



Mobilizing Occurrence Data of Alien and Endemic Plant Species of Nepal

Result sharing meeting

8 Jestha 2076 (22 May 2019)

Organized by

Central Department of Botany Tribhuvan University, Kathmandu Department of Plant Resources Thapathali, Kathmandu

Supported by

Biodiversity Information Fund for Asia (BIFA) program of Global Biodiversity Information Facility (GBIF)

Venue: Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu









Mobilizing occurrence data of alien and endemic plant species of Nepal: Outcomes and lessons learned

Bharat Babu Shrestha

Central Department of Botany, Tribhuvan University Kirtipur, Kathmandu

Result sharing meeting, Central Department of Botany, Tribhuvan University, Kirtipur 8 Jestha 2076 (22 May 2019)

Collaborating institutions:

 Central Department of Botany, Tribhuvan University, Kathmandu

>Tribhuvan University Central Herbarium, TUCH

 Department of Plant Resources, Ministry of Forest and Environment, Kathmandu

>National Herbarium and Plant Laboratory, KATH

• Royal Botanic Garden Edinburgh, UK

Team

- Principle investigator: Prof. Mohan Siwakoti, CBD, TU
- Co-Principle Investigator: Sanjeev Kumar Rai, DPR
- Coordinator: Dr. Bharat Babu Shrestha, CDB, TU

• Team members:

- Dr. Suresh K Ghimire, CDB, TU
- Kalpana Sharma-Dhakal, DPR
- Tirtha Raj Pandey, DPR-KATH (until Sept. 2018)
- Sajita Dhakal, DPR-KATH (from Oct. 2019)
- Dr. Mark Watson, RBGE, UK
- Dr. Bhaskar Adhikari, RBGE, UK

Team...

Research Assistants:

- Yagya Raj Paneru
- Ganesh Dutt Joshi

Funding

Biodiversity Information Fund for Asia (BIFA) program of Global

Biodiversity Information Facility (GBIF) funded by Ministry of

Environment, Government of Japan

- BIFA funding: € 14,008
- Co-funding (DPR + CDB,TU + RBGE): € 17,160

Duration

• May 2018 – March 2019 (Extended to May 2019)

Global Biodiversity Information Facility (GBIF)

" an international network and research infrastructure funded by the world's governments, aimed at providing anyone, anywhere, open access to data about all types of life on Earth."

www.gbif.org

GBIF | Global Biodiversity Information Facility

Free and open access to biodiversity data



Occurrence records 1,299,722,872

Datasets 44,750

Publishing institutions 1,405

Peer-reviewed papers using data 3,668



Angola becomes the newest member of the GBIF network 20 May 2019



Classifying crickets chirps: acoustic profiling in Orthoptera 15 May 2019



2019 GBIF Ebbe Nielsen Challenge seeks open-data innovations for biodiversity Deadline: 1 August 2019



Data mobilization and capacity building essential to address global biodiversity crisis 6 May 2019

Biodiversity Information Fund for Asia (BIFA)

Objectives:

- More biodiversity data for science and policy
- Networks to support long-term mobilization, management and use of biodiversity information
- Expanding the GBIF network in the Asian region

BIFA 2017: PROJECTS

Georeferencing and mobilization of plant occurrence data from Pakistan

Mobilizing occurrence data of alien and endemic plant species of Nepal

> Mobilizing a country-wide, long-term camera trap data set in Cambodia

> > Digitizing and databasing Sumatran flora

Data mining of historical herbarium specimens from the Korean peninsula

> Data mobilization of Vietnamese herbarium Cryptogam collections

Alien reptiles and amphibians of the Philippines

The Biodiversity Theses Database

(Maheva B Laursen, BIFA Programme coordinator)

Biodiversity Data of Nepal in GBIF Network

	May 2018	May 2019	Addition in one year (% of May 2018)
Occurrence records	2,56,269	3,67,510	1,11,241 (43.41%)
Dataset	474	534	60 (12.66%)
Countries and areas contributing data	35	36	1 (2.8%)
Data publishers	175	187	12 (6.85)
Publishers from Nepal	0	2	_

