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Ovary structure of the genus *Gyrogyne* (Gesneriaceae, Epithemateae)

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Abstract. The anatomical re-investigation of the ovary in the holotype of *Gyrogyne subaequifolia* W.T.Wang is carried out in order to clarify the ovarian structure of the genus *Gyrogyne* W.T.Wang (Gesneriaceae), a seemingly unusual ovarian structure according to its original description. The present anatomical re-investigation reveals that the ovary is, in fact, bilocular with a swollen axile placenta in the centre, that is, the median area of the membranous septum. The ovarian structure of *G. subaequifolia* shows, thus, a common feature frequently observed in the ovaries of Gesneriaceae rather than a unique ovarian characteristic that contributes to the family Gesneriaceae. The systematic placement of *Gyrogyne* and the relationship between *Gyrogyne* and allies are discussed.

Introduction

The monospecific genus *Gyrogyne* W.T.Wang (Gesneriaceae) endemic to China was established on the basis of the only species, *G. subaequifolia* W.T.Wang, described at the same time (Wang 1981). In the original description, the author noted that this species had a very curious unilocular ovary with two parietal placentae projecting together from one place on the ovary wall into the locule (Wang 1981). This type of ovary and placentation constituted a new ovarian characteristic in the family Gesneriaceae (Wang 1981). This poorly known species was originally described on the basis of only two specimens (Wang 1981). Since then, additional field collections have been examined by the author several times without success. Recently, the author made a further detailed anatomical re-investigation on the ovary of the holotype of this species. The systematic placement of *Gyrogyne* and phylogenetic relationship between *Gyrogyne* and allies will be discussed on the basis of the anatomical re-investigation, together with comparative data.

Materials and methods

Flowers were taken from the holotype specimens of *G. subaequifolia* W.T.Wang. (Y. Z. Huang 3-22094, Herbarium Institute of Medicine and Pharmacy Guangxi, China). The flowers were boiled in water for several hours. After dehydration in an ethanol series, they were embedded in paraffin. Consecutive microtome sections were cut to a thickness of 6–8 μm and stained with safranin (0.5% in 50% ethanol) and fast green (1% in 95% ethanol). Photographs were taken with Shanghai GP3-100, PAN film using a photomicroscope (Leitz Orthoplan).

Results

The transections at the basal part of the ovary are not clear, for the flower is very depressed (not shown). Upward from the lower part, the structure of the ovary gradually becomes visible. The ovary is divided into two locules by a membranous septum with a swollen axile placenta in the centre, that is, the median area of the septum (Fig. 1). The membranous septum is almost broken on the right side (between the swollen median area and the right side of the ovarian wall) owing to the septum being too thin to endure the prolonged boiling (Fig. 1). In the middle part of the ovary, the membranous septum is continuous on both sides (Fig. 2). Numerous ovules born along the margin of the swollen axile placenta are faintly visible (Fig. 2). In the upper part of the ovary, the placental column degenerates to be divided into two parts in each locule (Fig. 3). The two parts are adjoined together to the almost discontinuous median area of the septum (Fig. 3). Further upward, the median area becomes discontinuous in the septum (Fig. 4). At the junction of ovary and style, transmitting tissue can be faintly observed in the centre of the transection (Fig. 5).

Discussion

The monospecific genus *Gyrogyne* was placed in the tribe Epithemateae when established by Wang (1981). In the original description of the species *G. subaequifolia*, Wang (1981) described its ovary as unusually unilocular with two parietal placentae projecting together from one place on the ovary wall into the locule. In Gesneriaceae, the syncarpous

