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Checklist and key to the Scrophulariaceae of Bihar, India

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Abstract

Family Scrophulariaceae was documented and a checklist has been prepared with the help of relevant literatures and herbarium specimens deposited in Central National Herbarium, herbarium of Ranchi University and National Botanical Research Institute. All the species and varieties are enumerated with identification keys. The generic diversity at global, national and state level has been provided. The valid names of the species along with author(s), flowering and fruiting time and occurrence at district level are mentioned. Our study revealed that the family Scrophulariaceae in Bihar is represented by 42 species under 21 genera. The purpose of the checklist is to document the diversity of the family Scrophulariaceae in Bihar and taxonomic key is to offer students and botanist a means for identification.

Keywords: Scrophulariaceae, Biodiversity, Checklist, Flora, Bihar.

Introduction

The word 'Bihar' has originated from the 'Viharas' which means the resting house of Buddhist monks. The state of Bihar is situated in eastern part of India in between lat $21^0$58' 10" N and $27^0$31'15" N and long 83^0 16' E and 88^0 30' E. It is 13^{th} largest by territory with a geographic area of 94,163 km^2 and third largest state by population. The state shares boundary with Nepal in north, Jharkhand in the south, West Bengal in the east, Uttar Pradesh and Madhya Pradesh in the west. Bihar is one of the oldest inhabited places with a history going back to 3000 years. Among 16 Mahajanpada, 3 were in Bihar (i.e. Magadha, Anga & Vanga and Vajji), after power struggle Magadha was emerged as most powerful and established the first Indian empire. Bihar was important for Biritishers for plantation of indigo, cotton because of fertile land drained by river Ganges and its tributaries. It was also a trade centre cotton, textile, saltpetre and indigo.

The vast stretch of very fertile flat land splits by river Ganges, which flows from west to east. The northern plain is located in Terai region, flood plains of Koshi river. The southern plain is comparatively narrow than northern plains. In addition to Ganges, other important rivers are Sone, Bagmati, Kosi, Budhi Gandak, and Phalgu. Central parts of Bihar have some small hills and Plateau, for example the Rajgir hills, Kaimur

plateau and Himalayan foot hills in West Champaran district. Soil of the state is broadly classified into 3 types: (1) Piedmont Swamp Soil (northern area of West Champaran district), (2) Terai Soil (along with Nepal border), (3) Gangetic Alluvium (most of the area of Bihar).

Climate of Bihar is monsoon type due to location is tropical to sub-tropical and presence of Himalayas in north which cause heavy precipitation in Terai area. Broadly 3 types of seasons: winter, summer and rainy. Winter is from November to February, Summer is from April to June and rainy season is from July to September. In summer temperature may reach up to 44 ºC in southern districts and minimum temperature may falls up to 4 ºC in West Champaran district. The average annual rainfall varies from 100 to 125 cm.

The forest cover is just 7.6% (7305 sq. km) and the dense forest is 3280.32 sq. km which is very less than required forest cover. A total of 21 wildlife sanctuaries and 1 national park are in the state and Valmiki National Park is only national parks situated in West Champaran district. As per Champion and Seth (1968) Classification for Forests, the state has ten forest types viz. Cane Brakes, Bhabar Dun Sal Forest, West Gangetic Moist Mixed Deciduous Forest, Eastern Wet Alluvial Grassland, Dry Siwalik Sal Forest, Dry Peninsular Sal Forest, Northern Dry Mixed Deciduous Forest, Dry Deciduous Scrub, Boswellia Forest and Dry Bamboo Brakes. Main species of Bihar forests are *Shorea robusta, Terminalia tomentosa, T. arjuna, Anogeissus latifolia, Gmelina arborea, Madhuca longifolia, Dillenia pentagyna, Abrus precatorius, Biophytum sensitivum, Costus speciosus, Vanda tessellata, Murraya paniculata, etc.*

Review of Literature

Exploration of plants started by Buchanan-Hamilton from 1809-1813. The next collector was Hooker (1848) who had collected plants from Gaya, Kymore hills, Purnea, etc. Anderson (1863) had published checklist on plant species of Bihar. On the flora of undivided Bihar and Orissa contribution of Hanes is significant, he had collected plants mainly in Jharkhand and Orissa and published "The Botany of Bihar and Orissa" in six volumes in between 1921-1925. Mooney (1941; 1950) published "Supplement to the Botany of Bihar and Orissa". But his work was mainly focused on area which at present falls under Jharkhand. Some major publications are on Champaran district (Thothathri, 1965; Banerjee and Banerjee, 1969; Bhattacharya & Krishnendu, 1998), Udaipur forest of Champaran district (Thothathri, 1966; Maurya *et al*., 2021); Bhagalpur (Paul, 1967; 1981); A sketch of the vegetation of Champaran district of North Bihar by Banerjee and Banerjee (1969); useful plants of Bihar and vegetation of Muzaffarpur, Purnea, Saran, Champaran, Patna by Srivastava (1955-58), vegetation of Darbhanga district by Thakur (1963), Patna (Singh, 1986) and West Champaran (Bhattacharya & Krishnendu, 1998). Other notable publications are Sanyal (1957), Thakur (1963), Mishra (1969-1971), Mishra (1985), Mishra & Jha (1972), Jain *et al.* (1975), Paul (1966, 1973), Saxena (1976, 1978), Srivastava *et al.* (1966) and Uniyal and Datta (1984), Singh (2005), Bhattacharya *et al.* (2011), Kumar *et al*. (2020), Bharati and Maurya (2018), Bharati (2019), Maurya and Bharati (2019), Maurya *et al*., 2021. Published literature shows that many literatures are available but the state doesn't have any separate comprehensive account on the family Scrophulariaceae, therefore, the present study was undertaken.

The main objective of the study was to prepare a checklist of Scrophulariaceae with key to the species; it will help in assessment of diversity at district level and identification of species.

