

Feeding Behavior and Prey Preference of the Camel Spider *Galeodes turcmenicus***Birula, 1937 (Solifugae: Galeodidae) in Iraq under Laboratory Conditions****Abbas K. Jaber^{1,*}, Azhar M. Al-Khazali²**^{1,2}Department of Science, College of Basic Education, University of Sumer, Thi Qar, Iraq

*Corresponding author: abaaskalas@hs.uos.edu.iq

Phone number: 07817376301

Abstract

This study aimed to evaluate the predation mechanism and acceptance of several prey species in adult male *Galeodes turcmenicus* under structured laboratory conditions. Sixteen adult male *G. turcmenicus* individuals were collected from four stations in Dhi Qar Governorate, southern Iraq, and kept individually in individually perforated boxes under laboratory conditions according to standards. After that, the laboratory experiment was conducted on them by presenting seven types of prey, and for each prey presented, it was based on the number of spiders in the experiment, as the prey was different in terms of body size, the rigidity of the exoskeleton, in addition to the ability to move. Prey acceptance and feeding behavior were then recorded, with locust acceptance (*Schistocerca* sp.) reaching (100%), while the percentage of field cockroaches reached (93.8%), followed by wolf spiders (87.5%), and house flies (87.5%). It showed an average acceptance rate (56.3%) for American cockroaches, while the acceptance rate for geckos (*Hemidactylus* sp) was Less frequent (37.5%), and a rate (0%) was recorded for dark beetles (Tenebrionidae). Feeding behavior followed a unique sequence that began with detecting and guiding prey, then rapid attack, using pedipalps to capture it, transferring prey to chelicerae, stabilizing, breaking up prey tissue, then swallowing liquefied tissue and finally rejecting indigestible residue. The results show clear prey selectivity in *G. turcmenicus*. Prey with soft, mobile bodies was preferred, while prey with very stiff bodies was rejected. These results indicated that the rigidity of the prey's exoskeleton and its body size are key acceptable prey specifications. This study was the first experimental evaluation of *G. turcmenicus* prey acceptance, preference, and feeding behavior in the Iraqi environment, providing new data on the feeding ecology of solifuges in the Middle East.

Keywords: Feeding behavior, Predation, Prey preference, Sun spider.**سلوك التغذية وتفضيل الفريسة لعنكبوت الجمل *Galeodes turcmenicus* Birula, 1937 (Solifugae: Galeodidae) في العراق في ظل ظروف المختبر****عباس كلاص جابر الحسين¹، أزهر محمد غالي الخزعلي²**^{1,2} قسم العلوم، كلية التربية الأساسية، جامعة سومر، ذي قار، العراق**الخلاصة**

