

# Notes on the genus *Comastoma* Toyok. (Gentianaceae) from Pakistan and Kashmir

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Objektyp: **Article**

Zeitschrift: **Candollea : journal international de botanique systématique = international journal of systematic botany**

Band (Jahr): **47 (1992)**

Heft 2

PDF erstellt am: **22.07.2024**

Persistenter Link: <https://doi.org/10.5169/seals-879585>

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# Notes on the genus *Comastoma* Toyok. (Gentianaceae) from Pakistan and Kashmir

SAOOD OMER

## RÉSUMÉ

OMER, S. (1992). Notes sur le genre *Comastoma* Toyok. (Gentianaceae) du Pakistan et du Cachemire. *Candollea* 47: 539-553. En anglais, résumés français et anglais.

Le genre *Comastoma* Toyok. est révisé pour le Pakistan et le Cachemire. Une espèce nouvelle est signalée: *Comastoma pseudopulmonarium* Omer alors que *C. pulmonarium* est indiquée pour la première fois dans la région. Les grains de pollen sont réticulés avec des muri épais et des lumières minces. De même les graines sont striées avec des striures irrégulières et une disposition indéfinie des stries.

## ABSTRACT

OMER, S. (1992). Notes on the genus *Comastoma* Toyok. (Gentianaceae) from Pakistan and Kashmir. *Candollea* 47: 539-553. In English, French and English abstracts.

The genus *Comastoma* Toyok. is revised from Pakistan and Kashmir. One new species, *Comastoma pseudopulmonarium* Omer, is recognized, whereas *C. pulmonarium* is recorded for the first time from the region. The pollen grains are reticulate with a thick muri and thin lumen. Similarly, the seeds are striated with irregular striations and indefinite striae patterns.

## Introduction

While studying the genus *Gentiana* L. (s.l.) from Pakistan and Kashmir, it has been shown that there are nine genera in Pakistan and Kashmir, and the genus *Gentiana* L. (s.str.) does not occur in the area under consideration (OMER, 1991; OMER & QAISER, 1992).

*Comastoma* Toyok. possesses fimbriate corolla throat, with sessile gynoeceum and stigma. The fimbriae in the genus are fairly uniform and are arranged in a definite pattern. The genus is fairly close to *Gentianella* Moench (s.str.), but differs on the basis of arrangement of fimbriae, and the absence of gynophore. It is often regarded as congeneric with *Gentianella* Moench (s.l.) by many workers (SMITH, 1967; CHATER, 1982; ZUYEV, 1985; GARG, 1987). TOYOKUNI (1961, 1962); MA (1980); LÖVE & LÖVE (1975) and LÖVE (1986) have pointed out several criteria for separating *Comastoma* Toyok. from *Gentianella* Moench. The genus is annuals or biennials, with long pedicelled flowers, a short calyx tube, sessile stigma and ovary, and corolla lobes with few fimbriate scales. The different morphological characters were also discussed in detail elsewhere (OMER, 1991; OMER & QAISER, 1992). There seems to be no justification in treating *Gentianella* Moench and *Comastoma* Toyok. as a single entity. PHILIPSON (1972) has also pointed out the differences at the sectional levels in anatomy and called the group as sect. *Comastoma* Wettst. TOYOKUNI (1965) has discussed in detail the differences at the generic level. He even pointed out that the chromosome number also differs from the related *Gentianella* Moench. LÖVE (1986) has also indicated that chromosome number also differs in *Comastoma* Toyok. ( $2n = 10$  &  $30$ ) from that of *Gentianella* Moench ( $2n = 36$ ).

There are studies on pollen morphology of the genus *Gentiana* L. (s.l.), but these studies failed to accept the differences at the generic level (NILSSON, 1967). On the other hand, there are no reports on the seed morphological studies of the genus *Gentiana* L. (s.l.)

A comparative account of different genera have already been discussed (OMER & QAISER, 1991).

## Materials and method

### *Palynological studies*

Polleniferous material from 5 taxa belonging to *Comastoma* Toyok. from Pakistan and Kashmir were obtained from herbarium sheets. Wherever possible 25 pollen grains were studied and measured. In most of the cases, more than one specimen was studied. Pollen grains were studied with light and scanning electron microscopy.

### *Light microscopic studies*

Pollen slides were prepared by the usual acetolysis method of ERDTMAN (1952). Measurements of polar axis, length and breadth of the grain, mesocolpium, apocolpium, intercolpi distance and diameter of the pollen grain, alongwith the thickness of exine. PAI (polar area index) was also calculated.

### *Scanning Electron Microscopy*

Mostly acetolysed pollens grains were mounted on metallic (brass) stubs, with the help of double adhesive tape. However, in few cases pollen were directly dusted on stubs. The specimen were coated with gold, by conventional method. The specimens were observed under JSM-T 200 and JSM-T 20 at the Biological Research Center, University of Karachi and Electron microscopy Unit, Plant Science Laboratory, University of Reading, U.K., respectively.

### *Seed morphology*

Seed samples were collected from the field and herbarium specimens. Only healthy and mature seeds were studied. Following parameters were studied.

1. *Seed size.* — Length and breadth of atleast 20 seeds were measured with the help of an ocular micrometer upon a Nikon SE model microscope with an electrical illumination. Length and breadth was taken from end to end and the central part respectively.
2. *Seed shape.* — Seed shapes were determined by the help of ratios obtained by the measurements of length and breadth. The ratios applied for the shape were similar as applied to leaves and other parts of the plant.
3. *Seed surface.* — Seed coat surface patterns were observed by the help of light as well as scanning electron microscope. For light microscopy, a Nikon SE model microscope was used and surface pattern were analyzed. For SEM studies, seeds were mounted on a metallic stub with the help of double adhesive tape and coated with gold for a period of 6 minutes in a sputtering unit of Jeol and observed in SEM Jeol JSM-T 200.

### *Morphological studies*

More than 5000 specimens from the following herbaria were studied: B, BM, CAL, E, G, K, KUH, LE, LINN, O, P, PES, PFI-B, RAW, RNG and W. The specimens belonged to the collective genus *Gentiana* L. (s.l.). Only specimens belonging to the genus *Comastoma* Toyok. were incorporated here. Similarly, specimens were studied from the entire range of distribution for the geographical assessment.

