



## ANNUAL REPORT *JULY 2019-JUNE 2020*

TO BE SUBMITTED JOINTLY BY COLLABORATING SUB-PROGRAMME COORDINATORS TO OVERALL COORDINATOR

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*Capacity building in Interdisciplinary Molecular Biosciences*

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**PARTICIPANTS:** The project is carried out in partnership of four Universities, Dar es Salaam, Uppsala, Swedish University of Agriculture, Gothenburg and Lund

### 1. Executive summary of sub-programme

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Different communities in Tanzania have utilized various plants and microbes for medicinal purposes (Chhabra *et al.*, 1982, 1987, 1989; Hedberg *et al.*, 1982, 1983a & b). However, scientific information on the benefits of the various indigenous remedies is very minimal due to lack of expertise and infrastructure required to conduct these researches. The project thus aimed to build capacity in Interdisciplinary Molecular Biosciences thus, strengthen knowledge for enhancing technological development in the country. Specifically the program intended to accomplish the following objectives:

#### 1.2. OBJECTIVES:

- i. Develop a taught PhD in Inter disciplinary Molecular Biosciences
- ii. To train human resource with expertise for research in molecular biosciences

- iii. To procure research equipment for IMB laboratories equipped with modern facilities
- iv. To train human resource with expertise for research in mycoscience including lichens
- v. To train technical staff with skills for maintain and repair procured equipment.

**Table 1: Overall Sub Programme Budget (2015-2020)**

<b>Institution/Year</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>	<b>2019/20</b>	<b>TOTAL</b>
<b>UDSM</b>	4,028,300	1,236,000	2,194,000	1,224,000	822,000	8,110,000
<b>SWEDEN and ISP</b>	400,000	564,000	454,000	1,704,000	200,000	3,322,000
<b>ISP STUDENTS</b>	448,000	346,000	450,000	532,000	242,000	2,018,000
<b>GRAND TOTAL</b>	<b>4,876,300</b>	<b>2,146,000</b>	<b>3,098,000</b>	<b>3,460,000</b>	<b>1,264,000</b>	<b>13,450,000</b>

**1.3. AREA OF STUDY:** The project deals with Molecular biosciences specializing in Infectious diseases, bioactive compounds, bioinformatics, biofuels, Mycology specializing in Mushrooms and Lichens.

**1.4. METHODS:**

The research involve training of seven PhD who carryout research in different lines of specialization in Interdisciplinary Molecular Biosciences. It involve attending classes, going to presenting findings in form of publications, conference papers/oral presentations, posters, thesis and policy briefs. On strengthening research it involved procuring of major equipment for Molecular bioscience researches.

**1.5. MAJOR ACCOMPLISHMENTS AND SUMMARY OF ACHIEVED RESULTS**

- i) A taught PhD curriculum in Inter disciplinary Molecular Biosciences was successfully developed, approved by the senate and subsequently accredited by TCU. The program enrolled six PhD students in year 2016/2017 five of them supported by the Project.
- ii) Five PhD students (human resource) with expertise for research in molecular biosciences were successfully recruited on the developed PhD program and are on the final stages of data analysis and thesis writing.
- iii) The major research equipment for IMB researches whereby a total of eleven equipments were successfully procured and installed.
- iv) Two PhD students (human resource with expertise for research in mycological science s including lichens were successfully recruited, One (Dr Juma Hussein) successfully defended and graduated in April 2020.

v) Two technical staff with skills to maintain and repair procured equipment. The technical staff training at Uppsala and Gothenburg schedule was interfered by Covid 19, and so they had to come back until the situation calms down.

vi) Strengthened collaboration between UDM and Swedish partners. The collaboration between MBB department of the University of Dar es Salaam and the five participating Swedish universities Uppsala, Swedish University of Agriculture, Gothenburg and Lund were strengthened.

Vii) Publication and dissemination of research findings has been done through publishing six journal papers in international peer reviewed journals, 13 conference posters/talks and one policy brief.

## **2. General objectives and expected results 2015-2020**

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The general objective of this programme is to build capacity in Interdisciplinary Molecular Biosciences thus, strengthen knowledge in molecular biology, biotechnology, mycology and lichenology in Tanzania, and enhance technological development in the country. By achieving this general objective, the following are the expected results to be realized between 2015 – 2020:

- (i) A taught PhD curriculum in Molecular Biosciences accredited by the Tanzania Commission for Universities (TCU).
- (ii) Completion of teaching and evaluation of PhD in Molecular Biosciences.
- (iii) Human resource with expertise for research in molecular biosciences and research laboratory equipped with modern facilities
- (iv) Human resource with expertise for research in the sciences of mycology and lichenology.
- (v) Technical staff with skills to maintain and repair acquired equipment.

