A NEW HYDRANGEA FROM MEXICO

LORIN I. NEVLING, JR., AND ARTURO GÓMEZ-POMPA

THE GENUS *Hydrangea* is familar to both layman and scientist primarily through species which have ornamental value. Since the species most widely cultivated are shrubby, with the exception of the spectacular climbing *H. anomala* D. Don, and usually have been selected for inflorescences bearing large numbers of sterile flowers, one tends to have a distorted impression of the genus as a whole. In the recent monograph by Elizabeth McClintock (1957) two sections were recognized: HYDRANGEA and CORNIDIA, containing 11 and 12 species respectively. Section HYDRANGEA includes most of the cultivated species, all of which are shrubs, excepting *H. anomala*. Two species of this group, *H. arborescens* L. and *H. quercifolia* Bartram, are native to the southeastern United States, the remainder are Asiatic. In contrast, species of section CORNIDIA seem to be more flexible in growth form with many species occurring both as shrubs and climbers, depending on circumstances of position and, perhaps, age. The normal mature form, however, is a root climber. The species of this section are native to the New World, excepting *H. integrifolia* Hayata of Formosa and the Philippines. Thus 13 of 23 species are climbers.

In this paper a new climbing species of section CORNIDIA is described as *Hydrangea nebulicola* (FIGS. 1 and 2). It was discovered in the deciduous liquidambar-oak forest of the Sierra de Chiconquiaco north of Jalapa, Veracruz, México. This zone can be characterized floristically by the abundance of individuals of *Alnus, Clethra, Cyathea, Hedyosmum, Liquidambar, Magnolia, Meliosma, Podocarpus*, and *Quercus* (see Gómez-Pompa, 1966). The climate in this region is temperate due to altitude (ca. 1500 m.) and extremely humid, not only because of high rainfall (250–300 cm. annually), but also because of the many clouds which sweep through the forest. It is difficult to determine the temperature in this zone exactly. However, from data obtained from a climatological station nearby (Naolinco, Ver.) we are able to give a mean temperature of between 17° and 18° C. The coldest month is January with an average of 12° to 14° C, the extreme minimum temperatures during this period being some degrees below 0° C. The topography is rather rugged with slopes of 10 to 40 percent. The soil, which is derived from volcanic rock, contains abundant organic matter. The new species is abundant only locally, and it possesses several characteristics which we believe to be of important evolutionary significance within the genus and which mark it as a very specialized member of section CORNIDIA. One of the most interesting aspects of this species is its vegetative reproduction. We believe that this type of reproduction has an adaptive value sufficient for the species even though the scarcity of individuals is notable. Several trips have been made without

FIG. 1. *Hydrangea nebulicola.* (*Gómez-Pompa 1541*). Flowering branch with details of inflorescence and pubescence of lower leaf-surface.

success to search for pistillate specimens. All that we have observed is that the flowering of the species is rare although it may continue over several months. With these considerations in mind and the realization that the species is both rare and dioecious we can understand the importance of vegetative reproduction and its rôle in survival.

In climbing species of this genus, three kinds of shoots are generally found: juvenile, found only in young plants; the terminal one, which functions as a climbing shoot; and the lateral shoot, which supports the reproductive functions and the primary photosynthetic activity. When a tree is the substrate the climbing often is restricted to a single individual. In this new *Hydrangea* several deviations from the general ground plan just mentioned are to be found. Although no juvenile plants were located in spite of a careful search, a fourth type of shoot bearing a marked re-

FIG. 2. Flowering branch of *Hydrangea nebulicola* showing paired inflorescences at anthesis and young inflorescences enclosed by cucullate bracts. Photograph from *Nevling & Gómez-Pompa 39*.

semblance to juvenile shoots was found. These, termed runner-shoots, were discovered along the forest floor, sometimes covered by leaf-litter. They permit a single plant to climb several individual trees simultaneously. Runner-shoots (FIG. 3) were quite common and are characterized morphologically by reduced bract-like deciduous leaves and adventitious roots on the lower and lateral surfaces, similar in external appearance to those found in *Hedera helix* L. These peculiar shoots seem to be selective as to the substrate tree, for they were found ascending only relatively mature tree trunks, although no selection as to substrate species is obvious. As a runner-shoot begins an ascent the reduced leaves become larger with a few marginal serrations above the middle of the lamina but very soon become similar to the mature leaf in form and size. The climbing shoot (FIG. 3) is characterized by a very marked unequal production of secondary xylem, the mass of the new wood being produced in the direction of the substrate. This apparently permits the continuing production of the adventitious roots necessary for attachment to the substrate. It is believed that detailed comparison of the wood anatomy of climbing *vs.* non-climbing species of *Hydrangea* might prove useful in the determination of evolutionary direction within the genus.

