



RESEARCH ARTICLE

NEIGHBORHOOD POPULATION STUDY OF *IMPATIENS LEVINGEI* GAMBLE EX HOOK. F. (ENDEMIC) IN SELECTED NATURAL HABITAT OF NILGIRIS

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ABSTRACT

Impatiens are commonly known as 'Balsams' (Jewel weeds). *Impatiens* L. is one of the largest genera of flowering plants. Among 850 species found in the tropics and north temperate regions. 86 species reported from the Western Ghats, 76 are found to be endemic. Bryophyte, wild *Impatiens* and some Pteridophytes are more sensitive environmental indicators. They survive well in adjoining fresh water seeping habitat. Endemic plants association depend one another to maintain their micro climate and ecosystem. So neighborhood population study helps to conserve endemic plants. This study shows Bryophyte population also helps to *impatiens levingei* succession in untainted environment. 13 endemic species placed in the study area.

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INTRODUCTION

Impatiens levingei is the widespread genera of Balsaminaceae family in Angiosperms. *Impatiens* group plants generally known as 'Balsams' (Jewel weeds). Some *Impatiens* are cultivated as ornamental and some are used in medicine and cosmetics. *Impatiens levingei*. is one of the largest genera in flowering plants comprises 850 species found in the tropics and north temperate regions (Mabberley, 1993) among 210 species represented in the Eastern Himalaya and the Western Ghats. Both regions show a high degree of endemism (Mittermeier *et al.*, 2004). 86 species reported from Western Ghats in that 76 were found to be endemic (Nair 1991). Two groups of *Impatiens* occurring in India one group had short swollen spindle shaped pods distributed in peninsular region other one group had long and narrow pods distributed in the Himalayan region (Hooker 1874). Seeping springs water areas are the natural habitat of *Impatiens*. These areas shows abnormal habitat type differ from other habitat and interesting subject to study species environment relationships. More sensitive environmental indicators of Bryophyte, wild *Impatiens* and some Pteridophytes are survives well in fresh water adjoining habitat and grassland. Direct interaction of Bryophytes includes providing food, shelter and nesting material for small mammals and invertebrates. Indirectly, they serve as a matrix for a variety of interaction between Organisms (Srivastava and Alam, 2005).

Seeping spring water habitat shows clear variation from the neighborhood habitats. Springs natural drivers for ecosystem functioning. According to Frahm and Klaus (2001) Terrestrial lower life forms are ecologically very important grow in a variety of life forms due to they are component of montane forest ecosystem. Bryophyte has high degree of soil binding capacity and water holding capacity (smith, 1982; Richards, 1984). Interaction between herbaceous life forms in spring water habitat helps to neighborhood species succession. So neighborhood population study helps to conserve endemic *impatiens*.

MATERIALS AND METHODS

Study area: Three natural habitat locations of *Impatiens levingei* were selected for population study. They are Lamb's Rock (Shola forest) (11°21'03"N 76°49'14"E), Droog (Grassland) (11°18'43"N 76°49'01"E). Carrington (Grassland) (11°12'59"N 76°36'56"E). 1m×1m size of 20 quadrates were selected in each locations to study herbaceous population. The collected specimens were identified by standard keys as following. Gamble (1935), Fyson (1915), Hooker (1872-1897) were used for Angiosperms identification. Beddome (1830 - 1911), Baynes (1887), Manickam and Irudayaraj (1992) were used for Pteridophyte identification. Gangulee (1957,1959, 1969 -1980), Afroz Alam (2011), (2012) were used for Bryophyte identification.