## **3. Summary of achieved results as of June 2020**

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**Table 2: Summary of achieved results as of June 2020**

	<b>Objective</b>	<b>Achieved Results</b>
<b>1</b>	Develop a taught PhD in Inter disciplinary Molecular Biosciences	Achieve by 100%. Program developed and accredited by TCU
<b>2</b>	To train human resource with expertise for research in molecular biosciences (5PhD)	Achieved by more than 100%; The program enrolled 6 students but only five are supported by the Project
<b>3</b>	To procure research equipment for IMB laboratories equipped with modern facilities	Completed by 90%; All eleven (11) major equipment successfully procured and installed. But few minor equipments/gadgets were not procured and some are under process to be procured
<b>4</b>	To train human resource with expertise for research in mycoscience including lichens (2PhD)	Achieved by 100%; Two PhD enrolled and one graduated in April 2020
<b>5</b>	To train technical staff with skills for maintain and repair procured equipment.	Achieved by 40%. Two technical staff went to Sweden for training but had to come back due to Covid 19



**Juma Hussein**  
(Graduated)



**Herieth Mero**  
End of year (EY)



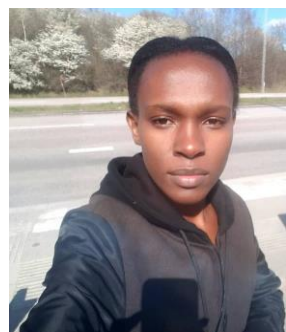
**Stella Temu** (September)



**Donath Damian**  
(EY)



**Jackson Mole**  
(EY)



**Bernadeter Rugumisa**  
(EY)



**Ruben Maghembe**  
(EY)

**Figure 1. SEVEN PhD in IMB with the expected graduation dates (EY = early next year)**

**4. Dissemination of research results:** During the reporting period (highlighted in blue), the following **Impacts/outcomes were realized or emanated** from trained PhDs and disseminated in various publications media:

#### 4.1 Published Journal Papers

4.1.1 Hussein JM, Tibuhwa DD, Tibell S (2018) Phylogenetic position and Taxonomy of *Kusaghiporia usambarae* gen. et sp. nov. (Polyporales) *Mycology: An International Journal of Fungal Biology*. DOI: 10.1080/21501203.2018.1461142

4.1.2 Tibuhwa DD, Hussein JM, Sijaona M, Ryvaden L and Tibell S. *Laetiporus baudonii* revisited: Re-evaluation and resolving phylogenetic position. (*Fungal Diversity – in Press*).

4.1.3 Stella GT, Tibuhwa DD, Tibell L, Phillippe C, Tibell SS (2019) Phylogeny of the subgenus *Eumitria* in Tanzania. *Mycology: An International Journal of Fungal Biology* DOI:10.1080/21501203.2019.1635217.

4.1.4 Stella G. Temu, Sanja Tibell, Donatha D. Tibuhwa & Leif Tibell (2019): Crustose Calicioid Lichens and Fungi in Mountain Cloud Forests of Tanzania. *Microorganisms* 7, 491; doi:10.3390/microorganisms7110491.

4.1.5 Donath Damian, Reuben Maghembe, Modester Damas, Jonas Johansson Wensman and Mikael Berg (2020). Application of Viral Metagenomics for Study of Emerging and Reemerging Tick-Borne Viruses. *Vector-Borne and Zoonotic Diseases* DOI: 10.1089/vbz.2019.2579

4.1.6 Reuben Maghembe, Donath Damian, Abdalah Makaranga, Stephen Samwel Nyandoro, Sylvester Leonard Lyantagaye, Souvik Kusari, Rajni Hatti-Kaul (2020). Omics for Bioprospecting and Drug Discovery from Bacteria and Microalgae. *Antibiotics* 2020, 9, 229; doi:10.3390/antibiotics9050229.

#### 4.2 Conference papers/Posters presented and Public talks

4.2.1. Juma M. Husseina, Donatha D. Tibuhwa and Sanja Tibell (2018). Phylogenetic position and Taxonomy of *Kusaghiporia usambarae* gen. et sp. nov. (Polyporales). Presented at the 11th Mycological Congress held on 16-21 July 2018 in San Juan, Puerto Rico, United States of America available at: <http://imc11.com>

4.2.2. Stella G. Temu, Philippe Clerc, Leif Tibell, Donatha D. Tibuhwa, Göran Thor, Sanja Tibell (2018). *Usnea* in mountain rainforests of Tanzania: A study of species diversity and phylogenetic relationships. Presented at the 11th Mycological Congress

held on 16-21 July 2018 in San Juan, Puerto Rico, United States of America available at: <http://imc11.com>