Species occurrence data of Nepal in GBIF

Taxonomic groups	May 2018	May 2019	Addition in one year (%)
Animalia	1,37,140	2,34,755	97,615 (71%)
Plantae	1,10,868	1,18,442	7,574 (6.8%)
Fungi	3,301	3,602	301 (9.1%)
Others	571	7,647	7,076 (1240%)



Species occurrence data of Nepal in GBIF network (May 2019)

(https://www.gbif.org/country/NP/about)

OCCURRENCES PER DATASET		Ca. 50% occurrence		
	Dataset	EOD – Bird observation	Count	
œ	EOD - eBird Observation D	ataset	181,023	
œ	Royal Botanic Garden Edin	ıburgh Herbarium (E)	35,760	
œ	A global database for the	distributions of crop wi	15,420	
œ	Natural History Museum (London) Collection Specime	11,748	
œ	The reptiles and amphibia	ns collection (RA) of the	7,620	
œ	Field Museum of Natural H	History (Zoology) Bird Col	7,274	
œ	Bacterial diversity in snow	from mid-latitude moun	6,843	
œ	The Himalayan Uplands P	ant database (HUP Version	6,817	
œ	The System-wide Informat	tion Network for Genetic Re	5,924	
Θ	Bioversity Collecting Miss	ion Database	5,745 https://www	v.gbif.org/country/NP/about (May 2019)

OCCURRENCES PER DATASET

	Dataset	Count
Θ	EOD - eBird Observation Dataset	83,123
Θ	Royal Botanic Garden Edinburgh Herbarium (E)	34,054
Θ	A global database for the distributions of crop wi	15,420
Θ	Natural History Museum (London) Collection Specime	11,384
Θ	The reptiles and amphibians collection (RA) of the	7,619
Θ	Field Museum of Natural History (Zoology) Bird Col	7,275
Θ	The Himalayan Uplands Plant database (HUP Version	6,817
Θ	The System-wide Information Network for Genetic Re	5,924
Θ	Bioversity Collecting Mission Database	5,745
Θ	Database of Vascular Plants of Himalaya	5,516

https://www.gbif.org/country/NP/about (May 2018)

Species occurrence records accessible through GBIF over time



Animalia records as observed in GBIF index over time



https://www.gbif.org/country/NP/about

Plantae records as observed in GBIF index over time







0 DATASETS

0 OCCURRENCES

PUBLISHER | SINCE NOVEMBER 27, 2018

Central Department of Botany, Tribhuvan University

ABOUT ⇔ HOME PAGE

Description: The Central Department of Botany manages Tribhuvan University Central Herbarium (TUCH) which has collection of herbarium specimens of the plant species from different parts of Nepal.

different parts of Nepal.

Endorsed by: Participant Node Managers Committee

Administrative contact: Bharat Shrestha

Country or area: Nepal



PUBLISHER | SINCE NOVEMBER 29, 2018

Department of Plant Resources, MoFE, Government of Nepal

Description: The Department of Plant Resources under the Ministry of Forest and Environment (formerly known as Department of Medicinal Plants) was established in 1960 A.D. This organization is conducting and providing services in the field of research and development of plant resources in Nepal. Resource survey and collection of plant materials and preservation of the specimens in the National Herbarium and Plant Laboratories is its main objective.

Endorsed by: Participant Node Managers Committee

Technical contact: Kalpana Sharma Dhakal

Country or area: Nepal





0 DATASETS

0 OCCURRENCES

Mobilizing occurrence data of alien and endemic plant species of Nepal

Background Alien plants

Alien plant species may be:

- Casual/cultivated (e.g. potato, *Eucalyptus*)
- Naturalized
 - Non invasive (e.g. Trifolium repens, Datura metel)
 - Invasive (e.g. Lantana camara, Parthenium hysterophorus)

Focus of present work: Naturalized species

Background Alien plants...

