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Studies in the floral anatomy and morphology of Rubiaceae*

IV. Rhondeletieae and Cinchoneae

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In the present part of this series, two tribes will be described. No information has yet been given on the floral anatomy for these tribes.

Tribe Rhondeletieae. This tribe is diagnosed as: imbricate or convolute corolla-lobes, two-loculate ovary with many horizontal ovules, capsular fruit, seed usually without wing, and the absence of raphide. Some twenty genera are known from Central and South America, and rarely from tropical Asia. Here, two species belonging to different genera are observed as in Table 4.

Table 4. The species examined and the voucher specimens.

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<th>Tribe Rhondeletieae</th>
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<th>Tribe Cinchoneae</th>
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Rhoneletia—The flower of R. odorata is 5- or 6-merous, though the filiform calyx-lobes are often pleiomery. A small appendage is found between calyx-lobes. The throat of a trumpet-shaped corolla has an annular callosities. The stamens are inserted at the middle level of a corolla-tube and the filament fuses to corolla-tube at its entire length except free apex. A globose ovary has two or rarely three loculi. A swollen placenta is attached to the septum by broad connection and bears many horizontal ovules (Fig. 15-C, 16-A). An annular disc is slightly swollen. There are many crystal sands aggregated together in an ovary including placenta. In an ovary the tannin cells occur in epidermis and its neighbouring cells, the cells surrounding bundles, and placentae (Fig. 15).

In a pedicel a vascular cylinder gives off the bundles, each of which supplies a

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filiform bracteole (Fig. 16-A). In a receptacle this cylinder gradually divides radially into more than ten bundles running up in the periphery of an ovary (Fig. 15-A, B). In the case which the number of calyx-lobes and corolla-ones is isomerous, each of alternative five bundles in 5-merous flower (or six in 6-merous one) forks tangentially into two in the lower half of an ovary including the level still below the bottom of loculus, though a calyx bundle becomes distinct in the upper half in all the four flowers observed (Fig. 15-C, D). The outer bundle supplies calyx and the inner one is corolla—disc one (Fig. 15-D, 16-A). Among ten bundles in the periphery of an ovary, the other five are corolla—disc one. Ten main bundles in periphery except independent calyx bundle and dorsal ones give off small disc bundles repeatedly throughout the levels of an ovary. These small bundles run up to a disc in the inner portion of periphery, as they branch, fuse to other disc bundle, and end blindly. At the uppermost level, some of corolla bundles and stamen ones respectively branch a thick bundle scattering in a disc (Fig. 15-C). In a calyx-lobe, a bundle gives off one or two branches (Fig. 16-B). The dorsal bundles of carpels are branched from the bundles at the dorsal portion of loculi in the lower half of an ovary, and run up in a style (Fig. 16-A).

In a flower having eight calyx-lobes, six corolla-ones, and six stamens, the vasculari-

Fig. 15. 6-merous flower of Rhondeletia odorata. A. Cross section of receptacle (×50). B. Cross section at level just below loculi (×30). C. At middle level of ovary (×30). D. At the uppermost level of ovary (×30).
Fig. 16. Diagrams showing vascularization of flower in *Rhodeletia odorata*. A. Longitudinal section of flower. B. Cross section at upper half of ovary, where there are eight calyx bundles, five corolla ones, five stamen ones, and two dorsal ones. A calyx-lobe is supplied by one bundle. Broken lines of B show bundles branched from a bundle in periphery of ovary.

zation of the bundles supplying calyx, corolla, and stamens is shown in Fig. 16-B. As obvious in this figure, the calyx bundle fuses to a stamen one or a corolla one.

The bundles remaining in the center of receptacle come together and form a loop in the center of receptacle (Fig. 15-B). These bundles give off repeatedly small branches in the broad connection (Fig. 15-C, 16-A). These bundles supply into placenta.

*Wendlandia*—The flower of *W. formosana* is 5-merous. An ovary has two loculi. A swollen placenta is attached to the middle portion of septum by rather slender stalk and bears many vertical ovules (Fig. 17-C, 18-A). The style is bifide and the stigmas are very broad. An annular disc much develops. The crystal is not observed in ovary. There are many tannin cells in the periphery of an ovary especially in its outer portion, placentae, and the epidermis of ovules developing into the wing of seed.