- 4.2.3. Donatha D. Tibuhwa, Mark E. R. Sijaona, Sanja S Tibell. (2018). Pathogenicity Pathogenicity of a parasitic macrofungus in the Southern regions of Tanzania Presented at the 11th Mycological Congress held on 16-21 July 2018 in San Juan, Puerto Rico, United States of America available at: <http://imc11.com>
- 4.2.4. Stella G. Temu, Philippe Clerc, Leif Tibell, Donatha D. Tibuhwa, Göran Thor, Sanja Tibell (2018). Usnea in mountain rainforests of Tanzania: A study of species diversity and phylogenetic relationships. Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14<sup>th</sup> – 15<sup>th</sup> November 2019.
- 4.2.5. Donatha D. Tibuhwa, Juma Hussein, Mark E. R. Sijaona, Sanja S Tibell. (2019) “A new polyporus macrofungi parasite from Tanzania elucidated using four gene datasets” made during The 4th World Mycology & Mushroom Congress” held in July 15-16, 2019, Osaka, Japan. <https://www.meetingsint.com/conferences/mycology>.
- 4.2.6. Rugumisa, B. T, Massawe, N. S, Sangeda, R. Z and Lyantagaye, S. L. (2019). Maternal characteristics as risk factors for preterm delivery. Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14TH – 15<sup>th</sup> November 2019.
- 4.2.7. Mollel JT, Said J, Masalu RJ, Bergstrom T, Trybala E (2019). Antiviral Activity of Medicinal Plants from Kagera Region in Tanzania Presented at the 16th Smögen Summer Symposium on Virology, held August 22-24, Sweden.
- 4.2.8. Mollel JT, Said J, Masalu RJ, Mbunde MVN, Masimba PJ, Nondo RSO, Bergstrom T, Trybala E (2019). Anti-Respiratory Syncytial Virus Activity of Medicinal Plants from Kagera Region in Tanzania. Presented at the 4<sup>th</sup> Tofo Advanced Study Week on (Re-) Emerging Viruses
- 4.7.9. Herieth Rhodes Mero (2019). Time-series, Genomic study of Cassava Brown Streak Viruses (CBSVs) among Selected varieties of Cassava in Coast region, Tanzania. Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14TH – 15<sup>th</sup> November 2019.
- 4.7.10. Donath Damian, Modester Damas, Jonas Johansson Wensman, Mikael Berg (2019). Morphological and Molecular Survey of Ticks Collected from Selected Areas of Wildlife-Livestock interface Ecosystem of Mvomero District, Morogoro Region, Tanzania. Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14TH – 15<sup>th</sup> November 2019.
- 4.7.11. Donath Damian, Modester Damas, Jonas Johansson Wensman, Anne-Lie Blomström, Mikael Berg (2020). Diversity of viruses in hard ticks collected from wildlife-livestock interface ecosystem of Mikumi National Park, Tanzania. Conference paper

presented on August 21, 2020. (17th Smogen Summer Symposium on Virology, Swedish Society of Virologists)

- 4.7.12. Reuben S. Maghembe, Donath Damian, Abdallah Makaranga, Stephen S. Nyandoro, Sylvester L. Lyantagaye, Souvik Kusari, Rajni Hatti-Kaul. OMICS for Bioprospecting and Drug Discovery from Bacteria and Microalgae. Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14TH – 15<sup>th</sup> November 2019.
- 4.7.13. Juma M. Hussein, Donatha D. Tibuhwa, Leif Ryvardeen, Mark E.R. Sijaona, Sanja Tibell (2019). Revisiting the taxonomy of *Laetiporus Baudonii* (Polyporales, Basidiomycota): Re-evaluation and Resolving its Phylogenetic Position using a Four Molecular Markers Dataset. Poster Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14TH – 15<sup>th</sup> November 2019.
- 4.7.14. Stella G. Temu, Sanja Tibell, Donatha D. Tibuhwa, and Leif Tibell. Crustose calicioid lichens in mountain cloud forests of Tanzania. Poster Presented during the The 2nd Annual Conference On Research And Inclusive Development Dodoma, Tanzania on 14TH – 15<sup>th</sup> November 2019.

### **4.3 Policy brief:**

- 4.3.1. Adopting mushroom as a strategic crop for improved livelihood in Tanzania.

## **5. Analysis**

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The IMB program had five objectives out of which three are now completed, while the remaining two will be completed by the end of June 2020. One PhD in mycological Sciences completed his studies April 2020. Two activities remaining are based on training 6 PhD students who are expected to complete their studies early next year, the two technical staff who will have to go back to complete their training which was interfered by Covid 19 and Procure small gadgets, and chemicals to enhance proper functioning of the procured equipment.

Risk	Level	Remedial action	Responsibility
PhD students not graduating on time	Low	Monitor their progress monthly	Sub-programme coordinators, and Swedish Coordinator
Failure to prepare good proposal for the next phase	Low	Begin preparation as early as possible	Programme coordinator, Research team members and Swedish partners
Not publishing on time	Low	Monitor the progress and Abiding to rule as students need to publish before graduation	Supervisors

## 6. Recommendations and measures to be taken

Two technical staff will have to go back to Sweden to complete the training by the end of the year. The remaining Six PhD students are closely followed up by supervisors to ensure that they complete their studies by early next year while the minor gadgets to enhance smooth running of the procured major equipments have to be fast tracked procured.