Methodology

The present work was initiated with gathering of information on the said family with help of relevant literatures like, the Botany of Bihar & Orissa (1921–1925), some additions to the Botany of Bihar & Orissa (1941), Supplement to the Botany of Bihar & Orissa (1950), Flora of Bihar analysis (2001) and Flora of west Champaran district Bihar (1998) were referred.

In addition, the specimens deposited in Central National Herbarium (CAL), herbarium of Ranchi University and National botanical research Institute (LWG) were consulted. Worldwide distribution of species was verified through Mabberley (2008). The National level and state level distribution was taken from databases like, Plants of the World Online (https://powo.science.kew.org), Flora of India (https://efloraindia.bsi.gov.in/) and district level distribution was verified from Flora of Bihar analysis (2001). The nomenclatures were updated through authentic online databases: the plant list (http://www.theplantlist.org) and International Plant Name Index (http://www.ipni.org). The Benthum and Hooker's systemof classification was followed and a diagnostic generic and species key have also been framed for easy identification of taxa.

Results and Discussion

Scrophulariaceae family has 66 genera and 1800 species worldwide, cosmopolitan in distribution, especially in tropical and warm climatic conditions, especially in South Africa (Mabberley, 2017); 62 genera and 368 species in India (Karthikeyan, 2000); 21 genera and 41 species in Bihar.

In present study, the diversity in the genera and species of the Bihar has been compared at global and national level (Table-1). After comparison, it was observed that most diversified genera is *Verbascum* (464 species) followed by *Veronica* (461 species), *Lindernia* (160 species), *Jamesbrittenia* (84 species), *Torenia* (69 species), *Bacopa* (62 species), *Striga* (53 species), *Vandellia* (52 species), *Mimulus* (51 species), *etc* (Fig. 1). Distribution at national level is maximum observed in *Veronica* (34 species), *Lindernia* (27 species), *Limnophila* (20 species), *Torenia* (19 species), *Striga* (10 species), *etc*. Species level diversity is maximum in *Limnophila* (8 species), followed by *Lindernia*, *Striga*, *Vandellia*, *Bonnaya*, *Lindenbergia* (3 species each), *Veronica*, *Torenia*, *Adenosma* (2 species each) and rest of the genera represented by one species only.

Table 1: Diversity of Scrophulariaceae at global, national and state level.

S. No.	Genus	World wide	India	Bihar
1.	*Verbascum*	464	6	1
2.	*Veronica*	461	34	2
3.	*Lindernia*	160	27	3
4.	*Jamesbrittenia*	84	1	1
5.	*Torenia*	69	19	2
6.	*Bacopa*	62	3	2
7.	*Striga*	53	10	3
8.	*Vandellia*	52	9	3
9.	*Mimulus*	51	2	1
10.	*Mazus*	40	5	1
11.	*Alectra*	40	2	1
12.	*Limnophila*	37	20	8
13.	*Nanorrhinum*	29	3	1
14.	*Bonnaya*	16	9	3
15.	*Adenosma*	15	3	2
16.	*Lindenbergia*	12	7	3
17.	*Mecardonia*	10	1	1
18.	*Misopates*	8	1	1
19.	*Centranthera*	6	4	1
20.	*Glossostigma*	6	1	1
21.	*Microcarpaea*	2	1	1
	Total	**1677**	**168**	**42**

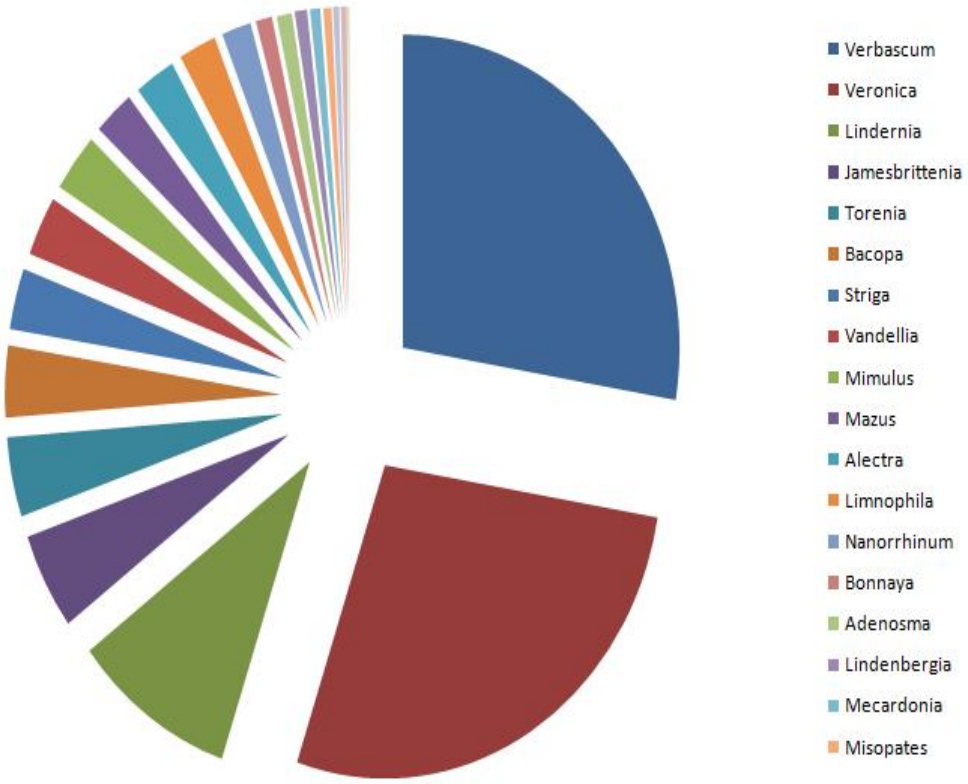
Verbascum
Veronica
Lindernia
Jamesbrittenia
Torenia
Bacopa
Striga
Vandellia
Mimulus
Mazus
Alectra
Limnophila
Nanorrhinum
Bonnaya
Adenosma
Lindenbergia
Mecardonia
Misopates