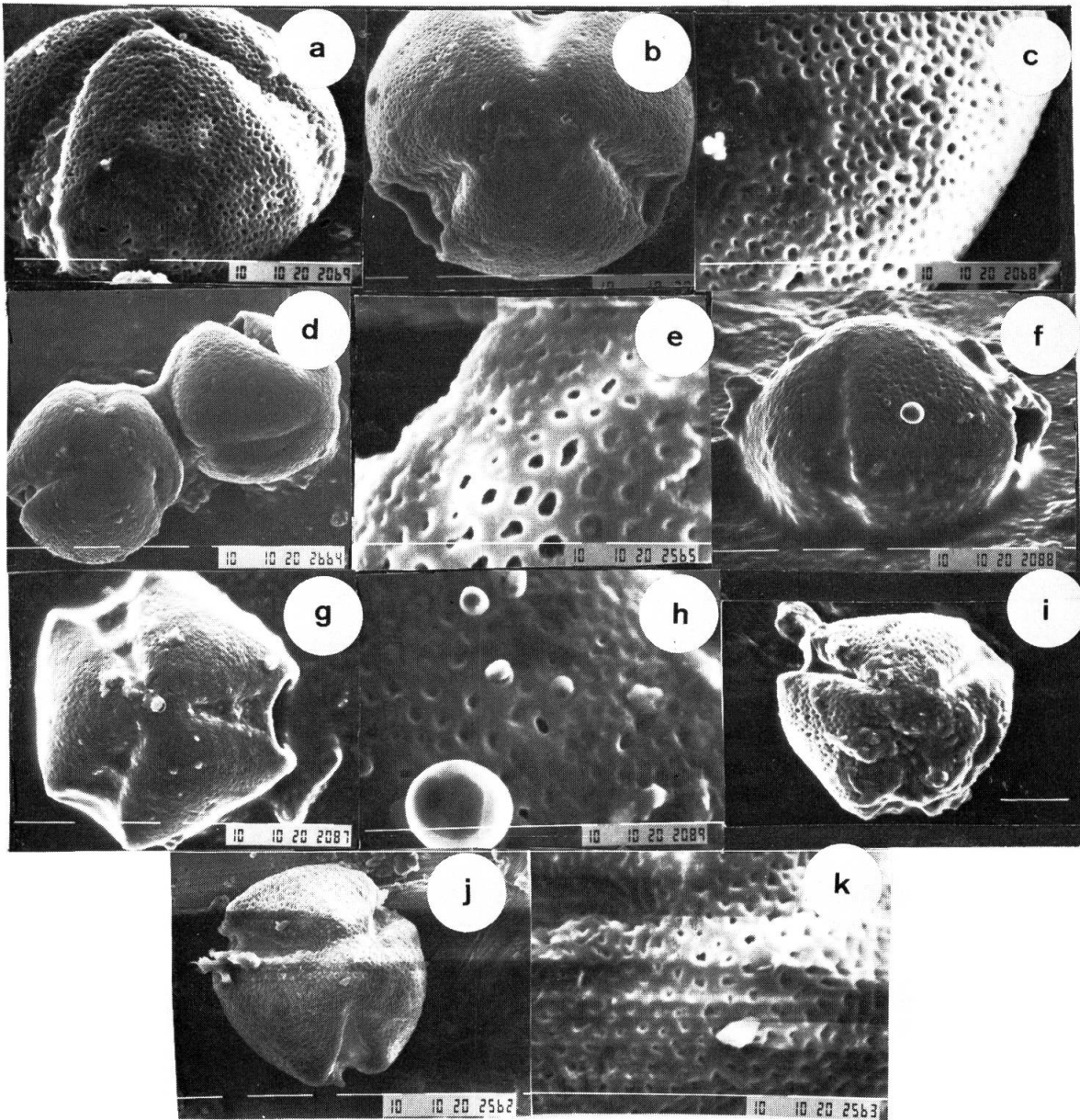


Fig. 1. — SEM pollen micrographs of *Comastoma*.  
 a-c, *C. falcatum* (Koelz 2527, NY); d-e, *C. pulmonarium* (R. R. Stewart 9847a, NY); f-h, *C. pseudopulmonarium* (Duthie 11822, O); i-k, *C. borealis* (Omer & Qaiser 2648, KUH).

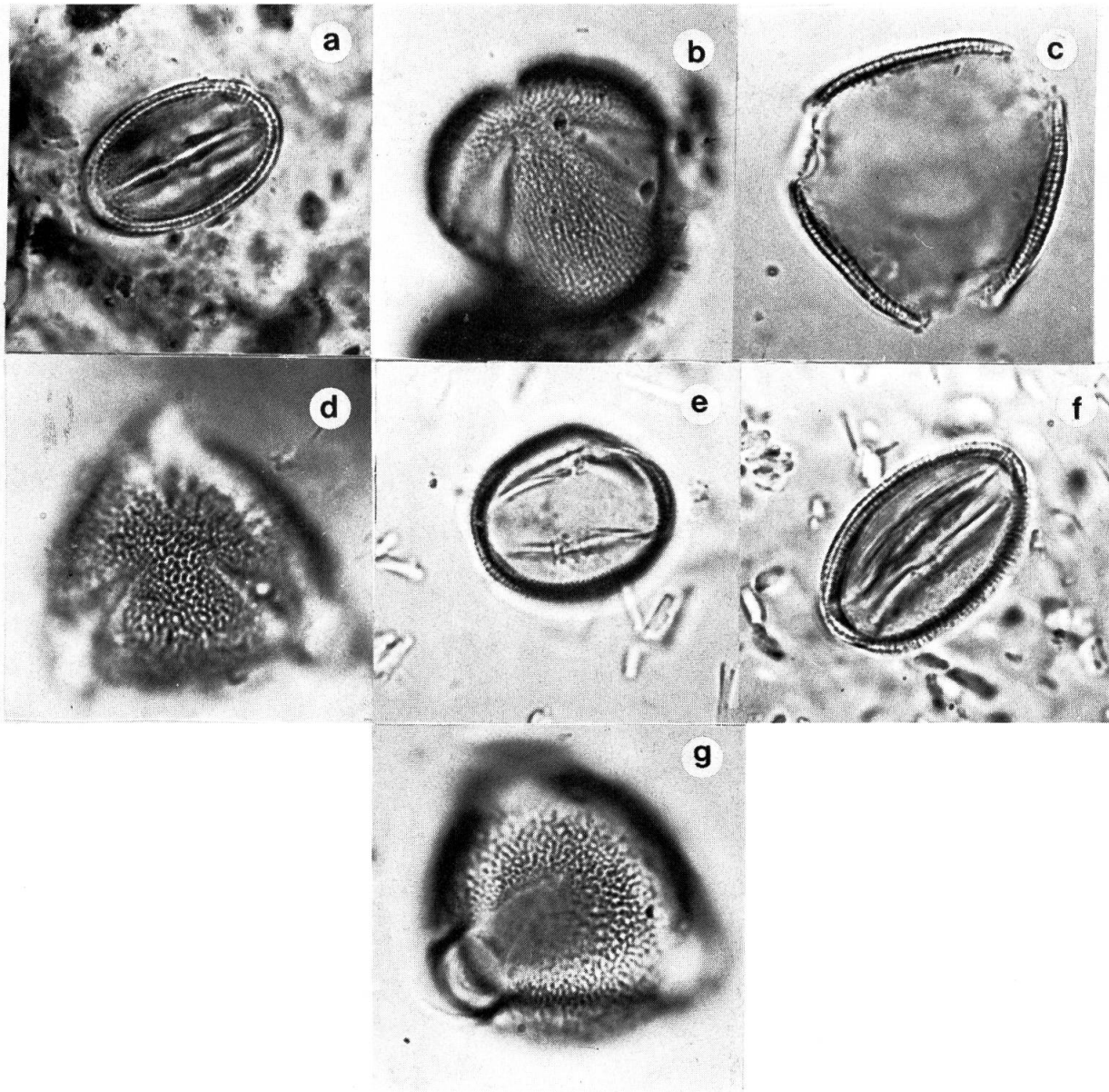


Fig. 2. — LM micrographs of *Comastoma*.  
**a-b**, *C. falcatum* (Koelz 2527, NY); **c-d**, *C. pulmonarium* (R. R. Stewart 9847a, NY); **e**, *C. pseudopulmonarium* (Duthie 11822, O); **f-g**, *C. pedunculata* (R. R. Stewart 12935, K).