## 7. Enclosures

### 7.1. Financial reports. To be replaced with the current version Waiting from Accountant

Date: _____										
Name of Sub-program: WATER RESOURCE										
Fiscal Year: JULY 2019-JUNE 2020										
Tanzanian Institution/Dept: UNIVERSITY OF DAR ES SALAAM										
Collaborating Institution in Sweden: _____										
Exchange Rate: _____										
OBS Student allowances should be under ISP										
Tanzania	Funds expected to be forwarded from previous year (2018/2019)		July - June 2019		January - June 2020		Total allocated funds (July 2019 to June 2020)		Total funds to be executed	
	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS	SEK	TZS
Curriculum Development	-	-	-	-	-	-	-	-	-	-
Research equipment	114,148.00	30,819,960.00	-	-	-	-	-	-	114,148.00	30,819,960.00
Maintenance	-	-	8,000.00	2,160,000.00	8,000.00	2,160,000.00	16,000.00	4,320,000.00	16,000.00	4,320,000.00
Research Consumables	120,000.00	32,400,000.00	85,000.00	22,950,000.00	40,000.00	10,800,000.00	125,000.00	33,750,000.00	245,000.00	66,150,000.00
Travel	130,000.00	35,100,000.00	13,000.00	3,510,000.00	39,000.00	10,530,000.00	52,000.00	14,040,000.00	182,000.00	49,140,000.00
Field/Lab work	25,000.00	6,750,000.00	-	-	-	-	-	-	25,000.00	6,750,000.00
Student stipends x	-	-	118,744.00	32,060,880.00	100,000.00	27,000,000.00	218,744.00	59,060,880.00	218,744.00	59,060,880.00
Student fees	-	-	114,860.00	31,012,200.00	-	-	114,860.00	31,012,200.00	114,860.00	31,012,200.00
Conferences	50,400.00	13,608,000.00	137,600.00	37,152,000.00	-	-	137,600.00	37,152,000.00	188,000.00	50,760,000.00
Publication costs	-	-	-	-	33,600.00	9,072,000.00	33,600.00	9,072,000.00	33,600.00	9,072,000.00
Travel insurance	3,600.00	972,000.00	1,200.00	324,000.00	1,200.00	324,000.00	2,400.00	648,000.00	6,000.00	1,620,000.00
Other Cost	106,560.00	28,771,200.00	57,094.00	15,415,380.00	-	-	57,094.00	15,415,380.00	163,654.00	44,186,580.00
Indirect costs (Institutional Fee)	-	-	78,399.00	21,167,730.00	12,499.00	3,374,730.00	90,898.00	24,542,460.00	90,898.00	24,542,460.00
<b>SUB-TOTAL TANZANIA</b>	<b>549,708.00</b>	<b>148,421,160.00</b>	<b>613,897.00</b>	<b>165,752,190.00</b>	<b>234,299.00</b>	<b>63,260,730.00</b>	<b>848,196.00</b>	<b>229,012,920.00</b>	<b>1,397,904.00</b>	<b>377,434,080.00</b>
<b>Sweden</b>										
Supervision	-	-	200,000.00	54,000,000.00	375,000.00	101,250,000.00	575,000.00	155,250,000.00	575,000.00	155,250,000.00
<b>SUB-TOTAL SWEDEN</b>	<b>-</b>	<b>-</b>	<b>200,000.00</b>	<b>54,000,000.00</b>	<b>375,000.00</b>	<b>101,250,000.00</b>	<b>575,000.00</b>	<b>155,250,000.00</b>	<b>575,000.00</b>	<b>155,250,000.00</b>
ISP - student allowances	-	-	242,000.00	65,340,000.00	540,000.00	145,800,000.00	782,000.00	211,140,000.00	782,000.00	211,140,000.00
<b>SUB-TOTAL-ISP</b>	<b>-</b>	<b>-</b>	<b>242,000.00</b>	<b>65,340,000.00</b>	<b>540,000.00</b>	<b>145,800,000.00</b>	<b>782,000.00</b>	<b>211,140,000.00</b>	<b>782,000.00</b>	<b>211,140,000.00</b>
<b>GRAND TOTAL</b>	<b>549,708</b>	<b>148,421,160</b>	<b>1,055,897</b>	<b>285,092,190</b>	<b>1,149,299</b>	<b>310,310,730</b>	<b>2,205,196</b>	<b>595,402,920</b>	<b>2,754,904</b>	<b>743,824,080</b>

Overall objective:



**Date First Prepared: 24<sup>th</sup> June 2015 Date Revised: 06<sup>th</sup> August 2015; Date Re-revised: 22<sup>nd</sup> March 2016.**

**Summary Problem Statement:**

Inadequate expertise and infrastructure to conduct research contributes to poor utilization of the very large diversity of medicinal plants, microbes, wild mushrooms and microalgae for sustainable technological development in Tanzania.

**Overall Objective:** Research capacity building in biosciences for utilization of biodiversity to enhance technological development in Tanzania.

**Specific Objective 1:** Accreditation of curriculum for taught PhD programme in Interdisciplinary Molecular Biosciences by August 2016.

**Specific Objective 2:** Increase expertise and infrastructure for research in interdisciplinary molecular biosciences by 2020.

**Specific Objective 3:** Increase staff expertise and infrastructure for research in myco-sciences and lichenology by 2020.

Types of Outputs	Outcomes (including targets)  2015/2020	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	[Key] Outputs produced in year to obtain Outcome in 2019/20
Curriculum for Taught PhD programme	1.1 Programme approved and accredited by responsible organs.	Taught programme Programme accredited	0 taught PhD programmes under Sida support	Taught PhD programme curriculum developed and accredited by TCU	Accredited ongoing taught PhD program Six PhD students studied and passed Courses work now on data analysis and thesis writing
Trained 5 PhD candidates in interdisciplinary molecular biosciences in either of the thematic areas*, at least 40% are women. Specialized research equipment procured and installed	2.1 At least five t PhD candidates graduate by 2020  2.2 Increase use specialized research equipment by students	Number of PhD graduate  -Number of the equipment being used by students	2 PhD under previous Sida support  Six minor equipment under previous Sida support	Seven PhD students enrolled in IMB programme  Specialized research equipment procured	Seven PhD students being trained. One graduated  All eleven (11) equipment were procured and installed

