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Household spider species exhibit Kleptoparasitism: An interaction between *Plexxippus paykulli* and *Hasarius adansoni*

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Abstract

Spiders of the family salticidae are kleptoparasites that steal prey from other web spiders. In this paper we have described the kleptoparasitism between two species Plexxippus paykulli and Hasarius adansoni. Observation on distance of attack and prey stealing success rate were carried out for different body sizes of both species. Significant correlations were obtained for attacking strategy and prey stealing between different body classes of both species. We conclude from these co-relative studies that the larger the leg span of kleptoparasites shows profound degree of such behavior as compared to that of the relative body size. it also shows that the relative changes in body sizes of kleptoparasite proves to dominant on varied body size range in hosts.

Keywords: *Plexxippus paykulli, Hasarius adansoni,* kleptoparasitism, attack distance, prey stealing

Introduction

In the unpredictable natural world, every species has developed a unique strategy of survival. Many arthropods have found it adaptive to sequester, and sometimes personally guard, resources for their future use or the use of their offspring [1, 2]. For example, some dung beetles spend many hours shaping, moving, burying, and shielding a fecal fragment they may either eat, or into which they may lay an egg [3]. Catching results in a delay between taking possession of a resource and its final consumption, and during these period owners are vulnerable to thieves, which are often spoken of as Kleptoparasites [4]. Kleptoparasitic spiders (those which regularly steal food from other species of spiders) are known to occur in five families [5, 6, 7] 1) Theridiidae (*Argyrodes* species), 2) Dictynidae (*Archaeodictyna ulova*), 3) Salticidae (*Portia* and *Simaetha* sp.), 4) Symphytognathidae (*Curimagua bayano*), and 5) Mysmenidae. In the family of jumping spiders (Salticidae), *Portia* and *Simaetha* species are the most recorded species exhibiting the kleptoparasitic behavior [9]. Here we observed the kleptoparasitic association between two another wide-spread species i.e. *Plexippus paykulli* and *Hasarius adansoni*. Here we demonstrate the species interaction in laboratory conditions to prove the interaction and also the significance of such a behavior.

The observations of these two species interaction suggest that *Plexippus paykulli* acts as a kleptoparasite on *Hasarius adansoni*, which acts as a Host. Their major food comprises of the Lepidopteran and Dipteran insects. They were observed to be feeding on *Catochrysops strabo* Fabricius (Lepidoptera) and *Zizina otis* Fabricius (Lepidoptera), in wild, for most of the times (personal observation, unpublished). Both of the species of spiders are often found in the houses and near any kind of human residence. However, these both species often come inside the houses to feed on house flies, *Musca domestica*. Thus these all observations were utilized to design the experimental set-ups and observations were made.

Material and Methods

An extensive search for both the spider species was done in field to collect individuals of different sizes. Identification of species was done using standard key available[9,10]. Individual feeding habits were also recorded in wild and the species of its most preferred food was noted. This species were collected from the field as and when required.

Based on our extensive field observations, we designated *Plexippus paykulli* as Kleptoparasite (K) and *Hasarius adansoni* as Host (H). We obtained 13 *Plexippus paykulli* males (K) of various sizes and kept in different boxes and given a designation by small alphabets to each to avoid the confusion. For the *Hasarius adansoni* female (H) we used the boxes of 30×30×30 cm with a slit of 2×5 cm area at its top to put the prey inside the box. This slit was kept closed with a scotch-tape and is opened only while putting the prey species inside. 13 different individuals of *H. adansoni* females of different sizes also were obtained and given individual designations by capital alphabets to avoid confusion. We fed individual *H. adansoni* with same species of butterfly *Catochrysops strabo* (Fabricius) once a day for 10 successive days and hence the saturation of feeding is avoided. We transferred *Plexippus paykulli* immediately after the prey is captured by *Hasarius adansoni.* To elucidate the effect of body size on distance of attack and success rate of prey stealing by K, experiments were carried out with different body sizes of both K and H. Observations were taken for distance of attack immediately after the attack was attempted by K on H by marking the sites where they were sitting before the attack.