Fig .1

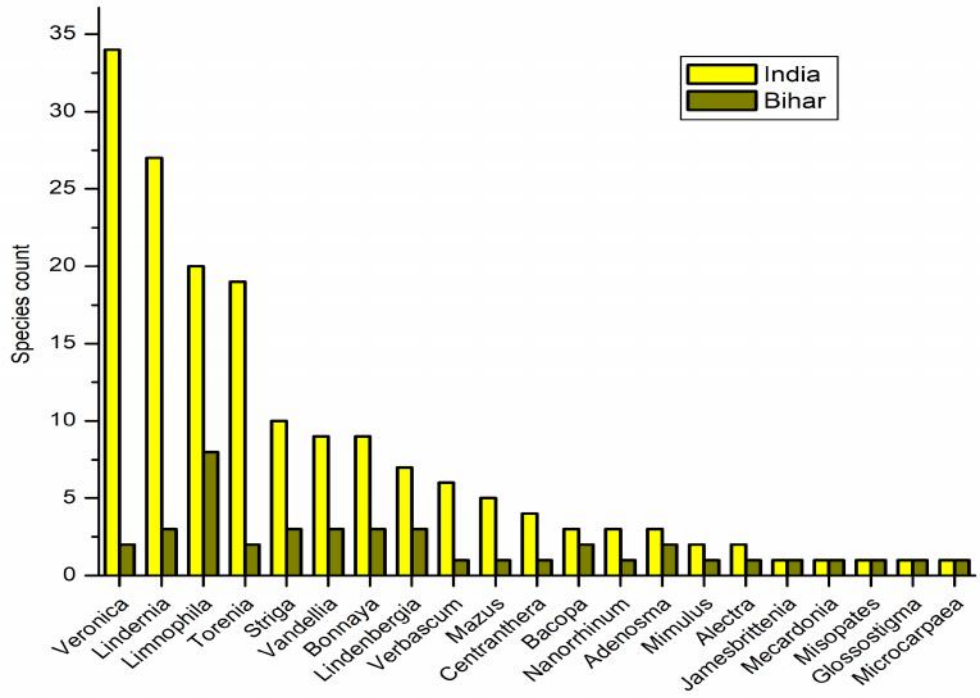
India
Bihar
Species count
0
5
10
15
20
25
30
35
Veronica
Lindernia
Limnophila
Torenia
Striga
Vandellia
Bonnaya
Lindenbergia
Verbascum
Mazus
Centranthera
Bacopa
Nanorrhinum
Adenosma
Mimulus
Alectra
Jamesbrittenia
Mecardonia
Misopates
Glossostigma
Microcarpaea

Fig .2

Enumerations of taxa are as follows:

ADENOSMA R. Br.

About 15 species are known to occur in China, Indo-Malesia and Australia (Mabberley, 2017); 3 species in India (Santapau & Henry, 1973) and 2 species in Bihar.

Adenosma indianum (Lour.) Merr., Trans. Amer. Phil. Soc. 24(2): 351. 1935; N.P. Singh *et al.*, Fl. Bihar: 349. 2001. *Manulea indiana* Lour., Fl. Cochinch. 2: 386. 1790. *Adenosma capitatum* Benth. *ex* Hance in J. Linn. Soc. London (Bot.) 13: 114. 1873; Hook.f., Fl. Brit. India 4: 264. 1884; Haines, Bot. Bihar Orissa 625. 1922 (Repr. ed., 2: 655. 1961).
Fl. & Fr.: August - February.
Distrib.: West Champaran.

ALECTRA Thunb.

About 40 species from tropical Africa to Asia (Mabberley, 2008); 2 species in India; 1 in Bihar.
Alectra thomsonii Hook.f., Fl. Brit. India 4: 297. 1884; Haines, Bot. Bihar Orissa 639. 1922 (Repr. ed., 2: 670. 1961); N.P. Singh et al., Fl. Bihar: 349. 2001. *Melasma thompsoni* (Hook.f.) Wettst. in Engler & Prantl, Nat. Pflanzenfam. IV. 3b: 91. 1891.
Fl. & Fr.: October - January.
Distrib.: Sahibganj.

BACOPA Aubl., *nom. cons.*

About 62 species distributed in warm countries especially America (Mabberley, 2017; https://powo.science.kew.org); 3 species in India (Santapau & Henry, 1973); 2 species in Bihar.

Key to the species

1a. A creeping herb; branches terete; corolla pale blue to white; capsule ovoid... **B. monnieri**
1b. An erect herb; branches quadrangular; corolla pink or yellow; capsule never ovoid globose or ellipsoid…… …… **B. hamiltoniana**

Bacopa monnieri (L.) Wettst., Engler & Prantl, Nat. Pflanzenfam. IV. 3b: 77. 1891; N.P. Singh et al., Fl. Bihar: 350. 2001. *Lysimachia monnieri* L., Cent. Pl. 2: 9. 1756. *Herpestis monnieri* (L.) Rothm. Repert. Spec. Nov. Regni Veg. 50: 73.1941.; Benth., Scroph. Ind. 30. 1835; Hook.f., Fl. Brit. India 4: 272. 1884; Haines, Bot. Bihar Orissa 622. 1922 (Repr. ed., 2: 652. 1961), '*monniera*'.
Fl. & Fr.: July - March.
Distrib.: Patna, West Champaran, Hajipur.

Bacopa hamiltoniana (Benth.) Wettst., Engler & Prantl, Nat. Pflanzenfam. IV. 3b: 77. 1891; N.P. Singh et al., Fl. Bihar: 350. 2001. *Herpestis hamiltoniana* Benth., Scroph. Ind. 30. 1835; Hook.f., Fl. Brit. India 4: 272. 1884; Haines, Bot. Bihar Orissa 622. 1922 (Repr. ed., 2: 652. 1961).
Fl. & Fr.: September - December.
Distrib.: Purnia.

BONNAYA Link & Otto

About 16 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 9 species in India (https://efloraindia.bsi.gov.in/); 3 species in Bihar.

