

TAKHTAJAN A. L.

HIGHER TAXA OF VASCULAR PLANTS EXCEPT FLOWERING

The paper on the main higher taxa of the Higher Plants except *Flowering* ones has been connected with the poor knowledge of the paper among the international scientific societies.

The system by A. L. Takhtajan presented 10 division of the vascular plants (except *Bryophyta*): *Rhyniophyta*, *Lycopodiophyta*, *Psilotophyta*, *Equisetophyta*, *Polypodiophyta*, *Lyginopteridophyta*, *Ginkgophyta*, *Pinophyta*, *Cycadophyta*, *Gnetophyta*. Also there are 23 classes inside the named division.

Թախտաջան Ա. Լ. Անորակոր բույսերի բարձրագույն տարրերը՝ բացառությամբ Ճաղկավորների: Բարձրակարգ բույսերի՝ բացառությամբ Ճաղկավորների, հիմնական խոշոր տարրերի մասին հողվածի բարգմանության անհրաժեշտությունը պայմանավորված է նրանով, որ այն մնացել է անհասանելի միջազգային գիտական հանրության համար:

Համակարգի առաջարկված տարրերակում առանձնացված են անորակոր բույսերի 10 բաժիններ (բացառությամբ *Bryophyta*-ի)՝ *Rhyniophyta*, *Lycopodiophyta*, *Psilotophyta*, *Equisetophyta*, *Polypodiophyta*, *Lyginopteridophyta*, *Ginkgophyta*, *Pinophyta*, *Cycadophyta*, *Gnetophyta*: Բերվում են նաև 23 դասեր իրենց նոր անվանումներով:

Тахтаджян А. Л. Высшие таксоны сосудистых растений, за исключением цветковых. Необходимость перевода статьи об основных крупных таксонах Высших Растений, за исключением Цветковых, связана с тем, что ее содержание осталось недоступным для международного научного сообщества.

В предложенной системе выделены 10 отделов сосудистых растений (за исключением *Bryophyta*): *Rhyniophyta*, *Lycopodiophyta*, *Psilotophyta*, *Equisetophyta*, *Polypodiophyta*, *Lyginopteridophyta*, *Ginkgophyta*, *Pinophyta*, *Cycadophyta*, *Gnetophyta*. Представлены также 23 класса с их новыми наименованиями.

A Commentary to the paper “Higher taxa of Vascular Plants except Flowering”. The idea of the repeated publication of the paper by A. L. Takhtajan (1986) in the new Armenian Botanical Journal devoted to him and named in honor of him “Takhtajania” belong to his students. The paper on the main higher taxa of the Higher Plants except *Flowering* ones has been connected with the poor knowledge of the paper among the international scientific societies. But names and the volume of many his taxa were accepted mainly by Russian palaeobotanists.

The paper was published in 1986 at the Memorial book “Problems of Palaeobotany” dedicated the century of A. N. Kryshstofovich. He was eminent scientist, a palaeobotanist, the head of the Russian palaeobotanical school, and the chief of the Palaeobotanical Laboratory in Komarov Botanical Institute before A. L. Takhtajan who was his devoted friend and had accepted many Kryshstofovich ideas connected with the perspective development of palaeobotanical researches in the world. It was issued by the publishing house “Nauka” (now it is the firm “Nauka”) in Saint-Peterburg. The book was very soon spread and became the bibliographical rarity.

The system by A. L. Takhtajan presented 10 division of the vascular plants (except *Bryophyta*): *Rhyniophyta*, *Lycopodiophyta*, *Psilotophyta*, *Equisetophyta*, *Polypodiophyta*, *Lyginopteridophyta*, *Ginkgophyta*, *Pinophyta*, *Cycadophyta*, *Gnetophyta*. Also there are 23 classes inside the named division. The author commented new approaches to the classification of higher taxa basing on the data knowing to the end of 1986 about extinct and extant plants included in the system. It is possible to find many critical commentary made by A. L. Takhtajan in the preface to his paper and in the footnotes.