Species	Length	Breadth	P/E	Shape	Colpi Length	Colpi Breadth	Exine $\mu\text{m}$	Meso-colpium	Apocolpium	Colpi-colpi
1. <i>C. pulmonarium</i> sx + cv	44.148 1.421 .410 3.218	42.246 1.546 .446 3.659	104.50	sub-spheroidal (pro-spher)	36.414 1.552 .448 4.262	5.470 .356 .102 6.508	2.766 .221 .064 7.989	30.821 .954 .275 3.095	6.307 .735 .212 11.653	10.232 1.468 .424 14.347
2. <i>C. pseudo-pulmonarium</i>	36.652 .824 .476 2.248	27.608 3.297 1.903 11.942	132.75	prolate	27.608 3.297 1.903 11.942	1.666 .412 .238 24.729	2.618 .206 .119 7.868	25.228 .824 .476 3.266	6.668 .824 .476 12.364	10.948 .824 .475 7.526
3. <i>C. pedunculata</i>	34.518 2.991 .902 8.665	32.402 2.859 .862 8.823	106.53	sub-spheroidal (pro-spher)	26.223 1.944 .578 7.413	1.460 .107 .032 7.328	2.781 .144 .043 5.159	26.742 1.440 .434 5.384	6.620 .720 .217 10.876	9.087 1.155 .348 12.710

Table 1. — Pollen morphology data of *Comastoma* Toyok.

## Observations and results

### *Palynology*

The overall palynological studies have revealed the existence of four broad groups within *Gen-tiana* L. (s.l.) from Pakistan and Kashmir (OMER, 1991). The pollen grains are reticulate with variation in the type of reticula. The reticulum is variable in relation to the size of muri and lumen. *Comastoma* Toyok. falls under a broad group named after itself. The size of muri is thick and lumen is small (Fig. 1, 2), and all the five species investigated belongs to this group. Apart from that, genus *Jaeschkea* Kurz is also a constituent of the group. The detailed measurements of three species are indicated in Table 1.

### *Seed morphology*

Seeds circular or rounded, 0.5-0.96(-1.0) mm in diameter, reddish brown or brown, glabrous; surface areolate with middle of the areoles elevated with a punctae in middle, areoles uneven and usually at intervals, surface sometimes with a depression. Areole walls very thin, running up and down over the uneven rugulate undersurface with a light impression thus forming an areole, many areolar walls uniting at one point and forming a knot. Hilum scar prominent with a depression.

The seed surface in *Comastoma* Toyok. is striate. The striations are irregular without any particular pattern. The size of striations are very small in this category in comparison to the other groups. The seed size of *Comastoma* Toyok. and *Aloitis* Rafin. is similar and ranges between

<i>Species</i>	<i>Length</i> $\mu\text{m}$	<i>Breadth</i> $\mu\text{m}$
1. <i>C. falcatum</i> . . .	.520	499
sd	0.46	.044
error	.011	.011
cv	8.846	8.817
r		.170
t		.622
correlation		none
2. <i>C. pseudo-pulmonarium</i>	.654	.587
	.050	.009
	.028	.005
	7.64	1.533
		.8848
		3.206
		significant
3. <i>C. pedunculata</i>	.723	.596
	.039	.052
	.015	.021
	5.394	8.724
		.848
		3.206
		significant
4. <i>C. borealis</i> . . .	2.659	2.101
	.2009	.196
	.070	.069
	.070	.069
	7.521	9.328
		-.233
		-.587
		none

Table 2. — Seed measurement in *Comastoma* Toyok.

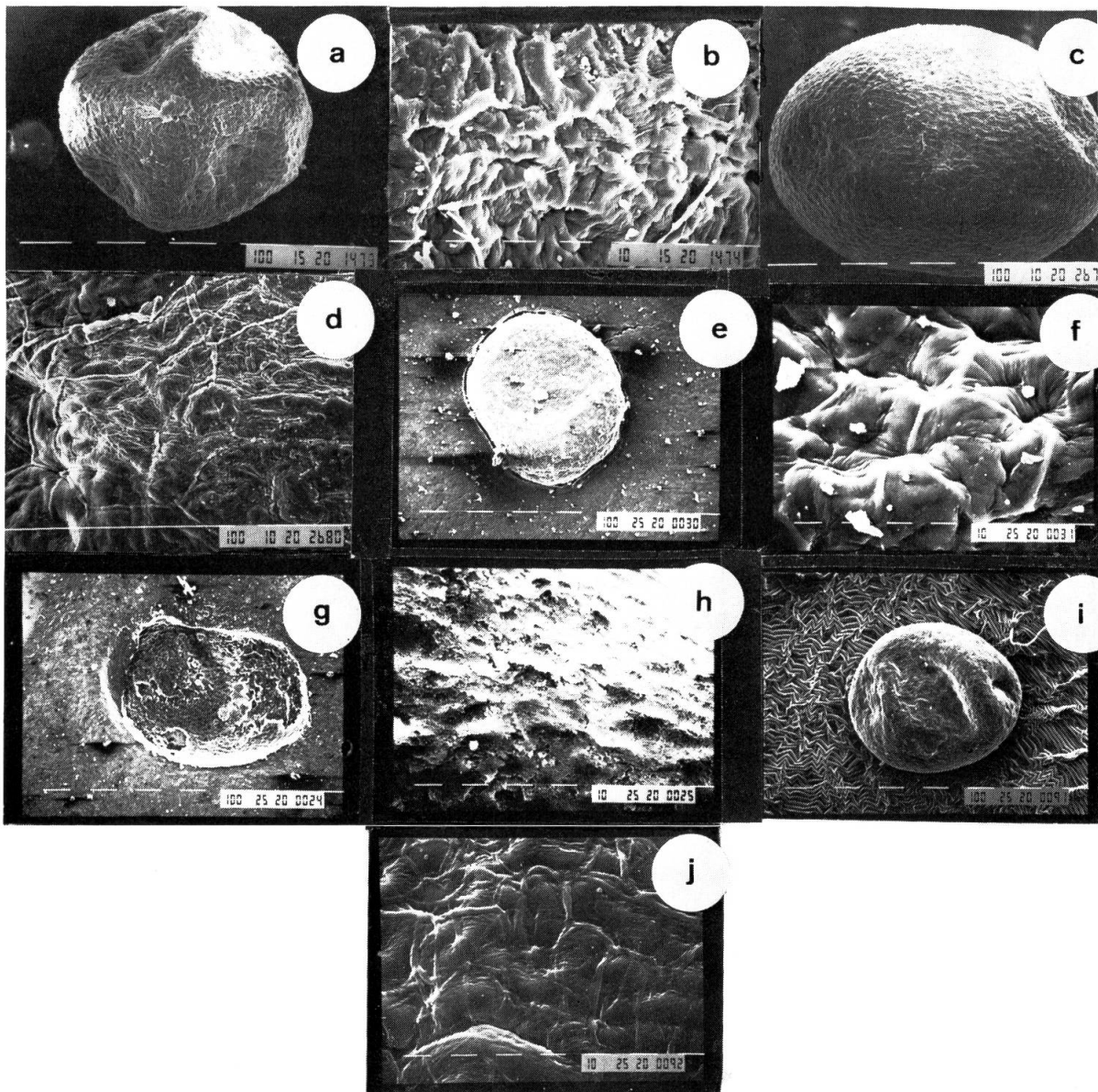


Fig. 3. — SEM seed micrographs of *Comastoma*.  
**a-b**, *C. falcatum* (Abedin & Qaiser 9018, KUH); **c-d**, *C. pulmonarium* (Permanand 1170, NA); **e-f**, *C. pseudopulmonarium* (Steane 52, E); **g-h**, *C. pedunculatum* (Thomson s.n., K); **i-j**, *C. borealis* (R. R. Stewart 26516, RAW).



