

Does India have the invasive brown marmorated stink bug, *Halyomorpha halys* (Stål)

India is one of the largest agrarian economies of the world, its contribution to the global food basket is colossal. But the economic liberalization and globalization have increased the risk of invasive species. Brown marmorated stink Bug (BMSB), *Halyomorpha halys* (Stål)¹ (Figure 1 c and h), an invasive species and member of Pentatomidae (Hemiptera: Heteroptera), has gained importance during recent years due to its rapidly expanding geographical distribution outside its native range, East Asia. It is a polyphagous pest with a wide host range of nearly 275 plant species, including fruits and vegetables². A similar species, of Indian origin, *Halyomorpha picus* (Fabricius) (Figure 1 a and b) is widely distributed across India and unlike other invasive species, *H. picus* is not known to cause significant economic loss to any crops even though it is a polyphagous pest of minor importance. Due to close resemblance of *H. picus* with *H. halys* in external morphology, size and colouration, it is difficult to differentiate them unless the structures of male and female genitalia are dissected and examined. Many a time, misidentification of such cryptic species goes unnoticed resulting in serious repercussion in the case of invasive species. It results in the failure of biological control programmes of serious pests, and negatively impacts international trade of commodities affected by such pests. In this communication we establish that all published reports on the occurrence of *H. halys* in India are based on misidentification and *H. halys* does not occur in India.

H. picus was originally described as *Cimex picus* from 'India orientali' by Fabricius³. Later, Fabricius⁴ described *Cimex marmoratus* from the same region. Despite synonymization of the latter species with *H. picus* by Stål⁵, it was known as the marmorated bug, *Halyomorpha marmorata* in India by various researchers^{6,7}. But the trend of identification and citation by recent publications from India has shifted from marmorated bug (*H. picus*) to brown marmorated stink bug (*H. halys*), a probable but quite harmful misidentification. The genus *Halyomorpha* Mayr is represented by five species in India^{8,9}. Among these, *H. picus* is a

widely distributed species with close resemblance to *H. halys* externally. In order to verify the presence of *H. halys*, we have examined nearly 2000 specimens of *H. picus* collected from different parts of India (Figure 2) according to the mandate of the ICAR-National Bureau Agricultural Insect Resources (NBAIR), Bengaluru. These specimens were dis-

sected and examined for the male and female post-abdominal structures, which revealed that all of them belonged to *H. picus*. The paramere of *H. picus* (Figure 1 d) is entirely different from that of *H. halys* (Figure 1 e), which was illustrated by Véték *et al.*¹⁰. Table 1 provides the key characters available to differentiate between *H. picus* and *H. halys*.

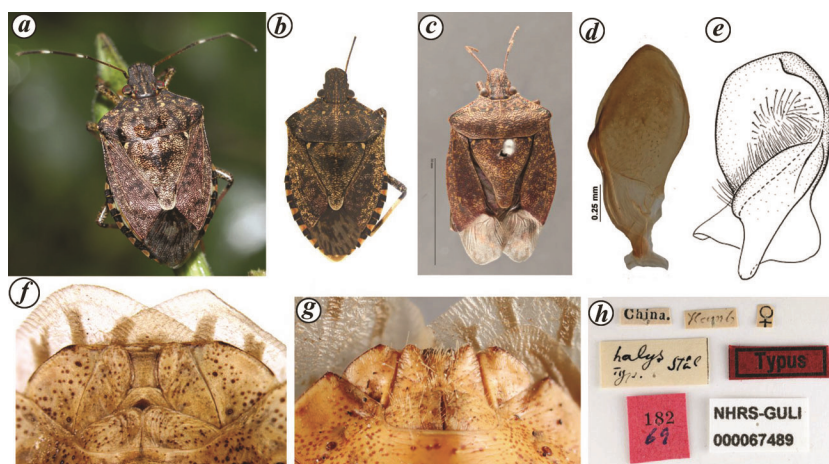


Figure 1. *Halyomorpha* spp. **a**, *H. picus* (Fabricius); **b**, *H. picus* (Fabricius) – specimen studied by Nikkam and More¹²; **c**, *H. halys* (Stål) (NHRG-GULI 000067489); **d**, Paramere of *H. picus*; **e**, Paramere of *H. halys* (© Magnolia Press, Auckland, New Zealand, Reproduced with permission from Copyright holder). **f**, Terminalia of *H. picus*; **g**, Terminalia of *H. halys*; **h**, Label data of *H. halys* Typus. **c**, **g** and **h**, Photographed by Gunvi Lindberg (© 2020 Naturhistoriska riksmuseet). Original photograph cropped, light levels and contrast adjusted. Made available by the Swedish Museum of Natural History under Creative Commons Attribution 4.0 International Public License, CC-BY 4.0 (<https://creativecommons.org/licenses/by/4>).

