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Conspectus of the families Aizoaceae, Molluginaceae and Gisekiaceae in Bihar

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Abstract

The conspectus of the families Aizoaceae, Molluginaceae and Gisekiaceae in Bihar is presented here based on the study of literature, field tours to different parts of Bihar and herbarium specimens. Aizoaceae is represented by one genus and two species; Molluginaceae by four genera and five species and Gisekiaceae by one genus and one species. Accepted name, followed by basionym, if any, synonyms, phenology, distribution and specimens examined with full nomenclature citation have been provided. A key to the genera and species has been also added.

Keywords: Aizoaceae, Bihar, Conspectus, Gisekiaceae, Molluginaceae

Introduction

Bihar is the 13th largest state in the country and covers an area of 94,163 sq km, of which about 7,305 sq km is under forest cover that constitutes 7.76% of total geographical area (FSI, 2019). It shows that there are limited areas of forest in the state which is mainly distributed in Aurangabad, Banka, Gaya, Jamui, Kaimur, Munger, Rohtas and West Champaran districts. The state is demarcated by the river Ganges into two prominent zones, North Bihar and South Bihar. The annual rainfall ranges from 1,000 to 2,000 mm and the average annual temperature varies from 20°C to 28°C. The state has one National Park and 12 Wildlife Sanctuaries covering 3.44% of its geographical area (FSI, 2019).

The families Aizoaceae, Molluginaceae and Gisekiaceae were previously treated under Aizoaceae s.l. (Bentham and Hooker, 1867). Hutchinson (1926) was the first to establish the Molluginaceae as a distinct family. Phylogenetic study also suggests that *Mollugo* L. is polyphyletic (Thulin et al., 2016). Nakai (1942) elevated the genus *Gisekia* L. to family rank and phylogentic study also supported that Gisekiaceae should be treated as distinct family (Bissinger et al., 2014).

Materials and Methods

The present study was based on the study of literature (Haines, 1910, 1921–1925; Mooney 1950; Mishra, 1969; Bhattacharya and Sarkar, 1998; Singh et al., 2001), field tours to different parts of Bihar and herbarium specimens deposited at CAL, LWG and Gaya College. The identity of the species was confirmed with the help of regional flora (Haines 1921-25; Bhattacharya and Sarkar, 1998). The nomenclature of plants was updated using Plants of the World Online (2020). Each species is provided

with accepted name, followed by basionym, if any, synonyms, phenology, distribution and specimens examined with full nomenclature citation. A key to the genera and species are also provided. Genera and species are arranged alphabetically in the present investigation.

Results

Aizoaceae

Trianthema L.

Key to the species

1a. Petiole base with a pair of scarious stipular appendages; stamens 10–18..... **1. T. portulacastrum**

1b. Petiole base with a pair of minute dentiform stipules; stamens 5. ……**2. T. triquetrum**

1. Trianthema portulacastrum L., Sp. Pl.: 223. 1753; P.K. Bhattach. & K. Sarkar, Fl. West Champaran: 74. 1998; N.P. Singh et al., Fl. Bihar: 222. 2001. *T. monogynum* L., Mant. Pl. 69. 1767, *nom. illeg.*; C.B. Clarke in Hook.f., Fl. Brit. India 2: 660. 1879; Haines, Bot. Bihar Orissa: 49. 1921. **Fig. 1a-c**

Fl. & Fr.: July-December.

Distrib.: Bhagalpur, Gaya, Patna, West Champaran.
Specimens examined: Gaya, Gautam Buddha Wildlife Sanctuary, Doath, 31.08.2012, *Anand Kumar* 57079 (CAL); Jaigir, 22.07.2015, *Anand Kumar* 63658 (CAL).

2. Trianthema triquetrum Rottler & Willd., Neue Schriften Ges. Naturf. Freunde Berlin 4: 181. 1803; K.K. Mishra in J. Econ. Tax. Bot. 6: 411. 1985.

Fl. & Fr.: July-December.

Distrib.: Gaya.

Specimens examined: Gaya, Barabar hills, *K.K. Mishra* 1372 (Gaya college).

