A CONTRIBUTION TO THE TAXONOMY OF THE GENUS RUSCUS

P. F. YEO

(*University Botanic Garden, Cambridge*)

ABSTRACT

The genus *Ruscus* is divided into two new Series, *Ramosae* and *Simplices*. An account of the taxonomy of the *Simplices* is given: the group consists of four species, replacing each other geographically from the Caucasus to Madeira, and a putative hybrid. The effects of the new taxonomy on the results of previous morphological and chromosomal studies are indicated, and the importance of voucher specimens is emphasized. Attention is drawn to the demonstration by Motte that certain abnormalities arise from continuous variation of the inflorescence position from adaxial to abaxial. Similar abnormalities are reported in a putative natural hybrid between parents which differ in their inflorescence position (*R. colchicus* and *R. aculeatus*). It is suggested that *R. ponticus* (Series *Ramosae*) does not deserve specific rank. The chromosome number of *R. colchicus* ($2n=40$) is reported for the first time and preliminary indications of interspecific cross-fertility are given.

INTRODUCTION

This paper gives an account of the five taxa which can be recognized in that part of the genus *Ruscus* in which the stems are unbranched (Series *Simplices*), and includes remarks on the taxa with branched stems (Series *Ramosae*). The existence of these first five taxa was briefly indicated by Yeo (1966). The first suggestion that the existing taxonomy of the *Simplices* was inadequate resulted from the acquisition by the Cambridge Botanic Garden of a plant of *R. hypophyllum* L. which was conspicuously different in habit and colouring from another plant, supposedly of the same species, already present in the garden. When the flowers of these two forms were compared in the living state it was found that they showed striking differences. Thus the opportunity of observing these two plants in cultivation led to the recognition of a new species, *R. streptophyllus* Yeo, endemic to Madeira. Meanwhile the notes and determinations recently made on the specimens of this genus in the Kew Herbarium provided a clue to the recognition of a taxon which turned out to be the largely neglected *R. microglossus* Bertol. Finally, owing to the poor representation in British herbaria of the group from E Turkey and the Caucasus, a loan was requested from the Komarov Herbarium, Leningrad. When these specimens were received, it immediately became apparent that the Caucasian material of the genus represented another species, *R. colchicus* Yeo.

R. microglossus is so far known only in the female state and it is probably a hybrid between *R. hypoglossum* L. (which has a large foliaceous inflorescence-bract) and *R. hypophyllum* (which has a very small, often papery, inflorescence-bract). The remaining four taxa replace each other geographically, from East to West, in the following order: *R. colchicus*, *R. hypoglossum*, *R. hypophyllum*, *R. streptophyllus* (fig. 1). They differ in a number of qualitative, as well as quantitative, characters, and it is difficult to visualize their origin by diversification of an initially homogeneous population through geographical fragmentation. For this reason they are not here treated as subspecies. Possibly they evolved radially from a single common ancestor, now extinct, and migrated radially to their present habitats.

New and Old Taxonomy on Series Simplices

In the very earliest stages of this study it was noted that there were discrepancies in the literature as to the position (adaxial or abaxial) of the inflorescence. For example, Rehder (1940, p. 893) and Hegi (1939, p. 330) described the genus *Ruscus* as having the inflorescences on the upper surfaces of the cladodes, while Bean (1951, p. 255) and Maire (1958, p. 213) said that in *R. hypophyllum* the inflorescences are on the lower surfaces of the cladodes. Arber (1924), however, reported variation in this respect within both *R. hypophyllum* and *R. hypoglossum*. In fact, the inflorescence position is variable in *R. hypophyllum* and *R. microglossus*, and constantly adaxial in *R. hypoglossum*.

Since the time of Linnaeus there has been almost universal recognition of two taxa (corresponding to *R. hypoglossum* and *R. hypophyllum*), though there has been disagreement as to the rank which they merit. However, it was argued by Motte (1939 a, b, and c) in the course of interesting morphological studies, that it was not possible to recognize even varieties within this group, though he conceded that "the forms *hypoglossum*, *hypophyllum* and perhaps *microglossus*" could be distinguished as fixed points in a range of variation. Motte proposed that the single species which he considered worthy of acceptance should be called *R. alexandrinus*, taking into account pre-Linnaean and, indeed, classical usage, but ignoring the International Code of Botanical Nomenclature, under which this name is illegitimate. I consider that Motte's drawings (1939 c) which purport to show continuous variation in size of inflorescence-bract, in fact show discontinuities corresponding to the taxa which I recognize, and they are accordingly cited later under the appropriate taxa.

The mention of *R. microglossus* quoted above appeared without authority (Motte 1939 c) and is the only appearance of this name in Motte's publications. This taxon has been almost completely ignored by authors dealing with the genus. It is, however, very frequent in cultivation, at least in botanical gardens on the continent of Europe, and it is clear that it has been used in morphological and anatomical studies which have been carried out on this vegetatively and florally remarkable genus. Thus Danek's paper (1914) contains two illustrations which are said to represent *R. hypoglossum*, though they evidently show *R. microglossus*. Arber's report (1924) of finding abaxial as well as adaxial inflorescences in *R. hypoglossum* evidently refers to *R. microglossus*, which is illustrated under the former name in her figs. 21A and 24; her fig. 20E shows a cladode of true *R. hypoglossum* drawn from a herbarium specimen (BM), and referred to as "probably var. *macroglossa*" (sic; no authority cited). Motte's *R. hypoglossum* type II (1939 b) is evidently *R. microglossus*, while, as explained later, the published chromosome count for *R. hypoglossum* (Martinoli, 1951) was probably made on material of *R. microglossus*. We thus have here an example which lends practical support to the resolution of the 10th International Botanical Congress regarding the desirability of preserving herbarium material of plants used in research of whatever kind.

THE NATURE OF THE CLADODE

This paper is not primarily concerned with interpretative morphology, but it may be helpful to summarize the views expressed in the more recent publications on the nature of the cladode of *Ruscus*. Arber (1924) interpreted the cladode as a prophyll (bract) to which is adnate the distal part of the axis that bears it; she considered that the predominance of the prophyll is such that no trace of axial anatomy remains in the lower part of the prophyll (cladode)—it only shows itself in the potentiality for producing axial appendages. This view was considered by Arber to make it slightly easier to understand how inflorescences can arise on either side of the cladode, instead of, as expected, on the lower, axillant-leaf, side. Wenck (1935) investigated the earliest stages of shoot development, and concluded, unlike Arber, that the cladode is a stem-structure, and does not include a prophyll. Motte's conclusions are the same, though partly based on quite different evidence, but unfortunately he did not refer to Arber's and Wenck's work; he states that the vascular system of the cladode is cauline in nature, both below and above the inflorescence, as well as in sterile cladodes and in the cladode-like and frequently pluri-alate structure which terminates the stem (Motte, 1939 a). In his second paper Motte (1939 b) gave sets of drawings showing the different possible positions of the inflorescence in the different clones available to him. (The legends for the illustrations are transposed, as they are in his third paper, 1939 c). The fullest series was obtained from *R. hypophyllum* (Motte's fig. III, the caption for which is attached to fig. II); when there is one inflorescence it can be adaxial (supra-paginal), abaxial (infra-paginal), marginal or submarginal. A marginal inflorescence is in fact centrally placed but facing laterally, the margin of the cladode being notched to the mid-line to accommodate it. A submarginal inflorescence faces obliquely up or down, and is deflected away from the mid-line of the cladode, being accommodated in or associated with a shallow notch (fig. 2). Thus the inflorescence may be thought of as occupying any position in relation to the plane of the cladode, the complete series of stages representing a reversal of position from adaxial to abaxial, and back again, through 360° of arc. Where the inflorescence does not face at right angles to the plane of the cladode, its presence is associated with the suppression of the lamina of the cladode so as to form a notch, and, in this particular clone, the marginal inflorescences are associated with wings distal to them and at right angles to the main lamina of the cladode, resembling the wings present on the terminal cladode. A similar series of displacements, notches and wings can occur when two inflorescences are present on the same cladode. The two inflorescences are normally served by the same stele, and the adaxial one is distal to the abaxial; when the two inflorescences are submarginal the stele is deflected at the appropriate levels to serve them. An example which does not fit into this series is a cladode with two submarginal inflorescences, each served by a separate stele from the base of the cladode. Motte's "*R. hypoglossum* type II" is *R. microglossus*, which does not have winged terminal cladodes, nor are wings formed distal to the inflorescences when these are marginal or submarginal. There is, however, a series of inflorescence positions as in *R. hypophyllum*, and also a type of cladode with twin central inflorescences set in a deep apical slit. Motte's "*R. hypoglossum* type I" is a form of *R. hypo-*

phyllum with constantly adaxial inflorescences; its lack of abnormalities of the kind found in the other two clones supports Motte's theory. All these observations are held by Motte to indicate a cauline nature for the cladode. An observation of my own which also supports this idea of a reversal series can be found on p. 262.

Two abnormalities which I have noticed in *R. hypophyllum* may be worth recording. In one, a cladode produces a miniature cladode in place of the inflorescence; this is about the size of a large inflorescence-bract of *R. hypoglossum* but it is tapered at the base (fig. 7H). The other abnormality is a dual one; it consists of a cladode which has a submarginal inflorescence near the base with a deflected vascular strand, and in addition has a median vascular strand which bears near its base a scale, in the axil of which is a normal, fertile cladode (fig. 7J). A similar subsidiary cladode is shown by Maire (1958, p. 212), though it cannot be seen whether it is fertile.