In a pedicel there are five bundles, which gradually divide into ten bundles taking an upward course from the upper part of a pedicel to a receptacle (Fig. 17-A, B). These ten bundles run up in the periphery of an ovary, giving off disc bundles. Among ten bundles, each of the alternative five forks a median calyx bundle and a stamen—disc one in the upper half of an ovary. Each of other five divides a small calyx bundle and a corolla—disc one at the uppermost level (Fig. 18). The former divides into two lateral calyx bundles at the base of a calyx-tube. The disc bundles are branched from the bundles in the periphery of an ovary except distinct calyx bundle and dorsal one mainly in the upper
Fig. 17. Flowers of *Wendlandia formosana* (×75). A. Cross section of pedicel (or receptacle). B. Cross section at further upper level than A. C. Longitudinal section of ovary, showing placenta and ovules whose wing already develops to some extent.

Fig. 18. Diagrams showing vascularization of flower in *Wendlandia formosana*. A. Longitudinal section of flower. B. Cross section in upper half of ovary. Upper half of B shows three median and two lateral calyx bundles, and in lower half three lateral ones do not still become free.
level than that where the median calyx bundles become distinct, and also fairly in lower half including the base of an ovary. The disc bundles form a network in the lower half of a disc, but do not run up in the further upper part of a disc (Fig. 18-A). The dorsal bundles of carpels are separated from the bundles in periphery at the dorsal portion of two loculi at the middle level of an ovary and sometimes in lower half.

In a receptacle the bundles give off centripetally the branches, which enter the center of receptacle and fuse a linear bundle at the level as high as the bottoms of loculi. In this bundle, the vessels group in two. The bundle divides into two at the level where the stalk of placenta is attached to septa. Both of the two bundles enter the placentae and supply many ovules.

Tribe Cinchoneae. This tribe is diagnosed as: tree or shrub, corolla-lobes valvate, imbricate, or convolute in bud, two-loculate ovary, very numerous ovules, capsular fruit, seed with wing, and the absence of raphide. About thirty-five genera are known mainly from Central and South America, rarely from the Tropical Asia and Africa. Only one species is here observed.

Coptosopelta—The flower of C. diffusa is 5-merous. There are five small subulate appendages, each of which occurs between calyx-lobes. The corolla-lobes are imbricate in bud. A globose ovary has two loculi. A placenta is attached to the septum by broad connection and bears many ovules (Fig. 19-A, C, 20). A stigma is not bifide but fusiform. An annular disc develops as high as calyx-lobes. There are small raphides aggregated together in the uppermost level of an ovary, in disc, and in small number in placenta (Fig. 19-B).

![Fig. 19. Flower of Coptosopelta diffusa. A. Cross section at upper half of ovary where a few bundles remain in septa after departure of placenta bundles and many small disc bundles are observed in inner portion of periphery (×27). B. Small raphides (×533). C. Longitudinal section of ovary showing placenta bundle (arrow), placenta and ovules (×50).](image-url)
In a receptacle a vascular cylinder divides two dorsal bundles and ten bundles which run up in the periphery of an ovary. Among the latter bundles, each of the alternative five forks two in the upper half where placenta bundles enter into placenta (Fig. 19-A, C, 20). The outer bundle is a median calyx one. The inner one runs up a stamen giving off disc bundles or rarely not. Each of the remaining five bundles also forks into two at the uppermost level, where dorsal bundles move inward. The outer small bundle supplies a calyx and divides into two lateral bundles at the base of a calyx-tube. The inner large bundle supplies a corolla. All the ten bundles in periphery except dorsal bundles give off branches throughout the levels of an ovary. Among these bundles, most of them branch and fuse with each other and sometimes form simple reticulum in periphery as observed in fruit.

