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Original Article

First report of the white-spotted stink bug, *Eysarcoris ventralis* (Westwood, 1837) (Hemiptera: Pentatomidae) infesting rice agroecosystems in northern Thailand

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Abstract

Insect pests, especially various sucking insects, present significant threat to rice production worldwide including Thailand. This research remarks, for the first time, the occurrence of the white-spotted stink bug (*Eysarcoris ventralis* Westwood, 1837) in rice fields in northern Thailand. We conducted surveys in 304 rice fields across 12 provinces, collecting data on cultivation practices, water management systems, and rice growth stages, while also recording samples of both nymphs and adult rice pests. The surveys revealed that 26.64% of rice fields were infested by *E. ventralis*. Morphological analysis confirmed the insect is a member of the genus *Eysarcoris,* family Pentatomidae. Broadcasting rice fields reported an infestation level at 70.37%, while irrigated rice fields showed a 77.78% of infestation. Ecological factors, such as high moisture, dense plantings, and continuous planting create a favorable condition for the spread of this insect. The susceptible stages of rice are the booting and heading stages. During these stages, both nymphs and adults feed on leaves, stems, and especially developing grains This feeding results in damaged seeds and reduced yields. Six surrounding grass weeds were also found to be alternative host plants for development and off-season survival. Our results emphasize the significance of the white-spotted stink bug, *E. ventralis*, as a new emerging insect pest of rice in Thailand.

Keywords: White-spotted stink bug, *Eysarcoris ventralis*, Insect pest infestation, Rice insect pest, Sporadic pest

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Introduction

Insect pests pose a significant threat in rice fields, leading to considerable crop losses and higher production costs. Stink bugs (Hemiptera: Heteroptera: Pentatomidae) have long been recognized as a major pest that impacts a range of economically significant crops worldwide (McPherson and McPherson, 2000). Their feeding behavior causes damage to fruits, seeds, leaves, and stems, which considerably decrease crop yield and quality (Panizzi et al., 2000). At least 17 species from nine different genera have been recorded as major pests of rice (Singh and Tiwari, 2020). In Thailand, some notable insect pests are non-native species that have migrated into the country, for example, rice black bug (*Scotinophara coarctata* Stål) (Ruayaree, 2001; Joshi et al., 2007; Lawanprasert, 2017; Rice Research and Development Division, Rice Department, 2023).

Recent preliminary surveys in various rice-growing areas of northern Thailand have uncovered a significant threat of an unreported insect pest, known as the white-spotted stink bug, *Eysarcoris ventralis* (Westwood, 1837) (Hemiptera: Pentatomidae). In some rice fields infested by this pest, the damage observed is comparable to that caused by the rice black bug (*S. coarctata*) or the brown planthopper (*Nilaparvata lugens*). The feeding behavior of this elusive insect closely resembles that of the rice black bug (S. *coarctata*). A report in Thailand by the Rice Research and Development Division, Rice Department (2023) identified this insect as a pest of wheat along with *Nezara viridula*, and *Pygomenida varipennis*. Of these, *E. ventralis* infests wheat across all growth stages and parts of the plant, especially destroying grains, which results in grains that are either shriveled or incomplete. Nonetheless, there have been no documented cases of this insect being classified as a pest in rice fields in Thailand so far.

The white-spotted stink bug, *E. ventralis*, has been reported as an insect pest of various economical crops, including cotton, soybean, wheat, rice, and upland rice, similar to the other members of this genus, *E. aeneus* and *E. trimaculatus* (Ito, 1978; Learmonth, 1980; Linnavuori, 2008). This stink bug is distributed across several regions, including Tropical Africa, Central Europe, the Mediterranean, the Middle East, Hawaii, Australia, and Central Asia (Wood and McDonald, 1984; Rider, 2006; Jalaeian et al., 2019). Rice-growing countries in Asia such as China, Japan, Korea, India, Bangladesh, Myanmar, Malay Peninsula and Iran, have reported the infestation of the white-spotted stink bugs (Linnavuori, 2008; Nasiruddin and Roy, 2012; Salini and Viraktamath, 2015; Jalaeian et al., 2019; Rider et al., 2022).