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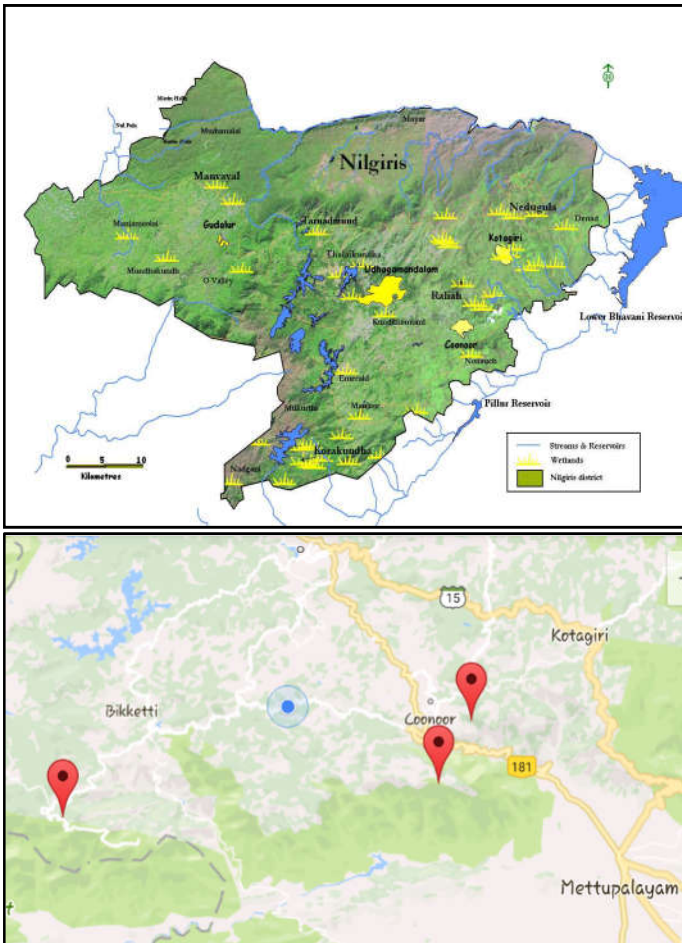


Figure 1: Study Area

Figure 2: *Impatiens levingei* Gamble ex Hook. F.

RESULTS

In the natural habitat of *Impatiens levingei* over all 54 plant species were found in the herbaceous layer. It includes 34 family. The dominant family found in the study area is Lamiaceae, Orchidaceae, Poaceae each family consist 4 species

Isodon wightii (Benth.) H.Hara,
Anisochilus suffruticosus Wight,
Leucasrosmarinifolia Benth,
Pogostemon nilagiricus Gamble,
Aerides crispa Lindl,
Coelogyne nervosa A.Rich,
Habenaria longicornu Lindl,
Phyllorchis nilgherensis (Wight) Kuntze,
Cymbopogon flexuosus (Nees ex Steud.) W. Watson,
Isachne kunthiana (Wight & Arn. ex Steud.) Miq,
Panicum gardneri Thwaites,
Themeda triandra Forssk respectively (Table 1).

