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Natural Parasitism associated with species of Sarcophagidae family of Diptera in Iran

Kamran Akbarzadeh, Abbas Ali Mirzakhanelou, Hossein Lotfalizadeh¹, Azam Malekian, Teymour Hazratian², Kosar Rezaei Talarposhti³, Rahman Babapour Darzi¹, Ehsan Radi⁴, Abbas Aghaei Afshar⁵

School of Public Health, Tehran University of Medical Science, ¹Head of East-Azarbaijan Research Center for Agriculture & Natural Resources, ²Tabriz University of Medical Sciences, ³Babol University of Medical Sciences, ⁴Urmia University of Medical Sciences, ⁵Leishmania research center, Kerman University Of medical sciences

Abstract

Context: Sarcophagidae is one of the most important families of Muscomorpha. They have been reported from various parts of Iran. Native biological control agents, which may be substantial candidates for control of Sarcophagidae, have not been extensively studied in Iran. **Aim:** To identify main parasitoid wasps that are actively parasites pupa of Sarcophagidae in Tehran. **Setting and design:** Mass collection was done primarily by means of bottle traps in three city parks of Tehran. Collected pupa were kept solely in each plastic cup, and the wasps or adult flies were counted after emergence. **Statistical Analysis Used:** Means and rates. **Results:** Two parasitoid species, *Nasonia vitripennis* (Hymenoptera: Pteromalidae) and *Brachymeria podagrica* (Hymenoptera: Chalcididae) emerged from the Parasited pupae. Parasitic rate for *N. vitripennis* was nearly 26.7%, and that for *B. podagrica* was closely 2.2%. The highest number of emerged adults from one pupa was 16 for *N. vitripennis*, with an average of about 10. In this study, *Sarcophaga argyrostoma* recorded as the dominant species of nonparasitized pupa and *Wohlfahrtia nuba* were fewer in number. **Conclusion:** Except for personal protection methods, there aren't other control measures for fly population in Iran. Before large-scale application of these parasitic wasps for the reduction of fly populations, their mass rearing and the methods of dispersing and their field evaluations have to be done.

Keywords: Sarcophagidae, natural parasitism, Chalcididae, Pteromalidae, Iran

Introduction

Some members of the infraorder Muscomorpha, belonging to the order Diptera, are of economic importance in medical and veterinary aspects.^[1] They can transmit some pathogens mechanically,^[2] or may produce myiasis by their larvae in human and animal body.^[3] Myiasis disease has been reported more or less in various parts of Iran, not excluding the capital, Tehran.^[4] Their potency in transmission of pathogens has been delineated by a study conducted on *Musca domestica* in Iran.^[5] Activities of some members of this group

on human and animal cadavers have been very well documented in Iran.^[6,7]

Chemical control of the medical and veterinary important flies may lead to serious problems such as insecticide resistance and hazards on the environment.^[8] These agents can also be a component of Integrated Pest Management programmes.^[9]

Some studies have confirmed that synchronized use of

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Correspondence:

Dr. Abbas Aghaei Afshar, Leishmaniasis Research Center, Kerman University of Medical Sciences, Kerman, Iran. E-mail: afshara2@yahoo.com

parasitoid wasps and Insect Growth Regulator (IGR) have resulted in a better control of fly population.^[10]

Biological control methods have been adopted extensively in the control of various pests in Iran since 1932,^[11] and great efforts for reducing the population of anopheline vectors of malaria in some places in Iran have been started.^[12] Biological control methods were not utilized in control of pests of public health importance in Iran. Sarcophagidae family of Muscomorpha comprises of flies which are important medically, veterinary, and forensically. They are reported from various parts of Iran.^[13] Some species of this family have been reported recently in Tehran.^[14]

Native biological control agents who may be potential candidates for control of Sarcophagidae haven't been extensively studied in Iran yet. This study has been conducted for identifying main parasitoid wasps, which are active on pupae of Sarcophagidae in Tehran.

Materials and Methods

The presence and activity of parasitoid wasps has been studied on pupae of family Sarcophagidae, which were collected from various places of Tehran including Kharazm, Shahr, and Laleh city parks during late summer and early autumn 2014. Three bottle traps have been installed in each park. Each trap has been equipped with 25 cow meat as bait. Adult Sarcophagidae flies were attracted to the bottles and deposited their larvae on the bait provided. The sampling process was conducted as a monthly schedule to allow maximum time for pupation of larvae in each bottle. Collected pupae were solely kept in cups covered with fine mesh net. Subsequently, after two weeks, the components of each cup were observed to detect parasitoids.

Collected parasitoid wasps were sent to the Agricultural and Natural Research Center of East Azarbayjan of Iran for species identification. Identification of adult Sarcophagidae flies was done by relevant keys.^[15] Parasitic index was calculated by dividing of parasitized pupae per all exposed pupae, multiplied 100.^[16]

Results

As much as 270 pupae of Sarcophagidae family were placed exclusively in cups. A total of 72 pupae were parasitized by *Nasonia vitripennis* (Hymenoptera: Pteromalidae), and six pupae were parasitized by *Brachymeria podagrica* (Hymenoptera: Chalcididae). Therefore, parasitic rate for *N. vitripennis* was closely 26.7% and that of *B. podagrica* computed to be 2.2%.

