Short Communication

Biological characteristics of *Meccus phyllosomus pallidipennis* (Hemiptera: Reduviidae: Triatominae) fed on two different hosts

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**Abstract**

**Introduction:** Different blood meal sources can affect biology of triatomines. **Methods:** We studied the influence of two different blood meal sources (rabbits and hens) on five biological parameters in *Meccus phyllosomus pallidipennis* and collected biological parameters. **Results:** The cohort fed on rabbits had a shorter median life-cycle and lower mortality rate than that fed on hens. Both cohorts required a similar number of blood meals to reach adulthood. Median longevity and number of blood meals for adults were similar between both cohorts. **Conclusions:** The studied parameters reflect the high grade of adaptation of *M. p. pallidipennis* feeding on different hosts.

**Keywords:** Biology. *Meccus phyllosomus pallidipennis*. Chagas disease. Mexico.

Chagas disease is a zoonosis transmitted in natural foci with defined environmental characteristics. It is estimated that between six and seven million people are infected by *Trypanosoma cruzi* around the world, with more than 5,700,000 infected people living in American countries and almost 900,000 infected in Mexico[1]. Food resource use by triatomines has a direct effect on the developmental time of nymphs and adult reproduction, which are important regulating factors of population density[2]. Published studies have demonstrated the influence of different blood meal sources on various biological parameters of different species of triatomines. The animals serving as blood meal sources in most of these comparative studies have been pigeons, mice, hens, and rabbits[2-4]. In most cases, the triatomines that feed on mammals have more outstanding biological parameters than those that feed on birds[2-4]. Similarly, the influence of different blood meal sources on some feeding and defecation behaviors have been studied in *Meccus phyllosomus pallidipennis*, considered as one of the most important vectors of *T. cruzi* in Mexico[4]. Interestingly, based on their study of some biological parameters of *M. p. pallidipennis* in Brazil, some authors find it reasonable to assume the potential role of this species as a vector in environments other than those naturally found in Mexico. This implies that Brazilian environmental conditions would be favorable for survival of *M. p. pallidipennis*. Study of longevity in triatomines contributes to estimating the importance of this species as a vector in environments other than those naturally found in Mexico. This implies that Brazilian environmental conditions would be favorable for survival of *M. p. pallidipennis*. Study of longevity in triatomines contributes to estimating the importance of this species as a vector of *T. cruzi*, since this parameter affects its capacity to infest human dwellings[4]. Similarly, the number of blood meals required for triatomines to survive until the adult stage has not been studied, even though this information could contribute to estimating the importance of a specific triatomine species as a vector. This current study aimed to contribute to understanding the influence of feeding of different blood meal sources on the *M. p. pallidipennis* life-cycle, nymphal mortality, number of blood meals to reach adulthood, as well as on longevity and number of blood meals of adults.
The insects used in this study were selected from the third generation of a colony previously established from at least 30 individuals initially collected in Chilpancingo de los Bravos, Guerrero, Mexico (17°33’N, 99°30’W) in 2015. The initially collected specimens were identified according to the most commonly used taxonomic key by Lent and Wygodzinsky, taking into account the revalidation of Meccus. That colony, as well as the two studied cohorts of Meccus, were maintained under laboratory conditions similar to those in a recent study (Valenzuela-Campos et al., 2020). The developmental cycle periods and number of blood meals needed to molt were compared among the two cohorts. The Chi-square test of homogeneity was used to compare the developmental cycle periods and number of blood meals needed to molt. The Mann-Whitney U-test was used to compare percentages of both cohorts.

When the total egg-to-adult development times between the two cohorts were compared, a significantly less time (U = 1041, p = 0.03) was recorded for the cohort fed on rabbits (Table 1). No significant differences (U = 1407, p = 0.54) were recorded when comparing the total number of blood meals for molting through each nymphal instar of each cohort (Table 1). The average length of adult survival was similar regardless of sex and cohort (Table 2), with no significant differences (U = 1497, p = 0.12) in females (or males) fed on hens compared to those fed on rabbits. Even though the number of blood meals among females fed on hens was lower than that of the cohort fed on rabbits, no significant differences were recorded (U = from 1243, p > 0.05). Similarly, males fed on rabbits and those fed on hens had a different median number of blood meals in adulthood; however, these differences were not significant (Table 2).

