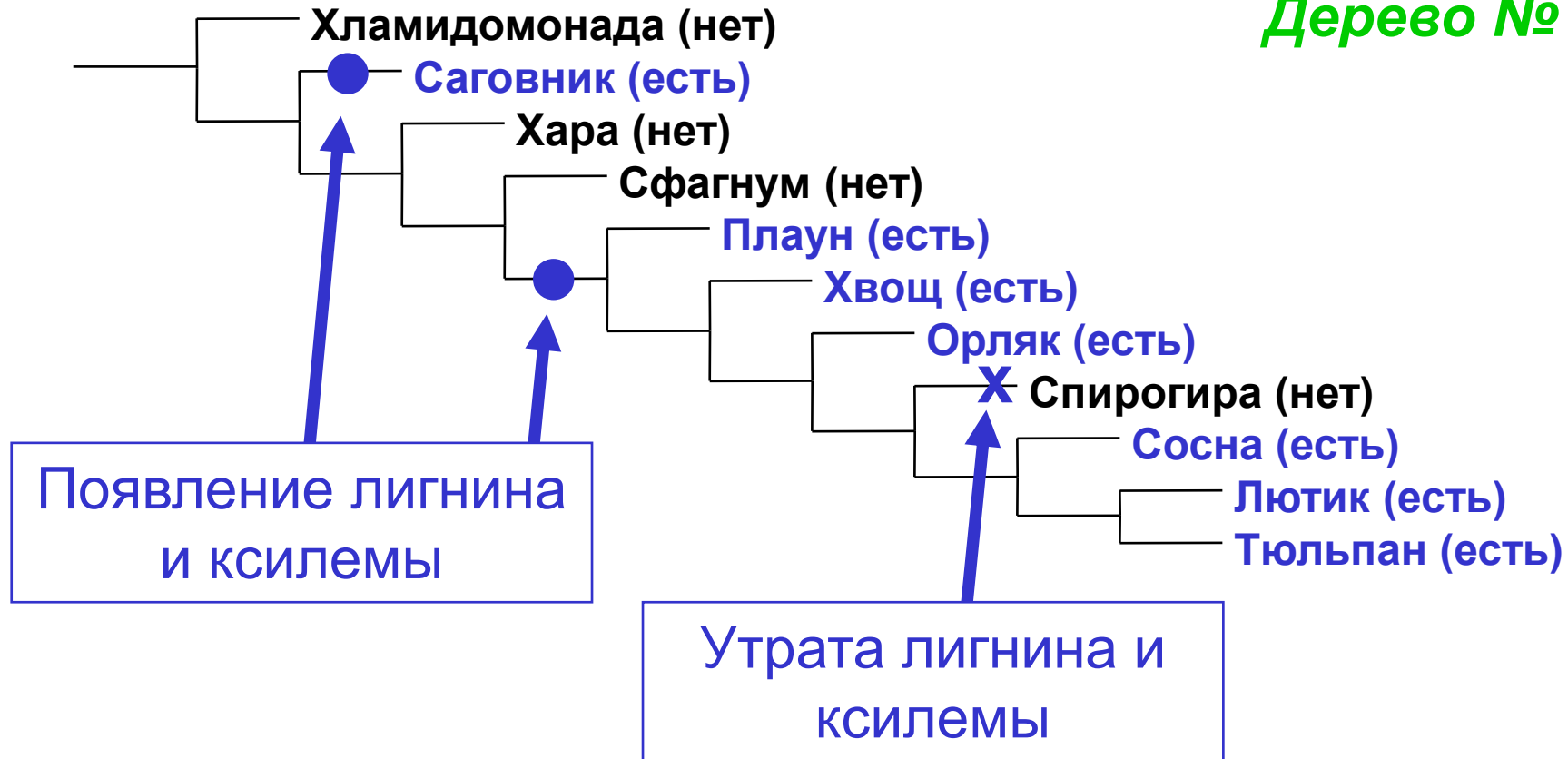
Признак № 2: способность к биосинтезу лигнина и наличие проводящих элементов ксилемы (нет/есть)



Длина дерева № 2 по признаку № 2 = 1 шаг

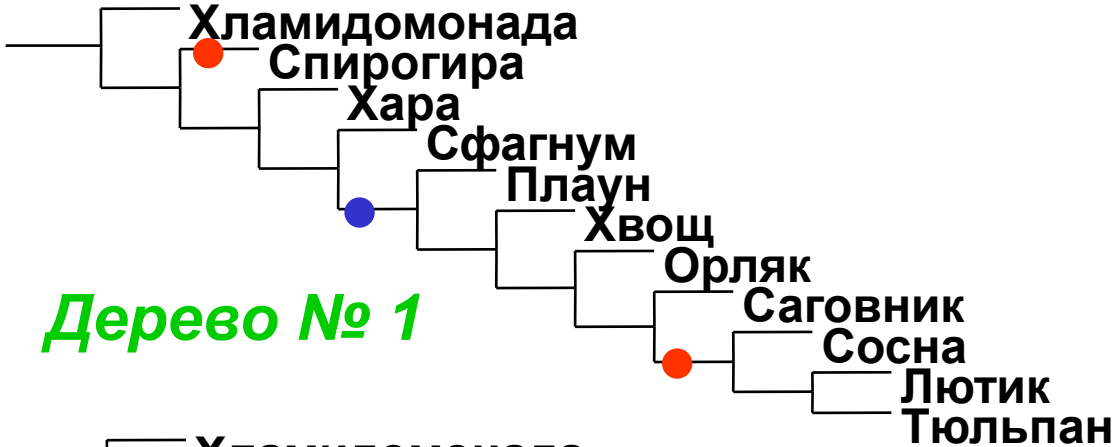
Признак № 2: способность к биосинтезу лигнина и наличие проводящих элементов ксилемы (нет/есть)

