

Gryllus bimaculatus De Geer, 1773 in the Temperate Forest of Sikkim Himalayan Region

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Abstract

Gryllus bimaculatus De Geer, 1773 is the one of the subtropical and tropical species which is distributed in the different parts of the world. It is used as the live food for many amphibians and reptiles. Certainly, its nutritional data also attracted many farm developers and researchers. It has several essential compositions where 15 g of its powder contains cholesterol (35 mg), sodium (55 mg), total carbohydrate (<1 g), dietary fiber (<1 g), protein (8 g), calcium (20 mg), iron (167 mg) and potassium (150 mg). In addition to this, this species is used for the neurological and toxicity studies in many scientific works. At the amidst, this writing has the reporting of this species from temperate forest of Sikkim Himalaya, which was not reported earlier.

Keywords: Cricket, *Gryllus bimaculatus*, Sikkim Himalaya

INTRODUCTION

Gryllus bimaculatus an African–Mediterranean Field cricket that has spread across China, Indonesia, Borneo, and other parts of the world with the advent of time [1–3] and is a species of tropical and sub-tropical regions of Asia, Africa, and Europe [1].

This edible species that contains crude protein 54.10%, 6.90% crude fiber, 26.40% fat, and 78.90% total digestible nutrients, as well as essential amino acids such as methionine, lysine, histidine, valine, and leucine [4, 5]. Further, it has several essential compositions where 15 g of its powder contains cholesterol (35 mg), sodium (55 mg), total carbohydrate (<1 g), dietary fiber (<1 g), Protein (8 g), calcium (20 mg), iron (167 mg) and potassium (150 mg) (<https://jrunique.com>). Therefore, it is considered a live food for pet animals, amphibians, reptiles, and fish [6, 7]. Additionally, this species plays a role in inflammation and liver dysfunction [8]. In addition, it has been used as an anti-cancer [9]. It has also been reported that this species causes damage to potato, cotton, rice, millet, and sugarcane crops [10]. In Saudi Arabia, *Gryllus bimaculatus* De Geer is considered a pest because of an occasional outbreak on farmlands.

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Received Date: August 20, 2024
Accepted Date: August 29, 2024
Published Date: September 4, 2024

Citation: Durga Kumar Pradhan. *Gryllus bimaculatus* De Geer, 1773 in the Temperate Forest of Sikkim Himalayan Region. Research & Reviews: Journal of Veterinary Science and Technology. 2024; 13(2): 14–17p.

Even so, *G. bimaculatus* De Geer has been extensively used in areas such as neurobiology, insect physiology, reproduction, and behavior since the 1960s [11–13]. Therefore, it is a scientific tool or model used in various studies.

This writing is the recording of *Gryllus bimaculatus* De Geer in the Sikkim Himalaya up to an elevation of 6000 feet in a temperate forest.

Specimen Examined

Gryllus bimaculatus De Geer, 1773 (Figure 1)
Gryllus bimaculatus various studies m. Ins., 3: 521.



Figure 1. *Gryllus bimaculatus* De Geer, 1773.

Material examined: Upper Burtuk, Gangtok, and Sikkim. Coll. D.K. Pradhan.

Date: 14. August, 2024.

Distribution: Fambong Lho Wildlife Sanctuary, Burtuk, Luing.

GPS location: 27.3569N–88.615E.

Elevation: 1583 m

There are several scientific publications on this species, which are used for scientific studies in neurobiology, immunology, etc. To enrich these aspects, some studies were included in this review. The results were outstanding in one of the studies of macrophage cells with *Gryllus bimaculatus* water extract at different concentrations (31.25, 62.5, 125, 250, 500, and 1,000 $\mu\text{g}/\text{mL}$). The data obtained after 24 h showed no cytotoxicity at concentrations between 31.25 and 1,000 $\mu\text{g}/\text{mL}$ [14, 15]. Similarly, it was also observed that the production of cytokines increased after treatment with 250 and 500 mg/mL . *Gryllus bimaculatus* water extract. The production of cytokines was, therefore, dependent on the *G. bimaculatus* water extract concentration in RAW 264.7 cells. Thus, the experiment concluded that *G. bimaculatus* water extract could induce macrophage activation through cytokine production and show immunological activity [14].

