THE NATIVE HARLEQUIN BUG (*DINDYMUS VERSICOLOR*) IN AUSTRALIA: CURRENT KNOWLEDGE ON DISTRIBUTION, ECOLOGY, AND MANAGEMENT

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Summary

The harlequin bug (*Dindymus versicolor* Herrich-Schäffer 1853; Hemiptera: Pyrrhocoridae) is a widespread native Australian species occurring across New South Wales and other eastern and southern states, including Queensland, Victoria, South Australia, and Tasmania. It is commonly observed in gardens, orchards, production nurseries and natural vegetation, and is recognised as a pest of fruit, vegetable, and ornamental plants. *D. versicolor* feeds primarily on plant tissues, fruits, and seeds, and occasionally scavenges on dead insects, which has led to confusion regarding its ecological role. Periodic outbreaks occur during warm, dry seasons in inland and coastal regions, where aggregations on flowering or fruiting plants can cause noticeable fruit damage. Although usually of minor economic importance, *D. versicolor* can blemish fruits such as apples, pears, berries, tomatoes, and citrus and disfigure ornamental plants through sap-feeding. Reports from multiple fruit-growing regions indicate that certain apple varieties are highly attractive to the bug. Evidence from related pyrrhocorids suggests that opportunistic feeding and aggregation behaviour are ancestral traits within the family, supporting its persistence under diverse environmental conditions. Observations from growers and citizen science platforms such as “iNaturalist” confirm the species’ broad distribution across Australia. This review synthesises historical records, recent observations, and citizen science data to synthesise the biology, host range, pest status, and ecological context of *D. versicolor*, and to improve recognition of its agricultural significance and management considerations.

Key words: Pyrrhocoridae, phytophagy, nuisance pest, omnivore, Native Australian species, aggregation behaviour, fruit and vegetable pest, sap-feeding.

INTRODUCTION

Dindymus versicolor belonging to the family Pyrrhocoridae, are known as cotton stainers or red bugs. The family includes several phytophagous species of agricultural concern, such as *Dysdercus* spp. Adults are conspicuous, striking red-and-black insects that attack a wide range of crop and ornamental plants, including cotton, pome fruits, stone fruits, figs, grapes, strawberries, vegetables, and ornamentals (Fletcher 2007).

Generally, *D. versicolor* is considered a minor pest in fruit orchards, market gardens, production nurseries and home gardens (French 1891, 1933; McKeown 1942; Evans 1943; Healey and Manners 2019). While damage is usually limited, populations can occasionally build up to levels that cause noticeable feeding injury, particularly on succulent fruit and young shoots. Historical reports indicate occasional severe damage; for example, French (1891) recorded significant losses in Victorian apple orchards. Observations at La Trobe University in 1976 documented up to 300 individuals feeding on single sunflower heads, causing wilting and reduced seed yield (R. Cawood pers. comm.). Additionally, feeding punctures can predispose peaches (*Prunus persica*) to fungal infection, rendering fruit unmarketable (J. Jorgensen pers. comm.). Although visually similar to some predatory heteropterans, *D. versicolor* is primarily sap-sucking with a broad host range that includes native and cultivated plants (Dodds and Fearnley 2021). In addition to agricultural settings and production nurseries (Healey and Manners 2019), it is commonly reported as a nuisance in urban gardens, where aggregations of adults and nymphs can create concern for residents. Our review synthesises current knowledge on its biology, host range, pest status, ecological context, and distribution, integrating historical records, recent observations, and citizen science data. We use comparisons with related Pyrrhocoridae and Heteropterans provide insights into behavioural traits and feeding adaptations relevant to pest management.

Biology

Adults measure approximately 12 mm in length, with black head margins and forewing tips, and a reddish-orange thorax and basal forewing forming two red triangles (Figure 1) when wings are folded (Child 1968; Fletcher 2007; Stewart 2002; Teo 2022). The underside is yellow-green with red and black markings (Figure 2). While this colour pattern is characteristic, adults show considerable variation. Some individuals appear much darker overall, with duller tones, reduced contrast, or less distinct red triangular markings, whereas others retain the brighter red-orange pattern (Figure 3). This variation may be due to age (Thakur M pers. observation), environmental factors, or genetic differences, with rare individuals appearing almost entirely black.