500-850  $\mu\text{m}$ . The two genera can be separated from one another on the basis of definite pattern of striations in *Aloitis* Rafin., whereas the walls of the striations are not well formed in *Comastoma* Toyok. (Fig. 3). The details of different dimensions indicated in Table 2. The observations of the seeds of *Comastoma* Toyok. are also elucidated below. All the taxa represented in Pakistan, were investigated.

### *Taxonomy*

The present studies have revealed the existence of five taxa with one new species and a new record from Pakistan and Kashmir. The genus *Comastoma* Toyok. is treated here as follows.

- Comastoma** Toyok. in Bot. Mag. (Tokyo) 74: 198. 1961; in Acta Phytotax. Geobot. 20: 136, 1962; Ma in Fl. Intramongolica 5: 81. 1980; Ho in Fl. Rep. Pop. Sin. 62: 300. 1988.  
 = *Gentiana* L. sect. *Endotricha* Froel., Gent. 86. 1796.  
 = *Gentiana* L. sect. *Comastoma* Wettst. in Österr. Bot. Z. 46: 174. 1896.  
 = *Lomatogonium* A. Br. sect. *Comastoma* (Wettst.) Löve & Löve in Acta Horti Gothob. 20: 117. 1956.  
 = *Gentianella* Moench subgenus *Comastoma* (Wettst.) Gill. in Ann. Missouri Bot. Gard. 44: 262. 1967.

Biennial-perennial, glabrous, erect herbs. Basal leaves in a rosette; cauline leaves opposite, loosely arranged. Inflorescence solitary, terminal. Flowers pedunculate, peduncle long; tetramerous-pentamerous; bisexual, actinomorphic-zygomorphic, mostly campanulate-tubular. Calyx divided mostly upto the base, sometimes not forming a tube, not provided by an inner membrane. Corolla campanulate, sometimes tubular, variously coloured: blue purple, violet, red, pink or white; plicae or subsidiary lobes of the corolla absent, throat fimbriate; fimbriae linear-lanceolate or filiform, entire, acute or obtuse, arising from a crown inserted near the corolla tube. Stamens corresponding the number of and alternating the petals. Anthers strictly versatile, with filaments running down approximately to the base of tube. Nectaries present at the base of the corolla, two each on a petal. Ovary superior, unilocular with numerous ovules and parietal placentation, sessile; stigmas 2, sessile or stipitate, dehiscent septically from apex. Seeds light to dark brown, with ovoid or circular shape, mostly smooth, rarely reticulate.

A genus of ca. 10 species, distributed in the colder or alpine regions of Asia, Europe and America. Represented in Pakistan by 5 species.

### **Key to the species of *Comastoma***

- |                                                                       |                                       |
|-----------------------------------------------------------------------|---------------------------------------|
| 1. Calyx and corolla tetramerous .....                                | <b>5. <i>C. borealis</i></b>          |
| 1a. Calyx and corolla pentamerous.....                                | 2                                     |
| 2. Corolla lobes acute. Veins on calyx parallel.....                  | <b>2. <i>C. pulmonarium</i></b>       |
| 2a. Corolla lobes obtuse. Veins on calyx not parallel.....            | 3                                     |
| 3. Veins on calyx lobes numerous and very finely reticulated .....    | <b>4. <i>C. pedunculata</i></b>       |
| 3a. Veins on calyx lobes few and not finely reticulated .....         | 4                                     |
| 4. Stem short and branched from base. Calyx marginate or rimmed ....  | <b>1. <i>C. falcatum</i></b>          |
| 4a. Stem branched, from middle or above. Calyx emarginate or unrimmed | <b>3. <i>C. pseudopulmonarium</i></b> |

- 1. *Comastoma falcatum*** (Turcz. ex Kar. & Kir.) Toyok. in Bot. Mag. (Tokyo) 74: 198. 1961; Ma in Fl. Intramongolica 5: 81. 1980; Ho in Fl. Rep. Pop. Sin. 62: 306. 1988.  
 = *Gentiana falcata* Turcz. ex Kar. & Kir. in Bull. Soc. Nat. Moscou 15: 404. 1842; Grossh. in Shishkin & Babrov (eds.), Fl. URSS 18: 617. 1952; Stewart in Nasir & Ali (eds.), Ann. Cat. Vasc. Pl. Pak. Kashm.: 555. 1972.  
 = *Gentianella falcata* (Turcz. ex Kar. & Kir.) Smith in Nilsson, Grana Palynol. 7: 107. 1967; Chater in Hara & al., Enum. Fl. Pl. Nep. 3: 94. 1982. **Syntypes:** In humidis alpis Nuchusaban, 1834, *Turczaninow* (LE-Photo!); in lapidosis summorum alpium Alatau ad Sazchan et Aksu, *Karelin & Kirilloff 1712* (LE-Photo!).  
 = *Gentiana tenella* Fries var. *falcata* Griseb. in Gent.: 249. 1839; Clarke in Hook. f., Fl. Brit. Ind. 4: 110. 1883.

*Specimens examined.* — Gilgit: 74°30'E, 36°5'N, 15.000', 12.8.1961, *Flower-Ellis R-9* (K); Hazara-Gilgit: 14 km from Babusar village on way to Babusar top, 5.9.1988, *Omer & Qaiser 2678 & 2681* (KUH); Kashmir: Ladakh, above Choretren Chen, 17.000', 19.8.1931, *Koelz 2664* (NY); Baltistan: Lal Pir, 13.500', 10.8.1936, *Koelz 9542* (NA, NY, RAW); Karakorum glacier, near corner camp, 13.830', *Conway 266* (K); Thalle La, 15-16.000', 18.8.1940, *Stewart 20758* (NY, RAW); Talala (Thalle La), 13.000', *Koelz 9740* (NA, NY); Kichih Kundan glacier, 16.500', 28.7.1929, *Ludlow 576* (BM); Ladak, Zingpoche, 18.000', 3.8.1931, *Koelz 2527* (NY); Sasis pass, 15.000', Karakorum trade route, Ladak, 11.8.1928, *Ludlow 477* (BM); Shish nag, E. Lidder valley, ± 12.000', 16.8.1946, *Vaid s.n.* (NY); Agharwat, 13.000', 11.8.1919, *Rich 1251* p.p. (K).

*Distribution.* — USSR, Afghanistan, Pakistan, China, India, Bhutan, Tibet and Nepal (Fig. 5).

