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Identification and distribution of intermediate host snails in Mecha woreda, Amhara, North West of Ethiopia

Abstract

During summer, July 2016, Five kebeles of Mecha woreda were selected randomly and all the potential habitat of snails were visited including edges of springs, irrigation canals ,swamps, dam areas and some moist bushy places covered with plants. Five different kinds of snail genus were collected and identified as 46.1% land snails of the genus *Helix*, 23.7% *Lymnaea,* 13.2% *Bulinus*, and 9.2% *Planorbin*, and 7.9% *Oncomelania*. The majority of the land snails being found in moist bushy biotopes, the *Lymnaea* in swampy and irrigation canals whereas most of *Bulinus, Planorbis*, and *Oncomelania* being commonly found at the edges of rivers and near dams. Then in conclusion, as evidenced from the study, the study area is conducive environment for survival of snail intermediate host and overall prevalence of *Fasciola* species.

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Introduction

Back ground of the study

Snails are the common intermediate hosts of most parasitic diseases of animals.[1–3] In the study area, small scale traditional practices using small streams and large scale irrigational practices using Koga dam are the common life supporting activities by the community of Mecha district. These activities may create suitable condition for survival of snail intermediate hosts and are expected to increase the risk of water born trematode parasites. In addition to this, the sheep in the study area usually graze at natural fields and drink at ponds that are suitable for the snail intermediate hosts of *Fasciola.*[4] Mecha district (Merawi) is one of the areas where environmental conditions and altitude of the area is conducive for the occurrence of snail hosts. However little information is available about its type and distribution in the study area. Any intervention that improves the productivity of farm animals is important in creating wealth and improving the standard of living of resource-poor farmers of Ethiopia. Therefore, there is a need for the development of good preventive and control measures against intermediate host snails in the study area through improved programs.

Significance

Thus, the purpose of this study is to determine the type and distribution of intermediate host snails in the study area. More over to help the stakeholders to take actions, prevention and control measures, and the study may also help as a source of information for future further research on the field in the study area.

Objectives

General objective: To explore the type and distribution of host snails in Mecha woreda.

Specific objective

i. To association of different snail genus at different environmental temperature in Mecha district.

ii. To explain the distribution of snail genus at different biotopes of Mecha district.

iii. To describe the distribution of snail genus in different land cover (substrate in Mecha district.

Methods

The study area

The study was conducted in Merawi town the main town of Mecha district of west Gojjam zone in Amhara regional state, North west of Ethiopia located about 525km North West of Addis Ababa and 34 km South East of Bahir Dar the capital city of Amhara region. In Mecha, district the climatic condition, alternate between along summer rainfall and winter dry season with mean annual rainfall of 1500-2200mm. The mean temperature is between 24-27ºC and altitude ranges from 1800 to 2500m.a.s.l. The study area is located at latitude 10º30'N and longitude 37º29'E. The land is covered by Savanna grassland and bush lands vegetation. Agriculture is the main economic sector in the study area. The main agricultural activities currently practiced include irrigation (Modern and traditional) and mixed farming. The major agricultural products seasonally harvested include sorghum, maize, teff, wheat and other legume groups. In this district there are 192,556 cattle, 148,971 ovine, 23,106 equine and 204,181 poultry.[5]

During summer, July 2016, Five kebeles of Mecha woreda were selected randomly and all the potential habitat of snails were visited including edges of springs, irrigation canals ,swamps, dam areas and some moist bushy places covered with plants. In the collection, snails visible to the naked eye floating on the water surface and moist mud were picked by hand using glove, watery areas that were deep and full of vegetation were searched by using cloth that can pass water through and which is tied to a long stick according to.[6] The collection of snails is carried out at the morning and after rains, when the environmental temperature relatively low and humidity is available suitable for snail survival. Collection of snails was performed after rains by scooping and or hand picking conducted by two people at each site for 20min.[7] Snails were identified morphologically using a field guide to African freshwater snails (Figure 1).[8,9]

