APPLICATION OF THE CARPOLOGICAL METHOD TO THE TAXONOMY OF GESNERIACEAE

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(*Note.* This translation from the Russian (Primenenie karpologicheskogo metoda v sistematike semeistva Gesneriaceae Dum. in *Botanicheskii Zhurnal*, 50: 29-43, 1965) is published with the permission and co-operation of the author, Dr. L. I. Ivanina, who has kindly contributed additional footnotes in explanation of some of the carpological terms used. These footnotes can be read to replace the cross-references to other Russian literature in the text. The only other changes to the original text have been the addition to the nomenclatural innovations of references to the appropriate pages in the original paper.

The family Gesneriaceae is, after many years of neglect, now the object of a good deal of critical study. The issue of an English version of Dr. Ivanina's paper will, it is hoped, be of value to many students of the family. It is clear that Dr. Ivanina's views and my own are not always in harmony, and her arguments do not at present induce me to modify either my wider concept of the tribe *Didymocarpeae* or my refusal to undertake its subdivision until more critical data on many points are available (cf. Notes R.B.G. Edinb. 24: 205–220 (1963)). For instance, the subtribe Streptocarpineae embraces those members of Didymocarpeae which have spirally twisted fruits; but the sum total of known characters suggests that *Boea* is more closely related to the straight-fruited *Paraboea* than to *Streptocarpus*, and it is even possible that some asiatic species now in *Streptocarpus* really have more in common with species of *Chirita* from the same area than with the African *Streptocarpus*. Such matters will be taken up again later. I should add that in a paper just published (Bull. Bot. Surv. India, 7: 73, 1965), I propose the transfer of *Cyrtandromoea* (referred doubtfully by Dr. Ivanina to tribe Klugieae) from Gesneriaceae to Scrophulariaceae.

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B. L. BURTT).

The importance of the carpological method for the taxonomy of angiosperms is, in general, recognised by everybody, and carpological data are used in describing almost all taxa. But they are still not utilised fully in classification: to be exact, the main characters of the fruit are often not taken into account, and in a number of works are underestimated.

A major achievement of modern morphology is the establishment of the main types of gynoecium and fruits (Takhtadzhyan, 1942, 1948, 1964; Kaden and Smirnova, 1964). However, further development of carpology is made difficult by the incompleteness of available descriptions of fruits and the absence of a detailed analysis of carpological data. Accumulation of the latter is, apparently, a task not only for morphologists, but also for taxonomists, who deal with an immense variety of fruits and seeds when studying taxa. Insufficient attention paid by taxonomists to the morphology of the gynoecium and fruits also limits the possibilities of utilising the carpological method for classification of taxa and elucidation of their genetic relationships.

The bases of the morphogenetic classification of seeds have hardly been studied. Mention may be made of the work of Martin (1946), in which he suggests a general scheme of seed phylogenesis, based on the relationship

* Further information regarding the Russian Translations Scheme can be obtained from the N.L.L. and copies of their translation are available price £1 17s. 6d.

between the size of the embryo and the endosperm, and also on the position and form of the embryo. Of the work done by our own scientists investigations by K. K. Zazhurilo (1940) and I. V. Grushvitskii (1961, 1963) should be mentioned.

In the order Scrophulariales (as understood by Takhtadzhyan, 1959) the family Gesneriaceae Dum. is among those which have been insufficiently studied both from a purely taxonomic aspect and also from the point of view of morphology of fruits and seeds. More or less full descriptions of the family were published in the last century by De Candolle (1839–1845), Hanstein (1853–1866), Bentham (1876) and Baillon (1888). It must also be noted that a number of new genera and species of Gesneriaceae were described by Regel (1848) and others. The last monographic review of Gesneriaceae was made by Fritsch (1893–1894). According to Fritsch the family comprised 18 tribes, embracing 2 sub-families, Cyrtandroideae (Jack) Endl. and Gesnerioideae (Dum.) Endl. In our century the extent of the family Gesneriaceae has been considerably expanded in connection with description of new taxa. Recently particular attention was devoted to the problems of taxonomy and nomenclature of Gesneriaceae in the works of Morton (1938, 1939, 1944), Burtt (1947, 1954–1963), Moore (1957) and Leeuwenberg (1958). Finally, in 1963 Burtt published a preliminary key for the tribes and genera of the Gesneriaceae of the Old World and a complete list of the genera. Some data have also appeared on cytology (Rogers, 1954, Eberle, 1956, Ratter, 1963, etc.), and on embryology and palynology, which are still awaiting their utilisation in classification.

Interest in Gesneriaceae can be explained both by its practical aspects (many members of the family are ornamental), and by the possibility of using them as material for solving such problems as the origin of the inferior gynoecium, monocotyledony and so on.

At the present time Gesneriaceae includes about 120 genera and over 1800 species. They grow in subtropical and tropical latitudes of the Old and New World. In the taxonomy of the genera of the family Gesneriaceae morphological characters of the fruits and seeds have been used from the time of De Candolle: in the sub-family Cyrtandroideae principal attention was devoted to the form of fruits and partly to the methods of their dehiscence; in the subfamily Gesnerioideae attention was paid mainly to flower characters. Nevertheless, the morphology of fruits and seeds of this family has not been specifically dealt with in the literature. The seeds of Gesneriaceae have been studied very little and usually described incompletely. Only in the work of Leeuwenberg (1958) are sufficiently detailed descriptions given.

During our work we studied the fruits of 82 genera of the family Gesneriaceae, and seeds of 65 genera; morphological types and sub-types of the fruits have been recognised. In the work offered here these carpological data have been used for classification of the genera of the family and for elucidation of the direction of evolution in the sub-divisions of the family.

We used the collections in the Herbarium of the Komarov Botanical Institute of the Academy of Sciences of the USSR (BIN) as the principal material for the study of Gesneriaceae. In addition we studied the material sent to us for examination from the Edinburgh Botanical Garden, Kew Botanical Garden, the British Museum of Natural History in London, National Natural History Museum in Paris, Herbarium and Botanical

Garden in Geneva, Museum and Herbarium of the Utrecht University and the Southern China Botanical Institute in Huanchzhou. Samples of fruits and seeds from the Komarov Botanical Institute Museum and from the glasshouses of Leningrad University were also used.

ANALYSIS OF MORPHOLOGICAL CHARACTERS OF THE TYPES AND SUB-TYPES OF THE FRUITS AND SEEDS OF THE FAMILY GESNERIACEAE

Seven main types of fruits are found in the representatives of the family Gesneriaceae[1]: superior hemiparacarpous capsule and superior hemiparacarpous berry (subfamily Cyrtandroideae), half-inferior and inferior hemiparacarpous capsule (subfamily Gesnerioideae), superior paracarpous capsule and superior paracarpous berry (subfamily Episcioideae), superior syncarpous capsule (tribe Saintpaulieae) and superior hemilysicarpous berry (genus *Cyrtandromoea*).

In the order Scrophulariales we have mainly syncarpous and paracarpous fruits: it seems possible that paracarpous fruits originated from syncarpous. This transition can be followed between the family Scrophulariaceae and Gesneriaceae. The affinity of these two families was confirmed by the latest anatomical data obtained during a study of the gynoecium (Tiagi, 1962).[2]

For the classification of sub-types and groups of fruits the degree of intrusion of the placentae into the cavity of the fruit, the forms of the placentae and the methods of fruit dehiscence are of major importance. Placentae may be deeply intruding into the cavity of the fruit (placentation resembling marginal syncarpous, characteristic for syncarpous gynoecium), or intruding and almost pressed to the walls of the fruit; the margins of placentae may be curved (bent towards the walls of the fruit), bent, spirally

[1] In contemporary Russian carpological literature (cf. Kaden & Smirnova, 1964), botanists distinguish the *Coenocarpous gynoecium* (gynoecium coenocarpum), composed of carpels united between themselves, in contrast to the *Apocarpous gyneocium* composed of free carpels, not united between themselves.

One subdivides the coenocarpous gynoecium into:-

Hemisyncarpous gynoecium (g. hemisyncarpum Kaden), transitional between apocarpous and syncarpous gynoecia, with incomplete union of carpels (e.g. *Veratrum*).

Syncarpous gynoecium (g. syncarpum), bi- or multi-locular, composed of a varying number of carpels with complete dissepiments and central marginal placentation (i.e. marginal with respect to one carpel and central with respect to the whole ovary (e.g. *Lilium*).

Hemiparacarpous gynoecium (g. hemiparacarpum Kaden), transitional between syncarpous and paracarpous gynoecia, incompletely bi- or multi-locular, with dissepiments not reaching the longitudinal axis of the ovary, with the marginal placentation (e.g. *Saxifraga* p.p.).

