

Tieghem, P. van. 1896. Sur les phanérogames à ovule sans nucelle, formant le groupe des innucellées ou santalinées. Bulletin de la Société Botanique de France 43: 543-577. [pages 548-554 here]

2. ARJONACEAE.

Classified up to now in Santalaceae, the two Chilean genera *Arjona* and *Quinchamalium* differ from all the plants of this family by several characters. It will be enough here to announce three of them.

After the separation of the pistil, the staminiferous sepals remain concrescent tubes some, but this tube is not covered by a nectariferous disc; it is the pistil which produces, around the base of the style, a pad more or less thick nectary. In a word, the disc is not calicinal, as at Santalaceae, it is epigynous.

When the sepals produce, above the insertion of the stamens, as many tufts of hairs, which takes place in *Arjona*, these hairs are as usual of epidermal origin; they are not born from the exodermis by exfoliation of the epidermis, as in Santalaceae.

Lastly, the ovary is unilocular only in its higher area; in the remainder of its extent, it is plurilocular, with an ovule in each locule.

These differences are enough to justify the separation of these two genera of with Santalaceae and their constitution in a small distinct family, under the name of Arjonaceae.

The free central placenta which occupies the higher unilocular area of the ovary carries under its top as many hanging ovules as there are carpels, i.e. three, which go down in the three corresponding locules to the lower area. The ovule has the same structure as in Santalaceae; it is also reduced with the ovular leaflet, without nucellus nor integument. The embryo sac is also formed there at the top, on the ventral face. Its major extremity goes up, particularly in *Quinchamalium*, until in the placenta, then goes down again there along the axis until the base, thus behaving as in *Santalum*.

During the formation of endosperm and embryo, the single ovule which develops is reabsorbed, as well as the internal zone of the ovarian wall. The ripe fruit of these plants thus does not contain a seed.

From all of these features, Arjonaceae resemble Santalaceae and must, consequently, take a seat all beside them in the group which we study.

3. SCHOEPFIACEAE.

Established by Schreber in 1789 (1), the genus *Schoepfia* does not yet have, after more than one century, receipt of the place which belongs to it in the classification of Dicotyledons. It is, however, not the fault of being often studied and by the most eminent botanists. But, while seeking to specify its characters, they did not manage to agree on its affinities.

Vahl, in 1794, saw it as a neighbor of *Loranthus* (2) and, soon after, in 1808, A.-L. de Jussieu incorporated it, with *Loranthus* and *Viscum*, into the family Loranthaceae which he had just constituted (3). Later, in 1830, A.-P. de Candolle also attached it, following *Loranthus* and *Viscum*, to its family Loranthaceae (4).

Wallich, which, by the broad description and accompanying plate which he provided in 1824, of an Asian species, his *Schoepfia fragrans*, contributed much to make this genus well known, [and] brings it closer to Santalaceae (5). Blume, in 1850, reconciles these two opinions by making of this genus the type of a small distinct family, Schoepfiaceae, very close at the same time to Loranthaceae and Santalaceae (6).

The majority of botanists, however, sought elsewhere affinities of this genus. Don, in 1825, and Spach, in 1840, attach it to Symplocaceae; Bartling, in 1830, in Ebenaceae; A. Richard, in 1842, in Sapotaceae; Meisner, in 1843, and more recently Miers, in 1880, in Styracaceae.

Since 1844, Bentham classified it in Olacaceae and it is in this family from his example that the large majority of authors thereafter have placed it: Endlicher in 1842, A. de Candolle in 1857, Bentham and Hooker in 1867, Mr. Maxwell Masters in 1875, Mr. Engler in 1889, Baillon in 1892.

To show initially that the species currently allotted to the genus *Schoepfia* form three quite distinct series, which are as many genera [are] set up together in a small natural group; to then establish, by the study of the floral organization, that this group must be withdrawn from Olacaceae and be classified as an entirely family beside Arjonaceae and Santalaceae: such is the double object of this paragraph.

1. *Grouping of the species in three genera.* According to the mode of the inflorescence, the species currently joined together in the genus *Schoepfia* line up in three groups, for which it is advisable to give generic rank.

