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THREE NEW RECORDS OF *JUNGERMANNIA* SPECIES (HEPATICAE, JUNGERMANNIALES) FROM NEPAL

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Abstract

Jungermanniaceae is the largest family of the Order Jungermanniales, which includes three subfamilies viz Jamesonielloideae, Mylioideae and Jungermannideae representing 18 genera and 71 species in Nepal. This paper deals with three new records *viz*. *Jungermannia exertifolia* Steph., *J. infusca* (Mitt.) Steph. and *J. pumila* With., which were recorded in the year 2010 and 2011 at different elevations (150 to 1300 m) in Chitwan district of central Nepal. These species were observed mostly in the mesic habitats of Sal (*Shorea robusta*) forest with other tree species like *Dalbergia sisoo* and *Acacia catechue*. *Jungermannia pumila* was recorded in broad leaved deciduous forest at 1275 m of elevation.

Key Words: Habitat, Jungerminniaceae, new records, Nepal, subfamily

Introduction

Bryophytes show diverse distribution patterns than the vascular plants, perhaps of their greater dispersal capacity through minute spores. Many cosmopolitan species are found over all the continents. The high humidity and predominating rain are the important factors to create suitable environment for the luxuriant growth of bryophytes. The decrease in precipitation is directly associated to the decrease in the growth and distribution. Some bryophytes can tolerate high temperature, extreme desiccation and some can survive prolonged freezing under wet or dry conditions (Puri, 1973).

Jungermanniales is one of the largest orders of class Hepaticae, having 275 Genera and 7000 species in the world. Nepal represents the same order with 77 Genera, 353 species and 24 families (Pradhan and Joshi, 2009). Jungermanniaceae is the most diverse family representing three subfamilies viz Jamesonielloideae, Mylioideae and Jungermannideae with total of 18 genera and 71 species in Nepal. *Jungermannia*is the widely distributed genus of this family. They may be dioecious or paroecious ground flora of varying sizes. Shoots are prostrate or erect with lateral branches. Rhizoids pale white to brownish arise from the ventral surface. Lateral leaves oval with entire margin and succubous in arrangement. Innovation arises beneath the perianth.

Very few literatures are available on Nepalese bryophytes which are based mostly on the species diversity of eastern and central Nepal. Amakawa (1972) in his publications on

Asiatic species of Jungermanniaceae also has mentioned some species like *Jungermannia macrocarpa*, *Jungermannia kanaii* and *Jungermannia truncata* from eastern Nepal. Srivastava and Singh (1988) made remarkable study which added two more species of *Jungermannia* to the list of Himalaya. These were *Jungermannia fauriana* and *Jungermannia stephanii*. Likewise, Mizutani (1979) compiled a list of 128 species of Hepaticae including six species of *Jungermannia* which were recorded from east Nepal. Long and Grolle (1990) in their study on Bhutanese Hepaticae also has mentioned 13 species of *Jungermannia* from Nepal. Mizutani *et al*. (1995) recorded 97 species belonging to 42 genera and 16 families of Jungermanniales from the eastern and central Nepal. This included a total of 17 species of Jungermannia. This was the result of the Botanical Expedition of National Science Museum of Japan held in 1988.

Shrestha *et al.* (2004) in their publication presented a list of 75 species of Bryophytes collected in the Chitwan district of Nepal which also included six *Jungermannia* species. These were collected at different elevations (150-1300 m).

Hattori (1966) compiled a list of three genera and nine species of Jungermanniaceae of the eastern Himalaya. Of them, *Jungermannia glauca* Amak. was mentioned endemic to Nepal which was collected at the elevation of 2500-3000 m.

Materials and Methods

Study Area

Chitwan is the central district of Nepal, lies between 27º 21’ to 27º 52’ N and 83º 54’ to 84º 48’ E. Major part of this district is incorporated into the National Park system where potential floral components are found. This district is mostly dominated by the *Shorea robusta* forest including other tree species like *Dalbergia sisoo, Terminalia alata, Bombyx ceiba, Acacia catechue, Trewia nudiflora, Adina cordifolia,* etc. Common bryophytes of this district are *Asterella wallichiana, Marchantia emarginata, Plagichiasma pterospermum, Fissidens sylvaticus, Bryum coronatum, Physcomytrium eurystomum,* etc.

