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Herbarium collections of the Botany Department, Fergusson College, Pune, India

Herbaria provide researchers with several services and opportunities, including the identification of specimens, the preservation of voucher and type specimens and as teaching aids. They also form the basis for research including the preparation of floras and monographs (Stace, 1984). Further, herbaria are of value as they can help in mapping the geographical distribution of species, the establishment of ecological relationships, information on ethnobotanical uses (Chaudhuri *et al.*, 1977; Jain & Rao, 1977), and as a resource for phytochemical analyses (Mann, 1994). Herbarium specimens can also be used to study a species complex, and inter-continental studies can help to provide information on which to reorganize species at a global level (Benson, 1962). Data on herbarium specimens has recently proved useful in understanding changes in phenology in response to global warming (Miller-Rushing *et al.*, 2006). Apart from the several large national herbaria in India, there exist many more with smaller, yet interesting holdings. The herbarium of the Botany Department of Fergusson College, Pune, India is one such, which contains about 2000 sheets collected by botanists from 1885 onwards. The current paper provides an introduction to the botanists whose collections are present in this herbarium along with an enumeration of some of the noteworthy specimens.

***The early works: Cooke's flora and associated botanists*:** The beginning of systematic botany in India was marked by the monumental publications *Os Coloquios* (1563) by Garcia de Orta (1501–1568) and *Hortus Indicus Malabaricus* (1678) by Hendrik Adriaan von Rheede tot Draakestein (1637–1691). The 19th century witnessed the publication of the pioneering national flora by William Roxburgh (1751–1815), his *Flora Indica* (1832). There followed the *Flora Indica* (1855) of Joseph Dalton Hooker (1817–1911) & Thomas Thomson (1817–1878), and Joseph Hooker's seven-volume *Flora of British India* started in 1872 and completed in 1897. Nichol Alexander Dalzell (1817–1878) and Alexander Gibson (1800–1867) compiled a flora for the Bombay province published in 1861, the first flora for the region having been John Graham's (1805–1839) of 1839.

The Botanical Survey of India was established in 1890 and reorganized in 1952 (Pathak & Bharati, 2014); in 1955 a Western Circle was established with Poona (now Pune) as its headquarters (Singh, 1977). Dr. Theodore Cooke (1836–1910), an engineer by profession, was the first principal of the College of Science, Poona (now, College of Engineering, Pune) who also served as honorary director of the Botanical Survey of Western India (Anonymous, 1901; Puri, 1959; Desmond, 1994). Realizing the need to supplement the national flora with regional ones, Cooke, between 1903 and 1908, compiled his substantial *Flora of the Presidency of Bombay*, which is still widely referred to by botanists in western India (Sathish Kumar, 2010). The herbarium on which this flora was based was housed initially at the College of Science, Poona, but was destroyed completely by fire in May 1902 (Cooke, 1903; Puri, 1959). However, a duplicate set of specimens was donated by Cooke to the herbarium, which was then shifted to the College of Agriculture, Poona (Gokhale & Godbole, 1953; Basak, 1983). George Marshall Woodrow (1846–1911) was appointed as assistant to Cooke (and later succeeded him as director) and, along with a few native plant-collectors, was tasked with carrying out a vegetation survey of the Bombay Presidency (Singh, 1977).

Woodrow, who held the position of lecturer in Botany at the College of Science, Poona, published a series of papers along with other members of the Botanical Survey (Woodrow, 1897–1898).Woodrow was also in charge of the Ganeshkhind Botanical Garden,

and in 1872 all the official gardens in Poona were brought under his charge (Burkill, 1965). He also made significant contributions in the field of horticulture and ecology (Woodrow, 1897, 1904) with his *Gardening in India* being published in 1889 and reprinted in 1999 and 2010. He is credited as the discoverer of several new species, including *Abutilon ranadei* Woodrow & Stapf (1894), which is now critically endangered (Mishra & Singh, 2001). Several species such as the critically endangered *Crinum woodrowii* Baker, 1898 were named after him and Woodrow is also credited as having established the Agri- Horticultural Society's Garden at Pune, now known as the Empress Botanical Garden (Almeida, 1996).