Дерево № 3



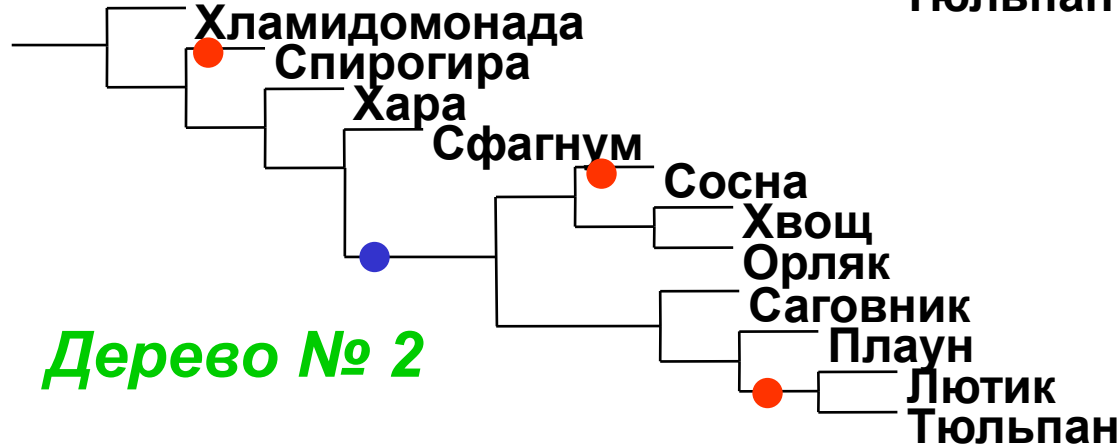
Длина дерева № 3 по признаку № 2 = 3 шага