Tiwari et al 2005: "166 alien species naturalized in Nepal"

21 species reported as invasive

Unfortunately translated into "166 invasive plant species" (Bhattarai et al. 2014)





CHECKLIST DATASET REGISTERED 28 SEPTEMBER 2017

Global Register of Introduced and Invasive Species- Nepal

Published by Invasive Species Specialist Group ISSG

🖾 Bharat Babu Shrestha • Prem Bahadur Budha • Lian Jenna Wong • Shyama Pagad



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G	LOBAL REGISTER OF RODUCED AND INVASIVE SPECIES								

CLICK HERE TO DOWNLOAD THIS REPORT <u>CSV</u> / <u>PDF</u>											
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cacia farnesiana	Willd. (L.)	Nepal	Plantae	terrestrial	Alien		1	2017	٢		
acia nilotica	Delile (L.)	Nepal	Plantae	terrestrial	Alien		1	2017	٢		
anthospermum spidum	DC.	Nepal	Plantae	terrestrial	Alien		1	2017	٢		
enostemma silianum 🛈	Cass.	Nepal	Plantae	terrestrial	Alien		1	2017	٢		
ve cantala	Roxb. ex Salm- Dyck (Haw.)	Nepal	Plantae	terrestrial	Alien		1	2017			
ratina	King & H. Rob.	Nepal	Plantae	terrestrial	Alien	Yes	1	2017	٢		

Naturalized flowering plant species: 179 + # Naturalized pteridophytes: 4 + Alternanthera pungens = 174

Background *Alien plants*...

- # Naturalized flowering plant species: 179
- # Naturalized pteridophytes: 4
- Recent addition: *Alternanthera pungens*
- Total naturalized vascular plant species: 174
- # Invasive plant species: 26 (Shrestha et al 2017)

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Simple Advanced		Scientific name	Country or area	Coordinates	Month & year	Basis of record
License	~	Parthenium hysterophorus L.	Nepal	27.6N, 84.5E	2004 November	Preserved specimen
Scientific name	^	Parthenium hysterophorus L.	Nepal		1996 January	Preserved specimen
Parthenium hysterophorus L.		Parthenium hysterophorus L.	Nepal		1996 January	Preserved specimen
Explore Major groups		Parthenium hysterophorus L.	Nepal		1996 October	Preserved specimen
Plantae 8		Parthenium hysterophorus L.	Nepal		1995 October	Preserved specimen
Tracheophyta 8 Magnoliopsida 8		Parthenium hysterophorus L.	Nepal		1995 October	Preserved specimen
Asterales 8		Parthenium hysterophorus L.	Nepal			Preserved specimen
Asteraceae 8 Parthenium 8		Parthenium hysterophorus L.	Nepal			Machine observation
Parthenium h	ysterophorus 8	4				

Parthenium hysterophorus:

8 occurrence records but only one with geographic location





Lantana: Current Management Status and Future Prospects



Michael D. Day, Chris J. Wiley, Julia Playford & Myron P. Zalucki



Global distribution of *Lantana camara* (Day et al. 2003)

Lantana was shown to be absent in Nepal (white color in the map)

But the weed must be widespread by that time (2003)

Currently the weed is widespread from east to west and from Tarai to Mid Hills

Native

4000

Introduced

6000 Km

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Scientific n	name		^		Lai	ntana camara L.			Nepal			29.3N, 81.0E		2009 June		Preserve	d specimen
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Explore Plan	Major groups				Lai	ntana camara L.			Nepal					1996 January		Preserve	d specimen
	Tracheophyta 14	l a 14			Lai	ntana camara L.			Nepal					1996 January		Preserve	d specimen
	Lamiales	14			Lai	ntana camara L.			Nepal					1990 July		Preserve	d specimen
	Verben	aceae 14			Lai	ntana camara L.			Nepal					1977 August		Preserve	d specimen
Lantana 14 Lantana camara 14			Lantana camara L.			Nepal	Nepal				1974 April Preserved specimen						

14 occurrence data with only two having geographic coordinates

Background Endemic plants

ENDEMIC FLOWERING PLANTS OF NEPAL PART 1



Keshab Raj Rajbhandari ^{and} Mahesh Kumar Adhikari



Government of Nepal Ministry of Forests and Soil Conservation **Department of Plant Resources** Thapathali, Kathmandu, Nepal **2009** ENDEMIC FLOWERING PLANTS OF NEPAL PART 2



Keshab Raj Rajbhandari and Suraj Ketan Dhungana



Government of Nepal Ministry of Forests and Soil Conservation

Department of Plant Resources Thapathali, Kathmandu, Nepal

2010

ENDEMIC FLOWERING PLANTS OF NEPAL PART 3



Keshab Raj Rajbhandari and Suraj Ketan Dhungana



Government of Nepal Ministry of Forests and Soil Conservation Department of Plant Resources Thapathali, Kathmandu, Nepal 2011
Background Endemic plants...

