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Medicinal species of Fabaceae occurring in Bangladesh and their conservation status

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Abstract

Research work has been carried out to assess the number of total medicinal species of Fabaceae and evaluate their status in the flora of Bangladesh. The family has revealed significant richness with 169 (*i.e.* 67%) medicinal species under 61 genera among 254 total species under 69 genera. A total of 62 medicinal species are assessed to be threatened under different categories set by International Union for Conservation of Nature and Natural Resources (IUCN) due to environmental degradation, over exploitation and depletion of ecosystem diversity. Among them, 33 endangered, 7 critically endangered, 6 vulnerable and 16 rare. Out of 169 medicinal species of the family Fabaceae, 25 genera are represented by single species in the flora of Bangladesh. Among these 25 genera, 7 *i.e.*, 28% are threatened. The study is based on long-term field investigations, examination of herbarium specimens and survey of relevant floristic and medicinal literature.

Keywords: Medicinal plant, threatened species, conservation, fabaceae, Bangladesh

1. Introduction

Now a day's numerous medicinal plants are used to cure several diseases in developing countries. The aromatic medicinal plants are containing large amount of secondary metabolites and essential oils of traditional and therapeutic importance. So many desirable drugs are isolated from various types of plant parts like root, leaf and stem. Several local people still depended on the medicinal plants for their primary healthcare and treatment of various diseases (Samyurari *et al.* 2012) [76]. The important advantages claimed for therapeutic uses of medicinal plants in various ailments are their safety besides being economical, effective and their easy availability (Atal and Kapoor 1989) [7].

The family Fabaceae consists of about 483 genera and 12,000 species (Lewis *et al.* 2005) [48]. In Bangladesh, it is represented by 69 genera and 254 species (Ahmed *et al.* 2009) [1]. With regard to medicinal uses, it has been pointed out that, Fabaceae are found amongst the five botanical families richest in therapeutic properties in the pharmacopeia of indigenous and rural populations in Holarctic, Neotropical and Sub-Antarctic regions. In particular, it has been found that the family Fabaceae is second in importance to Asteraceae in terms of richness of medicinal taxa. Their medicinal value lies partly in their effectiveness in the treatment of a wide variety of human ailments. The variety of chemically active constituents, such as tannins, flavonoids, alkaloids and terpenes often found in members of this family, are substances with a high level of biological activity.

The international market of medicinal plants related trade showed that, the use of these plants had a growth rate of 7% per annum and the annual cost of usage of these plants is valued as 1200 million (Jose *et al.* 2001) [37]. According to Sarasan *et al.* (2006) [77], more than eight thousand plant species were added to the RED list of Threatened Species during the period 1996-2004 by International Union for Conservation of Nature and Natural Resources (IUCN). During the same period, these authors noted that the number of plants recorded as "critically endangered" are increased by over 60%. IUCN and the World Wildlife Fund (WWF) estimated that up to 60,000 higher plant species could become extinct or nearly extinct by the year 2050, if the current trends of utilization continue (Etkin 1998; Phani Kumar *et al.* 2011) [19, 50].

The increased commercialization has resulted in overharvesting of some medicinal plants, many of which have become threatened. Threatened medicinal plant species have become the focus of world attention because they represent vanishing flora in need of protection and conservation and because of their role as an essential commodity for health care

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(Kala 2002) [38], the present investigation was carried out to explore the abundance of medicinal species of Fabaceae and assessment of rare, critically endangered, endangered and vulnerable (RED list) species in Bangladesh. These kinds of plants are in need of proper conservation and management plans for its medicinal properties and medicinal plant resources before it lost forever.

2. Materials and Methods

Assessment of the threatened medicinal taxa has been made to the family Fabaceae of Bangladesh through field investigations, examination of the collected herbarium specimens and consultation of the relevant floristic literature. The filed investigations, collection of specimens and field data, determination of status of occurrence, documentation of conservation status have been made by repeated field visits throughout the flora. The places of occurrence of the previously recorded taxa has been documented by consulting Roxb. (1814, 1824, 1832) [72, 74, 75], Wall. (1828-49) [88], Hook. f. (1872-1897) [26], Kurz (1877) [47], Prain (1903) [51], Heinig (1925) [23], Cowan (1929) [13], Raizada (1941) [69], Datta and Mitra (1953) [15] and Sinclair (1956) [78].