The inflorescences of species of *Hydrangea* are marked by having either monomorphic or dimorphic flowers. These two conditions are denoted by students of the genus as fertile and sterile flowers: fertile flowers being bisexual with androecium and gynoecium normally developed; sterile

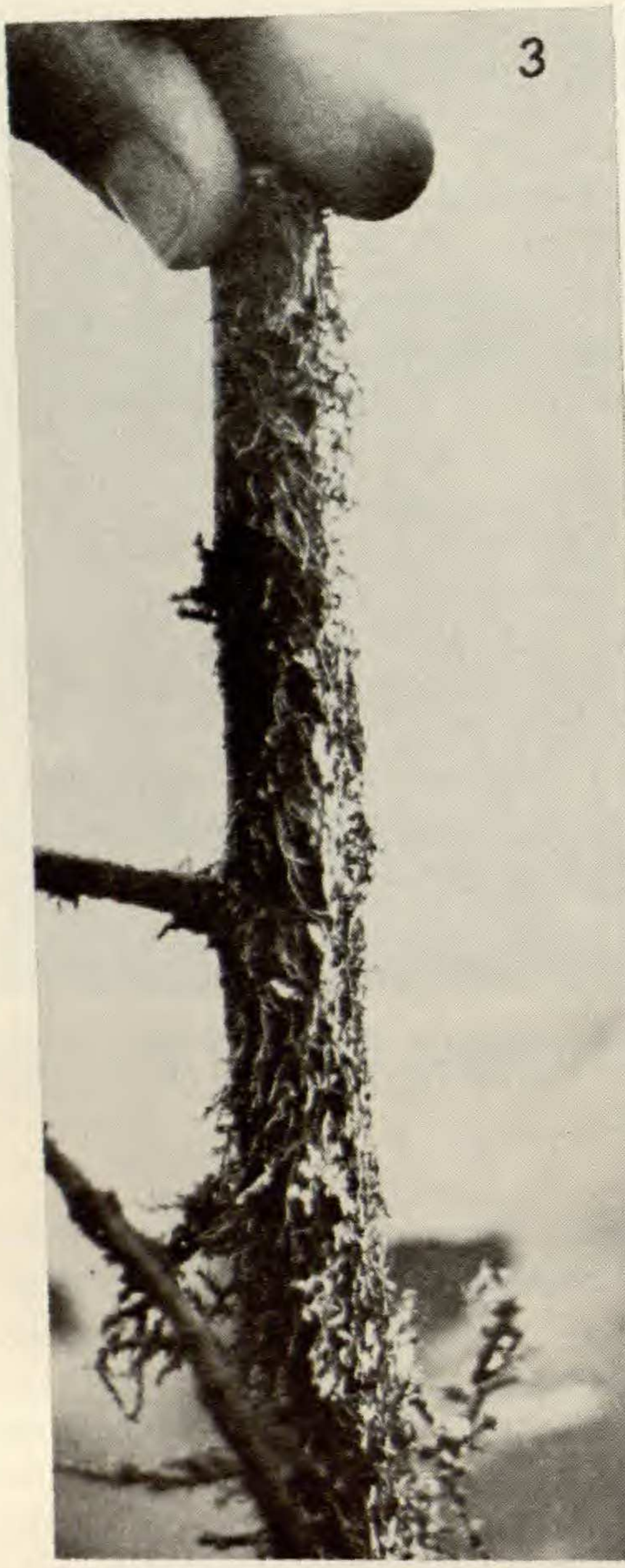


FIG. 3. Young climbing shoot of *Hydrangea nebulicola* showing side normally appressed to substrate. Note adventitious roots and lateral branches, × approximately 3/4.

FIG. 4. Apex of runner-shoot of *Hydrangea nebulicola* showing reduced bract-like leaves, approximately natural size.