Development and Germination

The vegetative parts of the aerial shoots of *Ruscus* are entirely pre-formed in the bud; by the time the shoot emerges from its sheathing scale-leaves all the cladodes are formed and all the inflorescence-bracts are present. The shoots, therefore, are of limited growth. The inflorescences, however, are present only as buds at this stage, and their development begins later and continues until the death of the shoot, probably about two years later. In most species, the plumule of the seedling bears a small number of sheathing scale-leaves and terminates in a reduced shoot (also formed before emergence from its sheath, and of limited growth) such as is produced by a weak axis of a mature plant. The growth of the seedling is continued by the development of shoots in the axils of these sheathing scale-leaves; the lateral shoots themselves have scale-leaves and produce aerial shoots. The portions of the primary and lateral shoots which bear scale-leaves represent the beginning of the rhizome system of the plant. There is thus, as previously shown by Dymes (1921) and Arber (1924), no juvenile stage in which photosynthesis is carried out by true leaves. In *R. colchicus* and *R. hypophyllum* the primary photosynthetic shoot consists of a stem and two cladodes, the lower being subtended by a cauline scale-leaf whereas, as in all shoots of *Ruscus*, the terminal is not (fig. 4D, E). In *R. aculeatus* the cladodes of the plumule are more numerous than in the Series *Simplices*; the seedlings may have from six to about thirteen cladodes, the first six or seven forming two whorls. The seedlings of *R. streptophyllus* are considerably different, producing at intervals one or more normal leaves at the apex of the plumule (fig. 4F, G); a one-leaved seedling is almost identical with that of *Semele androgyna* (L.) Kunth (see Arber, 1924, fig. 47A), while a two-leaved one is similar to older *Semele* seedlings which I have found in the Cambridge Botanic Garden, which have several normal leaves. In *R. streptophyllus* the transition from sheathing scale-leaves to true leaves is more abrupt than in *Semele*, the tips of the sheaths being merely more flattened than usual, instead of being produced into a distinct petiole-like structure.

Germination seems to take place in late summer, autumn and winter, after an interval of from two to twelve months from the time of sowing. According to Dymes (1921) seedlings of *R. aculeatus* do not produce their aerial shoots until the year following the emergence of the plumule and radicle. In my experience in the years 1966–7 this pause in the growth of the plumule is sometimes omitted in this species, emergence and expansion being completed by some individuals without delay. The two types of behaviour have also been found in the Series *Simplices* in interspecific hybrids. After the expansion of the plumule the axillary shoots may emerge at once, or only after a considerable delay, individual variation occurring here also.

The Flower

The unisexual flowers are more or less horizontal in posture or pendent. Male flowers and unfertilized female flowers last nearly a week. I have not seen half-opened flowers; opening probably takes place quickly at night or in the early morning. The perianth segments converge somewhat in ageing flowers. There appears to be no nectar and no scent. The pollen is slightly sticky but can be made to fall by disturbance of the flower. As far as I am aware, nothing has been reported about the pollination mechanism. Bushes of *R. aculeatus* are haunted by numerous small *Diptera*, which perhaps occasionally choose the flowers as alighting places. The minutely papillose surfaces of the perianth segments and staminal column, the similarity of the column in flowers of both sexes, and the glutinosity of the stigmatic secretion (probably sufficient to trap a small fly) are presumably related to the pollination mechanism. The flowers open successively, one at a time, so that attempts to use the number of flowers in the inflorescence for taxonomic purposes are futile, and drawings showing several flowers open simultaneously are misleading (fertilized female flowers, however, wither slowly and two or three may appear moderately fresh simultaneously).

Collecting Ruscus for the Herbarium

The failure in the past to recognize the true taxonomic situation in a genus so important botanically as *Ruscus* can be attributed partly to the inadequacy of herbarium material. When collecting *Ruscus*, attention should be paid to representing, if possible, the following features: stems sufficiently young to show the shape of the cauline scale-leaves and inflorescence-bracts; flowers of both sexes, and their distribution (some species are monoecious, some dioecious); markings and shape of staminal column (preferably noted down from the fresh specimens); variation, if any, in position of inflorescence. (The production of fruit can sometimes be inferred, as the perianth of fertilized female flowers becomes horny, and may persist even after the fruit has dropped.)

Hybridization

A number of interspecific pollinations have been carried out. In all crosses between species of Series *Simplices*, at least a proportion of pollinated flowers have produced full-sized fruits; some of the fruits have ripened and seeds of five hybrids have germinated. In crosses between a member of the *Ramosae* and members of the *Simplices* fruit has developed well (see p. 262, under *R. aculeatus*). The supposed hybrid *R. microglossus* is at least partly fertile when pollinated with *R. hypophyllum*. Thus there may be no barriers of sterility to interbreeding between the species.

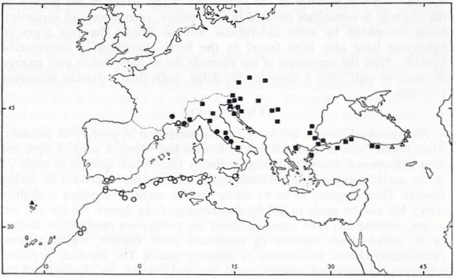

FIG. 1. Distribution of *Ruscus*, Series Simplices, based on specimens seen by the author. △ *R. colchicus;* ■ *R. hypoglossum;* ● *R. microglossus;* ○ *R. hypophyllum;* ▲ *R. streptophyllus.*

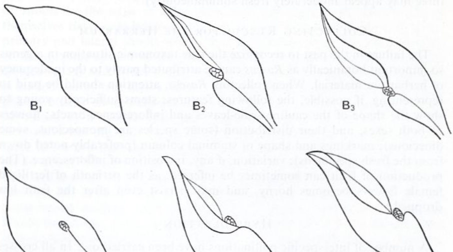

FIG. 2. *Ruscus hypophyllum.* Cladodes in which the inflorescence position is intermediate between adaxial and abaxial. A, adaxial surface and B, abaxial surfaces of the same cladodes. A_1, B_1, adaxial, submarginal inflorescence, deflected towards the right. A_2, B_2, abaxial, submarginal inflorescence, deflected towards the right. A_3, B_3, marginal inflorescence, deflected towards the right. (After Motte, 1939b.)

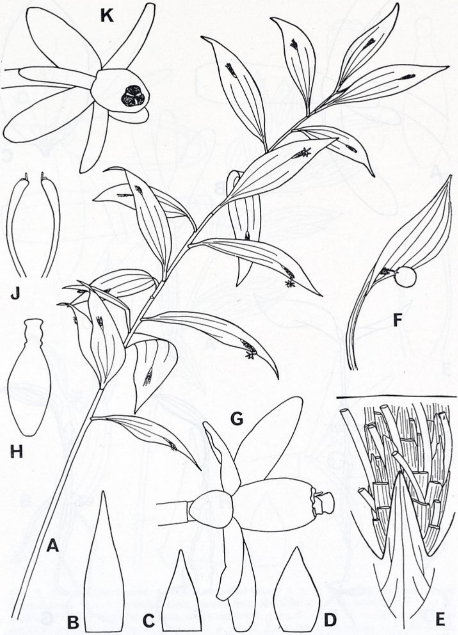

FIG. 3. *Ruscus colchicus*. A, complete aerial shoot × ⅜. B, C, and D, cauline scale-leaves × 2. E, inflorescence-bract and part of an old inflorescence in its axil × 6. F, fruiting cladode × ½. G, female flower, side view, showing articulation with pedicel and staminodial anthers. H, ovary × 12. J, section of staminal column, ovary removed × 12. K, male flower after removal of pollen, ¾—front view × 12. D was drawn from a herbarium specimen (*Görz*, Iter Anatolicum 1931, no. 770, LE); the others from one male and one female plant supplied by Batum Botanic Garden and drawn from life.

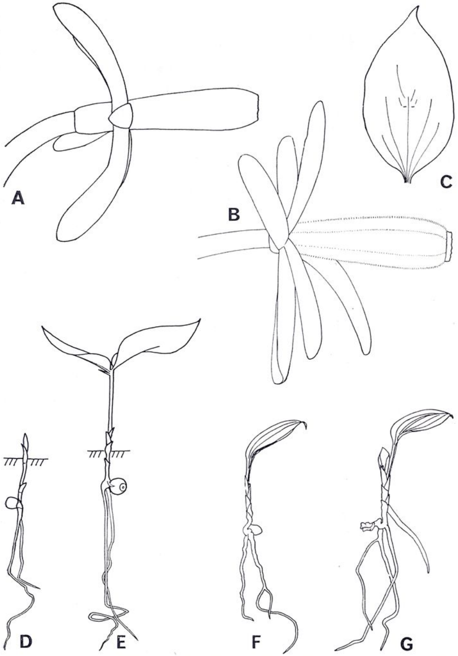

FIG. 4. A–E, *Ruscus colchicus*. A, B, male flowers with exceptionally long column; in B note the minute hairs forming six rows on the staminal column × 12. C, cladode of broader outline than those shown in Fig. 3. × ½. D, seedling just after penetrating surface × ½. E, seedling, not more than eight weeks after penetrating surface × ½. F–G, *R. streptophyllus*. F, seedling first seen on 31 x 1966, drawn 8 xii 1966 (its leaf was fully expanded by 30 xi) × ½. G, seedling first seen on 25 viii 1966, drawn on 8 xii 1966 (its first leaf was nearly fully expanded by 29 ix, its second shown partly expanded, margins still involute) × ½. A–C living material from Sukhum Botanic Garden; D–E, from Batum Botanic Garden; F–G from Cambridge Botanic Garden.