هدفت هذه الدراسة الى تقييم الية الافتراس وقبول انواع عديدة من الفرائس لدى الذكور البالغة من *Galeodes turcmenicus* تحت ظروف مختبرية منظمة حيث تم جمع 16 فرد ذكور بالغة من *Galeodes turcmenicus* من اربع محطات من محافظة ذي قار جنوب العراق وتم الاحتفاظ بها بشكل فردي في صناديق مثقبة بشكل منفرد تحت ظروف مختبرية وفقاً للمعايير. بعد ذلك اجريت عليهم التجربة المختبرية بتقديم سبعة انواع من الفرائس وفي كل فريسة يتم تقديمها تكون على عدد العناكب في التجربة حيث كانت الفرائس مختلفة من حيث حجم الجسم، وصلابة الهيكل الخارجي بالإضافة إلى القدرة على الحركة. بعد ذلك تم تسجيل قبول الفريسة وسلوك التغذية، حيث بلغت نسبة قبول الجراد (*Schistocerca* sp) (100%)، في حين بلغت نسبة الصراصير الحقلية (93.8%)، تليها العناكب الذئبية بنسبة (87.5%)، والذباب المنزلي (87.5%). وأظهر معدل قبول متوسط (56.3%) بالنسبة للصراصير الأمريكية، في حين كان معدل قبول الوزغات (*Hemidactylus* sp) أقل تواتراً (37.5%)، وتم تسجيل معدل (0%) بالنسبة للخنائس الداكنة (Tenebrionidae). اتبع سلوك التغذية تسلسلاً فريداً يبدأ باكتشاف الفريسة وتوجيهها، ثم الهجوم السريع، باستخدام اللوامس الفكية لالتقاطها، ونقل الفريسة إلى الكليس، والتثبيت، وتفتيت أنسجة الفريسة، ثم ابتلاع الأنسجة المسالة وأخيراً رفض البقايا غير القابلة للهضم. وتظهر النتائج انتقائية واضحة للفرائس في *G. turcmenicus*. تم تفضيل الفرائس ذات الأجسام الرخوة والمتحركة، في حين تم رفض الفريسة شديدة التصلب. أشارت هذه النتائج إلى أن صلابة الهيكل الخارجي للفريسة وحجم جسمها من المواصفات الرئيسية للفريسة المقبولة. اعتبرت هذه الدراسة أول تقييم تجريبي لقبول فريسة *G. turcmenicus* وتفضيلها وسلوك التغذية في البيئة العراقية، مما يوفر بيانات جديدة حول البيئة الغذائية للـسوليفوجيس في الشرق الأوسط.

الكلمات المفتاحية: سلوك التغذية، الافتراس، تفضيل الفريسة، عنكبوت الشمس.

1. Introduction

Solifugae is an ancient order within Arachnida, with a fossil record dating back to the Carboniferous Geologic Period, showing a long evolutionary history [1]. Their environments are the tropical, subtropical, and temperate regions worldwide. The solifugae highest density and diversity are found in desert and semi-desert environments [2]. Ecologically, these creatures are too important as they consider as predators in terrestrial ecosystems, that balancing various arthropod populations. However, many details about these creatures and their ecology and behavior are still mysterious compared to other their groups [3]. Solifugae are exclusively carnivorous and voracious feeders; there are documented cases of individuals consuming big amount of food that their abdomens become visibly distended [4].

has powerful jaws capable of tearing feathers and hair, delicate bones even can crushed by these jaws [5].

Their predatory scenario starts with an active hunt, using visual, pedipalps, as well as soil vibrations to locate the exact location of the prey [4]. After finding the prey, they may hold it by their pedipalps or chelicerae according to size and type of the pray [6]. The prey then mechanically fragmented by the powerful chelicerae through alternating movements that macerate its tissues and extract the liquefied body contents, allowing the solifugae to extract nutrients before swallowing [4].

Camel spider is known for its broad diet, feeding on various and different preys such as insects, other spiders, other arthropods, as well as scorpions. Some species have been observed preying on small vertebrates like rodents, lizards, and small birds, demonstrating their ability to utilize diverse nutrition sources [4]. While most of them are generalist predators, some show dietary specialization, especially those that mainly feed on termites [7]. Prey selection depends on a set of characteristics, the most prominent of which are the size of the prey, the degree of rigidity of its outer shell, and the ease of reaching and catching it. In general, predator preference tends to be lower towards large prey with stiffer structures compared to small and less rigid prey. [8].

Despite the too many studies about solifugae biology and their behavior, most studies focus on the natural history and predatory activities of specific species, leaving limited information on feeding behavior and prey preference, especially for species presence in the Middle East region [3].

Information of solifugae in Iraq is generally limited, the previous researches mainly covering species recording and their distribution, without mentioning about their biology, ecology, and behavior. Locally, no researches have studied the prey preference or feeding behavior for any solifugae species. Due to *Galeodes turcmenicus* was recently added to the Iraqi fauna [9], The present study was aimed at studying the digestive behavior and predation of *Galeodes turcmenicus* Birula, 1937 (Solifugae: Galeodidae) in laboratory conditions. In particular, the study was aimed at assessing *G. turcmenicus*' food reaction to different prey species, determining prey preferences, and studying the effects of prey characteristics, especially size, exoskeleton hardness, and ease of capture, on the selection of production. The study also aimed to provide insights into the nutritional ecology of this species and contribute to a better understanding of its predatory behavior in controlled laboratory settings.