The widespread distribution of the white-spotted stink bug can be attributed to human activities, such as the transportation of infested agricultural products as well as natural dispersal. This insect is considered as an outstanding flyer, its capability of migration is considerably possible (Simov and Antonov, 2006). The adult stage can hibernate among weeds or within leaf litter during harsh winters in sub-montane regions. In Europe, several plant families play an important role as alternative host plants that facilitate their lifecycle (Derjanschi and Péricart, 2005; Linnavuori, 2008). Since there were reports of this insect pest in the rice fields of neighboring countries in Asia, Thailand may not be an exception.

To date, there have been no documented reports of the white-spotted stink bug, *E. ventralis*, infesting rice fields in Thailand, although it has been noted as a pest of wheat (Rice Research and Development Division, Rice Department, 2023). Nonetheless, our preliminary surveys have discovered this previously undocumented insect pest in rice-growing regions in the North of Thailand. Therefore, our study outlines the infestation of this new rice insect pest, highlighting its morphological characteristics, distribution based on field characteristics, and damage patterns. The present data can help assess the potential threat this insect poses to rice cultivation in Thailand. This assessment will inform future monitoring and management strategies.

Material and Methods

Insect surveys and collections

The rice field surveys were carried out throughout 12 provinces in the northern region of Thailand, including Phitsanulok, Nakhon Sawan, Uthai Thani, Phichit, Phetchabun, Kamphaeng Phet, Uttaradit, Tak, Sukhothai, Lamphun, Lampang, and Chiang Mai. Insect samples were collected using insect sweeping nets with a randomized sample technique. Collected adult bugs were preserved in 60% alcohol for subsequent morphological examinations, while nymphs were kept in separate plastic containers. They were transferred to the Entomology Laboratory at the Department of Biology, Faculty of Science, Naresuan University, for additional studies.

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Rearing of the white-spotted stink bug
Nymphs of the white-spotted stink bug collected from the field were reared in mesh cages which were kept under controlled conditions at the temperature of 25±2°C and a relative humidity of 60±10%, and the insects were exposed to 12 hours of light and 12 hours of darkness. In each cage (95 × 126 ×110 cm), potted rice plants in the tillering stage (30-50 days old) were placed to provide the suitable environment and nourishment to the rearing bugs. The potted plants were changed when they turned yellow or degenerate to ensure optimal conditions. The stink bug nymphs were reared in cages until they reached adulthood. Approximately 100 nymphs were kept in each cage, with a total of 3–4 cages maintained during the study period. The adults were carefully collected and preserved for morphological examination.

Morphological studies and identification
Adult stink bug specimens collected from field surveys and rearing were examined for their morphological characteristics. Each characteristic of the bugs was meticulously studied and compared according to the descriptions from relevant sources using a stereo microscope to assist with their identification. The references for identification consisted of Barrion and Litsinger, 1994**;** Biswas et al., 2014; Pal et al., 2023; Salini, 2019; Salini and Viraktamath, 2015; Wood and McDonald, 1984. The morphological characteristics examined included body size, features of the head, thorax, and abdomen, as well as the appearance of their appendages.

The white-spotted stink bug's life cycle study
The collected stink bugs were separated and individually kept in plastic rearing containers (15 × 7 × 5 cm). Each container was provided with moistened cotton, rice leaves, and panicles to provide nutrition and serve as an oviposition site for laying eggs. The duration and characteristics of each developmental stage were recorded.

Data collection in rice fields
Field surveys also recorded relevant data, i.e., damage patterns to the rice plants by visual observations and ratings, growth stages, cultivation methods, and irrigation practices.