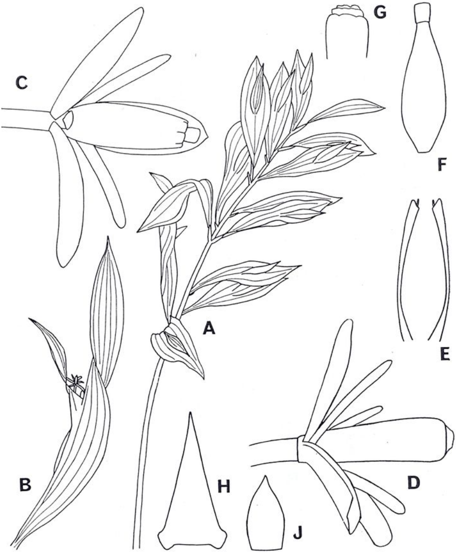

FIG. 5. *Ruscus hypoglossum*. A, complete aerial shoot × ⅓. B, flowering cladode, viewed from the side × 1. C, female flower, viewed from the side × 12. D, male flower × 12. E, section of female staminal column, ovary removed × 12. F, ovary × 12. G, apex of male staminal column at earlier stage than D × 12. H, J, cauline scale-leaves × 2. All drawn from life. A–F from plant from Messrs. Hillier & Sons, Winchester; G, H, from plant collected in Hungary by Dr. J. Domokos.

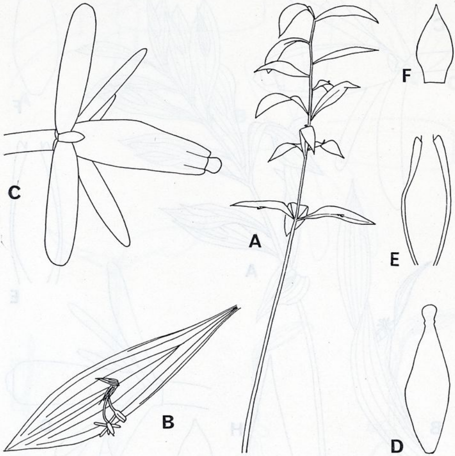

FIG. 6. *Ruscus microglossus*, female. A, complete aerial shoot × ¼. B, flowering cladode surface view × 1. C, flower, viewed from the side × 12. D, ovary × 12. E, section of staminal column, ovary removed × 12. F, cauline scale-leaf × 2. Drawn from living plant from Miss M. S. Campbell.

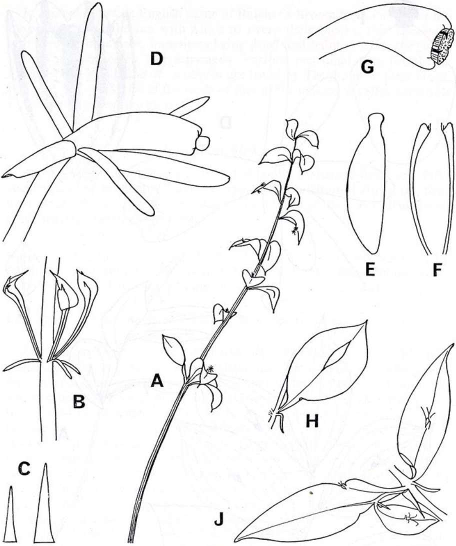

FIG. 7. *Ruscus hypophyllum*. A, complete aerial shoot × $\frac{1}{6}$. B, lowest node of a young shoot with three cladodes not yet fully expanded each of which bears two inflorescences × $\frac{1}{2}$. C cauline scale-leaves; the larger is from the node shown in B, the smaller from the next node above that × 1. D, female flower, viewed from the side × 12. E, ovary × 12. F, section of staminal column, ovary removed × 12. G, staminal column of male flower × 12. H, cladode in which inflorescence is replaced by a cladode-like structure × $\frac{1}{2}$. J, cladode with its own (submarginal) inflorescence and bearing, in addition, a "cauline" scale-leaf with axillary fertile cladode × $\frac{3}{4}$. A–H, plant from Miss N. Lindsay, A–G drawn from life; J from herbarium specimen, Algiers (*Durando*, Fl. Atl. Exs., 1856, CGE).

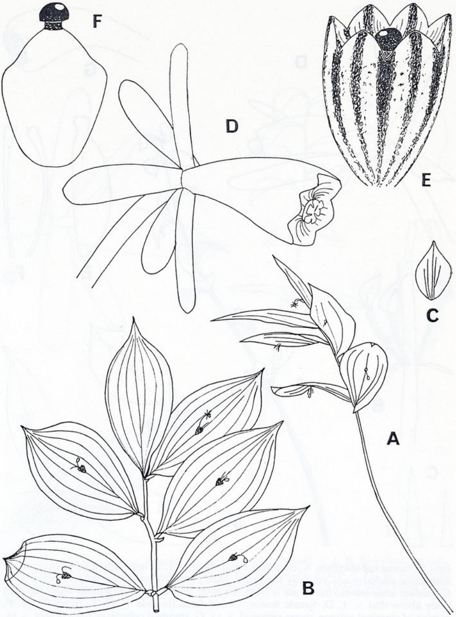

FIG. 8. *Ruscus streptophyllus*. A, complete aerial shoot in natural posture × ¼. B, aerial shoot seen from below, lower stem omitted × ½. C, cauline scale-leaf × 1·5 D, male flower, ¾-front view × 12. E, staminal column of female flower, shaded to show distribution of violet colouring × 12. F, ovary, shaded to show extent of blackish violet colouring × 12. Drawn from old Cambridge Botanic Garden plant.

USES

R. aculeatus gets its English name of Butcher's Broom from its former use by butchers as a broom with which to sweep their blocks; this species is also used for ornament, sometimes being dried and painted, while the young shoots may be eaten like asparagus. Various medicinal uses for the *R. hypophyllum* group and *R. aculeatus* are listed by Täckholm & Drar (1954, pp. 311, 313, 314). Use of the seeds of *Ruscus* for making a coffee-substitute is recorded by Hegi (1939, p. 334).

TAXONOMY

Ruscus is traditionally placed in Subfamily Asparagoideae (or Tribe Asparageae) of the family Liliaceae. However, Hutchinson (1959, pp. 619–621) places *Ruscus*, *Semele* and *Danaë* in a family of their own, Ruscaceae, while leaving *Asparagus* in Liliaceae.

Ruscus L., Sp. Pl. 1041 (1753); Kunth, Enum. 5: 273 (1850); Schneid., Ill. Handb. Laubholzkunde 2: 861 (1912); Krause in Engler, Pflanzenfam., ed. 2, 15a: 366 (1930); Hutchinson, Fam. Fl. Pl., ed. 2, 2: 619 (1959).

Lectotype: *R. aculeatus* L. (see Stearn, 1959, pp. 105, 140).

Rhizomatous shrubs or perennial herbs. *Rhizomes* stout, knotty, with short internodes. *Leaves* reduced, forming sheathing rhizome-scales, cauline scales, inflorescence-bracts and flower-bracts. *Stems* simple or branched, branches whorled below, opposite or alternate above, stems and branches terminated by a leaf-like cladode. *Cauline scales* membranous, becoming scarious, bearing in their axils leaf-like cladodes, which may be sterile or fertile; cladodes often whorled below, opposite or alternate above, coriaceous or horny, evergreen. *Inflorescence-bract* membranous or herbaceous, normally near the middle of the adaxial or abaxial surface of the cladode, occasionally in a notch in the edge of the cladode, occasionally two present on one cladode. *Inflorescence* a raceme with very short internodes and minute, sheathing, scarious bracts. *Flowers* produced one at a time, jointed to the pedicel, dioecious or monoecious (exceptionally andromonoecious). *Perianth segments* 6, pale green, often slightly peppered with dark violet, the outer 3 broader than the inner 3, margins recurved, inner more or less crumpled a short distance from the apex (this is caused by pressure from the anthers in the young flower-bud); inner surfaces of all minutely papillose. *Stamen-filaments* united into a fleshy, hollow column; anthers 3, sessile on or sunk into the apex of the column, contiguous, reduced to a collar of papery membranes in the female flower; column dark violet, sometimes faintly to strongly striped with pale violet or white, minutely papillose. *Ovary* 1–2-locular, filling the cavity of the column in female flowers, vestigial in male flowers; stigma globose or pileiform, glutinous, more or less violet-tinted; ovules anatropous to hemianatropous. *Fruit* a scarlet berry with thin, juicy flesh and 1–4 hard, endospermous seeds; seeds spherical or segmental, about 4–10 mm wide.

Series RAMOSAE P. F. Yeo, **Ser. Nov.** Holotype: *Ruscus aculeatus* L.