Table 1 Check list of Plant species collected in study area

S.No.	Binomial Name	Family
1	<i>Adiantum raddianum</i> C. Presl	Pteridaceae
2	<i>Aerides crispa</i> Lindl.	Orchidaceae
3	<i>Anaphalis subdecurrens</i> (DC.) Gamble	Compositae
4	<i>Anisochilus suffruticosus</i> Wight	Lamiaceae
5	<i>Anthoceros erectus</i> Kashyap	Anthocerotaceae
6	<i>Bryumar genteum</i> Hedw.	Bryaceae
7	<i>Bryum billarderi</i> Schwagr	Bryaceae
8	<i>Campylopus schmidii</i> (Müll. Hal.) A. Jaeger	Dicranaceae
9	<i>Christella meeboldii</i> Holttum	Thelypteridaceae
10	<i>Coelogyne nervosa</i> A.Rich.	Orchidaceae
11	<i>Cymbopogon flexuosus</i> (Nees ex Steud.) W. Watson	Poaceae
12	<i>Cyperus cyperinus</i> (Retz.) Suringar	Cyperaceae
13	<i>Deparia petersenii</i> (Kunze) M. Kato	Athyriaceae
14	<i>Disporum cantoniense</i> (Lour.) Merr.	Colchicaceae
15	<i>Dumortiera hirsuta</i> (Sw.) Nees	Marchantiaceae
16	<i>Entodon plicatus</i> Müll. Hal.	Entodontaceae
17	<i>Erigeron trilobus</i> (Decne.) Boiss.	Compositae
18	<i>Fissidens bryoides</i> Hedw.	Fissidentaceae
19	<i>Fossombronina pusilla</i> (L.) Dumort.	Fossombroniaceae
20	<i>Habenaria longicornu</i> Lindl.	Orchidaceae
21	<i>Hemionitis arifolia</i> (Burm. f.) T. Moore	Pteridaceae
22	<i>Heracleum rigens</i> Wall. ex DC.	Apiaceae
23	<i>Hydrocotyle javanica</i> Thunb.	Araliaceae
24	<i>Impatiens cuspidata</i> Wight & Arn.	Balsaminaceae
25	<i>Impatiens levingei</i> Gamble ex Hook. f.	Balsaminaceae
26	<i>Iphigenia indica</i> (L.) A. Gray ex Kunth	Colchicaceae
27	<i>Isachne kunthiana</i> (Wight & Arn. ex Steud.) Miq.	Poaceae
28	<i>Isodon wightii</i> (Benth.) H.Hara	Lamiaceae
29	<i>Justicia procumbens</i> L.	Acanthaceae
30	<i>Kalanchoe grandiflora</i> Wight & Arn.	Crassulaceae
31	<i>Knoxiasum atrensis</i> (Retz.) DC.	Rubiaceae
32	<i>Leucasros marifolia</i> Benth	Lamiaceae
33	<i>Lindernia hyssopoides</i> (L.) Haines	Linderniaceae
34	<i>Lophocolea bidentata</i> (L.) Dumort.	Lophocoleaceae
35	<i>Nephrolepis auriculata</i> Trimen	Nephrolepidaceae
36	<i>Ophiopogonin termedius</i> D. Don	Asparagaceae
37	<i>Ophiorrhiza brunonis</i> Wight & Arn.	Rubiaceae
38	<i>Osbeckia leschenaultiana</i> Wight	Melastomataceae
39	<i>Panicum gardneri</i> Thwaites	Poaceae
40	<i>Peperomia heyneana</i> Miq.	Piperaceae
41	<i>Philonotis falcata</i> (Hook.) Mitt.	Bartramiaceae
42	<i>Phlebodium aureum</i> (L.) J. Sm.	Polypodiaceae
43	<i>Phyllanthus virgatus</i> var. <i>gardnerianus</i> (Wight) Govaerts & Radcl.-Sm.	Phyllanthaceae
44	<i>Phyllorchis nilgherensis</i> (Wight) Kuntze	Orchidaceae
45	<i>Pogonatum microstomum</i> (R. Br. ex Schwagr.) Brid.	Polytrichaceae
46	<i>Pogostemon nilagiricus</i> Gamble	Lamiaceae
47	<i>Pteridium aquilinum</i> (L.) Kuhn	Dennstaedtiaceae
48	<i>Pterobryopsis acuminata</i> (Hook.) M. Fleisch.	Pterobryaceae
49	<i>Selaginella radicata</i> hort. ex Alston	Selaginellaceae
50	<i>Stegogram mapozoi</i> (Lag.) K. Iwats.	Thelypteridaceae
51	<i>Themeda triandra</i> Forssk.	Poaceae
52	<i>Thuidium cymbifolium</i> (Dozy & Molck.)	Thuidiaceae
53	<i>Youngia japonica</i> (L.) DC.	Compositae

Herbaceous population of Lamb's rock comprises 14 Angiosperms 70.01% (Table 2). 5 Pteridophytes 7.49% (Table

3). 9 Bryophytes 22.5% (Table 4). Herbaceous population of Droog 15 Angiosperms 71.83% (Table 2). 3 Pteridophytes 8.99% (Table 3). 7 Bryophytes 19.18% (Table 4). Herbaceous population of Carrington 11 Angiosperms 77.92% (Table 2). 3 Pteridophytes 6.88% (Table 3). 6 Bryophytes 15.19% (Table 4).

Graph 1, 2, and 3 showing *Impatiens levingei* population comparison with other herbaceous species. Graph 1 shows Lamb's Rock Shola had highest population of *Impatiens levingei* 30.03% in 70.01% of Angiosperm population and Bryophyte population is (22.5%) also high compared to other two study area.