Paracarpous gynoecium (g. paracarpum), unilocular, composed of two or several carpels, with marginal-parietal (marginal with respect to one carpel, parietal with respect to the whole ovary, e.g. *Orchis*) or basal placentation (e.g. *Asteraceae*).

Hemilysicarpous gynoecium (g. hemilysicarpum Kaden), transitional between syncarpous and lysicarpous gynoecia, incompletely bi- or multi-locular: with complete dissepiments and central marginal placentation in the lower part of the ovary, in the upper part unilocular and with central columnar placentation (e.g. *Silene*).

Lysicarpous gynoecium (g. lysicarpum Takht.), unilocular, composed of several carpels, having central columnar placentation (e.g. *Primula*).

Apoparacarpous gynoecium (g. apoparacarpum Kaden), transitional between apocarpous and paracarpous gynoecia. It has the aspect of a hemiparacarpous gynoecium but different origin (e.g. *Papaver*—see Takhtadjan, 1964, p. 22, Fig. 20).

The types of gynoecium enumerated are also employed for the denomination of large groups of fruit types in a morphogenetical carpological classification.

[2] At the present time the primitiveness of the syncarpous gynoecium of Scrophulariaceae is in doubt (Tiagi, 1962). It is possible that the syncarpy found in the fam. Gesneriaceae is also secondary.

rolled, or straight. The character of seed arrangement on the placentae also differs: placentae may carry seeds either on the outer surface, facing the wall of the fruit, or on the inner (facing the medial line of the fruit), or on both surfaces, all over the surface, or at the ends.

Fruit dehiscence may be septicidal, i.e. by separation of the carpels along the septa (tribes Ramondeae and others), dorsal, by dehiscence along the middle veins of carpels (in the majority of the fruits of the family), or dorsal-septicidal and septicidal-dorsal, complete (up to the base of the fruits) and incomplete (only in the upper part). Furthermore, dehiscence may take place by a transverse split or irregularly; non-dehiscing fruits occur more rarely (berries). The least advanced method of dehiscence is considered to be the septicidal, and the most advanced dehiscence by cracks, without meridional direction.

The seeds of the Gesneriaceae are mainly small, numerous, developing from an anatropous ovule with one integument; the embryo is straight, occupying either almost the whole seed (mainly in representatives of the subfamily Cyrtandroideae), or a lesser part of it (in the subfamilies Gesnerioideae and Episcioideae); in the majority of epiphytes the embryo is weakly differentiated. The seed coat of Gesneriaceae is either hard and thick (subfamily Cyrtandroideae), reticulate, pitted, more rarely prickly or tuberculate, or thin, obliquely or longitudinally lined (mainly in the subfamilies Gesnerioideae and Episcioideae). The funicle falls off or remains on the seed in the form of a short strand; the place where the funicle falls off—the hilum—is situated at the lower end of the seed, seldom on the ventral side, nearer to the base (for example, in the seed of the genus *Saintpaulia*). From the hilum parallel with the lateral surface of the seed there is a groove along which not infrequently ridges are formed (in seeds of the genera *Saintpaulia*, *Streptocarpus* and others); the seed groove is hardly noticeable and can only be seen because of the slightly irregular (mostly dense) arrangement of the cells, pits and ribs. In some seeds (more advanced genera) there are additional aril-like appendages or hairs.

The seeds of the family Gesneriaceae can be divided into four groups according to size: 1) very small (between 0·2 to 0·5 mm long), 2) small (between 0·5 to 1 mm long), 3) medium (between 1·0 to 1·5 mm long) and 4) comparatively large (between 1·5 to 4 mm long). Increase in the size of seeds is related to the decrease of their number in the fruit.

Subfamily 1. Cyrtandroideae (Jack) Endl.

Tribe 1, Ramondeae (A. DC.) Fritsch. The capsule is ovate, oblong-elliptic or oblong, 6–20 mm long, hemiparacarpous; placentae intrude into the cavity, more rarely are almost pressed to the walls of the fruit (genus *Ramonda*), bent or curled at the edge, carrying seed here (on the outer surface, or on both surfaces); dehiscence septicidal, occasionally septicidal-incomplete-dorsal; valves do not twist. Seeds are very small or small, 0·2–0·9 mm long, oblong-elliptic or elliptic in outline, blunt at the ends, faintly finely-reticulate or finely ribbed, more rarely prickly (genus *Ramonda*).

Herbs, found in the mountains of Southern Europe (Pyrenean and Balkan peninsulas) and in Eastern Asia (Eastern Himalayas and North West China).

Genera: *Ramonda* Rich. (Fig. 1, 1, Fig. 2, 1), *Jankaea* Boiss., *Haberlea* Frivald. (Fig. 1, 2, Fig. 2, 2), *Corallodiscus* Batalin s. str. (Fig. 1, 3), *?Platystemma* Wall. (Fig. 2, 3).

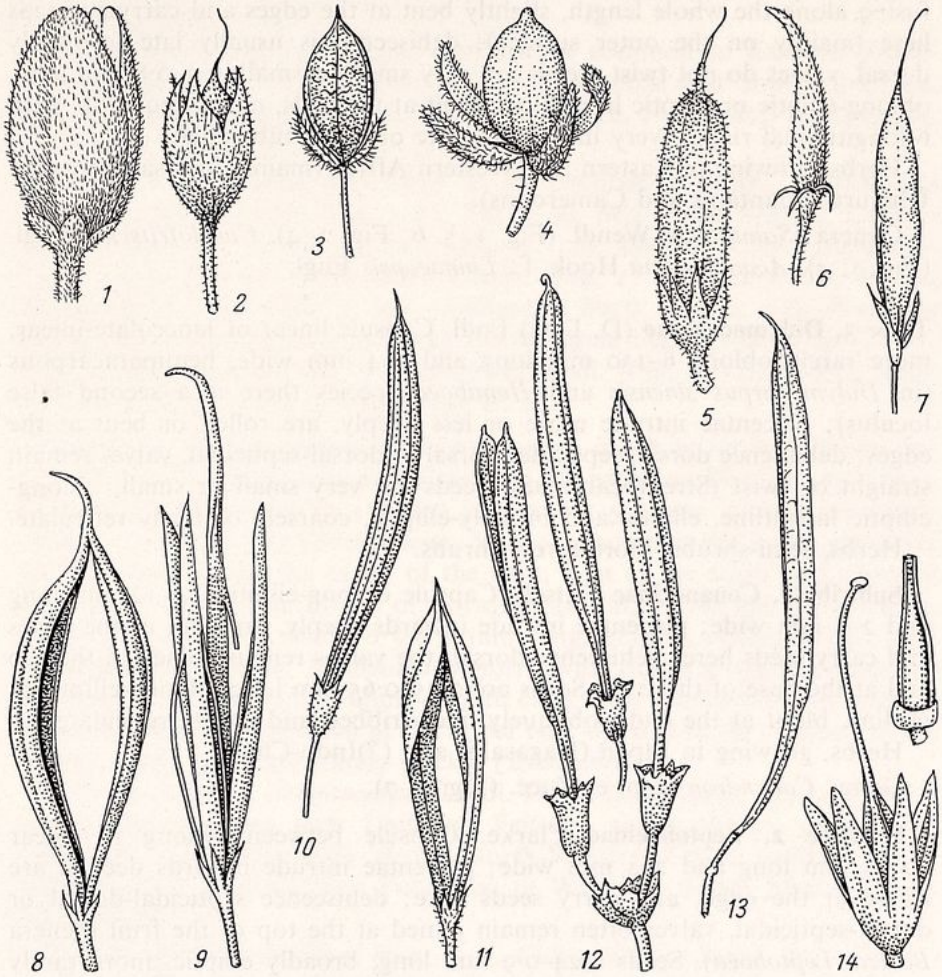

FIG. 1. Fruits of some representatives of the tribes Ramondeae, Saintpaulieae and Didymocarpeae.