Nymphs are bright red, wingless, and develop darker markings through five instars (Figure 4). Young nymphs may appear entirely red with a black head and three black spots on the abdomen (Figure 4a), gradually developing additional dark markings as they progress through successive instars (Figure 4b).

Females are slightly larger (Figure 1) and noticeably fuller-bodied than the slenderer males, developing a rounder, heavier abdomen as their eggs mature (Figure 1 right). Mating occurs in an end-to-end position (Figures 1 and 2). In Victoria, mating pairs of *D. versicolor* are locally referred to as the "Sex Beetle" due to their conspicuous mating behaviour (Melbourne Australia Photos 2017), in which they align end-to-end during copulation, with the larger female usually leading the direction of movement (Museums Victoria Staff 2010; Dodds and Fearnley 2021; Atlas of Living Australia, 2025). Additionally, this distinctive behaviour has earned the mating pairs the nickname "push-me-pull-me bug" (Teo 2022).

Adult females lay eggs in clusters of 60-100 on or near host plants, often in undisturbed areas such as soil or on the leaves of orchard floor vegetation (Dodds and Fearnley 2021; Teo 2022; Herbiguide 2025). Development from egg to adult typically takes 4-8 weeks, depending on temperature and host availability, with overlapping generations common in NSW (DPI 1979; DPI QLD 2000). Under optimal warm conditions, the entire life cycle can be completed in approximately 28 days (DPI QLD 2000), allowing multiple generations per season.

Adults and nymphs are conspicuous, especially when aggregating on sun-exposed surfaces and are most abundant from late spring through early summer, declining during winter. Observations from iNaturalist (2025) indicate that adults peak in November, whereas nymphs reach their highest numbers in January, reflecting the seasonal progression of life stages (Figure 5 and 6). Figure 5 shows the combined seasonal fluctuations of adults and nymphs based on iNaturalist observations across Australia, highlighting these distinct peaks. Some vegetable gardeners and online observers (e.g. Heidi 2012) have anecdotally reported increased activity of *D. versicolor* following rainfall. Although these accounts are informal and not scientifically validated, they suggest a possible association between moisture conditions and bug activity. These pulses in activity can contribute to sudden population spikes, particularly when fruiting hosts are available.

Frequently, both adults and nymphs are found aggregating in large numbers on sun-exposed surfaces such as native tree trunks, trellis posts, hail-netting posts, fruiting plants, fence palings, or other structural supports within or adjacent to orchards (Dodds and Fearnley 2021; Dodds 2020). Such aggregation behaviour appears to serve multiple ecological functions, including mate location, and communal occupation of favourable micro-habitats such as sun-warmed surfaces near host plants and cracks in timber trellis and netting structures (Dodds 2018; Dodds and Fearnley 2021). These gatherings likely provide both reproductive and protective advantages. The bright aposematic colouration deters predators by signalling chemical defences typical of pyrrhocorids (Caro and Ruxton 2019). Overwintering occurs predominantly as adults sheltering in bark crevices, under timber, or within dry leaf litter (Stewart 2002).

Figure 1. Mating pairs of Dindymus versicolor (larger females on the right-hand side in the pictures); Photo: Meena Thakur, NSW DPIRD

Figure 2. Markings on the underside of the body of the adults; Photo: Meena Thakur, NSW DPIRD

Figure 3. Colour variation among Dindymus versicolor adults, one adult with only black colouration on wings; Photo: Meena Thakur, NSW DPIRD

Figure 4. Colour variation among Dindymus versicolor nymphs; a) first instar nymph; b) fifth instar nymph with wing pads; Photo: Meena Thakur, NSW DPIRD