ДЛИНА ДЕРЕВА



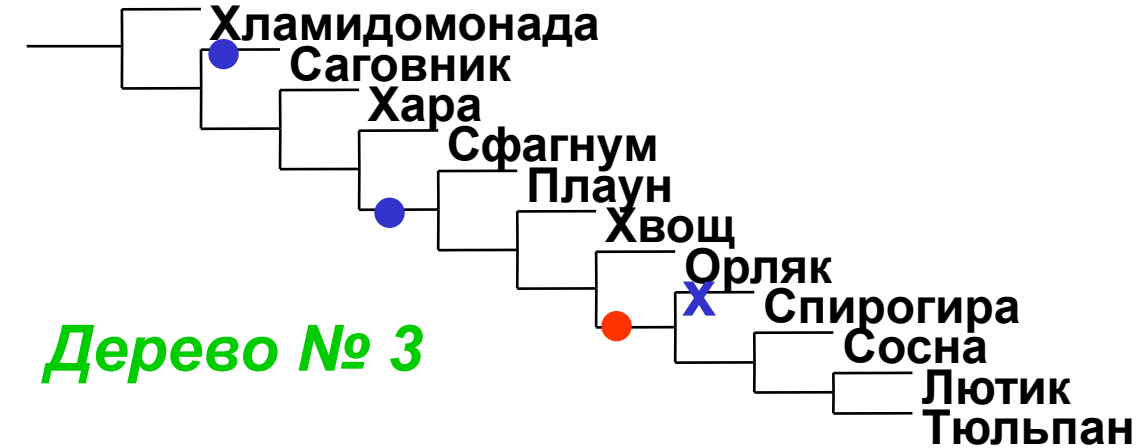
Дерево № 1

2 + 1 = 3



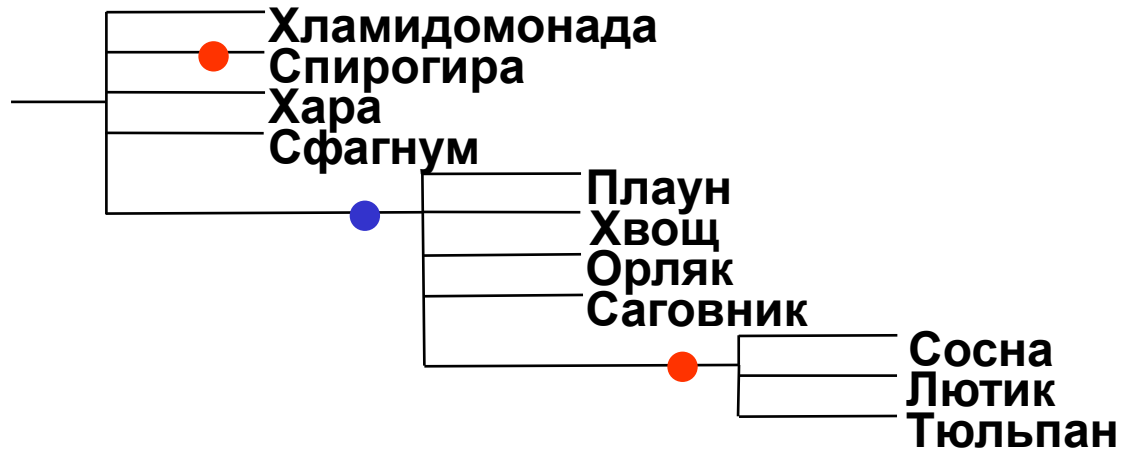
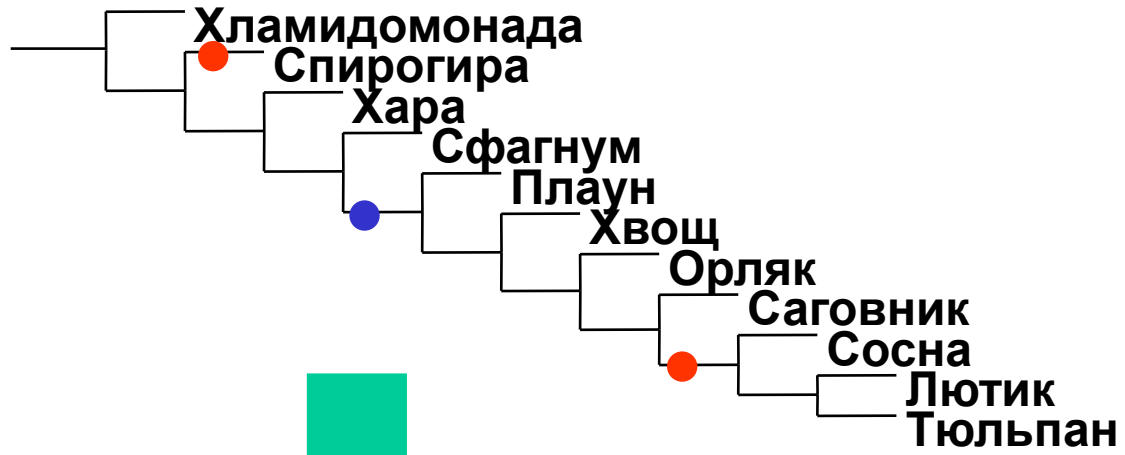
Дерево № 2