Results

Insect surveys and collections
A survey of 304 rice fields across 12 provinces revealed that 81 fields (26.64%) were infested with white-spotted stink bugs (Table 1).

In this study, the white-spotted stink bug infestation occurrence strongly correlated with cultivation practices, water management, and rice growth stages. Broadcasted fields showed a relatively higher infestation rate (70.37%) compared to those of the transplanting method (29.63%). Additionally, water supply was a significant factor in infestation rate, as the irrigated fields showed a greater susceptibility to the attack by this stink bug (77.78%) compared to rain-fed fields (22.22%). Infestation levels increased with crop maturity. The seedling stage had the lowest infestation incidence at 7.41%, followed by the tillering stage (29.63%), while the heading and booting stages showed the highest infestation (62.96%).

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Table-1. Field counts and infestation percentages by white-spotted stink bug for each category.

Provinces	Number of surveyed fields	Number of infested fields	Cultivation Methods		Water System		Rice Growth Stage		
			Broadcasting	Transplanting	Irrigation	Rain-fed	Seedling	Tillering	Booting and heading
Phitsanulok	57	39	53	4	49	8	0	32	25
	Percentage (%)	68.42%	92.98%	7.02%	85.96%	14.04%	0%	56.14%	43.86%
Nakhon Sawan	10	7	6	4	7	3	0	3	7
	Percentage (%)	70%	60%	40%	70%	30%	0%	30%	70%
Uthai Thani	65	9	31	34	0	65	9	30	26
	Percentage (%)	13.85%	47.69%	52.31%	0%	100%	13.85%	46.15%	40.00%
Phichit	4	4	3	1	4	0	0	0	4
	Percentage (%)	100%	75%	25%	100%	0%	0%	0%	100%
Phetchabun	17	1	0	17	17	0	4	12	1
	Percentage (%)	5.88%	0%	100%	100%	0%	23.53%	70.58%	5.89%
Kamphaeng Phet	20	5	18	2	20	0	0	7	13
	Percentage (%)	25%	90%	10%	100%	0%	0%	35%	65%
Uttaradit	23	10	10	13	16	7	0	17	6
	Percentage (%)	43.47%	43.47%	56.53%	69.57%	30.43%	0%	73.91%	26.09%
Tak	20	0	14	6	0	20	0	20	0
	Percentage (%)	0%	70.00%	30.00%	0%	100%	0%	100%	0%
Sukhothai	18	0	18	0	15	3	0	8	10
	Percentage (%)	0%	100%	0%	83.33%	16.67%	0%	44.44%	56.56%
Lamphun	15	1	0	15	9	6	5	0	10
	Percentage (%)	6.67%	0%	100%	60.00%	40.00%	33.33%	0%	66.67%
Lampang	34	3	0	34	19	15	11	23	0
	Percentage (%)	8.82%	0%	100%	55.88%	44.12%	32.35%	67.65%	0%
Chiang Mai	21	2	0	21	13	8	2	19	0
	Percentage (%)	9.52%	0%	100%	61.90%	38.10%	9.52%	90.48%	0%
Total fields	**304**	81	153	151	169	135	31	171	102
Percentage (%)	**100%**	26.64%	50.33%	49.67%	55.59%	44.41%	10.20%	56.25%	33.55%

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Morphological characteristics of the white-spotted stink bug

The white-spotted stink bugs *were* identified as *Eysarcoris ventralis (Wetswood*, 1837) based on morphological description. Their taxonomic classification is as follows:

Order Hemiptera
Family Pentatomidae
Subfamily Pentatominae
Tribe Eysarcorini
Genus *Eysarcoris*

A morphological analysis of the samples examined showed the following characteristics for *E. ventralis* (Figure 1)

General Appearance: Small-sized; body length approximately 5.5-6.5 mm, and width 3.7-3.8 mm.
Brownish to dark brown body with a slight yellowish tint.