Commentary to the new print and translation from Russian in to English of the preface to the paper by A. L. Takhtajan were made by **N. S. Snigirevskaya** and **A. S. Byalt** (Komarov Botanical Institute of the Russian Academy of Sciences Saint-Peterburg)

More than 35 years ago (Takhtajan, 1950) I tried to present the system of the higher plants (without angiosperms)

based upon our knowledge of that time about the extinct and the extant plants. During past three and a half decades a morphology and systematics of the higher plants have made so important successes that the system became very obsolete. So it seemed to me very important to renovate it, using as the new big actual material accumulated during these years, as new ideas and new systems presented by other authors. Many, not rare wonderful palaeobotanical finds so in our as in other countries of the world, and also revision of many old materials, and their studies using the new methods including the electron microscopy, were especially important. All these have so enriched the modern palaeobotany that many works of the first half of our century have been demanded the fundamental revision. A picture of the plant world evolution was seemed to us as quite another, and much unlike to the past schemes and presentations. But it is impossible to say that the past system of our ideas was crashed down totally. General lines of the higher plant evolution, and the same general outlines of their phylema did not treat fundamental corrections. But many separated parts of phylema (and accordingly of the system), sometimes its big branches have been subjected by the radical changes.

As in my past works I considered *Rhyniophyta* the most primitive and ancestral group of the higher plants and included in it two classes – *Rhyniopsida* and *Zosterophyllopsida*, but the position of the last is questionable. Most of the authors are inclined to bring them together *Rhyniales*, but others – in the division *Lycopodiophyta*. An absence of leaves brings them with rhyniopytes but lateral position of sporangia and the exarch xylem in *Goslingia* – together lycopsids. Bierhorst (1971) on the basis does separate zosterophylls to the independent division *Zosterophyllophyta*. I think it would be more expedient now to stay them inside *Rhyniophyta* in the separate classes especially, and it is scarcely probable that lycopsids have been originated from such specialized group.

The division *Lycopodiophyta*, named the *Lycopside* type by myself in earlier publications, I consider as before that they derivated from *Rhyniophyta*, sooner from *Rhyniales*, even in spite of the appearance of the earliest lycopodiophytes almost in the same time with rhyniophytes. But there are all the reasons to think that the lateral position of their sporangia (as in zosterophylloids) originated from the terminal one of primitive rhyniophytes. In my book “The Higher Plants” (Takhtajan, 1956, fig. 46) I tried to represent hypothetical scheme of the transformation of the terminal position to lateral one. Zimmermann (1930, 1950) presented principally another scheme of the sporangia lateral position origin but he also proceeded from primitive character of the terminal position.

The division *Lycopodiophyta* – is one of the difficult objects in palaeobotanical studies, and its system has been not settled yet. I include in the division two classes – *Lycopodiopsida* and *Isoetopsida*. The classis *Lycopodiopsida* I begin from *Asteroxylales* considered now by all the authors inside lycopodiophytes. The second classis – *Isoetopsida* is undoubtedly the most difficult for the classification and put on front of researchers the most complicated morphological tasks.

The division *Psilotophyta* (type *Tmesopsida* earlier) I continue preserve in a range of a division but change little its position in a system. I also come to a conclusion that *Tmesipteris* genus expediently to consider as the separate family *Tmesipteridaceae*.

The division *Equisetophyta* (earlier a type *Sphenopsida*) also has been treated with the great changes. The ordo *Hyeniales* I continue to refer in *Equisetophyta*. I think its place sooner between *Iridopteridales* and *Cladoxylales*. These three orders are enough naturally jointed into classis *Hieniopsida*. The boundaries and a bulk of next classes

Sphenophyllopsida and *Equisetopsida* are good enough traced. The problems are appeared only in connection with their dividing in to orders and families (especially families of the ordo *Calamitales* where now much is not clear yet).

The big division *Polypodiophyta* (earlier a classis *Filicinae* inside the type *Pteropsida*) I begin from the classis *Protopteridiopsida* as the connecting link between *Rhyniophyta* and polypodiophyts. Further there is the ordo *Archaeopteridales* placed, it is almost undoubtedly connected closely with *Protopteridiales*. The relation of orders *Rhacophytales* and *Protopytales* to the classis is less indisputable. The next classis *Noeggerathiopsida* is one of the most problematic inside the division *Polypodiophyta*. Further subclasses *Zygopteridopsida*, *Ophioglossopsida*, *Marattiopsida* and *Polypodiopsida* are placed. Ophioglossopsids have been sooner originated directly from some homosporous protopteridiopsids able to produce the secondary xylem (an active functioning cambium was observed in the large species *Botrychium* and in *B. virginianum* is even known the good developed secondary xylem), but marattiopsids and polypodiopsids have sooner originated from zygopteridopsids directly. The classification of the classis *Polypodiopsida* known in the extant flora by many families is connected with big difficulties. The system of the classis has been radically revised by myself taking into account many new publications (Bierhorst, 1971; Holttum, 1973; Crabbe et al., 1975; Pichi Sermolli, 1977; Tryon R., Tryon A., 1982). In the difference of earlier versions of my ferns system I accept now more subclasses, orders and families but not a number of small families, presented by Pichi Sermolli (Pichi Sermolli, 1946 et al.).