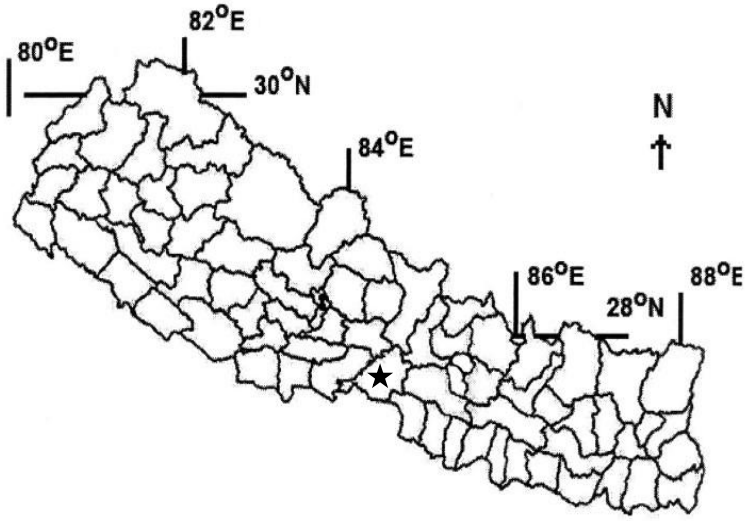

Fig. 1. Map of Nepal and Location of Chitwan (star)

The present study was carried out from November to February (2010 – 2011) during sporophytic stage. Laboratory knife and a standard wood chisel were used to scrape bryophytes from rocks and tree barks.

The identification of bryophytes was done using standard published literature such as Arnell (1956), Kashyap (1972), So (1995), Smith (1996), and Zhu and So (1996). Brummitt and Powell (1992) was consulted to confirm the authority of the species.

Some of the delicate vegetative thalli of these plants were kept in wet conditions in biology laboratory for further anatomical study. The collected specimens were preserved in clean and sterilized glass bottles using a mixture of 4% Formalin, FAA Solution (5 ml Formalin, 5 ml Glacial Acetic Acid , 90 ml of 70 % Ethyl Alcohol) and 50 % Ethanol (Manandhar 1982).

Results

Family: Jungermanniaceae

Jungermannia L., Sp. Plant. ed.**1**: 1131, 1753.

1. Jungermannia exertifolia Steph., Spec. Hepat.**6**: 86, 1971; Vana, J. Hattori Bot. Lab.**35**: 312, 1972; Sm., Liverworts Brit. & Ireland: 142, 1996.

Plants dioecious or paroecious, vary in sizes, yellowish green to brown. Shoots prostrate to erect, 5-6 cm long, profusely branches, arise laterally. Rhizoids are hyaline to brown or deep red to purple and end to the knob like structure. Leaves alternate, obliquely inserted, succubous, reniform, orbicular, broadly ovate to cordate with entire margin and 3x2 mm in size, middle laminal cells hexagonal, 34x17 µm in diameter, thin walled with 5-6 oil bodies and without trigones. Underleaves and gemmae are usually lacking. Innovations appear underneath the perianth. Spores spherical, light brown, 10-24 µm in diameter (Fig.2).

Habitat: Wet boulder stones.

Status: Rare

Specimens Examined: **C**. Nepal: *Chitwan*, Daughat-Phedi forest, 300 m, 20.11.2010, Pradhan 235 (NHM).

Distribution: Nepal; British Columbia, Canada, Caucasus, China, Europe, Greenland, Iceland, Japan, North Italy and South Spain.

2. Jungermannia infusca (Mitt.) Steph., Spec. Hepat.**2**: 74, 1901.

Prectocolea infusca Mitt., Trans. Linn. Soc. London 2, **3**: 196, 1891.

Nardia infusca (Mitt.) Steph., Bull. Herb. Boiss. **5**: 81, 1897.