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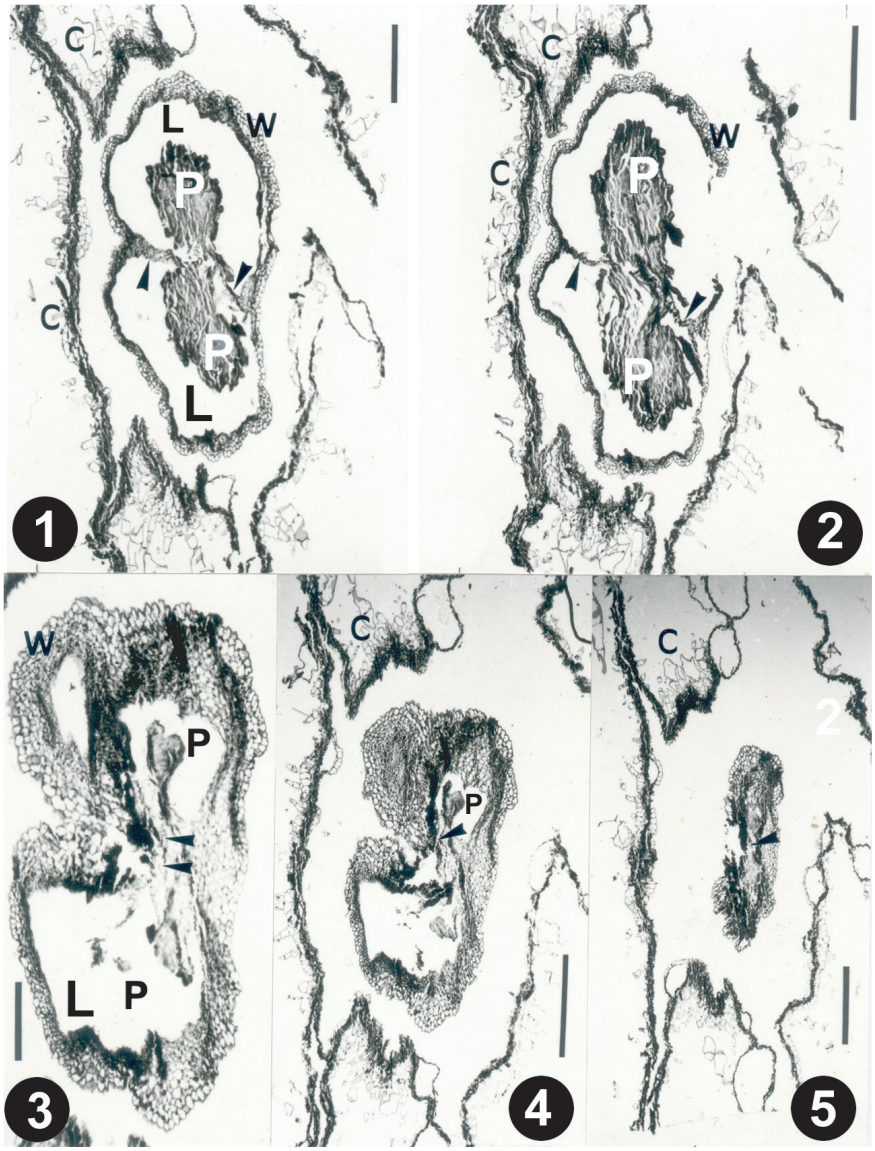

Figs 1–5. Transections of the ovary of *G. subaequifolia*. Abbreviations: C, calyx lobe; W, ovarian wall; L, locule; P, placenta. **Figs 1, 2.** Bilocular ovary with swollen axile placenta from the lower to middle part, surrounded by plicated calyx lobes (C). **Fig. 1.** Lower part of ovary, note the membranous septum (arrowheads), of which the septum on the right side is almost broken. **Fig. 2.** Middle part of ovary, showing that the membranous septum (arrowheads) is continuous on both sides. **Figs 3, 4.** Upper parts of ovary, showing the placental column degenerated to two pairs of placentas in the ovary. **Fig. 3.** Upper part of ovary, showing two pairs of placentas adjoined together to the median area of the septum where the septum is almost discontinuous (arrowheads). **Fig. 4.** Part further up the ovary, showing that the median area of the septum becomes discontinuous (arrowhead). **Fig. 5.** Transection at the juncture of the ovary and style, filled with transmitting tissue in the centre (arrowhead).