Experiments were done between July 2009 to July 2010, at The Department of Zoology of The Maharaja Sayajirao University of Baroda, Vadodara; Gujarat, India. All the measurements like body size, leg span (extended) were taken by standard digital vernier Callipers while measurement of distance of attack was taken with the help of standard measuring scale. All the boxes of both the species were kept in laboratory at a constant temperature of 30°C, with proper aeration to all the boxes and usual day-night cycles of light (intensity was not measured).

A Pearson's Correlation has been used to compare different observations; the graphs were plotted using Microsoft Excel.

Result and Discussions

Kleptoparasites with larger body size are intrepid in attacking the Hosts: When H is kept smallest (8.8 mm) in size and K of different body sizes were allowed to go inside the box, we got a strong negative correlation (figure 1). This is clear from the figure 1 that, as the body size of K increases the distance of attack reduces. This concludes that the K of smaller body sizes keeps a distance from H in response to predation done by H of smaller size and also this distance is maintained to avoid the inter-specific competition. But K of larger size is bold enough and can dominate the H of smaller size and also may give better kleptoparasitic attempts.

When the Leg span of K is correlated with distance of attack by keeping the H smallest again, we found a correlation which is negative (figure 2). This implies that as the leg-span increases success in stealing a prey increases. Here it also implies that the leg-span can also influence the host in terms of size so the kleptoparasite may become a pirate or a robber when the host is significantly smaller than Kleptoparasite.

To confirm the assumption we correlated the body size and leg span of K with distance of attack keeping the largest H (7.8 mm). Here we observed a lesser significant correlation (figure 3, 4) which suggests that the K becomes indecisive when the size of H is significantly large.

Host possess an ability to shield the food in response to Kleptoparasites: Percent prey stolen is total number of successful steals out of total attempts. When we correlated the body size of H with % prey stolen by keeping the K largest (11 mm), we found that % prey stolen increases significantly. While correlating the same by keeping the K smallest (8.8 mm) we observed a strong negative correlation. This implies that as soon as the body size of a kleptoparasite is decreased, the influence of H increased. When the kleptoparasite is shortest, host becomes more and more audacious. (figure 7, 8)

To prove this assumption we also studied the correlation of % prey stolen with body size of K by keeping the host constant. When H was largest (7.8 mm) successful prey steals increased significantly (figure 5). However, when the correlation of % prey stolen was done by keeping H smallest, a very significant correlation was expected but the correlation is not significant (figure 6). Hence it can be concluded that the host is able to defend its prey from the kleptoparasite. But since it becomes audacious, it may loss its prey.

To understand, whether leg span of K can influence success of steals, we correlated the % prey stolen with leg span by keeping H constant. When the H is smallest K made successful attempts in stealing the prey. However, when H is largest, K still could steal the prey successfully. This implies that the leg span has greater influence than body size. This also suggests that the H with larger body size become overconfident and lose the prey. (figure 9,10)

The use of leg span in defining the body size is an imperative tool for these spiders. Alone the body size does not have an immense impact on another species. Here we demonstrated that K with largest leg span has been more successful in stealing the food rather than having a largest body size. In other words, Host can hoard its food successfully when the leg span of K is not large enough, even though the body size is larger. But host was found little unsuccessful in preventing the prey steal when the K is with largest leg span.

Hasarius adansoni is a very common species in houses, whereas, *Plexipus paykulli* is not so frequent in the houses (personal observation, unpublished). This actually reduces the encounters between these species. Hence the encounters cannot be seen very frequently in wild. But when we brought these species in captivity, they showed the kleptoparasitic behavior.