Large patch of velvety bright green plants found intermingle with mosses, generally creeping and overlapping each other. Stems usually unbranched, 8-10 mm long, flat with rectangular cells (12x23 µm in diameter). Rhizoids pale brown, grow numerous on the ventral surface of the stem. Lateral leaves on exposed parts are succubous, large, oval with entire margin and leaves on unexposed stems are little distant, pale brown, oval and 442x430 µm in sizes, laminal cells hexagonal, 34x23 µm in diameter, chlorophyllous and 2-3 oil bodies, trigon**e**s feebly developed. Capsule spherical, dark purplish to maroon, 0.5 mm in diameter, on smooth

hyaline seta. Spores spherical, light brown, 20.5 µm in diameter, elaters light brown, double banded with blunt ends (Fig. 3).

Habitat: Sandy soil.

Status: Rare.

Specimens Examined: **C**. Nepal: *Chitwan*, Jugedi, 250 m, 21.11.2010 Pradhan 266 (NHM).

Distribution: Nepal; China, Japan, Taiwan, and U.S.S.R.

3. Jungermannia pumila With., Arrang. Brit. Pl. ed. 3,**3**: 883, 1796; Arnell, Moss Fl. Fennos **1**: 106, 1956; Amakawa, J. Hattori Bot. Lab.**22**: 49, 1960; Vana, J. Hattori Bot. Lab.**35**: 315, 1972; Sm., Liverworts of Brit. & Ireland*:* 138-140, 1996.

Jungermannia zeyheri Hubuene, Hep. Germ. : 89, 1834.

Jungermannia rostellata Hubuene, Hep. Germ.: 95, 1834.

Jungermannia clavata Hook. F. & Tayl., London J. Bot. **4**: 88, 1845.

Aplozia pumila (With.) Dumort., Bull. Soc. Roy. Bot. Belgique**13**: 59, 1874.

Aplozia pumila var. *rivularis* Schiffn., Lotos **48**: 326, 1900.

Plants small, dull green to blackish green. Shoots 1-2 cm long and 0.3 mm broad. Stems procumbent, apical part of stem ascending. Rhizoids hyaline to pale brownish. Leaves loosely imbricate, obliquely inserted, more or less uniform, dark green, elliptical to ovate, somewhat concave, erect to erecto-patent and 0.4x0.3 mm in size, margin entire, cells more or less hexagonal, double walled, isodiametric measuring 32x18 µm in diameter, trigones absent, oil bodies oval-spherical usually brown. Female bracts resemble stem leaves, male bracts 4-8 in pairs below narrower and fusiforms perianth. Spores spherical, small, 16-20 µm in diameter (Fig. 4.).

Specimens Examined: **C**. Nepal: *Chitwan*, Shaktikhor-Upperdang Gadi, 1000-1275 m, 15.11.2010, Pradhan 186 (NHM).

Habitat: Bank and wet rocks.

Status: Rare.

Distribution: Nepal; China, Iceland, Ireland, Greenland, Peninsula, North Britain, North Fennoscandia, North Italy, Siberia, Tanzania, West Russia and Yugoslavia.