Among the bundles remaining in the center of receptacle, most of the bundles run up in the center of septa where these bundles gradually fuse to form a linear bundle until at middle level, though a few bundles pass the inner portion of periphery. These bundles seems to be disc bundle. In addition, a bundle runs up in the middle portion of septum and ends blindly at the middle level of an ovary. In the upper half of an ovary the linear bundle divides into two placenta ones and two small ones. After the departure of the bundles to placentae, the latter bundles continue slightly upward to the uppermost level of loculi where disc bundle begins to move inward (Fig. 19-A). At this level the bundles in septa either are anastomosed by a disc bundle or end blindly.

Taxonomical comments—The Rhondeletieae are distinguished from the Cinchoneae practically by the absence of the wing of seed and horizontal ovules. As recognized by BREMEKAMP (1934) both the tribes may also be different in the shape and size of ovary and fruit. In Wendlandia the wing of seed develops weakly, or distinctly as in W. formosana. The horizontal ovules occur in Rhondeletia and Coptosapelta, and in Wendlandia the ovules are regarded as vertical. These genera are similar to each other in the floral anatomical features as follows: swollen placenta, many ovules, the presence and distribution of tannin cells in an ovary, and showing a tendency that the bundles supplying calyx, corolla, stamens, disc, and style separate to each other in the periphery of an ovary. From these respects, the Rhondeletieae and the Cinchoneae resemble each other, if Coptosapelta were regarded as typical for Cinchoneae. BREMEKAMP noted that Coptosapelta ought to be transferred from Cinchoneae to its own tribe next to Ixoreae.
Reference


摘要 ベニマツリ属のベニマツリ属とアクアミズキ属およびキナノキ属のヒョウタンカズラ属の3属3種の花の内部形態を観察した。各属の花における管束走行は図16、18、および20に要約される。これら3属は花柄の管束走行、胎座への管束の入り方、花弁やがく管束などで違いは認められるが、次のような形質で互に似ている：発達した胎座、多数の胚珠、タンニン細胞の存在、花の各部へ入る管束が子房周辺部において互に離れている傾向を示すことなど。

BREMEKAMPによるヒョウタンカズラ属はいわゆるIxoroid受粉機構をもつこと、葉間托葉は単純なこと、花冠裂片が回転状に閉じていることなどからキナノキ属として独立させ、サンダカ属の近くに置いた方が良いという。VERDROUガモ花の類似性や針状結晶の存在からBREMEKAMPの意見に賛成している。またヒョウタンカズラの胚珠は垂平で、上向性胚珠をもつキナノキ属の他とは異なる。一方アクアミズキ属は仮向性の胚珠をもつことや種子の翼が弱く発達するものからキナノキ類の両端に長く伸長したもの（たとえばアクアミズキ）であり、ベニマツリ属よりむしろキナノキ類に近縁なように見える。またベニマツリ属は2〜3の属を除いて総て熱帯アメリカに分布していて、分野からもアクアミズキ属の所属に疑問がある。

アクアネの虫媒花 The gall flower of Rubia akane

アクアネは秋に多数の小花をつける植物であるが、小花にまじって大型のずんぐりした花が散在していることが多い。小型の正常な花では子房は直径、長さとも約1mm、花冠は直径4〜5mmである。一方大型の花は子房、花冠とも3倍ほどの大きさである。花冠は質厚く閉じたままで、やがて黒ずんで枯れようになって子房から落ちる。この花冠の中には体長約2mmの淡黄色をした幼虫が寄生している。神戸大学農学部奥谷志一教授に同調をお願いしたが、普通果実に寄生するミベエの一種であるとのことであった。虫満花の花粉や雄性は被られた様子はないので、花盤から分泌される蜜を吸っていると考えられる。なお幼虫は花冠とともに落ち土の中で越冬するという。子房に寄生する例があるが、このように花冠の中におさまり蜜を吸っている例は珍らしいだろう。虫満花の子房は直径3mmほどになり一見ソクズの花序にみられる腺体のようにみえるが、正常な若実にくらべ子房壁が厚くなっているのに対し胚珠や胎座の発達は悪い。

野外で観察していると多くの個体に虫満花があるが、全くない個体群もある。現状で調べたが虫満花のつくアクアネは日本と朝鮮産のものだけであった。またアクアネ属、オオキタソウなどアクネ属の他の種にはみられない。（福岡誠行）