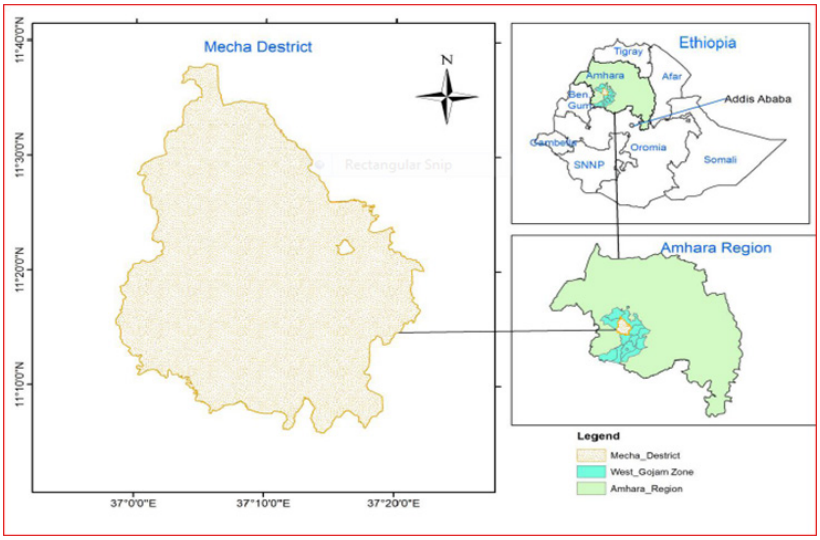

Figure 1 Map of the study area.

Results

Distribution of snail genus

In the present study, from the result of snail survey, five types of snail genus were distinguished. The distribution of different snail genus in five biotopes showed that genus *Helix, Lymnaea, Bulinus, Planrbin and Oncomelania* exist in 46.1%, 23.7%, 13.2%, 9.2%, and 7.9% respectively. That was 35 *Helix,* 18 *Lymnaea*, 10 *Bulinus*, 7 *Planorbis,* and 6 *Oncomelania* (Table 1).

Table 1 The distribution of different snail genus at different environmental factors

Factor		Number of snails collected in each genus						95%.CI.	DF	χ2	p- value
		h	l	b	p	o	sum				
Land cover	Vegetation	20	3	2	2	0	27	0.00-0.039	12	23.244	0.013
	Leaf litter	7	12	4	3	2	28				
	Mud	7	3	4	2	4	20				
	others	1	0	0	0	0	1				
	total	35	18	10	7	6	76				
Biotope	Moist bushy	23	1	0	0	0	24	0.00-0.039	16	89.089	0
	Swampy area	2	8	0	0	0	10				
	Irrigation canals	3	7	1	0	0	11				
	Stream sides	7	0	2	3	1	13				
	Dam area	0	2	7	4	5	18				
	total	35	18	10	7	6	76				
Temperature	(10-15)°c	5	6	4	4	4	23	0.00-0.039	8	25.845	0
	(16-20)°c	9	10	5	2	2	28				
	(20-25)°c	21	2	1	1	0	25				
	total	35	18	10	7	6	76				
Environmental moisture	Morning	20	10	7	3	3	43	0.809-0.954	4	1.388	0.882
	After rain	15	8	3	4	3	33				
	total	35	18	10	7	6	76				

Association between biotope and snail genus distribution

As shown below (Figure 2), from the result of the present study, 65% of helix is found in moist bushy area, 83.33% of *Lymnaea* are found in swampy and irrigated areas, 70% of *Bulinus* are found near dam areas, all of the *Planorbis* are found near stream (sides and dams).

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83.33% of the *Oncomelania* are found near dam areas. Statistical analysis showed that there is a significant ($\chi 2$=89.089; p=0.000) association between the distribution of snail genus and habitat.

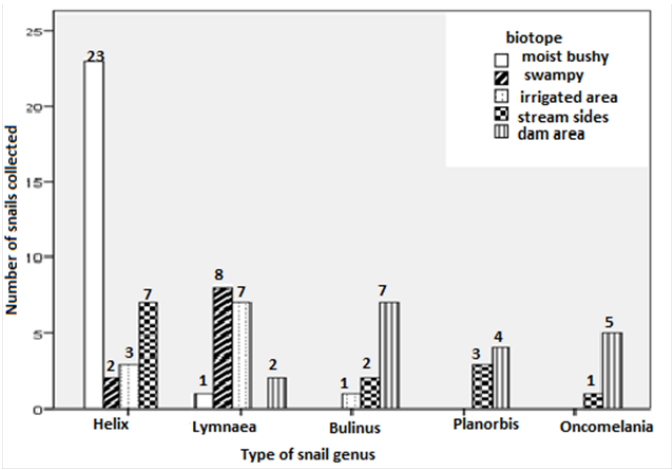

Figure 2 The distribution of snail genus in different biotopes.