Molluginaceae

Key to the genera

1a. Leaves all cauline; indumentum often of stellate hairs; staminodes present; ovary 3–5-loculed; styles 3–5; seeds arillate, the aril filiform-appendaged ..……**1. Glinus**

1b. Leaves both radical and cauline; indumentum often of glandular hairs, papillae or absent; staminodes absent; ovary 3-loculed; styles 3; seeds exarillate or aril minute and without appendage…….....**2**

2a. Stipules absent……....3. **Paramollugo**

2b. Stipules present, at least on upper leaves, sometimes smallor forming a narrow rim, clasping the node……**3**

3a. Flowers in umbel-like cymes; seeds D-shaped, reticulate.....2. **Hypertelis**

3b. Flowers in panicle- or raceme-like cymes; seeds reniform, tuberculate ……..…4.**Trigastrotheca**

1. Glinus L.

Key to the species

1a. Plants densely stellate tomentose; leaves obovate to sub–orbicular, entire along margins, stellate tomentose on both surfaces; flowers sessile or subsessile; ovary 5-loculed; styles 5; capsules 5-valved, densely stellate tomentose..…..1. **G. lotoides**

1b. Plants glabrous to puberulous; leaves oblong–obovate, entire with sparse teeth along margins, glabrous; flowers pedicellate; ovary 3-loculed; styles 3; capsules 3-valved, glabrous…2. **G. oppositifolius**