Head: Triangular, dark brown to black. Width approximately 1.7-1.8 mm; length 2.1-2.2 mm
Numerous coarse dark punctures.

Eyes: Black, round compound eyes on the posterior end of the head, adjacent to the pronotum. Two simple red ocelli.

Antennae: Filiform with 5 segments covered with setae. Segments 1-3 yellow; segments 4-5 brown to dark brown. Antenna length approximately 3.4-3.6 mm.

Mouthpart: Piercing-sucking type; slender, with broad and pointed base and apex. Color ranges from brown to dark brown.

Thorax:

Pronotum: Hexagonal, hairless, yellowish-brown with two transverse black bands and scattered small black spots. Lateral margins are smooth. Width approximately 4.2-4.5 mm; length 1.7-2.0 mm.

Scutellum: Medium-sized with a rounded apex. A creamy white round spot is present at each basal angle, with additional scattered small black spots.

Wings: Forewing hemelytra, cuneus membranous apex transparent with brown spots, length 4.5-4.8 mm. Hindwings fully membranous.

Legs: Femur and tibia slender, yellowish-brown with scattered brown spots and setae. Tarsus dark brown.

Abdomen: Width 3.5-3.8 mm; length 2.6-2.9 mm. Sternum black, without a median longitudinal groove and pale-yellow lateral margins. One red band on the middle of the first and second abdominal segments.

Life Cycle

The white-spotted stink bug undergoes three developmental stages: egg, nymph, and adult. After mating, females began to lay eggs in clusters, with each batch containing around seven to fifteen eggs. Under laboratory conditions, the egg stage takes about five to seven days to hatch. After hatching, the nymphs develop with five instars over a period of 25 - 30 days. Subsequently molting into the adult stage, the stink bugs gradually began mating and laying eggs, with the adult stage lasting 30 - 50 days (Figure 2).

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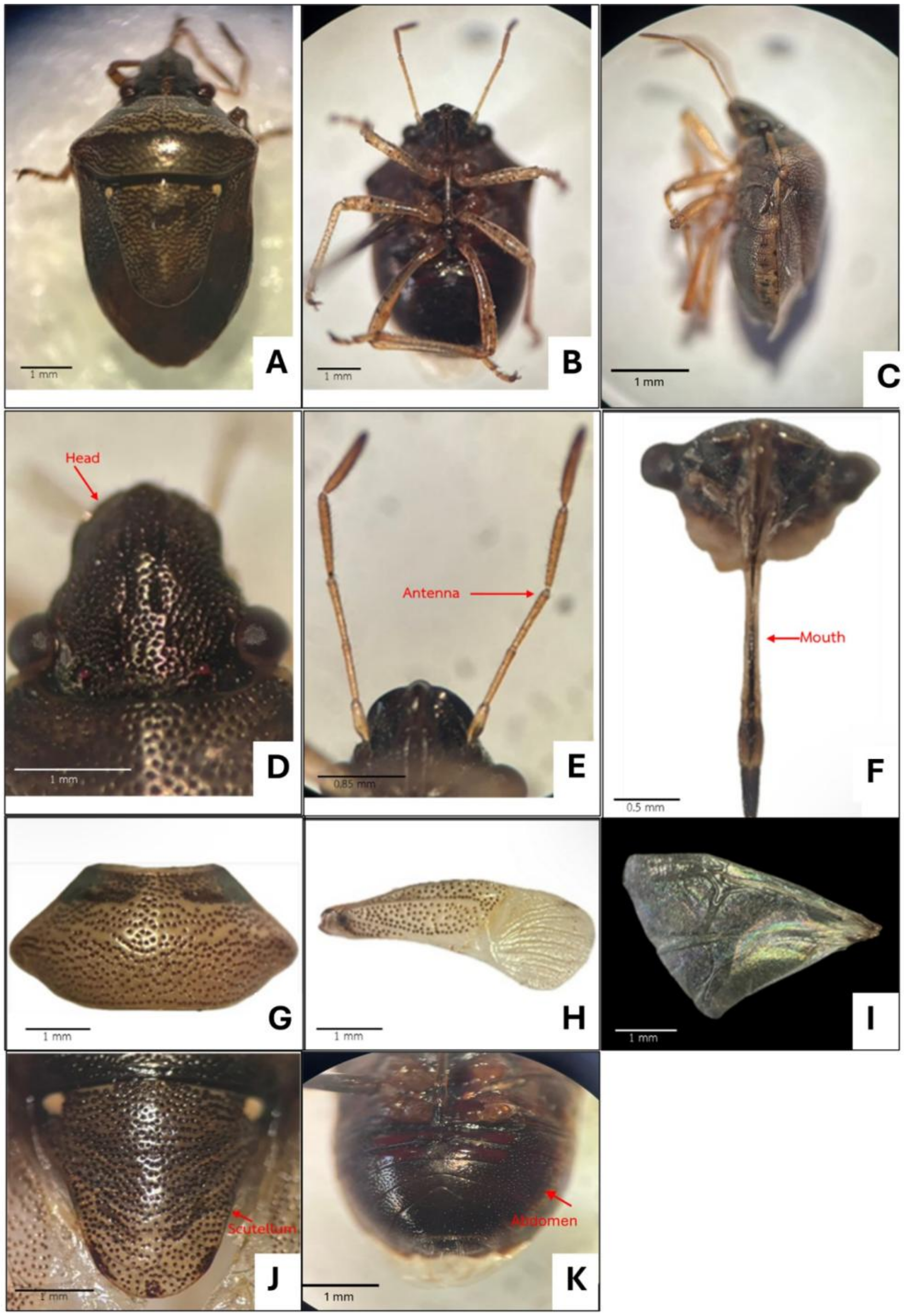