Table 2. Check list of Angiosperm population in Lamb's Rock Shola

S.No.	Binomial name	Family	Population (%)
1	<i>Impatiens levingei</i> Gamble ex Hook.f.	Balsaminaceae	30.03
2	<i>Panicum gardneri</i> Thwaites	Poaceae	5.82
3	<i>Hydrocotyle javanica</i> Thunb.	Rubiaceae	5.57
4	<i>Isachne kunthiana</i> (Wight & Arn. ex Steud.) Miq.	Poaceae	4.99
5	<i>Cyperus cyperinus</i> (Retz.) Suringar	Araliaceae	4.16
6	<i>Lindernia hyssopoides</i> (L.) Haines	Linderniaceae	3.33
7	<i>Disporum cantoniense</i> (Lour.) Merr.	Colchicaceae	2.50
8	<i>Isodon wightii</i> (Benth.) H.Hara	Lamiaceae	2.50
9	<i>Ophiorrhiza brunonis</i> Wight & Arn.	Rubiaceae	2.41
10	<i>Knoxiasumatrensis</i> (Retz.) DC.	Cyperaceae	2.41
11	<i>Ophiopogon intermedius</i> D.Don	Asparagaceae	2.29
12	<i>Pogostemon rotundatus</i> Benth.	Lamiaceae	1.91
13	<i>Youngia japonica</i> (L.) DC.	Compositae	1.66
14	<i>Impatiens cuspidata</i> Wight & Arn.	Balsaminaceae	0.42
TOTAL POPULATION			70.01

Table 3. Check list of Pteridophyte population in Lamb's Rock Shola

S.No.	Binomial name	Family	Population (%)
1	<i>Selaginella radicata</i> hort. ex Alston	Selaginellaceae	2.50
2	<i>Adiantum raddianum</i> C. Presl	Pteridaceae	1.66
3	<i>Nephrolepis auriculata</i> Trimen	Nephrolepidaceae	1.25
4	<i>Stegno grammopozoi</i> (Lag.) K. Iwats.	Thelypteridaceae	1.08
5	<i>Deparia petersenii</i> (Kunze) M. Kato	Athyriaceae	1.00
TOTAL POPULATION			7.49

Table 4. Check list of Bryophyte population in Lamb's Rock Shola

S.No.	Binomial name	Family	Population (%)
1	<i>Thuidium cymbifolium</i> (Dozy & Molck.)	Thuidiaceae	3.08
2	<i>Dumortiera hirsuta</i> (Sw.) Nees	Marchantiaceae	3.04
3	<i>Bryum billarderi</i> Schwagr	Bryaceae	3.00
4	<i>Philonotis falcata</i> (Hook.) Mitt.	Bartramiaceae	2.66
5	<i>Anthoceros erectus</i> Kashyap	Anthocerotaceae	2.58
6	<i>Fissidens bryoides</i> Hedw.	Fissidentaceae	2.41
7	<i>Entodon plicatus</i> Müll. Hal.	Entodontaceae	2.25
8	<i>Pogonatum microstomum</i> (R. Br. ex Schwagr.) Brid.	Polytrichaceae	1.83
9	<i>Lophocolea bidentata</i> (L.) Dumort.	Lophocoleaceae	1.66
TOTAL POPULATION			22.5

Table 5. Check list of Angiosperm population in Droog

S.No.	Binomial name	Family	Population (%)
1	<i>Themeda triandra</i> Forssk.	Poaceae	8.99
2	<i>Impatiens levingei</i> Gamble ex Hook. F.	Balsaminaceae	7.11
3	<i>Pogostemon nilagiricus</i> Gamble	Lamiaceae	6.84
4	<i>Coelogyne nervosa</i> A. Rich.	Orchidaceae	6.57
5	<i>Phyllanthus virgatus</i> var. <i>gardnerianus</i> (Wight) Govaerts & Radcl.-Sm.	Phyllanthaceae	5.63
6	<i>Justicia procumbens</i> L.	Acanthaceae	5.50
7	<i>Erigeron trilobus</i> (Decne.) Boiss.	Compositae	5.23
8	<i>Habenaria longicornu</i> Lindl.	Orchidaceae	4.16
9	<i>Cymbopogon flexuosus</i> (Nees ex Steud.) W. Watson	Poaceae	3.89
10	<i>Osbeckiales chenaultiana</i> Wight	Melastomataceae	3.82
11	<i>Pogostemon nilagiricus</i> Gamble	Lamiaceae	3.76
12	<i>Iphigenia indica</i> (L.) A. Gray ex Kunth	Colchicaceae	3.49
13	<i>Anisochilus suffruticosus</i> Wight	Lamiaceae	2.82
14	<i>Heracleum mrigens</i> Wall. ex DC.	Apiaceae	2.55
15	<i>Aerides crispa</i> Lindl.	Orchidaceae	1.48
TOTAL POPULATION			71.83