H. adansoni of shorter size could defend the food from getting stolen although *P. paykulli* was significantly larger, is perhaps because *H. adansoni* dwell in houses more, so getting encountered with diverse predators like *Hemidactylus flaviviridis*, *Hemidactylus brookii*, and competitor spiders like *Menemerous bivittatus*, *Telamonia dimidiata*, *Lycosa* sps, *Pardosa* sps, *Crossopriza lyonii* etc. and in relatively smaller area and hence developed a stronger strategy to defend itself and its food, whereas *P. paykulli* dwells in gardens and other sort of vegetations. It is a wanderer and covers larger area than *H. adansoni* in search of food. In doing so it can avoid many other predators and has more access to variety of prey species, but it may not be able to decrease its time spent in search of food. As per the optimal foraging theory [11] animals should employ foraging tactics to maximize their energy intake rate per unit time. By specifically targeting those individuals that take longer to handle prey, are smaller in size and are more vulnerable to attack, kleptoparasites may increase the efficiency and value of kleptoparasitism as a foraging strategy[12] and hence *P. paykulli* has developed kleptoparasitic strategy. In captivity, neither of the spiders had access to avoid each other and kleptoparasitism by *P. paykulli* is observed. However, as *H. adansoni* stays in higher pressure of predation and competition, it should also have developed the strategy of stealing the food, which has not been seen in our experiments. Here the reasons could not be demonstrated and experimented as they are beyond the scope of this paper. Nevertheless, the reasons can be explained again by optimal foraging theory, as *H. adansoni* has higher predation pressure and it perhaps has an ability of decreasing the time spent in search of food by occupying specific microhabitats in houses. Hence *H. adansoni* here could not show any kleptoparasitic behavior.

Kleptoparasitism among these two spider species has been experimented for the first time. As such it is even rare to see the struggle between these two species for food in natural habitats. This study has provided some very important conclusions regarding kleptoparasitism as well as the species' behavior. The research on kleptoparasitic behavior has a great significance in understanding the evolution of foraging strategies among different organisms. This would help in understanding species behavior in different circumstances and variable environmental factors. Further research in this respect may give novel results and the species used here may turn to be a good model system to study behavioral ecology in laboratory conditions.

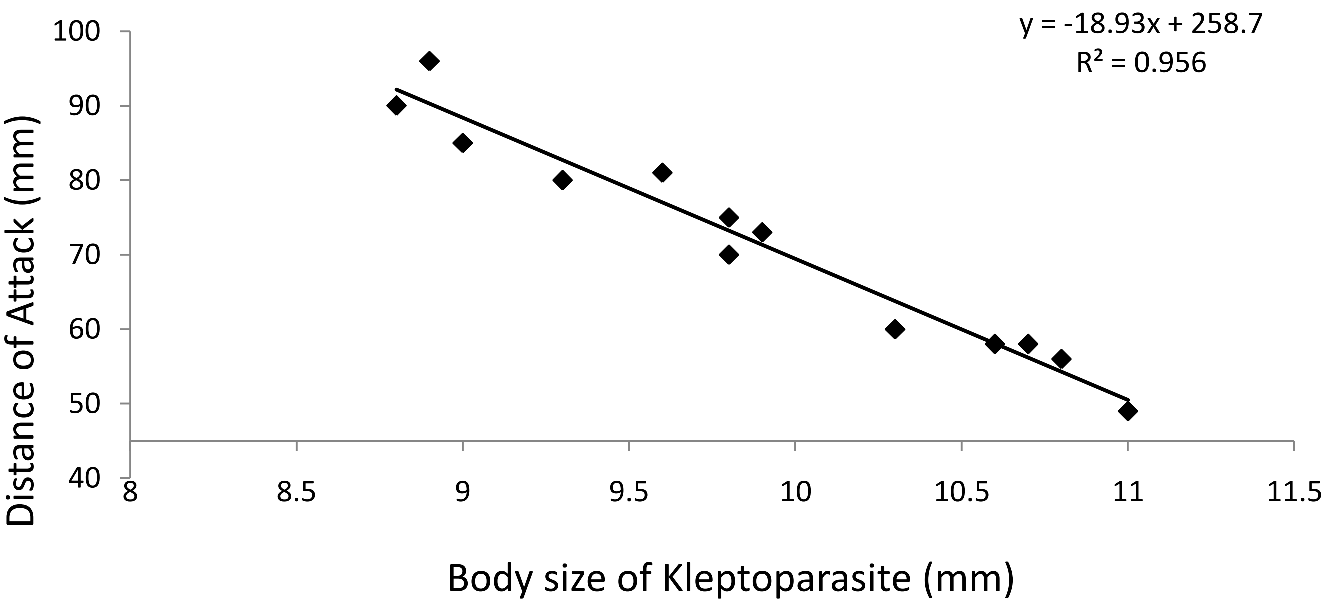

Figure 1
Body size vs distance of attack (H smallest)