Caules supraterrestres ramosi; cladodia apice aculeato longitudinem 3 cm non attingentia. *Inflorescentiae* adaxiales. *Flores* plerumque dioici. *Plumula* cladodiis 6 vel pluribus.

Aerial stems branched, cladodes less than 3 cm long, spine-tipped. Inflorescences adaxial. Flowers normally dioecious. Plumule with 6 or more cladodes. (See p. 261).

Series SIMPLICES P. F. Yeo, **Ser. Nov.** Holotype: *Ruscus hypoglossum* L.

Caules supraterrestres simplices; cladodia apice inermi plerumque 3 cm vel longiora. *Inflorescentiae* adaxiales vel abaxiales. *Flores* dioici vel monoici. *Plumula* cladodiis 0–2.

Aerial stems unbranched, cladodes normally more than 3 cm long, muticous. Inflorescence adaxial or abaxial. Flowers dioecious or monoecious. Plumule with true leaves or with two cladodes.

A REVISION OF SERIES SIMPLICES

1. Inflorescence-bracts 3·5–13 mm wide, 5–15-veined 2
+ Inflorescence-bracts not more than 3 mm wide, with 4 veins or fewer 3
2. Inflorescences constantly adaxial; inflorescence-bracts 11 mm or more long, with 5–11 (–15) veins . . . . . 2 *R. hypoglossum*
+ Inflorescences abaxial (only an occasional one adaxial); inflorescence-bracts not more than 8 mm long, with 3–6 veins 1 *R. colchicus*
3. Inflorescences adaxial but facing down owing to resupination of cladodes; staminal column turbinate or cup-shaped, striped, 6-lobed; stigma pileiform . . . . . 5 *R. streptophyllus*
+ Inflorescences variable in position or normally abaxial; cladodes not resupinate; staminal column not turbinate nor cup-shaped, not distinctly striped nor lobed; stigma approximately spherical 4
4. Inflorescences abaxial (only an occasional one adaxial); inflorescence-bracts with the edges at the base adnate to the cladode; pedicels jointed 0·5–1 mm below the perianth; female staminal column not more than 2 mm long . . . . . 1 *R. colchicus*
+ Inflorescences variable in position (though sometimes constant throughout a shoot, or even a whole plant); inflorescence-bracts free; pedicels jointed to the base of the perianth; female staminal column not less than 2·75 mm long 5
5. Stems erect; cladodes dark green, usually ovate, acuminate; inflorescence-bracts green or scarious, 1–4-veined; flowers monoecious (? sometimes dioeciou); staminal column clavate or almost cylindrical . . . . 4 *R. hypophyllum*
+ Stems oblique, arching above; cladodes usually pale green, usually obovate-lanceolate or oblanceolate; inflorescence-bracts green, 3–4-veined; staminal column narrowly ovoid, somewhat contracted near the apex; flowers female only . . . . . 3 *R. microglossus*

1. **R. colchicus** P. F. Yeo in Feddes Rep. 73: 18 (1966). Figs. 3, 4A–E.

Type. USSR: Black Sea Area, Sochi Region, Golovinskaya Dacha, *Buxus* wood on right bank of River Bzych, *N. A. Bryzzhev*, 27 v 1930, State sci.-

invest. inst. forestry farm Cauc. exped., no. 5 (planta feminina) (LE, holotype!).
Ic.: Chernyakovska in Komarov, Fl. URSS 4: 445, tab. 26, fig. 4 (1935), as *R. hypophyllum*.

Stems to 60 cm tall, erect or oblique, sometimes arching above, with up to c. 28 cladodes, internodes $\frac{1}{8}$–$\frac{4}{5}$ as long as cladodes. *Cauline scale-leaves* 6·5–12 × 3·5–6 mm, broadly to narrowly ovate or deltoid, often $\frac{1}{2}$ as broad as long or more, sometimes auricled at base, 3–7-veined. *Cladodes* more or less petiolate, 4–13·5 × 2·5–5·3 cm, broadly to narrowly obovate, or elliptic to narrowly elliptic, occasionally ovate, base tapered gradually or, in ovate cladodes, abruptly, apex subacute to acute, sometimes caudate, nerves usually prominent beneath, surfaces somewhat glossy. *Inflorescences* abaxial or rarely an occasional one adaxial. *Inflorescence-bract* 4·5–8 × 2–3·5 mm, deltoid, ovate, ovate-lanceolate or elliptic, herbaceous, 3–6-veined, the edges at the base adnate to the cladode for $\frac{1}{4}$ to more than $\frac{1}{2}$ their length, the bases of the free margins sometimes forming ridges excurrent from the junction with the cladode. *Pedicels* 2–8 mm long. *Flowers* dioecious, nodding, with a receptacular zone 0·5–1 mm long between the joint with the pedicel and the base of the perianth segments. *Outer perianth segments* 2·5–4 × 1–1·75 mm, spreading or slightly recurved, oblong, flat or with recurved margins; inner perianth segments 1·5–3·5 × c. 0·5–1·25 mm, widely divergent to slightly recurved, sometimes violet-tinged, linear, margins recurved or revolute. *Staminal column* in male flowers 0·5–3·5 mm long, up to 1·7 mm thick, turbinate, cylindrical or ovoid, in female flowers 1·25–2 mm long, c. 1·5 mm thick, ovoid, dark violet, sometimes with paler striations, especially towards the base, unequally six-sided, the obtuse angles each bearing a band of minute and sometimes sparse hairs, which are sometimes white (the hairs are distinctly longer than the papillae mentioned in the generic description). *Anthers* violet or possibly sometimes white, pollen cream-coloured or bluish. *Anther-walls* of female flowers white, prominent. *Stigma* more or less spherical, striated with violet, in dried specimens sometimes depressed and overtopped by the staminodial anther-walls; ovary unilocular; ovule 1 (perhaps sometimes 2, superposed). *Berry* spherical, 10–15 mm in diameter. $2n = 40$ (Morisset, unpublished; seedling of 380B–65 Batum, specimen of parent dated 23 × 1965 in CGG).

Distribution: coastal regions of the eastern Black Sea, from Sochi (*Bryzzhev* 5, 1930, LE) in Western Transcaucasia to Elehu, near Tirebolu (39°E.) (*Handel-Mazzetti* 832, 1907, WU) in NE Turkey (CGE, E, K, LE, WU).

This species has been confused with *R. hypophyllum** but differs in its broader cauline scale-leaves, constantly abaxial inflorescences (I have seen two adaxial inflorescences in about 13 herbarium sheets and over 30 living shoots), in its green, partially adnate inflorescence-bract with up to 6 veins, the receptacular zone below the flower, the dioecious flowers and short female staminal column. It evidently replaces *R. hypoglossum* in E Turkey but the two species are separated (on present knowledge) by a gap of 100 miles extending from Elehu in the East to near Ünye in the West. *R. colchicus*

* *R. hypophyllum* sensu Chernyakovska in Komarov, Fl. URSS 4: 444 (1935) quoad pl. USSR et sensu Boiss., Fl. Or. 5: 341 (1884) quoad pl. Transcauc.

is probably only found in the maritime zone of its area. There is a fragment at Cambridge (CGE) marked "Erzeroum, *Calvert* 830" but, as explained by Davis (1958), Calvert's material was collected between Erzurum and Trabzon. There is a specimen in Kew (K), collected by Olguin in "Kurdistan" (before 1867); according to Davis (l.c.), this should have come from Persia, which, however, seems unlikely in this case.

Thanks to the kindness of the Directors of the Botanic Gardens of Sukhum and Batum this species is now in cultivation at Cambridge. From Sukhum I had three roots, representing one, or possibly two, male clones. From Batum I had one female and two male clones, both of which were in flower when sent. The female plant had several young fruits, of which eleven were collected and sown in March, 1966; ten seeds germinated but one seedling died. One of the survivors was used for the chromosome count cited above; it is hoped to collect herbarium material from it when mature but meanwhile the cited specimen of the female parent must serve as a voucher. As in other species of *Ruscus* (Martinoli, 1951) the caryotype shows extreme variation in chromosome size.

I have found in cultivation that unfertilized fruits often develop until they are about 3 mm long, and then turn red and drop.

As far as I know the plants grown at Cambridge represent the first introduction of this species into cultivation in the British Isles. Nothing is yet known of its hardiness here.

2. R. hypoglossum L., Sp. Pl. 1041 (1753) et L., Sp. Pl. ed. 2, 2: 1474 (1763) descr. emend. Fig. 5.

Type in herb. Hort. Cliff. (BM, lectotype!).

Syn.: *R. alexandrinus* Gars., Fig. Pl. Anim. Med. t. 503 (1764), fide Thellung (1908), nom. illegit.
R. humilis Salisb., Prodr. 255 (1796), nom. illegit. pro *R. hypoglosso*.
R. troadensis E. D. Clarke, Travels 2 (1): 146 (1812). Type: Mount Gargarus, district of Troy. Source of the Simois. 11 iii 1801 (BM, lectotype!).
R. hypophyllum L. var. *hypoglossum* (L.) Baker in Journ. Linn. Soc. London (Bot.) 14: 630 (1875).
R. alexandrinus Motte in Bull. Soc. Bot. France 86: 162 (1939), pro parte, nom. illegit. pro *R. hypophyllo* et *R. hypoglosso*.
R. hypophyllum L. subsp. *hypoglossum* (L.) Domin, Pl. Čechosl. Enum. 20 (1935); in Preslia 13–15: 20 (1936).
R. hypoglossum L. var. *laticladodia* Yaltirik in Notes R.B.G. Edinb. 28: 16 (1967). Type: Turkey, Prov. Istanbul: Beykoz near Elmali, 30 iv 1893, *Aznavour* (G).