The Division *Lyginopteridophyta* (*Pteridospermophyta* of the other authors) was accepted earlier by myself as subclassis *Pteridospermidae* inside *Gymnospermae*. The group is without doubt the most primitive among seed plants.

The big and diverse classis *Lyginopteridopsida* is placed in the base of lyginopteridophytes. The classis I divide to subclasses *Lyginopteridae*, *Medullosidae*, *Peltaspermidae* and *Glossopteridae*. The classification of the division has the preliminary character and future palaeobotanical studies will undoubtedly bring to it the important changes.

Further in the system the separate division *Ginkgophyta* I taken out directly from classis *Lyginopteridopsida* (possibly from *Calamophytales*). Most of authors connect the enigmatic group *Czekanovskiales* with the order *Ginkgoales*. They are probably are related in spite their reproductive organ structure big difference. I stay them in the division *Ginkgophyta*.

In to the next division *Pinophyta* include only cordaits and conifers. They seemed to be originated from *Calamophytales*. Now so named gymnospermous plants are included in the group, but I think it is necessary to divide the very heterogenous group in to some separate divisions. Account to the all data they have been originated independently and heterochronously from different groups of *Lyginopteridophyta*. Though classes of *Cordaitopsida* and *Pinopsida* undoubtedly are related there is no the complete sureness that conifers have been independently originated from cordaits as Florin (1954) supposed and it is not excluded that both these classes have only general origin.

During the last decades (in the postflorinous epoche of conifers researches) there have been made so many in the study of extinct and partly extant representatives of pinopsids that we need to revise the conifers system completely. Although the ordo *Voltziales* does continue preserve its position as the most ancient and primitive pinopsids group, the previous reconstruction of the female cone and ovule of *Lebachia* underwent the important changes. In particular it was found to be not radially-symmetric (as in *Corgaianthus*) but tangentially depressed and more similar to the

seed bract of the Cretaceous and Cenozoic *Pinaceae* (look Rothwell, 1982).

The extinct orders *Cycadocarpidiales* and *Palissyales* uptake directly to *Voltziales*. The modern family *Cephalotaxaceae* (Florin, 1951; Schweitzer, 1963) as separate ordo *Cephalotaxales* is adjoined to *Palissyales*. The ordo *Podocarpales* – the most ancient group among the extant conifers with the first truth remains known since the earliest Triassic has the common origin with *Cephalotaxales*. The next ordo *Taxales* has the common origin with two previous orders but to much specialized in comparison with them.

The ordo *Araucariales* seems to be uptake to the ancestors of the type *Cheirolepidiaceae* (ordo *Voltziales*). The truth araucariopsids have been not known earlier then the Lower Jurassic, or their remains are doubt in any case. The similar ordo *Pinales* began its development only in the Middle Jurassic and has preserved some primitive characters in the reproductive sphere (free and more primitive seed bract).

The family *Sciadopityaceae* is so much different from the extant conifers including *Taxodiaceae* (macromorphology, wood structure, position of archegonia, development of ovule, very unusual structure of pollen coats etc.). It is worthy to be separate in the ordo *Sciadopityales*. Its origin is not clear and possible it was originated directly from *Voltziaceae*. The ordo *Cupressales* has been undoubtedly originated from *Voltziaceae* (family *Taxodiaceae* is especially similar to the family).

The division *Cycadophyta* is much younger than pinophyts. Their truth remains are known since the Lower Triassic. They have also the other origin sooner from *Medullosidae*. Among the three classes — *Cycadopsida*, *Pentoxyllopsids* and *Cycadeoideopsida* (= *Bennettitopsida*) phyletic connections are not enough clear for pentoxyllopsids. Only future detail researches of the enigmatic Jurassic group will show what are their relations with other cycadophyts.

The system is finishing by the division *Gnetophyta*. Every from three included genera does demonstrate separated families, ordo and classis. In spite the difference of so high taxonomic ranges they have the general characters and the same origin. *Gnetophyta* is seems to be a much reduced and specialized branch of Mesozoic *Cycadeoideopsida* (Takhtajan, 1950).