Key to the species

1a. Flowers solitary-axillary; seeds yellow ……..…. **B. antipoda**
1b. Flowers in terminal raceme; seeds not yellow…….……..**2**
2a. Within the inflorescences no leaf-like flower-opposite bracts; lower corolla lips with pink spots; pedicel ascending in fruit…….…… …….**B. ciliata**
2a. Within the inflorescences many leaf-like flower-opposite bracts; lower corolla lips without pink spots; pedicel deflexed in fruit……. **B. oppositifolia**

Bonnaya antipoda (L.) Druce, Rep. Bot. Exch. Club Soc. Brit. Isles 3: 415. 1914. *Lindernia antipoda* (L.) Alston in Trimen, Handb. Fl. Ceylon Suppl. 6. 214. 1931; N.P. Singh et al., Fl. Bihar: 356. 2001. *Ruellia antipoda* L., Sp. Pl. 635. 1753. *Gratiola veronicifolia* Retz., Observ. Bot. 4: 8. 1786. *Bonnaya veronicifolia* (Retz.) Spreng., Syst. Veg. 1: 41. 1824; Hook.f., Fl. Brit. India 4: 285. 1884. *Vandellia veronicifolia* (Retz.) Haines, Bot. Bihar Orissa 633. 1922 (Repr. ed., 2: 664. 1961), '*iveronicaefolia*'. *Gratiola verbenifolia* Colsm., Prodr. Descr. Gratiol. 9. 1793. *Bonnaya verbenifolia* (Colsm.) Spreng., Syst. Veg. 1: 42. 1824. *Vandellia verbenifolia* (Colsm.) Haines, Bot. Bihar Orissa 634. 1922 (Repr. ed., 2: 664. 1961), '*verbenaefolia'*. *Bonnaya veronicifolia* (Retz.) Spreng. var. *verbenifolia* (Colsm.) Hook.f., Fl. Brit. India 4: 285. 1884.
Fl. & Fr.: August - February.
Distrib.: Purnia, West Champaran.

Bonnaya ciliata (Colsm.) Spreng., Syst. Veg. 1: 41. 1824. *Lindernia ciliata* (Colsm.) Pennell, Brittonia 2: 182. 1936; N.P. Singh et al., Fl. Bihar: 356. 2001. Gratiola ciliata Colsm., Prodr. Descr. Gratiol. 14. 1793. G. serrata Roxb., Fl. Ind. (Carey & Willich ed.) 1: 139. 1820. *Bonnaya brachiata* Link & Otto, Icon. Pl. Select. 2: 25. t. 11. 1821; Hook.f., Fl. Brit. India 4: 284. 1884. *Vandellia brachiata* (Link & Otto) Haines, Bot. Bihar Orissa 632. 1922 (Repr. ed., 2: 663. 1961).
Fl. & Fr.: August - February.
Distrib.: Begusarai, Gaya, Purnia, West Champaran.

Bonnaya oppositifolia (Retz.) Spreng., Syst. Veg. 1: 41. 1824. *Lindernia oppositifolia* (Retz.) Mukerjee, J. Indian Bot. Soc. 24: 134. 1945. *Gratiola oppositifolia* Retz., Observ. Bot. 4: 8. 1786. *Bonnaya oppositifolia* Spreng., Syst. Veg. 1:41. 1824; Hook.f., Fl. Brit. India 4: 286. 1884. *Vandellia oppositifolia* (Retz.) Haines, Bot. Bihar Orissa 634. 1922 (Repr. ed., 2: 664. 1961).
Fl. & Fr.: June - September.
Distrib.: West Champaran.

CENTRANTHERA R. Br.

About 5 – 6 species distributed from China to Australia (Mabberley, 2008); 4 species in India and 1 species in Bihar (Santapau & Henry, 1973; https://efloraindia.bsi.gov.in).

Centranthera nepalensis D. Don, Prodr. Fl. Nepal. 88. 1825; N.P. Singh et al., Fl. Bihar: 351. 2001. *C. hispida auct. non* R. Br., 1810: Hook.f., Fl. Brit. India 4: 301. 1884; Haines, Bot. Bihar Orissa 637. 1922 (Repr. ed., 2: 668. 1961).
Fl. & Fr.: July - October.
Distrib.: Purnia, West Champaran.

GLOSSOSTIGMA Wight & Amott *ex* Amott, *nom. cons.*

About 6 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 1 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Glossostigma diandrum (L.) Kuntze, Revis. Gen. Pl. 2: 461. 1891; N.P. Singh et al., Fl. Bihar: 351. 2001. *Limosella diandra* L., Mant. Pl. 252. 1771. *Microcarpaea spathulata* Hook., Bot. Misc. 2: 101. Suppl. t. 4. 1830. *Glossostigma spathulatum* (Hook.) Wight & Amott *ex* Amott, Nova Acta Acad. Leop. Nat. Cur. 18: 355. 1836; Hook.f., Fl. Brit. India 4: 288. 1884; Haines, Bot. Bihar Orissa 636. 1922 (Repr. ed., 2: 667. 1961).
Fl. & Fr.: August - March.
Distrib.: Patna.

JAMESBRITTENIA Kuntze

About 84 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 1 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Jamesbrittenia dissecta (Delile) Kuntze, Revis. Gen. Pl. 2: 461. 1891. *Sutera dissecta* (Delile) Walp., Repert. Bot. Syst. 3: 271. 1844. *Capraria dissecta* Delile, Descr. Egypte, Hist. Nat. (Fl. Egypte) 239. t. 32. f. 2. 1812. *Sutera glandulosa* Roth, Nov. Pl. Sp. 291. 1821; Hook.f., Fl. Brit.

India 4: 258. 1884; Haines, Bot. Bihar Orissa 621. 1922 (Repr. ed., 2: 651. 1961).
Fl. & Fr.: December - March.
Distrib.: Patna.