Egg-to-adult development time of the two studied cohorts can be considered to be medium (around 7 months). This is equivalent to up to two generations obtained per year, which could lead to increased risk of vectorial transmission of T. cruzi to human and animal reservoirs, due to the high abundance of Meccus, a triatomine species with outstanding vectorial characteristics. Short development times could indicate how successful a triatomine population can be, since it represents the ability of a species to repopulate and re-establish after a disturbance, such as those caused by insecticides. Development times of both cohorts were similar to those in a recent study of a

### Table 1: Median time of development from egg to adult (in days), percentage of cumulative mortality and median number of blood meals to molt in nymphs of two Meccus phyllosomus pallidipennis cohorts.

<table>
<thead>
<tr>
<th>Instar</th>
<th>Hen</th>
<th>Life cycle (interquartile range)</th>
<th>Mortality (%)</th>
<th>Blood meals (interquartile range)</th>
<th>Rabbit</th>
<th>Life cycle (interquartile range)</th>
<th>Mortality (%)</th>
<th>Blood meals (interquartile range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg-N1</td>
<td>93</td>
<td>19a (17-21)</td>
<td>-</td>
<td>-</td>
<td>78</td>
<td>19a (17-21)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>N1-N2</td>
<td>87</td>
<td>19a (15-24)</td>
<td>6.45 (1-1)</td>
<td>1a</td>
<td>73</td>
<td>17a (17-18)</td>
<td>6.41 (1-1)</td>
<td>1a</td>
</tr>
<tr>
<td>N2-N3</td>
<td>79</td>
<td>22a (18-27)</td>
<td>8.60 (1-2)</td>
<td>1a</td>
<td>68</td>
<td>25b (23-27)</td>
<td>6.41 (1-2)</td>
<td>1a</td>
</tr>
<tr>
<td>N3-N4</td>
<td>77</td>
<td>40a (3.5-42)</td>
<td>2.15 (1-2)</td>
<td>2a</td>
<td>65</td>
<td>26b (24-30)</td>
<td>3.85 (1-2)</td>
<td>2a</td>
</tr>
<tr>
<td>N4-N5</td>
<td>73</td>
<td>52a (34-60)</td>
<td>4.30 (2-3)</td>
<td>2a</td>
<td>60</td>
<td>42b (39-45)</td>
<td>6.41 (2-3)</td>
<td>2a</td>
</tr>
<tr>
<td>N5-AD</td>
<td>64</td>
<td>60a (54-73)</td>
<td>9.68a (2-3)</td>
<td>2a</td>
<td>58</td>
<td>58b (54-63)</td>
<td>2.56b (2-3)</td>
<td>2a</td>
</tr>
<tr>
<td>Total</td>
<td>64</td>
<td>202a (178-225)</td>
<td>31.18a (8-10)</td>
<td>9a</td>
<td>58</td>
<td>191b (170-204)</td>
<td>25.64b (8-10)</td>
<td>9a</td>
</tr>
</tbody>
</table>

Medians in columns followed by different letters are significantly different (p < 0.05).
M. p. pallidipennis population from southern Mexico, whereby two cohorts, one fed on hens (Red Star race), and one on rabbits (Chinchilla race), were studied. Similar to a previous study\(^4\) comparing M. p. pallidipennis development times between blood meal sources from two rabbit breeds (New Zealand vs. Chinchilla), when we combine with our current study, we also recorded an apparent lack of influence of rabbit breed (Silver Marten vs. Chinchilla vs New Zealand) on development times.

Unexpectedly, an apparent lack of influence of hen breed (Red Star vs. Turken) was noted in our study. This contrasts with a previous study\(^4\) that reported apparent influence of hen breed (Leghorn vs. Red Star) on development times. Similarly, no influence of the origins of both M. p. pallidipennis populations (southern for current and western Mexico for the previous one) was noted\(^6\). Development time results for both cohorts were shorter than those for Triatoma sordida (371 days)\(^10,11\) and for Panstrongylus chinai (621 days)\(^12\). In contrast, both cohorts showed slightly longer development times than those for a western Mexican population of T. lecticularia (168 days)\(^12\). T. lecticularia is an important vector of T. cruzi in some areas of northeastern and northwestern Mexico and in the United States\(^12\). Similar to a previous study where two cohorts (fed on Red Star hens or Chinchilla rabbits) of a M. p. pallidipennis population from western Mexico were compared, egg-to-adult development time for the cohort fed on rabbits (a mammalian) in our study were shorter than that fed on hens (avian)\(^4\). These findings are consistent with different epidemiologically important South American species such as T. infestans, T. sordida, T. pseudomaculata and T. brasiliensis, in which cohorts fed on mice had shorter egg-to-adult development times than those fed on pigeons\(^5\).