1, *Ramonda myconii* Reichb. (Bordère, vii 1857; ×3)[1]; 2, *Haberlea rhodopensis* Frivald.; (Střibrny, 5 vii 1893; ×3); 3, *Corallodiscus conchaefolius* Batalin (Potanin, 19 ix 1895; ×3). 4, *Carolofritschia diandra* Engl. (Zenker 4259; ×3); 5, *Saintpaulia ionantha* Wendl. (BIN's[2] glasshouses, 1959; ×3); 6. *S. shumensis* Burtt (Leningrad State Univ. glasshouses, 1963; ×2); 7, *Conandron ramondioides* Sieb. et Zucc. (Maximovicz, 21 ix 1863; ×4); 8, *Leptoboea multiflora* Gamble (Clarke 36877A; ×3), dehisced fruit; 9, *Boeica filiformis* Clarke (Clarke 34815; ×5), dehisced fruit; 10, *Didissandra lanuginosa* (Wall. ex DC.) Clarke (Potanin, 23 viii 1885; ×3); 11, *Tremacron forrestii* Craib (Forrest 20532; ×2), dehisced fruit; 12, *Didymocarpus macrophyllus* Wall. (herb. Winterbottom, 1848; ×2); 13, *Chirita chlamydata* W. W. Smith (Henry 2417B; natural size); 14, *Hemiboea henryi* Clarke (Henry 6493A; ×1½).

[1] In brackets are given the names of collectors, no. of herbarium specimen or date of collection, fruit magnification or seed size.

[2] BIN—Komarov Botanical Institute of the Academy of Sciences of USSR.

Tribe 2, Saintpaulieae Ivanina, trib. n. (in Bot. Zhurn. 50: 31, 42 (1965)). Capsule between ovate and oblong, 4–25 mm long, syncarpous or hemiparacarpous (placentation forms closely resembling syncarpous); placentae intrude very deeply into the cavity of the fruit on the septum, usually fusing at the base along the median line, in the apical part more or less free or fusing along the whole length, slightly bent at the edges and carrying seeds here (mainly on the outer surface); dehiscence is usually late, probably dorsal, valves do not twist. Seeds are very small or small, 0·3–0·8 mm long, oblong-elliptic or elliptic in outline, blunt at the ends, not infrequently with 6 longitudinal ridges, very finely reticulate or finely tuberculate.

Herbs, growing in Eastern and Western Africa (mainly in Usambara and Uluguru mountains and Cameroons).

Genera: *Saintpaulia* Wendl. (Fig. 1, 5, 6; Fig. 2, 4). *Carolofritschia* Engl. (Fig. 1, 4), *Acanthonema* Hook. f., *Linnaeopsis* Engl.

Tribe 3, Didymocarpeae (D. Don) Endl. Capsule linear or lanceolate-linear, more rarely oblong 6–130 mm long and 2–4 mm wide, hemiparacarpous (in *Didymocarpus sinensis* and *Hemiboea* species there is a second false loculus); placentae intrude more or less deeply, are rolled or bent at the edges; dehiscence dorsal, septicidal-dorsal or dorsal-septicidal, valves remain straight or twist (Streptocarpinae). Seeds are very small or small, oblong-elliptic in outline, elliptic and broadly-elliptic, coarsely or finely reticulate.

Herbs, semi-shrubs, more rarely shrubs.

Subtribe 1, Conandrinae Fritsch. Capsule oblong-elliptic, 10–12 mm long and 2–3 mm wide; placentae intrude inwards deeply, are bent at the edges and carry seeds here; dehiscence dorsal, the valves remain joined at the top and at the base of the fruit. Seeds are 0·55–0·65 mm long, oblong-elliptic in outline, blunt at the ends, obliquely finely ribbed and faintly reticulate.

Herbs, growing in Japan (Nagasaki) and (?)Indo-China.

Genus *Conandron* Sieb. et Zucc. (Fig. 1, 7).

Subtribe 2, Leptoboeinae Clarke. Capsule between oblong to linear 10–25 mm long and 2–4 mm wide; placentae intrude inwards deeply, are rolled at the edge, and carry seeds here; dehiscence septicidal-dorsal or dorsal-septicidal, valves often remain joined at the top of the fruit (genera *Boeica*, *Leptoboea*). Seeds 0·24–0·9 mm long, broadly elliptic, more rarely elliptic in outline, blunt at the ends, tuberculate-thickened, finely-reticulate, sometimes coarsely-reticulate, very seldom prickly.

Semi-shrubs and shrubs, more rarely herbs, found in Eastern and South-Eastern Asia (South-West and South China, Eastern Tibet, Northern India, Burma and the islands of Malacca, Sumatra, Kalimantan, Java and Ceylon).

Genera: *Leptoboea* Benth. (Fig. 1, 8; Fig. 2, 6), *Boeica* Clarke (Fig. 1, 9; Fig. 2, 7), *Championia* Gardn. (Fig. 2, 8), *Tetraphyllum* Griff., *Trisepalum* Clarke, *Tengia* Chun, *?Isometrum* Craib, *?Briggsia* Craib.

Subtribe 3, Roettlerinae Fritsch.* Capsule linear or oblong, 6–70 mm long and about 2–3 mm wide; placentae intrude into the cavity of the fruit, are rolled at the edges, carry seed here on both surfaces, occasionally only bent

* The correct name for this subtribe under the International Code is subtribe Didymocarpineae G. Don. B.L.B.

Didissandra, *Petrocosmea*); dehiscence dorsal, more rarely dorsal-septicidal, or late dehiscence (genus *Didissandra*, some species of the genera *Chirita* and *Didymocarpus*). Seeds 0·24–0·90 mm long, oblong-elliptic and elliptic in outline, blunt or slightly blunt at the ends, with tuberculate thickenings, often with 4–6 longitudinal facets, sometimes with short hairs, coarsely or finely reticulate.

Herbs, more rarely shrubs or semi-shrubs common in Eastern, South-Eastern and Southern Asia (North-Western, Central and Southern China, Taiwan, Japan, Northern India, Burma, Malacca, Indonesia), in Australia, Madagascar and West Africa.

Genera: *Petrocosmea* Oliv. (Fig. 2, 5), *Oreocharis* Benth., *Dasydesmus* Craib, *Tremacron* Craib (Fig. 1, 11; Fig. 2, 9), *Beccarinda* Kuntze, *Cathayanthe* Chun, *Ancylostemon* Craib (Fig. 2, 10), *Bournea* Oliv., *Isometrum* Craib, *Anna* Pellegr., *Didissandra* Clarke (Fig. 1, 10), *Petrocodon* Hance, *Raphiocarpus* Chun (Fig. 2, 13), *Opithandra* Burtt (Fig. 2, 11), *Primulina* Hance, *Hemiboea* Clarke (Fig. 1, 14), *Trachystigma* Clarke, *Paraboea* (Clarke) Ridl., ? *Codonoboea* Ridl., *Didymocarpus* Wall. (Fig. 1, 12), *Chirita* Ham. ex D. Don (Fig. 1, 13), ? *Loxocarpus* R. Br.

Subtribe 4, Streptocarpinae (Fritsch) Ivanina, comb. n. (in Bot. Zhurn. 50: 33 (1965))—Trib. Streptocarpeae Fritsch in Pflanzenfam. IV (3b), 150 (1894). Capsule usually linear, 20–130 mm long and 1·5–3 mm wide, more rarely oblong, 6–16 mm long (*Dichiloboea*, *Sinoboea*) acute at the apex; placentae deeply intruded into the cavity of the fruit, bent at the edges and carrying seeds here; dehiscence dorsal or dorsal-septicidal, valves spirally twisting. Seeds very small or small, 0·3–0·8 mm long, elliptic, oblong-elliptic and rounded-elliptic (*Boea*, *Rhabdothamnopsis*), with ridges along the seeds, or prismatic, blunt or slightly blunt at both ends, with tuberculate thickenings, sometimes with a protrusion at the upper end, often with the remains of the funicle, finely reticulate, rarely prickly (*Dichiloboea*).

Type of subtribe: *Streptocarpus* Lindl. Herbs (sometimes with one leaf—species *Streptocarpus* sect. *Unifoliati* Fritsch), rarely shrubs, growing in East and South-East Asia (from North-Western China southwards to Indonesia), in Australia and Polynesia, in West and South Africa and on Madagascar.

Genera: *Dichiloboea* Stapf (Fig. 3, 1), *Chlamydoboea* Stapf, *Boea* Comm. ex Lam. (Fig. 3, 2), *Rhabdothamnopsis* Hemsl., *Ornithoboea* Parish ex Clarke, *Sinoboea* Chun, *Streptocarpus* Lindl. (Fig. 2, 12; Fig. 3, 3, 4).

Tribe 4, Trichosporeae (G. Don) Fritsch. Capsule linear, between 1 to 40 cm long, hemiparacarpous; placentae very deeply intruding into the cavity of the fruit, spirally inrolled at the edges and carrying seeds here; dehiscence dorsal, more rarely dorsal-septicidal, valves not twisting. Seeds very small or small, 0·4–0·8 mm long, with one long hair at the apex (1–3 cm long) and usually with 1–2 hairs at the lower end, or without any, more rarely with numerous hairs; seeds oblong-elliptic or oblong, faintly finely reticulate, ribbed, with a few prickles or smooth.