Association between land cover and snail genus distribution

The result of the present study showed that most of the genus helix was found in vegetation cover, many of the *Lymnaea* are found in leaf litter, most of the genus *Oncomelania* are found in leaf litter and mud. Result of the snail survey indicated that there was a statistically significant ($\chi 2$=23.244; p=0.039) association between the distribution of different snail genus and land cover of the place where snails are found (Figure 3).

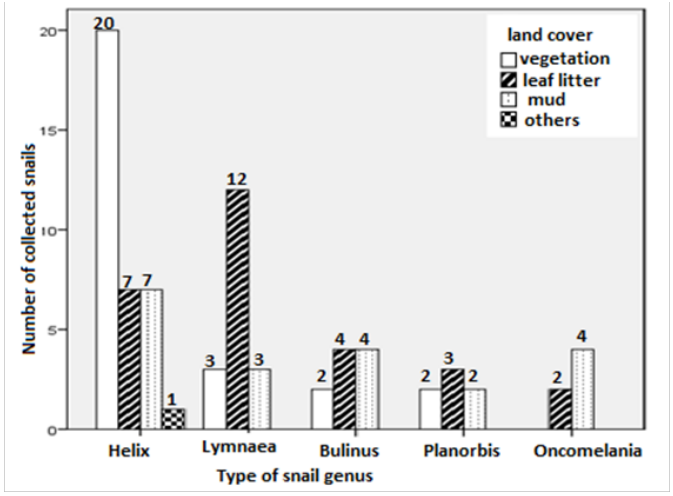

Figure 3 The distribution of snail genus collected in different land cover (substrate).

The association of temperature with snail genus identification

As it is shown (Figure 4), sixty percent of helix snails were found at temperature from (21-25)ºc, 55.5% of *Lymnaea* were found at (15-20)ºc, 50% of *Bulinus* at (16-20)ºc ,57.1% of *Planorbis* at (10-15)ºc and 66.66% of *Oncomelania* at (10-15)ºc. From the statistical analysis of the present study there exists a significant ($\chi 2$=25.845; p=0.00) association between temperature during snail collection and the type of snail genus collected.

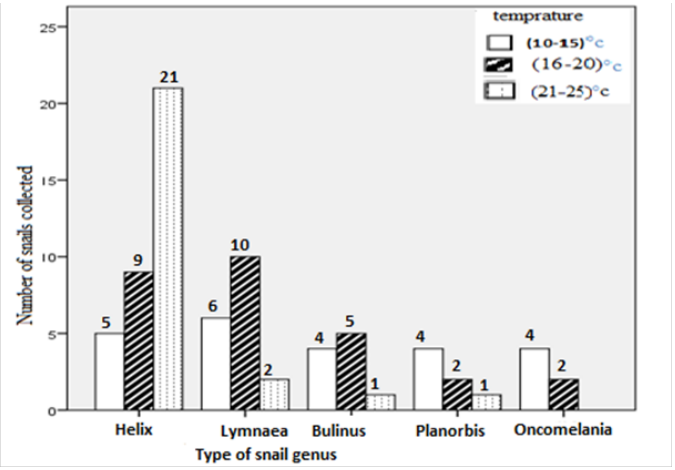

Figure 4 Association of snail genus at different environmental temperature.

Discussion

The snail survey carried out in 15 biotopes of the study area revealed the presence of five genera of snail. These include genus *Helix, Lymnea, Bulinus, Planorbis,* and *Oncomelania*. Of which, the most commonly occurring was the non-vector snail species belonging genus *Helix* and the least being genus *Oncomelania*.[10]

In relation to habitat preference of the snail species identified, it was observed that species of *Helix* genera were the most common in most bushy area while those of the members of genus *Lymnea* were mainly encountered in irrigation canals and swampy or paddy fields and the remaining three genera were commonly found near damps and edges of stream.[11]