Figure-1. Morphological structures of a white-spotted stink bug (*E. ventralis*): A = adult habitus, B = ventral view, C = lateral view, D = dorsal view of head, E = antennae, F = sucking mouth part, G = ventral view of pronotum, H = hemelytral forewing, I = membranous hindwing, J = scutellum, K = dorsal view of abdomen.

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Figure-2. Different developmental stages of the white-spotted stink bug: A = nearly hatched eggs, B = nymphal stage, C = adult, D = mating of male and female adults.

Damage pattern of rice plants

Our field surveys noted that both nymphal and adult stages of *E. ventralis* utilize their piercing-sucking mouthpart to puncture and extract sap from rice plants. Their infestations affect all stages of rice development, from seedlings to the heading stage, until grain filling stage. They attack various parts of the plants, including tender stems, leaves, and developing grains. Although damage can be caused by both stages, adult stink bugs usually cause more severe damage due to their extended feeding durations.

The highest levels of infestations were recorded during the booting and heading stages of rice plants, followed by the tillering stage, while the seedling stage experienced the lowest infestation rates (Table 1). During both the seedling and tillering phases, feeding by this insect on leaves, leaf sheaths, and stems causes wilting of leaf tips and a yellowing of leaves and stems. In the heading stages, *this bug* is commonly found to attack the newly developing grains, including partially matured grains. Grains that are infested show puncture marks and dark brown to black discoloration. The infestation may cause severe damage to the grains and ultimately resulted in a reduction in yield (Figure 3).

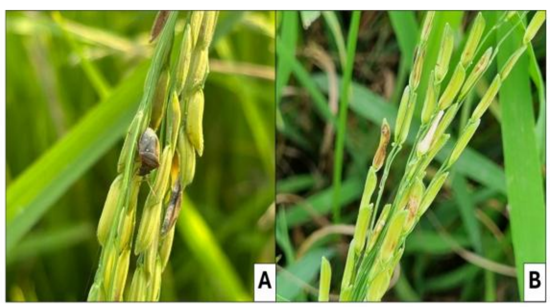

Figure-3. Rice grain damage caused by the white-spotted stink bugs: A = a white-spotted stink bug feeding in immature rice grain, B = the damaged rice grains.

