

Needs Assessment Survey for M.Sc. Studies in Entomology in Ethiopia

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Abstract

Needs assessment survey were conducted in Ethiopia for launching M.Sc. studies in Entomology at Wollega University (WU), one of the public universities that aims to develop graduate programs in the western part of the country. The objective of the survey was to obtain training needs, gaps, specialization options, program structure and courses that are relevant to the needs of stakeholders associated with entomology. A facility-based data survey, focus group discussion (FGD) with key informants and needs assessment questionnaire to the stakeholders were used for data collection for the study. Data were analyzed by descriptive statistics. Facility survey results showed that average number of MSC holder Entomologists were very low. On average there were 0.19 MSc holder entomologists in Ethiopian universities, 0.33 in Ethiopian research sector and 0.15 in industrial sector. In line with these findings, participants of FGD revealed that most of the organization where they work need M.Sc. degree and above in entomology. Need assessment questionnaire survey results indicated 98.7% need for M.Sc level qualification in entomology, 96.0% need to employ new M.Sc graduates in entomology and 93.3% need for the Ethiopian organizations to upgrade their existing staff to M.Sc. level in entomology. In conclusion, the survey results underline high demand for M.Sc. training in Entomology in Ethiopia. Furthermore the concern of topsoil depletion and agricultural loss impacted by termite pests and white mango scale insects and biodiversity loss impacted by deforestation by insecticides warrant advanced entomological studies in western Ethiopia.

Keywords: Insects, M.Sc. in Entomology, Need Assessment, Wollega University

1. Background

The major policy and strategic direction for Ethiopian economy is agricultural development-led industrialization (ADLI) that aims at transforming the country's economy (Gudeta, 2009). The roles of higher learning institutions (HLI) such as Wollega University is creating human capacities for improving and transforming the country's economy by producing multi-disciplinary professionals specifically breeders, agronomists, pathologists, entomologists, and others by designing and developing relevant undergraduate and post graduate curricula and programs.

The major purpose of regional establishment of WU and other second and third generation Ethiopian public universities is to offer real support to its immediate community based on their context and needs. Developing contextual demand driven education and training programs necessitate conducting needs assessment survey for the development of relevant education and training curricula.

The relevance and importance of entomological education, training and research to Ethiopia is apparent. As a developing nation aspiring to achieve overall advancement, the country has the option to combine both low and high level knowledge in entomology and other biological sciences to benefit its society particularly in the areas of food security, health, environmental protection and climate change. The country promotes biological sciences through advanced level university study and research (MOE, 2013). Entomology is a subject worthy of our study and of the recruitment of new people to follow that discipline (Loxdale, 2016) because all entomological work is crucial to the well-being of mankind, both in terms of the health of ourselves, livestock, and crops, as well as the ecology of the agro-ecosystem, and hence is badly in need of adequate and stable study and funding (Loxdale, 2016).

In Ethiopia, insects merit priority concern and action in academic, research and community engagement activities because as it is the case in other Sub Saharan Africa, one of the root cause for Ethiopian poverty, food and water security challenges are insect pests and disease vectors Deressa *et al.*, 2007). For instance, malnutrition and infections such as malaria are the major causes of morbidity and mortality in under-five children in Ethiopia (Shikur *et al.*, 2016). Traditionally, risk of communicable vector-borne disease hazards particularly the dreadful effects of malaria and trypanosomiasis in Ethiopian lowlands have impacted on population movement and settlement concentrating high population density in malaria free highland areas that has caused over-cultivation, over-population and severe environmental degradation and depletion of top soil, leading to extensive drought and recurrent famine in many Ethiopian mid- and highland areas (Roundy, 1976; Deressa *et al.*, 2006). Conversely, high population growth and ecological degradation in the highland and midland areas of Ethiopia have induced population mobility into lowland areas. This has led to increased exposure of people to the vector-borne diseases that are rampant in the lowland areas (Deressa *et al.*, 2006). Therefore, human population dynamics and ecological and climate changes and the resultant changes in

arthropod vectors and pests necessitate special priorities for advanced entomological studies in Ethiopia.