Types of Outputs	Outcomes (including targets)  2015/2020	Performance Indicator of Outcome	Baseline (if established)	Annual Outcome Targets for 2019/20	[Key] Outputs produced in year to obtain Outcome in 2019/20
Trained 1 Postdoc in bioinformatics and omics tools	2.3 At least 1 Postdoc trained by 2020	Number of Post doc trained	3 staff members with skills in bioinformatics and 1 with skills in omics.	Zero Postdoc enrolled for training	None was trained as the objective was removed due to budget cut
Publications in peer reviewed journals increased	2.4. At least 15 publications in Peer reviewed Journals by 2020.	Number of peer reviewed articles	32 journal articles from the previous Sida support	Five article published	Six article published Six more being submitted
Research training links between local and Swedish partners increased	2.5. At least five joint publications published in proposed thematic areas in peer reviewed journals by 2020	Number of joint publications reviewed	0 joint publications	Two joint article published	Six joint articles published and Six being submitted
Presentation of research findings at international conferences increased	2.6. At least 5 presentations at international conferences by 2020	Number of conference attended	3 presentations from previous Sida support	Seven Presentations	Thirteen (13) presentations
Trained 2 PhD candidates in fungal taxonomy and Lichenology, at least 50% are women.	3.1. At least 2 PhD candidate graduate in mycological sciences by 2020	Number of PhD graduate	1 fungal taxonomist and 0 lichenologist	2 PhD students enrolled	1 PhD student graduated while the other 6 to graduate Early next year
Scientific publications in peer reviewed journals	3.3 At least 8 publications in Peer reviewed Journals by 2020.	Number of publications in Peer reviewed Journals	24 in mycology and 0 in lichenology	Zero article published	Six papers published. One doctoral thesis and six manuscripts submitted
Research training links between local and Swedish partners increased	3.4. At least two joint publications published in proposed thematic areas in peer reviewed journals by 2020	Number of joint publications reviewed	2 in mycology under previous Sida support phase	Two joint article published	Six joint article published Six being submitted

### 7.3: Aggregated Student Progress

<b>PhDtraining</b> Name of student:	(M/F)	Year training started	Training in Sweden (no. months)	Local PhD Expected/ Year of completion	Sandwich PhD Expected/ Year of Completion	Progress %	Prel. title of dissertation
<b>PhD students</b>							
1. Juma Hussein		2016	39		2020	<u>100%</u>	Investigation of some economically important Mushrooms of Tanzania
2. Stella Temu		2016	42		2020	<u>90%</u>	Taxonomy of Tanzania cloud forest lichens
3. Donatha Damian		2016	6	2020	2020	<u>80%</u>	Viral metagenomics and molecular epidemiology of vector-borne diseases in the wildlife-livestock interface
4. HeriethRhodes Mero		2016	6	2020	2020	<u>70%</u>	Genetic diversity and Chloroplast genomics of cassava land cares and selected wild cassava relatives in Tanzania
5. Bernadether Rugumisha		2016	6	2020	2020	<u>70%</u>	Influence of inter-pregnancy interval after abortion on vaginal microbiome during the first trimester
6. Jackson Thomas Mollel		2016	6	2020	2020	<u>70%</u>	Investigation of anti-HIV-1 activity and inhibitory properties of medicinal plants used for treatment and management of HIV/AIDS in Tanzanian
7. Reuben Silas Maghembe		2016	6	2020	2020	<u>80%</u>	Molecular mapping of diversity and bioactivity of microalgae from selected marine and fresh water ecosystems in Tanzania
<b>Total: 07</b>							

## 7.4. Students Individual Plans and Popular Summary of the Study

### Preamble

Interdisciplinary Molecular Biosciences (IMB) is a five year (2015 -2020) capacity building program jointly implemented by University of Dar es Salaam (UDSM), Tanzania and the Lund University, Swedish University of Agricultural Sciences and Uppsala University, Sweden. The project sponsors sponsored 7PhD students.

### Progress in terms of studies completion rate

Seven (7) PhD students, enrolled for PhD students, two registered in Sweden at Uppsala University (April 2016) under sandwich mode while 5 registered at UDSM (October 2016) under the developed taught Intermolecular Bioscience PhD program (IMB).

The two students in Sweden are in their final year One expecting to defend his study between April and June 2020 while the second had maternity leave for three month and her defence is planned in September 2020.

The five PhD student registered at UDSM are finalizing data collection, doing Laboratory work and data analysis for manuscript and dissertation writing. They are expected to complete their studies by the end of this year.

**Students activities and action plan** are provided in table 1 to 7 in the order of preceded by the respective popular summary of their studies:

Table 1-1:Hussein Juma Mahmud

Table 1-2: Stella G. Temu

Table 1-3: Reuben S.Maghembe

Table 1-4: Donath Damian

Table 1-5: Jackson T.Mollel

Table 1-6: Herieth R. Mero

Table 1-7: Bernadether T. Rugumisa

### Table 1-1: Hussein Juma Mahmud (2017-07-00205)

#### 1.1 Popular summary:

#### 1.6.2 Popular Sciences of the PhD research areas

##### 1.6.2.1. Juma Mahmud Hussein – PhD student

**Title of the research:** Investigation of some economically important Mushrooms of Tanzania.

#### **Popular Summary of the Project:**

Fungi represent a large group of eukaryotic organisms including both microbial (yeasts and

