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Short Communication

Establishment of *Hymenolepis diminuta* Life Cycle to Provide Parasite Mass Production

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ABSTRACT

Background: The main object of this experimental work was to practise laboratory production both adult and the larval stage of *Hymenolepis diminuta* with conventional modification to make further studies easier.
Materials & Method: Adults *H. diminuta* were collected from urban rats in Tehran, Iran. The beetles became infected using blended gravid segments with flour as bait. Cysticercoids have been saved after precise dissection of invertebrate hosts. The exposure of infected beetles to laboratory rats was performed to establish the life cycle.
Result: Out of 57 collected rats, three rats were infected with *H. diminuta*. Almost all exposed beetles found infected with the larval stage of parasite. About one-month later *H. diminuta* eggs were seen in stool examination of laboratory rats.
Conclusion: Rare human occurrence of *H. diminuta* along with light level of clinical manifestation of this parasite, underestimate the concerns toward its public health importance. Nowadays, various field of studies, such as biochemistry with special focuses on the capability of *H. diminuta* tegument absorption have performed apart from parasitological views alone. In the present study, establishment of this parasite life cycle has practically provided the access of adult and cysticercoid stages of the tapeworm in further researches.
Keywords: *Hymenolepis diminuta*, Life cycle, Rat, Flour beetle

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Introduction

Parasites of higher importance in public health and veterinary always are of the major concerns for authorities in national health sectors .Although rare, there are several recorded helminthes in humans with very low pathogenic effects, which have never been seriously regarded. *Hymenolepis diminuta* commonly known as "rat tapeworm" is exemplary to remind this group of parasites. *H. diminuta* does necessarily depend on arthropods, specifically flour beetles, Tenebrionidae family in completion their lifecycle.

Reports of human infections are occasionally appearing in the global literature. In a paper describing the infection in a child in the United States, the overall human cases until 1990 was estimated to be 200 occurrences worldwide (1). For some parts of Iran, the prevalence rate of these cestodes has been recorded 11% and 38.8% in *Rattus norvegicus* and *Meriones persicus* respectively (2, 3). During a systematic survey of intestinal parasites which has been carried out in a rural area near the Persian Gulf in south of Iran in 1972, five cases had been detected out of 635 individuals (4). Meanwhile three decades later in 2008, our national literatures witnessed the latest human infection in a 16-month female infant (5).

Regardless of its expected prevalence, which seems to be higher than what it is appears, *H. diminuta* should not be considered as a serious harmful cause of illness within the human population. Nowadays the core subject of the papers concerning *H. diminuta* has recently been switched on to the other aspects rather than pure Parasitology. As a biological model, application of rat tapeworms has been extended toward the territory of biochemistry, for instance recognition of glutamate as a neurotransmitter in plathyhelminthes (6). The bioindicatory role of helminthes, which can be an available means of environmental assessment, has also been confirmed for *H. diminuta* (7).The main object of this experimental work, was to practise laboratory production both adult and the larval stage of *H. diminuta* with conventional modification to make further studies easier .

Materials and Methods

Adult worms were obtained during sequential tracks of rat sampling in some urban areas in Tehran, Iran in 2010. Out of 70 captured rats, three infected individuals (4.2%) were seen in one location. Tenebrionidae beetles, which have been provided for this study, had been collected from southern part of the country for continual generation procedures in insectarium. Gravid segments of the worms were selected to mix up with wheat flour for supplying infected paste to be exposed to the beetles. Blending should carefully be optimized to avoid eggs from crashing while the bait being prepared. Dryness of the paste is also a vital issue for exposing to the beetles. Feeding the beetles were performed in a more convinced manner rather than using filter paper enriched with proglottides as previous researchers have practiced (8). Two grams of paste were provided for 10 two days famished beetles placed in a 1 ml plastic containers punched with 10 pores using 0.6x30 mm hypodermic needles to keep enough air circulation. Containers were kept under the insectarium condition (28-30 ˚C and 20%-40% humidity). Two weeks later on beetles were examined for cysticercoids in a careful manner of dissection in the binocular microscopy. Pictorial stepwise procedure of this experiment is shown below (Fig. 1).

Results

Almost all exposed vectors were experimentally infected with larval stage of *H. diminuta*. Along with cysticercoid produc-tion, exposure of the 24 hours starved laboratory rats were carried out while negative result for *H. diminuta* eggs was confirmed for each. In this phase, 10 crashed infected beetles containing approximately 10 larvae were placed in cucumber slices to be offered to 6 rats in private cages. To guarantee the exposure course, the cages have been carefully cleaned and kept empty of chaff prior to position the rats in. Ten days post exposure, stool examination was commenced and repeated twice a week in order to be aware of the time appearance of eggs. For more accuracy in examination, feces laid in each cages were separately collected, merged, and studied, using direct and routine concentration methods. Around one month later *H. diminuta* eggs were gradually came into sight.

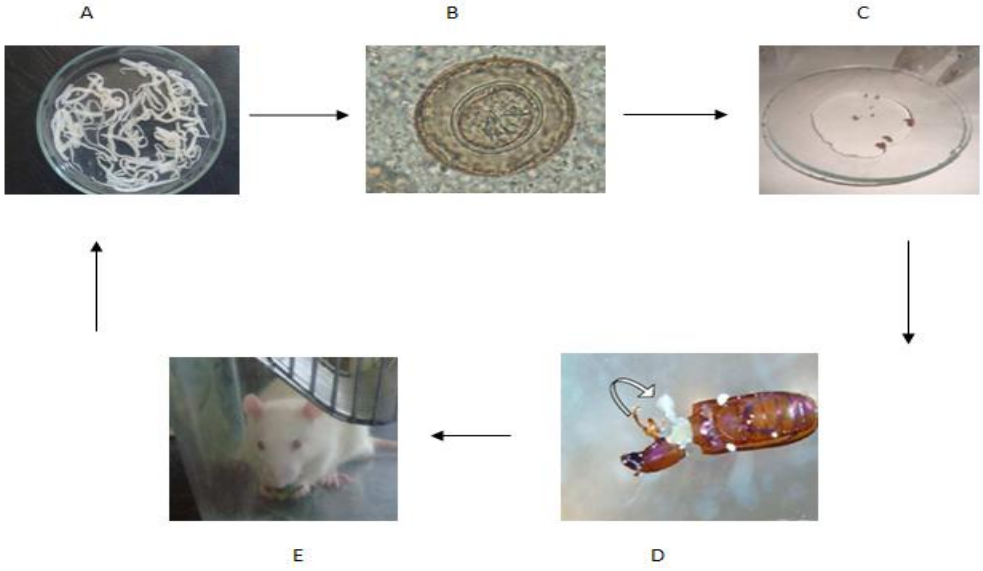

Fig. 1: A: *H. diminuta* obtained from naturally infected rat, B: eggs obtained from *H. diminuta* gravid segment, C: Infected bait preparing as paste, D: Immerged cysticercoid larvae (curved arrow) from experimentally infected flour beetle, E: Laboratory rat feeding on bait containing cysticercoids. (Source: authors)

Discussion

Elaborated application, which has been provided in this study, can be repeatable in laboratories with ordinary equipments to facilitate the access of investigators to this cestod as a practical model in various fields of biological and medical research.

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