2. Materials and Methods

2.1 Specimens collection

Adult specimens of *Galeodes turcmenicus* were collected from four localities in Dhi Qar Province, southern Iraq, namely Karma Bani Saeed, Al-Tar, Al-Fuhud, and Al-Islah districts (Figure 1), between June 2025 and May 2026. Sampling was conducted at night using handheld flashlights. Captured specimens were individually collected by hand and transported alive to the laboratory for subsequent experimental procedures.

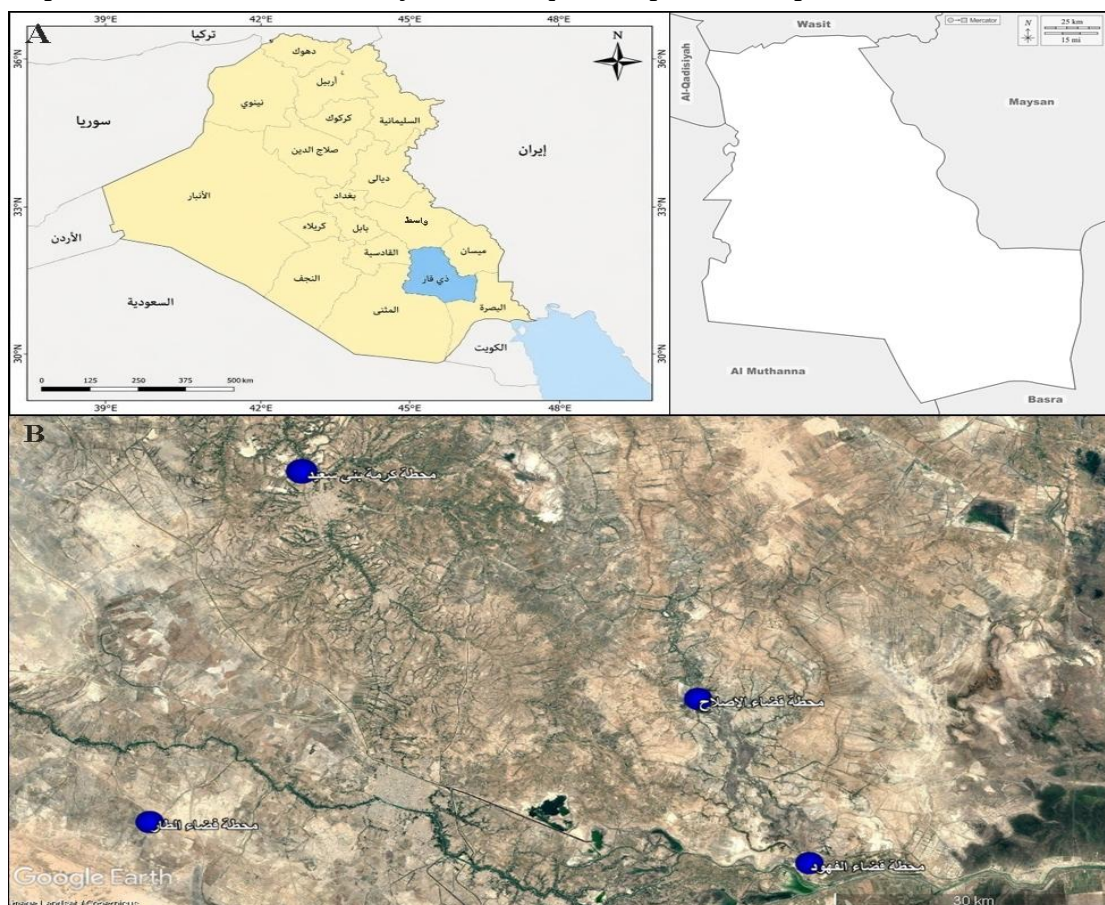


Figure-1 Map of Iraq, showing the specimen collection of *Galeodes turcmenicus*, from Thi-Qar Province including circles, Al-Tar , Karmat Bani Saeed ,Al-Fhood, and Al-Islah. The map was prepared by the authors based on the sampling data collected during the present study.