Reprint Bulletin of Department of Plant Resources (Nepal), No. 38, 2016

Endemic Flowering Plants of Nepal: An update

Keshab Raj Rajbhandari, Sanjeev Kumar Rai and Ganga Datt Bhatt

Number of endemic flowering plant species of Nepal:

 $324 \rightarrow 312 + 1$

← → C Secure https://www.gbif.org/occurrence/search?country=NP&taxon_key=5696852								
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License	~	Taraxacum nepalense Soest	Nepal	ר	1954 April	Preserved specimen		
Scientific name	^	Taraxacum nepalense Soest	Nepal		1929 June	Preserved specimen		
Taraxacum nepalense Soest		Taraxacum nepalense Soest	Nepal			Machine observation		
Finite 3 Fracheophyta 3 Magnoliopsida 3 Asterales 3 Asterales 3 Taraxacum 3 Taraxacum nepalense 3								

(Photo: Tirtha R Pandey, KATH)

Background...

Overall reflection:

- Occurrence data of alien and endemic plants of Nepal have been poorly represented in GBIF network
- Nepal's scenario may not be well represented in global assessments of conservation priorities and environmental problems

Objective of BIFA funded project:

• Mobilizing occurrence data of alien and endemic plant

species of Nepal to fill geographic gap and inform

policy process for the conservation of biodiversity

Activities

- Data capturing (data source: herbarium specimens at KATH and TUCH)
- Preparation of catalog of herbarium specimens of endemic plants of Nepal
- Data publication in GBIF

Activities related to data capturing

- Checklist of alien (naturalized) and endemic plant species
- Sorting herbarium specimens (particularly in TUCH)
- Collection of herbarium specimens from mid-western Nepal
- Call for voluntary contribution of herbarium specimens to students and researchers of Central Dept. of Botany, TU
- Data capturing from herbarium sheets
- Photography and photo processing
- Georeferencing

Collection of herbarium specimens from midwestern Nepal (co-funding from RBGE)

• Team

- Bharat Babu Shrestha, CDB TU, Nepal
- Tirtha Raj Pandey, KATH, Nepal
- Bhaskar Adhikari, RBGE, UK
- Allan Elliott, RBGE, UK
- Duration: 24 Sept 8 Oct 2018
- Districts covered: Dang, Salyan, Surkhet, Jajarkot





Collection of herbarium specimens...

- Number of specimens: 81
- Number of species: 23

 Herbarium specimens contributed to both KATH and TUCH

Voluntary contribution of herbarium specimens in TUCH: Individuals

Contributors	# specimens
Mahesh Raj Bist	143
Bharat Babu Shrestha	38
Pratikshya Chalise and Prabhat Chalise	26
Suresh K. Ghimire	23
Yogendra Poudel, Ganesh Datt Joshi, Kiran Panthi	12
Himal Yonjan Tamang, Sandeep Dhakal, Sita Gyawali, Srijana Poudel	9
Bikram Gyawali	5
Deviram Bhattrai	3
Roshan Chhetri	3
Total	262

Voluntary contribution of herbarium specimens in TUCH: Darwin Initiative project

Collectors	# specimens
Ganesh Dutt Joshi et al	182
Bhawani Nyaupane et al	59
Rashmi Poudel et al	37
Total	278

Contribution of herbarium specimens in TUCH during project implementation: 35%



Data capturing from herbarium sheets

- Human resources: 2 research assistants (Yagya + Ganesh)
- Duration of work: 7 months (Aug 2018 Feb 2019) (TUCH + KATH)
- Activities:
 - Sorting and cleaning herbarium specimens
 - Checking identifications
 - Identification confirmation by experts (Prof. Mohan Siwakoti + Prof. Sureh K Ghimire in TUCH)
 - Annotation of new identifications
 - Putting barcode and stamp
 - Data entry





KATH





(Donated by RBGE)

TRIBHUVAN UNIVERSITY CENTRAL HERBARIUM NEPAL







Launching digitization at TUCH



1 - 1 =











ANNOTATION Saussurea ramchaudharyi S.K. Ghimire & H.K. Rana Asteracea Det. By: Suresh Kumar Ghimire Date: 17/12/2017

CHH 1247 Saussurea sp.