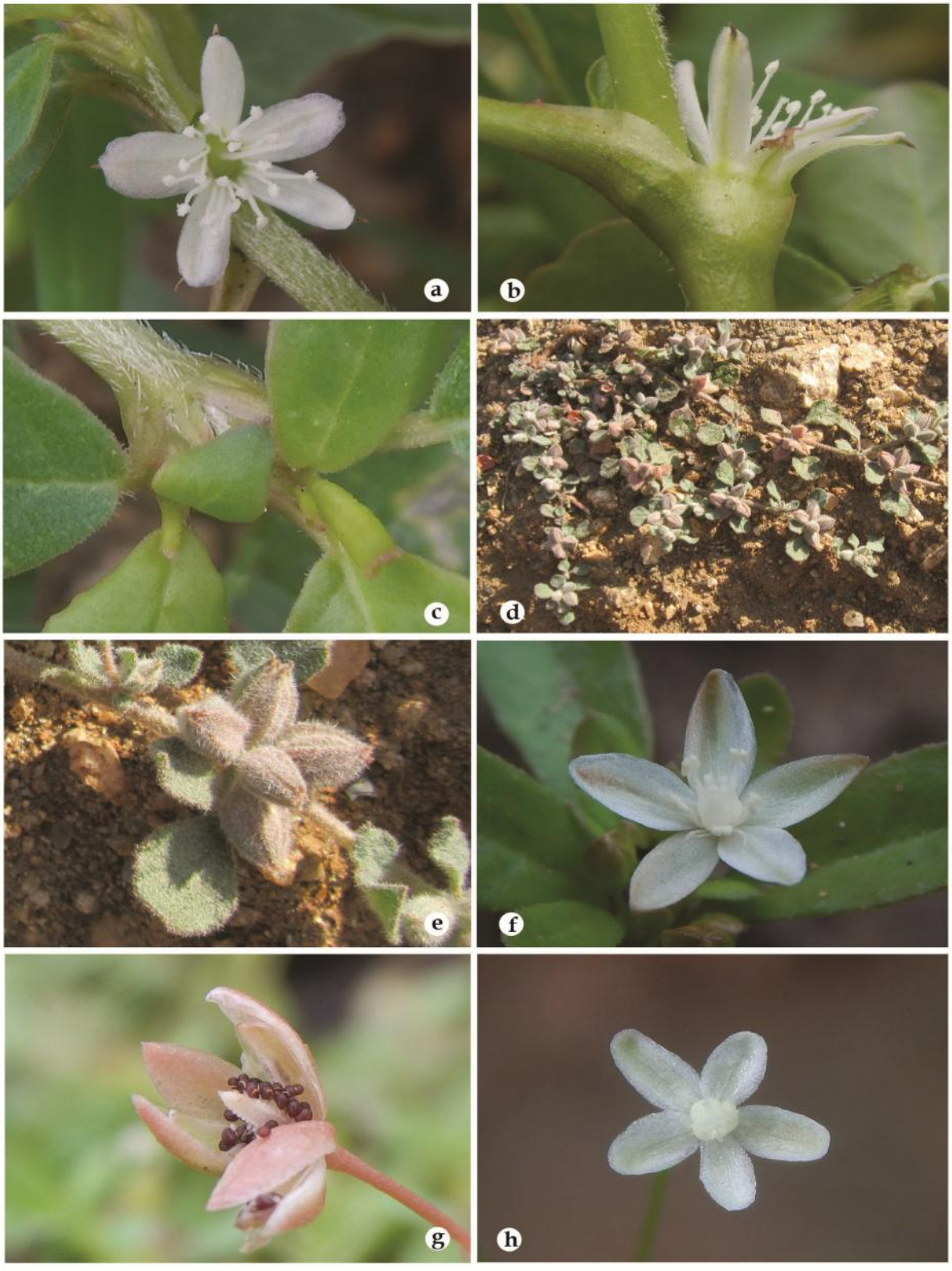

Fig. 1. a-c. **Trianthema portulacastrum** L., d-e. **Glinus lotoides** L., f-g. **G. oppositifolius** (L.) Aug. DC., h. **Trigastrotheca pentaphylla** (L.) Thulin

1. *Glinus lotoides* L., Sp. Pl.: 463. 1753; N.P. Singh et al., Fl. Bihar: 223. 2001. *Mollugo hirta* Thunb., Prodr. Fl. Cap.: 24. 1794; C.B. Clarke in Hook.f., Fl. Brit. India 2: 662. 1879. *Mollugo lotoides* (L.) Arcang., Comp. Fl. Ital.: 247. 1882; Haines, Bot. Bihar Orissa: 48. 1921. **Fig. 1d-e**

Fl. &*Fr*.: February-April.

Distrib.: Bhagalpur, Gaya, Patna, West Champaran.

Specimens examined: Gaya, Gautam Buddha Wildlife Sanctuary, Piprahi, 21.03.2013, *Anand Kumar* 57308 (CAL); Patna, Sarmaspur, near Fatwa, 22.12.1957, *J.G. Srivastava & Party* 46740 (LWG); West Champaran, Gobardhan village, near Someshwar hill, 11.03.1958, *J.G. Srivastava & Party* 48705 (LWG).

2. *Glinus oppositifolius* (L.) Aug. DC., Bull. Herb. Boiss. ser. 2, 1: 559. 1901; N.P. Singh et al., Fl. Bihar: 223. 2001. *Mollugo oppositifolia* L., Sp. Pl.: 89. 1753. *M. spergula* L., Syst. Nat. ed. 10, 2: 881. 1759; C.B. Clarke in Hook. f., Fl. Brit. India 2: 662. 1879; Haines, Bot. Bihar Orissa: 48. 1921. **Fig. 1f-g**

Fl. & *Fr*.: Almost throughout the year.

Distrib.: Bhagalpur, Darbhanga, Gaya, Patna, West Champaran.

Specimens examined: South Bihar, Horhap, 28.07.1977, *S.K.B. & B.N.C.* 26 (CAL); Rajgir, Rajgir WLS, G H Area, 17.09.2003, *A.K. Ghosh* 32993 (CAL); Gaya, Gautam Buddha Wildlife Sanctuary, Singhpur, 21.03.2013, *Anand Kumar* 57318 (CAL).

2. Hypertelis E. Mey. ex Fenzl

Hypertelis cerviana (L.) Thulin in Taxon 65: 787. 2016. *Pharnaceum cerviana* L., Sp. Pl.: 272. 1753. *Mollugo cerviana* (L.) Ser. in DC., Prodr. 1: 392. 1824; C.B. Clarke in Hook.f., Fl. Brit. India 2: 663. 1879; N.P. Singh et al., Fl. Bihar: 223. 2001.

Fl. & Fr.: November-December.

Distrib.: Chapra, Gaya, Munger, Saran.

Specimens examined: Chapra, Ganges diara, December, 1854, *J.G. Srivastava* 2073 (LWG); Munger, Kiul, *K.K. Mishra* 2810 (Gaya college); Gaya Nilajan, *K. K. Mishra* 4480 (Gaya college).

3. Paramollugo Thulin

Paramollugo nudicaulis (Lam.) Thulin in Taxon 65: 786. 2016. *Mollugo nudicaulis* Lam., Encycl. 4: 234. 1797; C.B. Clarke in Hook.f., Fl. Brit. India 2: 664. 1879; N.P. Singh et al., Fl. Bihar: 223. 2001.
Fl. & Fr.: March-June.