2.2 Laboratory maintenance

Upon arriving at the laboratory, each specimen was placed separately in a clear plastic container measuring $30 \times 20 \times 20$ cm. A 5-cm layer of soil from the same collection site was added to mimic the natural environment. The specimens were kept under lab conditions at temperatures between 24 and 30°C with about 20% relative humidity. All containers were well ventilated during the experiment.

2-3 - Feeding experiment

A feeding experiment with 16 adults of *Galeodes turcmenicus* was carried out. Before testing, all were starved for 72 hours to standardize hunger levels. Seven prey types from different taxonomic groups were used to assess prey preference: locusts (*Schistocerca* sp.), field crickets (*Gryllidae*), wolf spiders (*Lycosidae*), house flies (*Musca* sp.), American cockroaches (*Periplaneta* sp.), house geckos (*Hemidactylus* sp.), and darkling beetles (*Tenebrionidae*). Prey sizes ranged between 8 to 30 mm as shown in Table 1. Each prey type

was offered individually to every experimental sample, with Seven prey types per examined spider. A 72-hour time interval was kept between feeding trials to reduce the impact of prior meals on prey preference and acceptance. Prey acceptance was determined by noting whether each prey was partially or fully eaten. The predation rate (%) was calculated by dividing the number of preys consumed by the total prey offered for each experimental sample.

2. 4 Feeding behavior observations

Feeding behavior was monitored throughout each experiment, starting with the presentation of the prey till finally with the end of feeding. Observations steps consisted of prey detection and capture methods, the appendages involved in holding the prey, the initial attack point, prey-handling techniques, and the feeding's duration. After 24 hours (one day), any uneaten prey or prey remains were removed to prevent contamination, fungal growth and ensure hygienic conditions. Selected feeding viewers were photographed during the experiments as shown in Figure 2.

2.5-Statistical Analysis

The data were analyzed using single variance analysis (One-way ANOVA) by IBM SPSS Statistics, and the statistical significance level was adopted at ($P \leq 0.05$)