gynoecium consists of two carpels. Ovaries in most groups of the family are basically unilocular with two opposite parietal placentae (Weber 1971). However, there exists conspicuous variation in the proportions of their bilocular (syncarpous) and unilocular (paracarpous) regions in the ovaries of these groups (Weber 1971; Wang *et al.* 1997; Yin-Zheng Wang unpublished data). On the contrary, ovaries in some groups are completely bilocular with an axile placenta in the centre, such as those of *Whytockia* and *Monophyllaea* in the tribe Epithemateae (Weber 1976; Burtt 1978; Wang and Pan 1998; Wang *et al.* 2002). The number of ovarian locules is related to the different degrees of the carpellary closure in varied groups or in different regions of an ovary (Weber 1971; Wang *et al.* 1997, 2002; Yin-Zheng Wang unpublished data). That is to say, the bilocular ovary with an axile placenta in the centre or two opposite parietal

placentae in the unilocular ovary corresponds to the bicarpellate condition of the syncarpous gynoecium in Gesneriaceae. Therefore, it is impossible that a unilocular ovary has two parietal placentae projecting together from one place on the ovary wall into the locule in a bicarpellate gynoecium unless in an apocarpous gynoecium. Even though the microtome sections look poor because of the unavailability of better material, the present anatomical re-investigation provides one important piece of information about the ovary of *Gyrogyne*. Its ovary is in fact bilocular with a swollen axile placenta in the centre, that is, the median area of the membranous septum. The original description apparently comes from an inaccurate observation on the greatly depressed flowers of the dried specimens, in which the membranous septum cannot be easily detected. Thus, the ovary of *G. subaequifolia* shows a common feature frequently observed in the ovaries of members of the families Gesneriaceae and Scrophulariaceae rather than a new ovarian characteristic in the family Gesneriaceae as Wang (1981) suggested.

The relationship between Scrophulariaceae and Gesneriaceae is very close and at times the two families are not clearly separable (Li 1948; Burtt 1954, 1962, 1965). The traditionally applied distinction is mainly based on the number of the ovarian locules (Li 1948; Burtt 1954, 1962; Chin 1979). However, detailed comparative and developmental research in the gynoecium shows that conspicuous variation in the proportions of bilocular and unilocular regions in ovaries is frequently observed in both Scrophulariaceae and Gesneriaceae (Hartl 1956; Weber 1971; Kampny and Canne-Hilliker 1987; Wang *et al.* 1997, 2002; Wang and Pan 1998). In addition, in the tribe Epithemateae *Monophyllaea* and *Whytockia* have a typical axile placentation with a bilocular ovary and there is no doubt that they are members of Gesneriaceae, tribe Epithemateae (Weber 1976; Burtt 1978; Wang and Pan 1998; Wang *et al.* 2002; Mayer *et al.* 2003). Within Epithemateae, Wang (1981) placed *Gyrogyne* next to *Stauranthera*, because only these two genera have the plicate calyx in the tribe. However, the ovarian structure of the genus *Gyrogyne* is related to that of *Monophyllaea* and *Whytockia* (Weber, 1976; Wang and Pan 1998; Wang *et al.* 2002). In addition, *Gyrogyne* is also similar to *Cyrtandromoea* in equal or subequal opposite leaves and the ovarian structure (Burtt 1965). *Cyrtandromoea* has been frequently shuttled between Scrophulariaceae and Gesneriaceae (Burtt 1962, 1965; Ivanina 1965; Singh and Jain 1978). The cladistic analysis based on *ndh*F sequence data support placement of *Cyrtandromoea* in the tribe Epithemateae (Smith *et al.* 1997). However, it was not taken into account in the phylogenetic analysis of the tribe Epithemateae based on sequence data of cpDNA *rbc*L/*atp*B-spacer and *trn*L–F intron spacer (Mayer *et al.* 2003). The systematic position of *Cyrtandromoea* is still somewhat in doubt. It is regrettable that the genus *Gyrogyne* is not included in the cpDNA sequence data in Mayer *et al.* (2003) owing to the lack of adequate material. From the above data, the author suggests that the genus *Gyrogyne* should be temporarily retained in the tribe Epithemateae in the family Gesneriaceae. Further research on fresh material is urgently needed to properly determine the systematic position of the genus *Gyrogyne*.

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