The angiosperms are absent in the list of the higher plants. As I limit my self only by the vascular plants *Bryophyta* also do not include in the list. For all families their authors and the year of their publication, sometimes also names of genera are citing. But the search of families authors were very difficult and I am not sure that in all cases they are correct. I used partly “the fossil record” (1967) but a number of extinct families and all the extant ones are absent in the book. Many families had no descriptions at all and in a fact are nomina nuda. Some diagnoses were wrong. We are going with S. Zhilin to undertake the special work on the validisation of such families.

Taxa superiora plantarum vascularum exclusus Magnoliophyta

Divisio I. *Rhyniophyta* («*Psilophyta*») ¹

Classis A. *Rhyniopsida* (*Psilophytopsida*)

Ordo 1. *Rhyniales*

Rhyniaceae Kidston et Lang 1920²

1 The name *Psilophytophyta* would be more correct but because of the twice recurrence of the composite “phyta” it is inadmissible.

2 The genus *Renalia* placed in *Rhyniaceae* is so much different from the other representatives of the family (Gensel, 1976) that could be separate to independent family *Renaliaceae*.

- Cooksoniaceae* Banks 1968
Horneophytaceae Koidzumi 1939, nomen novum
 (*Horneaceae* Hirmer 1927)
Taeniocradaceae Nemejc 1963
Hedeiaceae Nemejc 1963 (incl. *Yarraviaceae* Nemejc
 1963?)
Sciadophytaceae Krausel 1938³
- Ordo 2. *Psilophytales* (*Trimerophytales*)
Psilophytaceae Hirmer 1927 (*Trimerophytaceae*
 Banks 1967)⁴ (*Psilophyton*, *Trimerophyton*, *Per-
 tica*, etc.)
- Classis B. *Zosterophyllopsida*
 Ordo 1. *Zosterophyllales*
Zosterophyllaceae Krausel 1938
 Ordo 2. *Barinophytales*
Barinophytaceae Krausel et Weyland 1961
- Divisio II. *Lycopodiophyta*
- Classis A. *Lycopodiopsida*
 Ordo 1. *Asteroxylales*
Asteroxylaceae Kidston et Lang 1920
 Ordo 2. *Drepanophycales* (*Baragwanathiales*)
Drepanophytaceae Krausel 1938
 Ordo 3. *Lycopodiales*
Lycopodiaceae Mirbel 1802 (incl. *Phylloglossaceae*
 Kuntze 1843, *Urostachyaceae* Rothmaler 1944,
Huperziaceae Rothmaler 1962)
 Ordo 4. *Protolpidodendrales*
Protolpidodendraceae Zimmermann 1930 (Krausel
 et Weyland 1949)
Sublepidodendraceae Krausel et Weyland 1949 (Sch-
 weitzer 1965; *Lepidodendropsidaceae* Radczenko
 1956)
Eleutherophyllaceae Krausel et Weyland 1949
Leptophloeaceae Krausel et Weyland 1949
Archaeosigillariaceae Krausel et Weyland 1949
 ? *Ulodendraceae* Potonie et Gothan 1921
 Ordo 5. *Barrandeinales* (*Duisbergiales*)
Barrandeinaceae Krausel et Weyland 1948 (*Duisber-
 giaceae* Nakai 1943, nomen nudum) (*Barrandeina*,
Duisbergia, *Enigmophyton*, etc.)
- Classis B. *Isotopsida*
 Ordo 1. *Selaginellales*
Selaginellaceae Milde 1865
 Ordo 2. *Miadesmiales*
Miadesmiaceae Hirmer 1927
 Ordo 3. *Lepidodendrales*
Cyclostigmataceae Potonie et Gothan 1921
Omphalophloiaceae Nakai 1943 (? *Caenodendraceae*
 Radczenko 1963, *Pinakodendraceae* Chaloner 1967)
Lycopodiopsidaceae Chaloner 1967
Lepidodendraceae Endlicher 1836
Lepidocarpaceae Hirmer 1927
Bothrodendraceae Potonie 1899
Sigillariaceae Unger 1842
 Ordo 4. *Pleuromeiales*
Pleuromeiaceae Potonie 1904
- Ordo 5. *Takhtajanodoxales*
Chaloneriaceae Pigg et Rothwell 1983
Takhtajanodoxaceae Snigirevskaya 1980
- Ordo 6. *Isoetales*
Isoetaceae Reichenbach 1828 (incl. *Nathorstianaceae*
 Nemejc 1963)
- Divisio III. *Psilotophyta*
- Classis A. *Psilotopsida*
 Ordo 1. *Psilotales*
Psilotaceae Kanitz 1887 (Engler 1892)
Tmesipteridaceae Nakai 1943
- Divisio IV. *Equisetophyta*
- Classis A. *Hyeniopsida* (incl. *Cladoxylopsida*)
 Ordo 1. *Iridopteridales* (*Ibykales*)
Iridopteridaceae Arnold 1940 (incl. *Arachnoxyllaceae*
 Arnold 1940)
 Ordo 2. *Hyeniales* (*Calamophytals*)
Hyeniaceae Krausel et Weyland 1926 (Hirmer 1927)
Calamophytaceae Krausel et Weyland 1926
 Ordo 3. *Cladoxylales* (incl. *Pseudosporochnales*)
Pseudosporochnaceae Hirmer 1927
Cladoxylaceae Potonie 1902
- Classis B. *Sphenophyllopsida*
 Ordo 1. *Pseudoborniales*
Pseudoborniaceae Nathorst 1902
 Ordo 2. *Sphenophyllales*
Sphenophyllaceae Potonie 1897
Tristachyaceae Lilpop 1937
Cheirostrobaceae D. Scott 1907
- Classis C. *Equisetopsida*
 Ordo 1. *Calamitales*
Archaeocalamitaceae Stur 1875 (*Asterocalamitaceae*
 Hirmer 1927)
Autophyllitaceae Nakai 1943 (*Autophyllaceae* Rad-
 czenko 1960)
Apocalamitaceae Radczenko 1957
Calamitaceae Unger 1842
Sorocaulaceae Radczenko 1956
Neurophyllaceae Kon'no 1941
 Ordo 2. *Equisetales*
Phyllotheceae Nakai 1943
Equisetaceae Richard ex A. P. de Candolle 1805
- Divisio V. *Polypodiophyta*
- Classis A. *Protopteridiopsida* (*Aneurophytopsida*)
 Ordo 1. *Protopteridiales* (*Aneurophytales*)
Protopteridiaceae Krausel 1938 (Krausel et Weyland
 1941)
Aneurophytaceae Krausel et Weyland 1941
 ? *Svalbardiaceae* Zimmermann 1959 (Radczenko
 1963)
 Ordo 2. *Rhacophytals*
Rhacophytaceae Krausel et Weyland 1941 (Barnard
 et Long 1975)
 Ordo 3. *Archaeopteridales*
Archaeopteridaceae Schmalhausen (Tr. Геол. ком.
 1894. Т. 8, № 3. С. 8). Typus: *Archaeopteris*
 Dawson
 Ordo 4. *Protopytales*
Protopytaceae Walton 1957