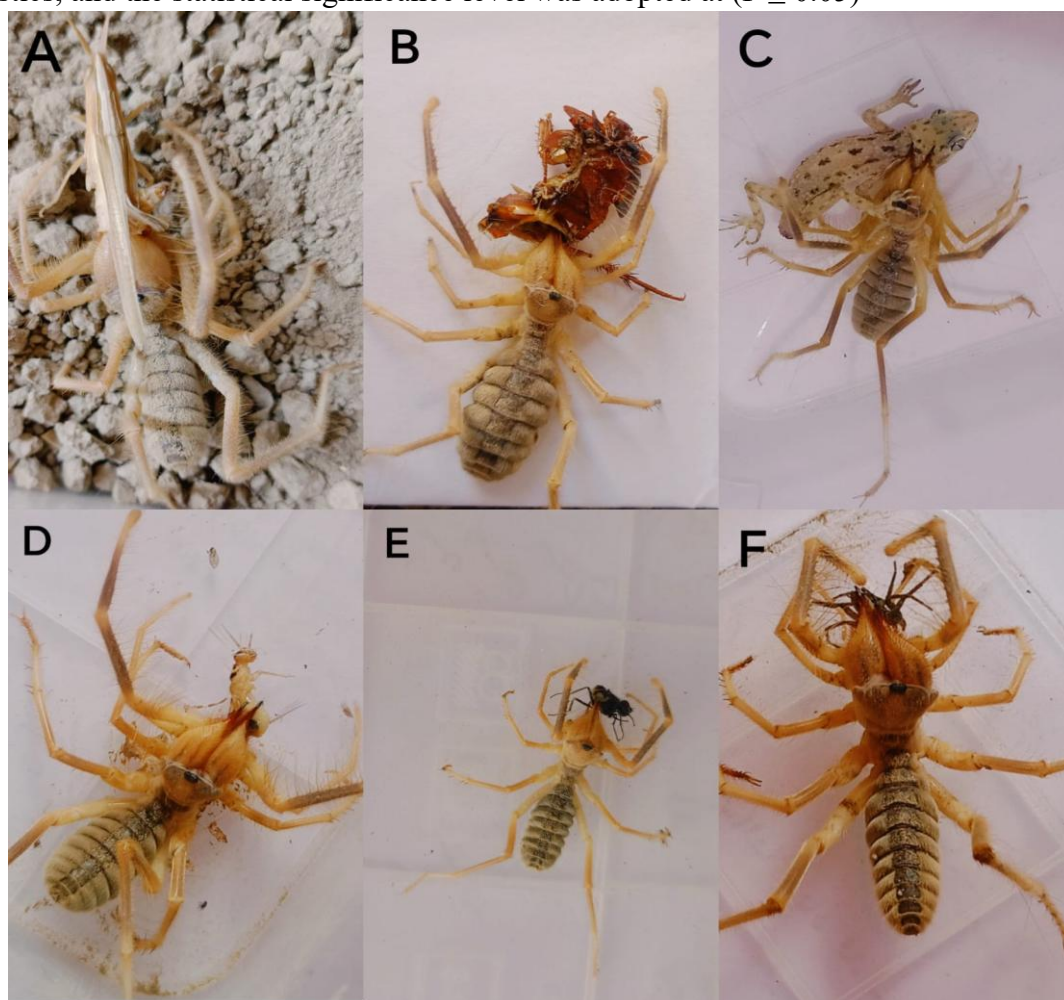


Figure -2 Feeding behavior and feeding of *Galeodes turkmenicus* on different prey types. A: grasshoppers, b: American cockroach, c: *Hemidactylus turkicus*, d: Oriental cockroach, e: *Musca* sp, f: wolf spider

3. Results

3.1 Prey preference

The laboratory feeding experiment shows significant differences in prey acceptance of *Galeodes turcmenicus* when provided with 7 prey types (Figure 3). Locusts showed the highest acceptance rate of (100%) with all 16 individuals consumed. Field crickets followed, with a 93.8% acceptance rate (15/16). Wolf spiders and house flies both had acceptance rates of 87.5% (14/16). American cockroaches were less frequently eaten, with a 56.3% acceptance rate (9/16), while geckos showed the lowest acceptance among consumed prey at 37.5% (6/16). No predation was observed on darkling beetles (*Tenebrionidae*), resulting in a 0% acceptance rate. The corresponding data for prey size, numbers offered and consumed, and acceptance rates are summarized in Table 1.