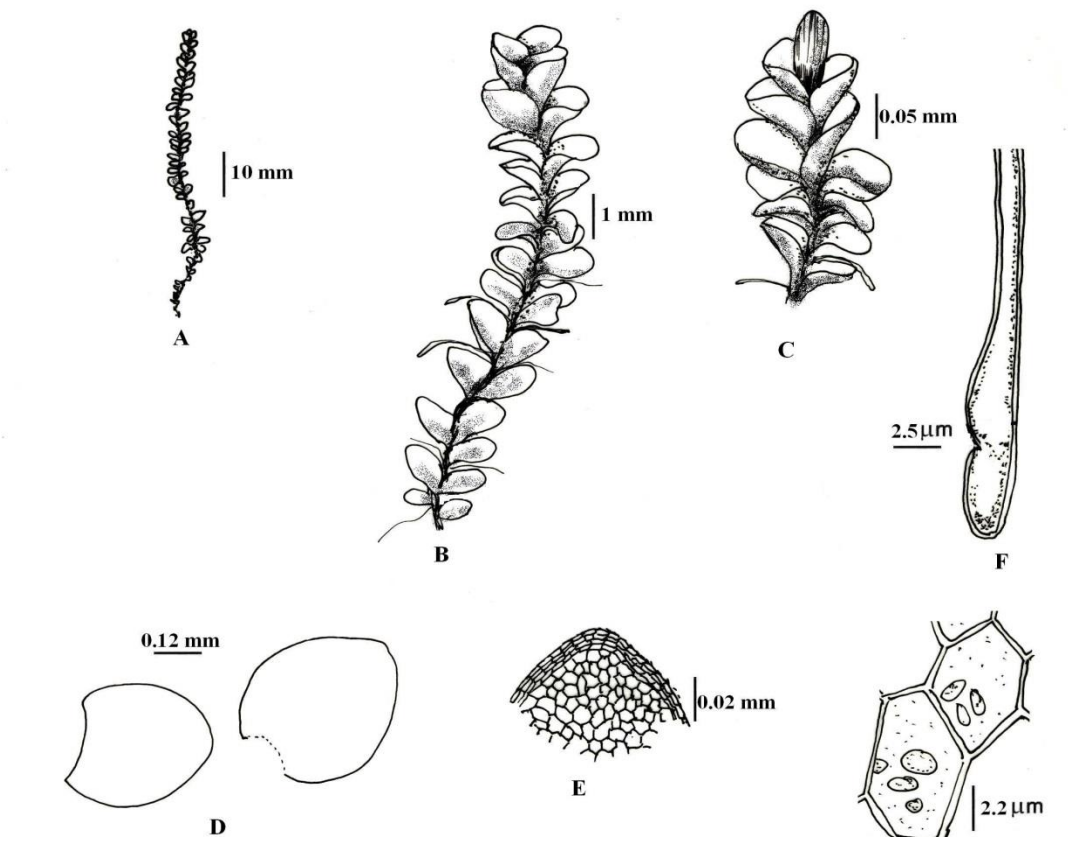

Fig. 2. *Jungermannia exertifolia* Steph. (Pradhan 235). A. habit, B. the sterile plant enlarged, C. a portion of female branch, D. portion of rhizoid with knob end, E. leaves, F. apical portion of the leaf, G. laminal cell.

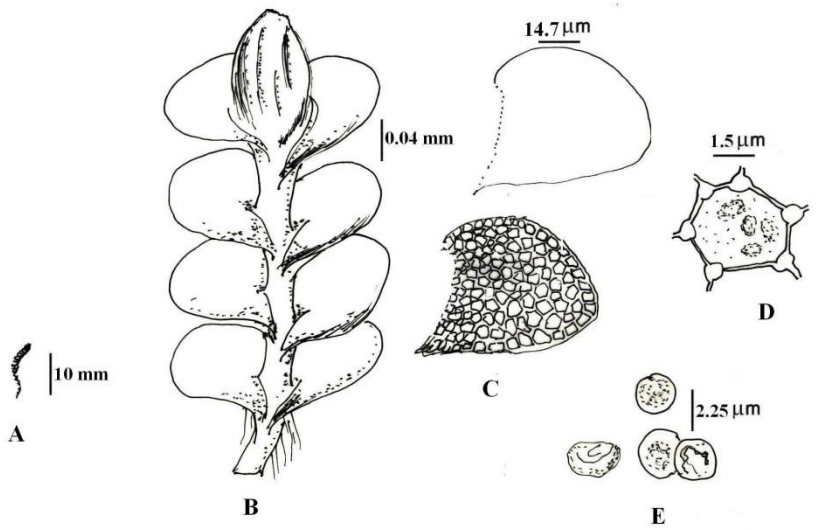

Fig. 3. *Jungermannia infusca* (Mitt.) Steph. (Pradhan 266) A. habit, B. a fertile branch, C. leaves, D. a laminal cell with trigones, E. spores.