Ic.: Sibth. & Smith, Fl. Graeca 10: t. 955 (1840); Reichenb., Ic. Fl. Germ. 10: t. 437, fig. 969 (1848); Kerner, Pflanzenleben 1: 307 (1887) (=Kerner & Oliver, Nat. Hist. Pl. 1: 333, 1894); Hegi, Ill. Fl. Mitteleur. 2: 266, fig. 378 (1909); Motte, Bull. Soc. Bot. France 86: 159, fig. I, 1–9 (legend on p. 158) (1939).

Stems to c. 40 cm tall, oblique, sometimes arching above, with up to c. 22 cladodes, internodes not more than $\frac{1}{2}(-\frac{3}{4})$ times as long as cladodes. *Cauline scale-leaves* 4–12 × 2·25–6 mm, ovate or triangular-ovate, or sometimes narrowly deltoid on very vigorous shoots, $1\frac{1}{2}$–2(–4) times as long as wide, sometimes auricled at base, 3–5-veined. *Cladodes* usually not petiolate, channelled and twisted at base (except when whorled) so that the shoot is more or less secund, 3–10(–11) × 1–3·3 (–5·2) cm, usually obovate to obovate-lanceolate, sometimes (chiefly at lower nodes) ovate or broadly ovate, gradually tapered to the base, apex more or less acuminate, with an acute or subacute point, surfaces matt. *Inflorescences* adaxial. *Inflorescence-bract* 11·5–33 × 3·5–13 mm, ovate or lanceolate, herbaceous, 5–11(–15)-veined, the edges at the base adnate to the cladode for a distance of 1·5 to 4 mm. *Pedicels* 5–8 mm long. *Flowers* dioecious, horizontal or slightly nodding, jointed to the pedicel at the base of the perianth segments. *Perianth segments* darker green than in other species; outer 3–4 × 1–1·75 mm, widely divergent or spreading, margins recurved; inner 1·5–3 × c. 0·5 mm (without flattening), widely divergent, violet-tinged, linear, margins revolute. *Staminal column* in male flowers 3–3·5 × 1 mm, subcylindrical, slightly tapered towards the base from near the apex, in female flowers 2·5 × c. 1·25 mm, narrowly ovoid, tapered towards the apex, dark violet, with six obscure whitish veins or with faint greenish striations, apex rounded, very obscurely 6-lobed, anthers violet. *Anther-walls* of female flowers white. *Stigma* spherical, violet; ovary unilocular; ovules 2, superposed. *Berry* spherical to ovoid, 8–13 mm long.

Distribution: Italy, Danube Region, N Turkey, Crimea (*fide* Flora URSS).

ITALY. From near Salerno (*Lacaita* 240/08, BM) to Ceriana near San Remo, Liguria (*Bicknell*, 1895, E) and Desio, Lombardy (*anon.*, 1834, MPU).
AUSTRIA. Wienerwald, Schöpfl (*Zehetbauer*, 1958, W) and naturalized near Vienna (♀) (*Korb*, 1932, W).
CZECHOSLOVAKIA. St. Georgen near Bratislava (formerly Pressburg) (CGE, E, K, MPU, W, WU), Lučenec (formerly Losoncz) (*Kržisch*, 1859, WU).
HUNGARY. Near Pécs (*Kárpáti*, 1953, W).
RUMANIA. Oravitza, Banat (*Halácsy*, W).
YUGOSLAVIA. Frequent in the North-West from I. of Arbe (or Rab) (*Morton*, 1913, WU) northwards; Suva Planina (*Ilic*, 1889, WU) and Versecz (*Wagner* 3088, WU) in the East.
GREECE. Athos Peninsula (BM, K, W).
BULGARIA. E Stara Planina Mts. (*Vihodzevssky* cent. IV, 333, W); Strandža Planina (*Wiśniewski & Sliwinska*, 1927, K).
TURKEY. Istranca Dağ (*Kayacik* 77, E), near Istanbul (BM, E), and from Mysia (Mount Ida, *Sintenis* 403, BM, K, LE) to eastern Paphlagonia (between Ünye and Niksar, *Furse* 4163, K).

Reports of the occurrence of this species in France apparently refer to *R. microglossus* and *R. hypophyllum*.

This dioecious species is at once distinguishable by its large green inflorescence-bracts borne always on the adaxial surface of the cladode. In spite of this, faulty descriptions and erroneous distributions are frequently given. In the original description in Species Plantarum (1753), Linnaeus wrote "Ruscus foliis subtus floriferis sub foliolo" (*Ruscus* with the leaves flowering beneath, under a leaflet); that this was an error is shown by the diagnosis in Linnaeus (1737, p. 466) where "supine" appears in place of "subtus" (its opposite, used in the diagnosis of *R. hypophyllum*, is "prone"), as well as by the fact of its being corrected in the second edition of Species Plantarum. The mistake continued to be repeated, however, long after the correction (cf. Boissier, 1882–4, p. 341, Rouy, 1910, p. 452). Boissier (l.c., p. 758) made another error by citing in his addenda further material of *R. hypoglossum* under the name *R. hypophyllum*. Another complication is that some authors circumscribe *R. hypoglossum* in such a way as to include *R. microglossus*, in which the inflorescence can be adaxial or abaxial. Motte (1939 c) states that the inflorescence position is variable in material represented by his fig. 1, cladodes 3, 6 and 13–16. Cladodes 3 and 6 are clearly *R. hypoglossum*, and this led me to make a new search of the available herbarium material in order to look for abaxial inflorescences. I estimate that the inflorescence position was examined in at least three hundred cladodes, but the search was negative, although several times I at first thought I had found an abaxial one. Since then I have examined the actual specimens used by Motte and found that all the inflorescences present on these two sheets are adaxial, so that Motte's statement was evidently an error.

I have at present in cultivation a female clone, received from Messrs. Hillier and Sons, of Winchester, a different, slenderer, female clone from the Royal Botanic Gardens, Kew, and a similar looking female clone from the Royal Botanic Garden, Edinburgh. In the first two I find that abortion of many flowers takes place just before they are due to open, the plants being grown in a cool greenhouse. A female plant collected by Rear-Admiral Furse (no. 9186) from the same area as his no. 4163, and a male collected in Hungary by Dr. J. Domokos, have also been received recently. *R. hypoglossum* is hardy in the British Isles.

3. R. microglossus Bertol., Fl. Ital. 10: 401 (1854) ("microglossum"). Fig. 6.

Syntypes (non vidi): Roma, in villa Pansili, *Mauri*; ex sepibus collium circa Neapolim, *Tenore*. (Bertoloni's herbarium was at Bologna—BOLO—but material of *Ruscus* was destroyed during the war).

Syn.: *R. hypoglossum* L. var. *angustifolius* Kunth, Enum. 5: 275 (1850) (based on *R. hypoglossum* β, Poll., Fl. Veron. 3: 195 (1824) and *R. hypoglossum* β, Bertol., Amoen. Ital. 52 (1819).
R. hypoglossum L. subsp. *microglossum* (Bertol.) Arcangeli, Comp. Fl. Ital. 681 (1882).

Ic.: Colonna, Phytobasanos sive Pl. Aliqu. Hist. 64 (1592); Bonnier, Fl. Compl. Fr. 10: t. 597 (1929), as *R. hypoglossum*; Graf, Exotica 3: 1103 (1963) as *R. hypoglossum*; Motte, Bull. Soc. Bot. France 86: 79, fig. II (legend on page 77); ibid.: 159, fig. I, 10, 13–16, (legend on p. 158), (1939).

Stems to c. 60 cm tall, oblique, sometimes arching above, with up to c. 19 cladodes, internodes $\frac{1}{2}$–$1\frac{1}{4}$ times as long as cladodes. *Cauline scale-leaves* (4·5–)6–12 × 2·5–5 mm, triangular-ovate to narrowly deltoid, 1–5-veined. *Cladodes* more or less petiolate, twisted at the base (except when whorled) so that the shoot is slightly secund, 4·5–10(–14) × 1·4–3(–4·5) cm, obovate-lanceolate, or oblanceolate, rarely ovate-lanceolate, gradually tapered to the base, apex acuminate or caudate-acuminate, with an acute or sometimes subacute point, surfaces rather light green, matt. *Inflorescences* on any one shoot either all adaxial or both adaxial and abaxial on different cladodes. *Inflorescence-bract* 5·5–11·5(–15) × 1·5–2·5(–3) mm, narrowly deltoid or lanceolate, herbaceous, 3–4-veined, the edges at the base not or scarcely adnate to the cladode. *Pedicels* 3–6(–7) mm long. *Flowers* dioecious, nodding or pendent, jointed to the pedicel at the base of the perianth segments. Outer *perianth segments* c. 4 × 1·5 mm, spreading, margins recurved; inner perianth segments nearly as long as outer, c. 0·75 mm wide, spreading, margins pale purplish brown, revolute. *Staminal column* of male flower unknown, in female 2·75–3·5 × 1–1·5 mm, narrowly ovoid, somewhat contracted towards apex, obscurely 6-angled, slightly curved, rich dark violet, very slightly paler on the angles, apex rounded, obscurely 3-lobed, anther-walls white. *Stigma* spherical, blackish violet with clear apex; ovary unilocular; ovules 2, superposed. Berry spherical, 7·5–11 mm diam., scarlet (description from fruits produced by flowers artificially pollinated by *R. hypophyllum*). $2n=40$? (Martinoli (1951); see below regarding voucher specimens).