The previously collected specimens of the Fabaceae preserved in different herbaria of Bangladesh, viz., Bangladesh National Herbarium (BNH), Dhaka University Salar Khan Herbarium (DUSH), Bangladesh Forest Research Institute Herbarium (BFRIH), Herbarium, Bangladesh Council of Scientific and Industrial Research (BCSIRH), Herbarium of Chittagong University (HCU) and in international herbaria, viz., British Museum (BM), Calcutta Herbarium (CAL), have been examined critically to record the data of each species. The relevant and up to date floristic literature published since Sinclair (1956) [78], such as, Khan and Afza (1968) [42], Khan and Banu (1972) [41], Huq and Begum (1984) [28], Huq and Khan (1984) [29], Khan *et al.* (1984) [41], Naderuzzaman and Islam (1984) [49], Alam (1988, 1995) [2], Huq (1988) [27], Khan *et al.* (1994) [45], Rahman and Hassan (1995) [66], Rahman and Uddin (1997) [60], Yusuf *et al.* (1997) [90], Dey *et al.* (1998) [17], Uddin *et al.* (1998, 2002, 2003) [80, 81, 82], Uddin and Rahman (1999) [85], Das and Alam (2001) [14], Khan and Huq (2001) [40], Rashid and Mia (2001) [70], Rashid *et al.* (2001) [70], Uddin and Hassan (2004, 2010, 2002) [80, 81, 84], Hossain *et al.* (2005) [25], Alam *et al.* (2006) [3], Momen *et al.* (2006) [50], Islam *et al.* (2009) [33], Barbhuiya and Gogoi (2010) [10], Rahman *et al.* (2010, 2010a, 2012, 2013, 2016) [63, 64, 67, 68], Rahman and Jahan (2016) [57], Tutul *et al.* (2010) [79], Rahman and Hasan (2015) [68], Arefin *et al.* (2011) [6], Uddin *et al.* (2013) [83], have been surveyed to trace the report of collection/occurrence of the taxa of the Fabaceae. The assessment and recognition of the taxa as threatened is based on the criteria of IUCN (IUCN 2012) [34].

Determination of the recorded species as medicinal have been made by consulting medicinal books and published articles, e.g., Dunn (1912) [18], Gillett (1958) [22], De Kort and Thijsse (1984) [16], Ambasta (1986) [4], Kaur and Kapoor (1990) [39], Jain (1991) [36], Ghani (2003) [21], Yusuf *et al.* (2009) [88], Kim *et al.* (2010) [46], Quattr. (2012) [54] and Rahman and Asfaq (2012) [59].

3. Result and Discussions

Inventory of the medicinal species of Fabaceae for determining their conservation status in the flora revealed that

out of 254 species of the family, 169 i.e., 67% species under 61 genera are medicinal, 85 species have no medicinal properties. 62 medicinal species under 26 genera are threatened under different IUCN categories. In total threatened species, 16 are rare and conservation dependent, 6 vulnerable, 33 endangered and 7 critically endangered. Examination of the herbarium specimens of the Fabaceae of Bangladesh preserved at BNH, DUSH, HCU, BFRIH, BCSIRH, BM and CAL revealed that they are very limited in their distribution. Out of 169 medicinal species, 25 genera are represented by single species in the flora of Bangladesh. Among these 25 genera, 7 i.e., 28% threatened, 15 i.e., 60% cultivated and only 3 i.e., 12% are common (shown in fig. 1).