Total number of adult *N. vitripennis* that were collected was 718, which emerged from 72 parasitized pupae [Table 1]. The highest number of emerged adults recorded from one pupae was 16 for this species, with an average of nearly 10.

The emerged adult for *B. podagrica* was one by one host pupae. The occurrence of this species with low-parasitic rate was more scattered with respect to months and places.

Parasitized Sarcophagidae pupae died and couldn't be identified. Four species belonging to the family Sarcophagidae emerged from unparasitized pupae in the study area [Table 2]. Dominant species in this study was *Sarcophaga argyrostoma* and *Wohlfahrtia nuba* had fewer numbers.

Discussion

N. vitripennis is a cosmopolitan species, which is parasitic on Cyclorrhaphan fly's pupae such as Calliphoridae and Sarcophagidae,^[17] associated with various nests as well as carrion,^[18] therefore, can be additionally used as a forensic indicator in crime scenes.^[19]

In a similar study, which has been conducted in Brazil, three species of parasitic wasps have been collected on pupae of *Chrysomya megacephala*. Two of these three wasps were remarkably the same as investigated wasps in this study, *N. vitripennis* and *B. podagrica*.^[20] Similarly, in Argentina, these two species were recorded among some other parasitoids, and in agreement with this study, *N. vitripennis* was the most abundant parasitoid species.^[21]

N. vitripennis has been reported for first time as a potential biological control agent of *Musca domestica* in Iran.^[22] This species was confirmed in a preliminary checklist deduced by Lotfalizadeh and Gharali 2008.^[23] Recently, this species has been collected from Babol (Mazandaran province), north coast of Iran, during the conduction of a study on animal carrions (unpublished data). Interestingly, this is the first documentary report on activity of this species on pupae of Sarcophagidae in Iran.

One of the widely distributed genus in Chalcididae family of Hymenoptera is *Brachymeria* Westwood. Members of this genus are parasitoids of various important insect pests^[24] such as muscoid flies.^[25]

Previously, the genus *Brachymeria* belonging to the subfamily Chalcidina of family Chalcididae has been reported from Iran.^[26] *B. podagrica* has been reported from

Table 1: Number of parasitoid wasp, *N. vitripennis* (Hymenoptera: Pteromalidae), emerged from separated Sarcophagida pupa, Tehran, Iran 2014

Cup number	Study area									Total
	Kharazm Park			Shahr Park			Laleh Park			
	Aug	Sept	Oct	Aug	Sept	Oct	Aug	Sept	Oct	
1	14	0	13	13	10	16	13	11	16	106
2	6	12	18	4	9	16	2	6	13	86
3	12	13	8	6	16	9	0	13	10	87
4	7	13	16	4	13	16	1	16	16	102
5	11	7	2	12	7	2	7	11	2	61
6	6	3	4		11	9		3	12	48
7	9	11	15			16		16	13	80
8		14	2			11		7	10	44
9		15	12			14			5	46
10		16				3			13	32
11						15			11	26
Number of parasite pupa	7	10	9	5	6	11	5	8	11	72
Number of non-parasited pupa	23	20	22	25	24	17	25	22	20	198
Total	30	30	30	30	30	30	30	30	30	
Parasitic rate	23.33333333	33.33	30	16.667	20	36.667	16.6667	26.6667	36.667	
Average parasitic rate (total)	26.67									

Table 2: Number of Sarcophagidae species emerged from non-parasitized pupa .

	Kharazm Park			Shahr Park			Laleh Park			total
	Aug	Sept	Oct	Aug	Sept	Oct	Aug	Sept	Oct	
Female	11	9	11	13	12	8	12	12	11	101
<i>S. argyrostoma</i>	1	1	4	4	1	3	5	0	1	19
<i>S. africa</i>	5	4	4	5	8	4	8	5	4	46
<i>S. aegyptica</i>	3	3	3	2	3	2	0	4	3	23
<i>S. variegata</i>	3	3	0	1	0	0	0	1	1	9
all non-parasited	23	20	22	25	24	17	25	22	20	198

Kerman^[27] in 2011 and East Azarbayjan in 2012.^[26] The species has been reported as parasitoid of various families, for example, Calliphoridae and Sarcophagidae.^[28]

It is evidently showed that these two collected species of parasitic wasps act synergistically. Clearly, attacks of parasitic wasps is species-specific.^[29] However, the interaction between these species and their rate of specificity for any host of Iranian Sarcophagidae species is unclear.

Effectiveness of natural parasitoid, *N. vitripennis* in association with IGRs has been tested and proven for

controlling house fly populations in United Kingdom.^[8] This species along with some other species of family Pteromalidae is available commercially for use in the control of medically important flies.^[30] Therefore, exploiting these natural enemies of medically and veterinary important flies for their control, and defining new protocol for fly control, is highly recommended.

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Conflict of interest

There are no conflicts of interest to declare.

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