3 + 1 = 4



Дерево № 3

1 + 3 = 4

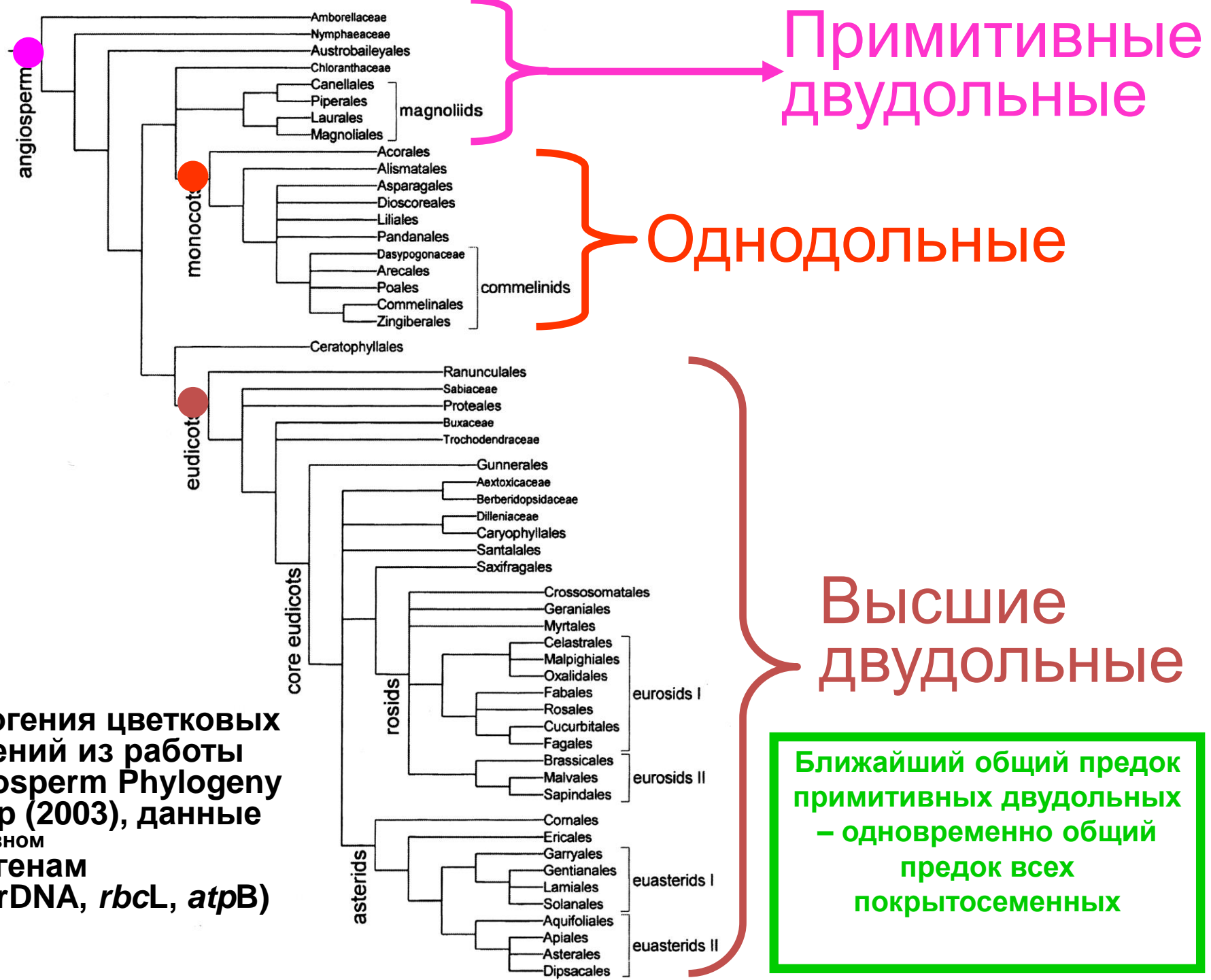


Общий вид первичных данных, используемых в молекулярно-филогенетическом анализе

Признак – позиция нуклеотида

Состояние признака – А, Т, G, С, наличие/отсутствие

```
[2.Kebirita roudaireiGAGAATACCAGATTATA----GATATTTGTAATCAATCACTGATCATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
[3.Syrmatium glabrum64GAGAATACCAGATTATA----GATATTTGTAATCAATCACTGATCATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
[4.Hammatolobium lotoiGAGAATACCAGATTATA----GATATTTGTAATCAATCACTGATCATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
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[7.Tripodion tetraphylGAGAATACCAGATTATAGTATAGATATTTGTAATCAATCACTGATCATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
[8.Dorycnopsis abyssinGAGAATACCAGATTATA----GATATTTGTAATCAATCACTGATCATTTAATTTAGGGGAGGAACA-----ATTTAGTATTTTCATTGCTACAAATATGGATT
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[35.Anthyllis aurea805GAGAATACCGGATTATA----GATATTTGTAATCAA-----ATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
[36.Anthyllis polycephGAGAATACCAGATTATA----GATATTTGTAATCAATCACCAATCATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
[37.Anthyllis onobrychGAGAATACCAGATTATA----GATATTTGTAATCAATCACCAATCATTTAATTTAGGGGAGGAACA-----ATATAGTATTTTCATTGCTACAAATATGGATT
```

Филогения цветковых растений из работы Angiosperm Phylogeny Group (2003), данные в основном по 3 генам (18S rDNA, *rbcL*, *atpB*)

Филогения покрытосеменных по
Hans Hallier (1893-1912)