In addition, insect pests are the major causes of household food security challenges driven by losses of durable and perishable crops in Ethiopia and reduction of losses could contribute to food and nutritional security (Mezgebe *et al.*, 2016). The introduction of alien insect pests into the country driven by globalization and the worldwide increase of trade and transport necessitates advanced entomological studies in the country. Major examples include the introduction of the new invasive alien insect pest on maize called Fall Armyworm (*Spodoptera frugiperda*, Smith) (Lepidoptera: Noctuidae) in to Africa in 2016 from America (Goergen *et al.*, 2016) and its advent to Ethiopia in early 2017 that is now responsible for significant losses in maize and sorghum in many parts of Ethiopia (Demissie, 2017).

Today the key components of applied entomology such as using integrated pest and vector management techniques and safe and judicious use of pesticides for insect pest and vector control is highly prioritized in Ethiopia and elsewhere. Furthermore, environmental pollution, biodiversity loss, prediction, prevention and control of migratory pest outbreak and management of insect resistance against pesticides are the burning issues which warrant continuous processes of education and research. Advanced education to the students at M.Sc. and PhD level, in entomology, involves the use of modern/advanced teaching methods and innovative analytical techniques for insect pest and vector problem solving attitudes and techniques establishment.

General and applied entomology courses have been included in the Harmonized Curriculum of Biology teaching for the Bachelor Degree Program across the Ethiopian public universities (MOE, 2013). However harmonized curriculum of entomology is lacking at postgraduate level that could linear the under graduate courses in the country. In addition, limited conventional curricula exist in the country regardless of the immense biodiversity and economic importance of the insect fauna in the country. At WU and most universities in western part of the country no M.Sc. program exist in entomology so far. To bridge the gap and contribute to the existing entomology curricula and training practices in the country, the department of biology at wollega university is preparing M.Sc. curriculum in entomology. It provides capacity building and training opportunities inline with the vision of the country: “Building an education and training system which assures quality and equity of education that produce competent citizens” (MOE, 2013).

Launching M.Sc in entomology is particularly prioritized to combat vector borne tropical and infectious diseases such as malaria which has been endemic in Ethiopia. Besides, M.Sc in entomology contributes to the control of devastating problems of termite pests which warrant urgent concern and action in western Ethiopia particularly in Wollega zones and to protect existing and emerging new exotic insect pests particularly white mango scale insect and the American Fall Armyworm (FAW). The white mango scale insect was first reported from Uke area in Eastern Wollega and the FAW was also first evidenced from western part of the country. All of these insect pests need community-based interventions particularly monitoring, prevention and control and need advanced entomological knowledge and research. Practical course works and thesis works in applied entomology will provide qualified graduates for the community to reduce knowledge and skill barriers and contribute to sustainable development plan of the country.

2. Objectives of the need assessment survey

The needs assessment survey was undertaken to identify the training needs for professionals in the field of entomology at M.Sc. level in Ethiopia. In particular, the needs assessment survey was carried out to obtain practical information on the training needs, specialization options, perceived gaps in job performance and skill, courses desired to be included in the curriculum of the program, suggestion for structure of the program, that are relevant to the needs of stakeholders and sector organizations that require the services of entomology professionals. It is believed that, participation of stakeholders in needs assessment contributes towards ensuring employer organizations needs and developing collaborative partnership with stakeholders starting from curriculum design for a success of a demand-driven postgraduate training program in entomology in Ethiopia.

3. Methodology used for the needs assessment

An entomology related facility survey, focus group discussion with key informants and needs assessment questionnaire to the stakeholders were used as data collection tool for the study. Facility-based document studies such as number of entomologists in the target sector organizations and indicators of M.Sc. training requirements were surveyed. In addition detailed information was gathered in the form of focus group discussion with key informants and administration of needs assessment questionnaire. The focus group discussion with key informants and the needs assessment questionnaire was employed for the needs assessment study and are by large essentially opinion based.

Key informants for the FGD was selected from government and none government organizations in Ethiopia including academic and research institutions, agricultural and horticultural institutions, human and animal health care systems and environmental authorities. The informants were selected on the basis of their field of specialization in addition to their qualification, experience and their current occupation and responsibility. A

protocol for the FGD was prepared that include the need for M.Sc. in entomology training program, perceived gaps in job performance and skill, the suggestion for structure of the program, and courses desired to be included in the curriculum of the program.