Woodrow was succeeded by George Alexander Gammie (1864–1935), F.L.S. (Puri, 1959). Prior to this Gammie had been in charge of the Saharanpur Botanical garden, the Lloyd Botanical garden, Darjeeling and from 1894 to 1896 was Curator of the Calcutta Botanic Garden herbarium (Burkill, 1965; Almeida, 1996). Gammie was appointed as a Lecturer in 1899 at the College of Science, Poona and was also in charge of Botanical Survey of the Bombay Presidency from 1904–1908 (JSTOR, 2014). He made extensive collections in other states apart from Bombay, thereby expanding the scope of the herbarium (Puri, 1959). Along with his contribution to floristics (Gammie, 1903, 1905–1912), he is also well known for his work on economic botany (Gammie, 1907).

Hari Purushottam Paranjapye (1879–1977), younger brother of (Wrangler) Sir Raghunath P. Paranjapye graduated from the Fergusson College in 1905 and worked under Gammie and other British botanists at the herbarium of the Economic Botanist housed at the College of Agriculture, Pune (Almeida, 1996). He was one of the first persons to report the occurrence of the invasive weed *Parthenium* in India during the 1950s (Rao, 1956) and retired as the District Horticultural Officer (Paranjapye, 1950). He took great interest in conserving and developing the Ganeshkhind Botanical Garden, Pune and was later made its chief. Paranjapye wrote a number of articles in Marathi (including his popular book on fruit trees first published in 1923 and reprinted in 1930 and 1950) and was also associated with the Maharashtra Association for the Cultivation of Science (now Agharkar Research Institute) as its secretary (Mahabale, 1987). In collaboration with the late Principal J. R. Gharpure, he took a keen interest in the reforestation of the Law College hill (Vartak, 1964).

Ramchandra Kashinath Bhide (1873–1946) whose collections are also present in the Fergusson herbarium, was appointed as keeper by Cooke (Almeida, 1996). He was well known for his trained taxonomic eye and botanical drawings (Gokhale & Godbole, 1953) that were published in works such as Blatter & McCann (1935). He described several new grass species, including *Dichanthium paranjpyeanum* (Bhide) Clayton (1978), *Danthonia gammiei* Bhide (1912), *Enteropogon badamicus* Bhide (1912) and *Tripogon roxburghianus* Bhide (1912). *Kalanchoe bhidei* T. Cooke (1903) and the genus *Bhidea* Stapf ex Bor (1949) were named after him.

Hormasji Maneckji Chibber (1894–1921) was one of the first biology teachers in India and was transferred to the Bombay Presidency during 1906 (Burma & Chakravorty, 2010). He added a large herbarium collection from Sind (Puri, 1959) and was associated with the College of Agriculture, Poona in the early 20th century. Some of his prominent works are listed in the bibliography.

L. D. Garade, George Michael Ryan (–1932) and Gangadhar Balwant Patwardhan (1873–1961) also made voluminous collections that were referred to by Blatter and McCann in their Revision of the *Flora of the Bombay Presidency* (starting from 1926) and in their *The Bombay Grasses* (1935). Ryan, who was an officer in the Forest department of Thana, arrived in India in 1883 (Burkill, 1965) and published several natural history observations from Thana (Ryan, 1902, 1903, 1904). Patwardhan, a horticulturist was Superintendent of the Ganeshkhind Botanical Gardens, Poona, and published papers on various themes (Patwardhan, 1912–13, 1931). He was known for his research work on roses, pomegranates, exotic ornamentals, plant pathology, crop breeding and book on garden crops of Bombay (Patwardhan, 1928).

Professor Dhundiraj Laxman Dixit (1869–1948), (alias Annasaheb Dixit) served the Fergusson College for 32 years as a professor, and later in 1907 as the head of Biology department (Almeida, 1996). He was known for his studies on vascular cryptogams from Western India (Mahabale, 1987) and initiated the establishment of the herbarium in the Botany department (Vartak, 1958a). The bryophyte,

Aspiromitus dixitianus Mahab. (1941), was described by his student Dr. T. S. Mahabale.