³ In difference from other families of *Rhyniales* which type genera are presented by sporophytes the genus *Sciadophyton* does represent the gametophyte (Remy et al., 1980; Schweitzer, 1980). That is why connections of the genus with families based upon sporophytes do not clear now.

⁴ The new name *Trimerophytaceae* (and accordingly *Trimerophytales*) given by Banks (1967) instead *Psilophytaceae* has no excuse and quite unnecessary as it does include the type of the earlier described family *Psilophytaceae*.

- Classis B. *Noeggerathiopsida*
 Ordo 1. *Noeggerathiales*
Noeggerathiaceae F. Nemejc 1931
 Ordo 2. *Discinitales*
Discinitaceae
 Ordo 3. *Tingiales*
Tingiaceae F. Nemejc 1963
- Classis C. *Zygopteridopsida*
 Ordo 1. *Zygopteridales*
Zygopteridaceae P. Bertrand 1909
Tedeleaceae Eggert et T. Taylor 1966
 Ordo 2. *Anachoropteridales*
Anachoropteridaceae P. Bertrand 1909
Botryopteridaceae Renault 1883
 Ordo 3. *Stauropteridales*
Stauropteridaceae Hirmer 1927
- Classis D. *Ophioglossopsida*
 Ordo 1. *Ophioglossales*
Ophioglossaceae Agardh 1822 (Presl 1836)
- Classis E. *Marattiopsida*
 Ordo 1. *Marattiales*
Asterothecaceae Stur 1883 (incl. *Psaroniaceae* J. Morgan 1959)
Marattiaceae Bercht. et J. S. Presl 1820 (Kaulfuss 1824) (incl. *Angiopteridaceae* Bommer 1866)
Danaeaceae Agardh 1822 (incl. *Christenseniaceae* Ching 1940)
- Classis F. *Poiypodiopsida*
 Subclassis *Osmundidae*
 Ordo 1. *Osmundales*
Osmundaceae R. Brown 1810 (Berchtold et J. S. Presl 1820)
 Ordo 2. *Plagiogyriales*
Plagiogyriaceae Bower 1926
 Subclassis *Schizaeidae*
 Ordo 1. *Schizaeales*
Sckizaeaceae Kaulfuss 1827
Anemiaceae Link 1833 (incl. *Mohriaceae* Reed 1948)
Lygodiaceae Presl 1845
 ? *Temskyaceae* C. B. Read et R. W. Brown 1937
 Ordo 2. *Pteridales*
Pteridaceae Reichenbach 1837 (Ching 1982) (incl. *Acrostichaceae* Frank 1877 *Actiniopteridaceae* Pichi Sermolli 1962, *Cheilantheaceae* Nayar 1970, *Cryptogrammeaceae* Pichi Sermolli 1963, *Hemionitidaceae* Pichi Sermolli 1966, *Negripteridaceae* Pichi Sermolli 1946, *Sinopteridaceae* Koidzumi 1934, *Taenitidaceae* Pichi Sermolli 1975)
Parkeriaceae Hooker 1825 (*Ceratopteridaceae* Underwood 1900)
Platyzomataceae Nakai 1950
Adiantaceae Presl 1836 (Ching 1940)
Vittariaceae Presl 1836 (Ching 1940) (incl. *Antrophyaceae* Ching 1978)
 Subclassis *Marsileidae*
 Ordo 1. *Marsileales*
Marsileaceae Mirbel 1802 (incl. *Pilulariaceae* Wettstein 1903)
 Subclassis *Gleicheniidae*
 Ordo 1. *Gleicheniales*
Stromatopteridaceae Bierhorst 1968