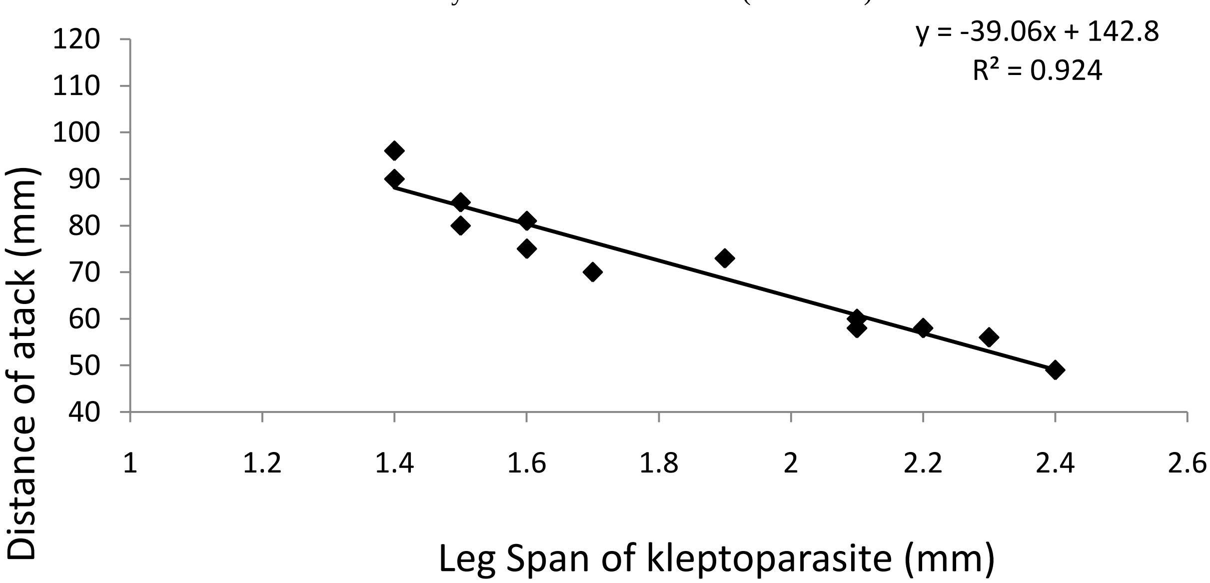

Figure-2
Leg span vs distance of attack (H smallest)