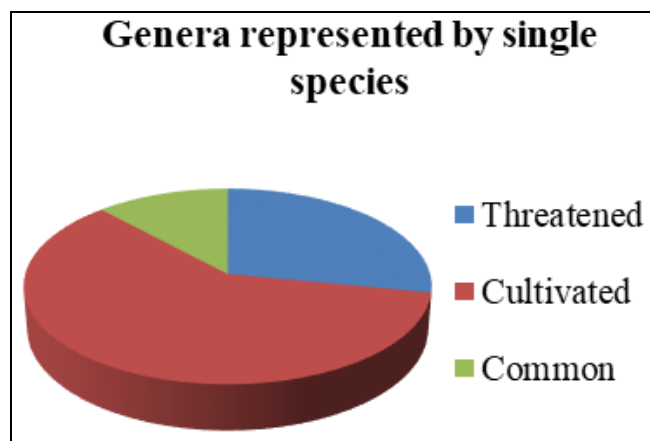


Fig 1: Pie chart showing status of genera represented by single species

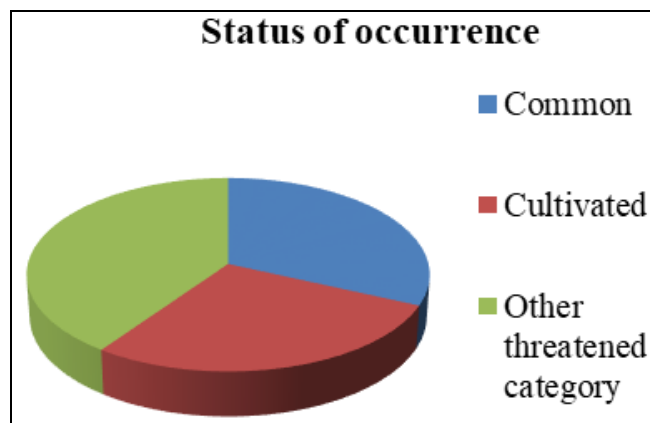


Fig 2: Pie chart showing status of the medicinal species of Fabaceae.

Among 169 medicinal species, 49 i.e., 29% belonging to 23 genera are common and 43 i.e., 25% under 32 genera including 7 introduced species are cultivated in Bangladesh for pulse (one of the important source of protein), ornamental, timber, medicinal, forage and other potential uses (shown in fig. 2).

Survey of all published relevant and local floristic literature also ensured the findings. All these species, recognized as threatened to Bangladesh, are found to be widely distributed in many countries and highly potential for their medicinal properties and uses. These threatened species with their status of occurrence, habit and potential medicinal value are given in table 1.

Table 1: List of threatened medicinal taxa of Fabaceae with their medicinal use and potential therapeutic properties