LIMNOPHILA R. Br., *nom. cons.*

About 37 species in Old World tropics (Mabberley, 2017); *c.* 20 species in India (Santapau & Henry, 1973); 8 species in Bihar.
Key to the species
1a. Leaves pinnatifid or pinnatisect and few upper entire ……..…….……**2**
1b. Leaves entire, crenate or serrate or serrulate or denticulate……..…**4**
2a. Flowers pedicelled, pedicels longer than calyx……. **L. indica**
2b. Flowers sessile or subsessile, if subsessile pedicel shorter than calyx…….**3**
3a. Leaves half amplexicaule at base; corolla 1.5–1.8 cm long; filaments slightly curved …… **L. sessiliflora**
3b. Leaves amplexicaule at base; corolla 0.5–0.6 cm long; filaments not curved……. **L. heterophylla**
4a. Leaves subamplexicaul…… ……..…….**5**
4b. Leaves not subamplexicaul…… ……**6**
5a. Filaments larger pair *c.* 6 mm long, smaller one *c.* 4 mm long; anthers of each pair conniving…… ……..…..**L. aquatica**
5b. Filaments larger pair 2.5–3.5 mm long, smaller one 1-2 mm long; anthers not conniving…… …….. **L. repens**
6a. Leaves in whorls of usually 3 or rarely 4; 1-nerved……**L. chinensis**
6b. Leaves opposite, pinnately nerved ……..…..**7**
7a. Calyx lobes striate in fruit ……..……..….. **L. pullcherrima**
7b. Calyx lobes not striate in fruit……..……**L. rugosa**

Limnophila indica (L.) Druce, Rep. Bot. Exch. Club Brit. Isles 1913(3): 420. 1914; N.P. Singh et al., Fl. Bihar: 353. 2001. *Hottonia indica* L., Sp. Pl. ed. 2: 208. 1762. *Limnophila gratioloides* R. Br., Prodr. 442. 1810; Hook.f., Fl. Brit. India 4: 271. 1884, incl. vars. *elongata* and *intermedia*; Haines, Bot. Bihar Orissa 628. 1922 (Repr. ed., 2: 658. 1961).
Fl. & Fr.: September - February.
Distrib.: Gaya, Purnia, West Champaran.

Limnophila sessiliflora (Vahl) Blume, Bijdr. Fl. Ned. Ind. 14: 749 1826; Hook.f., Fl. Brit. India 4: 270. 1884; Haines, Bot. Bihar Orissa 628. 1922 (Repr. ed., 2: 659. 1961). *Hottonia sessiliflora* Vahl, Symb. Bot. 2: 36. 1791.
Fl. & Fr.: September - November.
Distrib.: Purnia, West Champaran.

Limnophila heterophylla (Roxb.) Benth., Scroph. Ind. 25. 1835; Hook.f., Fl. Brit. India 4: 270. 1884; Haines, Bot. Bihar Orissa 629. 1922 (Repr. ed., 2: 659. 1961); N.P. Singh et al., Fl. Bihar: 353. 2001. *Columnea heterophylla* Roxb., Fl. Ind. 3: 97. 1832.
Fl. & Fr.: October - December.
Distrib.: Purnia.

Limnophila aquatica (Roxb.) Alston, Ann. Roy. Bot. Gard. Perad. 11: 205. 1929. *Cyrilla aquatica* Roxb., Pl. Corom. 2: 47. t. 189. 1798. *Limnophila racemosa* Benth., Scroph. Ind. 26. 1835; Hook.f., Fl. Brit. India 4: 271. 1884; Haines, Bot. Bihar Orissa 628. 1922 (Repr. ed., 2: 658. 1961).
Fl. & Fr.: October - January.
Distrib.: Purnia, West Champaran.

Limnophila repens (Benth.) Benth. in DC., Prodr. 10: 387. 1846; N.P. Singh et al., Fl. Bihar: 354. 2001. *Stemodia repens* Benth. in Lindl., Bot. Reg. 17. sub t. 1470. sp. 11. 1832. *Limnophila conferta* Benth. in DC., Prodr. 10: 387. 1846; Hook.f., Fl. Brit. India 4: 266. 1884; Haines, Bot. Bihar Orissa 626. 1922 (Repr. ed., 2:657. 1961).
Fl. & Fr.: October - December.
Distrib.: Purnia.

Limnophila chinensis (Osb.) Merr., Interpr. Herb. Amboin.: 47. 1917; N.P. Singh et al., Fl. Bihar: 353. 2001. *Columnea chinensis* Osb., Dagb. Ostind. Resa 230. 1757. *Stemodia hirsuta* Heyne *ex* Benth. in Lindl., Bot. Reg. 17: t. 1470. sp. 15. 1832. *Limnophila hirsuta* (Heyne *ex* Benth.) Benth. in DC., Prodr. 10: 388. 1846; Hook.f., Fl. Brit. India 4: 268. 1884; Haines, Bot. Bihar Orissa 627. 1922 (Repr. ed., 2: 658. 1961).
Fl. & Fr.: September - December.
Distrib.: Purnia.

Limnophila pulcherrima (Griff.) Hook.f., Fl. Brit. India 4: 267. 1884, *excl. descr. Herpestis pulcherrima* Griff., Notul. 4: 104. 1854; N.P. Singh et al., Fl. Bihar: 354. 2001. *Limnophila diffusa* Benth. in DC., Prodr. 10: 387. 1846; Hook.f., Fl. Brit. India 4: 266. 1884; Haines, Bot. Bihar Orissa 627. 1922 (Repr. ed., 2: 657. 1961).
Fl. & Fr.: November - February.
Distrib. : Purnia.

Limnophila rugosa (Roth) Merr., Interpr. Herb. Amboin. 466. 1917; N.P. Singh et al., Fl. Bihar: 354. 2001. *Herpestis rugosa* Roth, Nov. Pl. Sp. 290. 1821. *Limnophila roxburghii auct. non* G. Don, 1837-1838: Hook.f., Fl. Brit. India 4: 265. 1884; Haines, Bot. Bihar Orissa 626. 1922 (Repr. ed., 2: 656. 1961).
Fl. & Fr.: August - December.
Distrib.: Munger, West Champaran.

LINDENBERGIA Lehm.