In addition, there have been reports on the anticancer properties of *Gryllus bimaculatus* where, where the molecular pathways responsible for apoptotic effects on cancer cells have been analyzed [16, 9]. Lim and Byun, 2021 [9] treated cells with *G. bimaculatus* water extracts at 250 or 500 $\mu\text{g}/\text{mL}$ for 24 h, and its Bcl-2 family proteins were studied, and their data indicated that water extracts of *Gryllus bimaculatus* prevented the induction of apoptosis in H460 human lung cancer cells. In this study, it was concluded that the water extract of this species has tremendous potential for treating lung cancer.

The team of Sardari [17] studied the cricket protein fractions based on their solubility and [18] studied the case with some modification, taking 200 g of fresh cricket in de-ionized water (1:5 *w/v*) and extracted using deionized water, 5% NaCl, 0.1 M NaOH, and 70% ethanol. During this process, all supernatants were centrifuged to collect the precipitate and lyophilized. In this study, the less than 3 kDa fraction was separated into distinct fractions by size-exclusion chromatography. Using a Sephadex G-25 gel filtration column, the setup was run at a flow rate of 5 mL/min at 220 nm and 280 nm absorbances, and the results were analyzed and identified using the MS peaks of LC-MS [19].

Note that the experiment used the lyophilized peptide powder dissolved in 0.1% formic acid in water (0.2 $\mu\text{g}/\text{mL}$), which was injected into the instrument having ESI ion source operated at 3.2 kV. The technical details of the equipment are as follows: column temperature 60°C during the separation and the use of mobile phases such as high-grade water with 0.1% formic acid (A) and acetonitrile with 0.1% formic acid (B). The separation of the compounds was performed in the gradient elution program where 0 min, 95% A, 15 min, 60% A, 20 min, 20% A, 25 min, 5% A, and 35 min, 95% A to obtain MS-acquisition of LC-MS. This study reported ten antioxidant peptide sequences with molecular weights

of 359.23–721.37 Da. The results showed the presence of bioactive peptides containing hydrophobic and essential amino acids such as leucine and alanine. Since the presence of peptide sequences with hydrophobic and aromatic amino acids exhibits strong antioxidant potential [20, 21], the availability of similar peptide sequences in *Gryllus bimaculatus* strongly confirmed the occurrence of antioxidant properties of *Gryllus bimaculatus* lyophilized peptide powder [22, 23].

Given these facts, it was ascertained that *Gryllus bimaculatus* contains a high source of protein with therapeutic value. Several reports have documented the presence of 70.6% protein in the extract, with glutelin content being the highest. Subsequently, [18] reported the presence of prolamin, albumin, and globulin was reported. Hence, they are a good source of edible bioactive peptides. This study has back-to-back support to other studies where there were publications on highly rich protein cricket meals. Furthermore, *Gryllus bimaculatus* can also reduce the protozoal population and mitigate methane production [4].

CONCLUSION

Gryllus bimaculatus De Geer is a tropical and sub-tropical species of regions such as Asia, Africa, and Europe, and has been used as a scientific organism in neurobiology and physiology studies since 1960. However, this subtropical and tropical species appears at a higher altitude of the Sikkim Himalaya and reaches a height of 6000 feet, which might be due to the global climatic effect. However, the habitat of *Gryllus bimaculatus* De Geer is mostly in tropical regions with a reproductive cycle of 40–50 days at around 28°, where the female lays 1000 eggs in her lifetime. Having said this, it was observed that the increase in the Himalayan region's temperature and other adipogenic factors led to a shift in the habitat of many creatures. Therefore, the rise in temperature due to climatic effects in the Himalayan region might have encouraged the cricket *Gryllus bimaculatus* De Geer to spread across the temperate region of the Himalayan belt. Thus, this writing encompasses the recording of this species in the temperate forest of the Sikkim Himalaya, but it further warrants research on its impact and economic roles in the Sikkim Himalaya.

Acknowledgment

The author thanks the Forest and Environment Department, Government of Sikkim, for the valuable support and extend thanks to Triansh Maske for the valuable recording of evidence in the forest-fringed area.

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