Semi-shrubs, often epiphytes, with opposite, more rarely whorled (1 to 4 leaves) or alternate leaves (genus *Agalmyla*). Common in the mountains at a height of 1000–2500 m above sea level in East and South-East Asia (Eastern

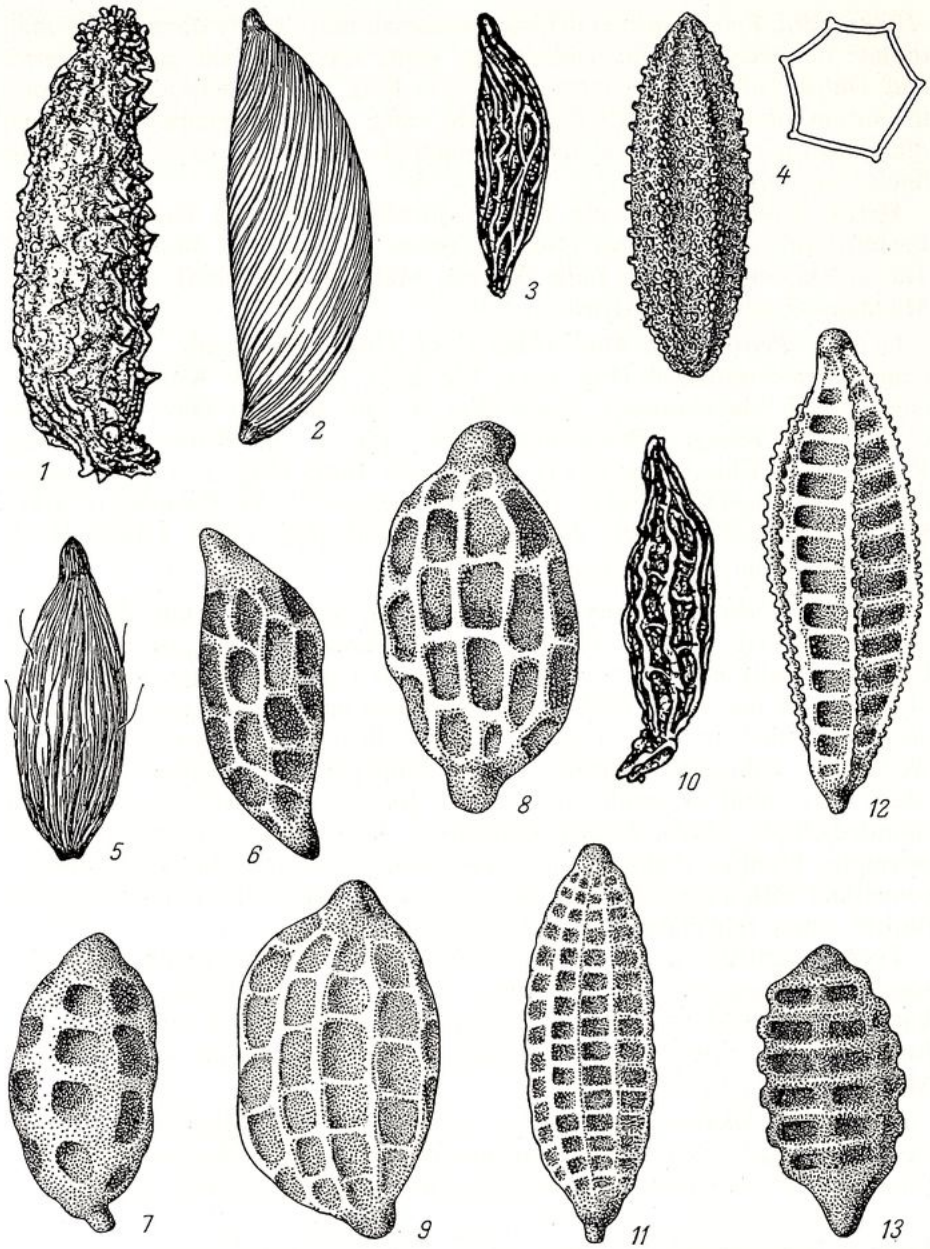

FIG. 2. Seeds of some representatives of the tribes Ramondeae, Saintpaulieae and Didymocarpeae.

1, *Ramonda myconii* Reichb. (Bordère, vii 1857; 0·75×0·2 mm); 2, *Haberlea rhodopensis* Frivald. (Střibrny, 5 vii 1893; 0·7 × 0·22 mm); 3, *Platystemma violoides* Wall. (Strachey & Winterbottom, 21 viii 1848; 0·9×0·23 mm); 4, *Saintpaulia shumensis* Burtt (Leningrad State Univ. glasshouses, 1963; 0·57×0·19 mm); 5, *Petrocosmea iodioides* Hemsl. (Henry 10259; 0·5×0·17 mm); 6, *Leptoboea multiflora* Gamble (Clarke 36877A; 0·43×0·15 mm); *Boeica fiiliformis* Clarke (Clarke 34815; 0·33 × 0·17 mm); 8, *Championia reticulata* Gardn. (Walker 370; 0·4×0·28 mm); 9, *Tremacron forrestii* Craib (Forrest 20537; 0·55×0·3 mm); 10, *Ancylostemon saxatilis* (Hemsl.) Craib (Henry 7809; 0·85×0·25 mm); 11, *Opithandra primuloides* (Miq.) Burtt (Makino, 1884; 0·65×0·22 mm); 12, *Streptocarpus buchananii* Clarke (Hildebrandt, vii 1880; 0·75×0·24 mm); 13, *Raphiocarpus sinicus* Chun (Chun 65870; 0·45×0·23 mm).

Himalayas, Central, South-Western and South China, Japan, Northern India, Malacca, Indonesia and Philippine Islands) and on the island of New Guinea.

Genera: *Aeschynanthus* Jack (Fig. 3, 5; Fig. 4, 1), *Dichrotrichum* Reinw. (Fig. 4, 2), *Agalmyla* Blume, *Loxostigma* Clarke (Fig. 3, 6), *Lysionotus* D. Don (Fig. 4, 3), *Micraeschynanthus* Ridl., ? *Oxychlamys* Schlechter, ? *Euthamnus* Schlechter.

Tribe 5, Cyrtandreae Blume. The fruit is an oblong, linear or ellipsoid berry; placentae intruding deeply into the cavity, bent at the edges and carrying seed here; fruit indehiscent. Seeds very small or medium, 0·3–0·7 mm long, ellipsoid, with tuberculate thickenings, without the remains of the funicle, blunt at the ends, reticulate or ribbed, brown or dark purple.

Shrubs or semi-shrubs, sometimes small trees, common on the islands of the Indian and Pacific oceans (Indonesia, Philippine Islands, New Guinea, etc.), occasionally on the Malacca peninsula and in Southern China.

Genera: *Cyrtandra* J. R. et G. Forst. (Fig. 3, 9), *Protocyrtandra* Hosakawa, *Cyrtandropsis* Lauterb.

Tribe 6, Rhynchotecheae Ivanina, trib. n. (in Bot. Zhurn. 50: 33, 42 (1965)). Fruit is berry-like, ovate or almost spherical, 3–8 mm long, hemiparacarpous, placentae intrude very deeply into the cavity, curved, carrying seeds on both surfaces, fruit indehiscent. Seeds very small, 0·25–0·5 mm long, elliptic, pitted or coarsely-reticulate. Semi-shrubs, growing in South-East Asia (South China, Taiwan, India-Assam and Bengal, Burma, Malay peninsula, Indonesia, Ceylon, Philippine Islands), in New Guinea and in Australia.

Genera: *Rhynchotechum* Blume (Fig. 3, 7 and Fig. 4, 4), *Isanthera* Nees (Fig. 3, 8).

Tribe 7, Klugieae Fritsch. Capsule usually berry-like, ovate or almost spherical, 3–16 mm long, usually with persistent style, hemiparacarpous or hemilysicarpous, placentae are either on a short septum, carrying seeds all over both surfaces, or in the genus *Cyrtandromoea* (described by Clarke, 1883) placentae are fused at the base and free at the apex, on ripening they separate from the thin wall, forming a column in the middle, which from the top appears divided into four; dehiscence dorsal (more rarely dorsal-incomplete-septicidal), annular or irregular. Seeds are very small or small, 0·27–0·8 mm long, elliptic or oblong-elliptic in outline, pointed or blunt at the ends, sometimes with a protrusion, usually with remains of the funicle, spirally-reticulate, reticulate or ribbed (genus *Epithema*).