Some collections by Govind Gopal Kolhatkar (1901–1982), another faculty member at the Fergusson Botany department, are also present. Kolhatkar was the teacher of, and had a major influence on, V.D. Vartak (see below) (pers. comm. P. S. Karekar, 2015). He also described the pteridophyte *Marsilea poonensis* Kolhatkar (1957) now treated as a synonym of *Marsilea minuta* L.

***Early collections in the Fergusson herbarium*:** The herbarium of Fergusson College Botany Department holds over 150 sheets that were collected by the aforementioned researchers (Appendix 1). Some of these sheets could also have been used by Cooke for his flora. Interestingly none of the above mentioned researchers (except Paranjapye Dixit and Kolhatkar) were associated with Fergusson College and these sheets were probably obtained, by exchange or purchase, by early workers associated with what was then the College of Agriculture herbarium. The Herbarium at Agriculture College, Poona, mentioned by Gokhale & Godbole (1953), was in 1956 moved to its present location at the Botanical Survey of India, Western Regional Circle (BSI) (Puri, 1959). It is important to note that in 1958 Vartak stated that the herbarium housed 5000 sheets (Vartak, 1958a), but today less than half of this number remains, and only a handful of specimens that were collected from the College campus before Vartak's collection.

***The Vartak era*:** Vaman Dattatreya Vartak (1925–2001) graduated in botany from the Fergusson College, Pune and after post-graduate studies, was appointed there as a demonstrator (Ghate, 2001). During his tenure, Dr. Vartak conducted an extensive floristic survey of the campus, of which only the analysis was published (Vartak, 1958a), thereafter this was supplemented by articles including Vartak (1959a, 1960). He also dealt with the Fergusson flora indirectly in other publications (Vartak, 1957a, 1959b, c, d, e, 1964). References to rare or endangered plants and plants of botanical interest present in the botanical hotspot of the College's Botanical Garden were also made in most of these articles.

Vartak's initial interests were in floristics and taxonomy, as is evident from his several publications on these topics (Vartak, 1957b, 1958b, 1962, 1964, 1966a, b). After 1973, he utilized his taxonomic skills to better understand the treasures of sacred groves and is credited as having done pioneering work in the field of Indian ethnobotany (Gadgil & Vartak, 1975; Vartak & Gadgil, 1981; Vartak & Mandavgane, 1981; Upadhye *et al.*, 1986, also refer Ghate *et al.*, 2004). A lichen *Parmotrema vartakii* Hale (1977) and an asclepiad *Brachystelma vartakii* Kambale & S.R.Yadav (2014) were named after Vartak.

***Vartak specimens in the Fergusson herbarium*:** Over 700 herbarium sheets of specimens collected from the Fergusson campus by V. D. Vartak are present in the Fergusson College herbarium, which comprise the vouchers for the Fergusson flora (Vartak, 1958a). Additional specimens from the campus are to be found in the Agharkar Research Institute Herbarium (AHMA). The data retrieved from these two herbaria have revealed that the campus once possessed many rare, threatened and botanically interesting species (Nerlekar *et al.*, 2016). Some of the trees from which specimens were collected by Vartak are still present on the campus, of which most are of rare occurrence in the city of Pune (Ingalhalikar & Barve, 2010; Nerlekar *et al.*, 2016). Some sheets in the Fergusson herbarium also form vouchers for important local floras, including a flora of Raigad Hill (Vartak, 1966b), Sinhagad Hill (Vartak, 1957b), Katraj Ghat (Vartak, 1962) and additional compilations (Vartak, 1959b, c). Several sheets of interesting species collected by Vartak from other parts of India are also present in the herbarium (Appendix 2).

Another notable collection in the herbarium is of pteridophytes gathered by Nalini Gunjatkar (1934–1989). She completed her doctoral work under Dr. Vartak, was a faculty member of the Botany department, Fergusson College during the 1980s and worked on ethnobotany (pers. comm. D. K. Kulkarni, 2015). Some of her major contributions to the field were published in Gunjatkar & Vartak (1982, 1983). Other collections in the herbarium are those of S. S. Ranade, S. R. Deshpande, M. N. Kanitkar, D. P. Deshmukh and Anand Karve, collected in and around Pune. S. S. Ranade was associated with the Fergusson College and Vartak, whose collections were referred to by Razi (1952). Vartak acknowledged M. N. Kanitkar several times in his publications for assistance with his projects and providing inputs to manuscripts.