Sl. No.	Name of Species	Habit	Status of occurrence	Medicinal use	Medicinal properties
1.	<i>Aeschynomene americana</i> L.	Shrub	EN	Skin complaints, Rheumatism	Anti-rheumatic
2.	<i>Aganope heptaphylla</i> (L.) Polhill	Climbing shrub	EN	Bacterial infection, also used for poisoning	Antibacterial, Toxic
3.	<i>Alysicarpus bupleurifolius</i> (L.) DC.	Herb	R	Asthma, Fever, Wounds	Anti-septic
4.	<i>Alysicarpus rugosus</i> (Willd.) DC.	Herb	EN	Cough, Dropsy, Edema, Fever, Guinea worm, Headache Indigestion, Pulmonary troubles, Swelling	Astringent, Emetic, Febrifuge
5.	<i>Cajanus crassa</i> (Prain & King) van der Maesen	Climbing Shrub	EN	Jaundice, Piles, Mumps	Anti-viral
6.	<i>Cajanus goensis</i> Dalz.	Woody climber	EN	Rheumatism, Impure blood, Biliousness, Fever, Swellings	Anti-rheumatic
7.	<i>Canavalia maritima</i> Thou.	Climber	CR	Boils, Cold, Labor, Leprosy, Malaria, Poisonous, Rheumatic pain	Aphrodisiac, Anti-rheumatic, Tonic, Toxic
8.	<i>Crotalaria alata</i> D. Don	Herb	VU	Abscesses, Bedwetting, Boils, To help Digestion, Fever, Labor, Snakebite	Antidote, Tonic, Toxic
9.	<i>Crotalaria albida</i> Heyne ex Roth	Herb	EN	Chronic back pain, Indigestion, Wart on the sole	Antibacterial, Purgative, Tonic
10.	<i>Crotalaria bracteata</i> Roxb. ex DC.	Shrub	EN	Used for medicinal purposes in Comboia (Thuan 1987, from ILDIS database)	
11.	<i>Crotalaria cytisoides</i> Roxb. ex DC.	Shrub	EN	Cut and wounds	Anti-septic
12.	<i>Crotalaria laburnifolia</i> L.	Shrub	EN	Helminthiasis, Skin fungus	Anti-fungal
13.	<i>Crotalaria nana</i> Burm. f.	Herb	EN	Diarrhoea	Anti-diarrheal
14.	<i>Crotalaria prostrata</i> Rootler ex Willd.	Herb	VU	Bleeding, Delivery, Diarrhoea, Fever, Gout, Postpartum remedy, Skin disease, Stomach disorder	Anti-fungal, Anti-septic, Derangement
15.	<i>Crotalaria quinquefolia</i> L.	Herb	EN	Fever, Impetigo, Lung diseases, Scabies	Anti-microbial, Toxic
16.	<i>Crotalaria retusa</i> L.	Undershrub	R	Coughing up blood, Cold, Fever, Impetigo, Lung diseases, Skin infection, Scabies, Thrush, Skin eruptions, Skorpion bite, Urinary problem	Abortifacant, Analgesic, Anti-septic, Febrifuge CNS depressant, Emetic, Laxative, Spasmolytic, Hepatotoxic, Vermifuge
17.	<i>Cullen corylifolium</i> (L.) Medic.	Herb	EN	Caries, Cough, Cold, Conception, Deafness, Diarrhoea, Filaria, Itch, Impotence, Leprosy, Lumbago, Poisoning, Psoriasis, Skin diseases, Vitiligo, Wounds	Antidote, Aphrodisiac, Diuretic, Laxative
18.	<i>Dalbergia latifolia</i> Roxb.	Tree	EN	Dyspepsia, Diarrhoea, Leprosy, Obesity, Worms	Anthelmintic, Stomachic, Stimulant, Spasmogenic, Tonic
19.	<i>Dalbergia lanceolaria</i> L.f.	Tree	R	Dyspepsia, Jaundice, Menorrhagia, Rheumatism	Analgesic, Anti-arthritis, Anti-diarrheal and Anti-inflammatory
20.	<i>Dalbergia pinnata</i> (Lour.) Prain	Woody climber	R	Nervous complaints, Skin disorder, Varicose veins	Anthelmintic, Vermifuge
21.	<i>Dalhousiea bracteata</i> (Roxb.) Grah. ex Benth.	Shrub	EN	Fresh cuts	Antiseptic
22.	<i>Dendrolobium triangulare</i> (Retz.) Merr.	Shrub	EN	Snakebite, Strengthening bones and building muscles, Poisonous	Antidote, Emetic, Toxic
23.	<i>Dendrolobium umbellatum</i> (L.) Benth.	Shrub	EN	Enlarged spleen, Fever, Headache, Malaria	Antibacterial, Antimycobacterial, Astringent, Tonic
24.	<i>Derris cuneifolia</i> Benth.	Woody climber	EN	Poisonous to fish	Toxic
25.	<i>Derris elegans</i> Benth. var. <i>vestita</i> (Baker) Prain	Woody climber	EN	Snakebite, used for poisoning	Antidote, Toxic
26.	<i>Derris ferruginea</i> (Roxb.) Benth.	Woody climber	CR	Poisonous to fish	Toxic
27.	<i>Deris trifoliata</i> Lour.	Climbing shrub	R	Chronic dysentery, Chronic paralysis, Dysmenorrhoea, Fever, Rheumatism, Sores, Fish poison	Anti-spasmodic, Anti-septic, Anti-rheumatic, Anti-arthritis, Carminative, Counter irritant, Cytotoxic, Insecticidal, Laxative, Stimulant, Toxic