In the first, the inflorescence offers the most complicated state; it is an axillary, sessile umbel, made up of pauciflorous spikes. The bud which produces it, born during the preceding vegetative time, is covered with imbricated scales, which persist around the base of the umbel, in the shape of perula [covered with scales] or involucre. The branch ends initially in a short spike; then, within the axil of the scales of the perula, it is gradually done as many secondary branches, which finish in the same manner: from where sessile umbel. Each spike is pedicellate and increases a certain number of main [mother] bracts, often two or three only towards its top. In the axil of each main bract, the pedicel, very short and concrescent to this bract, carries initially two lateral bracteoles and they terminate at once on the flower. The main bract and two the lateral bracteoles are concrescent in a trefoil involucre, which surrounds the base of the flower.

This group includes all the currently known American species, ten approximately. We will form the genus *Codonium* from it, established by Rohr, in 1792, for a species collected by him in the Antilles, in the islands Sainte-Croix and Montserrat, that Vahl described under the name of *Codonium arborescens* (7). It is necessary for it to add several new species which will be described in my Report, in particular that which Mr. Eggers reported of the Bahama islands in 1888 and which I will name, because of the pale color green of its leaves after desiccation, *Codonium pallidum*.

In the second group, the inflorescence is a simple axillary cluster. The bud which produces it, also born during the preceding vegetative time, is also covered with scales which persist at the base of the stalk in the shape of a perula. Each pedicel, long and slim, are concrescent with the main bract to all its extent; above it, it produces two lateral bracteoles and ends at once in flower. The main bract and the two lateral bracteoles are concrescent at the base in a trefoil involucre, which surrounds the flower.

This group includes up to now only three Asian species, of which one is *Schoepfia fragrans* of Nepal, described and illustrated by Wallich, in 1824; the second, *S. acuminata* Wall., of the Khasia mountains; the third, *S. Miersii* Pierre, of Kampuchea. The generic name of *Schoepfia* is conserved, published by Schreber with no indication of species, nor place of origin.

Lastly, in the third group, the inflorescence is a simple axillary spike. The bud which produces it is born within the axil of a young leaf on the branch from that year and develops immediately, without being wrapped in scales and leaving consequently a perula at the base of the stalk. On this one, within the axil of each main bract, a sessile flower is formed, entirely

deprived of lateral bracteoles. There is thus no involucre here around the base of each flower, as in the two preceding series.

This group has as a type *Schoepfia jasminodora*, originating in Japan, described in 1846 by Siebold and Zuccarini (8). It is necessary for him to add *S. chinensis* Gardn. et Champ., of Hong-Kong, a new species found in Macao by Callery, in 1844 (n° 241), that I will name *S. gibbosa*, and another collected in the Himalayas directed by Griffith (n° 819), that I will name *S. Griffithii*: in total four species. One will join them together under the generic name of *Schoepfiopsis*, given by Miers, in 1880, for the ensemble of Asian species, species which he constituted in the state of a distinct genus, by leaving the name of *Schoepfia* for the whole of the American species.

Thus briefly defined, these three genera form together a small family, Schoepfiaceae, which it is now necessary to compare with Santalaceae and Arjonaceae with regard to their floral organization.

2. *Floral organization.* That it acts of *Codonium*, like *C. chrysophylloides* (A. Rich.), of *Schoepfia*, like *S. fragrans* Wall., or of *Schoepfiopsis*, as with *S. jasminodora* (Sieb. and Zucc.), three species which I mainly studied under this regard, the floral organization remains the same one in its essential features and it will be enough to only make known one description.

The pistil has an almost completely inferior ovary; after its separation from the external parts, it is prolonged into a flattened dome finished by the style, around the base of which there is a raised pad.

The perianth, which is gamophyllous, carries outwards, on the level of its separation, a notch formed by a fold of the epidermal; later, it is detached above this notch, leaving the lower pad adhering to the ovary. It is this pad external of the perianth, of the same origin and of comparable nature as the pad formed by the pistil around the base of the style, that all the authors took for a calyx, looking consequently like the tubular perianth of a gamopetalous corolla. In reality, the perianth is thus a gamosepalous calyx.

The androecium includes as many stamens as sepals, superimposed on the sepals and concrescent with them in almost all the length of the filament. Without being for that fluctuating, the anthers stick at the end of the filament by the medium of its dorsal face. Below of the departure of stamen, the sepal produces a tuft of hairs, which are epidermal, as in *Arjona*, and nonexodermic, as in Santalaceae.