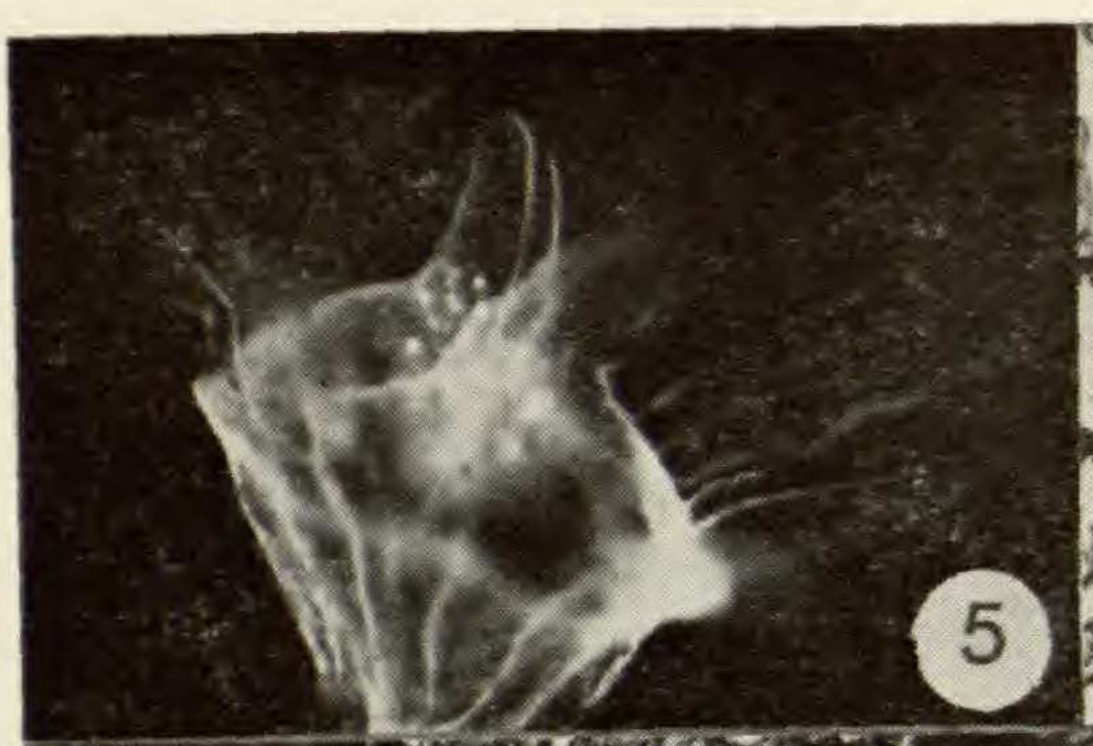
flowers having neither androecium nor gynoecium normally developed but with the calyx lobes becoming greatly enlarged and showy. An intermediate type with enlarged calyx lobes and functional reproductive organs is found in *H. scandens* (L.f.) Seringe. The inflorescence in this species also contains "normal" fertile flowers. Inflorescences containing both fertile and sterile flowers generally are considered more specialized than those composed of fertile flowers only. The addition of sterile flowers or the conversion of fertile flowers to sterile ones probably is related to increased efficiency in terms of insect attraction. Although in some species such

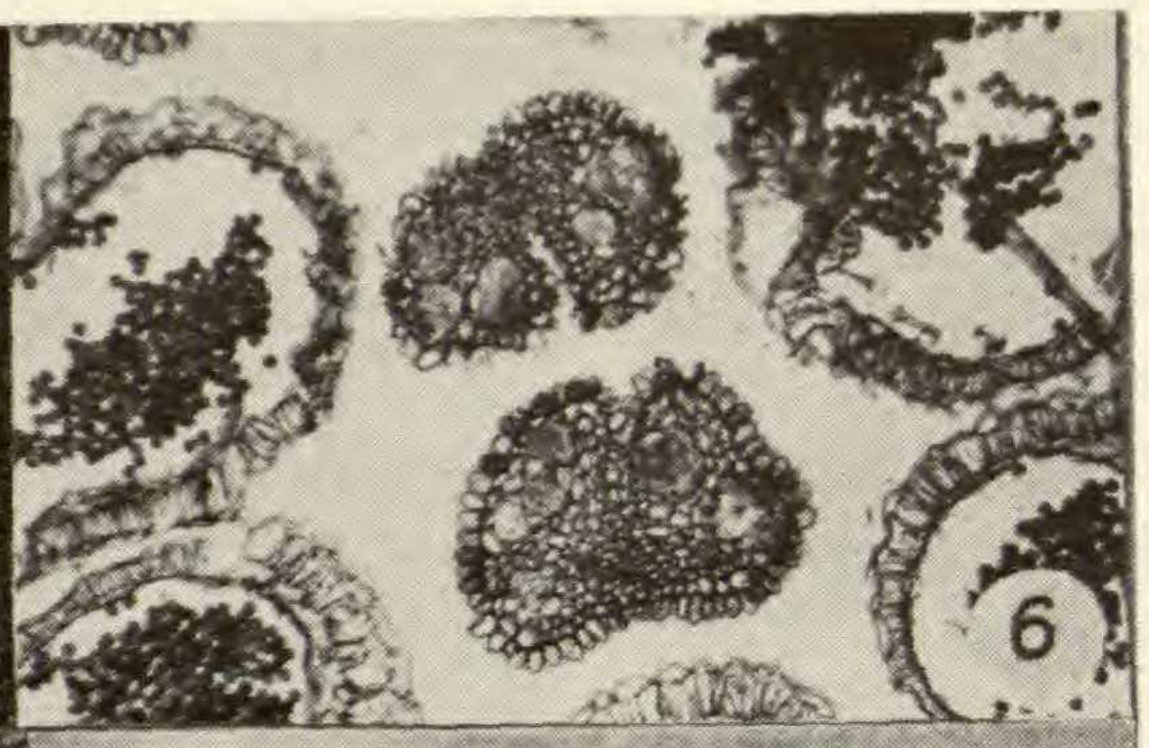
as *H. anomala* D. Don the number of sterile flowers per inflorescence varies somewhat from year to year, the presence or absence of sterile flowers appears to be a relatively reliable taxonomic character. Two notable exceptions are *H. arborescens* L. and *H. scandens* in which considerable variability occurs.