28.	<i>Desmodium concinnum</i> DC.	Shrub	CR	Indigestion	Tonic
29.	<i>Desmodium microphyllum</i> (Thunb.) DC.	Herb	R	Eye problem, Headache, Boils and Blisters, Wounds, Fever, Coughs, Dispelling Phlegm	Anti-septic
30.	<i>Desmodium styracifolium</i> (Os.) Merr.,	Shrub	EN	Chickenpox, Dropsy, Edema, Irritation from nettle, Kidney stone, Jaundice, Gall bladder, Nephritis, Urethra inflammation	Aperient, Colic, Deobstruent, Diuretic, Emmenagogue, Stomachic, Toxic
31.	<i>Desmodium velutinum</i> (Willd.) DC.	Undershrub	R	Blood in urine, Diarrhoea, Toothache	Anti-diarrheal
32.	<i>Dunbaria glandulosa</i> (Dalz.) Prain	Woody climber	EN	Sterility	Anti-sterility
33.	<i>Erythrina suberosa</i> Roxb.	Tree	EN	Swelling and Boils	Anti-inflammatory, Anti-septic, Cathartic, Diuretic, Toxic
34.	<i>Flemingia chappar</i> Buch. – Ham. ex Benth.	Shrub	EN	Cataract, Diarrhoea, Dysentery, Bodyache, Epilepsy, Eye trouble, Fever, Indigestion, Intestinal worm, Spermatorrhoea	Anti-diarrheal, Stimulent
35.	<i>Flemingia stricta</i> Roxb.	Shrub	EN	Asthma, Fever, Manstrual irregularities	Anti-cholinergic, Contraceptive
36.	<i>Indigofera hirsuta</i> L.	Herb	R	Used for poisoning	Toxic
37.	<i>Indigofera linifolia</i> (L. f.) Retz.	Herb	CR	Amenorrhoea, Boils, Bowel complaints, Febrile eruptions, Fractured bone, Liver diseases, Menstrual troubles, Scorpion bite, Sores and Wounds	Laxative, Toxic
38.	<i>Indigofera linnaei</i> Ali	Herb	EN	Dandruff, Sprue, Wounds	Purgative
39.	<i>Indigofera prostrata</i> Willd.	Shrub	EN	Leucorrhoea, Rheumatism	Anti-rheumatic, Nutritive, Restorative, Tonic
40.	<i>Indigofera suffruticosa</i> Mill.	Shrub	EN	Blood purifier, Diarrhoea, Fever, Stomachache	Anti-diarrheal, Tonic
41.	<i>Indigofera trita</i> L. f.	Woody herb	EN	Impaction in animals	Laxative
42.	<i>Medicago polymorpha</i> L.	Herb	R	Cancer, Tumor	Anti-oxidant, Anti-cancer, Cytotoxic
43.	<i>Melilotus officinalis</i> (L.) Pall.	Herb	R	Conjunctivitis, Diarrhoea, Dysmenorrhoea, Sciatic neuralgia	Aromatic, Antidote, Anticoagulant, Astringent, Carminative, Colic, Tonic, Febrifuge, Emollient, Styptic, Toxic
44.	<i>Millettia extensa</i> (benth.) Baker	Woody climber	CR	Used for poisoning, Menstrual problems	Toxic, Contraceptive
45.	<i>Millettia pachycarpa</i> Benth.	Shrub	R	Poisonous to human	Toxic
46.	<i>Mucuna bracteata</i> DC. ex Kurs	Climber	VU	Bacterial infection	Anti-microbial
47.	<i>Mucuna gigantea</i> (Willd.) DC.	Woody climber	R	Poisonous, Pod hair causes irritation	Toxic
48.	<i>Mucuna macrocarpa</i> Wall.	Woody climber	EN	Sprains	Anti-inflammatory
49.	<i>Mucuna nigricans</i> (Lour.) Steud.	Climbing Shrub	EN	Causes Dermatitis, Itching, Irritation, used for Asthma, Cholera, Cough, Fever, Snakebite, Throat pain, Ulcer of genital organs of both sex	Toxic, Vermifuge
50.	<i>Pterocarpus marsupium</i> Roxb.	Tree	EN	Asthma, Cough, Diabetes, Graying hair, Heart disease, Jaundice, Menorrhagia, Skin disease	Astringent, Anti-inflammatory
51.	<i>Pterocarpus santalinus</i> L. f.	Tree	EN	Acne, Burning sensation, Bleeding, Blood diseases, Chronic bronchitis, Chronic dysentery, Diabetes, Diarrhoea, Edema, Fracture, Gonorrhoea, Headache, Hemorrhage, Inflammation, Menorrhagia, Mental aberrations, Pimples, Skin disorders, Swelling, Ulcers, Vision defects, Vomiting, Wounds, Wrinkles	Aphrodisiac, Anthelmintic, Anti-bacterial, Anti-septic, Astringent, Colic, Diaphoretic, Tonic
52.	<i>Pueraria lobata</i> (Willd.) Ohwi.	Climbing shrub	VU	Chicken pox	Anti-viral
53.	<i>Pueratia peduncularis</i>	Climbing	EN	Used for poisoning	Toxic plant