Unilocular in its higher area, where a free central placenta gives off as many pendulous ovules as there are the carpels, superimposed on these carpels, the ovary is plurilocular in the major part of its length and each ovule goes down into one of the locules, where it fills it almost completely. The axis of the ovary is occupied by a system of inverse phloem fiber bundles, with little developed wood, in same number as the carpels, on which they are superimposed. Towards the free top of the placenta, each one of its bundles curves outwards and goes down in the external area from an ovule, which it traverses in all its length; arriving at the end, it bends and goes up into the internal region until a quarter its height. The ovule of these plants thus has primarily the same structure as that of Santalaceae; it also has the same morphological importance. Here also, is the ovular leaflet in its entirety, deprived at the same time of nucellus and integument. There is, however, a difference; here, the ovular lobe is bent in inside at its end and the going up portion of the hook is concrescent with the remainder. For Santalaceae, when it bends thus, as one saw above for Osyrideae and Comandreae, the curve takes place outwards and the going up portion of the hook is independent of the different one.

In the ovule thus made up, the embryo sac is formed under the epidermis, not at the end, as at

Santalaceae and Arjonaceae, but some share on the internal face, above the level where the part going up to the phloem fiber bundles ceases, i.e. towards one third the length, not which, however, corresponds, as it has been just said, at the organic top of the ovule. The ovule should not about it less be known as *pleurocyste* [lateral cyst?]. The peripheral end of the sac, at its summit, digests at once the superimposed epidermis, appears at the outside and goes up between the ovule and the placenta, by digging a furrow in the internal face of the ovule and also sometimes in the placenta, until in the higher axil. There, without penetrating into the placenta, it circumvents the base of the ovule and thus gains the higher face of the placenta, where it receives the contents of the pollen tube. The major end of the sac, its base, also lengthens, but in opposite directions, while remaining included in the ovule; it walks on in the phloem fiber bundle, which it digests on its passage by sending all around the prolongations like glove fingers, and thus reached its end; I did not see it going up on the opposite face. This double lengthening of the embryo sac, at the same time apically external and basally internal, recalls, but with well marked differences, the way in which it behaves in Santalaceae and Arjonaceae.

During the formation of the embryo and endosperm, which here one and the other are deprived of starch, the single ovule which develops is completely reabsorbed, as well as the internal zone of the ovarian wall. Thus there is no seed in either of these plants.

3. *Affinites*. The existence of well differentiated ovules, going away first in Schoepfiaceae [and] not only from the family from Loranthaceae, in which of Jussieu and de Candolle incorporated them, but still in the entire Loranthinées group, such as it was made up in a former communication. The absence of a corolla clearly separates them from the family Olacaceae, where all the most recent authors introduced them.

By the absence of a corolla, by the isostemonous androecium, the episealous and concrescent calyx, by the inferior ovary with free central placenta carrying at the top as many pendulous ovules as there are the carpels, superimposed on these carpels and reduced to the ovular leaflet without nucellus, nor integument, finally by the double lengthening of the embryo sac and the later resorption of the ovule, Schoepfiaceae much resemble Santalaceae and Arjonaceae, it is thus advisable to classify them at their side. They are distinguished clearly from Santalaceae by the plurilocular ovary in its lower area, by the epigynous disc, the epidermal origin of the post-staminal sepalic hairs, three characters which bring them closer Arjonaceae. Those, they differ especially by the external pad from the calyx and the pleurocyst of the ovule.

All things considered, it is thus not far from Santalaceae and very close to Arjonaceae, that the family of Schoepfiaceae comes to take seat in the group which at this moment we work to establish. This place is precisely, as mentioned above, that which Blume already assigned them nearly one half-century ago.

- (1) Linné, *Gen. plant.*, 8th edition, p. 129. 1789.
- (2) Vahl, *Symbolae botanicae*. III, p.36, 1794.
- (3) A.-L. de Jussieu, *Annales du Muséum*, XII, p. 300, 1808.
- (4) A.-P. de Candolle, *Mémoire sur les Loranthaceae*, p. 23, 1830 et *Prodromus*, IV, p. 319, 1830.
- (5) Wallich, *Tentamen Florae Nepalensis*, I, p. 18, pl. 9, 1824.
- (6) Blume, *Museum bot. Lugduno-batavum*, I, p. 175, 1850.
- (7) Vahl, *Skrivter of Nat. hist. Selskabet*, II, p. 206. Copenhagen, 1792.
- (8) Siebold et Zuccarini, *Florae jap. fam. natural.* (*Abhandl. der Akad. der Wiss. München*, IV, 3rd Abth., p. 135, 1846).