In addition, this stink bug has been observed infesting a range of grass weeds surrounding rice fields. These grass species included Egyptian crowfoot grass or Beach wiregrass (*Dactyloctenium aegyptium*), Chinese sprangletop (*Leptochloa chinensis*), Barnyard grass (*Echinochloa crus-galli*), Wrinkle duck-beak grass (*Ischaemum rugosum*), Jungle rice (*Echinochloa colona*), and Weedy rice (*Oryza sativa* f. *spontanea*) (Figure 4). This indicates that the white-spotted stink bug does not depend solely on rice plants; it may also utilize various grass species as alternative hosts for laying eggs and off-season survival.

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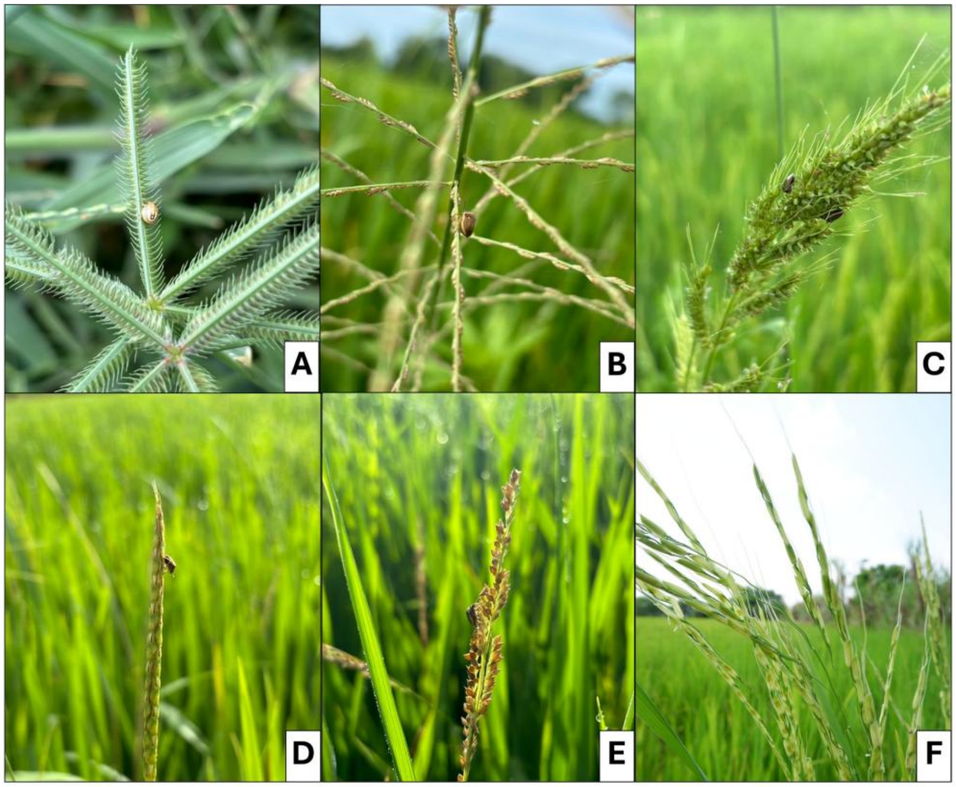

Figure-4. Weeds as alternative hosts for white-spotted stink bugs: A = Egyptian crowfoot grass (*Dactyloctenium aegyptium*), B = Chinese sprangletop (*Leptochloa chinensis*), C = Barnyard grass (*Echinochloa crus-galli*), D = Wrinkle duck-beak grass (*Ischaemum rugosum*), E = Jungle rice (*Echinochloa colona*), F = Weedy rice (*Oryza sativa* f. *spontanea*).