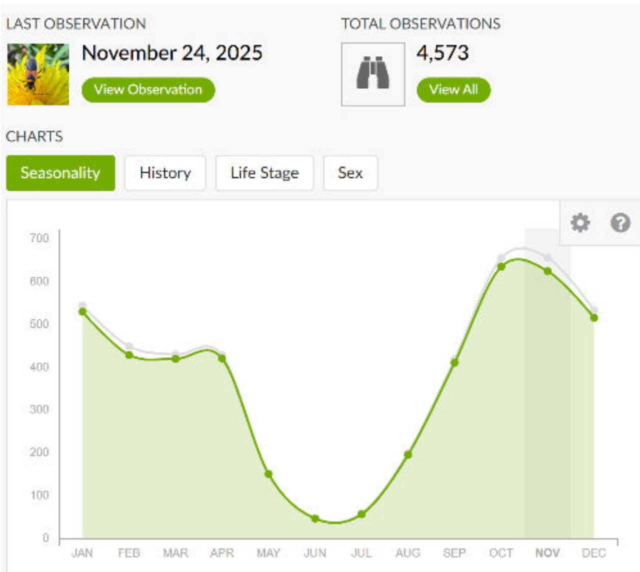

Figure 5. Seasonal fluctuations in the reported populations of *Dindymus versicolor* (both adult and nymphs) as per the observations on iNaturalist, Australia, accessed November 2025; Source: https://www.inaturalist.org/taxa/424590-Dindymus-versicolor

Figure 6. Seasonal fluctuations of adults and nymphs of *Dindymus versicolor* by month as reported on iNaturalist, Australia, accessed November 2025; Source: https://www.inaturalist.org/taxa/424590-Dindymus-versicolor

FEEDING BEHAVIOUR, HOST RANGE, AND PEST STATUS

Feeding behaviour and host preference

Primarily, *D. versicolor* is phytophagous with a polyphagous, opportunistic sap-sucking feeding habit (Stahle 1979, 1981). They use their needle-like proboscis (Figure 7) to pierce the epidermis of the host plant tissue. Feeding primarily targets young shoots, the underside of leaves, and developing fruits, leading to wilting, shrivelling of berries, and marked petals of flowers. Feeding activity is seasonal, with adults and nymphs entering diapause from May to September in bark, leaf litter, or other debris. Seasonal shifts in host use reflect the availability of high-quality plant tissues. As plants mature or seed, *D. versicolor* shifts sequentially to alternative available plant species, demonstrating dietary flexibility driven by food quality and availability (Stahle 1981). Field and laboratory studies have shown strong feeding preferences for sunflower (*Helianthus annuus*), select Malvaceae, minced beef, and conspecific carcasses (Stahle 1981).

This pattern of polyphagy, seasonal host switching, and mobility is consistent with other pyrrhocorid and hemipteran species. Many pyrrhocorids, as well as other "stink bug" species, exhibit similar dietary flexibility, moving among available plant hosts in response to tissue quality, senescence, or habitat disturbances (Larue and Johnson 1989; Toscano and Stern 1976).

Figure 7. Adult *Dindymus versicolor* feeding on a sunflower seed using its proboscis; Photo: Meena Thakur, NSW DPIRD

Opportunistic protein feeding and cannibalism

In addition to its plant feeding, *D. versicolor* is a facultative opportunistic protein feeder. Adults and nymphs feed on carcasses of insects (including conspecifics, Figure 8), millipedes, birds, mammals, and lizards, soft-bodied invertebrates, including gastropods and even bird and mammal faeces (French 1933; Stahle 1981; Steinbauer 1996; Jackson and Barrion 2004; Field Guide to the Insects of Tasmania 2025). Cannibalism of dead, moribund, or teneral conspecifics is occasionally observed, likely providing essential nutrients, particularly nitrogen and protein, which may enhance reproductive fitness.

Figure 8. Cannibalistic feeding by an adult female *Dindymus versicolor* on a conspecific nymph; Photo: Meena Thakur, NSW DPIRD

Comparative behaviour in Pyrrhocoridae

Other pyrrhocorids, such as *Dysdercus* spp., *Antilochus coquebertii* (Fabricius 1803), and *Dindymus rubiginosus* (Fabricius 1787), exhibit similar piercing-sucking feeding on seeds and fruit of cotton and okra, causing staining and fibre deterioration (Cassis and Gross 2002; Schaefer and Panizzi 2000). However, some of these species, notably *A. coquebertii* and *D. rubiginosus*, also display mixed feeding strategies, occasionally preying on other insects or scavenging on carrion (Schaefer and Panizzi 2000). Observations of congeneric *Dindymus* species indicate that occasional scavenging is likely opportunistic rather than a sign of an obligate predatory lifestyle (Sudakaran *et al*. 2015).

Similarly, *D. versicolor*'s consumption of insect carcasses, conspecifics, and other protein sources reflects a flexible trophic role influenced by prey availability, environmental conditions, and local host-plant resources. Comparative evidence from other *Dindymus* and pyrrhocorid species supports the interpretation that opportunistic protein feeding is a common ecological strategy within the genus. Dolling (1991) suggested that feeding on extra-phytophagous resources may provide essential nutrients lacking in a plant-sap diet. This notion may be supported by Ralph (1976), who reported that nymphs of *Oncopeltus fasciatus* consumed dead or weakened conspecifics when reared on nutritionally poor substrates.