moulds) and familiar fresh mushrooms (macrofungi, macromycetes, higher fungi). Mushrooms are mediators in many biological processes in land ecosystems. They take part as saprophytes (major contributors to the degrading and recycling all plants and animals), parasites (often on crops, in forests or sometimes on humans), and symbionts furnishing plants with vital living conditions such as mycorrhiza and entering symbioses with different organism. Mushrooms are also an excellent source of proteins, vitamins, minerals, fibers, trace elements, and have low/no calories and cholesterol. The first part of this project focuses on classical and modern approaches using morphological and molecular techniques to describe large polyporoid edible mushroom from the West arc of the Usambara Mountains, that at maturity one fruit body weighs more than 10 kg. This mushroom has a long history of being used as food and medicine by "Sambaa" people in Tanzania. Results from morphology and molecular data have shown that the studied mushroom is new to science. Therefore, a new genus and species name has been proposed to accommodate this mushroom in *Laetipoaceae* Family. Further studies will be done to determine bioactive compounds associated with this mushroom. In the second part of the study involves a polyporoid parasitic mushroom from Southern parts of Tanzania that has been observed to cause wilting and death of cashew trees, eucalyptus, cassava, and other local indigenous trees. Morphological and molecular approach, combined with pharmacognosy and chemical ecology will be used to describe and determine metabolic pathways and a possibility to mitigate its parasitism in plants. NGS technology will serve as an interface between chemistry and biology in characterizing this fungus.

**Geographic locations:** Usambara, Korogwe, Lushoto –Tanga, Mtwara.

**The research questions:** (i) What is the phylogenetic position of studied mushrooms? (ii) Which bioactive compounds are found in studied mushrooms? (iii) What are the possible pathways to mitigate plants parasitism in the studied mushroom?

**Paper: (Published)**

- i. Hussein JM, Tibuhwa DD, Tibell S (2018) Phylogenetic position and Taxonomy of *Kusaghiporia usambarae* gen. et sp. nov. (Polyporales). Mycology: An International Journal of Fungal Biology. DOI: 10.1080/21501203.2018.1461142
- ii. Donatha D. Tibuhwa, Juma M. Hussein, Mark E.R. Sijaona, Leif Ryvaden. Sanja Tibell (2020) Revisiting Taxonomy of *Laetiporus baudonii* (Polyporales, Basidiomycota): Re-evaluation and resolving its phylogenetic position using four gene datasets Mycologia (In press)

**1.2 Action plans: He successfully defended his thesis in April 2020**

**Table 1-2: Stella G. Temu (870626-8581)**

**2.1 Popular summary**

**Title of the research:** Taxonomy of Tanzania cloud forest lichens.

**Popular Summary of the Project:**

Lichens are formed by two intimately associated organisms, usually alga or cyanobacterium and a fungus (most often an ascomycete). Lichens are sensitive to environmental changes and have often been used as bioindicators in surveying different types of environmental conditions. One of the major threats in Tanzania presently is deforestation and climatic

change, which both have a very adverse effect on montane rainforests. Lichens have the ability to absorb water directly from the air and to capture atmospheric water which significantly influences the ecology and soil properties of rainforests. Therefore, this project aims at investigating the taxonomy, secondary chemistry, bioactivity and ethnomycology of lichens in Tanzania.

**Geographic locations:** Usambara, Korogwe –Tanga, Kilimanjaro.

**The research questions:** (i) What are the lichen species found in the Tanzanian montane forests? (ii) Which bioactive compounds are found in lichens? (iii) What is the efficacy of the bioactive compounds found in lichens?



Poster preparation and presentation at International Lichenological Symposium, Brazil.										
Thesis printing, administration procedures in Uppsala University towards completions of a PhD and defense.										

**Table 1-3: Reuben Maghembe (2016-07-00295)**

### 3.1 Popular summary

**Title of the research:** Molecular mapping of diversity and bioactivity of microalgae from selected marine and fresh water ecosystems in Tanzania.

**Popular Summary of the Project:**

Microalgae present a group of prokaryotic and eukaryotic microorganisms capable of carrying out photosynthesis on a wide range of habitats from marine, fresh water and waste water to terrestrial habitats. Microalgal diversity has enabled microalgae to colonize and adapt various ecological conditions including those of alkaline water and hot springs. The ability of microalgae to produce various organic compounds amid environmental challenges has created an evolving bioprospecting research arena. Contemporary research is mainly focused on the value of microalgae as a source of nutraceuticals, biofuels, animal feed, bioremediation, and bioactive therapeutic compounds, among others. This research focuses on metagenomic phylogenetic characterization of microalgae from two saline lakes (Lake Natron and Lake Rukwa) and the coast of Indian Ocean (marine ecosystem). The project also aims at studying the bioactivity of extracts from selected microalgal genera on selected viral strains and cancer cell lines and characterizing the chemistry of the extracts and related mechanism of action of the most potent compound.

**Geographic locations:** Rukwa, Arusha, Tanga.

**Research Questions:** (i) What is the phylogenic pattern of microalga communities from the selected ecosystems? (ii) What are the effects of the extracts from microalgae on viral strains? (iii) What are effects of the extracts from microalgae on cancer cell lines? (iv) What are the chemical ingredients and structures of bioactive compounds in the extracts? (v) How does the most potent compound mediate antiviral or anticancer activity?

### 3.2 Action plan

	2019		2020											
Activity details	N	D	J	F	M	A	M	J	J	A	S	O	N	D
								J						



1	Revise manuscript and submit to journal ( <i>Antibiotics</i> )														
2	Receive and analyse DNA and RNA seq data from Macrogen (Objective I)														
3	Receive and analyse proteome and metabolome data from Creative Proteomics (objective III)														
4	Cultivate <i>Spirulina</i> for biomass production														
5	Chemical extraction and antiviral assays (Objective II)														
6	Proteomics and metabolomics II and bioinformatics														
7	Thesis writing and submission														

**Table 1-4: DONATH DAMIAN (2016-07-00292)**

#### 4.1 Popular summary

**Title of the research:** Viral metagenomics and molecular epidemiology of vector-borne diseases in the wildlife-livestock interface.