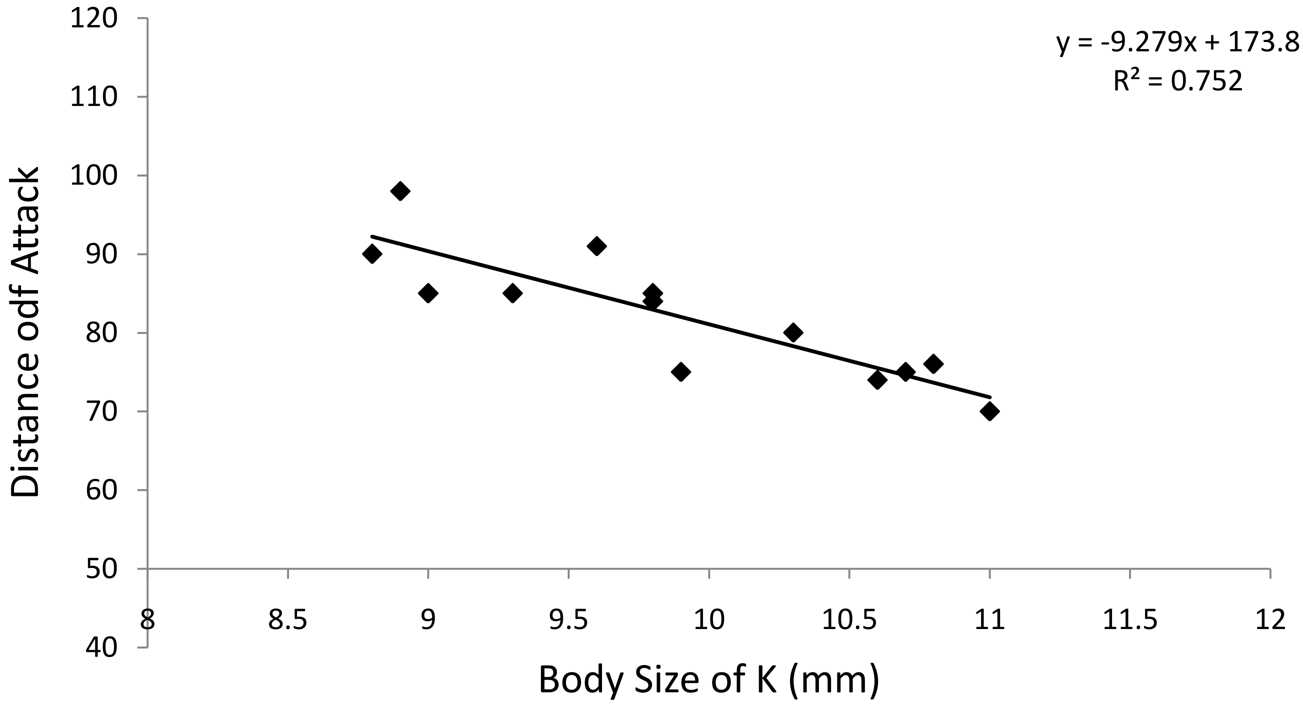

Figure-3
Body size Vs distance of attack (H largest)

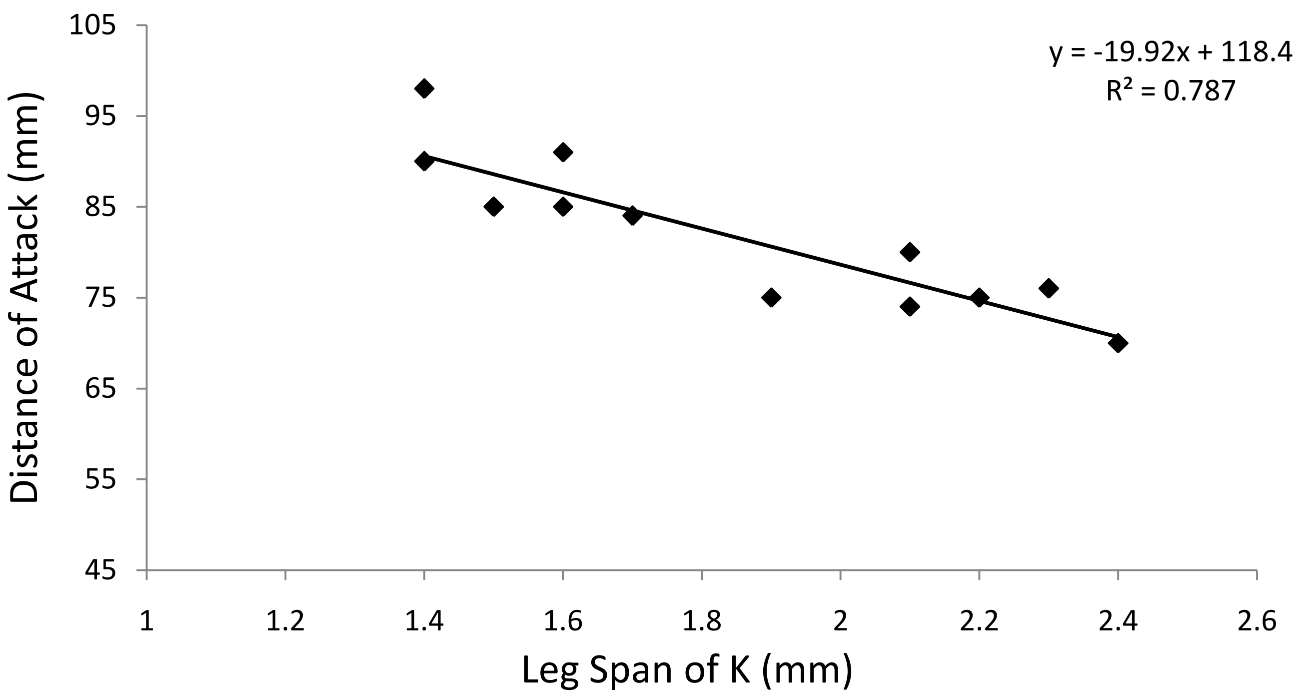

Figure-4
Leg span vs distance of attack (H largest)