Table 6. Check list of Pteridophyte population in Droog

S.No	Binomial name	Family	Population (%)
1.	<i>Pteridium aquilinum</i> (L.) Kuhn	Dennstaedtiaceae	3.55
2.	<i>Hemionitis arifolia</i> (Burm. f.) T. Moore	Pteridaceae	2.88
3.	<i>Christella meeboldii</i> Holttum	Thelypteridaceae	2.55
TOTAL POPULATION			8.99

Table 7. Check list of Bryophyte population in Droog

S.NO	Binomial name	Family	Population (%)
1.	<i>Campylopus schmidii</i> (Müll. Hal.) A. Jaeger	Dicranaceae	5.23
2.	<i>Pogonatum microstomum</i> (R. Br. ex Schwägr.) Brid.	Polytrichaceae	2.95
3.	<i>Fossombronina pusilla</i> (L.) Dumort.	Fossombronaceae	2.95
4.	<i>Bryum billarderi</i> Schwagr.	Bryaceae	2.82
5.	<i>Bryumar genteum</i> Hedw.	Bryaceae	2.28
6.	<i>Fissidens bryoides</i> Hedw.	Fissidentaceae	1.48
7.	<i>Anthoceros erectus</i> Kashyap	Anthocerotaceae	1.48
TOTAL POPULATION			19.18

Table 8. Check list of Angiosperm population in Carrington

S.No	Binomial name	Family	Population (%)
1.	<i>Coelogyne nervosa</i> A.Rich.	Orchidaceae	22.5
2.	<i>Peperomia heyneana</i> Miq.	Piperaceae	10.26
3.	<i>Anaphalis subdecurrens</i> (DC.) Gamble	Compositae	8.05
4.	<i>Aerides crispa</i> Lindl.	Orchidaceae	5.97
5.	<i>Impatiens levingei</i> Gamble ex Hook.f.	Balsaminaceae	5.58
6.	<i>Osbeckiales chenaultiana</i> Wight	Melastomataceae	5.45
7.	<i>Justicia procumbens</i> L.	Acanthaceae	4.68
8.	<i>Phyllorchis nilgherensis</i> (Wight) Kuntze	Orchidaceae	4.16
9.	<i>Leucasos marinfolia</i> Benth	Lamiaceae	3.77
10.	<i>Kalanchoe grandiflora</i> Wight & Arn.	Crassulaceae	2.73
11.	<i>Pogostemoni lagiricus</i> Gamble	Lamiaceae	2.73
TOTAL POPULATION			77.92

Table 9. Check list of Pteridophyte population in Carrington

S.No	Binomial name	Family	Population (%)
1.	<i>Hemionitis arifolia</i> (Burm. f.) T. Moore	Pteridaceae	2.73
2.	<i>Stegnogram mapozoi</i> (Lag.) K. Iwats.	Thelypteridaceae	2.21
3.	<i>Phlebodium aureum</i> (L.) J. Sm.	Polypodiaceae	1.95
TOTAL POPULATION			6.88

