

Gymnocolea (Dumort.) Dumort. (Anastrophyllaceae, Marchantiophyta) – a genus new to India

While studying the bryophytic vegetation of different forest types along an altitudinal gradient ranging from 500 to 2100 m in Nainital district, Uttarakhand, Western Himalaya, India, we came across an unique leafy liverwort *Gymnocolea* (Dumort.) Dumort. The name ‘*Gymnocolea*’ refers to the exposed position of the perianth exerted well above the two spreading bracts¹. The presently reported leafy liverwort was found colonizing the shaded, mesic, basal side of *Shorea robusta* tree trunks in a west-facing sal forest area (29°19'1"N, 79°31'3"E; 691 m) along the Kathgodam–Ranibagh Road. Based on a survey of the literature regarding the occurrence and distribution of this Anastrophyllaceous leafy liverwort from 1932 till the present^{2–6}, it was concluded that this species has never been documented earlier from any part of the country. Here we report its occurrence in India from the Kumaun region of Western Himalaya.

Distinct dark green to blackish patches of the leafy liverwort were conspicuous on the wetter basal part of the sal tree trunks. On further examination, the species was identified as *Gymnocolea inflata*, commonly known as ‘inflated notchwort’. It is noteworthy that copiously fruiting population of *G. inflata* was found in constant association with other leafy liverworts, namely *Lopholejeunea sikkemensis* Steph. and *Cololejeunea latilobula* (Herzog) Tixier. Amongst mosses, *Octoblepharum albidum* Hedw., *Fissidens laxitextus* Broth. ex Gangulee and *Herpetineuron toccocae* (Sull. & Lesq.) Cardot were predominantly observed as its close associates. The pH of the underlying substrate of *G. inflata* ranged from 5.0 to 6.5, and hence acidic.

Gymnocolea inflata (Huds.) Dumort., Recueil Observ. Jungerm. 17. 1835. *Jungermannia inflata* Huds., Fl. Angl. ed. 2: 511 1778.

Leafy gametophyte somewhat erect, rarely branched, acrogynous; shoot 8–22 mm long, 0.50–0.90 mm wide, including leaves. Stem slender, 80–150 µm in cross-section, 7–8 cells across diameter; cortical cells 20–25 µm, thin walled; medullary cells comparatively smaller, 13–17 µm. Rhizoids colourless or sometimes brown. Leaves succubously arranged in

two lateral rows, obliquely inserted especially near the bases of the shoots, where they become widely spaced, 0.18–0.24 × 0.17–0.18 mm, bilobed with a V-shaped sinus, lobes with obtuse apex, margin entire; apical leaf cells 16–24 × 13–20 µm; median leaf cells 23–29 × 16–20 µm, basal leaf cells 20–26 × 19–22 µm, trigones inconspicuous; oil-bodies 4–9 per cell (Figure 1 c). Underleaves absent. Gammae not seen. Dioicous. Male bracts in 4–6 pairs; antheridia brown, globose to subglobose with uniseriate stalk. Gynoecea terminal on the main shoot; bracts spreading; bracteole absent. Perianth cylindrical, 0.42 mm long, 0.28 mm wide, smooth, slightly plicate apically. Seta 0.9 mm long and 0.08 mm wide, several vertical cell rows thick with large outer cells encircling smaller inner cells; capsule ovoid to shortly cylindrical, 0.33 × 0.25 mm, wall two-layered; cells of outer capsule wall with nodular thickenings; those of inner layer of capsule wall with sinuate-nodulose thickenings on radial walls occasionally extending on the tangential walls as transverse bands. Spores yellowish-green, 13–16 µm in diameter,

finely papillose. Elaters reddish-brown, 120–176 µm long, 6–9 µm wide, with bispiral thickenings (Figure 2).

The Indian plants with their characteristically shaped leaves and their arrangement; completely exposed or ‘naked’, inflated perianth exerted well above the bracts; several vertical cell rows-thick seta with comparatively larger outer cells, and two-layered capsule wall with cells of both the layers having sinuate-nodulose thickenings on radial walls occasionally partially or fully extending on the tangential walls, fully match with typical *G. inflata* – a species so far known only from Europe, North America, Antarctica, Russia and Japan.

Ecology: The study site lies in the west-facing slope of sal forest in the Kathgodam–Ranibagh area. This area is considered the ‘Cherrapunji of Kathgodam’ due to high rainfall, constant mesicness and high humidity prevailing throughout the year, which perhaps provide suitable microclimate for the growth of this species.

Specimen examined: India, Western Himalaya, Uttarakhand, Nainital, along

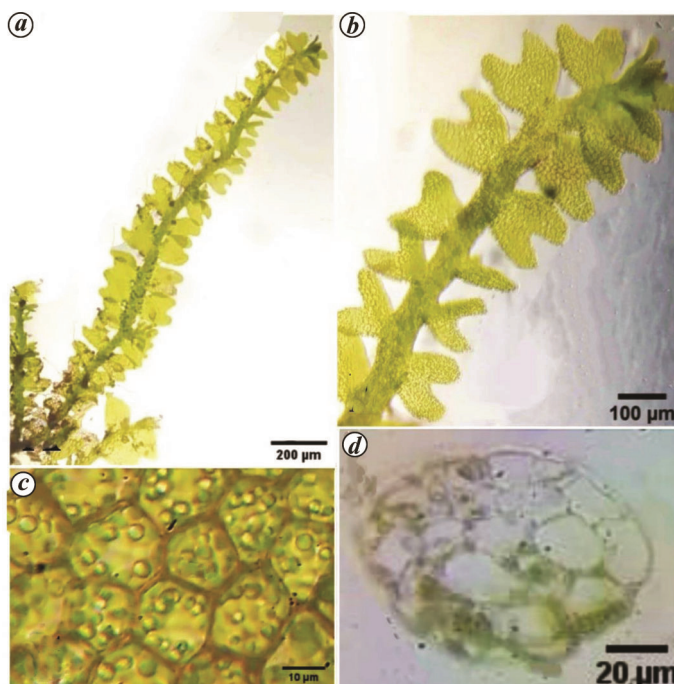


Figure 1. *Gymnocolea inflata* (Huds.) Dumort. *a*, Habit. *b*, A portion of vegetative shoot enlarged (note blunt to rounded leaf lobes with broad, V-shaped sinus). *c*, Median leaf lobe cells with oil-bodies. *d*, Cross-section of stem.