Perennial herbs and shrubs. Common in South-East Asia (South China, Taiwan, North-East India, Burma, Malay peninsula, Indonesia, Ceylon, Philippine Islands), in New Guinea, West Africa and tropical America (Mexico, Venezuela and Colombia).

Genera: *Rhynchoglossum* Blume (Syn.: *Klugia* Schlechtd.) (Fig. 3, 10: Fig. 4, 6), *Epithema* Blume (Fig. 4, 5), *Monophyllaea* R. Br., *Stauranthera* Benth., ? *Loxonia* Jack, ? *Cyrtandromoea* Zollgr.

Tribe 8, Coronanthereae Fritsch. The fruit is an ovate or ellipsoid capsule, 7–15 mm long, pointed at the apex, hemiparacarpous; placentae in *Coronan-*

FIG. 3. Fruits of some representatives of the tribes Didymocarpeae (subtribe Streptocarpinae), Trichosporeae, Rhynchotecheae, Cyrtandreae, Klugieae.

1, *Dichiloboea birmanica* (Craib) Stapf (Henry 12305A; × 3); 2, *Boea hygrometrica* (Bunge) R. Br. (Tatarinov; × 2), a—capsule dehiscing; 3, *Streptocarpus kewensis* N. E. Br. (BIN's glasshouses; × 2), young indehisced capsule; 4, *Streptocarpus gardenii* Hook. (BIN's glasshouses; × 2), younge indehisced capsule; 5, *Aeschynanthus superbus* Clarke (King, Herb. Calcuttensis; half-size); 6, *Loxostigma griffithii* Clarke (Henry 10882; × 1½); 7, *Rhynchotechum vestitum* Hook. f. et Thoms., a—fruit without the calyx (Henry 12216A; × 4); 8, *Insanthera discolor* Maxim. (Elmer 104346; × 4); 9, *Cyrtandra angularis* Elm. (Elmer 10698; × 1½); 10, *Rhynchoglossum notonianum* (Wall.) Burtt (Lipskii, 26 vii 1908; × 2½), a—the same, but with calyx removed.

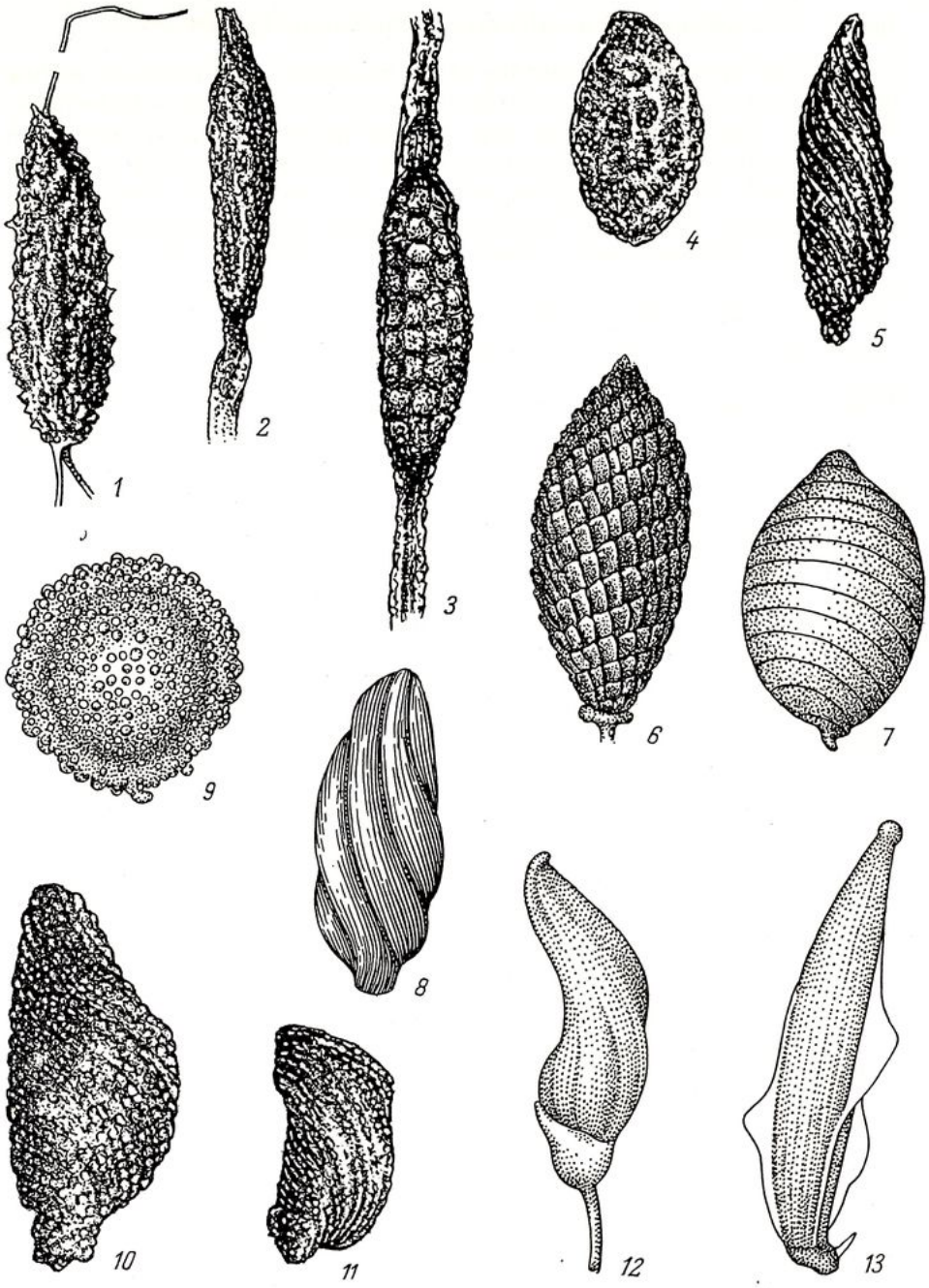

FIG. 4. Seeds of some representatives of the tribes Trichosporeae, Rhynchotecheae, Klugieae, Episcieae and Columneae.

1, *Aeschynanthus parasiticus* (Roxb.) Wall. (Herb. Griffith; 1863–1864; 1 × 0·3 mm, hairs 5 mm long); 2, *Dichrotrichum clarkii* Elm. (Elmer 0219; 0·8 × 0·23 mm; hairs 3 mm long); 3, *Lysionotus pauciflorus* Maxim. (Wilson 1312; 0·6 × 0·18 mm); 4, *Rhynchotechum ellipticum* DC. (J. D. Hooker, Khasia; 0·35 × 0·2 mm); 5, *Epithema brunonis* Decne. (Elmer 8318; 0·54 × 0·15 mm); 6, *Rhynchoglossum notonianum* (Wall.) Burtt (Lipskii, 25 vi 1908; 0·6 × 0·22 mm); 7, *Episcia melittifolia* (L.) Mart. (Egger 613; 0·5 × 0·3 mm); 8, *Chrysothemis rupestris* (Benth.) Leeuw. (Leeuwenberg 1328; 0·65 × 0·28 mm); 9, *Tylopsacas cuneata* (Leeuw.) Leeuw. (Spruce 3379; 0·35 × 0·35 mm); 10, *Besleria lutea* L. (Hahn 1420; 0·6 × 0·28 mm); 11, *Alloplectus vittatus* Linden & André (BIN'S seed laboratory, no. 1383; 0·65 × 0·35 mm); 12, *Hypocyrta radicans* Klotzsch & Hanst. (Dusen 1426; 1·5 × 0·55 mm); 13, *Codonanthe calcarata* (Miq.) Hanst. (Fanshawe 22838; 3·5 × 0·9 mm).

thera aspera intrude deeply into the cavity on an incomplete septum, having the appearance of a short straight lamina and carry seeds on both surfaces; dehiscence dorsal, dorsal-septicidal and septicidal-dorsal; in some representatives the valves remain joined at the apex. Seeds 0·3–0·9 mm long, oblong-elliptic in outline, slightly pointed at the ends, faintly reticulate and finely striped, more rarely covered with small prickles (*Coronanthera aspera*).

Shrubs, common in New Zealand, in New Caledonia and on Lord Howe island.

Genera: *Coronanthera* Vieill. ex Clarke (Fig. 5, 2), *Depanthus* S. Moore, *Rhabdothamnus* A. Cunn., ? *Negria* F. Muell.