Host plants

Dindymus versicolor feeds on a wide range of host plants (Table 1), including ornamental species such as *Hibiscus rosa-sinensis* (hibiscus), *Syzygium australe* (lilly pilly), *Callistemon* spp. (bottlebrush), and *Eucalyptus* spp. (Eucalypts), as well as garden and native plants such as *Brachychiton populneus* (kurrajong), *Wisteria* spp., *Dahlia pinnata* (dahlia), and *Viola* spp. (violets) (Stahle 1981; Fletcher 2007; DPI QLD 2000). Also, fruit and vegetable crops are affected, including *Citrus* spp., *Capsicum annuum* (capsicum), *Solanum lycopersicum* (tomato), *Gossypium* spp. (cotton), pome fruits (*Malus domestica*, apple; *Pyrus* spp., pear), stone fruits (*Prunus persica*, peach; *P. armeniaca*, apricot; *P. avium,* cherries), *Ficus carica* (figs), *Vitis vinifera* (grapes), *Fragaria × ananassa (*strawberries), *Prunus dulcis* (almonds), *Ribes uva-crispa* (gooseberries), *Ribes nigrum* (black currants), *Rubus idaeus* (raspberries), *Solanum tuberosum* (potatoes), *Cynara cardunculus var. scolymus* (artichokes), *Helianthus annuus* (sunflower), and brassica vegetables such as *Brassica oleracea* var. *capitata* (cabbage), *B. oleracea* var. *italica* (broccoli), and *B. napus* (rape) (Froggatt 1915; Stahle 1981; Fletcher 2007; Cassis and Gross 2002; DPI QLD 2000; Teo 2022).

Table 1. Host plant records of *D. versicolor* (Stahle 1981; DPI QLD 2000; Fletcher 2007; Heidi 2012; EPPO 2015; Dodds 2018; Teo 2022)

Plant Family	Scientific Name	Common Name / Description
Anacardiaceae	*Schinus molle*	Peppertree
Asteraceae	*Arctotheca calendula*	Capeweed
Asteraceae	*Chrysanthemum leucanthemum*	Chrysanthemum
Asteraceae	*Cynara cardunculus var. scolymus*	Artichoke
Asteraceae	*Dahlia pinnata*	Dahlia
Asteraceae	*Erigeron bonariensis*	Flax leaf fleabane
Asteraceae	*Helianthus annuus*	Sunflower
Asteraceae	*Lactuca sativa*	Lettuce
Asteraceae	*Picris echioides*	Bristly ox-tongue
Asteraceae	*Senecio linearifolius*	Fireweed groundsel
Asteraceae	*Tanacetum vulgare*	Tansy