The need assessment questionnaire that was designed and administered included request of information about the respondents' area of specialization, their qualification, years of experience and the organizations in which they are currently working. The questions asked in the questionnaire also included the need for M.Sc. program, if the respondents' respective organizations would benefit from the proposed M.Sc. training in entomology, questions about the program structure and specialization options, courses desired to be included as compulsory and specialization options of the program, mode of delivery and duration of the M.Sc. program for both the full time and part time modes. In addition, information on new and emerging challenging issues to be addressed within in the proposed M.Sc program, additional skills needed to be introduced to increase the employability of the graduates and other useful suggestions of respondents were included in the questionnaire as well.

The objective of the needs assessment survey was explained in detail in the cover letters accompanying the questionnaire. In addition, and as a matter of ethics, the cover letter explained that the individuals' participation and responses was confidential and only aggregated data and results were released anonymously. The questionnaire was pre-tested through response obtained from a number of professionals before being distributed to the wider participants.

The questionnaires were distributed to professionals in various organizations in Ethiopia whose activities require the services of entomology professionals. A sample size of 85 respondents were initially chosen and out of the 85 questionnaires distributed the number and percentage that were filled and returned by the respondents were determined to find out a response rate of 75 (88.2%).

4. Results and discussions of the need assessment survey

4.1. Information on number of M.Sc. holder entomologists obtained from facility survey

A total of 26 randomly selected Ethiopian public universities were surveyed for the number of M.Sc. and PhD holder entomologists they own in 2017 (Table 1). On average the number of M.Sc. holder entomologists in the country was 0.19 ranging from 0 to 1 whereas that of PhD holder entomologists was 1.11 ranging from 0 to 4. This shows that there were some universities lacking entomologists. This might be due to lack of qualified professionals in entomology at M.Sc. and/or PhD level on market for recruitment.

As can be seen from the table, many most recently established universities such as Gambella, Dembi Dollo and Mizan Tape universities were lacking entomologists during the survey period. These results implicate the need for launching additional M.Sc. and PhD program in entomology in the country. During the survey period WU had two PhD holder entomologists and one M.Sc. holder entomologist. In addition, two entomologists were on study leave for PhD in Agricultural entomology. This indicates that the university had enough human resource to launch M.Sc. in entomology.

Table 1: Number of M.Sc. and PhD holder entomology professionals in selected Ethiopian universities in 2017.

S. N	University	No. of entomologists	MSc	PhD
			n	n
1	Wollega	3	1	2
2	Metu	1	1	0
3	Dembi Dollo	0	0	0
4	Asosa	1	0	1
5	Ambo	1	0	1
6	Jimma	2	1	1
7	Gambella	0	0	0
8	Walkite	0	0	0
9	Wachamo	0	0	0
10	Addis Ababa	4	0	4
11	Bahir Dar	3	1	2
12	Debre Markos	2	0	2
13	Arsi	0	0	0
14	Adama	1	0	1
15	Haro-amaya	2	0	2
16	Debre Birhan	0	0	0
17	Gonder	2	0	2
18	Awassa	1	0	1
19	Dilla	2	1	1
20	Arbaminch	2	0	2
21	Walayita Sodo	1	0	1
22	Mada-Walabu	1	0	1
23	Jijjiga	2	0	2
24	Mekelle	3	0	3
25	Bule Hora	0	0	0
26	Mizan Tapi	0	0	0
	Average number of Entomologists	34/26 = 1.31	5/26 = 0.19	29/26 = 1.11

Overall 30 research centers were surveyed in this study to assess number of M.Sc. holders in entomology (Table 2). Out of the 30 research centers on average 0.70 M.Sc. and PhD holder entomologists were found. Many of the research centers had neither M.Sc. holder entomologists nor PhD holder during the survey period. This implicates that additional M.Sc. holder entomologists are needed for Ethiopian research centers by either upgrading the existing staff via M.Sc. training or recruiting qualified entomologists if available on market.