***Implications*:** It has recently been shown that herbaria are one of the major sources

for the discovery of new species and orienting research towards critical examination of existing herbaria is thus as important as field collection (Bebber *et al.*, 2010). Some sheets in the herbarium have either not been identified or have been incompletely identified, and some of the names used are designated 'unresolved' in The Plant List (2013). Thus, experts are urged to critically examine the collection. And while the herbarium collection is small (<5000), and consequently not listed in the Index Herbariorum, it does deserve attention from students and botanical researchers owing to its rich array of historical collections [See Figs. 1–3 for sample sheets]. After the requisite validation of identifications and data digitization, it is suggested that the collection should be made available to interested researchers through virtual means – similar to AVH (2014) and FRLHT (2014).

Unfortunately, no research work apart from maintenance has been carried out on the herbarium since Dr. Vartak's collection of 1960. Also, no significant collection has been added to the herbarium since 1960. In a broader sense, this also highlights the rapid decline of willingness to carry out taxonomic studies by students and teachers alike. Much of this is the result of a failure by universities to generate interest among students by under-rating taxonomy (Venu, 2002). Lack of allocation of appropriate funds has also resulted in the reduction in natural history collections of educational institutes worldwide (Gropp, 2003). Therefore, in this global scenario, with a dearth of field taxonomists (Khoshoo, 1995; Sen, 2013), effort must be directed towards taxonomic studies and to allied institutes such as these smaller herbaria, which must be conserved and utilized by researchers. Simultaneously, every effort should be made to develop the collection and engage students in its curation.

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Appendix 1: Some noteworthy angiosperms collected from locations other than Fergusson College campus. The families and names were checked using the latest version of The Plant List (2013). Occurrence status has been given following relevant publications of respective areas.

1. Apocynaceae –*Tabernaemontana heyneana* Wall.; Londa, 20 Mar 1908, *H. M. Chhibber s.n.* (Endemic to western peninsula India [Cooke, 1903-08]).

2. Araceae –*Pothos scandens* L.; Castle Rock, 24 Oct 1902, *G. A. Grammie 15552* (Possibly used by Cooke [1903-08]; see also Vartak [1966a]).

3. Asclepiadaceae–*Ceropegia lawii* Hook.f.; Sinhagadh, Poona, 24 Jul 1951, *V. D. Vartak 68* (Endemic and endangered [Mishra & Singh, 2001]).

4. Asteraceae –*Cyathocline lutea* Law ex Wight; Lonavala, Poona, 1952, *V. D. Vartak s.n.* (Endemic to India [Singh *et al.*, 2001] and endangered [Mishra & Singh, 2001]).
– *Erigeron linifolius* Willd.; Vetal Hills, Pune, 18 Aug 1902, *R. K. Bhide s.n.* (an addition to the flora of the Vetal Hills [refer Joshi & Kumbhojkar, 1997]).

5. Dioscoreaceae–*Dioscorea pentaphylla* L.; Gunjavani, 11 Feb 1954, *V. D. Vartak 2990* (Material for the Rajgad flora- Vartak [1966b]).

6. Ericaceae –*Rhododendron nilagiricum* Zenke; South India (endemic).

7. Euphorbiaceae–*Jatropha nana* Dalzell & A.Gibson; Katraj hills, Poona, 24 Jun 1951, *V. D. Vartak 26* (Endemic, Endangered [Mishra & Singh, 2001]).

8. Hydrocharitaceae–*Ottelia alismoides* (L.) Pers.; Vithalwadi, Poona, 1952, *V. D. Vartak s.n.*
–*Vallisneria spiralis* L.; Varoli, Bombay, 1951, *V. D. Vartak s.n.* (male plant).

