

## GONATANTHUS KLOTZSCH IN KHASI AND JAINTIA HILLS, ASSAM

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## A B S T R A C T

The genus *Gonatanthus* Klotz. including only two species, both occurring in K. & J. Hills, has been discussed after a detailed study of live plants and herbarium specimens. Apart from descriptions, and documentation of specimens, notes on variations and confusions in literature, are added, including a *de novo* description of the hitherto unknown spadix of *G. ornatus* Schott. The two species are illustrated with analytical drawings.

The genus *Gonatanthus* (Araceae) was founded by Klotzsch in 1841, on the basis of *Arum sarmentosum* of F. E. L. Fischer, published prior to 1839. Later four more species: *G. ornatus* Schott, *G. griffithii* Schott, *G. cuprus* Hort. ex G. Koch, and *G. peltatus* Hort. ex van Houtte, were described of which excepting for *G. ornatus* the rest were shown to belong to other allied genera. Currently, *Gonatanthus* includes only two species. Engler and Krause in their treatment of Araceae for the *Pflanzenreich*, in 1920, have dealt with these two species, with the nomenclatural change of the type species *G. sarmentosus* to *G. pumilus*, consequent on the taxonomic identity of *Caladium pumilum* D. Don of 1825.

While compiling data for Araceae as part of an account of several monocotyledonous families of Assam, we found that both *G. pumilus* & *G. ornatus* occur in the Khasi and Jaintia Hills. A review of literature and collections in our herbarium and at the Central National Herbarium, Calcutta, showed that while the type species is fairly well distributed and described, the second species was known only from Sikkim and Khasi hills and from scanty leaf material only, the flowering phase remaining unknown for more than a century. Since among the aroids generic distinction is based chiefly on floral details including placentation, Hooker's scepticism of the reference of *G. ornatus* to the genus was natural (*Fl. Brit. India* 6 : 522, 1893) and its generic affinity could not be settled until the flowering phase was discovered. Like in several other examples where we felt a detailed study of live population of plants would aid critical taxonomic decision and had gathered them in the experimental garden, we brought several plants of these two species also from the wild habitat in the experimental garden at 'Woodlands', Shillong. While *Gonatanthus pumi-*

*lus* is well-known and easily confidently gathered, we were more circumspecific in dealing with *G. ornatus*. The original description of Schott of the narrowly lanceolate-sagittate leaves with their lower surface coppery-purple between the green nerves and the broad green margins, made it easy to recognise the plants of *G. ornatus*. Since the authentic collections from the Khasi hills belonged to Hooker & Thomson, recourse was taken to the itinerary (June-October, 1850) and collection areas mentioned in the *Himalayan Journals* (2 : 1854) and the account, including its foot notes, was combed for any possible reference to these plants (not then named) which may lead to a specific locality. Study of authentic material used for the *Pflanzenreich* strengthened our notions of the leafy plant, but lacking as they did any field data, could not help with any lead to its classical locality. However, based on our study of the available herbarium material and circumstantial evidence pieced together from the rambling account of the *Himalayan Journal*, several undoubted plants of *G. ornatus* were collected from Mawphlong (28th August, 1966) and kept under observation in pots as well as in selected spots simulating the natural habitat, in 'Woodlands'.

In April 1968, two of these plants in the open, produced spadices directly from the corm, when they were devoid of leaves. A subsequent visit to the Mawphlong forest showed innumerable identical leafless spadices in various stages of maturity, produced in several spots of the dark, shady, humus-cushioned forest floor. A number of these spadix-bearing corms were gathered, studied in detail and planted in the 'Woodlands' experimental garden. In June, subsequent to the spadices developing into fruits from the same corms, thrust out the closely rolled lance-like young leaves, which

soon unfurled into the easily recognised, familiar arrow-shaped leaves with the coppery sheen on the under surface.

Parallel with these, a population of *G. pumilus* was also kept under observation and detailed study was made. This study has shown that *G. ornatus* is correctly placed under *Gonatanthus*. It has enabled drawing up of a detailed description of this species. Our observations have helped in compiling some additional notes on the type species, *G. pumilus*.