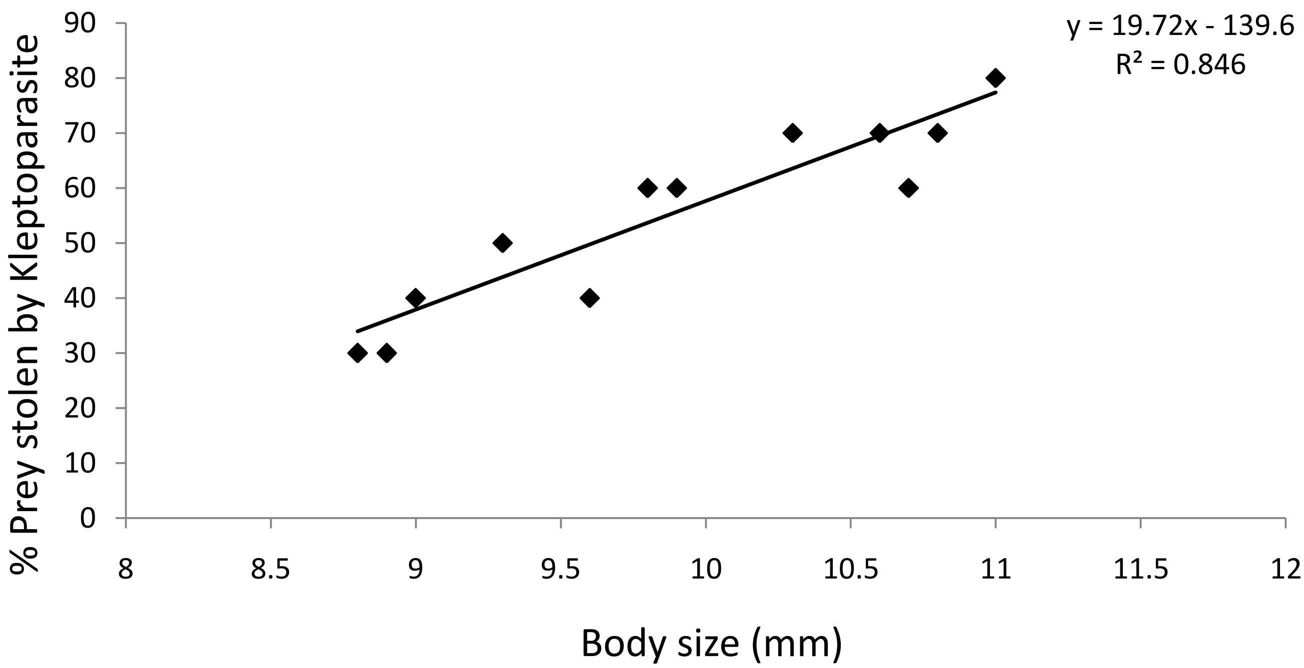

Figure-5
Body size of K vs % prey stolen (H largest)