Discussion

Worldwide, stink bugs (Hemiptera: Heteroptera: Pentatomidae) are one of the important insect pests of economic crops. These piercing-sucking insects have been reported as a significant pest of rice and its relatives in several countries (McPherson and McPherson, 2000; Marley et al., 2023). In Thailand, only the rice black bug (*S. coarctata*) has been reported as an invasive insect pest in rice fields since 1995 (Ruayaree, 2001). The white-spotted stink bug (*E. ventralis*) was recently documented as affecting wheat (Rice Research and Development Division, Rice Department, 2023); however, there are no recent records of it being a pest in rice.

Our results of the white-spotted stink bug infestations mark the first documentation of this pest's distribution across rice fields in northern Thailand. The low percentage of fields found with infestations (26.64%) suggested that they may only be considered as a minor pest at this time. Discussion with local farmers during the surveys revealed high usage of broad-spectrum insecticides, which provides a plausible explanation for the lower infestation rates observed in certain areas, especially those designated for commercial rice production. Farmers from these areas have indicated that the infestation of this insect occurred spontaneously, prompting regular applications of insecticides. Another reason for less concern may be because of overlapping of infestation or confusion with the rice black bug. Nevertheless, our surveys indicated that this insect is present across all surveyed locations. This suggests that its distribution may be similar to that of the rice black bug. Unexpectedly, our study revealed very few occurrences of rice black bug infestations, except for one location in Phitsanulok province in the lower northern Thailand. However, no co-occurrence of these two insect species was observed through our surveys.

According to data on rice insect pests in Thailand, no reports of this pest are available to date. We, therefore, propose a new report on the two-spotted stink bug's infestation in our rice fields. The occurrence of this pest across rice-growing areas may be attributed to various factors, such as seasonal movements – including being carried by the wind during the monsoon season – or accidental transmission through human activities. This was reported in Hawaii, as the insect was recorded as a new introduced species resulting from human introduction discovered in 1972 (Beardsley, 1979), and elsewhere (Rabitsch, 2008). In addition to human-mediated introductions, the expansion of agricultural produce markets and risks of climate change may promote the spread of invasive insect species, which could contribute to the increase in agricultural produce's damage (Bradshaw et al., 2016). The white-spotted stink bug could have potentially invaded Thailand via natural migration stimulated by seasonal monsoons or other means similar to those reports in other regions' invasions (Beardsley, 1979; Rabitsch, 2008). Therefore, it is important to monitor this newly identified pest distribution to prevent potential threats to rice cultivation.

Based on the data collected, we discovered that the insects inhabit the rice fields starting from the tillering stage. The damages increase when the infestation occurs during the booting and heading stages as they destroyed the developing seeds, leading to damage of rice seeds and resulting in yield losses. Both adults and nymphs have been reported feeding on panicles during the early ripening stage, including the milky and dough stages (Jalaeian et al., 2019). The damage caused by *E. ventralis* differs from *S. coarctata*. *S. coarctata* attack rice during the seedling stage through the tillering stage and up to the ripening stage and primarily found at the lower stems close to the ground, while *E. ventralis* is typically found on the upper part of the rice plants.

Moreover, the type of cultivation methods may also affect the degree of infestation in which broadcasting rice fields tend to be more infested by the insect pests than those transplanting fields. This may be due to the denser plant canopy that provides a more suitable habitat for the insects, is due to the dense rice plants in the paddy, like those reported by Katti and Padmavathi (2022). In the lower northern regions of Thailand, irrigation systems are well-maintained leading to continuously rice growing throughout the year. The observations showed that white-spotted stink bugs were commonly found in irrigated rice fields. This suggested that higher moisture levels typical of irrigated fields may be a significant factor contributing to the increased occurrence and outbreaks of this pest. From our observations it is indicated that *E. ventralis* infestations vary across rice-growing regions, potentially influenced by factors such as different rice varieties, local climate, planting practices, and insecticide uses. While infestations have been reported in both rain-fed and irrigated rice fields, the latter had higher infestations. Demis (2025) suggested that irrigated systems—with their higher moisture levels and continuous cropping—may create conditions conducive to pest proliferation However, further site-specific studies and empirical data are required to confirm these associations and to understand the extent to which irrigation systems contribute to the population dynamics of this pest.