	(Grah.,ex Benth.) Benth.	herb			
54.	<i>Pueraria tuberosa</i> (Roxb. ex Willd.) DC.	Climber	R	Burning sensations, Cleaning of voice, Fever, Leprosy, Urinary discharge	Aphrodisiac, Alterative, Cooling, Demulcent, Diuretic, Emetic, Galactagogue, Lactagogue, Refrigerant, Tonic
55.	<i>Rhynchosia minima</i> (L.) DC.	Climbing Herb	VU	Anemia, Antidote of snakebite, Asthma, Fish poison, Insect bite, Piles, Skin diseases	Abortificant, Anthelmintic, Antibiotic, Antifungal, Antimicrobial, Antioxidant, Toxic
56.	<i>Smithia sensitiva</i> Ait.	Herb	CR	Fever, Headache, Gravel, Difficulty in Micturition	Diuretic
57.	<i>Trigonella coniculata</i> (L.) L.	Herb	EN	Bruises, Swelling	Astringent, Bitter, Styptic
58.	<i>Vigna aconitifolia</i> (Jacq.) Marechal	Herb	R	Fever	Anti-nutritional
59.	<i>Vigna marina</i> (Burm. F.) merr.	Herb	R	Asthma, Boils, Fever, Stomachache	Anthelmintic, Diuretic, Spasmolytic
60.	<i>Vigna luteola</i> (Jacq.) Benth.	Climbing Herb	CR	Boils, Cuts, Coughs, Cold, Control lipid and Cholesterol level, Syphilis, Ulcer	Antimicrobial, Anti-neoplastic, Anti-inflammatory
61.	<i>Vigna trilobata</i> (L.) Verdc.	Herb	VU	Chichenpox	Anti-viral
62.	<i>Vigna vexillata</i> (L.) A. Rich.	Climbing herb	R	Rheumatism	Anti-inflammatory

EN= Endangered, CR= critically endangered, R= Rare. Inc= locality not cited.

4. Conclusion

The result of examination and determination of all collected specimens of the Fabaceae, and survey of local floristic literature although suggests that 7 species under critically endangered (CR) category, 33 species under endangered (EN) category, 6 under vulnerable (VU) category and 16 under rare (R) category. These species are closely related with local community and also drug industries. Over exploitation of these species may cause drastic change of nature. By conducting awareness program among the people, we can promote the knowledge about importance of diversity and also can conserve the threatened plants. Further survey, both extensive and intensive, is to be conducted throughout the flora of Bangladesh which may result in reconfirmation of their distribution. The present study is therefore recommends to continue more survey of the flora for re-determining their status of occurrence and to undertake appropriate conservation management like *in-situ* and *ex-situ*.

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