Distrib.: Patna.

Specimens examined: Patna, 1950–54, *J.G. Srivastava* 21492 (LWG).

4. Trigastrotheca F. Muell.

Trigastrotheca pentaphylla (L.) Thulin, Taxon 65: 784. 2016. *Mollugo pentaphylla* L., Sp. Pl.: 89. 1753; N.P. Singh et al., Fl. Bihar: 223. 2001. *M. stricta* L., Sp. Pl. ed. 2: 131. 1762; C.B. Clarke in Hook.f., Fl. Brit. India 2: 663. 1879; Haines, Bot. Bihar Orissa: 48. 1921. **Fig. 1h**

Fl. & Fr.: August-November.

Distrib.: Bhagalpur, Patna, West Champaran.

Specimens examined: Bihar, Hakasaburui line, 30.12.1961, *G.V.S. Rao* 23019 (CAL); South Bihar, Baliadangra, 20.07.1977, *S.K.B. & B.N.C.* 14 (CAL); Rajgir, Rajgir WLS, Vipur Giri, 13.09.2003, *A.K. Ghosh* 32849, 32897, 33026 (CAL); Sabalpur, 28.07.2015, *Anand Kumar*; Sakhwa, 05.09.2012, *Anand Kumar* 57153 (CAL).

Gisekiaceae

Gisekia L.

Gisekia pharnaceoides L., Mant. Pl. Altera 2: 562. 1771; C.B. Clarke in Hook.f., Fl. Brit. India 2: 664. 1879; K.K. Mishra in J. Econ. Tax. Bot. 6: 410. 1985.
Fl. & Fr.: August-October.

Distrib.: Gaya.

Specimen examined: Gaya, *K.K. Mishra* 130 (Gaya college).

Discussion

The results show that the family Aizoaceae is represented by the genus *Trianthema* and two species namely, *T. portulacastrum* L. and *T. triquetrum* Rottl. ex Willd. in Bihar. Singh et al. (2001) overlooked the publication of Mishra (1985) and not included *Trianthema triquetrum* in their enumeration. In India, the family is represented by three genera and nine taxa (Karthikeyan et al., 2000). *T. portulacastrum* can be identified based on petiole base with a pair of scarious stipular appendages and 10–18 stamens while *T. triquetrum* by petiole base with a pair of minute dentiform stipules and 5 stamens. The former species is the most commonly distributed in most parts of the state while the later species is rare and was reported from the single locality of Gaya district, Bihar in 1985.

The family Molluginaceae is represented by four genera and five species in Bihar. The genera include *Glinus* L., *Hypertelis* E. Mey. ex Fenzl, *Paramollugo* Thulin and *Trigastrotheca* F. Muell. The genus *Glinus* is represented by two species, *G. lotoides* and *G. oppositifolius* in the state. It can be easily differentiated from other members of Molluginaceae by its indumentum of often stellate hairs, presence of staminodes and filiform-appendaged aril on the seeds (Thulin et al., 2016).

Hypertelis, *Paramollugo* and *Trigastrotheca* comprises one species, *H. cerviana* (L.) Thulin, *P. nudicaulis* (Lam.) Thulin and *T. pentaphylla* (L.) Thulin, respectively in the state which was previously included under *Mollugo*. The genus *Hypertelis* can be easily distinguished by leaves linear, stamens 5, seeds D-shaped and reticulate. *Paramollugo* can be determined by leaves ex-stipulate, alternate, either in basal rosette or scattered along long shoots and crowded on short shoots, inflorescences mostly dichotomously branched and seeds papillose (Thulin et al., 2016). *Trigastrotheca* differs from *Mollugo* by the presence of stipules and broad-based filaments (Thulin et al., 2016).

Gisekiaceae is a monogeneric family represented by only *Gisekia pharnaceoides* L. in the state. Singh et al. (2001) overlooked the publication of Mishra (1985) and not included this species in their enumeration. The genus *Gisekia* can be characterized by the presence of whitish aphides throughout the plant surface and seemingly free carpels.

Therefore, it has been concluded that the families Aizoaceae, Molluginaceae and Gisekiaceae should be considered as distinct family in the state. The species belonging to the genus *Mollugo* should be treated under the different genera *Hypertelis*, *Paramollugo* and *Trigastrotheca* because the genus *Mollugo* is polyphyletic.

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