**Gonatanthus** Klotzsch in Link, Klotzsch et Otto Icon. Pl. Rar. Hort. Berol. 1: 33, t. 14, 1841 et 3: 14, 1844; Hook. f., Fl. Brit. India 6: 522, 1893; Krause in Engl. Pflreich. 71: 19, 1920. *Caladium* D. Don, Prodr. Fl. Nepal. 21, 1825. *Colocasia* Kunth, Enum. 3: 40, 1841, *p.p.*

Perennial, *monoecious* herbs. *Corm* subglobose with depressed top, sometimes bearing stolons, with or without bulbils. *Leaves* few, radical, simple, appearing along with or after spadices; petiole long, slender; lamina peltate, ovate-oblong or lanceolate, sagittate-cordate at base. *Peduncles* few, sheathed; sheaths few, outermost shortest, innermost longest. *Spathe* coriaceous, young fully convolute, mature partially opening; limb deciduous; tube accrescent over the infructescence. *Spadix* sessile or subsessile, shorter than the spathe, male and female floriferous zones widely separated by a neuter zone; male subcylindric or club-shaped; female subcylindric; appendage and perianth absent; synandria crowded, shortly stipitate, irregularly obconoid; stamens 2-3; connective thick; ovaries crowded, obovoid-subglobose, 1-celled (sometimes 2-3-celled at apex), placenta basal, ovules few to many; stigma sessile, capitate; neuters between male and female many, contiguous, narrow, compressed. *Berries* obovoid-subglobose.

Species 2. Type species—*Gonatanthus pumilus* (D. Don) Engler et Krause.

The spathe limb has been described earlier by Hooker (*l.c.*) and Krause (*l.c.*) as convolute, the former considering it to be characteristic in distinguishing it from the closely allied genus *Remusatia* Schott. Our observations reveal that in both the type species and the other one the spathe unrolls at maturity. Hooker (*l.c.*) has stated that there are no neuters between male and female inflorescences in the type species. Krause (*l.c.*) however, has described their presence. In both the species, we have observed a distinct zone of neuters.

#### KEY TO SPECIES

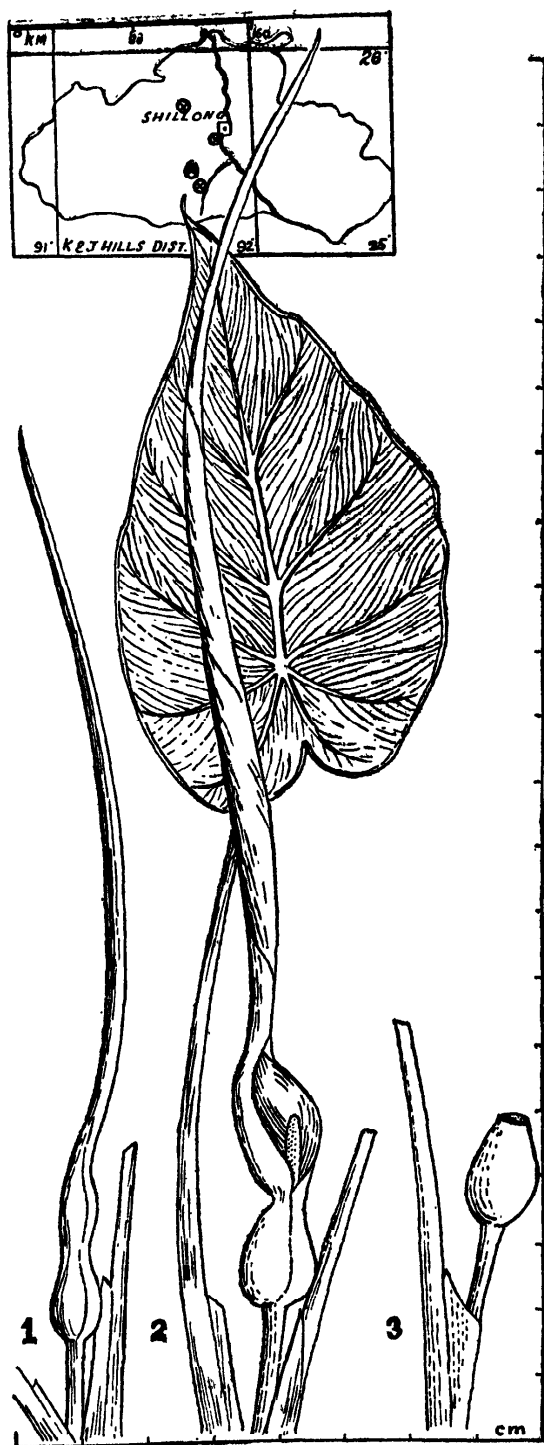
- |   |                   |
|---|-------------------|
| Leaves ovate or ovate-oblong, cuspidate-acute, glaucous beneath. Spadix appear <i>with</i> leaves. Spathe limb linear-lanceolate, 12-20 cm long, open like a dome, only at the base ... | <i>G. pumilus</i> |
| Leaves narrowly lanceolate, caudate-acuminate, bright purple beneath. Spadix appear <i>before</i> leaves. Spathe limb ovate, 2.7-5 cm long, unrolled almost all along its length ...    | <i>G. ornatus</i> |