9. Leguminosae –*Desmodium cephalotes* (Roxb.) Wight & Arn.; Castle Rock, 24 Oct 1902, *G. A. Gammie 15543* (Could have served as material for Cooke [1903-08]. Refer Vartak [1966a]).
–*Acacia sphaerocephala* Schltdl. & Cham.; Victoria gardens, Bombay, 1940.
–*Smithia purpurea* Hook.; Lonavali (Lonavala, Pune), 22 Sep 1902, *G. A. Gammie 15498* (An uncommon plant [Singh *et al.*, 2001], could have served as material for Cooke [1903-08]).

10. Lentibulariaceae–*Utricularia sp.*; Khandala, Poona, 5 Nov 1907, *H. M. Chhibber 94* (specific epithet unclear).

11. Asperagaceae–*Dipcadi ursulae* Blatt; Katraj hills, Poona, 10 Aug 1957, *V. D. Vartak 9759* (Endangered [Mishra & Singh, 2001]).
–*Chlorophytum orchidastrum* Lindl.; Parvati hill, Pune, 1954, *V. D. Vartak s.n.* (species doubful. Orchidastrum has been striked and written 'borivilianum').

12. Lythraceae –*Lagerstroemia lanceolata* Wall.; Sakharpathar (Lonavala), Poona, 21 May 1902, *G. A. Gammie 15190* (could have served as material for Cooke [1903-08]).

13. Malvaceae –*Erinocarpus nimmonii* J.Graham; Khandala to Khopoli, 30 Aug 1902 (Endemic to Western Ghats [Singh *et al.*, 2001]).

14. Myrtaceae –*Barringtonia acuminata* Korth.; Amboli ghat, 4 May 1902, *G. A. Gammie 15069* (could have served as material for Cooke [1903-08]).

15. Oleaceae –*Schrebera swietenioides* Roxb.; Chaturshingi hill, Poona, 17 Jun 1902, *L. D. Garade 450* (Not collected after 1918 from the mentioned location [Joshi *et al.*, 1992]).

16. Orchidaceae –*Habenaria longicalcarata* A.Rich.; Parvati hill, Pune, 23 Sep 1956, *D. P. Deshmukh 28* (Near threatened [Kumar *et al.*, 2001]).
–*Cheirostylis flabellata* (A.Rich.) Wight; South India.
–*Habenaria rariflora* A.Rich.; Simhagad, Poona, 11 Aug 1955, *A. Karve s.n.* (Near threatened [Kumar *et al.*, 2001]).
–*Eria braccata* (Lindl.) Lindl.; Khandala, 14 Jul 1888, *G. M. Woodrow s.n.* (Endemic [Pande *et al.*, 2001]).
–*Zeuxine sulcata* (Roxb.) Lindl.; Pashan, 25 Feb 1903, *G. A. Gammie 4175* (Rare [Pande *et al.*, 2010]. Historical record of occurrence in the locality).
–*Habenaria subpubens* A.Rich.; Londa, 20 Aug 1905, *4146*, (Near threatened [Kumar *et al.*, 2001]).
–*Habenaria commelinifolia* (Roxb.) Wall. ex Lindl.; Bassein, Thana district, 11 Sep 1903, *G. Ryan 1491* (Rare [Pande *et al.*, 2010]).
–*Aerides maculosa* Lindl.; Lonavali (Lonavala, Pune), 24 Jun 1903, *L. D. Garade 4173* (Endangered [Kumar *et al.*, 2001]).

–*Dendrobium chlorops* Lindl.; Penn to Khopoli, 15 Dec 1902, *G. A. Gammie 16087* (Vulnerable [Kumar *et al.*, 2001], could have served as material for Cooke [1903-08]).
–*Platanthera susannae* (L.) Lindl.; Sakharpathar (Lonavala), Poona, 7 Oct 1907, *H. M. Chhibber 123* (Rare [Pande *et al.*, 2010]).
–*Eulophia pratensis* Lindl.; Manjari farm (near Pune), 15 Feb 1904, *G. A. Gammie 4171* (Near threatened [Kumar *et al.*, 2001]).

17. Podostemaceae–*Lawia zeylanica* Tul.; Visapur fort, 15 Oct 1951, *S. S. Ranade 3901* (unresolved).

18. Ranunculaceae–*Delphinium dasycaulon* Fresen.; Torna fort, 26 Nov 1951, *V. D. Vartak 280* (Rare/ infrequent [Singh *et al.*, 2001]).