Высшие
двудольные

Однодольные

Примитивные
двудольные

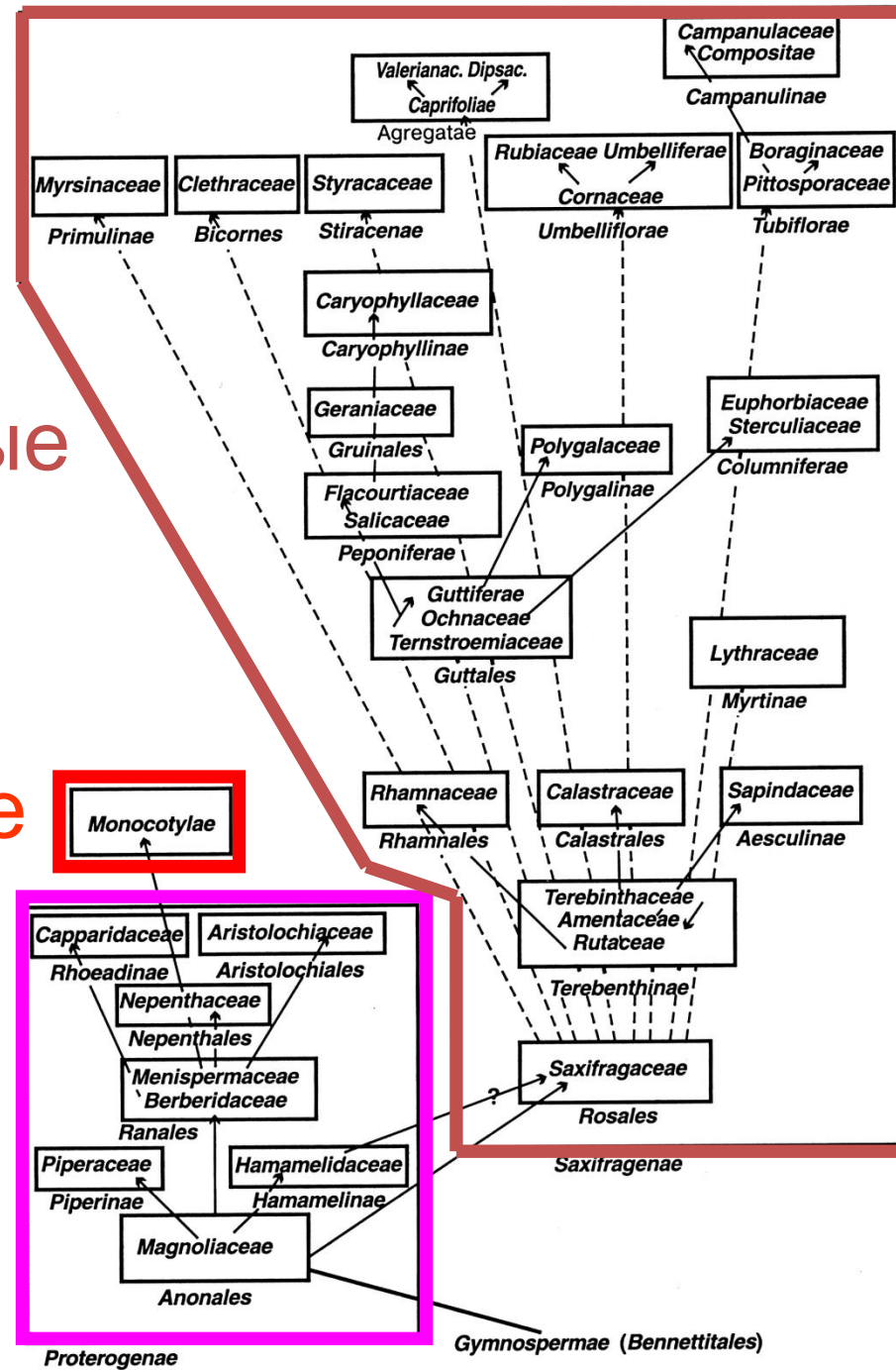
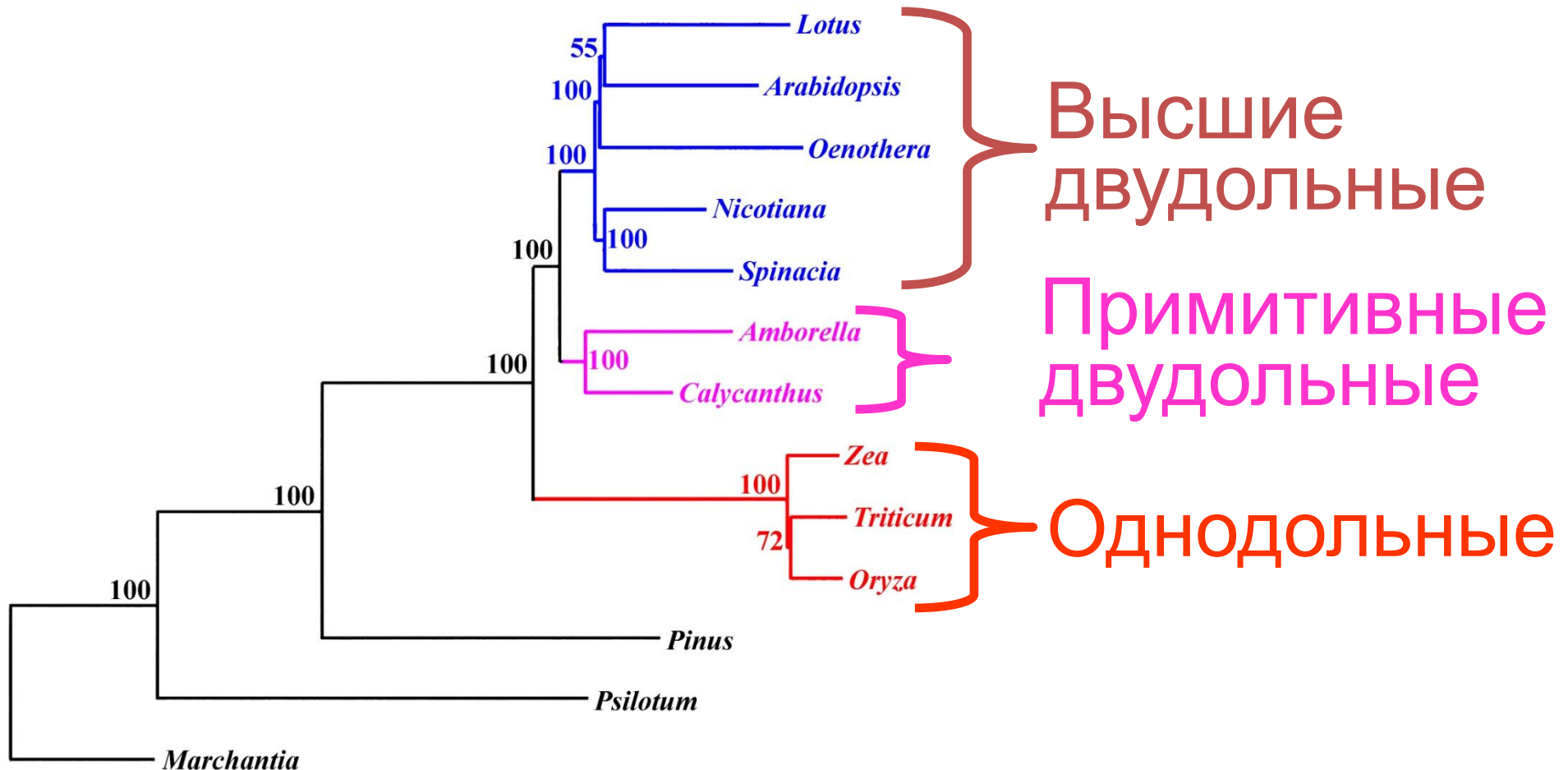