Upper Chungsa valley, above Selimen Lake, HUMLA Lat: 30º08.623'N, Long: 81º42.94'E 4650 m asl.

Suresh Kumar Ghimire, Asha Poudel, Laxmi Joshi, Smriti Lama, Prem Subedi and Chabi Thapa

10 September 2012





Photography and photo processing





Capturing image with the help of a special kind of scanner 'Herbscan" at 600 dpi



(Photo: Tirtha R Pandey)

Geo-referencing: Aliens in TUCH





Geo-referencing: Aliens in TUCH...

Resources



Geo-referencing: Endemic in TUCH



Trends and summary of captured data: Aliens in TUCH



Trends and summary of captured data: Aliens in TUCH...

species NOT represented in TUCH, 60, (34%)

> # species represented in TUCH, 119, (66%)

Trends and summary of captured data: Aliens in TUCH...



Trends and summary of captured data: Aliens in TUCH...







Number of herbarium specimens collected in different districts



Districts with ≥20 herbarium specimens collected



Number of herbarium specimens per alien species



Number of herbarium specimens per alien species






Trends and summary of captured data: Endemic in TUCH



Trends and summary of captured data: Endemic in TUCH...





Trends and summary of captured data: Endemic in TUCH...





Trends and summary of captured data: Aliens in KATH

- Number of specimens: 3515
- Number of species represented: >150

• Data cleaning and validation ongoing!!

Trends and summary of captured data: Endemic in KATH

- Total endemic flowering plants in Nepal: 313
- Species digitized during BIFA project: 50
- Specimens digitized during BIFA project: 275
- Previously captured data need to be included for complete picture

Trends and summary of captured data: Endemic in KATH...

Trends and summary of captured data: Endemic in KATH...

Trends and summary of captured data: Endemic in KATH...

Preparation of Catalog of Herbarium Specimens of Endemic Plants of Nepal

Next presentation by Kalpana Sharma Dhakal

Publication in GBIF

- Formatting data in **Darwin Core (DwC)** format
- Selection of data hosting institution with Integrated Publishing Toolkit (IPT) installed

Darwin Core (DwC) Standard

(https://www.gbif.org/en/darwin-core)

- Originally developed by Taxonomic Databases Working Group (TDWG), currently know as Biodiversity Information Standard (a not-for-profit, scientific and educational association).
- 'a stable, straightforward and flexible framework for compiling biodiversity data from varied and variable sources'
- Plays fundamental role in the sharing, use and reuse of open-access biodiversity data

Darwin Core: An Evolving Community-Developed Biodiversity Data Standard

John Wieczorek¹, David Bloom¹*, Robert Guralnick², Stan Blum³, Markus Döring⁴, Renato Giovanni⁵, Tim Robertson⁴, David Vieglais⁶

1 University of California, Berkeley, California, United States of America, 2 University of Colorado, Boulder, Colorado, United States of America, 3 California Academy of Sciences, San Francisco, California, United States of America, 4 Global Biodiversity Information Facility, Copenhagen, Denmark, 5 Centro de Referência em Informação Ambiental, Campinas, São Paulo, Brasil, 6 University of Kansas, Lawrence, Kansas, United States of America

Abstract

Biodiversity data derive from myriad sources stored in various formats on many distinct hardware and software platforms. An essential step towards understanding global patterns of biodiversity is to provide a standardized view of these heterogeneous data sources to improve interoperability. Fundamental to this advance are definitions of common terms. This paper describes the evolution and development of Darwin Core, a data standard for publishing and integrating biodiversity information. We focus on the categories of terms that define the standard, differences between simple and relational Darwin Core, how the standard has been implemented, and the community processes that are essential for maintenance and growth of the standard. We present case-study extensions of the Darwin Core into new research communities, including metagenomics and genetic resources. We close by showing how Darwin Core records are integrated to create new knowledge products documenting species distributions and changes due to environmental perturbations.