As it can be observed from the table, many of the research centers located in western part of the country such as Asosa Agricultural Research Center, Bedelle Tsetse and trypanosomiasis control research Institute, Asosa Tsetse and trypanosomiasis control research Institute and Haro Sabu Crop Research Center were lacking at least one M.Sc. holder entomologists. This is best evidence for the need for launching of M.Sc. in entomology at WU and other western universities in the country.

Table 2: Number of M.Sc. and PhD holder entomology professionals in selected Ethiopian Research Institutions in 2017.

S. N	Research Sectors	Entomologists	MSc	PhD
			n	n
1	Ambo Plant Protection Research Center	1	1	0
2	Asosa Agricultural Research Center	0	0	0
3	Bako National Maize Research Center	0	0	0
4	Chiro Sorghum Research and Training center	0	0	0
5	Debre Zeit Agricultural Research Center	1	0	1
6	Holeta Agricultural Research Center	1	1	0
7	Jimma Agricultural Research Center	0	0	0
8	Kulumsa Agricultural Research Center	0	0	0
9	Haro Sabu Crop Research Center	0	0	0
10	Bako Crop Research Center	1	0	1
11	Adami Tulu Crop Research Center	0	0	0
12	Machara Crop Research Center	0	0	0
13	Fedis Crop Research Center	0	0	0
14	Sinana Crop Research Center	1	0	1
15	Bore Crop Research Center	0	0	0
16	Yabello Crop Research Center	0	0	0
17	Asella Crop Research Center	0	0	0
18	Jimma Crop Research Center	1	1	0
19	Holeta Bee Research	2	0	2
20	Akililu Lemma Institute of Pathobiology	2	0	2
21	Kalit Tsetse and trypanosomiasis	1	1	0
22	Bedelle Tsetse and trypanosomiasis	0	0	0
23	Arbaminich TTCRI	1	1	0
24	Finot Selam TTCRI	1	1	0
25	Asosa TTCRI	0	0	0
26	Gambella TTCRI	0	0	0
27	Ethiopian Public Health Institute	4	2	2
28	Addis continental Institute of Public H.	2	1	1
29	National Veterinary Institute	0	0	0
30	Ethiopian Lives stock Research Institute	2	1	1
	Average number of Entomologists	0.70	0.33	0.36

The number of M.Sc. and PhD holder Ethiopian entomologists providing their professional services in industrial institutions is shown in Table 3. From a total of 13 industrial institutions on average 0.15 and 0.23 M.Sc. and PhD holder entomologists were found respectively. These results implicate high demand for qualified personnel in entomology who will work for these institutions. It should be noted that these institutions need professionals specialized on specific area of entomology such as Agricultural entomology, Medical entomology, environmental entomology and the like which will be obtained by joining graduate studies in these graduate programs.

Table 3: Number of M.Sc. and PhD holder entomology professionals in selected Ethiopian Industrial Institutions in 2017.

S. N	Industrial Sectors	Entomologists	MSc	PhD
			n	n
1	Adami Tulu Pesticide Company	0	0	0
2	Sher Ethiopia (Afriflora sher)	1	1	0
3	Arjo-Didessa Sugar Factory	0	0	0
4	Fincha Sugar Factory	0	0	0
5	Nekemte Plant Health Clinic	0	0	0
6	Jimma Plant Health Clinic	0	0	0
7	Erna Plant Health Clinic	0	0	0
8	Arsi-Bale Plant Health Clinic	0	0	0
9	Ziway Plant Health Clinic	0	0	0
10	Matahara Sugar Factory	0	0	0
11	Adama Medical Insectary	1	1	0
12	Tolayi Insect Ecology and physiology	2	0	2
13	Kalit Tsetse rearing for eradication	1	0	1
	Average number of Entomologists	5/13 = 0.38	2/13 = 0.15	3/13 = 0.23

4.2. Information obtained from focus group discussion

The participants of the FGD revealed that most of the organization where they work need M.Sc. degree and above in entomology. In addition, the FGD suggested the preferred structure for the M.Sc. program to be M.Sc. in entomology with common compulsory courses followed by specialization courses according to the options students choose such as Medical Entomology, Agricultural Entomology, Industrial Entomology and others. The participants also suggested common compulsory courses and specialization courses to be included in the curriculum such as Apiculture and Sericulture, Agricultural entomology, Medical and Veterinary entomology, Advanced Insect Ecology, Integrated pest management, Insecticides and their applications, Insecticides and Public Health Toxicology, Insect Pathology, Insect Molecular Biology, Research Methods in Entomology, Biostatistics, Epidemiology, Geographical Information System, Environmental entomology, Advanced insect systematics, M.Sc. Seminar and M.Sc. Thesis.