Distribution: Italy and adjacent parts of France and Yugoslavia.

FRANCE. Cannes, terrains vagues, *Rodié*, 1920 (MPU); Vallon de St. Nettre près Aix (B. du Rhône), *Bruyas*, 1881 (mixed with *R. aculeatus* var. *platyphyllus*) (BM).
ITALY. Caserta, 1845, *anon.* (K); Capri, sea-cliff, *Lees*, 1873 (BM); bois/bosquets des environs de Rome, *Neyra*, 1883 (BM); in Regno Neapolitano, *A. Prior*, 1845 (BM, E); Naples, said to grow in gardens and woods by Bertoloni (1854).
YUGOSLAVIA. Dalmatia, unter Gebüsch, Zara, *O. Krebs*, 1896 (E); Zara, *J. Schneider*, 1911 (W).

Cultivated or naturalized specimens (a selection):– Britain: Hexham, Northumberland, *Miller* H/0804/61, 1961 (K). France: jardins, Béziers, *Thévenau*, 1873 (W); Botanic Garden, Montpellier ("Hortus Monspeliensis"), 1813, 1817 (MPU); Menton-Garavan, A. M., *Campbell*, 375B–64, 1964 (CGE, CGG). Italy: in rupium fissuris viridarii Comitum Giusti Veronae, *Rigo*, 1873 (CGE, K) and 1874 (BM, K); Villa Pallavicini, Pegli, Liguria, *Richter*, 1871 (W); Pegli, ? planted, *W. M. Rogers*, 1875 (K, BM); Villa Pampili Doria, Rome, *Sanguinetti* (CGE); Botanic Garden, Cagliari, Sardinia 38B–65, 1965 (CGG); Miramar, bei Trieste, *Janchen*, 1903 (WU) (presumed to be naturalized, as "Park von Miramare bei Triest" is indicated for naturalized *R. hypoglossum*—probably in fact *R. microglossus*—by Hegi (1939, p. 334) and Marchesetti (1896–7, p. 548). Egypt: culta in hortis de Rosette, Egypt, herb. *Drake* (P).

This plant was recognized as a species by Bertoloni; although I have not been able to see type material the description and citations make it clear that this plant is the one which I described here. Bertoloni himself drew attention to it first in 1819 (Bertoloni, 1819, p. 52), and he there cited the work of Colonna (or Columna) (1592, p. 63), who made a clear distinction between it and *R. hypoglossum*, and remarked that neither he nor his friends had ever seen it with fruit over a period of twenty years. Bertoloni described the fruit but it is possible that it was produced by plants growing with, and pollinated by, another species. All the material that I have seen is female and although Bertoloni did not mention the absence of male flowers there is no positive evidence that he had seen them. In addition, most of the herbarium specimens I have seen have been cultivated in botanic gardens or elsewhere, while some of those cited above, which are labelled as though they were growing wild, are associated with civilization.

Since *R. microglossus* is morphologically more or less intermediate between *R. hypoglossum* and *R. hypophyllum*, my present hypothesis is that it is a hybrid between these species, and that it may consist of a single clone which has been distributed by human agency. It is conceivable, however, that in some of its apparently wild localities it is truly spontaneous, but in that case *R. hypophyllum* must be presumed to have had in the past a wider distribution in Europe than at present.

All the material which I have in cultivation appears to represent one clone; plants have been received from Miss M. S. Campbell (from her garden, Casa Rossa, Menton-Garavan, Alpes Maritimes, France), and under the name *R. hypoglossum*, from the botanic gardens of both Naples and Cagliari, Sardinia (the latter being, presumably, the stock from which Martinoli (1951) obtained his chromosome count of $2n = 40$ for "*R. hypoglossum*"). A herbarium specimen of the Cagliari plant (entry number 38B–65, 1 ii 1965) now exists in CGG. *R. microglossus* is apparently hardy in Britain, for there is a specimen at Kew cultivated in Northumberland and collected in 1961. What may be another, male, clone of this taxon occurs in cultivation and wild (but perhaps naturalized) at Barcelona; its identity is not certain and I have provisionally listed it under *R. hypophyllum*.

The French floras record *R. hypoglossum* from between La Seyne near Toulon and Bormes, and again from near Nice, treating it as a probable introduction. I have not seen any specimens from nearer Nice than Cannes, and they prove to be *R. microglossus*. Material from the other area, however, is *R. hypophyllum*.

4. R. hypophyllum L., Sp. Pl. 1041 (1753). Fig. 7.

Type in herb. Hort. Cliff. (BM!).

Syn.: *R. trifoliatus* Mill., Gard. Dict. ed. 8, no. 5 (1768) (spelt *trifoliatum* but corrected in back of volume). Type: presumably the undated specimen labelled *R. trifoliatus* Mill., ?cultivated (BM!).

R. lugubris Salisb., Prodr. 255 (1796), nom. illegit. pro *R. hypophyllo* L.

R. alexandrinus Motte, Bull. Soc. Bot. France 86: 162 (1939), pro parte, nom. illegit. pro *R. hypoglosso* et *R. hypophyllo*.

R. hypophyllum L. forma *lanceolatus* Maire, Contrib. Fl. Afr. Nord 33: 192 (1943) in Bull. Soc. Hist. Nat. Afr. Nord 34. Type: none cited.

R. hypophyllum L. forma *normalis* Maire & Weiller in Maire, Fl. Afr. Nord 5: 213 (1958), nom. illegit.

R. hypoglossum L. subsp. *hypophyllum* (L.) Arcangeli, Comp. Fl. Ital. 681 (1882), nom. illegit.

Ic.: Dillenius, Hort. Elth. t. 251 (1774); Maire, Fl. Afr. Nord 5: 212, fig. 864 (1958) (drawn with free stamens!); Gubb, Fl. Alger. 84 (1909) & Fl. Algér. 257 (1913); Coste, Fl. France 3: 356 (1905); Motte, Bull. Soc. Bot. France 86: 77, fig. III (legend on p. 78); ibid.: 158, fig. II, 1–8 (legend on p. 159) (1939).

Stems to c. 70(–100) cm tall, erect, with up to c. 16 cladodes (one of them occasionally replaced by a branch), internodes ½–2 times as long as cladodes. *Cauline scale-leaves* 8–14(–20) × 1·5–3(–5) mm, ovate-lanceolate to linear, 1–6-veined. *Cladodes* more or less petiolate (2·2–)5–9(–12·5) × (0·9–)1·2–5·5(–7) cm, usually ovate, abruptly contracted into the petiole, apex acuminate, abruptly acuminate or caudate-acuminate, with an acute point, cladodes sometimes ovate-lanceolate, lanceolate or obovate-lanceolate, surfaces usually dark green and somewhat glossy. *Inflorescences* on any one shoot abaxial, or adaxial, or mixed, occasionally on both sides of the same cladode (the adaxial one being proximal to the abaxial one). *Inflorescence-bract* 4·5–9(–13) × 1–2 mm, lanceolate or linear, scarious or herbaceous, 1–3(–4)-veined. *Pedicels* 5–10 mm. *Flowers* monoecious (or sometimes dioecious?), nodding or pendent, jointed to the pedicel at the base of the perianth segments. Outer *perianth segments* 4–4·5 × 1·25–1·5 mm, spreading, margins revolute; inner 3·5–4 × c. 0·5 mm, widely divergent or spreading, margins revolute and sometimes violet-tinged. *Staminal column* in male flowers 3–4 × c. 1·25 mm, clavate, in female flowers 2·75–3 × c. 1·25 mm, subcylindrical, often curved, dull violet, concolorous or faintly marked with pale lines, apex rounded, obscurely 3-lobed, sometimes paler in colour, anthers sunk into apex of column or slightly elevated, bluish, pollen greyish blue. *Anther-walls* of female flowers white. *Stigma* spherical, violet; ovary unilocular; ovules 2, superposed. *Berry* spherical, apiculate, 11 mm diam., or oblong, 10–14×7·5–12 mm. 2n=40 (Martinoli (1951); see below regarding voucher specimens).

Distribution: West Mediterranean Region.

SPAIN. Barcelone, sables du littoral, *Irlide*, 1905 (MPU, P) (?this species); Gibraltar (BM, CGE, E, P); Algeciras (P, WU).

FRANCE. Hyères, ruines du Vieux Château, *Chevalier*, 1894 (MPU).

ITALY. Sicily, Syracuse, *Rigo*, Iter Ital. 59, 1898 (P, W, WU).