An Irano-Turanian element, which extend into Sino-Japanese region in Nepal and in Kashmir.

*Fl. Per.* — August-September.

Flowers fairly late in the months of August and September.

*Ecology.* — Grows in alpine meadows in dry areas, among grasses at an elevation of 12-18.000'.

- 2. *Comastoma pulmonarium*** (Turcz.) Toyok. in Bot. Mag. (Tokyo) 74: 198. 1961; Ho, l.c., 307.  
 = *Gentiana pulmonaria* Turcz. in Flora, Beibl. 1: 19. 1834 (nom. nud.); in Bull. Soc. Nat. Moscou 22: 317. 1849; Grossh., l.c., 616. **Type:** In rupestribus jugo subalpinis prope terem ten Tuchultau 1829. *Turczaninow* (Holo & Iso LE, Photo!).

*Specimens examined.* — Kashmir: Sakti, Ladak, alt. 13.000', 4.8.1931, *Koelz 2538e* (NY); Luderwas Mt., Sonamarg, 13.000', 11.8.1928, *Stewart 9874a* (NY); Haramukh, 1.8.1940, *Ludlow & Sherriff 7894* (BM).

*Distribution.* — USSR, China, Pakistan, India and Tibet (Fig. 5).

An Irano-Turanian element.

*Fl. & Fr. Per.* — August.

*Ecology.* — A herb of alpine meadows, growing at an elevation of 12-18.000'.

A new record for Pakistan.

- 3. *Comastoma pseudopulmonarium*** Omer, spec. nov. (Fig. 4). **Type:** Bashahr State, Labrang to Runang pass, 19.8.1890, *J. H. Lace 540* (Holo-E!; Iso-E!).

Herba biennis, glabra, viridis, usque ad 15(-20) cm alta, ramosa. Caulis evolutus, ramus quisque flore terminatus. Folia basalia rosulata, 0.8-1.3 × 0.4-0.7 cm, elliptico-ovata, acuta, integra; folia caulina biformia; ea ramos axillares fulcrantia majora: 0.8-2.0 × 0.4-0.75 cm, ovata, acuta, integra, sessilia; ea ramos floriferos fulcrantia: 0.3-1.0 × 0.1-0.25 cm, lineari-lanceolata, acuta, integra, sessilia. Flores solitarii, pentameri, pedunculo usque ad 8 cm longo, suffulti; flores 0.8-2.0 cm longi, campanulati. Calyx 5-lobus, lobi inaequilongi, paribus binis inter se aequalibus;

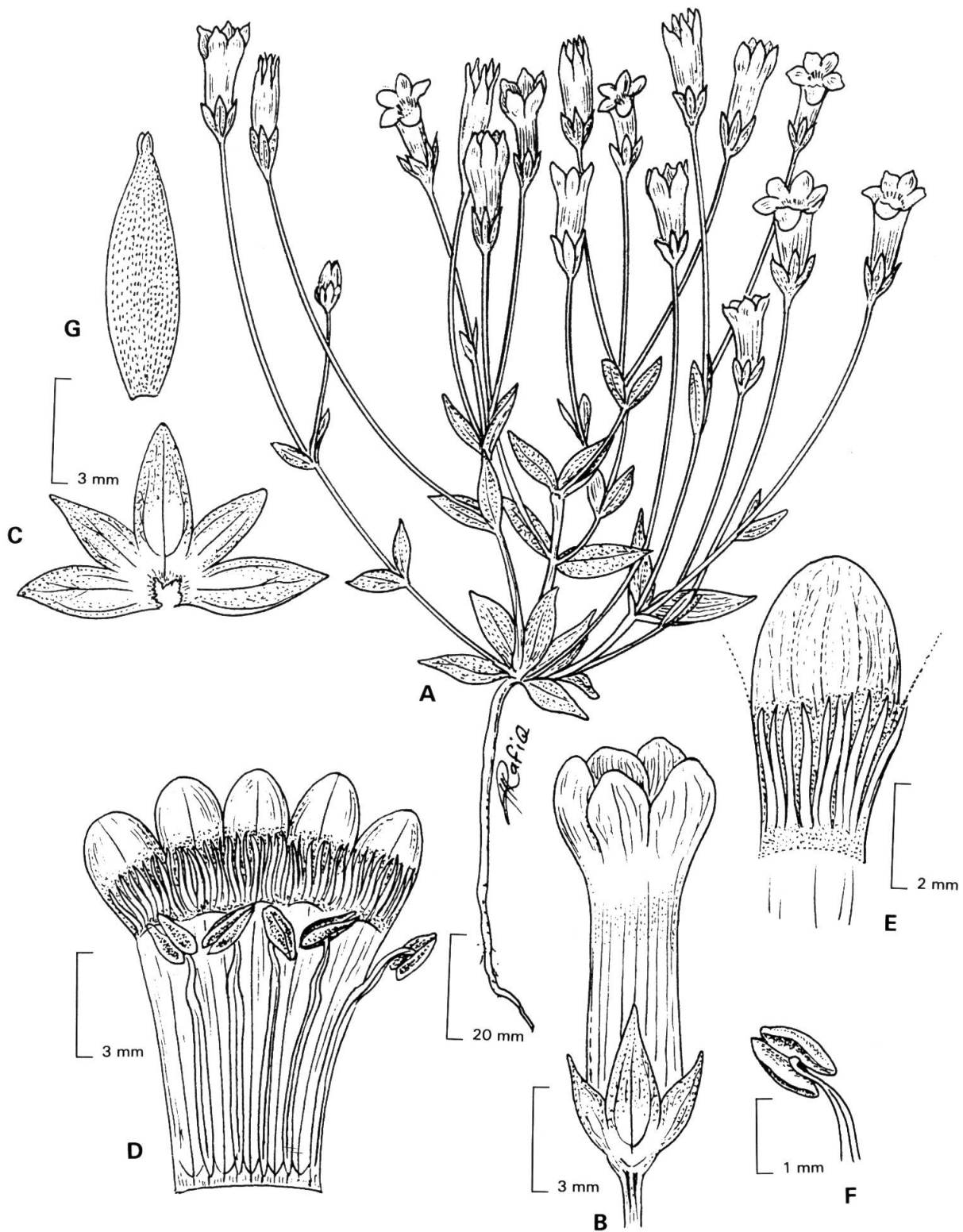


Fig. 4. — *Comastoma pseudopulmonarium*.  
 a, habit; b, flower; c, calyx; d, opened corolla; e, enlarged portion of corolla lobe to show fimbriae; f, stamen; g, ovary (Lace 1245, E).