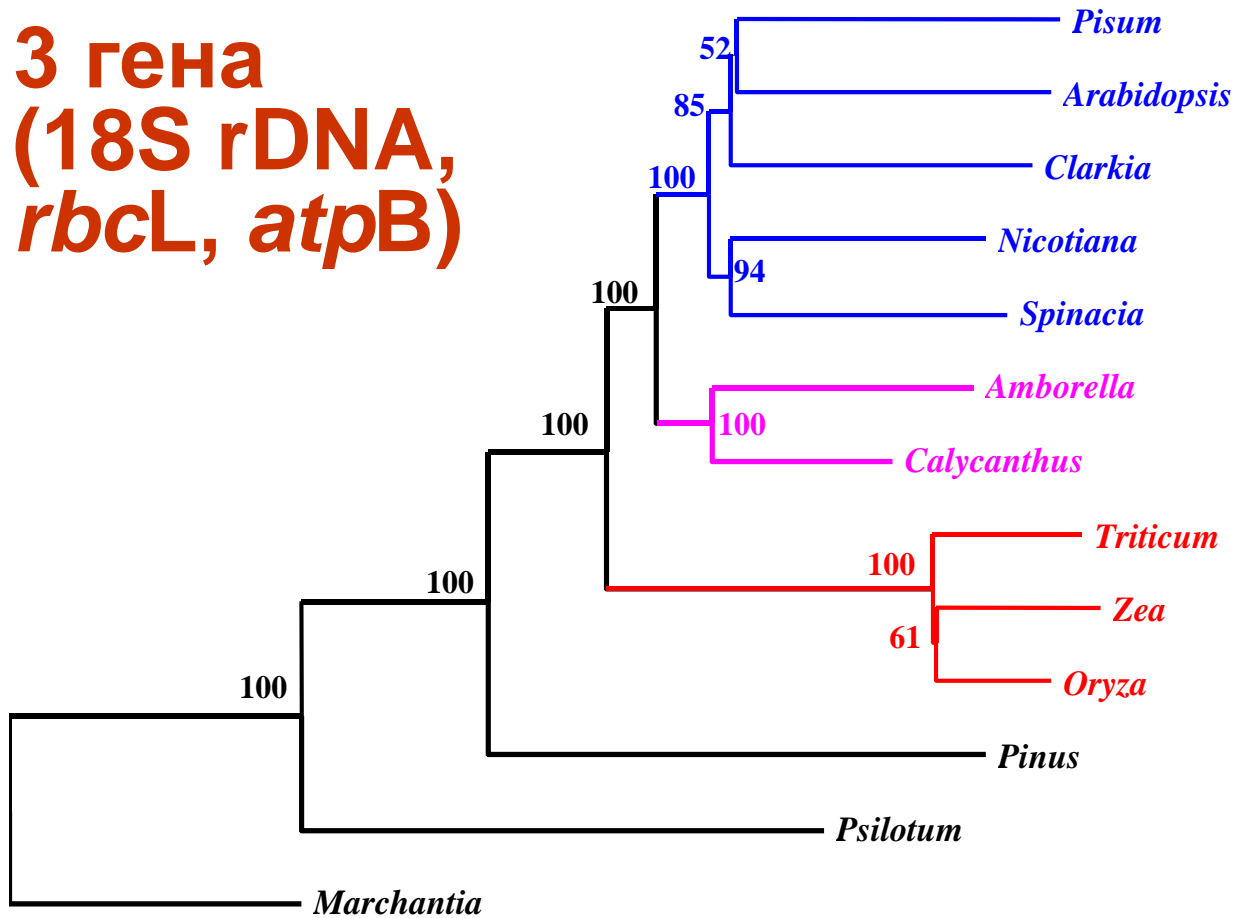
Рис. 5. Схема системы Г. Галлира

61 ген
(все белок-
кодирующие гены
хлоропластной ДНК)