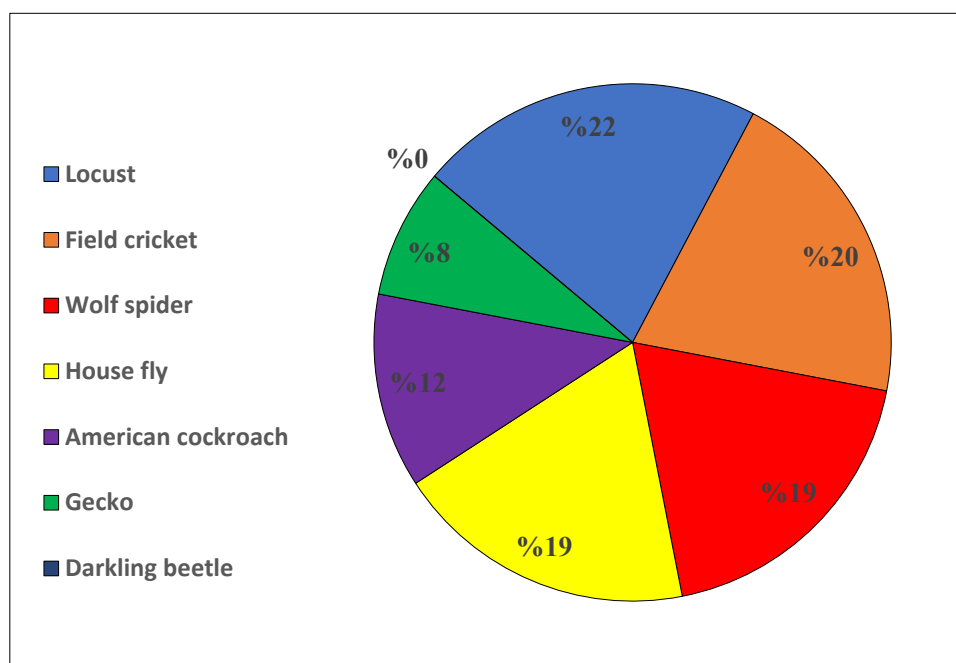


Figure -3 Prey acceptance rates of *Galeodes turcmenicus* for different prey types under laboratory conditions where percentages represent a maximum and minimum predation rate.

Table 1- The following table shows prey selection by *Galeodes turcmenicus* based on predation success under laboratory conditions, as well as prey species width, number of prey provided and consumed, prey size, and predation success rate.

Prey type	Taxon	Prey length (mm)	No. offered	No. consumed	Predation rate (%)
Locust	<i>Schistocerca</i> sp.	20.0	16	16	100.0
Field cricket	Gryllidae	11.0	16	15	93.8
Wolf spider ⁴	Lycosidae	11.0	16	14	87.5
House fly	Musca sp.	8.0	16	14	87.5
American	<i>Periplaneta</i> sp.	25.0	16	9	56.3
cockroach	<i>Hemidactylus</i> sp.	30.0	16	6	37.5
Gecko	Tenebrionidae	21.0	16	0	0
Darkling beetle					

3.2 Predatory Response to Different Prey Types

Laboratory observations showed that *G. turcmenicus* consistently followed a characteristic sequence of prey capture and feeding behavior. The general feeding sequence observed during all successful feeding events is summarized in Figure 4. When a live prey was offered and put into the experimental container, rapidly, individuals directed toward the prey and started an attack. The prey was first held by the pedipalps and then transferred to the chelicerae, where it was firmly restrained. Particularly in insects, feeding began with a bite to the anterior part of the prey. The chelicerae deal with soft tissues, which were subsequently ingested, whereas heavily sclerotized body parts were usually neglected. Although the general feeding sequence and behavior seems similar across all prey types, handling differed. *G. turcmenicus* rapidly attacked and consumed field crickets, locusts, house flies, and wolf spiders, while American cockroaches occasionally induced a brief hesitation before capture, but were eventually hunted and consumed. Geckos elicited the slowest predatory response, often requiring many attack attempts before being captured. In some cases, feeding was initiated but abandoned before completion. Darkling beetles also elicited an immediate predatory response. Individuals grasped them with the chelicerae but consistently released them shortly after contact, and no feeding was observed.

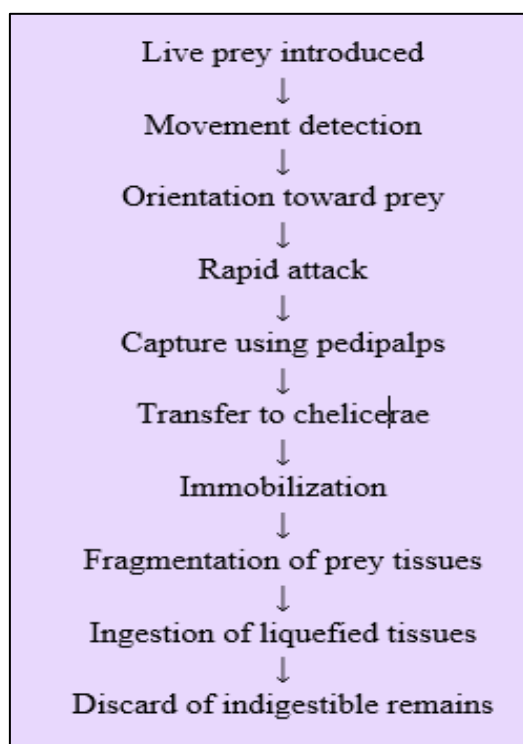


Figure -4 General sequence of prey capture and feeding behavior in *Galeodes turcmenicus*.