Table 10. Check list of Bryophyte population in Carrington

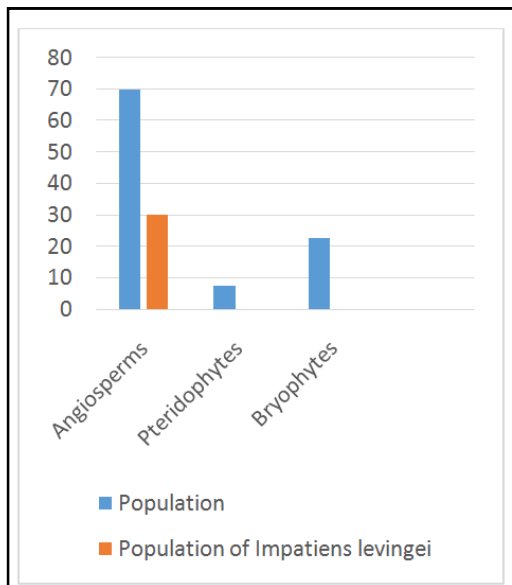
S.NO	Binomial name	Family	Population (%)
1.	<i>Campylopus schmidii</i> (Müll. Hal.) A. Jaeger	Dicranaceae	4.81
2.	<i>Pterobryopsis acuminata</i> (Hook.) M. Fleisch.	Pterobryaceae	2.73
3.	<i>Bryumar genteum</i> Hedw.	Bryaceae	2.47
4.	<i>Bryum billarderi</i> Schwagr.	Bryaceae	2.21
5.	<i>Fissidens bryoides</i> Hedw.	Fissidentaceae	1.56
6.	<i>Pogonatum microstomum</i> (R. Br. ex Schwägr.) Brid.	Polytrichaceae	1.43
TOTAL POPULATION			15.19

Graph 2 shows Droog had second leading population of *Impatiens levingei* 30.03% in 70.01% of Angiosperm population here Bryophyte population is 19.18%. Droog shows second leading population of *Impatiens levingei* 5.58% in 77.92% of Angiosperm population here Bryophyte population is 15.19%. *Selaginella radicata* Hort. ex Alston, *Adiantum raddianum* C. Presl, *Nephrolepis auriculata* Trimen, *Stegnogramma pozoi* (Lag.) K. Iwats. *Deparia petersenii* (Kunze) M. Kato are the Ravine ferns collected in Lamb's rock. Endemic fern *Selaginella radicata* associated with *Impatiens levingei*. *Aerides crispa* Lindl, *Anisochilus suffruticosus* Wight, *Coelogyne nervosa* A. Rich, *Heracleum rigens* Wall. ex DC, *Impatiens cuspidata* Wight & Arn, *Impatiens levingei* Gamble ex Hook.f, *Isodon wightii* (Benth.) H.Hara, *Kalanchoe grandiflora* Wight & Arn, *Leucas rosmarinifolia* Benth, *Ophiorrhiza brunonis* Wight & Arn,

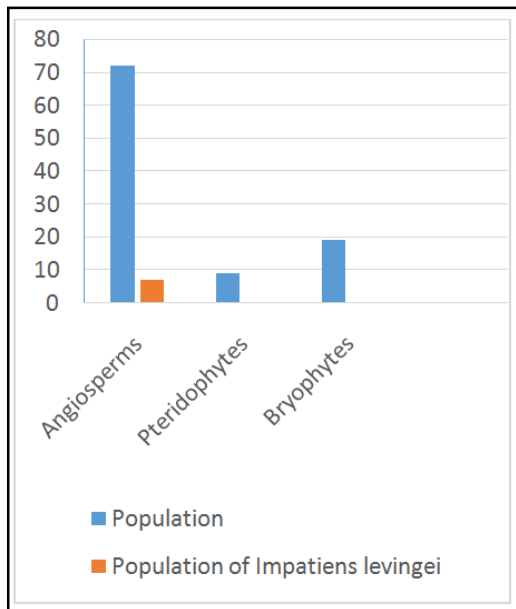
Osbeckia leschenaultiana Wight, *Pogostemon nilagiricus* Gamble, *Selaginella radicata* hort. ex Alston are the endemic species placed in the study area. Figure 2 shows entire habit of *Impatiens levingei*. Figure 3 shows total population of *Impatiens levingei* was 16.82% in 72.75% of Angiosperms.