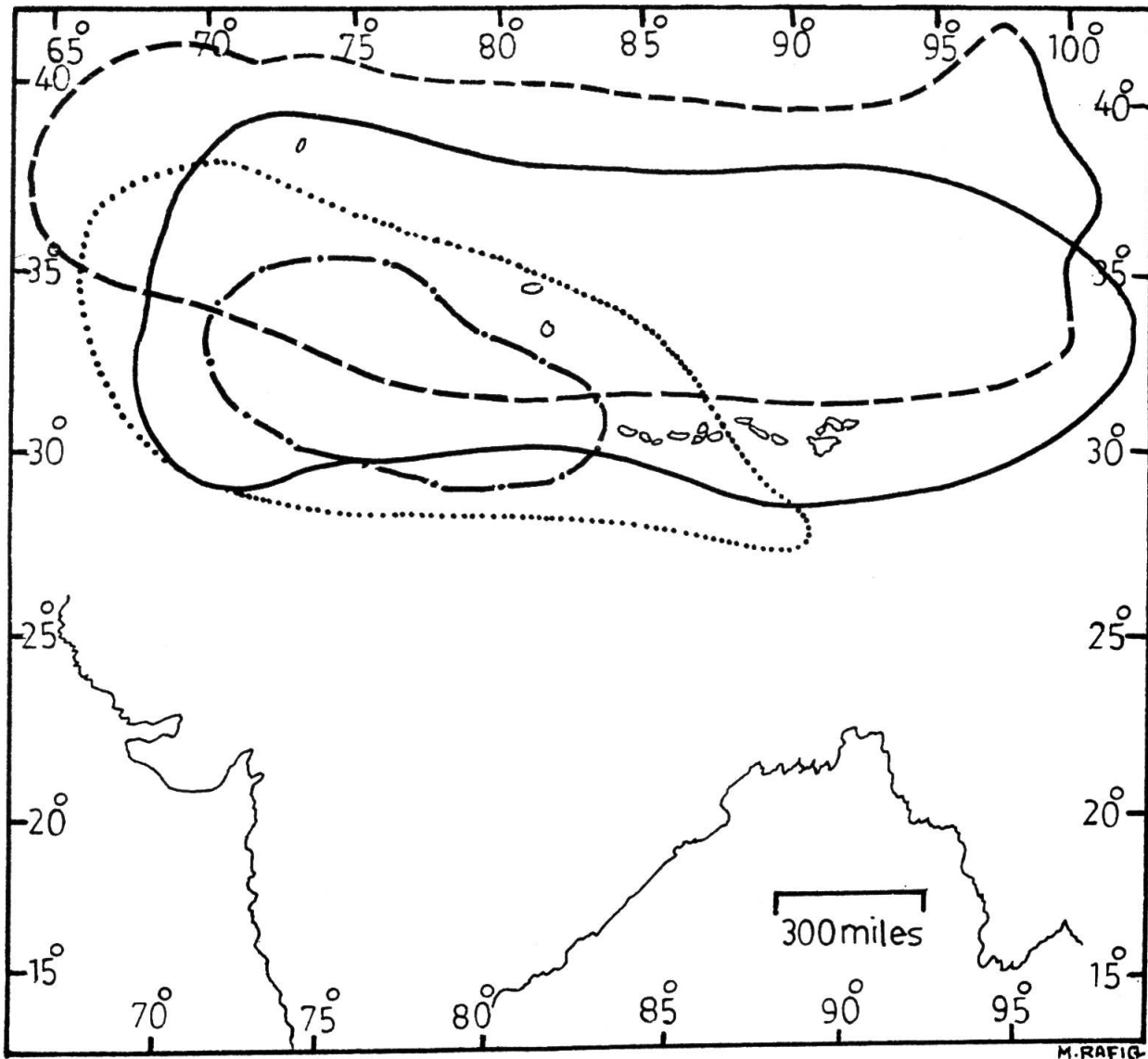


Fig. 5. — Distribution pattern of *Comastoma falcata* ( - - - ); *C. pulmonarium* ( — ); *C. pseudopulmonarium* ( · - · - · - · ) and *C. pedunculata* ( ······ ).

per minimum: 0.3-0.6 × 0.1-0.2 cm, lanceolatum, acutum, integrum; per maximum: 0.4-0.7 × 0.15-0.3 cm, lanceolatum, acutum, integrum; per quintum maximum: 0.45-0.8 × 0.15-0.35 cm, late lanceolatum, acutum, integrum, omnia obsolete pallelis nervosa. Corolla 0.8-2.0 cm longa, tubus quam lobi duplo longior (0.5-)0.6-1.5 cm longus; lobi 0.4-0.8 × 0.2-0.45 cm, obovati, obtusi, integri, fimbriati, fimbriis aequilongis, subexsertis, linearibus, acuminatis. Stamina 5; filamenta filiformia, corollae faucis in vel supra medium adnata; antherae dorsifixae, bicellulares, ovatae. Nectaria ad corollae faucem sita. Capsula subexserta vel exserta, 1.5-2.0 × 0.35-0.55 cm, lanceolata. Semina numerosa, non striata.

*Specimens examined.* — Kashmir: Apharwat, 10,000' upward, Sept. 1929, *Steans 52* (E); Shish Nag, upper Lidder valley, 12,000', 31.8.1925, *Stewart 8391a* (NA); Baltistan: Shingo valley, near Gulteri, 11-12,000', 5.7.1892, *Duthie 11822* (E, O); Chogolisa glacier, August 1955, *Francis 45* (RAW).

*Distribution.* — Himalayas and Karakorum (Fig. 5).  
An Eastern Irano-Turanian element.

*Fl. & Fr. Per.* — July-September.

*C. pseudopulmonarium* Omer comes very close to *C. pulmonarium* (Turcz.) Toyok. and *C. pedunculata* (Royle ex D. Don) Holub. The general habit of *C. pseudopulmonarium* Omer is identical to the habit of *C. pulmonarium* (Turcz.) Toyok. whereas the flower size and shape exactly matches the *C. pedunculata* (Royle ex D. Don) Holub. From *C. pulmonarium* (Turcz.) Toyok., it differs on shape and size of flower, and differs from *C. pedunculata* (Royle ex D. Don) Holub on the basis of general habit.

**4. *Comastoma pedunculata*** (D. Don) Holub in Folia Geobot. Phytotax. Praha 3: 218. 1968; Ho, l.c., 310.

- = *Eurythalia pedunculata* D. Don in Lond. Edinb. Philos. Mag. J. Soc. 8: 76. 1836.
- = *Gentiana pedunculata* Royle ex G. Don, Gen. Syst. 4: 182. 1837; Stewart, l.c., 557.
- = *Gentianella pedunculata* (D. Don) Smith in Nilsson, Grana Palynol. 7: 144. 1967; Chater in Hara & al., l.c. 94. **Type:** Habitat in Chachemire et Kunawur, Royle (LIV!).
- = *Gentiana tenella* auct. non Rottb.: Clarke in J. Linn. Soc. 14: 434. 1875; in Hook. f., Fl. Brit. Ind. 4: 109. 1883.