About 12 species in Old world tropics (Mabberley, 2017); 7 species in India (Santapau & Henry 1973); 3 species in Bihar.
Key to the species
1a. Leaf apex acute; calyx lobes lobes triangular; style 2.5–3.5 mm in length…….
…… **L. macrostachya**
1b. Leaf apex obtuse; calyx lobes ovate or oblong; style 5 mm or more in length…….**2**
2a. Tufted herb; corolla up to 15 mm long; stamens exserted ……..…….. **L. indica**
2b. Erect herb; corolla more than 20 mm long; stamens included …….. **L. muraria**

Lindenbergia macrostachya (Benth.) Benth., Scroph. Ind. 22. 1835; Hook.f., Fl. Brit. India 4: 262. 1884. *Stemodia macrostachya* Benth. in Bot. Reg. 17. no. 1470. 1832.
Fl. & Fr.: March - May.
Distrib.: West Champaran.

Lindenbergia indica (L.) Vatke, Osterr. Bot. Z. 25: 10. 1875; N.P. Singh et al., Fl. Bihar: 355. 2001. *Dodartia indica* L., Sp. Pl. 633. 1753. *Lindenbergia polyantha* Royle *ex* Benth., Scroph. Ind. 22. 1835; Hook.f., Fl. Brit. India 4: 262. 1884; Haines, Bot. Bihar Orissa 624. 1922 (Repr. ed., 2: 654. 1961).
Fl. & Fr.: October - March.
Distrib.: Purnia.

Lindenbergia muraria (Roxb. *ex* D.Don) Bruehl, J. Dept. Sci. Cal. Univ. (Bot.) 2: 27. 1920; N.P. Singh et al., Fl. Bihar: 355. 2001. *Stemodia muraria* Roxb. *ex* D. Don, Prodr. Fl. Nepal. 89. 1825. *Lindenbergia urticaefolia* Lehm. in Link & Otto, Icon. Pl. Rar. 95. t. 48. 1828; Hook.f., Fl. Brit. India 4: 262. 1884; Haines, Bot. Bihar Orissa 624. 1922 (Repr. ed., 2: 654. 1961).
Fl. & Fr.: October - May.
Distrib.: West Champaran.

LINDERNIA All.

About 160 species distributed in warm regions, especially Old World tropics (Mabberley, 2017); About 27 species in India (Santapau & Henry, 1973); 3 species in Bihar.
Key to the species
1a. Plants succulent……..……
……. **L. multiflora**
1b. Plants non-succulent……
……..**2**
2a. Fertile stamens 4
…….. **L. procumbens**
2b. Fertile stamens 2……
…… **L. parviflora**

Lindernia multiflora (Roxb.) Mukerjee, J. Indian Bot. Soc. 24: 131. 1945. *Torenia multiflora* Roxb., Fl. Ind. 3: 96. 1832. *Vandellia multiflora* (Roxb.) G. Don, Gen. Hist. 4: 549. 1837-1838; Hook.f., Fl. Brit. India 4: 280. 1884; Haines, Bot. Bihar Orissa 632. 1922 (Repr. ed., 2: 662. 1961).
Fl. & Fr.: July - October.
Distrib.: Munger, Sahibganj, West Champaran.

Lindernia procumbens (Krock.) Philcox, Taxon 14: 30. 1965; N.P. Singh et al., Fl. Bihar: 358. 2001. *Anagalloides procumbens* Krock., Fl. Siles. 2(1): 398. t. 26. 1790. *Lindernia pyxidaria* L., Mant. Pl. 2:252. 1771, *p.p.* (*quoad spec. excl. syn.*); Haines, Bot. Bihar Orissa 634. 1922 (Repr. ed., 2: 665. 1961).
Fl. & Fr.: October - April.
Distrib.: Purnia.

Lindernia parviflora (Roxb.) Haines, Bot. Bihar Orissa 635. 1922 (Repr. ed., 2: 665. 1961); N.P. Singh et al., Fl. Bihar: 358. 2001. *Gratiola parviflora* Roxb., Pl. Corom. 3: 3. t. 203. 1811. *Ilysanthes parviflora* (Roxb.) Benth. in DC., Prodr. 10: 419. 1846; Hook.f., Fl. Brit. India 4: 283. 1884.
Fl. & Fr.: August - October.
Distrib.: West Champaran.

MAZUS Lour.

About 40 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 5 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Mazus pumilus (Burm.f.) Steenis, Nova Guinea (n.s.) 9: 31. 1958; N.P. Singh et al., Fl. Bihar: 359. 2001. *Lobelia pumila* Burm.f., Fl. Ind. 186. t. 60. f. 3. 1768. *Lindernia japonica* Thunb. in J.A.Murray, Syst. Veg. ed. 14: 567. 1784. *Mazus japonicus* (Thunb.) Kuntze, Revis. Gen. Pl. 2: 462. 1891. *M. rugosus* Lour., Fl. Cochinch. 2: 385. 1790; Hook.f., Fl. Brit. India 4: 259. 1884; Haines, Bot. Bihar Orissa 621. 1922 (Repr. ed, 2: 651. 1961).
Fl. & Fr.: July - December.
Distrib.: Purnia, West Champaran.

MECARDONIA Ruiz & Pav.

About 10 species in warm regions of America (Mabberley, 2017); 1 introduced and almost naturalized in India including Bihar (Santapau & Henry, 1973).

Mecardonia procumbens (Mill.) Small, Fl. S.E. U.S.: 1065. 1903. *Bacopa procumbens* (Mill.) Greenm., Field Columb. Mus. Bot. ser. 2, 261. 1907; N.P. Singh et al., Fl. Bihar: 350. 2001. *Erinus procumbens* Mill., Gard. Diet. ed. 8. n. 6. 1768. *Lindernia dianthera* Sw., Prodr. 92. 1788. *Mecardonia dianthera* (Sw.) Pennell in Proc. Acad. Nat. Sci. Philadelphia 98: 87. 1946.
Fl. & Fr.: August - September.
Distrib.: West Champaran.

MICROCARPAEA R.Br.