**Popular Summary of the Project:**

Ticks are important vectors and reservoirs of broad range of pathogens which are capable of causing diseases in humans, livestock and wild animals. They have been implicated as arthropod vector of many viral, bacteria and protozoa agent. Their long-life cycle, expansive range of habitats and ability to feed on wide array of vertebrates immensely contribute to their potential for disseminating infectious agents to susceptible hosts. They are second only to mosquitoes as important arthropod vectors for spreading viruses from wildlife to domestic animals and humans. Therefore, this project aims at undertaking metagenomic profiling approach to identify ticks and tick-borne viral diversities circulating within the wildlife-









	(Objective II)														
3	Bioinformatics analysis of sequence data at SLU, Sweden (Objective I & II)														
4	(i) Time-series samples collections in the screen house (i) Analysis of the collected samples by digital PCR (Objective III)														
5	(ii) Write-up, of the PhD thesis and manuscripts (iii) Thesis Submission														
6	Defence of the PhD thesis														
7	PhD graduation														

**Table 1-7: Bernadether T. Rugumisa: (2016-07-00356)**

### 7.1 Popular summary:

**Title of the research:** Influence of inter-pregnancy interval after abortion on vaginal microbiome during the first trimester.

**Popular Summary of the Project:**

The composition of vaginal microbiome of pregnant women is dominated by *Lactobacillus species*. Vaginal microbiome of pregnant women has a critical role in prevention or facilitation of adverse pregnancy outcomes depending on dominating *Lactobacillus species*. Pregnancy comes with physiological, anatomical, immunological and microbiological changes in a woman's body to support fetal development. Sufficient inter-pregnancy interval is required to allow rebuilding, healing and restoration to normal of maternal body and to reduce the risk of adverse outcomes of a subsequent pregnancy. There is still a gap of knowledge in factors affecting maternal vaginal microbiome patterns and how the patterns prevent or fuel the risk of adverse pregnancy outcomes to both mother and child. The goal of this study is to evaluate how inter-pregnancy interval influences the structure and composition of vaginal microbiome during the first trimester in pregnant women who conceive in less than six months or in at least six months later following abortion, and its subsequent impact on pregnancy outcomes.

**Geographic locations:** Muhimbili national hospital-Dar es Salaam Tanzania.

**The research questions:** (i) What is the significance of interpregnancy interval following abortion on vaginal microbiome of a subsequent pregnancy? (ii) What type of vaginal microbiome lead to adverse pregnancy outcomes?

**The research questions:** (i)What is the significance of interpregnancy interval following abortion on vaginal microbiome of a subsequent pregnancy?(ii)What type of vaginal microbiome lead to adverse pregnancy outcomes?



### 7.5 Subprogramme Original Budget 2015-2020 (Compiled Summary)

Date: 12 April 2015

Sub Program: Capacity building in interdisciplinary Molecular Biosciences Program

Period: 2015-2020

Tanzanian Institution/Dept: Molecular Biology and Biotechnology

Collaborating Institution/s in Sweden:Uppsala ; Gothenburg , Lund , Swedish Agricultural University

Tanzania	2015/16	2016/17	2017/18	2018/19	2019/20	Total
	SEK	SEK	SEK	SEK	SEK	SEK
Curriculum development	195,920	-	-	-	-	195,920
Research equipment	3,106,967	-	-	-	-	3,106,967
Maintanance	-	-	8,000	8,000	16,000	32,000
Research consumables	27,000	270,000	135,000	125,000	125,000	682,000
Travel	78,000	65,000	39,000	125,000	26,000	333,000
Field/Lab work	65,840	117,120	68,320	31,040	-	282,320
Student fees	-	127,720	114,860	114,860	114,860	472,300
Student stipends	44,348	245,218	245,218	203,218	218,744	956,746
Conferences	-	34,400	-	136,280	137,600	308,280
Publication costs	-	4,800	-	33,600	33,600	72,000
Travel insurance	4,000	2,000	1,200	2,800	2,400	12,400
Audit	-	-	-	-	-	-
Other costs	63,040	174,680	33,040	129,540	33,040	433,340
Indirect costs	-	-	-	-	-	-
<b>SUB TOTAL 1</b>	<b>3,585,000</b>	<b>1,041,000</b>	<b>645,000</b>	<b>909,000</b>	<b>707,000</b>	<b>6,887,000</b>
<b>Sweden</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>	<b>2019/20</b>	<b>Total</b>
	SEK	SEK	SEK	SEK	SEK	SEK
Supervision	400,000	400,000	400,000	1,650,000	200,000	3,050,000
Curriculum development	-	-	-	-	-	-
Lecturing on courses	-	164,000	54,000	54,000	-	272,000
Other costs	-	-	-	-	-	-
Indirect costs	-	-	-	-	-	-
<b>SUB TOTAL 2</b>	<b>400,000</b>	<b>564,000</b>	<b>454,000</b>	<b>1,704,000</b>	<b>200,000</b>	<b>3,322,000</b>
<b>ISP - student allowance, exchange</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>	<b>2019/20</b>	<b>Total</b>
	SEK	SEK	SEK	SEK	SEK	SEK
<b>SUB TOTAL 3</b>	<b>448,000</b>	<b>346,000</b>	<b>450,000</b>	<b>532,000</b>	<b>242,000</b>	<b>2,018,000</b>
<b>TOTAL SUBTOTAL 1+2+3</b>	<b>2015/16</b>	<b>2016/17</b>	<b>2017/18</b>	<b>2018/19</b>	<b>2019/20</b>	<b>Total</b>
	SEK	SEK	SEK	SEK	SEK	SEK
	4,433,000	1,951,000	1,549,000	3,145,000	1,149,000	12,227,000
<b>INSTITUTIONAL FEES (10%)</b>	443,300	195,000	1,549,000	315,000	115,000	1,223,000
<b>GRANDTOTAL</b>	<b>4,876,300</b>	<b>2,146,000</b>	<b>3,098,000</b>	<b>3,460,000</b>	<b>1,264,000</b>	<b>13,450,000</b>