**Gonatanthus pumilus** (D. Don) Engler et Krause in Engl. Pflreich. 71: 19, 1920. *Caladium pumilum* D. Don, Prodr. Fl. Nepal. 21, 1825. *Arum sarmentosum* F. E. L. Fischer, Hort. Petropol. 1835-38. *Colocasia pumila* Kunth, Enum. 3: 40, 1841. *G. sarmentosus* Klotzsch in Link, Klotzsch et Otto, Icon. Pl. Rar. Hort. Berol. 1: 33, 1841; Hook. f. Fl. Brit. India 6: 522, 1893.

Terrestrial or epiphytic. *Corm* .5-3 cm in diam., pale brown, topped with fibrous remains of sheaths; long slender stolons radiating from the corm top soon after flowering; stolons several, branched, more profusely in the terminal part, 20-40 cm long, ca 2 mm thick, reddish-brown, bearing few to clusters of bulbils at nodes; bulbils ovoid, scaly, 1-2 mm long; scales ending in 3-12 mm long filiform processes. *Leaves* 1-4, appearing along with spadices; petiole 6-43 cm long, 2-4 mm thick near base, suberect; lamina ovate or ovate-oblong, rarely lanceolate, cuspidate-acute, 6-26 cm long, 4-15 cm broad, undersurface usually glaucous but sometimes purplish when young; apical lobe 5-19 cm long, ca 1.2 times longer than broad; basal lobes rotundate, ca 2.5-3 times shorter than the apical one, connate to .5-8 its length. *Peduncles* 1-2, suberect, curving in fruits, 3-11 cm long, 2-3 mm thick. *Spathe* 13-21 cm long; tube globose-ovoid, 8-1.5 cm long, 5-10 mm wide, elongating to 2-4 cm in fruits, green; limb linear-lanceolate, flexuous, 12-20 cm long, green when young, yellow afterwards, with a basal swelling enclosing the male floriferous zone, which flares open on maturity, the rest completely rolled; swelling globose-ovoid, 1.2-2.5 cm. *Spadix* 2.5-4 cm long, male and female floriferous zones separated by a 7-12 mm long neuter zone; male cylindric, 1-2 cm long, 3-5 mm thick, creamy, turning purplish with age; female .5-1 cm long, 3-6 mm thick, green; synandria 1-2 mm long; ovaries ca 1 mm long, ovules many; neuters between male and female zones many, elongate, 1-2.5 mm long, white, (Figs. 1-3).

*Flowers*: May-July.

The mature spathe opens in the suprabasal



*Gonatanthus pumilus* (D. Don) Engler et Krause  
Figs. 1-3: 1. Young spadix. 2. Mature spadix with  
a leaf. 3. Inflorescence (A. S. Rao 35693).  
Map denotes colln. localities ⊕.

region. Spadix bears distinct neuters between the male and the female floral zones (see notes under the genus).