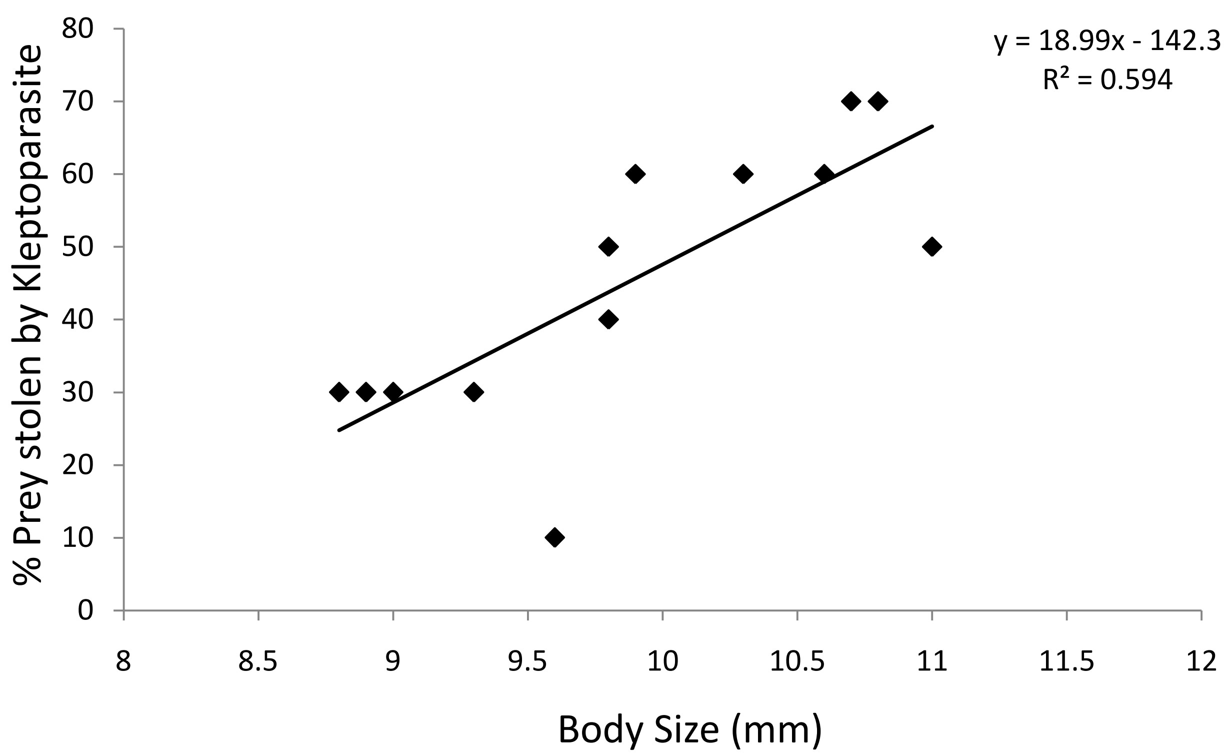

Figure-6
Body size of K vs % prey stolen (H smallest)