Gleicheniaceae Presl 1825 (incl. *Dicranopteridaceae* Chirig 1965)
 Ordo 2. *Matoniales*
Matoniaceae Presl 1848
 Subclassis *Polypodiidae*
- Ordo 1. *Polypodiales*
Dipteridaceae Seward et Dale 1907
Cheiropleuriaceae Nakai 1928
Polypodiaceae Berchtold et J. S. Presl 1820 (R. Brown 1810) (incl. *Drynariaceae* Ching 1978, *Grammitidaceae* Ching 1940, *Loxogrammaceae* Pichi Sermolli 1975, *Platyneriaceae* Ching 1978, *Pleurosoriopsidaceae* Ching 1978)
 Subclassis *Hymenophyllidae*
 Ordo 1. *Hymenophyllales*
Hymenophyllaceae Link 1833 (incl. *Trichomanaceae* Kunkel 1965)
 Ordo 2. *Loxosomatales*
Loxosomataceae Presl 1847
 Ordo 3. *Hymenophyllopsidales*
Hymenophyllopsidaceae C. Christensen 1938 (Pichi Sermolli 1970)
 Ordo 4. *Dicksoniales*
Thyrsopteridaceae Presl 1847
Culcitaceae Pichi Sermolli 1970 (Ching 1940)
Dicksoniaceae Bower 1908 (Presl 1847)
Lophosoriaceae Pichi Sermolli 1970
Metaxyaceae Pichi Sermolli 1970
Cyatheaceae Kaulfuss 1827 (Reichenbach 1828) (incl. *Alsophiluceaceae* Presl 1847)
Dennstaedtiaceae Pichi Sermolli 1970 (incl. *Hypolepidiaceae* Pichi Sermolli 1970, *Pteridiaceae* Ching 1975)
Lindsaeaceae Pichi Sermolli 1970
 Ordo 5. *Aspidiales*
Thelypteridaceae Pichi Sermolli 1970
Aspleniaceae Frank 1877
Aspidiaceae Mettenius ex Frank 1877 (incl. *Athyriaceae* Ching 1978, *Dryopteridaceae* Herter 1949, *Oncleaceae* Pichi Sermolli 1970, *Woodsiaceae* Herter 1949)
Lomariopsidaceae Alston 1956 (incl. *Bolbitidaceae* Ching 1978, *Elaphoglossaceae* Pichi Sermolli 1968)
Oleandraceae Pichi Sermolli 1965
Davalliaceae Frank 1877 (incl. *Gymmogrammitidaceae* Ching 1966, *Nephrolepidaceae* Pichi Sermolli 1975)
Blechnaceae Copeland 1947 (incl. *Stenochlaenaceae* Ching 1978)
 Subclassis *Salviniidae*
 Ordo 1. *Salviniales*
Salviniaceae Reichenbach 1828 (Dumortier 1829)
Azollaceae Wettstein 1903 (C. Christensen 1938)
- Divisio VI. *Lyginopteridophyta* (*Pteridospermophyta*)
- Classis A. *Lyginopteridopsida*
 Subclassis *Lyginopterididae*
 Ordo 1. *Calamopityales*
Calamopityaceae Gothan 1926
 Ordo 2. *Lyginopteridales* (*Lagenostomales*)
Buteoxylaceae Barnard et Long 1973
Lyginopteridaceae Potonie 1902 (*Lyginodendraceae* Gothan 1926)
Mariopteridaceae F. Nemejc 1968
Tetratmemaceae F. Nemejc 1968
 Subclassis *Medullosidae*
 Ordo 1. *Medullosales* (*Trigonocarpales*)
Medullosaceae Sterzel 1896
 Ordo 2. *Callistophytals*
Callistophytaceae Stidd et J. W. Hall 1970
 Subclassis *Peltaspermidae*
 Ordo 1. *Trichopityales*
Trichopityaceae Nemejc 1968