A point of argument was put forward by participants of the FGD that M.Sc. training should also be considered as a natural and logical progression for an insect science specialist who would want to aspire for a higher achievement in the field and for Ethiopia, as a country with increasing needs for addressing food security, human and animal health issues and should be considered as a necessary skill that is in demand.

4.3. Information obtained from need assessment questionnaire

4.3.1. Educational qualification and work experience of respondents

Educational qualification, area of competence and work experience of the respondents are shown in Table 4. As can be seen from the table, the highest number of respondents was first degree holders 37/75 (49.3%) and the least were diploma holders 3/75 (4.0%). These show high demand for graduate programs and the existence of high potential trainee in the country. Furthermore, the highest background field of study of the respondents was Biology 42/75 (56.0%) which is so relevant for providing informative suggestions for this survey and also to pursue their linear second degree and even their third degree in entomology. Most of the respondents replied that they worked for their institutions for less than 10 years. The results evident that to enhance their institutions capacities, most of the respondents had high potential for upgrading themselves to M.Sc. level in entomology.

Table 4: Educational qualification and work experience of the respondents, Ethiopia, 2017

Variable	Number	Percent (%)
Educational qualification		
Diploma	3	4.0
Degree	37	49.3
Masters	27	36
PhD	8	10.6
Field of specialization		
Biology	42	56.0
Animal science	5	6.7
Public health	5	6.7
Plant Science	13	17.3
Veterinary Science	5	6.7
Other specify	5	6.7
Years of experience in the institution		
Below 10 years	45	60.0
10-20 years	22	29.3
Above 20 years	8	10.7

4.3.2. Need for M.Sc. qualification in entomology

Out of the participants of the needs assessment questionnaire that responded to the question of the need of their organization M.Sc. qualified personnel, 98.7% believed that there is a need to have the indicated qualification (Table 5). Likewise, 93.3% of the respondents believed that there is a need to upgrade the existing staff to M.Sc. level and 96.0% of them showed that their organizations need to recruit M.Sc. graduates. Overall, the respondents felt that there is a need for M.Sc. degree qualified personnel in entomology in their respective organizations and there is a need to employ new M.Sc. graduates in entomology and upgrade the existing staff to M.Sc. level in applied entomology as well.

Table 5: Need for M.Sc. qualification in entomology, Ethiopia, 2017

Variable	Number	Percent (%)
Does your organization need M.Sc. qualification in entomology?		
Yes	74	98.7
No	1	1.3
Does your organization/institution need to employ new M.Sc. graduates in entomology?		
Yes	72	96.0
No	3	4.0
Does your organization need to upgrade the existing staff to M.Sc. level in applied entomology?		
Yes	70	93.3
No	5	6.7

4.3.3. Structure and content of the M.Sc. program in Entomology

The participants were also requested to suggest a structure for the M.Sc. degree program in Entomology (Table 6). The responses obtained as indicated in the table showed that 90.6% of the respondents preferred a program structure: M.Sc. in Entomology with common compulsory courses followed by specialization courses according to the options students choose such as apiculture, sericulture, medical entomology and the like. The next preferred choice is MSc. in entomology with common courses offered the same to all trainees. The program preferred by the respondents has a specialization option coupled with common courses taken by all students and offers the advantage of incorporating cross-cutting courses while offering the flexibility of specializing in certain areas.