Citation: Wieczorek J, Bloom D, Guralnick R, Blum S, Döring M, et al. (2012) Darwin Core: An Evolving Community-Developed Biodiversity Data Standard. PLoS ONE 7(1): e29715. doi:10.1371/journal.pone.0029715

Editor: Indra Neil Sarkar, University of Vermont, United States of America

Darwin Core (DwC) Standard...

- Familiarized with DwC during a workshop in Beijing (June 2018)
- Currently assisted by Manash Sah, GBIF Sweden

Integrated Publishing Toolkit (IPT)

• A free open source software tool that is used to publish and share biodiversity datasets through the GBIF network

 Installation and maintenance of IPT requires own internet server and IT experts

262 installation in 72 countries

https://www.gbif.org/en/ipt

South Asia: Installed in 3 countries –

India: WII Nepal: ICIMOD Bangladesh: IUCN

Nepal: ICIMOD

Integrated Publishing Toolkit (IPT)...

• Commonly, data publishing institutions use IPT installed by other data hosting centers (RBGE have not installed IPT!).

- Selection of IPT for publishing BIFA project generated data
 - Approached ICIMOD in Nov 2018 and March 2019 IPT not active
 - Selected TaiBIF (Taiwan) with the help of GBIF secretariat
 - ICIMOD IPT currently active (!); probably we will use this for KATH data.

Deliverables

Data set (to be published in GBIF.org); # dataset: 4

- Occurrence data of alien plant species of Nepal (KATH + TUCH)
- Occurrence data of endemic flowering plants of Nepal (KATH + TUCH)

Other deliverables

- Occurrence data of alien plant species of Nepal [Data paper]
- Occurrence data of endemic plant species of Nepal [Data paper]
- Catalogue of herbarium specimens of endemic plants of Nepal

Contributions of the project

- KATH and TUCH registered as data publishers from Nepal
- Increased share of Nepal (and Asia) to biodiversity data in GBIF network
- Contribute towards meeting Aichi Biodiversity Targets 2020 of the Convention on Biological Diversity (CBD)
- Improved representation of invasive species problems of Nepal in global assessments
- Capacity building: infrastructure and human resources

Challenges and lessons learned

Incomplete information: Locality not locatable

Ref No Botanical Name Oxy Common Name Local Name Family Fabaccae. I ocality Dhapphi volatitude 90 Dat . Collection.050-5-3 i iletted by Pac Identified by Field Notes

Oldest collection TUCH but locality not locatable

	Herbarium.
I	DEPARTMENT OF BOTANY.
	TRICHANDRA COLLEGE, Katmandu.
Ref. N	0.209
Scienti	fic name Lida Carpinifolis
Comm	on name
l.ocalit	y Eastern SLope of College Comp.
Remarl	CS
Collect	or Balade Date 7.9.53

Challenges and lessons learned...

Challenges and lessons learned...

Endemic species in KATH

Specimens of alien plants in KATH

Challenges and lessons learned...

- Continuity of the digitization process, particularly in TUCH?
 - ≻Funding
 - Space and herbarium racks
 - ➢Human resource
 - ➤Technical support
Challenges and lessons learned...

Lessons:

- •Need to make plant collectors aware of the value of recording vital information at the time of collection
- Protection of specimen is as important as collection; OLD IS GOLD perfectly applies here.

Challenges and lessons learned...

Lessons:...

- Collection is just the first step; there are several steps to be crossed to make the data visible and usable to the rest of the world
- Small effort to publish data in GBIF will increase the use value of our collection and let rest of the world know the huge effort we made for collection and maintenance of plant specimens

Acknowledgements

- Biodiversity Information Fund for Asia (BIFA) program of GBIF
- Central Department of Zoology for lending copy stand for herbarium photography
- Subash Khatri, Chief, National Herbarium and Plant Laboratory (KATH) for administrative support and cooperation
- Project management committee (Prof. Mohan Panthi + Prof. Sangeeta Rajbhandary +)
- Prof. Mohan Panthi (former Head) and Prof. Ram Kailash P Yadav (current Head) of the Central Dept. of Botany for all kinds of supports
- Office of Dean, Institute of Science and Technology, TU
- Project team and research assistants
- Central Department of Botany, TU (Administration, Procurement and account sections).

THANK YOU













QUERIES, COMMENTS AND SUGGESTIONS?