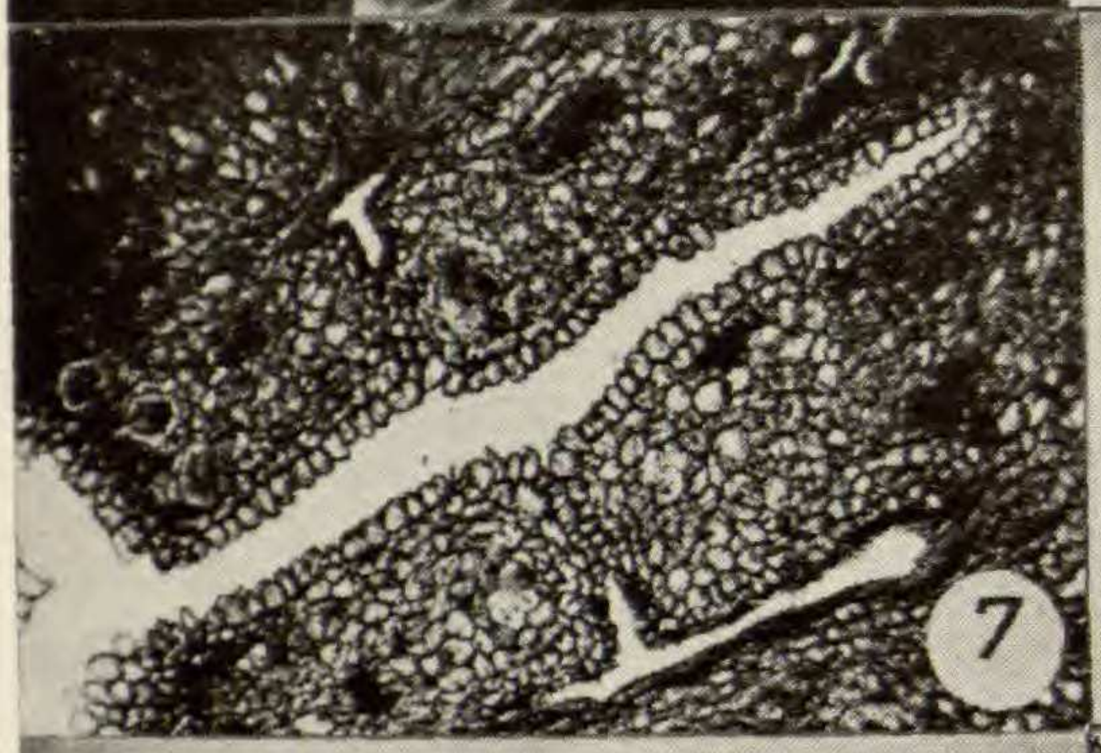
In *Hydrangea nebulicola* another floral condition is present: the inflorescences contain only fertile flowers which appear to be functionally unisexual. In our field studies one mature plant has been observed to be staminate through two flowering cycles and for this reason we are inclined to believe that the plants are dioecious rather than monoecious. Although McClintock has suggested proterandry for *H. serratifolia* (Hook. & Arn.) Phil. f., we do not make a similar interpretation for *H. nebulicola*. In the flowers examined, pollen stainability with cotton blue in lactophenol is approximately 98 percent and all grains appear to be properly formed. Ovules have not been observed and the sterile placentae are enlarged, filling the locule, and leaving little room for ovule development. In addition, no discernible stigmatic surface was found on the styles. Curiously, the placentation at the base of the ovary is of the axile type noted by McClintock but the massive central trace divides almost immediately into two smaller traces which supply the two large parietal placentae, the ovary being bicarpellate and uniloculate (FIGS. 5–12). Near the apex of the ovary the two placentae divide so that the two carpels are open and their margins free from one another. At the roof of the hypanthium the carpels are open (the opening in the form of a linear slit). It is at such a minute opening that the terminal poricidal dehiscence of *Hydrangea* fruits takes place in other species. The two styles reflect the open condition by being obviously grooved nearly to their apices. Unfortunately, it must be recalled that the situation described applies only to staminate flowers and confirmation must await discovery of pistillate flowers (although in the bisexually flowered *H. arborescens* the placental configuration is identical with that of *H. nebulicola*). If we are correct in our interpretation of sexual dimorphism in this species, the pistillate flowers should have smaller petals, shorter stamens, no stainable pollen, longer styles, papillate stigmatic surfaces, and many ovules borne on parietal placentae.