Table 6: Structure and content of M.Sc. program in entomology, Ethiopia, 2017

Variable	Number	Percent (%)
From the options given below which program structure do you suggest for M.Sc. in entomology?		
MSc. in entomology with common courses offered the same to all trainees.	3	4.0
M.Sc. in entomology mostly of common courses and few electives included to be taken according to students choice	2	2.7
M.Sc. in entomology with common compulsory courses followed by specialization courses according to the options students choose such as apiculture, sericulture, Agricultural pests and their management and Insect vectors and their control measures.	68	90.6
Any other recommendation	2	2.7

4.3.4. Courses Requirements for the M.Sc. Program in entomology

Courses to be included in the M.Sc. program in Entomology were requested to be suggested by the respondents and they provided a list of courses they feel that should be included within the program (Table 7). From the stream of Industrial Entomology, the courses suggested by greater number of respondents include, among others, apiculture and sericulture. From the stream of Agricultural entomology courses such as integrated pest management, insecticides and their application are suggested by the respondents. From Medical and Veterinary Entomology stream courses such as medical medical entomology, veterinary entomology and epidemiology are favored by the respondents to be included in the program.

Table 7: Course requirements for M.Sc. program in entomology, Ethiopia, 2017

Variable	Number	Percent (%)
From the list of courses identified below, please circle the letter that you suggest best requirements to be included and offered for M.Sc. program in entomology.		
Apiculture and Sericulture	75	100.0
Agricultural entomology	75	100.0
Medical and Veterinary entomology	75	100.0
Advanced Insect Ecology	75	100.0
Integrated pest management	75	100.0
Insecticides and their applications	75	100.0
Insecticides and Public Health Toxicology	74	98.7
Insect Pathology	75	100.0
Insect Molecular Biology	70	93.3
Research Methods in Entomology	75	100.0
Biostatistics	75	100.0
Epidemiology	70	93.3
Geographical Information System	72	96.0
Environmental entomology	73	97.3
Advanced insect systematics	75	100.0
M.Sc. Seminar	72	93.3
M.Sc Thesis	75	100.0
Others specify	75	100.0

4.3.5. Benefits from the proposed M.Sc. program and major skills the graduates are expected to have when they complete the M.Sc. degree in entomology

All of the respondents stated that their respective organizations will benefit from the proposed M.Sc. program in Entomology. Several of the respondents stated that their organizations will benefit in the major areas of applied entomology, namely, industrial entomology, agricultural entomology, medical entomology, veterinary entomology, environmental entomology and others. Provision of innovative solution is mentioned by some respondents as a result of M.Sc. qualification in entomological science. With graduates having the capacity for research and providing innovative solutions to insect pests and vector borne diseases, the respondents stated that a clear benefit is foreseen in terms of change brought towards improving the livelihood of people.

Responses were obtained from participants of the needs assessment questionnaire regarding the major skills that graduates in M.Sc. degree in Entomology are required to possess. The particular major skills suggested by the respondents are listed below.

Major skill requirements:

- Research and insect pest and vector survey skills
- Insect systematics and taxonomic skills

- Field exposure and experience on industrial entomology such as apiculture
- Scientific writing, presentation and publication and/or communication skills.
- Developing project proposals, project planning, monitoring and evaluation skills.
- Professional skills for agricultural pest surveillance and control
- Professional skills for the surveillance and control of human and animal disease vectors
- Skills on insecticide applications, occupational health and safety
- Skills on pesticides management, environmental and public health and safety.
- Skills to operate and work with entomological equipment such as insect dissecting kits, insect sampling tools, insect bio-assay tools, insecticide application equipment, etc.
- Skills to carry out an independent creative work, and act as an entrepreneur and join workforce through employment and/or creation of own jobs such as beekeeping, silkworm rearing and many others.

5. Conclusions

In conclusion, the survey results underline high demand for M.Sc. training in Entomology in Ethiopia. Furthermore the concern of topsoil depletion and agricultural loss impacted by termite pests and white mango scale insects and biodiversity loss caused by deforestation by insecticides warrant advanced entomological studies in western Ethiopia. There is a felt need to expand on the availability of advanced skills and knowledge at M.Sc. level in entomology and many of the surveyed organizations require personnel with post graduate qualification.

Competing interest

The authors declare that they have no competing interests.

Author contributions

Participated to the study design: OK, TS, and SA. Performed data collection: OK, TS, and SA. Performed data analysis and interpretation of results: OK. Drafted and revised the manuscript: OK, TS. All authors read and approved the final manuscript.

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