NORTH AFRICA. From northern Tunisia to Tangier and western Morocco (Djebel Hadid, *Cosson*, 1889, P).

forma **crispatus** Senn. & Mauric. ex Emb. & Maire, Cat. Maroc. 4: 960 (1941); Sennen & Mauricio, Cat. Fl. Rif Or. 118 (1934), nom. nud.

Type. Cited as "Gurugú"; the following is therefore probably type material: MOROCCO. Melilla, Gurugú, maquis, vers 800 m. Leg. *Sennen & Mauricio* Pl. D'Esp. 1932. *F. Sennen* no. 8537. 19 v 1932 (BM!).

Ic.: Motte, Bull. Soc. Bot. France 86: 158, fig. II, 9 (legend on p. 159) (1939).

Margins of cladodes undulate-crispate.

NORTH AFRICA. La Calle, Algeria (fide *Maire*, 1958, p. 213); Melilla, Spanish Morocco, *Sennen* 8537, 1932 (BM); Rif, Morocco (fide *Maire*, 1958, p. 213); Tangier, *anon.* (MPU).

Ruscus hypophyllum is distinguished by its narrow cauline scale-leaves, by its usually broad cladodes, abruptly contracted at both base and apex, by its small inflorescence-bract, and by its long, more or less clavate staminal column. The inflorescence position is variable, as some authors have noted (though most follow Linnaeus in describing it as abaxial); the variation is often present within a clone, but in many herbarium sheets only abaxial inflorescences are found, while a clone of *R. hypophyllum* described by Motte (see p. 5) has constantly adaxial inflorescences. The forms with green, 3-veined inflorescence-bracts approach *R. microglossus*, especially if the cladodes are narrow, as in some North African material and in that from Barcelona (two cladodes of which are illustrated in Motte, 1939c). The latter is probably this species, though it could possibly be a form of *R. microglossus*. (Irlide's specimen from Barcelona, however, and Sennen's 1921 (?) specimen mentioned in the next paragraph, have male flowers, so they certainly cannot be the same clone as other known material of *R. microglossus*). Monoecism in *Ruscus* is found elsewhere only in *R. streptophyllus*, but its constancy in *R. hypophyllum* is in doubt, for Maire (1958, p. 213) describes this species as dioecious. Cultivated material from four sources has proved to be monoecious, though it is not certain that more than one clone is involved. Although in cultivation male flowers are more abundant and produced over a longer period than female, they are rarer on herbarium specimens, possibly because they drop easily, while the female flowers, at least if fertilized, are retained. Nevertheless, I have found five instances of flowers of both sexes occurring on the same shoot in herbarium material, as follows: (1) Algiers, 1873, *Joad* (K), (2) La Calle, Algeria, 1840, *Durieu* (P), (3) Tangier, *Trethewy* 46 (K), (4) Fedhala, *Trethewy* 208A (K), (5) Djebel Kebir, Tangier, *Warburg* 256 (CGE). Maire's statement, therefore, cannot represent the whole truth. One herbarium specimen which I have seen, however, may represent a female plant, as it bears ten female flowers and no males (Algiers, 1856, *Wolfe*, K).

Ruscus hypophyllum is principally a north-west African species, but it has been much collected around Gibraltar and Algeciras and it is doubtless also native there, while Rigo's specimens from Syracuse are not indicated as introductions or cultivated plants. The French locality cited above, Hyères, is part of the more westerly area from which *R. hypoglossum* is listed (as a possible introduction) in French floras (see *R. microglossus*). Of the material from Barcelona cited above, Irlide's appears to come from a natural habitat (though it could be an escape), but Sennen's, dated 1921 (?) (BM) and 1929 (BM) are either marked "cultivated" or "Parc de la Bonanova".

Herbarium material has been seen from other countries as follows:—Portugal: unlocalized, before 1867, *Deakin* (K). France: cult. Paris (P). England: cultivated (CGG, K). Greece: Corfu, probably cultivated, 1914, *Ginsberger* (WU). Malta: cultivated (CGE). Egypt: unlocalized or cultivated (BM, P).

R. hypophyllum is not recorded in Portuguese floras, while in the Flora of Egypt (Täckholm & Drar, 1954, p. 312) it is marked as an alien (under the name *R. alexandrinus* Motte). Miller's *R. trifoliatus* from Greece (Zante) was probably an introduction there. The old idea of *R. hypophyllum* as a species extending from Madeira to the Caucasus must now be abandoned. Although *R. colchicus* is superficially similar to *R. hypophyllum*, all reports of the latter from south-east Europe and north-west Turkey seem to be based on cultivated plants or misidentifications.

Plants growing at Cambridge Botanic Garden have been obtained from the same sources as *R. microglossus* and also from the late Major L. Johnston's Garden, Serre de la Madone, Mentone, Alpes Maritimes, France, through Miss N. Lindsay, and the Montpellier Botanic Garden, through Professor J. Motte. The material from Cagliari presumably represents that from which Martinoli obtained his chromosome count; a fruiting specimen taken from the plant when it arrived has been preserved (entry number 38A–65, 1 ii 1965, CGG). A plant has been grown out of doors at Cambridge, against the wall of the Palm House, since about 1960. As the main growing period of the species appears to be winter, this plant does not thrive, though flowers have been seen on it even in January.

5. R. streptophyllus P. F. Yeo in Feddes Rep. 73: 17 (1966). ("streptophyllum"). Figs. 4F, G, 8.

Type. Madeira: San Antonio da Sena, x–xi 1865, *F. M. Norman* (CGE, holotype!).

Syn.: *R. hypophyllum* L. var. *latifolius* Lowe in Trans. Camb. Philos. Soc. 4: 11 (1833). Type: by the fountain in Ribeiro Frio. 14 iii 1827, *R. T. Lowe*, 313*, as *R. hypophyllum*, var. α (K, syntype!); Rib. Frio. 16 iv 1828. *R. T. Lowe*, 313*, as *R. hypophyllum* α *latifolius* (B.M. 2049) (K, syntype!).

R. hypophyllum L. var. *lanceolatus* Lowe in Trans. Camb. Philos. Soc. 4: 12 (1833). Type: woods up the Muchica Valley, 14 v 1827. 313* changed to 676*. *R. T. Lowe*, as *R. hypophyllum* var. β (BM, lectotype!); R. de Boa Ventura, x 1829. *R. T. Lowe*, 676*, as *R. hypophyllum* β *lanceolatus* (BM) and as *R. hypophyllum* (K).

Ic.: Bot. Mag. 46: t. 2049 (1819), as *R. hypophyllum*. Loudon, Arb. et Frut. Brit. 4: 2519, fig. 2388 (1844), as *R. hypophyllum*, copied from the preceding.

Stems to c. 60 cm tall, oblique, arching distally, with up to c. 18 cladodes, internodes $\frac{1}{5}$ to $\frac{1}{2}$ as long as cladodes. *Cauline scale-leaves* 7–14 × 3·5–8 mm, ovate, 3–7-veined. *Cladodes* subsessile, resupinate by the twisting of the base, distichous above, 5–18 × 2·2–8 cm, broadly elliptic or ovate to narrowly elliptic or lanceolate, base rounded or cuneate, often asymmetrical, apex acute or acuminate, abruptly acuminate in broad cladodes, surfaces pale green, matt. *Inflorescences* adaxial (but facing downwards through the twisting of the cladodes). *Inflorescence-bract* 4–11 × 1·5–2·5 mm, ovate-lanceolate to lanceolate, scarious or herbaceous, 1-veined or obscurely 3-veined. *Pedicels* 6–23 mm. *Flowers* monoecious, pendent. *Outer perianth segments* c. 3·5 × 1·75–2·5 mm, reflexed, elliptic, adaxial surface convex, or margins revolute; inner perianth segments about as long as the outer, divergent or spreading, narrowly linear, margins revolute. *Staminal column* 2·75–3·25 × 2–2·5 mm, turbinate in male flowers, cup-shaped in female flowers, whitish or pale violet, longitudinally striped with 12 alternately weaker and stronger violet bands, apex concave, bordered by six prominent

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* Lowe's numbers refer to taxa, not to gatherings.

lobes, the stronger stripes of the walls passing through the sinuses between the lobes, and joining a violet central area, the weaker passing over the lobes, anthers occupying only the very centre of the apex, bilobed, blackish violet; pollen greyish white. *Stigma* pileiform, blackish violet, ovary unilocular and 2-ovulate, or bilocular (at least partly) and 3–4-ovulate; ovules collateral. *Berry* spherical, 10–15 mm diam.

MADEIRA. I. of Madeira (BM, CGE, K, P).
BRAZIL. Minas, *Glaziou* 19946, before 1908 (K, P)—doubtless introduced.