Table 1. Comparison of key characters of *Halyomorpha picus* versus *Halyomorpha halys*

Characters	<i>H. halys</i>	<i>H. picus</i>
Apex of caudal lobes of genital capsule	Subhorizontal and obtusely truncate lobes	Medially sinuate with inner lobe angular
Apical margin of median projection on dorsal rim	Apical margin medially with narrow V-notch	Apical margin medially with shallow and broad concavity
Union of infoldings of dorsal rim on dorso-lateral sides of genital capsule	Smoothly uniting with dorso-lateral sides of genital capsule	End in a quadrangular tooth-like projection
Parameral crown	Nearly as long as broad (Figure 1 e)	Distinctly longer than broad (Figure 1 d)
Stem of paramere	Broad (Figure 1 e)	Narrow (Figure 1 d)
Apical receptacle	With two short tubercle-like projections	With two or three elongate finger-like projections
Laterotergite IX	Gradually pointed towards apex (apex angulate and pointed blunt) and slightly surpassing posterior margin of tergite VIII (Figure 1 g)	Nearly of uniform width throughout (apex acutely rounded) and shorter than tergite VIII (Figure 1 f)

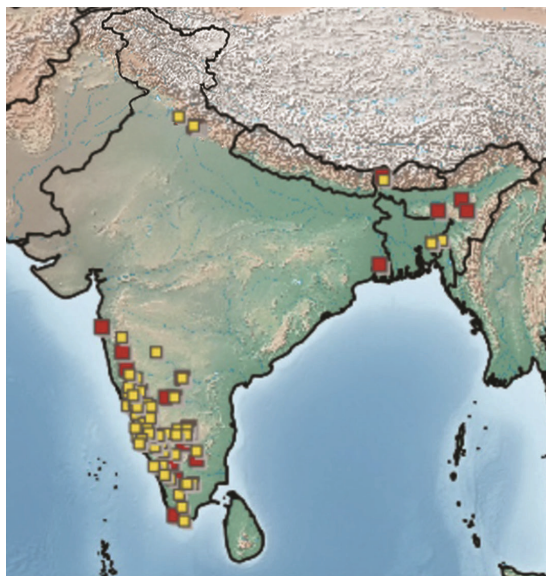


Figure 2. Distribution of *H. picus* (Fabricius) in India. ■, Data based on localities of collection; ■, Data based on the available literature.

Perusal of the literature, which claimed the presence of *H. halys* from India^{11–13}, revealed that the authors neither examined the post-abdominal structures of their study materials nor consulted experts working on this group, and might have only relied on the external phenotypic characters for identification. Karun and Sridhar¹¹ reported the incidence of medicinal fungus, *Ophiocordyceps nutans* on *H. halys* in the Western Ghats, India. Careful examination of the images in their publication¹¹, revealed that the bug imaged is not a species of *Halyomorpha*, rather one of *Tipulparra* Ghauri¹⁴.

Another report of *H. halys* is by Nikam and More¹², in which they included *H. halys* in the checklist of insects collected from Jangamhatti area, Maharashtra. Cianferoni *et al.*², and Kment and Březíková¹⁵ considered the report of *H. halys* by Nikam and More¹² from India as a misidentification of *H. picus* or *H. yasumatsui* Abbasi and Ahmad¹⁶, or another *Halyomorpha* species native to India. To confirm the same, we have examined the material studied (Figure 1 b) by Nikam and More¹² and found that it was *H. picus*, as evident from the female terminalia (Figure 1 f), which were compared with those of the type species (Figure 1 g).

Gupta and Pathania¹³ studied the diversity of hemipteran insects associated with apple plantations in Jammu and Kashmir, and reported the distribu-

tion and morphological diagnostic characters of *H. halys*. However, from the illustration provided in the report it is clearly evident that they had misidentified species of *Cahara* Ghauri. Species of the genus *Halyomorpha* possess smoothly rounded humeri compared to the nodulose or carinate humeri illustrated by Gupta and Pathania¹³, which are found in species of *Cahara* Ghauri. It may be noted that the species of *Cahara* are already known to feed on apples, especially in sub-Himalayan regions¹⁷.

An analysis of the published records of *H. halys* in India revealed that these were misidentifications. Based on the available scientific evidences, we would like to ascertain that *H. halys* is not present in India.

Wrong identification and erroneous reports of invasive species could have implications on the socio-economic status and biosecurity of the country. In case if *H. halys* invades India, it can become a serious menace due to the following attributes of the pest: (1) wide host range, including several fruit trees, field crops and forest trees; (2) aggregation behaviour causing public nuisance and (3) vector of phytoplasma. Moreover, its introduction can go unnoticed due to its close resemblance with native *H. picus*. In such a situation, the pest can not only inflict direct damage on horticultural crops production, but also adversely affect the export of horticultural commodities from India.

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