19. Rubiaceae –*Plectronia wightii* T.Cooke*;* 11 Jan 1946, *H. P. Paranjapye 249* (unresolved).
–*Gardenia turgida var. montana* (Roxb.) Hook.f.; Chaturshingi hill, Poona, 17 Jun 1902, *L. D. Garade 466* (not reported in the flora of these hills [Joshi & Kumbhojkar, 1997], could have served as material for Cooke [1903-08]).

20. Salicaceae –*Salix elegans* Wall. ex Andersson; not clear (probably Himalayas), 2 Jun 1943, *V. Mehendale s.n.*

Appendix 2: Some noteworthy angiosperm specimens collected from the Fergusson College campus. The families and names were checked using the latest version of The Plant List (2013). Occurrence status has been given following relevant publications of respective areas.

1. Annonaceae –*Saccopetalum tomentosum* Hook.f.& Thompson; 1 Feb 1957, *V. D. Vartak 7966* (Unresolved name; was only seen in the botanical garden [Vartak, 1959a]).

2. Apocynaceae –*Cerbera odallaum* Gaertn.; 20 Feb 1956, *V. D. Vartak 3746* (Not recorded from the city of Pune, refer Ingalhalikar & Barve [2010]).

3. Calophyllaceae–*Calophyllum inophyllum* L.; 20 Aug 1957, *V. D. Vartak 9865* (Rare in Pune [Ingalhalikar & Barve, 2010]).

4. Capparaceae –*Crataeva religiosa* G. Forst.; 15 Jul 1957, *V. D. Vartak 9381* (Occassional [Ingalhalikar & Barve, 2010]).

5. Clusiaceae –*Garcinia livingstonei* T.Anderson; 12 Nov 1956, *V. D. Vartak 7148* (Rare in Pune [Ingalhalikar & Barve, 2010]).

6. Combretaceae–*Terminalia bellirica* (Gaertn.) Roxb.; 3 Aug 1957, *V. D. Vartak 9633* (Rare in Pune [Ingalhalikar & Barve, 2010]).

7. Elaeocarpaceae–*Elaeocarpus ganitrus* Roxb. ex G.Don; 15 Jan 1958, *V. D. Vartak 12544* (Rare in Pune [Ingalhalikar & Barve, 2010]).

8. Leguminosae –*Haematoxylon campechianum* L.; 3 Nov 1957, *V. D. Vartak 11279* (Rare in Pune [Ingalhalikar & Barve, 2010]).

9. Malvaceae –*Adansonia digitata* L.; 5 Apr 1956, *3985* (garden exotic [Ingalhalikar & Barve, 2010]).

10. Meliaceae –*Cedrela toona* Roxb. ex Rottler; 20 Mar 1956, *V. D. Vartak 3826* (Rare in Pune [Ingalhalikar & Barve, 2010]).

11. Rosaceae –*Eriobotrya japonica* (Thunb.) Lindl.; 19 Jul 1957, *V. D. Vartak 9450* (Rare in Pune [Ingalhalikar & Barve, 2010]).

12. Rubiaceae –*Gardenia latifolia* Aiton; Jun 1957, *V. D. Vartak 9341* (Rare in Pune [Ingalhalikar & Barve, 2010] and only seen in F.C. Botanical garden in the city [Vartak, 1960]).

13. Sapotaceae –*Chrysophyllum cainito* L.; 15 May 1957, *8514*, (garden exotic [Ingalhalikar & Barve, 2010]).

14. Sterculiaceae–*Sterculia guttata* Roxb.; 19 Mar 1957, *V. D. Vartak 9433* (Rare in Pune [Ingalhalikar & Barve, 2010]).

15. Urticaceae –*Dorstenia indica* Wight; 3 Oct 1978, *V. Bhawanishankar & A. Saksena 212* (was cultivated due to its botanical importance for Coenanthium inflorescence).