*Specimens examined.* — Chitral: Drosh, Beorai Gol, 12.000', 28.7.1958, *Bowes-Lyon 212* (BM); Gilgit: Manu Gah nala, 12.500', 31.8.1950, *Thornley 22* (BM); Kashmir: Yamharu pass, 13-14.000', 13.8.1893, *Duthie 13569* (BM, E, K); id., 14.000', Sept. 1931, *Stewart 12935* (K); Sonamarg, 9000', 5.9.1917, *Stewart 3626 1/2* (K, NY); id., 18.8.1928, *Stewart 9898a* (K); Thajiwas, Sonamarg, 13.000', 13.8.1940, *Ludlow & Sherriff 7930* (BM, E); Rajparyan sanctuary, 10.500', 13.8.1943, *Ludlow & Sherriff 9296* (BM, E); Zoji-Matayan, Ladak road, 29.8.1922, *Stewart 7545* (K); Zoji La, 11.500-12.000', 27.8.1940, *Ludlow & Sherriff 8033* (BM, E); Gumbo nullah, Zoji La, 12.000', 25.8.1940, *Ludlow & Sherriff 8017* (BM); Apharwat, 13.000', 12.8.1956, *Polunin 56/223* (BM, E); id., 11.8.1919, *Rich 1251* p.p. (K); Kolahoi valley, 11-12.000', 8.8.1893, *Duthie 13518* (K); id., 11.000', 26.8.1956, *Polunin 56/509* (BM); id., 14.200', 27.8.1956, *Polunin 56/545* (BM); id., Sept. 1913, *Mrs. Evershed s.n.* (BM); Shingo valley, near Gurais, 11-12.000', 5.7.1892, *Duthie 11822* (BM); Top of Apharwat, 13.000', 27.8.1933, *Venning K-70* (K); Tilail, 12.000', 24.8.1876, *Clarke 30718A* (K); *30718B* (BM); Vishansar, 12.000', 17.8.1940, *Pinfold 365* (BM); Gulmarg, 10.000', Sept. 1922, *Barbour s.n.* (BM); Panamils, Nubra valley, 10.400', 13.8.1928, *Ludlow 488* (BM); Kimi, upper Nubra valley, 11.050', 26.7.1947, *Schomburg 17* (BM); Nund Koi, 11.500', 14.8.1940, *Pinfold 285* (BM); Zojpal, Sept. 1913, *ibid. s.n.* (BM); Tibet, Shingtsakbi, on the left side of the Mustak glacier below Tsoka, 19.8.1956, *Schlangintweit 6030* (BM); Nubra, Kartas to Kharand, 15.8.1856, *ibid. 2429* (BM); Astonmarg, 10.500', August 1936, *Timins 205a* (BM); Rama valley, S.W. of Astore, 13.000', 3.8.1967, *Lankaster & Prescott TEL 1383* (BM); id., 12.000', 9.8.1967, *ibid. TEL 1469* (BM).

*Distribution.* — Pakistan, India and Nepal (Fig. 5).

A Sino-Japanese element, penetrating in Irano-Turanian region also.

*Fl. Per.* — August-September(-November).

*Ecology.* — Grows near the water channels or in the moist grass lands, at an elevation of 8-14.000'.

The type is based upon Royle's collection (LIV!), which was actually described by D. Don (1836). Earlier, it was assumed that type specimen is at K. However, present investigations cleared these doubts.

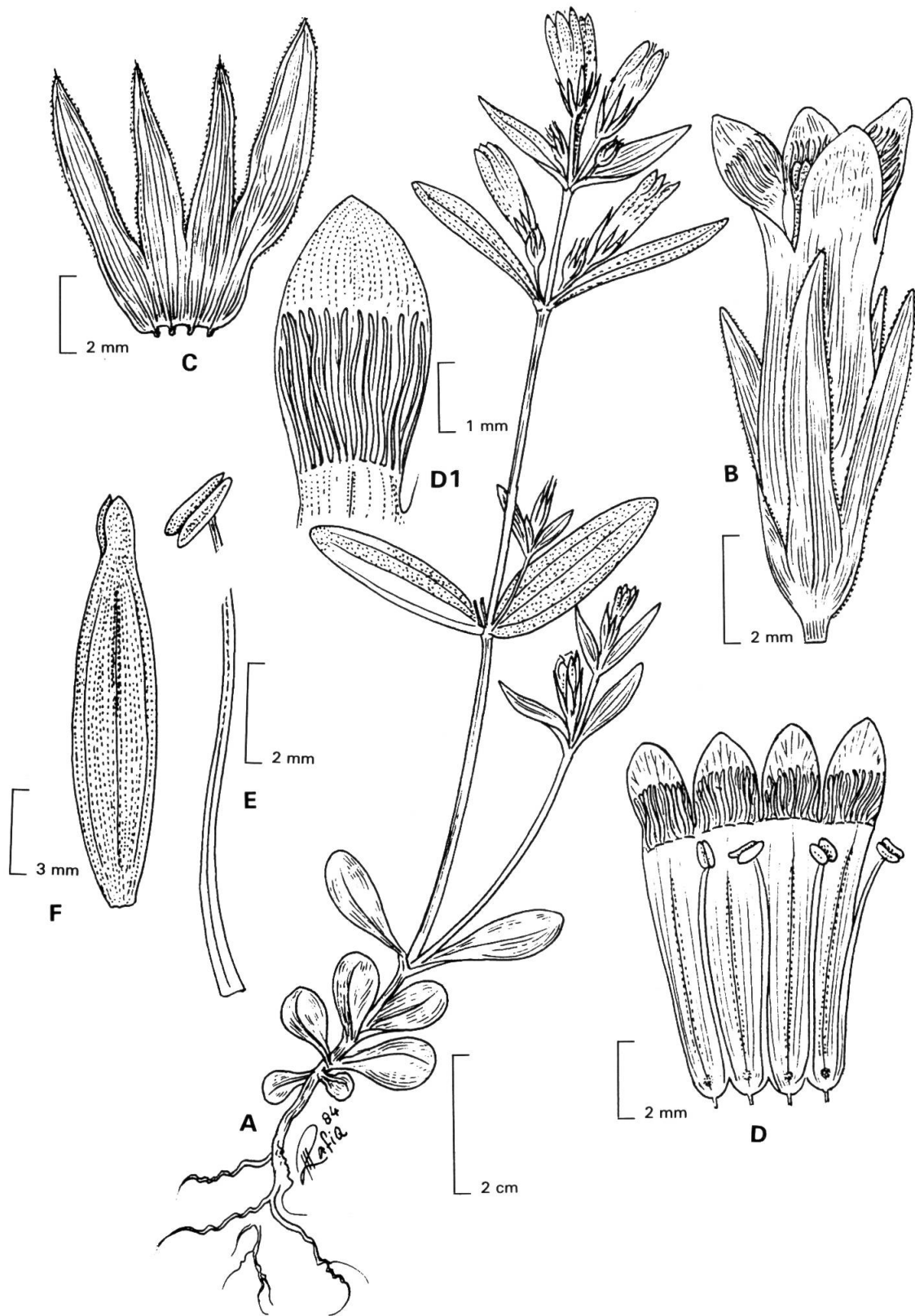


Fig. 6. — *Comastoma borealis*.

a, habit; b, flower; c, calyx; d, opened corolla; d1, enlarged portion of corolla lobe to show fimbriae; e, stamen; f, ovary (R. Stewart 26516, RAW).

5. *Comastoma borealis* (Bunge) T. N. Ho (Fig. 6).

= *Gentiana borealis* Bunge in Nouv. Mém. Soc. Imp. Nat. Moscou 1: 251. 1829; Clarke in Hook. f., l.c., 109; Stewart, l.c., 554. **Type:** Habitat ad sinum Kotzebuensem Americae borealis, ubilecta, *Chamisso & Eschscholtz* (LE).

= *Gentiana ajanensis* Murb. in Act. Hort. Berg. 2(3): 24. 1892.