Goremykin et al., 2004

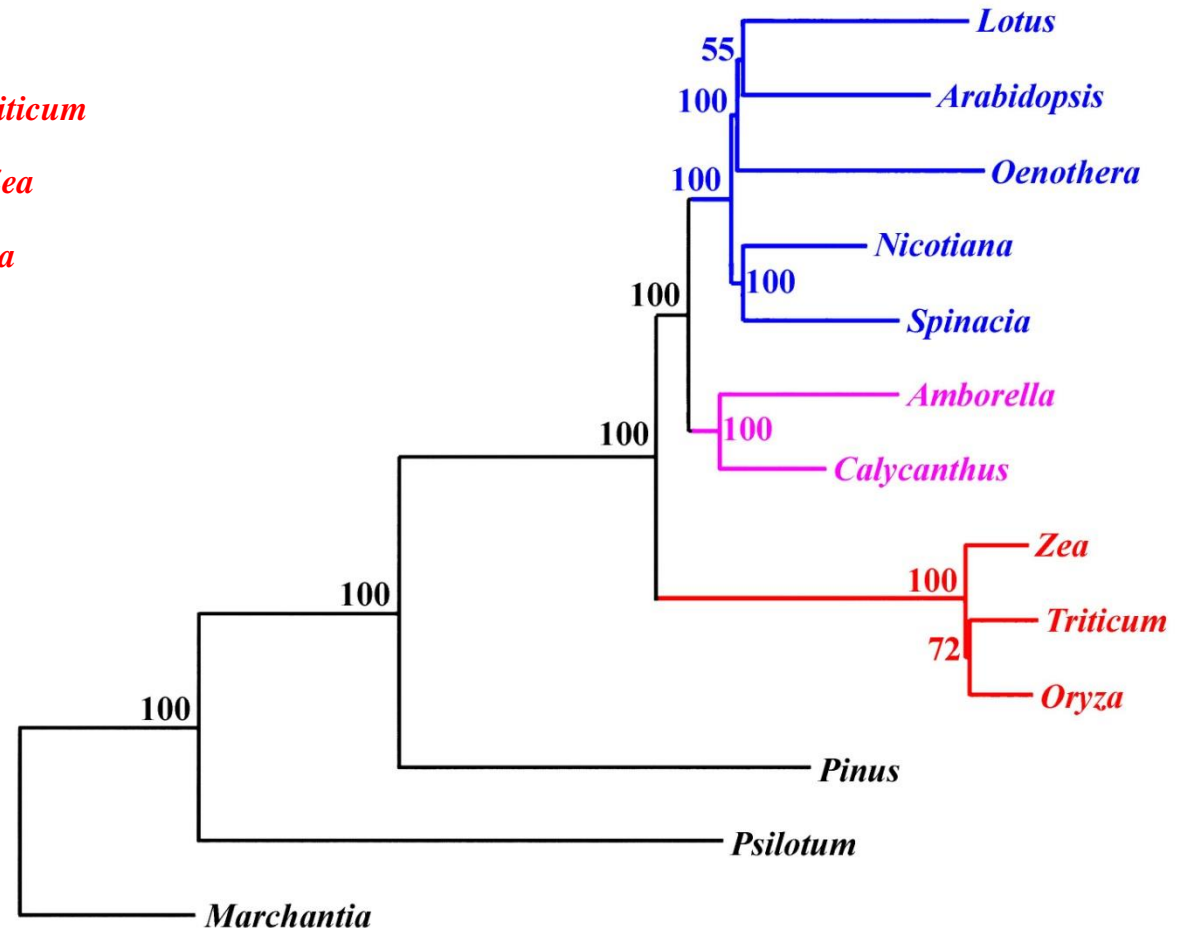
**3 гена
(18S rDNA,
rbcL, *atpB*)**



Degtjareva et al., 2004

Деревья очень
похожи друг на
друга

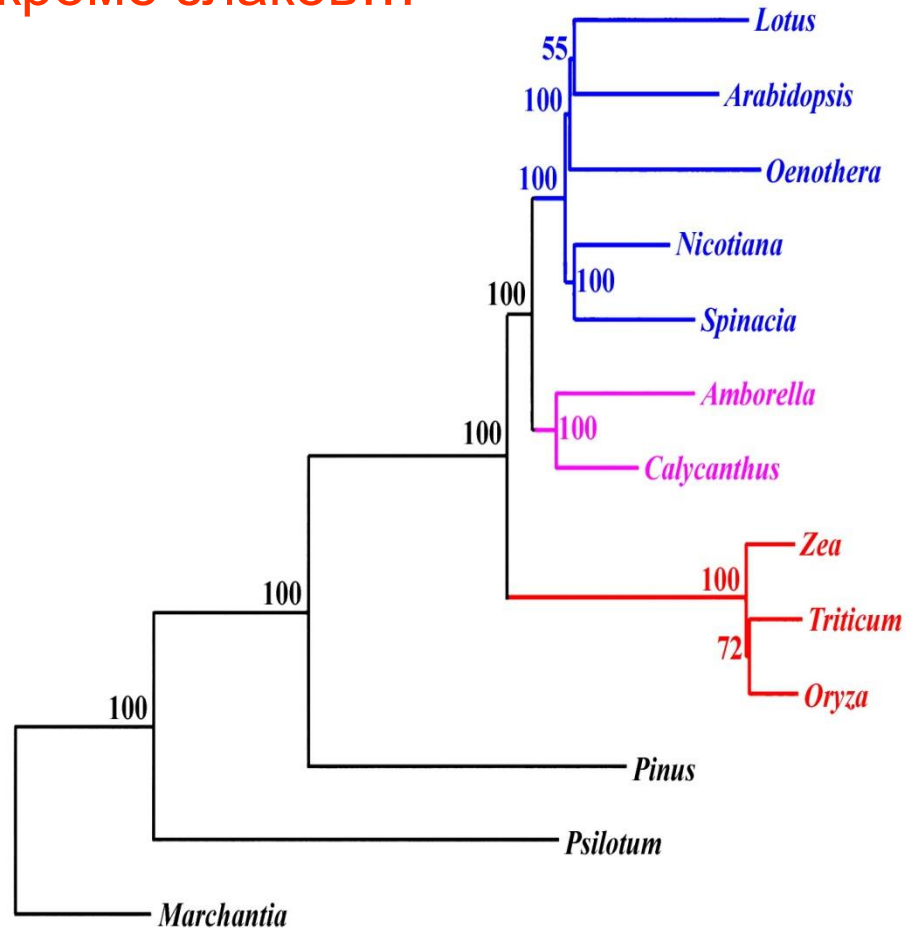
**61 ген
(все белок-
кодирующие гены
хлоропластной ДНК)**