About 2 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 1 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Microcarpaea minima (J. Koenig *ex* Retz.) Merr., Philipp. J. Sci. 7: 100. 1912; N.P. Singh et al., Fl. Bihar: 360. 2001. *Paederota minima* J. Koenig *ex* Retz., Observ. Bot. 5: 10. 1788. *Microcarpaea muscosa* R. Br., Prodr. Fl. Nov. Holland.: 436. 1810; Hook.f., Fl. Brit. India 4: 287. 1884; Haines, Bot. Bihar Orissa 635. 1922 (Repr. ed., 2: 666. 1961).
Fl. & Fr.: October - December.
Distrib.: Purnia.

MIMULUS L.

About 51 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 2 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Mimulus strictus Benth., Scroph. Ind. 28. 1835; N.P. Singh et al., Fl. Bihar: 360. 2001. *M. gracilis* auct. non R. Br., Prodr. Fl. Nov. Holland.: 439. 1810; Hook.f., Fl. Brit. India 4: 259. 1884; Haines, Bot. Bihar Orissa 623. 1922 (Repr. ed., 2: 653. 1961).
Fl. & Fr.: April - January.
Distrib.: Purnia.

MISOPATES Raf.

About 8 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 1 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Misopates orontium (L.) Raf., Autik. Bot.: 158. 1840. *Antirrhinum orontium* L., Sp. Pl. 617. 1753; Hook.f., Fl. Brit. India 4: 253. 1883; N.P. Singh et al., Fl. Bihar: 349. 2001.
Fl. & Fr.: December - March.
Distrib.: Muzaffarpur, West Champaran.

NANORRHINUM Betsche

About 29 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 3 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Nanorrhinum ramosissimum (Wall.) Betsche, Courier Forschungsinst. Senckenberg 71: 132. 1984. *Kickxia ramosissima* (Wallich) Janchen in Oesterr., Bot. Zeischr. 82: 152. 1933. *Linaria ramosissima* Wallich, Pl. Asiat. Rar. 2: 43. t. 153. 1831; Hook.f., Fl. Brit. India 4: 251. 1883; Haines, Bot. Bihar Orissa 620. 1922 (Repr. ed., 2: 650. 1961).
Fl. & Fr.: October - June.
Distrib.: Patna.

STRIGA Lour.

About 53 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 10 species in India (https://efloraindia.bsi.gov.in/); 3 species in Bihar.

Key to the species

1a. Calyx 10-ribbed, corolla yellow…… … **S. asiatica**
1b. Calyx 5 or 15-ribbed; corolla white ……..……**2**
2a. Calyx 5-ribbed ……..…. …. **S. densiflora**
2b. Calyx 15-ribbed ……..……. **S. angustifolia**

Striga asiatica (L.) Kuntze, Revis. Gen. Pl. 2: 466. 1891; N.P. Singh et al., Fl. Bihar: 362. 2001. *Buchnera asiatica* L., Sp. Pl. 630. 1753. *Striga lutea* Lour., Fl. Cochinch. 1: 22. 1790; Hook.f., Fl. Brit. India 4: 299. 1884; Haines, Bot. Bihar Orissa 641. 1922 (Repr. ed, 2: 671. 1961).
Fl. & Fr.: August - December.
Distrib.: Patna, Purnia, West Champaran.

Striga densiflora (Benth.) Benth. Companion Bot. Mag. 1. 363. 1836.; Hook.f., Fl. Brit. India 4: 299. 1884; Haines, Bot. Bihar Orissa 641. 1922 (Repr. ed, 2: 672. 1961). *Buchnera densiflora* Benth, Scroph. Ind. 41. 1835.
Fl. & Fr.: August - October.
Distrib.: Purnia.

Striga angustifolia (D.Don) C.J. Saldanha, Bull. Bot. Surv. India 5: 70. 1963; N.P. Singh et al., Fl. Bihar: 362. 2001. *Buchnera angustifolia* D. Don, Prodr. Fl. Nepal. 91. 1825. *B. euphrasioides* Benth., Scroph. Ind. 41. 1835, *non* Vahl, 1794. *Striga euphrasioides* Benth. in Hook., Comp. Bot. Mag. 1. 364. 1836, *excl. basionym Buchnera euphrasioides* Vahl; Hook.f., Fl. Brit. India 4: 299. 1884; Haines, Bot. Bihar Orissa 640. 1922 (Repr. ed., 2: 671. 1961).
Fl. & Fr.: July - November.
Distrib.: Purnia, West Champaran.

TORENIA L.

About 69 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 19 species in India (https://efloraindia.bsi.gov.in/); 2 species in Bihar.

Key to the species

1a. Corolla purplish blue, 4.5–7.0 mm long, tube not curved, pale yellow at base; style 2.5–3.0 mm long; capsules oblong-ovate…….. **T. crustacea**
1b. Corolla dark blue, *c.* 2.5 cm long; tube slightly curved; not yellow at base; style 1.0–1.3 cm long; capsules lanceolate…… ……. **T. bicolor**

Torenia crustacea (L.) Cham. & Schltdl. Linnaea 2: 570. 1827. *Lindernia crustacea* (L.) F.Muell., Syst. Census Austral. Pl. 97. 1882; N.P. Singh et al., Fl. Bihar: 357. 2001. *Capraria crustacea* L., Mant. Pl. 1:87. 1767. *Vandellia crustacea* (L.) Benth., Scroph. Ind. 35. 1835; Hook.f., Fl. Brit. India 4: 279. 1884; Haines, Bot. Bihar Orissa 631. 1922 (Repr. ed., 2:661. 1961). *Lindernia crustacea* var. *verticillata* (Haines) K.K. Khanna, *comb. nov. Vandellia crustacea* (L.) Benth. var. *verticillata* Haines, Bot. Bihar Orissa 631. 1922 (Repr. ed., 2: 662. 1961); N.P. Singh et al., Fl. Bihar: 357. 2001.
Fl. & Fr.: July - December.
Distrib.: Bhagalpur, Darbhanga, Muzaffarpur, Purnia, West Champaran.