- Ordo 2. *Peltaspermales*
Peltaspermales H. Thomas 1933
Zuberiaceae Nemejc 1968
 Ordo 3. *Umkomsiales* («*Corystospermales*»)
Cardiolepidaceae S. V. Meyen 1977 (?)
Umkomsiaceae Petriella 1981 (*Corystospermales*
 H. Thomas 1933)
 Ordo 4. *Caytoniales*
Caytoniaceae H. Thomas 1925
 Subclassis *Glossopterididae*
 Ordo 1. *Glossopteridales*
Glossopteridaceae Zimmermann 1930 (?)

Divisio VII. *Ginkgophyta*

- Classis A. *Ginkgoopsida*
 Ordo 1. *Ginkgoales*
Ginkgoaceae Engler 1897
 Ordo 2. *Czekanowskiales*
Czekanowskiaceae Harris 1951

Divisio VIII. *Pinophyta*

- Classis A. *Cordaitopsida*
 Ordo 1. *Cordaitales*
Cordaitaceae Grand'Eury 1887 (Engler 1887 ?,
 Renault 1881 ?)
 ? *Vojnovskyaceae* Neuburg 1955

- Classis B. *Pinopsida*
 Ordo 1. *Voltziales*
Walchiaceae Schimper 1870 (*Lebachiaceae* Florin
 1938) (incl. *Buriadia* ?)
 ? *Carpenteriaceae* Zimmermann 1959
Voltziaceae Arnold 1947
 ? *Ulmanniaceae* Zimmermann 1959
Cheirolepidiaceae Takhtajan 1963 (Alvin 1982)
 (*Cheirolepidaceae* Hirmer et Hornhammer 1934,
Hirmeriaceae T. Harris 1979)
 Ordo 2. *Cycadocarpidiales* (*Podozamitales*)
Cycadocarpidiaceae Chadeaud 1941
 (*Podozamitaceae* Nemejc ex Zimmermann 1959)
 Ordo 3. *Palissyales* (*Stachyotaxales*)
Palissyaceae Florin 1958 (*Stachyotaxaceae*
 Nemejc 1950, nomen nudum)
 Ordo 4. *Cephalotaxales*
Cephalotaxaceae Neger 1907
 Ordo 5. *Podocarpales*
Podocarpaceae Endlicher 1847
 (incl. *Pherosphaeraceae* Nakai 1938)
Phyllocladaceae Core (Nakai 1938)
 Ordo 6. *Taxales*
Austrotaxaceae Nakai 1938
Taxaceae S. F. Gray 1821
 Ordo 7. *Araucariales*
Araucariaceae Henkel et W. Hochstetter 1865
 Ordo 8. *Pinales*
Pinaceae Lindley 1836
 Ordo 9. *Sciadopityales*
Sciadopityaceae Hayata 1931
 Ordo 10. *Cupressales*
Taxodiaceae Warming 1884
Cupressaceae Bartling 1830