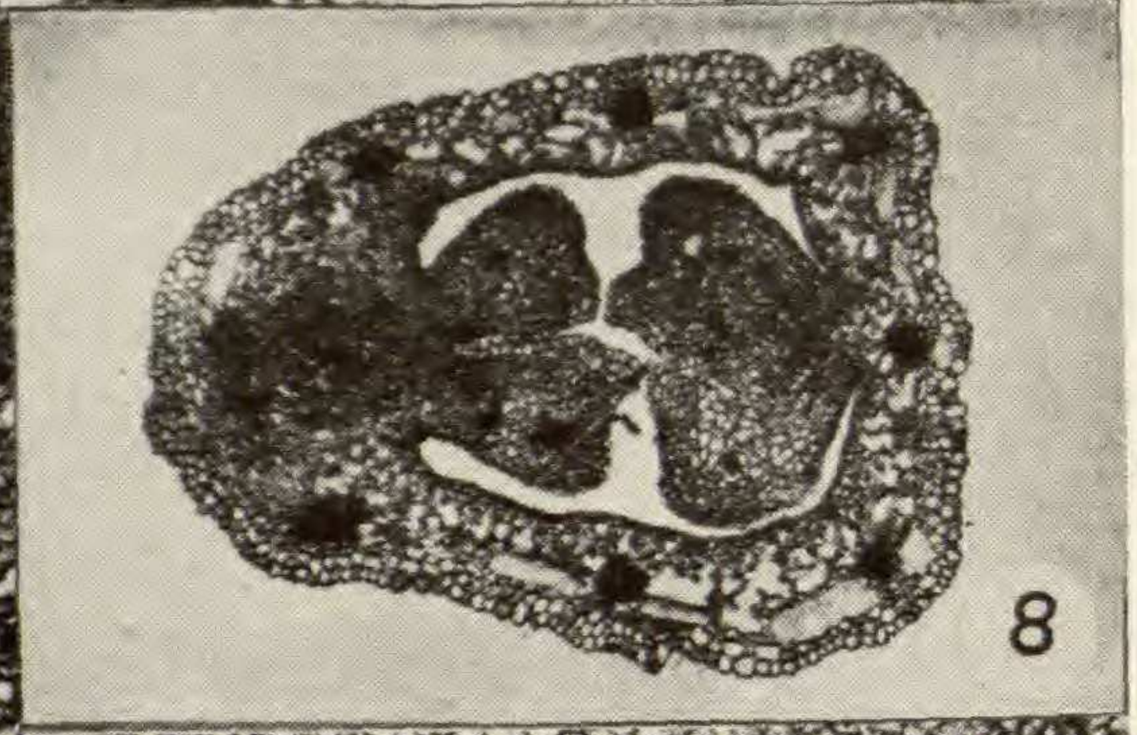
The evolutionary significance of the "advancement" of bisexual flowers to unisexual ones is difficult to estimate in *Hydrangea* because of the few floral characteristics in which the species vary and the small degree of the variation. The recognition of sexual differences among fertile flowers may be helpful in defining evolutionary pathways. Solely on the basis of the unisexuality of the flowers, *H. nebulicola* would seem to be a specialized member of section CORNIDIA which is in turn more advanced than section HYDRANGEA.

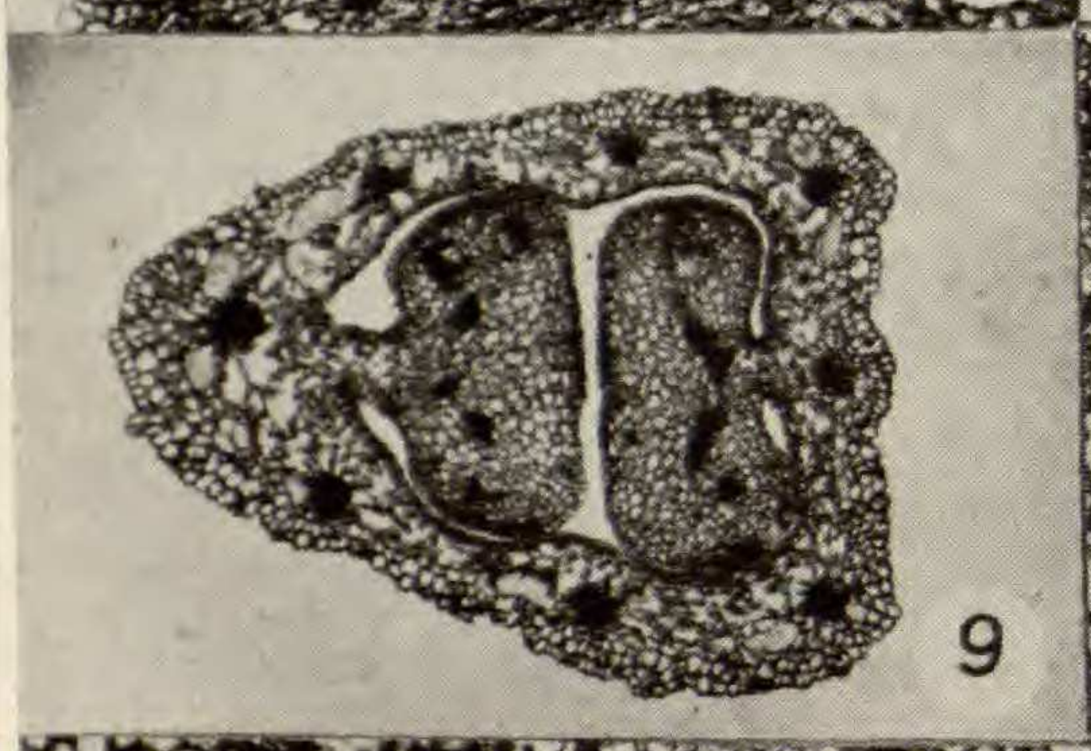
A case of sexual dimorphism similar (but not precisely identical because of the presence of sterile flowers) to that just described appears to be found in *Hydrangea oerstedii* Briquet and *H. peruviana* Moricand. The characters which McClintock employs in her key to *Hydrangea* to dis-