All specimens from the two cohorts required a medium total number (9) of blood meals to molt, independent of blood meal source. This finding represents two advantages. First, a medium number of required blood meals indicates that these triatomines have a lower risk of being killed by adverse environmental conditions (e.g., rain) when they leave their shelter or being eaten by a predator, since triatomines are at risk each time they leave their shelter to find a host\(^11\). Second, acquiring a similar number of blood meals indistinguishably from mammalian or avian source represents an advantage for M. p. pallidipennis, because that behavior means having access to a broader range of available hosts, and, as a consequence, such behavior may increase their chances of survival.

Mortality rates of both studied cohorts were more than 25%, but the rate for those fed on hens was slightly higher (31%). These similar rates of around 30% support that M. p. pallidipennis is well adapted to commonly feed on both mammals and birds under field conditions, as has been suggested by previous data of blood meals of collected triatomines under field conditions\(^14\). Similar results have also been recorded for three species fed on mammals and birds, including T. pseudomaculata and T. sordida, which are two important vectors for T. cruzi transmission in South America\(^3\).

In both cohorts, M. p. pallidipennis males in the current study lived for a median duration of over 1 year, whereas females lived for a median duration of around 10 months, independent of the blood meal source. Adaptability of males and females to both blood meal sources suggests an advantage for survival of M. p. pallidipennis. Both sexes of M. p. pallidipennis lived for long durations as adults (around 11 - 11.5 months), similar to those of T. melanica and T. brasiliensis, which are two important vectors of T. cruzi in Brazil, as well as males of M. p. pallidipennis (= T. pallidipennis) (around 1 year old) fed on Leghorn hens in previous studies\(^4,6\). Both sexes of M. p. pallidipennis lived for longer durations as adults than T. carcavalloi (males = 180 days, females = 160 days), a different vector of T. cruzi in Brazil\(^15\). Females of both cohorts lived around 70 days (median) less than males of both cohorts, with similar median times between both cohorts. These differences could be attributed to reproduction costs, as has been reported in previous studies of M. p. pallidipennis and T. melanica\(^4,6\). To our knowledge, this is the first study to investigate the number of blood meals required for survival among adults of a triatomine species. For M. p. pallidipennis, this number was similar for females and males of both cohorts, supporting that M. p. pallidipennis has a high capacity to adapt to different blood meal sources. Results from both cohorts showed that every M. p. pallidipennis individual fed on a host about 20 times during its complete life of around 500 days, from hatching to death. This supports that M. p. pallidipennis could survive at least a month of starvation, which allows this species to remain sheltered during adverse external environmental conditions (e.g., rain, cold), or survive even if a host is not available. These results also suggest that

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**TABLE 2**: Median number of blood meals to survive in adults and adult longevity (in days) of two *Meccus phillosomus pallidipennis* cohorts.

<table>
<thead>
<tr>
<th>Adults</th>
<th>Hen</th>
<th>Blood meals (interquartile range)</th>
<th>Longevity (interquartile range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Females</td>
<td>n</td>
<td>11a (7-20)</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>25</td>
<td>10a (5-14)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Rabbit</th>
<th>Blood meals (interquartile range)</th>
<th>Longevity (interquartile range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Females</td>
<td>n</td>
<td>15b (9-18)</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>31</td>
<td>6b (5-10)</td>
</tr>
</tbody>
</table>

Medians in columns followed by different letters are significantly different (p < 0.05).
every individual has many chances of transmitting \( T. \) cruzi to the hosts if infected, thus increasing its importance as a vector.

Most of the studied parameters, including those previously not studied (longevity and number of blood meals at adult stage), showed that \( M. \) p. pallidipennis is well adapted to feed on different hosts, which represents a higher risk of successful invasion among human dwellings, and, as a consequence, an increased risk of \( T. \) cruzi transmission to humans, as \( M. \) p. pallidipennis is considered an effective vector of this protozoan.

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Conflict of Interest

The authors declare that there is no conflict of interest.

REFERENCES