Tribe 9, Mitrarieae (Fritsch) Burtt. The fruit is a berry-like capsule, almost round or ovate, 8–14 mm long, often with persistent long style, hemiparacarpous (fruits of the genus *Asteranthera* are syncarpous); placentae are in the form of a lamina attached in the middle to a short septum, intrude into the cavity, sometimes fused, carrying seeds on both surfaces, lacking ovules in the centre of the lamina; dehiscence annular or irregular. Seeds medium, 0·8–1·7 mm long, or very small, 0·25–0·27 mm long (genus *Asteranthera*), oblong-elliptic, more rarely rounded-elliptic, sometimes slightly curved, at the ends tuberculate-thickened, the surface of the seeds is longitudinally striped, more rarely pitted (genus *Asteranthera*).

Creeping shrubs with alternate leaves, growing in Chile and in Australia (*Fieldia*).

Genera: *Mitraria* Cav. (Fig. 5, 3), *Sarmienta* Ruiz et Pav., *Fieldia* A. Cunn., ? *Asteranthera* Klotzsch et Hanst.

Subfamily 2. Episcioideae (Endl.) Ivanina, stat. n.
(in Bot. Zhurn, 50: 37, 42 (1965))

Tribe 10, Episcieae Endl. The fruit is a capsule, usually berry-like, almost spherical, 6–30 mm long, occasionally very small, 1·5–2 mm diam., or a berry (genus *Besleria*); placentae divided into two from the base, straight, carrying seeds on the tips, occasionally on the inner or both surfaces; dehiscence dorsal. Seeds are very small, 0·2–0·7 mm long, rounded, widely-elliptic or elliptic, sometimes with aril-like formations, obliquely ribbed, seldom coarsely reticulate or with small tubercles, bright-yellow, brown or dark cherry coloured.

Herbs, semi-shrubs or shrubs, epiphytes or terrestrial plants, many with trailing stems. Common in tropical America (Mexico, Central America, West Indies and South America—as far as Peru and southern Brazil) and in southern India.

Genera: *Episcia* Mart. (Fig. 4, 7), *Drymonia* Mart., *Chrysothemis* Decne. (Fig. 4, 8), ? *Tylopsacas* Leeuw. (Fig. 4, 9), *Nautilocalyx* Linden, *Besleria* L. (Fig. 4, 10), *Pterobesleria* Morton, *Alloplectus* Mart. (Fig. 4, 11; Fig. 5, 4), ? *Diplolegon* Regel, ? *Trichantha* Hook., *Hypocyrta* Mart. (Fig. 4, 12), *Napeanthus* Gardn. (Fig. 5, 1), ? *Jerdonia* Wight.

Tribe 11, Columneae Hanst. s. str. The fruit is a berry or berry-like capsule, spherical or almost spherical, about 11–14 mm diam., often with remaining curved style; placentae are usually divided into two from the base (from the

wall of the fruit), carrying seed almost on the tips, or are in the form of two tuberculate projections (genus *Codonanthe*) carrying seeds; fruits mainly indehiscent, occasionally dehiscing almost dorsally (genus *Nematanthus*). Seeds are comparatively large (usually 1–2, occasionally 3·5–3·9 mm long), oblong-elliptic in outline, longitudinally or obliquely striated (seeds of the genus *Codonanthe* with membranous aril-like formations at the sides of the seed), brown or dark cherry coloured (genus *Columnea*).

Shrubs, semi-shrubs or herbs, often epiphytes. Common in tropical America (Mexico, Central America, West Indies and South America—as far as Peru and southern Brazil).

Genera: *Columnea* L., *Nematanthus* Schrad. and *Codonanthe* (Mart.) Hanst. (Fig. 4, 13).

Subfamily 3. Gesnerioideae (Dum.) Endl.

Tribe 12, Bellonieae Benth. The capsule half-inferior or almost superior, widely ellipsoid or rounded, with remaining thickened style, hemiparacarpous; placentae (in *Niphaea rubida*) in the form of a lamina on a short septum, almost straight, carrying seeds on both sides; dehiscence dorsal; glandular disc is absent. The calyx campanulate-conical or ovate-tubular, with 5–7 or more often 5 lobes, or divided into 5 almost to the base. Seeds (*Bellonia*, *Niphaea*) are very small, 0·2–0·5 mm long, usually irregularly elliptic in outline, spirally twisted, striated with fine oblique ribs.

Herbs, or small shrubs with opposite leaves, common in West Indies, Mexico and Central America.

Genera: *Bellonia* Plum. ex L. (Fig. 5, 5; Fig. 6, 1), *Niphaea* Lindl., *Phinaea* Benth., *Anodiscus* Benth., *Scoliotheca* Baill.

Note: Genera *Anodiscus* and *Scoliotheca*, which have a more or less tubular calyx (and not a wide-campanulate) and a fully half-inferior ovary, deserve, apparently, to be put into a separate tribe.

Tribe 13, Kohlerieae Fritsch. The capsule is half inferior or two-thirds inferior, oblong-ellipsoid, ellipsoid or tubular-conical, with thick style, hemiparacarpous; placentae (*Smithiantha*) on a short septum in the form of a lamina, thickened, notched, carrying seeds on both sides; dehiscence dorsal; disc with five glands or annular. Calyx 5-lobed (lobes are large, leaf-like), or 5-dentate (teeth 2·5–4 mm long). Seeds are very small, 0·3–0·7 mm long, irregularly elliptic in outline, or oblong-elliptic, differing in form, mostly with tuberculate thickenings or protrusions (in the shape of a small crown), striated with fine oblique ribs, brown, wine-red and from dark-cherry to black coloured.

Herbs with scaly and tuber-like rhizomes or shrubs with opposite leaves. Found in West Indies, Mexico, Central and South America—as far as Peru, Bolivia and southern Brazil.

Genera: *Diastema* Benth. (Fig. 6, 2), *Kohleria* Regel (Fig. 5, 6; Fig. 6, 3), *Sinningia* Nees (Fig. 6, 4), *Synepilaena* Baill., *Pearcea* Regel, *Vanhouttea* Lem., *Koellikeria* Regel (Fig. 5, 7; Fig. 6, 5), *Smithiantha* Kuntze, *Heppiella* Regel.

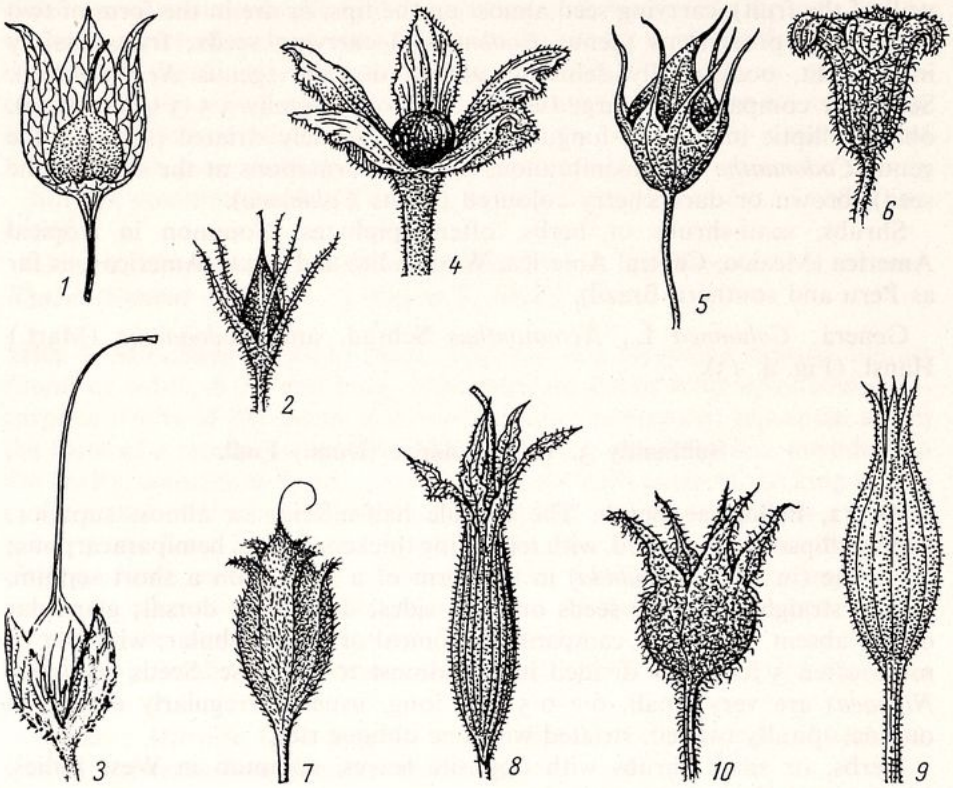

FIG. 5. Fruits of some representatives of the tribes Coronanthereae, Episcieae, Bellonieae, Kohlerieae, Gloxinieae, Rechsteinerieae and Gesnerieae.