*Specimens examined.* — Gilgit: Naltar valley, 11.000', 23.7.1954, *Stewart 26516* (BM, RAW); id., 11-12.000', 4.8.1892, *Duthie 12415* (BM); Minapin glacier, Nagar state, 10.000', 1.8.1961, *Lloyd & Megan 23* (BM); Gilgit, 74°30'S, 36°5'N, 15.000', 12.8.1961, *Flower-Ellis R-7* (K); Gilgit-Hazara: 8 km from Babusar village on way to Babusar top, 5.9.1988, *Omer & Qaiser 2648* (KUH); Kashmir: Cachenire, Imit, 3600 m, 2-3.8.1954, *Schmid 2082* (BM, RAW); East of Sekambaris glacier, 13.000', 8.8.1939, *Scott-Russel 1547* (BM); Yengutsa glacier, 13.000', south of Hispar village, 23.8.1960, *Polunin 6382* (BM); Baltistan: above Skardo, 10.000', 16.8.1936, *Koelz 9640* (NA); Skardo to Satpar valley (South of Skardo), 2.9.1856, *Schlagintweit 5548* (E); Thalle La to Bagmaharal, 30.8.1856, *Schlagintweit 5935* (BM); Karpuchu nala, 11-12.000', 9.7.1892, *Duthie 11943* (E); Shigar Nulla, 10.000', 22.8.1936, *Koelz 9708* (NA).

*Distribution.* — Pakistan (Kashmir, Hazara, Gilgit, and Baltistan) America(?) (Fig. 7).

The type locality of *Comastoma borealis* inadvertently indicated as North America, "boreali America". As there are no reports from North America and seems to be confined in Kashmir and

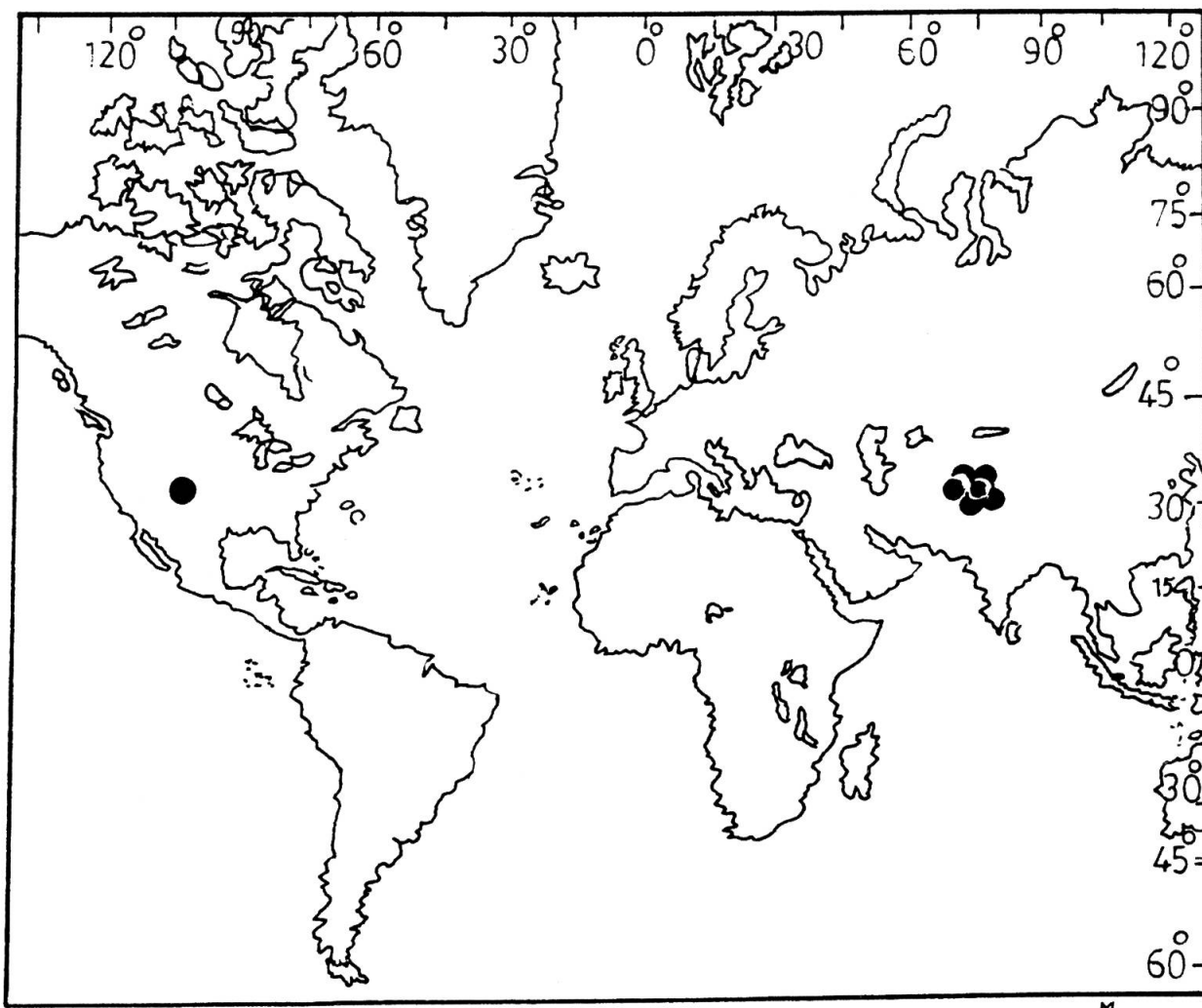


Fig. 7. — Distribution pattern of *Comastoma borealis* (●).

Baltistan. However, the type specimen is untraceable and the concept is strictly based on the original description and the figure supplied by BUNGE (1829).

*Fl. Per.* — July-September.

GILLET (1957) has treated this taxon as conspecific with *Comastoma tenellum* (Rottb.) Toyok. But it differs from it in several respects. In *C. borealis* (Bunge) Ho, the flowers are very shortly pedunculate, whereas the flowers are borne on long peduncles in *C. tenellum* (Rottb.) Toyok. The flowers are pentamerous and long pedunculate in *C. tenellum* (Rottb.) Toyok.

A formal combination of the species has not been proposed. Though, in "An Enumeration of the Vascular Plants of Xizang (Tibet)", published by Academia Sinica (year of publication is not known), it is indicated that a combination exists, which was proposed by T. N. Ho.

#### ACKNOWLEDGEMENTS

The author is thankful to Professors M. Qaiser and S. I. Ali (KUH) for the help and encouragement during course of study. The Latin description of the new species is provided by Prof. Dr. K. H. Rechinger (W), for which the author is extremely thankful. I am also thankful to Prof. Dr. H. W. Lack, Dr. M. I. Hakki (B); Mr. I. C. Hedge, D. J. Long, Dr. R. R. Mill (E); Dr. R. K. Brummitt, Dr. D. Goyder, Dr. K. Vollesen (K); Dr. S. L. Jury, Prof. Dr. J. B. Harborne (RNG); Dr. C. E. Jarvis and Mr. R. Vickory (BM). The loan of material and the facilities extended during the visit to the following herbaria is also acknowledged: B, BM, CAL, E, G, K, KUH, LE, LINN, O, P, PES, PFI-B, RAW, RNG and W. The financial assistance from USDA and ODA is also acknowledged here.

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