PLATE 11

Figure 1: Herbarium sheet of *Platanthera susannae* (family Orchidaceae). Photo courtesy: Botany department, Fergusson College, Pune, India

PLATE 12

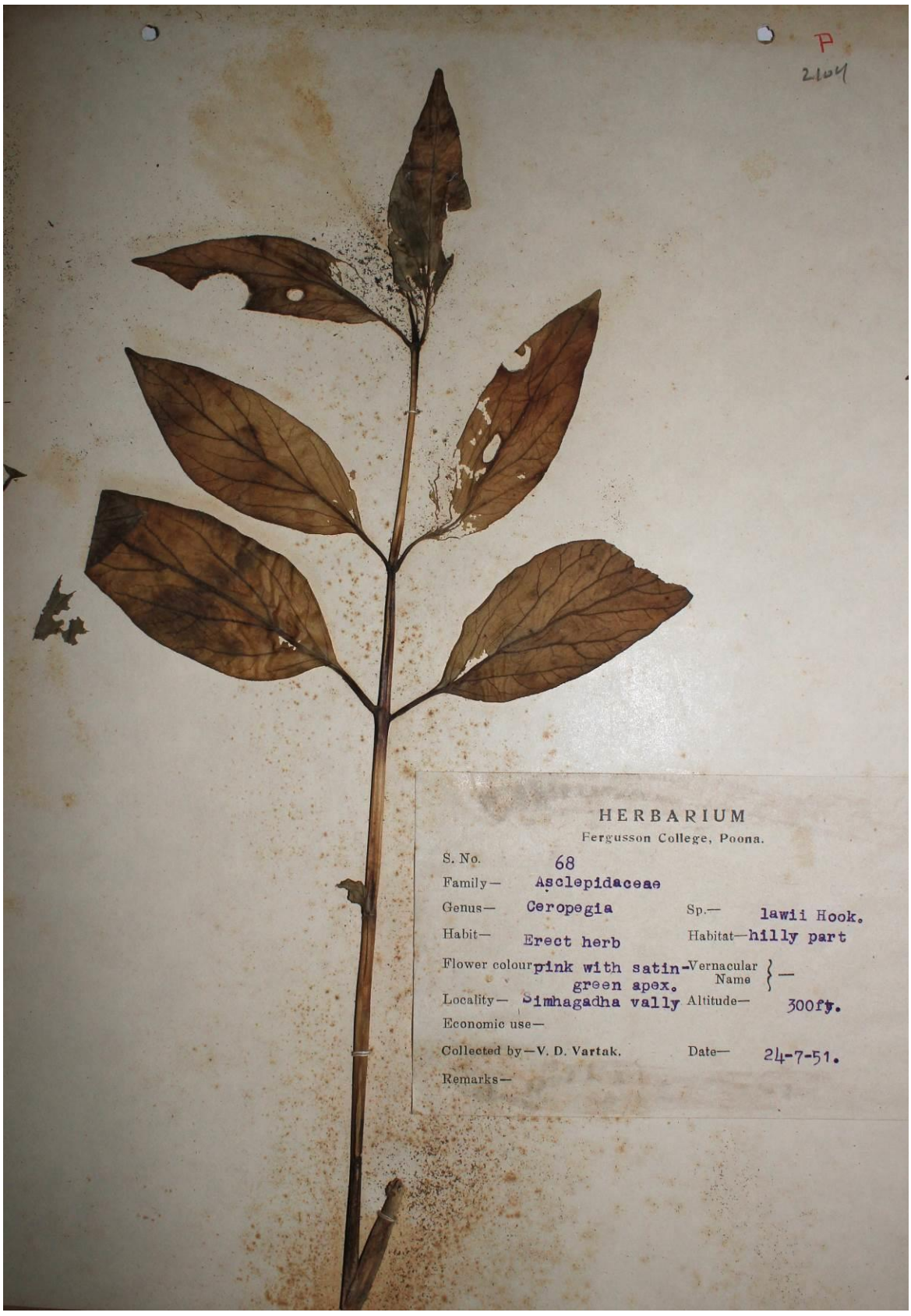

Figure 2: Herbarium sheet of *Ceropegia lawii* (family Asclepiadaceae). Photo courtesy: Botany department, Fergusson College, Pune, India