3.3 Statistical analysis

A Pearson's chi-square test indicated highly significant variations in prey acceptance among the seven prey types offered to *G.turcmenicus* in laboratory conditions ($\chi^2 = 57.91$, $df = 6$, $P < 0.001$). Pairwise Fisher's exact tests with Bonferroni correction revealed that locusts were significantly more accepted than geckos and darkling beetles. Likewise, field crickets showed significantly higher acceptance than geckos and darkling beetles. Wolf spiders, house flies, and American cockroaches also differed significantly from darkling beetles. No significant differences were found among the other prey types after applying the Bonferroni correction.(Table 2)

Table 2. Statistical comparison of predation success among prey types using Pearson's chi-square test.

Prey type	Predation rate (%)
Locust	100.0 ^a
Field cricket	93.8 ^a
Wolf spider	87.5 ^{ab}
House fly	87.5 ^{ab}
American cockroach	56.3 ^{bc}
Gecko	37.5 ^c
Darkling beetle	0.0 ^d

^{a, c, d} تشير الى وجود فرق معنوي في معدلات الافتراس = ^{ab} ، تشير الى وجود فرق معنوي في معدلات الافتراس = ^{a, c, d}

4. Discussion

The present study shows that *G. turcmenicus* exhibited clear differences in prey acceptance among the prey types tested. Locusts (*Schistocerca* sp.) were fully accepted, whereas field crickets (*Gryllidae*), house flies (*Musca* sp.), and wolf spiders (*Lycosidae*) showed high acceptance rates. These results indicate that prey acceptance was selective rather than uniform across the different prey types.

Although *G. turcmenicus* preys on various taxonomic groups, its prey's acceptances with the American cockroach (*Periplaneta* sp.) and the gecko (*Hemidactylus* sp.) notably decreased. This pattern agrees with previous study results that predation success depends on predator-prey interactions rather than the prey type only [7]; [10]. Feeding success may be impacted with the variations in how prey are handled, even when prey are widely available and abundant. This behavioral adaptability enables solifuges to target a wide prey spectrum while remaining selective based on prey suitability [8].

The Complete rejection (acceptance rate of 0%) of darkling beetles (*Tenebrionidae*) was one of the most notable findings of this study. This finding is consistent with previous evidence explained that prey availability does not necessarily result in prey acceptance. [11] reported a rejection of *Hypoprepia fucosa* that captured by individuals of the *Eremobates scaber* species group, this means that prey acceptance is affected by prey characteristics even after successful prey capture process. Similarly, [8]; [10] emphasized that feeding behaviour in solifuges was determined by the prey characteristics that play an important role in this issue. The complete rejection of *Tenebrionidae* in the present study provides additional evidence that prey selection in camel spiders is an active behavioral process rather than a simple response to prey confronting.

The feeding pattern observed in this study is consistent with previous researches, confirming that solifuges are opportunistic and selective predators at the same time, their feeding behavior depends on prey's characters and the efficiency of the predator [8]; [10]; [7]. This study also represents the first experimental insights into prey preferences of *G. turcmenicus*, that is a species whose feeding behaviors were largely unknown. As shown in [3], many aspects of Solifugae's natural history and feeding ecology remain poorly studied and understood, in spite of their ecological significance in terrestrial environments. Therefore, it is suggested for additional field studies along with experimental work with a wide range of prey types, are essential for enhancing the understanding of prey selection and trophic dynamics in *G. turcmenicus* and other Solifugae species.

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