## 7.6. Any other attachment (e.g. publications list etc.)

1.



**Mycology**  
An International Journal on Fungal Biology



ISSN: 2150-1203 (Print) 2150-1211 (Online) Journal homepage: <http://www.tandfonline.com/loi/tmyc20>

### Phylogenetic position and taxonomy of *Kusaghiporia usambarensis* gen. et sp. nov. (Polyporales)

Juma Mahmud Hussein, Donatha Damian Tibuhwa & Sanja Tibell

To cite this article: Juma Mahmud Hussein, Donatha Damian Tibuhwa & Sanja Tibell (2018): Phylogenetic position and taxonomy of *Kusaghiporia usambarensis* gen. et sp. nov. (Polyporales), *Mycology*, DOI: [10.1080/21501203.2018.1461142](https://doi.org/10.1080/21501203.2018.1461142)

2.



**microorganisms**



Article

### Crustose Calicioid Lichens and Fungi in Mountain Cloud Forests of Tanzania

Stella Gilbert Temu <sup>1,2,\*</sup>, Sanja Tibell <sup>1</sup>, Donatha Damian Tibuhwa <sup>2</sup> and Leif Tibell <sup>1</sup>

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3.



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ISSN: 2150-1203 (Print) 2150-1211 (Online) Journal homepage: <https://www.tandfonline.com/loi/tmyc20>

### Phylogeny of the subgenus *Eumitria* in Tanzania

Stella G. Temu, Philippe Clerc, Leif Tibell, Donatha D. Tibuhwa & Sanja Tibell

To cite this article: Stella G. Temu, Philippe Clerc, Leif Tibell, Donatha D. Tibuhwa & Sanja Tibell (2019): Phylogeny of the subgenus *Eumitria* in Tanzania, *Mycology*, DOI: [10.1080/21501203.2019.1635217](https://doi.org/10.1080/21501203.2019.1635217)

To link to this article: <https://doi.org/10.1080/21501203.2019.1635217>

4.

VECTOR-BORNE AND ZOO NOTIC DISEASES  
Volume XX, Number XX, 2020  
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DOI: 10.1089/vbz.2019.2579

## Application of Viral Metagenomics for Study of Emerging and Reemerging Tick-Borne Viruses

Donath Damian,<sup>1</sup> Reuben Maghembe,<sup>1</sup> Modester Damas,<sup>1</sup> Jonas Johansson Wensman,<sup>2</sup> and Mikael Berg<sup>3</sup>

### Abstract

Ticks are important vectors for different tick-borne viruses, some of which cause diseases and death in humans, livestock, and wild animals. Tick-borne encephalitis virus, Crimean-Congo hemorrhagic fever virus, Kyasanur forest disease virus, severe fever with thrombocytopenia syndrome virus, Heartland virus, African swine fever virus, Nairobi sheep disease virus, and Louping ill virus are just a few examples of important tick-borne viruses. The majority of tick-borne viruses have RNA genomes that routinely undergo rapid genetic modifications such

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antibiotics



5.

Review

## Omics for Bioprospecting and Drug Discovery from Bacteria and Microalgae

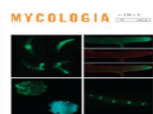
Reuben Maghembe <sup>1,2,3</sup>, Donath Damian <sup>1</sup>, Abdalah Makaranga <sup>2,4</sup>,  
Stephen Samwel Nyandoro <sup>5</sup>, Sylvester Leonard Lyantagaye <sup>1,6</sup>, Souvik Kusari <sup>7,\*</sup> and  
Rajni Hatti-Kaul <sup>3,\*</sup>

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<sup>3</sup> Division of Biotechnology, Department of Chemistry, Center for Chemistry and Chemical Engineering,

6.



Mycologia



1

2 (ACCEPTED)

3 **Short title for running head:** Elucidating the phylogeny of *Piptoporellus baudonii*

4

5

6 Elucidating the phylogeny of the serious plant pathogen *Piptoporellus*  
7 *baudonii* using a multigene molecular dataset

8

9 Donatha D. Tibuhwa<sup>1</sup> Juma M. Hussein<sup>1,2</sup>, Leif Ryvarde<sup>3</sup>, Mark E.R. Sijaona<sup>4</sup>,

10 Sanja Tibell<sup>\*2</sup>