This Madeiran endemic species is amply distinct from other species with small inflorescence-bracts in its constantly adaxial inflorescences, resupinate cladodes, reflexed outer perianth segments, distinctively shaped and coloured staminal column, and pileiform stigma. Less obvious for identification purposes, but probably more important phylogenetically, are the normal leaves of the seedling (see p. 240), the sometimes bilocular ovary and the collateral ovules (otherwise found only in Series *Ramosae*). The species is very variable in its cladode width and Lowe was led by this to propose the two varieties cited above. Lowe also indicated that var. *latifolius* had distichous cladodes, while var. *lanceolatus* had the lower cladodes whorled, but I find that the lower cladodes are sometimes whorled also in plants with broad cladodes, and I have therefore not kept up these varieties. It may be of interest to quote Lowe (1851, Appendix A, p. ii) thus: "This, or at least the var. α (i.e. *latifolius*), appears to be the true *R. hypophyllum* L.; differing from *R. hypoglossum* L., in the small dry chaff-like (instead of well-developed leaf-like) "hypophyllous" floral bract or bracts. The figure in Bot. Mag. t. 2049, well represents the Madeiran plant, in which the flowers are produced on short pedicels, each issuing in long succession from a tuft of dry scarious small acuminate bracts on the middle of the *upper* side of the leaves. These leaves become by a twist in the petiole almost uniformly resupinate, giving the flowers and fruit the appearance of being hypophyllous, which they really are not". Evidently Lowe did *not* know the true *R. hypophyllum* L., or he might well have recognized the Madeiran forms as distinct from it. I have chosen a lectotype for *R. hypophyllum* var. *lanceolatus* Lowe because the specimens from R. de Boa Ventura in the British Museum are poor ones and are mounted on the same sheet as a later gathering, the boundary between the two gatherings being doubtful.

Two stocks of *R. streptophyllus* are in cultivation at Cambridge; one has long been in the Cool Fern House under the name *R. hypophyllum*, and has provided most of the floral data for the present account; the other was collected by Major C. H. C. Pickering in Madeira in 1965 and has so far produced several stems, on which the cladodes are narrower than in our other plant, and a few male flowers. The production of fruits by this species in cultivation is recorded in the account in the Botanical Magazine, already cited, and spontaneous fruit-setting has also occurred on the plant in the Cool Fern House at Cambridge, though it is certainly infrequent. I have no information on the plant's hardiness, but it seems unlikely that it would survive out-of-doors in Eastern England. Its flowering under glass is restricted to the winter and early summer.

Notes on Series Ramosae

This group appears to consist of two species, namely *Ruscus aculeatus* L., Sp. Pl. 1041 (1753) and *R. hyrcanus* Woronow in Monit. Jard. Bot. Tiflis 7: 33 (1907). The latter differs from the former chiefly in that each stem bears only one whorl of branches, instead of several. However, a third species has been described, and is accepted by Chernyakovska in Flora URSS 4: 444 (1935); this is *R. ponticus* Woronow, in Woronow & Schelkownikow, Sched. Herb. Fl. Cauc. Fasc. 7: 50 (1916). Its original publication (in Russian) is somewhat informal; no specimens are mentioned, but the general distribution is indicated as "Lazistan, W Transcaucasia, and along the middle Kur River", and the synonym *R. aculeatus* var. *angustifolius* Boiss., Fl. Or. 5: 341 (1884), is cited. *R. ponticus* is described as having the branching habit of *R. aculeatus* but as differing from it in its glaucous, 1–3-veined cladodes of different form, more strongly and finely cuspidate. *R. aculeatus* var. *angustifolius* is described as having "cladodia diminuta lanceolata". Woronow's notes state that *R. aculeatus* sens. strict. is found in the Crimea and in the Mediterranean Region; presumably he regarded all the Transcaucasian material as belonging to *R. ponticus*. Later, in Flora URSS 4: 447 (1935), the Crimean material was transferred to *R. ponticus* and the general distribution was also shown as including the area "Balk.-Maloaz." (Balkans–Asia Minor). Since this is treated as a single unit in Flora URSS this need not be taken to imply that the species is considered to occur in Europe (it might apply to Turkish specimens only). However, Stojanoff & Stefanov (Fl. Bulg. ed. 2: 240, 1933) record it as occurring in Bulgaria (using the name *R. aculeatus* var. *ponticus* (Woron.) Stoj. & Stef., *nom. illegit.*) as well as *R. aculeatus* (as "var. *typicus*").

The impression I have gained from examination of material in the Cambridge and Kew Herbaria, and material on loan from Leningrad, is that there is in *R. aculeatus* a considerable variation in cladode width in relation to length, and that somewhat narrow cladodes are rather frequent from about Austria and Italy eastwards, but are absent west of this (i.e. in West Europe and North Africa). All gradations from the ovate of typical *R. aculeatus* to the lanceolate form described by Boissier and illustrated by Krüssmann (1962, p. 440) are found throughout this eastern area. The extreme states of this single-character variation give their possessors no claim to separate specific recognition. However, since the form with narrow cladodes has geographical significance, and owing to its strikingly distinct appearance, it seems worth recognizing it as a variety. This can only be defined abritrarily, and I would include in it all specimens in which the majority of cladodes are four or more times as long as broad.

Distribution of *R. aculeatus* var. *angustifolius* as thus defined: USSR, Transcaucasia, *Meffert* 82 (LE). Turkey: Trabzon, *Alboff* (LE); Cilicia, *Siehe* 666 (LE). Israel: El Muhrakha, *Hayne* (K). Cyprus: Kyrenia range, *Davis* 3604 (K). Yugoslavia: Istria, *Turrill* 1128 (K).

Within this area, the following specimens of var. *aculeatus* have been seen: USSR, Transcaucasia, *Dmitrieva* (LE), *Davis* 33653 (K). Turkey: Trabzon, *Schischkin* (LE); Seyhan, *Davis* 19792 (K). Israel: Wadi Qurrum, *Davis* 4833 (K). Cyprus: Perapedhi, *Meikle* 2804 (K). Yugoslavia: Istria, *Müller* (K).

Shoots with cladodes mostly only three times as long as broad can be found in material from the Azores, at the western extremity of the range of the species. A female clone of var. *angustifolius* is growing in Cambridge Botanic Garden, and has cladodes 4·5–8 times as long as broad.

Another striking variant of *R. aculeatus* is the so-called *R. ponticus* Woronow var. *macrophyllus* Woronow ex Chernyakovska in Flora URSS 4: 447 (1935). This was first described, without name, in the place where *R. ponticus* was described (see p. 261). The account is as follows: "It remains to note that in Kolkhide (in the direction of Tsebeldinsk in the district of Sukhum) I encountered whole colonies with very large (to 4 cm in length, 1·5 cm in width) cladodes, with the nervation of the type of *R. aculeatus* s. str. These examples I interpret as an atavistic deviation towards the basic form, the cradle of which appears to be the Mediterranean region." The Flora URSS describes the cladodes as 3·5–4 cm long, and 2 cm wide, and gives the distribution as "W Transcaucasia. (Sukhum and Kutais)." Two sheets were lent to me from Leningrad, one from Petzkir, and one from: "Abchasia, in quercetis prope Sukhum-Role, iii 1905, *Woronow*." The longest cladodes in these two sheets are respectively 5 and 4·5 cm long. The specimens also differ from *R. aculeatus* in the sparse branching (branches 7, 5 and 3 respectively in the three available shoots, as against the (7–)10–20 branches usual in *R. aculeatus*), in the restriction of the branches to the lower part of the stem, in the abaxial position of most of the inflorescences in the Petzkir specimen, and a few of those in the Sukhum one (constantly adaxial in *R. aculeatus*), and in the presence of frequent abnormalities (including a series corresponding to the "reversal" series of Motte (1939a) and the development of a wing on the cladode distal to a submarginal inflorescence). The specimens are without flowers or fruits. It seems to me quite probable that these plants are hybrids between *R. aculeatus* and *R. colchicus*; this would easily account for all the peculiarities just mentioned. The abnormalities would then represent the result of instability in regard to inflorescence-position, owing to the difference between the parent species in this respect. This, incidentally, would provide an excellent support for Motte's interpretation of the abnormalities of *R. hypophyllum* and *R. microglossus* as expressing intermediate positions of the inflorescence between adaxial and abaxial. In *R. hypophyllum* the position is usually inherently indeterminate, while in *R. microglossus* the indeterminacy could result from inheritance from *R. hypophyllum*; intermediate positions may be viewed as a consequence of this indeterminacy. On the other hand, *R. aculeatus*, *R. streptophyllus* and *R. hypoglossum*, with strictly determinate inflorescence-positions, show very few abnormalities.

It may seem improbable that *Ruscus* species belonging to different series should be interfertile, but, as mentioned earlier, a cross of this type has reached the stage of well-developed, ripe, fruit, though the seeds were soft; the parents are, in fact, *R. aculeatus* var. *angustifolius*, ♀ and *R. colchicus*, ♂. The chromosome number of *R. aculeatus* is 2n = 40 (Martinoli, 1951).

Another form of *R. aculeatus* with large cladodes occurs in SW Europe. This is the var. *platyphyllus* Rouy, Fl. Fr. 12: 452 (1910) with broadly ovate cladodes, mostly over 2 cm long and attaining 5·5 cm. It was described from material collected in Corsica by Rouy himself; I have not seen the type material but there is a specimen in CGE from Corsica, collected (?) by Babington. Apart from this, the herbarium material shows a strong association with localities for species of series *Simplices*, namely Algeciras (K, cf. *R. hypophyllum*), Béziers, SW France (K, loc. for cultivated *R. microglossus*, W), Menton (K, cf. *R. hypophyllum*, *R. microglossus*), Aix-en-Provence (BM, mixed sheet with *R. microglossus*), and Barcelona (BM, cf. *R. hypophyllum*). As far as I am able to tell at present, however, the specimens contain no morphological evidence for a hybrid origin.

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