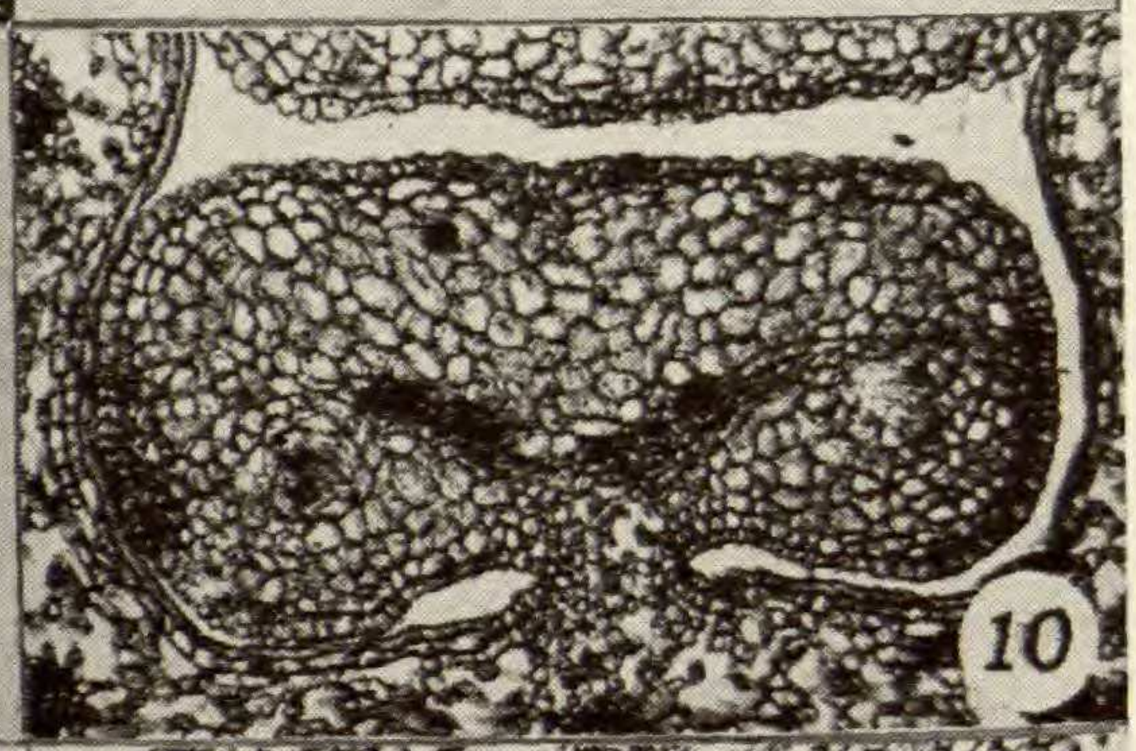


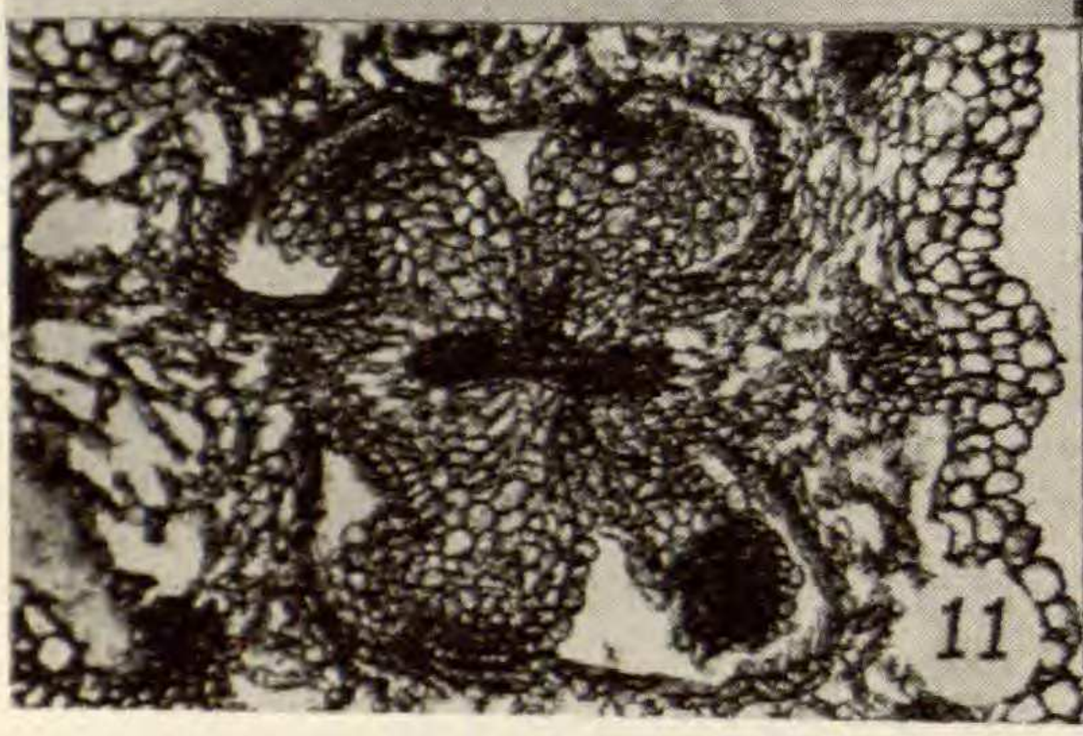


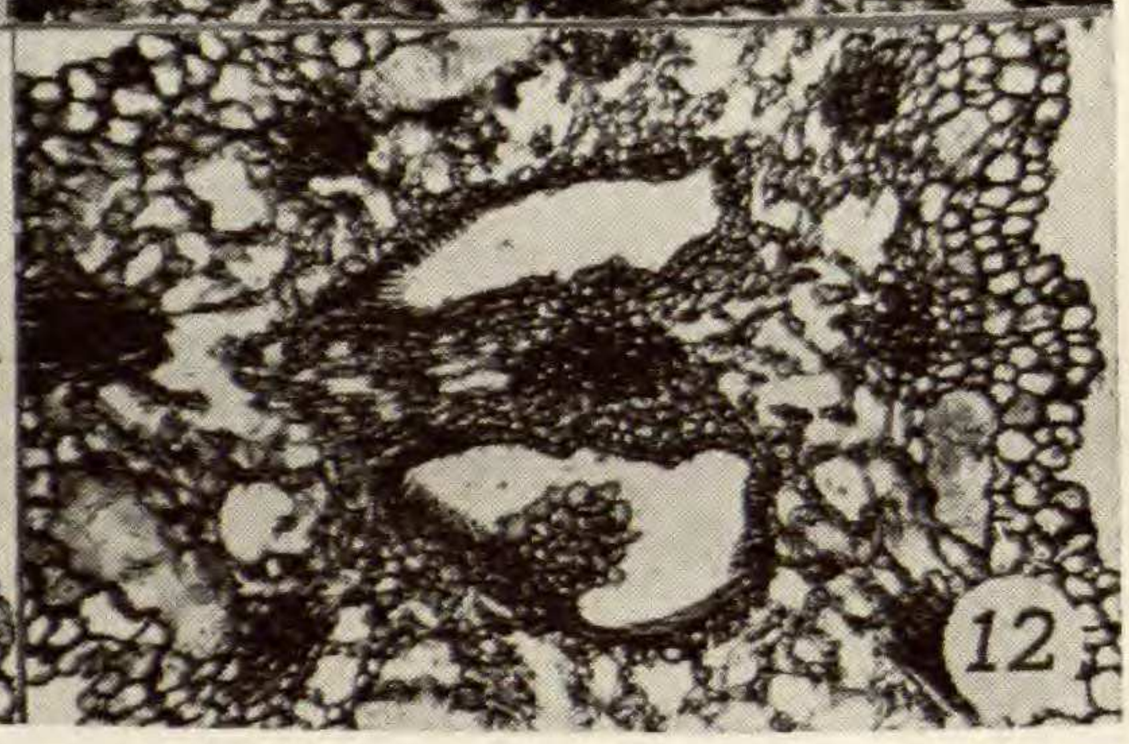












FIGS. 5–12. *Hydrangea nebulicola* (*Nevling & Gómez-Pompa 39*). FIG. 5. Cleared flower showing grooved style, × 20. FIGS. 6–12. Transverse sections of flower. FIG. 6. Section at level through style apices, note grooves, × ca. 58. FIG. 7. Section at level of hypanthium roof showing open carpels and stylar canals, × ca. 58. FIG. 8. Section of ovary immediately below hypanthium roof showing free margins of placentae, × ca. 25. FIG. 9. Section at mid-ovary showing the large, sterile, parietal placentae, × ca. 25. FIG. 10. Magnification of one placenta (inclined 90° from previous figure) showing vascularization and absence of ovules, × ca. 58. FIG. 11. Section at base of placentae. Note fusion of ventral traces with each carpel becoming closed, × ca. 58. FIG. 12. Section at base of ovary demonstrating bilocular condition and compound ventral trace, × ca. 58.

tinguish these species are (in part) the relative length of stamens and styles of fertile flowers. In *H. oerstedii* the stamens are 2–4.5 mm. long and the styles are 0.3–1 mm. long, while in *H. peruviana* they are 0.4–1.6 mm. long and 1–2 mm. long, respectively. McClintock suggests in her discussion that the two may represent two forms of a dimorphic species. It is our suggestion that these two species do reflect two sexual forms of the same species. In addition to the larger stamens in *H. oerstedii* is accompanying high pollen stainability (with cotton blue in lactophenol). The short-styled flowers lack both papillate stigmatic surface and functional ovules. In *H. peruviana* the short stamens have no stainable pollen, although the anthers appear reasonably well formed. The long-styled flowers have a papillate stigmatic surface and produce many well-developed ovules. The vegetative morphology and geographic distribution present no great difficulty in the interpretation of these two taxa as functionally staminate and functionally pistillate components of the same species.