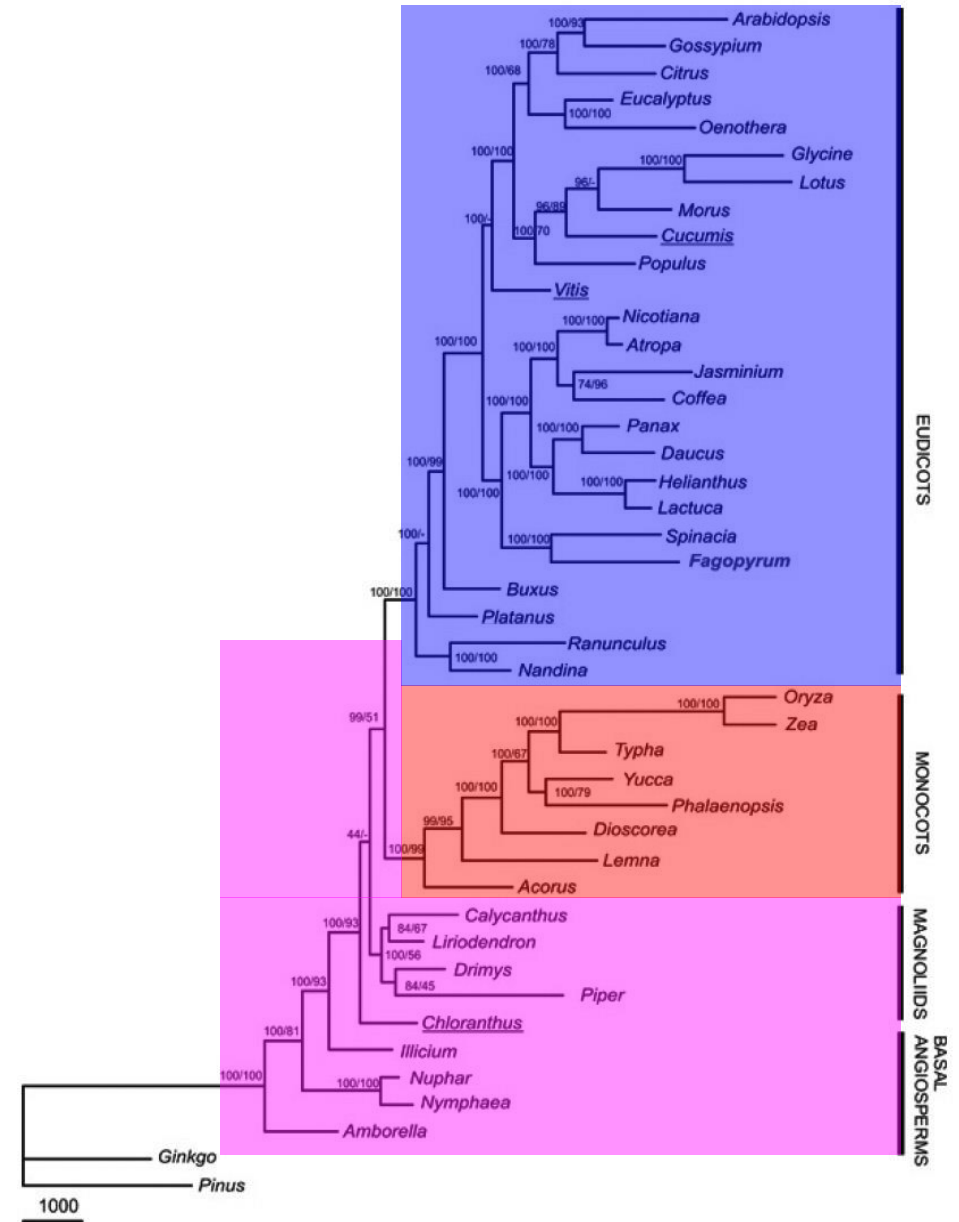
Goremykin et al., 2003

Даже используя данные о полных хлоропластных геномах, «верное» положение однодольных не удастся получить без привлечения репрезентативной выборки таксонов.

Представим себе, что вымерли все однодольные кроме злаков...



Goremykin et al., 2003



Logacheva et al., 2008