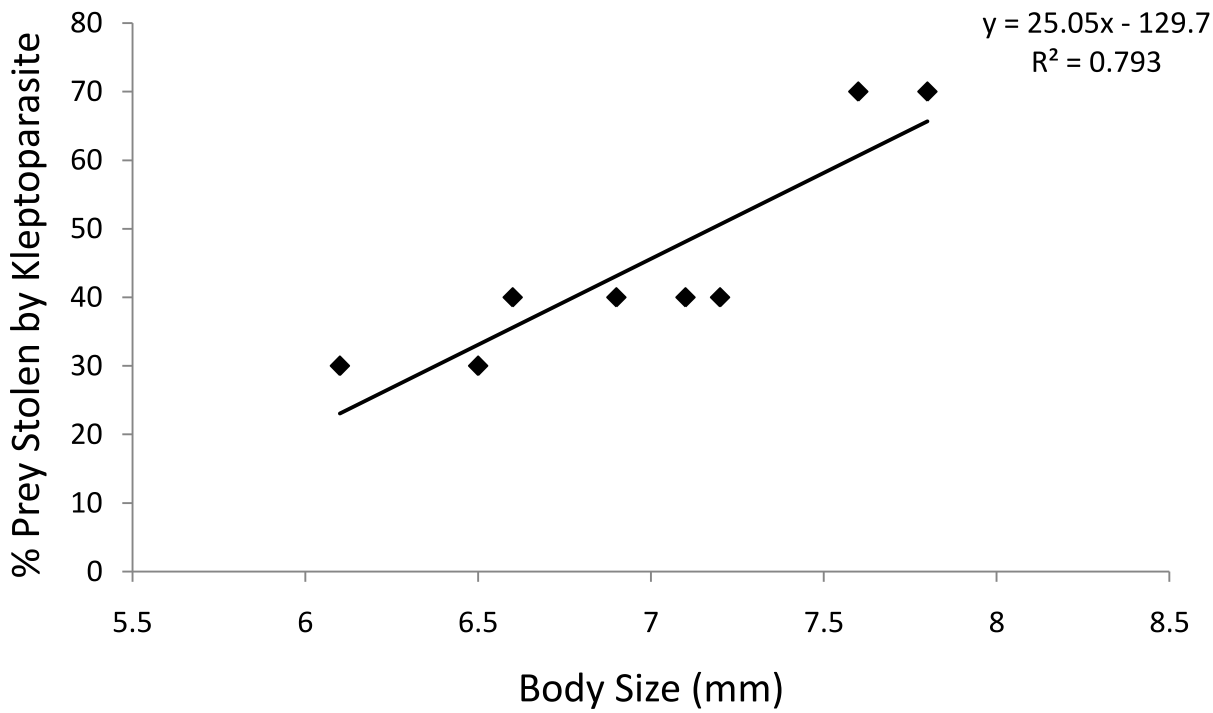

Figure-7
Body size of H vs % prey stolen (K largest)

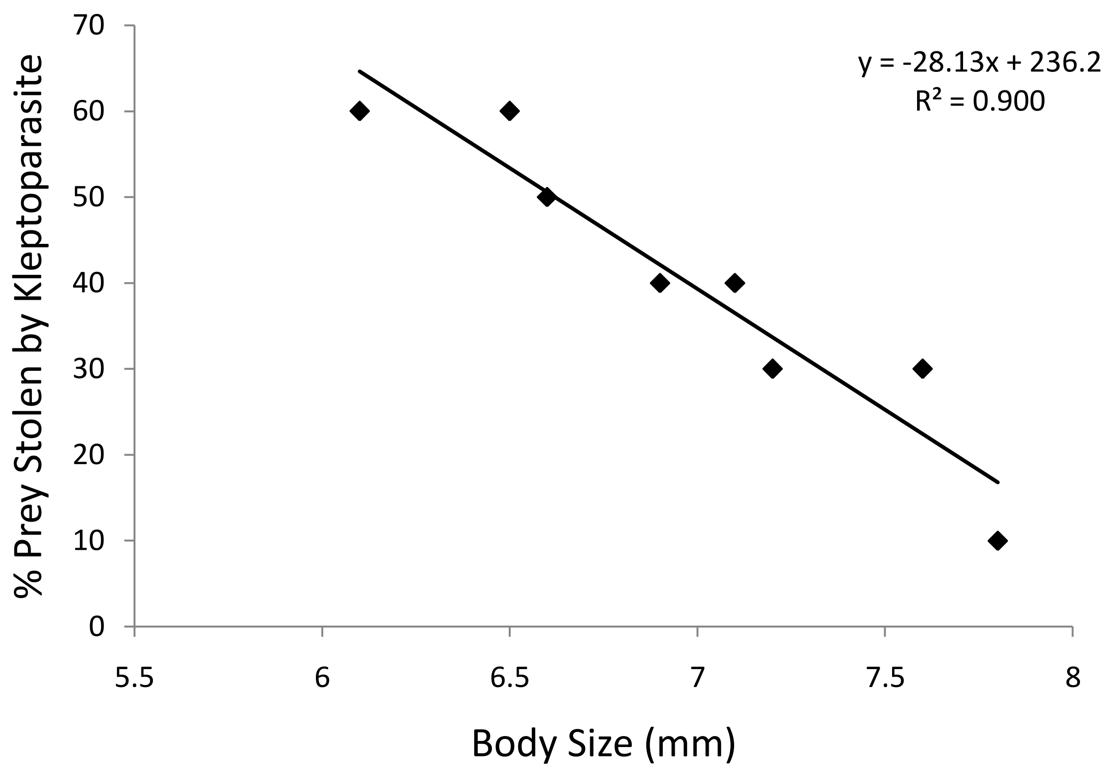

Figure-8
Body size of H vs % prey stolen (K largest)

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