PLATE 13

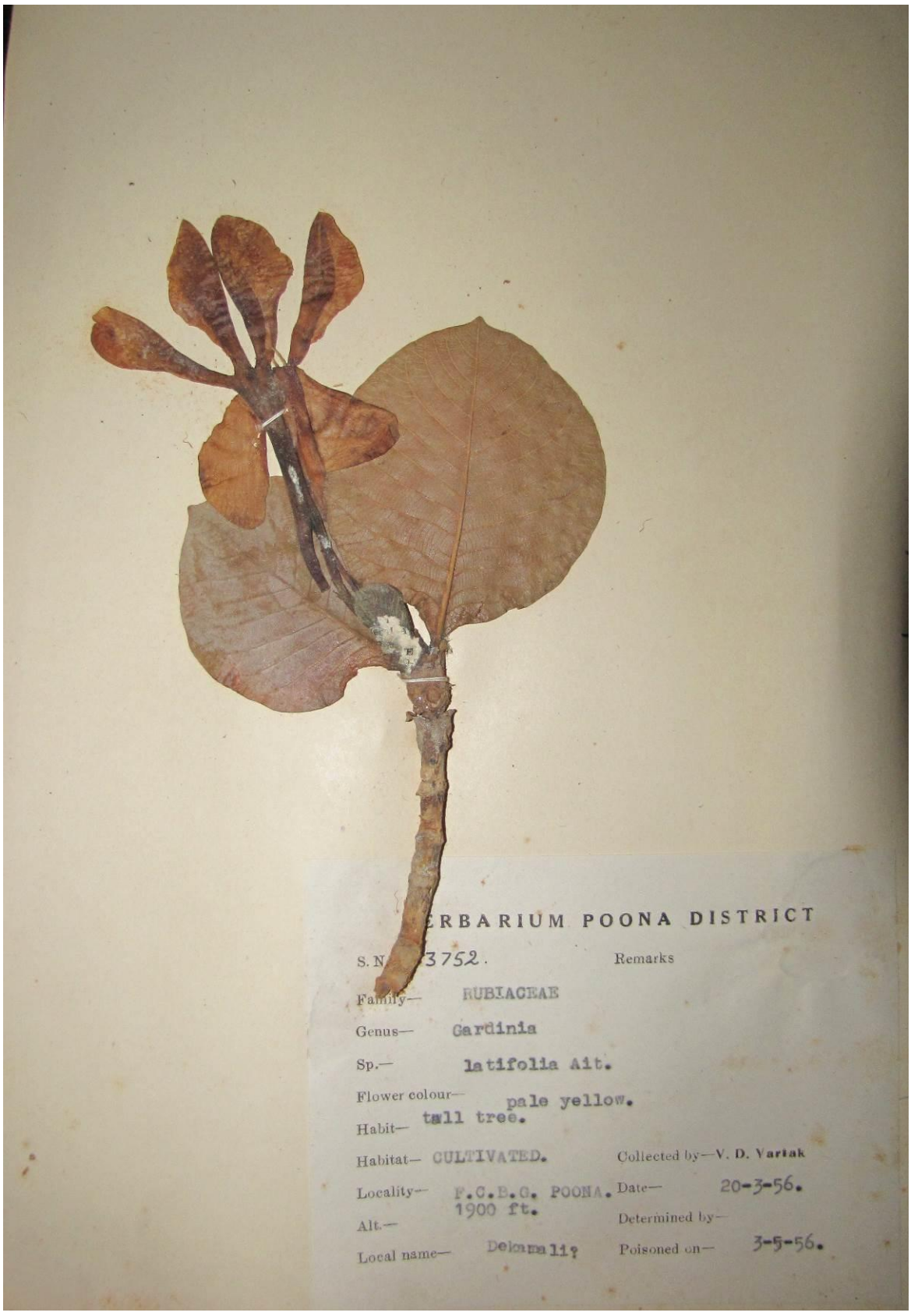

Figure 3: Herbarium sheet of *Gardenia latifolia* (family Rubiaceae). Photo courtesy: Botany department, Fergusson College, Pune, India