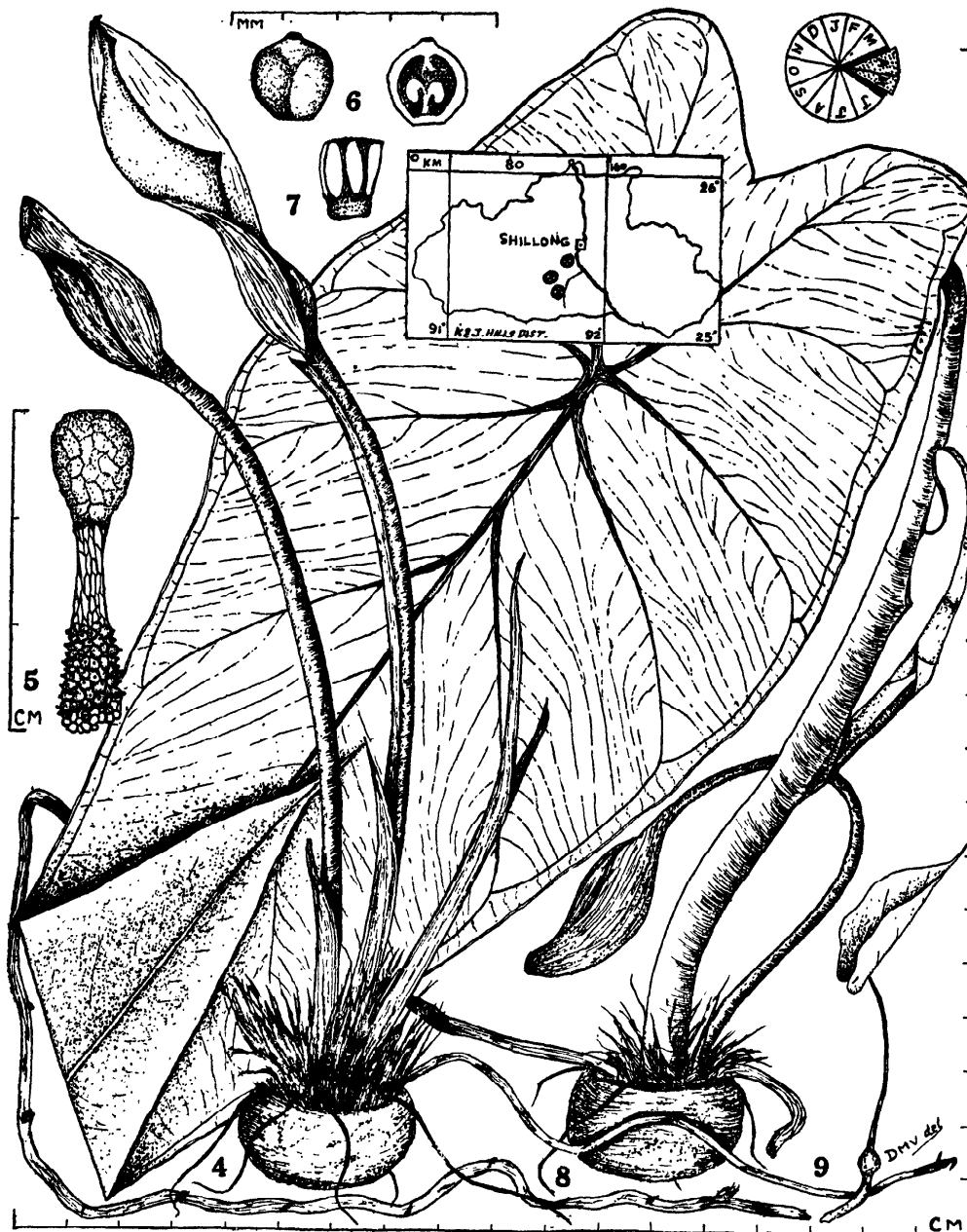
*Specimens examined*: INDIA: W. HIMALAYAS: Chamba State, Sao Valley, *Lace* 1214. Dalhousie, *Grant* s.n. (Acc. No. 496992). Dehra Dun, *Mackinnon* s.n. (Acc. Nos. 496993, 496994). Mussoorie, *King* s.n. (Acc. No. 496986); *Mackinnon* s.n. (Acc. No. 496995); *Anon.* s.n. (Acc. No. 496988). Kumaon, Basgaon, *Gill* 675. No precise locality, *King* s.n. (Acc. No. 496987); *Kurz* s.n. (Acc. No. 496991); *Anon.* s.n. (Acc. No. 496990) (CAL). EASTERN HIMALAYAS: Darjeeling, *Gamble* 9406. Kalimpong, *Ripley* 16 (CAL). Subansiri, *Kimin*, *Panigrahi* 19474. Nagaland, *Bor* 4481 (ASSAM). Khasi and Jaintia hills, Cherrapunji, *Burkill & Banerjee* 139, 35159 (CAL); G. K. *Deka* 12776, s.n. (Acc. Nos. 39828, 39829, 41891); *Naik* 19196; *Panigrahi* 3434; *Sharma* 16717 (ASSAM). Nongkhlaw, *Clarke* 44825 (CAL); *Panigrahi* 16217 (ASSAM). Serraim, G. K. *Deka* 9567 (ASSAM). Shillong, *Collett* s.n. (Acc. No. 497012) (CAL); G. K. *Deka* 22295; A. S. *Rao* 35693; *Verma* 35652 (ASSAM). No precise locality, *Kurz* s.n. (Acc. No. 497009); *Oldham* 8 (CAL). SIKKIM: Yakum, *Anderson* 1185. Great Rangiet, *Anderson* 1292. Guakabaree, *Kurz* s.n. (Acc. No. 496999). Namchi, W. W. *Smith* 2901. No precise locality, *Anon.* s.n. (Acc. No. 496996) (CAL). Sedonchen, R. S. *Rao* 1082, 1102 (ASSAM). BURMA: Kachin Hills, *Shaik Mokim* s.n. (Acc. No. 497005); Namloo, *Pottinger* s.n. (Acc. No. 497006). Myitkyina, Kinsa Yang to Lahok, *Rogers* 892 (CAL).