The result of the present study is in support of the previous works by Boray,[12] who reported the abundance of *Oncomelania* snails species in pools and dams, and the genus *Planorbis* and *Bulinus* snails are more common around stream side's and pools. Regarding *Lymnea* species, Michael[13] and Dida et al.[14] observed the abundance of this species in the irrigation channels because the water temperature and the vegetation found in irrigation cannels favors the development of the snails. In the present study, most of the genus *Helix* snails were collected on the surface of green leaves and many *Lymnea* snails were collected at leaf litter. The possible reason could be most of the land snails from genera *Helix* are herbivores feeding on plants and dwell mostly in vegetation, where as the *Lymnea* snails are detritivors that feed on various types of debris and organic matter in or on the surface of water bodies.[11,15,16] In the present study, a statistically significant association was observed between the environmental temperature during collection and the type of snail genus collected. Most of the *Helix* was collected at a range of temperature between (21-25)ºC. In addition, nearly all of the *Lymnea* were collected at a temperature range from (16-20)ºC and most of the three genera *Bulinus, Planorbis* and *Oncomelania* were collected at low environmental temperature range of (10- 15)ºC. This may be due the fact that the majority of the land snails are terrestrial, have adapted, and survive the warm environmental temperature while the *Lymnea* and *Bulinus* snails were best adapted at temperature between (16-20)ºC, although they can easily survive between 10ºC and 35ºC.[17] However, *Oncomelania* and *Planorbis* are more abundant at low water temperature.[18,19]

Lymnaid snails that act as intermediate hosts for *Fasciola hepatica* and *Fasciola gigantic* can be identified easily as compared to other freshwater snails. The opening of the *Lymnaid* snails is on the

right when the snail is held with the spires pointing away from the viewer. When the apex of the spire is facing the viewer, the spires turn clockwise.[20] have developed morphological identification based on a dichotomous key. Lymnea snails were identified based on the morphological features described by Pham & Phan[21] Allowing[10] discrimination between *G. truncatula* and *Radix* sp. From the result of the present study, 18 Lymnea snails were collected. 5 of them are *Galba truncatula* and 13 of them are *Lymnea natalensis*. Identification of the snail species was made by studying the morphological features of the shell based on given traits for the major snail categories according to Brown.[22] *Lymneaa* (*Radix*) natalensis measures 25mm in length and 14.5mmin width. The spire is generally much less high than the aperture. The surface may have spiral rows of small transverse grooves, but always lacks strong spiral ridges of periostracum. (Galba) *L. truncatula* is 11in length 6mm in width (often smaller), comparatively small, with the spire about as high as the aperture and strongly convex whorls. Columela straighter and more broadly reflected than in *L. natalensis* according to Emile et al.[23,10]

From the result of the present study, the most prevalent *Fasciola* species found in the study area was *Fasciola hepatica*. In contrast with this, the most abundant *Lymnea* species found was *Lymnea natalensis* the common intermediate host of *Fasciola gigantica*.[24]

The probable reason for this may be *Fasciola* species including *Fasciola hepatica* has wider range of hosts (not host specific) so may parasitize the *Lymnea natalensis* the common intermediate host of *Fasciola gigantica* so *Lymnea natalensis* may have acted as an intermediate host of the other *Fasciola* species, *Fasciola* hepatica. A review on this point demonstrated the existence of conflicting results.[25] Reported negative infections of *R. natalensis* with *F. hepatica*. Dreyfuss[26] reported successful infection of *R. natalensis* with *fasciola* hepatica in Malagasy. This may be because imperfection during identification of the two species. It may also be due to the difference in susceptibility of the two snail species in the process of parasite development in their body.

Conclusion

Five different kinds of snail genus were collected and identified as 46.1% land snails of the genus *Helix*, 23.7% *Lymnaea,* 13.2% *Bulinus*, and 9.2% *Planorbin*, and 7.9% *Oncomelania*. The majority of the land snails being found in moist bushy biotopes, the *Lymnaea* in swampy and irrigation canals whereas most of *Bulinus, Planorbis*, and *Oncomelania* being commonly found at the edges of rivers and near dams. Then in conclusion, as evidenced from the study, the study area is conducive environment for survival of snail intermediate host (Annex 1).[27–28]

Recommendations

Animals should be prevented either by keeping them away from these area or by fencing of dangerous areas and swampy areas should be well drained and also Strategic anthelmintic treatment with appropriate flukicicide drug should be administered.

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Conflict of interest

The author declares that there is no conflict of interest.

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