Divisio IX. *Cycadophyta*

- Classis A. *Cycadopsida*
 Ordo 1. *Cycadales*
Cycadaceae Persoon 1807
Stangeriaceae L. A. S. Johnson 1959
Zamiaceae Reichenbach 1837

- Classis B. *Pentoxyllopsida*
 Ordo 1. *Pentoxylales*
Pentoxylaceae Sahni ex Zimmermann 1959 (*Pen-*
toxyleae Sahni 1948)

- Classis C. *Cycadeoideopsida* (Bennettitopsida)
 Ordo 1. *Cycadeoideales* (Bennettitales)
Williamsoniaceae Carruthers 1870 (Nakai 1943)
Wielandiellaceae Nemejc 1968
Cycadeoideaceae Buckland 1828 (*Bennettitaceae*
 Engler 1892)

Divisio X. *Gnetophyta*

- Classis A. *Ephedropsida*
 Ordo 1. *Ephedrales*
Ephedraceae Dumortier 1829

- Classis B. *Welwitschiopsida*
 Ordo 1. *Welwitschiales*
Welwitschiaceae Markgraf 1929

- Classis C. *Gnetopsida*
 Ordo 1. *Gnetales*
Gnetaceae Lindley 1839

Литература

- Тахтаджян А. Л. 1950. Филогенетические основы системы высших растений // Бот. журн., 35: 113-135.
 Тахтаджян А. Л. 1956. Высшие растения. Т. 1: От псилофитовых до хвойных. М.; Л., 488 с.
 Bierhorst D. W. 1971. Morphology of vascular plants. New York, XII -f-560 p.
 Crabbe J. A., Jermy A. C., Mickel J. T. 1975. A new generic sequence for the pteridophyte herbarium // Fern Gaz., 11: 141-162.
 Florin R. 1951. Evolution in *Cordaites* and conifers // Acta horti berg., 15:285-88.
 Holttum R. E. 1973. The phylogeny and classification of the ferns // Bot. J. Linn. Soc., 67 (Suppl. 1):1-10. London.
 Michel J. T. 1974. Phyletic lines in the modern ferns // Ann. Mo. Bot. Gard., 61: 474-482.
 Miller C. N. 1982. Current status of Palaeozoic and Mesozoic conifers // Rev. Palaeobot. and Palynol., 37: 99-114.
 Pichi Sermolli R. E. G. 1946. *Negripteridaceae* e *Negripteris*, nuova famiglia e nuovo genere delle *Filicales* // Nuov. Giorn. Bot. Ital. 2, 53 (1-2): 129-159.
 Pichi Sermolli R. E. G. 1970. A provisional catalogus of the family names of living *Pteridophytes* // Webbia, 25, 1: 219-297.
 Pichi Sermolli R. E. G. 1977. Tentamen *Pteridophytorum* genera in taxonomicum ordinem redigendi // Webbia, 31, 2: 313-512.
 Pichi Sermolli R. E. G. 1981. Report of the Subcommittee for family names of *Pteridophyta* // Taxon, 30: 163-168.
 Remy W., Leisman G. A., Hass H. 1980. Der Nachweis von *Callipteris flabellifera* (Weiss 1879) Zeiller 1898 in Kansas, USA // Argumenta Palaeobotanica, 6: 1-36.
 Rothwell G. W. 1982. New interpretation of the earliest conifers // Rev. Palaeobot. and Palynol., 37: 7-28.
 Schweitzer H.-J. 1963. Der weibliche Zapfen von *Pseudovoltzia liebeana* und seine Bedeutung für die phylogenie der Koniferen // Palaeontographica, 113B: 1-29.
 The fossil record: A symposium with documentation. 1967 // W. B. Harland, C. H. Holland. M. R. House., N. F. Hughes, A. B. Reynolds, M. J. S. Rudwick, G. E. Satterthwaite, L. B. H. Tarlo, E. C. Willejd. (Eds.) 827 p. London.
 Tryon R. M., Tryon A. F. 1982. Ferns and allied plants. New York etc., XIV, 857 p.
 Zimmermann W. 1930. Die Phylogenie der Pflanzen. Jena., XI, 454 p.
 Zimmermann W. 1959. Die Phylogenie der Pflanzen. Stuttgart, XXIV-f-777 p.