1, *Napeanthus primulinus* (Karst.) Benth. & Hook. ex Jackson (Karsten; × 3), two lobes of the calyx removed; 2, *Coronanthera aspera* Clarke (Pancher, 1870; × 4); 3, *Mitraria coccinea* Cav. (Philippi 24; × 2); 4, *Alloplectus vittatus* Linden & André (1959, BIN's glasshouses; natural size); 5, *Bellonia spinulosa* Sm. (Miquel Fuertes, iii 1910; × 5); 6, *Kohleria bogotensis* Fritsch (Karsten; × 2½); 7, *Koellikeria argyrostigma* (Hook.) Regel (Weberbauer, 1929; × 4); 8, *Gloxinia reflexa* Rusby (M. Bang 1745; × 5); 9, *Monopyle leucantha* Moritz (Moritz 868; × 3); 10, *Gesneria libanensis* Gris. (Wright, 1860–1864; × 3).

Tribe 14, Gloxinieae G. Don. Capsule inferior, obovate (*Gloxinia*) conical (*Achimenes*), oblong, sometimes a little oblique at the base or distended (*Monopyle*), with persistent style, hemiparacarpous; placentae on a short septum, thickened, more or less notched, carrying seeds on the whole surface; dehiscence dorsal; glandular disc annular, sometimes 5-lobed, occasionally absent (*Monopyle*). Seeds are very small, 0·27–0·46 mm long, wide-elliptic or oblong-elliptic in outline, spirally curved, tuberculate, sometimes with remains of the funicle, with fine oblique ribs.

Herbs with long rhizomes, mainly fleshy and scaly. Found in Mexico, West Indies, Central and South America—as far as Peru and Brazil.

Genera: *Gloxinia* L'Herit. (Fig. 5, 8), *Achimenes* P. Br., ? *Seemannia* Regel, *Monopyle* Moritz (Fig. 5, 9).

Tribe 15, Rechsteinerieae Ivanina trib. n. (in Bot. Zhurn. 50: 39, 42 (1965)). Capsule half-inferior (mostly almost superior), ovate, oblong-ovate or conical, usually with persistent short style, hemiparacarpous; placentation

almost the same as in tribe Kohlerieae; dehiscence dorsal or dorsal-septicidal; valves often hairy at the edges; 1–5 glands, occasionally the disc is annular (genus *Lietzia*); calyx 5-dentate or occasionally divided into five almost to the base. Seeds mainly comparatively large, 0·8–1·5 mm long, occasionally

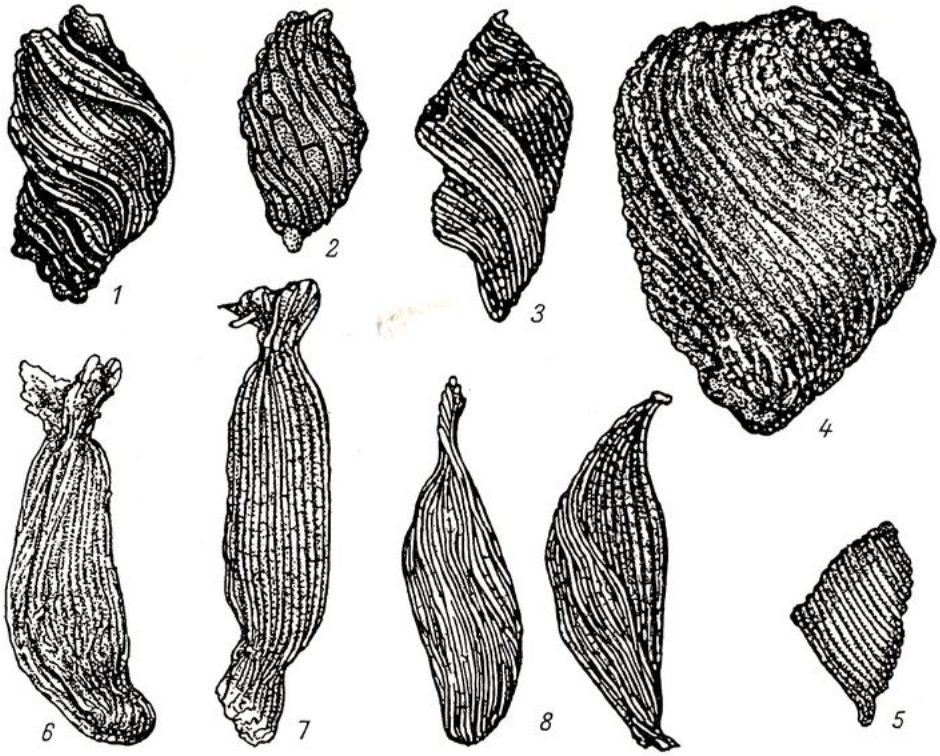

FIG. 6. Seeds of some representatives of the tribes Bellonieae, Kohlerieae, Rechsteinerieae and Gesnerieae.

1, *Bellonia spinulosa* Sm. (Miquel Fuertes, iii 1910; 0·45×0·22 mm); 2, *Diastema incisa* Karsten (Karsten; 0·35×0·18 mm); 3, *Kohleria bogotensis* (Nicholson) Fritsch (Karsten; 0·46 × 0·24 mm); 4, *Sinningia speciosa* (Lodd.) Hiern (BIN's seed laboratory, 0·65 × 0·45 mm); 5, *Koellikeria argyrostigma* (Hook.) Regel (Weberbauer, 1929; 0·3 × 0·16 mm); 6, *Rechsteineria cardinalis* (Lehm.) Kuntze (BIN's seed laboratory; 1·2×0·34 mm); 7, *R. douglasii* Lindl. (BIN's museum; 1·4×0·3 mm); 8, *Rhytidophyllum tomentosum* (L.) Mart. (Eggers 4743; 0·6×0·18 mm).

small, about 0·6 mm, oblong or oblong-elliptic in outline, slightly curved or spirally twisted, with an outgrowth at the upper end (in the shape of a small crown), sometimes with the remains of the funicle at the lower end, striated with fine longitudinal ribs, light- or dark-brown.

Herbs with tuber-like and scaly rhizomes and small shrubs. Found in Mexico, Central and South America from Colombia to northern Argentina and Uruguay.

Genera: *Lietzia* Regel, *Rechsteineria* Regel (Fig. 6, 6, 7), *Paliavana* Vell. ex Vandelli.

Tribe 16, Solenophoreae Fritsch. Capsule inferior. Only two glands developed. We did not see any fruits or seeds.

Shrubs with opposite leaves. Found in Mexico and Central America.

Genera: *Solenophora* Benth. and *Hippodamia* Decne.

Tribe 17, Gesnerieae DC. Capsule inferior, obconical, oblong, conical or semi-spherical, often 5-ribbed, hemiparacarpous; placentae on a short septum, bipartite, lobes notched or smooth, carrying seeds on the whole surface; glandular disc annular, thickened, often 5-lobed; calyx with 5 teeth, usually small, 1–2 mm long. Seeds small 0·48–0·9 mm long, elliptic or ovate in outline, both ends rounded or blunt, tuberculate, sometimes with a protrusion, but without a noticeable crown, with fine oblique ribs, brown.

Shrubs and small trees with alternate leaves, sometimes very downy. Found in West Indies, Mexico, Central and South America—as far as Peru and Brazil.

Genera: *Gesneria* L. (Fig. 5, 10), *Rhytidophyllum* Mart. (Fig. 6, 8).

THE MAIN TRENDS OF PHYLOGENY IN THE FAMILY GESNERIACEAE

On the basis of the taxonomic study and carpological analysis we shall now attempt to present the main directions of phylogeny in the family.