Hydrangea nebulicola Nevl. & Gómez-Pompa, sp. nov.

Planta fruticosa scandens ad 30 m. alta, sempervirens; ramuli ferruginei, glabriusculi. Folia simplicia, opposita, elliptica, 7–16 cm. longa, 4–9 cm. lata, apice acuminata, basi cuneata, coriacea, pubescentia pilis stellatis, 6–8-nervia; petioli 1–4 cm. longi. Inflorescentia in umbellis oppositis, 5–10 cm. in diametro, omnino velutina; flores steriles 0. Bracteae cucullatae, 1.5–3 cm. longae et latae. Flores ♂: hypanthia turbinata, 1–1.25 cm. longa, 1.5 mm. in diametro; petala 4, alba, ovata, 2–2.5 mm. longa, 1.25–2 mm. lata, caduca; stamina 8 vel 9, libera, quam petala longiora; filamenta 2–2.5 mm. longa; antherae oblongae; pistillum 2-carpellatum, ovulis 0; stylis effusis, ca. 0.5 mm. longis; stigmatibus 0. Flores ♀ et fructus non visi.

Powerful root climber, evergreen, to 20 cm. in diameter at the base, to 30 m. tall; bark of mature trunk gray, smooth and non-peeling; young shoots stout, tomentose, the trichomes stellate but often only the basal stalk persistent and then appearing simple, ferrugineous. Leaves simple, opposite, coriaceous, broadly elliptic, 7–16 cm. long, 4–9 cm. broad, acuminate at the apex, more or less cuneate at the base, sparsely ferrugineous-pubescent to glabrescent above, moderately ferrugineous-pubescent beneath, the midrib plane above, emersed beneath, the primary lateral veins 6–8 pairs, slightly arcuate, the margin entire; petiole 1–4 cm. long. Inflorescences borne in opposite axillary pairs near the apex of lateral (non-climbing) shoots, the axillary shoots 3–7 cm. long, ferrugineously felted, the inflorescences compound, umbelliform, 5–10 cm. in diameter, enclosed in bud by cucullate bracts, the bracts nearly orbicular, 1.5–3 cm. long and broad, chartaceous, pubescent, caducous. Sterile flowers absent. Fertile flowers unisexual by abortion, plants functionally dioecious (?). Staminate flowers: creamy white, glabrous throughout; pedicel ca. 2.5 mm. long; hypanthium turbinate, 1–1.25 mm. long, 1.5 mm. in diameter; calyx lobes

free, very shallowly deltate; petals 4, valvate, free, ovate, 2–2.5 mm. long, 1.25–2 mm. broad, caducous; stamens 8 or 9, free, the filaments folded in bud becoming erect at anthesis, the filaments 2–2.5 mm. long; anthers greatly exserted, oblong, ca. 2 mm. long, 1.5 mm. broad, basifixed, dehiscing by lateral slits; pistillode 2-carpellate, inferior, ovules 0, the 2 styles free, recurved, ca. 0.5 mm. long, slightly canaliculate, stigmatic surface not apparent. Pistillate flowers and fruit not seen.

México. VERACRUZ: región de Misantla, Sierra de Chiconquiaco y Misantla, a 1540 m. de altitud en bosque de encino-liquidambar, 9 de julio 1966, *A. Gómez-Pompa 1541* (holotype MEXU, isotype GH); *R. Hernandez M. 306* (MEXU), *Nevling & Gómez-Pompa 39* (GH, MEXU).

Although this new species is placed in section CORNIDIA without hesitation, its affinities with other species of the section are still uncertain. Prior to any speculation concerning affinities, the entire section should be reexamined in terms of problems of floral sexuality mentioned previously. In addition, there is at least one, possibly two, undescribed species of *Hydrangea* from Chiapas referable to this section. Until these species are studied, definitive placement seems fruitless.

BIBLIOGRAPHY

BURKETT, G. W. Anatomical studies within the genus *Hydrangea*. Proc. Indiana Acad. Sci. **41:** 83–95. 1932.

GÓMEZ-POMPA, A. Estúdios botánicos en la región de Misantla, Veracruz. Ed. del Inst. Méx. de Recursos Naturales Renovables, A.C. México, D.F. pp. 173. 1966.

MCCLINTOCK, E. The cultivated hydrangeas. Baileya **4:** 165–175. 1956.

———. Hydrangeas. Natl. Hort. Mag. **36:** 270–279. 1957.

———. A monograph of the genus *Hydrangea*. Proc. California Acad. Sci. **29:** 147–256. 1957.

NEVLING, L. I., JR. Climbing hydrangeas and their relatives. Arnoldia **24:** 17–39. 1964.

ARNOLD ARBORETUM AND GRAY HERBARIUM
CAMBRIDGE, MASSACHUSETTS

AND

INSTITUTO DE BIOLOGÍA
UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO
MÉXICO, D.F.