***Gonatanthus ornatus*** Schott in Osterr. Bot. Zeitschr. 8: 121, 1858 et Prodr. 143, 1860; Hook. f. Fl. Brit. India 6: 522, 1893; Krause in Engl. Pflreich. 71: 21, 1920.

Terrestrial, sometimes epiphytic. *Corm* 1-2 cm high, 1.5-3.5 cm broad, pale brown, sometimes purple-green tinged, topped with fibrous remains of sheaths; long slender stolons radiating from the corm top during vegetative phase and sometimes found during reproductive phase in a decayed state; stolons simple or rarely branched, 5-50 cm long, 1-2.5 mm thick, pale brown, sheathed at nodes, some, swelling at tips to produce ultimately new corms, others (particularly in epiphytic plants) winding and terminating in pendulous or more often upright, much-branched, bulbiferous shoots; bulbils profuse, tiny, ovoid, scaly, greenish-white, caducous;

scales with filiferous tips. *Leaves* 2-3, appearing after spadices; petiole 17-50 cm long, .5-1 cm thick near base, suberect; lamina narrowly lanceolate, acuminate, 15-40 cm long, 3.5-14.5 cm broad, undersurface green in very young leaves, otherwise

persistently bright purple, sometimes fading with age near the margin; costae green or sometimes purple-tinged; apical lobe 10-31 cm long, 1.5 to 3-times longer than broad, with almost straight sides, faintly indented at base and then continued into



*Gonatanthus ornatus* Schott

Figs. 4-9 : 4. Corm bearing spadices 5. Spadix. 6. Pistil and its long-section. 7. Synandrium (A. S. Rao 35684). 8. Plant with infructescence and young and old leaf. 9. Plantlet (A. S. Rao 35691). Inset map indicates colln. localities ⊕. The wedge in the pie diagram at top corner shows flowering period.

the basal lobes; basal lobes rotundate, 2 to 5-times shorter than the apical one, connate to ca half its length. *Peduncles* 1-3, suberect, reclining in fruits, 7-15 cm long, 3-4 mm thick. *Spathe* erect, 4.2-7.5 cm long; tube oblong, 1-2.5 cm long, 7-10 mm wide, elongating to 2.5-3.5 cm in fruits, green or faintly purple-tinged outside, deep purple-black inside, limb fully convolute when young, partly open with one side more inflexed on maturity, ovate, apiculate, 2.7-5 cm long, 2-3 cm broad, yellow on both surfaces with greenish margins and base. *Spadix* 1.7-3 cm long, male and female floriferous zones separated by a 4-6 mm long neuter zone; male protruding above the spathe tube, club-shaped, 5-7 mm long, 2.5-4 mm thick, creamy; female .8-1.3 cm long, 3-5 mm thick, green; synandria 1-1.5 mm long; ovaries 1-1.5 mm long, ovules few; stigma white or purple with age; neuters white, those between male and female zones many, elongate, 1.5-3 mm long, those at the base of female few, roundish, ca 1 mm (Figs. 4-9).

*Flowers*: April-May.

Contradictory observations have been noted even on the poorly described leafy material. Our observations of the leaf back being invariably purplish does not agree with both Hooker's and Krause's reference to the leaves being sometimes green and

concolorous. Lack of colour retention with corresponding lack of field data may easily lead to misinterpretations. While Hooker has clearly stated that no bulbilliferous shoots have been seen, Krause has described and illustrated densely-branched, plumose, bulbilliferous shoots for *G. ornatus*. Our observations have shown that when the plants are terrestrial the stolons normally remain simple, ending in cormlets and plantlets. But when the plants are epiphytic, the wiry stolons tend to take tortuous paths in crevices of barks, ending in either pendulous or upright, profusely branched, bulbilliferous shoots. This is seen in September-October months, in a later phase of the plant when the foliage will have begun to get aged and decay.

*Specimens examined*: INDIA: ASSAM: Khasi and Jaintia Hills, Lawlyngdoh forests (Mawphlong), *G. K. Deka* s.n. (Acc. Nos. 680, 681). Mawphlong forests, *G. K. Deka* 11088, 23203; *A. S. Rao* 35679, 35682, 35684, 35691, 35699. Serrarim, *G. K. Deka* 22209 (ASSAM). Lower ranges of Khasi Hills, *Anon.* 477 (Acc. No. 497016) (CAL).

#### ACKNOWLEDGEMENT

We thank the Keeper, Central National Herbarium, Sibpur, Howrah for the loan of specimens.