The most primitive characters are found in the subfamily Cyrtandroideae adapted to tropical and subtropical zones, mainly of the Old World (particularly of South-East Asia). In this subfamily genera are found which have not lost the archaic characters (syncarpous gynoecium, 5 stamens, almost actinomorphic corolla, small seeds, etc.). In this line of evolution changes involved the life forms (small trees, shrubs, herbs and epiphytes), vegetative organs (leaf arrangement, stem shape, etc.) and generative organs (flower—from almost actinomorphic with rotate corolla to tubular, almost bilabiate; stamens 5 to 2 and so on). Very important changes took place in the structure of the gynoecium and the fruit. We must mention here for the tribes Ramondeae, Didymocarpeae and Trichosporeae the evolution in the shape of the capsule from ovate to linear (incidentally the longest fruits are found in epiphytic woody plants of South-East Asia) and the appearance of long hairs on seeds (in the same epiphytes). It may be supposed that the hairs not only help in wind dispersal, as was suggested by Ulbrich (1928) and others, since in forest conditions this is not very effective, but also serve as organs of attachment to the bark of trees and for moisture absorption. The evolution of fruits and seeds of the tribes Ramondeae and Didymocarpeae is connected, apparently, with seed dispersal by wind. Their seeds are very small or small, found in hemiparacarpous capsules, situated on comparatively long peduncles; dehiscence of the capsules is entirely septicidal, dorsal or dorsal-septicidal. The plants grow mainly on rocks (in tropical and subtropical forests of the belt of low mountains) a slight air current is enough to send the seeds flying out of the open fruits. In many capsules of the tribe Didymocarpeae the valves on opening remain joined at the apex and at the base (the open capsule looks like letter O), and the swaying of the stems or branches with the fruit facilitates seeding (particularly in woody plants, for example in *Boeica* and *Leptoboea* and others). These plants are both "ballists" (Ulbrich, 1928) and "anemochors". In the tribe Saintpaulieae both basicarpy and

geocarpy exist; capsules of the genus *Carolofritschia* develop at the base of the rosette (basicarpy), pedicels of species of *Saintpaulia* bend and hang down as the fruits ripen, so that ripe capsules are found under the rosette leaves; according to the data found in the literature the fruits of *Saintpaulia* bury themselves in the ground (geocarpy). Twisting of the valves on dehiscence of the fruits in the genera of the subtribe Streptocarpineae is apparently connected with the adaptation for active dispersal of seeds ("automechanochory", according to Levina, 1957) of plants growing in relatively arid conditions of the tropics (South and East Africa and Madagascar). In the more advanced genera of the tribes Klugieae and Mitrarieae the presence of capsules, dehiscing by splits which have no meridional direction (irregular or transverse dehiscence) is, apparently, connected with the evolution of the fruits from those dehiscing longitudinally to indehiscent (tribe Cyrtandreae). In the tribes Klugieae, Coronanthereae and Mitrarieae the character of placentation (seeds situated on the entire inner surface) is more advanced than in the preceding tribes of the subfamily Cyrtandroideae. Burtt (1963) suggests that the tribes Coronthereae and Mitrarieae should be included in the subfamily Gesnerioideae, because representatives of these tribes are characterised by equal cotyledons as distinct from the genera of other tribes of Cyrtandroideae of the Old World. The majority of carpological characters (mainly the structure of the placenta, with the exception of the genus *Asteranthera*) and seed characters do in fact indicate the relationships of these tribes with the subfamily Gesnerioideae. However, the presence of a superior ovary and a number of other less advanced characters (5 stamens in the genus *Depanthus*, septicidal-dorsal dehiscence in the genus *Coronanthera*, pitted surface of seeds in the genus *Asteranthera* and others) bring these tribes closer to the subfamily Cyrtandroideae. Most genera of the tribes Mitrarieae and Cyrtandreae are found on islands, and the genus *Cyrtandra* is represented by approximately 120 species. The fruit is a berry. It is possible that the wide distribution of this genus on islands is connected with "ornithochory" (dispersal of seed by birds).

In the process of evolution of this family, in addition to the line of development which included the tribes of the subfamily Cyrtandroideae examined above (mainly in the Old World) two more lines were apparently determined very early, leading to the present day genera of Gesneriaceae of the New World. One line leads to the subfamily Episcioideae. In this line genera with more advanced characters predominate (paracarpous gynoecium, berries, small and large seeds (up to 4 mm long), mostly striped with lines and ribs, sometimes with aril-like appendages, and so on).

The other line leads to the genera of the subfamily Gesnerioideae. Judging by the areal (tropics and subtropics of the New World) and the presence of specialised characters of the gynoecium—half-inferior and inferior ovaries—it is possible that this differentiation occurred later than in the first line. In this subfamily changes were mainly concerned with the gynoecium and fruits (from almost superior to almost inferior), the shape of the corolla and anthers (from free to confluent), and other characters.

SOME CONCLUSIONS ON THE APPLICATION OF THE CARPOLOGICAL METHOD IN THE TAXONOMY OF THE FAMILY GESNERIACEAE

During the examination of carpological characters of the genera of the Gesneriaceae it appeared that the basic morphological structures of the fruits and seeds in the main agree with the accepted classification. However, the presence of certain discrepancies made us re-examine the main characters of the genera and the composition of the tribes, taking into account at the same time geographical connexions and cytological data. As a result of this re-examination we came to the conclusion that it was necessary to introduce a number of changes in the system.

In the subfamily Cyrtandroideae we separated the tribe Saintpaulieae, genera of which are distinguished from the genera of the tribe Ramondeae mainly by having a syncarpous gynoecium, late dorsal (and not septicidal) dehiscence of the capsule, flowers with two fertile stamens (and not 4 or 5) and other characters.

Apparently the basic number of chromosomes in *Saintpaulia* species is $x=15$ (and in *Ramonda* species $x=18$). In the same subfamily we describe a new tribe Rhynchotecheae, which contains genera with hemiparacarpous gynoecium and berry-like fruits. Then we re-establish the tribe Episcieae Endl. ($x=8, 9$), whose genera are characterised by paracarpous gynoecium.

The tribes Episcieae and Columneae we remove from the subfamily Cyrtandroideae and include them in the special subfamily Episcioideae.

The study of taxonomic subdivisions of the family Gesneriaceae and the analysis of the carpological characters of its representatives permits us to reach the following conclusions: 1) in one family there may be several basic types of fruits; 2) hemiparacarpous fruits are quite deservedly regarded as being a special type; 3) the type of hemiparacarpous berry-like capsule is very close to the type of hemiparacarpous berry and deserves to be recognised as a transitional type; 4) further study of the nature of syncarpy in the order Scrophulariales is essential for establishing the actual mode of development of paracarpy; 5) a study of the anatomy of seeds of representatives of the tribes and additional data on the presence of endosperm and so on are necessary.

When using the carpological method for taxonomic purposes one has first to establish what basic types of fruits are found in a given family. For this purpose it is essential to carry out a study of the structures of the gynoecium and the fruit, and in particular of placentation, while for the characteristic of the seeds we have to elucidate the presence of the endosperm, the position and size of the embryo, the position of the hilum and the raphe and the size of seeds, and also the types of structure of the seed coat. To separate subtypes and groups one has to characterise the method of dehiscence and the finer features of placentation (the shape of the placenta, the character of seed distribution on the placenta and so on); when describing the seeds, their shape, the character of their surface, the presence of appendages, colour, etc. should be considered in addition to the size.

DESCRIPTION OF NEW TAXA

Trib. Saintpaulieae Ivanina (subfam. Cyrtandroideae (Jack) Endl.), trib. n. (in Bot. Zhurn. 50: 31, 42 (1965)). Ovarium superum. Corolla tubo brevi et

limbo plano subbilabiato. Stamina fertilia 2. Gynoeceum syncarpium vel hemiparacarpium; placentae alte intrusae, subinflexae, marginibus ovuligeris. Capsula ovata vel oblonga; dehiscentia serotina, dorsalis; valvae non contortae. Semina parva, elliptica vel oblongo-elliptica, minute reticulata et tuberculata.

Typus: genus *Saintpaulia* Wendl.

Trib. Rhynchotecheae Ivanina (subfam. Cyrtandroideae (Jack) Endl.), trib. n. (in Bot. Zhurn. 50: 33, 42 (1965)). Ovarium superum. Corolla campanulata, limbo subbilabiato. Stamina fertilia 4 (interdum 5). Gynoecium hemiparacarpium; placentae alte intrusae, inflexae, marginibus fere undique ovuligeris. Fructus indehiscens, baccatus, ovatus, ellipsoideus vel subglobosus. Semina parva, elliptica vel subglobosa, foveolata vel reticulata.

Typus: genus *Rhynchotechum* Blume.

Trib. Rechsteinerieae Ivanina (subfam. Gesnerioideae (Dum.) Endl.), trib. n. (in Bot. Zhurn. 50: 39, 42 (1965)). Ovarium semiinferum (plerumque subsuperum). Corolla tubulosa vel campanulata. Stamina 4. Gynoecium hemiparacarpium; placentae intrusae, subrectae, in utraque facie ovuligerae. Capsula oblongo-ovata vel conica; dehiscentia dorsalis vel dorsali-septicida. Semina mediocria, rarius parva, oblongo-elliptica vel oblonga, apice appendiculata, longitudinaliter striatella.

Typus: genus *Rechsteineria* Regel.

Subfam. Episcioideae (Endl.) Ivanina, stat. n. (in Bot. Zhurn. 50: 37, 42 (1965)). Trib. Episcieae Endl. Gen. pl. 720 (1836–1840).

Typus: genus *Episcia* Mart.

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