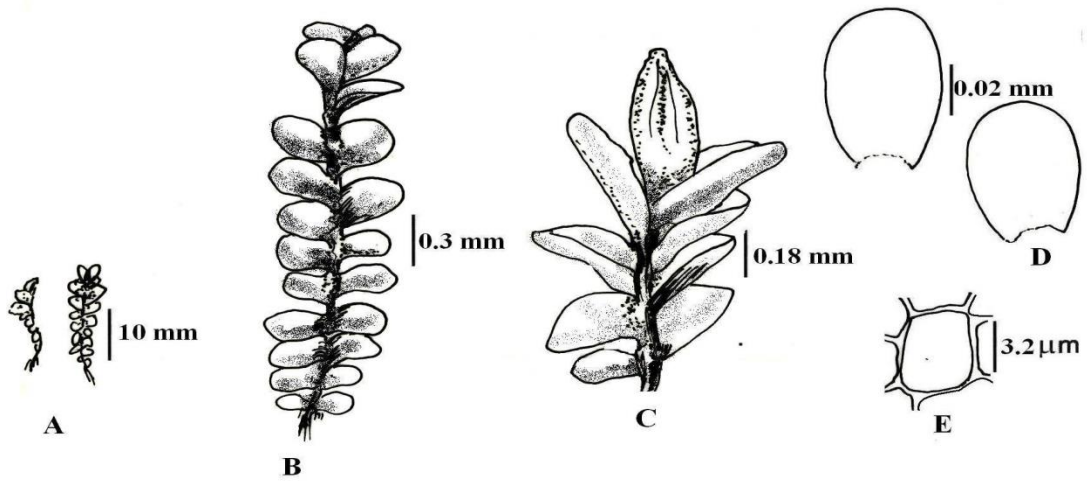

Fig. 4. *Jungermannia pumila*With. (Pradhan 186). A. habit, B. a sterile plant, C. a fertile shoot, D. leaves, E. a laminal cell

Discussion

The checklist of Nepalese bryophytes presents 307 species of liverworts, 766 species of mosses and 8 species of hornworts (Pradhan, 2000). The recent database at the Natural History Museum (Nepal) contains 1205 species of bryoflora collected from different geographical regions of Nepal (Pradhan, 2013).

Pradhan, (2000) documented 31 species of *Jungermannia* from different elevations of the country. Pradhan and Joshi (2009) listed 353 species, 77 genera and 24 families of the order Jungermanniales of Nepal which also included 41 species of *Jungermannia*. Grolle(1966) made a remarkable work on the bryophytes of Nepal which brought a list of 5 endemic species of *Jungermannia* like *Jungermannia atrorevoluta* Amak., *J. flagellaris* Amak., *J. poeltii* Amak., *J. raujeana* Amak. and *J. ventroversa* Grolle.

The three newly recorded species differ each other in various respects. *Jungermannia. exetrtifolia* and *J. infusca* are dioecious whereas *J. pumila* is paleocious. Tyigones in leaf cells are absent in *J. exertifolia* and *j. pumila* but feeble developed in *J. infusca*. The stem leaves of *J. exertifolia* are quite larger than *J. infusca* and *J. pumila*. The narrow fusiform perianth is characteristic of *J. pumila.* Amakawa (1960) and Vana (1972) considered it as a subspecies of *Jungermannia cordifolia* Hook. It differs from *J. cordifolia* by its ovate oblong leaves which are cordate at their base. But Schuster (1969) stated that both the taxa are conspecific.

Conclusion

Jungermanniaceae is the family of the order Jungermanniales which is represented by three subfamilies viz Jamesonielloideae, Mylioideae, Jungermannideae in Nepal. Altogether 18 genera and 71 species of this family have been reported in this country. Three species viz *Jungermannia exertifolia* Steph., *J. infusa* (Mitt.) Steph. and *J. pumila* With. are the newly

recorded and rare species which were collected within the elevation range of 150 to 1300 m in the mesic habitat of the Sal (*Shorea robusta*) forest at Chitwan district of central Nepal.

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