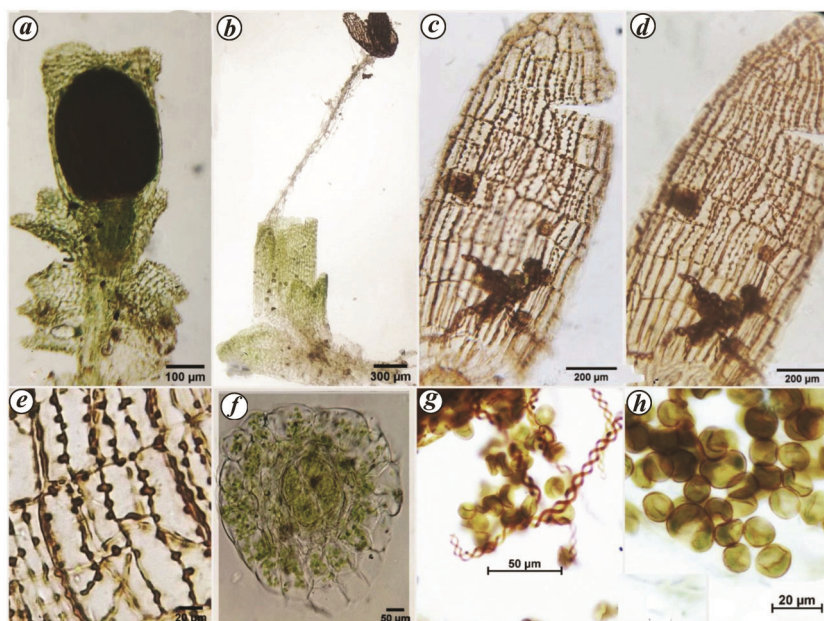


Figure 2. *G. inflata* (Huds.) Dumort. **a**, A fertile shoot bearing gynoecium. **b**, A mature sporophyte with elongated seta and dehiscent capsule. **c**, Outer capsule wall with nodular thickenings. **d**, Inner capsule wall showing nodular and transverse thickenings. **e**, Close-up of inner wall showing sinuate-nodulose thickenings. **f**, Cross-section of seta. **g**, Spores and elaters. **h**, Spores.

Kathgodam–Ranibagh sal forest area, 640–800 m, 25/12/18: R.W1.23, R.W1.41, R.W1.42, R.W1.52; 26/1/19: R.W2.13, R.W2.17, R.W2.22; 12/8/2019: R.R.7, R.R.8, R.R.9, R.R.11, R.R.13, R.R.14, leg. S.D. Tewari & Richa Arya (Herbarium Department of Botany, Indira Priyadarshani Govt. P.G. Girl's College of Commerce, Haldwani; LWG).

Distribution: India (present study), Antarctica, Czech Republic, Denmark, Finland, Italy, Japan, Norway, Poland, Portugal, Russia, Sweden, Switzerland, Turkey and USA⁷.

The present occurrence of *Gymnocolea* in India indicates the major range extension of this interesting leafy liverwort.

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ACKNOWLEDGEMENTS. We thank Dr Hugues Tinguy (3 rue du Faisan, F-67120 Molsheim of France), Dr John Brinda (Missouri Botanical Garden, USA), Dr D. K. Singh (formerly BSI, Lucknow) and Dr A. K. Asthana (CSIR-NBRI, Lucknow) for providing useful inputs regarding the confirmation of identification and also for related literature. We also thank Dr Shashi Purohit (Principal, Indira Priyadarshani Government P.G. Girl's College of Commerce, Haldwani) for providing the laboratory facilities, and our colleagues for help.

Received 27 June 2021; revised accepted 26 July 2021

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Reproductive features of ornamental caridean shrimps under captive condition

Caridean shrimps are a large and diverse group of the order Decapoda, comprising more than 3500 valid species^{1,2}. They are widely distributed from fresh to marine waters with an extensive range of habitats and reproductive features³⁻⁶. Many species of caridean are commercially important to fishery sector, being used for human consumption⁷. Some of them have been used in the ornamental trade as an aquarium pet, due to their attractive colours, bizarre morphology and display-

ing peculiar behaviour with other organisms^{8,9}.

Most of the decapod species have separate sexual systems. However, certain carideans have different reproductive patterns (e.g. hermaphroditism)¹⁰. During the copulation process in carideans, male deposits the spermatophore on the underside of the first abdominal segment of the female. The female carries the developing embryo underneath its abdomen till its maturation and releases the larva once it

reaches the zoeal stage⁹. In carideans, parental care activity is similar to stenopodideans. The incubation period of carideans ranges from a week to several months, and depends on species and environmental conditions^{11,12}.

Generally, caridean and stenopodidean shrimps are continuous breeders under stable abiotic and ecological conditions¹². However, some reports highlight their monogamous and polygamous activities. In carideans, the pre-mating events are