Torenia bicolor Dalz. in Hook., J. Bot. Kew Gard. Misc. 3: 38. 1851; Hook.f., Fl. Brit. India 4: 278. 1884.
Fl. & Fr.: October - November.
Distrib.: Bhagalpur.

VANDELLIA L.

About 52 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 9 species in India (https://efloraindia.bsi.gov.in/); 3 species in Bihar.

Key to the species

1a. Stem clothed with white hispid hairs; leaf apex acute; pedicels deflexed in fruits; stigma lamellate; capsule equalling the persistent calyx……..…….. **V. pusilla**

1b. Stem never clothed with white hispid hairs; leaf apex obtuse; pedicels straight in fruits; stigma not lamellate; capsule shorter or longer than calyx lobes……**2**

2a. Stigma capitate; capsules linear-lanceolate, longer than calyx; seeds ellipsoid…… **V. anagallis**

2b. Stigma curved; capsule broadly ovoid, shorter than calyx lobes; seeds cylindric…….. **V. viscosa**

Vandellia pusilla (Willd.) Merr., Philipp. J. Sci., C 7: 246. 1912. *Lindernia caespitosa* (Blume) Panigrahi, Taxon 33: 320. 1984; N.P. Singh et al., Fl. Bihar: 356. 2001. *Diceros caespitosus* Blume, Bijdr. 753. 1826. *Vandellia scabra* Benth., Scroph. Ind. 36. 1835; Hook.f., Fl. Brit. India 4: 281. 1884; Haines, Bot. Bihar Orissa 632. 1922 (Repr. ed., 2: 662. 1961). *Lindernia pusilla* (Thunb.) Merr., Philipp. J. Sci. Bot. 11: 312. 1916.
Fl. & Fr.: August - April.
Distrib.: Champaran, Purnia.

Vandellia anagallis (Burm.f.) T.Yamaz., J. Jap. Bot. 30: 176.1955. *Lindernia anagallis* (Burm.f.) Pennell, J. Arnold Arb. 24: 252. 1943. *Ruellia anagallis* Burm.f., Fl. Ind. 135. 1768. *Gratiola cordifolia* Colsm., Prodr. Descr. Gratiol. 15. 1793. *Lindernia cordifolia* (Colsm.) Merr., Enum. Philipp. Fl. Pl. 3: 437. 1923. *Vandellia pedunculata* Benth., Scroph. Ind. 37. 1835; Hook.f., Fl. Brit. India 4: 282. 1884. *V. angustifolia* Benth., Scroph. Ind. 37. 1835; Hook.f., Fl. Brit. India 4: 282. 1884. *V. cordifolia* (Colsm.) G. Don, Gen. Hist. 4: 549. 1837-1838; Haines, Bot. Bihar Orissa 633. 1922 (Repr. ed., 2: 663. 1961).
Fl. & Fr.: March - December.
Distrib.: Purnia, West Champaran.

Vandellia viscosa (Hornem.) Merr., Philipp. J. Sci., C 7: 246. 1912. *Lindernia viscosa* (Hornem.) Boldingh, Zakfl. Java 165. 1916. *Gratiola viscosa* Homem., Enum. Pl. Hort. Hafn. (rev. ed.) 19. 1807. *Vandellia hirsuta* Benth., Scroph. Ind. 36. 1835; Hook.f., Fl. Brit. India 4: 280. 1884; Haines, Bot. Bihar Orissa 632. 1922 (Repr. ed., 2: 662. 1961). *Lindernia hirsuta* (Benth.) Wettst. in Engler & Prantl, Nat. Pflanzenfam. 4. 3b: 79. 1891.
Fl. & Fr.: September - November.
Distrib.: Gaya.

VERBASCUM L.

About 464 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 6 species in India (https://efloraindia.bsi.gov.in/); 1 species in Bihar.

Verbascum chinense (L.) Santapau, Fl. Purandhar 90. 1957; N.P. Singh et al., Fl. Bihar: 364. 2001. *Scrophularia chinensis* L., Mant. Pl. 2:250. 1771. *Celsia coromandeliana* Vahl, Symb.

Bot. 3: 79. 1794; Hook.f., Fl. Brit. India 4: 251. 1883; Haines, Bot. Bihar Orissa 619. 1922 (Repr. ed., 2: 649. 1961).
Fl. & Fr.: September - May.
Distrib.: Darbhanga, West Champaran.

VERONICA L.

About 461 species are found globally (Mabberley, 2017; https://powo.science.kew.org/); 34 species in India (https://efloraindia.bsi.gov.in/); 2 species in Bihar.
Key to the species
1a. Erect herb; corolla pink or purplish; capsules orbicular-oblong, *c.* 2 mm in diam., compressed, not notched …………………………………………… **V. anagallis-aquatica**
1b. Prostrate herb; corolla blue to white; capsule biglobose, *c.* 6 mm in diam., not compressed, narrowly notched……,,,……
……… **V. agrestis**

Veronica anagallis-aquatica L., Sp. Pl. 12. 1753; Hook.f., Fl. Brit. India 4: 293. 1884 (as '*anagallis'*); N.P. Singh et al., Fl. Bihar: 364. 2001.
Fl. & Fr.: October - April.
Distrib.: Bhagalpur, Patna, Purnia, West Champaran.

Veronica agrestis L., Sp. Pl. 13. 1753; Hook.f., Fl. Brit. India 4: 294. 1884.
Fl. & Fr.: November - February.
Distrib.: Champaran.

Cultivated species:

Antirrhinum majus L.
Linaria bipartita Willd.
Mimulus orbicularis Wallich *ex* Benth.
Russelia coccinea Wettst. in Engler & Prantl
Russelia equisetiformis Schlechtend. & Cham
Russelia rotundifolia Cav.
Torenia fournieri Linden ex Foum.

Conclusion

A total of 42 taxa of family Scrophulariaceae are documented in Bihar through literature mining and consultation of herbarium specimens. Furthermore, distributions at global and national level of associated genera have been provided. This data will be ready references to assess the Scrophulariaceae diversity in the state of Bihar and the study will facilitate strategies for management of wild plants and habitat conservation aspects in terms of plant diversity and resource management.

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