We have observed several incidences of this insect pest, in both its nymph and adult satges, in the rice paddies and the surrounding vegetation. Since the white-spotted stink bugs are polyphagous insects, they can employ various plant species to ensure continuous feeding and support their developmental stages. Six different species of weed grasses have been observed being utilized for laying eggs and serving as feeding habitats. Our field surveys revealed that these weeds serve as temporary habitats for insects during the rice off-season, when rice plants are harvested and/ or during insecticide applications. The utilizations of alternative host plants have been reported in regions experiencing outbreaks, such as Europe and Asia, in which this insect tends to employ various plants, particularly Poaceae, Fabaceae, Brassicaceae, Cyperaceae, as well as other important plant families (Panizzi et al., 2000; Derjanschi and Péricart, 2005; Rider, 2006; Linnavuori, 2008; Jalaeian et al., 2019; Panizzi and Lucini, 2022). This adaptability emphasizes the pest's survival methods while also pointing out the possible difficulties it poses to agricultural practices and ecosystems.

Environmental changes, such as global warming, influence the distribution, abundance, phenology, and population dynamics in various insect species (Kiritani, 2007; Musolin, 2007). It is possible that these impacts may potentially occur in the white-spotted stink bug, *E. ventralis*. This could potentially affect population dynamics and may increase damage in rice production. However, due to limited documentation of this insect outbreaks in the country, further investigations are required, given the importance of Thailand as one of the major global rice producers.

Conclusion

Our study demonstrated the first report of *Eysarcoris ventralis*, the white-spotted stink bug, in rice fields in northern Thailand. The infestations were observed up to 26.64% of surveyed fields, particularly during the booting and heading stages of rice development. High infestation levels were associated with grain damage and potential yield reduction, especially in irrigated or densely planted broadcasting fields.
The infestations of this insect pest were observed in various growth stages of rice, with the significant damage was noted during the booting and heading phases. Different field conditions and agricultural practices influence the infestations, with more prevalence occurring in irrigated and/or broadcasting rice fields with high water levels and dense planting. Additionally, impacts of climate change and insecticide applications may accelerate their spread and outbreak, as reported in other insect pests (Kiritani, 2007; Musolin, 2007; Bhavanam et al., 2021). Therefore, ecological dynamics, impact of damages, and evaluation of long-term threat by the white-spotted stink bug should be further investigated. These implications remain speculative without in-depth investigation in the Thai agricultural system.
Given the importance of rice production in Thailand and neighboring Southeast Asian countries, consistent monitoring and ecological assessments are essential. The development of integrated pest management strategies will be essential to reduce the threat of this emerging insect pest and ensure sustainable rice productivity in the region.

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Conflict of Interest: None.

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Ethical Approval Statement
This research has been approved for the Ethics of Use of Animals for Scientific Work from Naresuan University (Approval No. 66-01-002).

Use of Generative AI Tools Statement
During the preparation of this work the author used a generative AI to enhance English language clarity and grammatical accuracy. After using these tools, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Contribution of Authors
Wattanacahiyingcharoen W: Conceptualization, resources, funding acquisition, project administration, methodology, investigation, formal analysis, visualization, validation, writing - original draft, review and editing.
Wanitsumran P: Methodology, investigation, data collection, formal analysis, visualization, first draft writing.
Saewa K: Investigation and data collection.
Wattanacahiyingcharoen D: Conceptualization, resources, data collection, investigation, formal analysis, writing - review and editing.

All authors read and approved final draft of the manuscript.

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