DISCUSSION

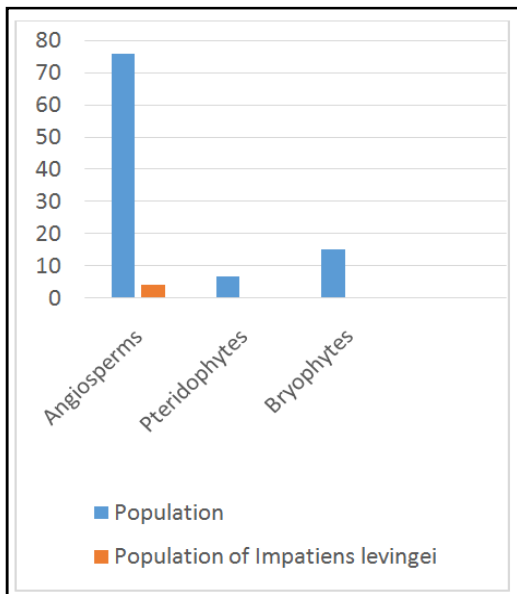
According to Thangavelu *et al.*, 2015 *Impatiens levingei* were neighborhood with *Malaxis nilgiriensis* grows mixed with *Malaxis versicolor*, *Anaphalis neelgerryana* Sch.-Bip.ex (DC.) DC., *Calanthe sylvatica* (Thouars) Lindl., *Eriocaulon odoratum* Dalz., f., *Malaxis rheedei* Sw, *Persicaiachinensis* (L.) Gross and *Persicaria nepalensis* (Meisner) H. Gross in Mukurthi National Park. *Impatiens levingei* and orchids succession is high in pollution free seeping spring water and



Lamb's Rock



Droog



Carrington

Graph 1: Population comparison of *Impatiens levingei* with neighborhood species

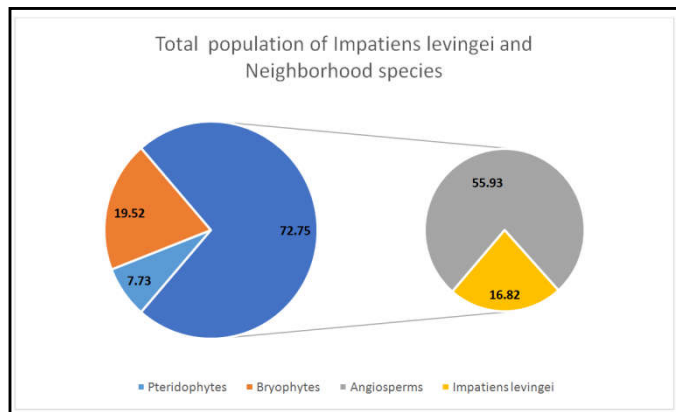


Figure 3: Total population of *Impatiens levingei* and Neighborhood species

grassland ecosystem. *Impatiens levingei* was collected by Gamble in 1883 from Lamb's Rock Shola forest (study area). Link address: <http://apps.kew.org/herbcat/getImage.do?imageBarcode=K000694893>. Three new taxa of *Impatiens* L., viz. *I. kawtityana* sp. Nov., *I. taihmushkulni* sp. Nov. and *I. nilgirica* Fisch. var. *nawtityana* var. nov. are described from southern Western Ghats of Tamil Nadu, (Tarun Chabra *et al.*, 2016.) *Impatiens rufescens* endemic reported from upper Nilgiri swamps in wetland habitat and narrow geographical range. It is very sensitive and once their habitat is lost or altered, they are usually unable to recover (Mohandass 2008). All endemic *Impatiens* are very sensitive they are the indicators of untainted environment. Rajeev Kumar 2016 referred *Impatiens levingei* as endemic plant to Western Ghats. According to Sahu *et al.*, (2007). Bryophytes are used as bio indicators for environment pollution because they are very sensitive. Water retaining capacity of Bryophytes helps the luxuriant growth of *Impatiens levingei* in spring water seeping area of Lamb's Rock. Because of this property the population dynamics of both Bryophyte and *Impatiens levingei* is faster in shola compared to grasslands. *Impatiens* and Bryophytes are mostly very sensitive plants groups. They are growing well in shady water dripping habitat like Lamb's Rock Shola forest. But in grasslands of Droog and Carrington they are not able to grow successfully. This study shows *Impatiens levingei* and Bryophyte population depends on one another.

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