Plant Family	**Scientific Name**	**Common Name / Description**
Brassicaceae	*Brassica oleracea var. capitata*	Cabbage
Brassicaceae	*B. oleracea var. italica*	Broccoli
Brassicaceae	*B. napus*	Rape
Brassicaceae	*Raphanus raphanistrum*	Wild radish
Brassicaceae	*Nasturtium officinale*	Nasturtium
Fabaceae	*Medicago polymorpha*	Burr medic
Fabaceae	*Vicia* sp.	Vetch
Fabaceae	*Wisteria spp.*	Wisteria
Grossulariaceae	*Ribes uva-crispa*	Gooseberry
Grossulariaceae	*Rubus idaeus*	Raspberry
Lamiaceae	*Salvia* sp.	Sage
Malvaceae	*Althaea rosea*	Hollyhock
Malvaceae	*Lavatera plebeja*	Common hollyhock
Malvaceae	*Malva* sp.	Marshmallow
Malvaceae	*Gossypium* spp.	Cotton
Malvaceae	*Brachychiton populneus*	Kurrajong
Malvaceae	*Hibiscus rosa-sinensis*	Hibiscus
Moraceae	*Ficus carica*	Fig
Myrtaceae	*Angophora lanceolata*	Bloodwood
Myrtaceae	*Syzygium australe*	Lilly Pilly
Myrtaceae	*Callistemon sp.*	Callistemon
Myrtaceae	*Eucalyptus maculata*	Spotted gum
Myrtaceae	*Eucalyptus spp.*	Eucalyptus
Myrtaceae	*Callistemon spp.*	Bottlebrush
Onagraceae	*Epilobium cinereum*	Hairy willow herb
Pittosporaceae	*Bursaria spinosa*	Sweet Bursaria
Plantaginaceae	*Plantago lanceolata*	Rib grass
Poaceae	*Bromus unioloides*	Prairie grass
Poaceae	*Triticum* sp.	Wheat
Poaceae	*Zea mays*	Sweetcorn
Polygonaceae	*Polygonum aviculare*	Wireweed
Polygonaceae	*Rheum rhaponticum*	Rhubarb
Polygonaceae	*Rumex acetosella*	Sorrel
Polygonaceae	*Fagopyrum esculentum*	Buckwheat
Primulaceae	*Anagallis arvensis*	Scarlet pimpernel
Proteaceae	*Grevillea laurifolia*	Holly leaf grevillea
Rosaceae	*Fragaria × ananassa*	Strawberry
Rosaceae	*Malus domestica*	Apple
Rosaceae	*Prunus amygdalus*	Almond
Rosaceae	*Prunus avium*	Cherry
Rosaceae	*Prunus persica*	Peach
Rosaceae	*Prunus armeniaca*	Apricot
Rosaceae	*Pyrus* sp.	Pear
Rosaceae	*Rubus idaeus*	Raspberry
Rosaceae	*Rosa sp.*	Rose
Rutaceae	*Citrus* spp.	Citrus
Solanaceae	*Solanum lycopersicum*	Tomato
Solanaceae	*Solanum tuberosum*	Potato
Solanaceae	*Capsicum annuum*	Capsicum
Vitaceae	*Vitis vinifera*	Grape

Pest status

Dindymus versicolor becomes a notable pest when preferred crops are abundant or alternative hosts are limited. Its seasonal and spatial host availability strongly influences local population abundance and aggregation patterns. Outbreaks are most common during warm, dry seasons and often are facilitated by nearby weeds or secondary hosts such as *Malva* spp. (marshmallow) and *Rumex* spp. (dock) (Dodds and Fearnley 2021; ABC Gardening Australia 2016). While populations can be patchy within orchards, certain crops or blocks may experience heavy infestation.

Historically, *D. versicolor* was considered a significant pest of apples, pears, figs, stone fruits, and berries in New South Wales (NSW) during the early 1900s (Littler 1918; French 1933). The widespread use of broad-spectrum insecticides in the mid-20th century likely suppressed populations, reducing their impact (Veens M pers. comm. 2024). In recent years, however, *D. versicolor* has resurged, driven largely by the adoption of integrated pest management (IPM) practices and reduced use of broad-spectrum insecticides (Dodds and Fernley 2021; Veens M pers. comm. 2024). This resurgence was observed across most fruit-growing regions of Australia. In NSW, it has been a notable problem in Batlow and Orange districts over the past decade. Other affected states include Queensland, Victoria (Shepparton area), Tasmania, and South Australia, with Western Australia experiencing occasional localised issues (Veens M pers. comm. 2024).

According to the Integrated Pest Management in Ornamentals Information Kit manual (DPI QLD 2000), *D. versicolor* is listed as a key pest in Victoria, highlighting its significance for both fruit crops and ornamentals. Adult flight enables dispersal within orchards and to adjacent host plants, emphasising its potential for rapid population spread.

ECOLOGY, BEHAVIOUR AND DISTRIBUTION

Behaviour and ecology

Adults of *D. versicolor* are primarily diurnal and thrive in hot, dry conditions. They disperse readily by flight, moving between host plants and nearby vegetation. Adults exhibit cryptic behaviour, often clustering in sheltered positions and emerging primarily to feed in sunny conditions (Heidi 2012). Aggregations are commonly observed on sun-exposed surfaces, particularly during late summer when populations peak (Herbiguide, 2025).

Behavioural parallels with Pyrrhocoridae, such as *Dysdercus* spp. include a hard exoskeleton that acts as a protective shield, bright aposematic colouration, aggregation, and a reliance on seeds or fruit for nutrition, reflecting shared evolutionary adaptations toward exploiting nutrient-rich reproductive plant tissues (Schaefer and Panizzi 2000).

There are anecdotal reports that males of *D. versicolor* produce semiochemicals that attract conspecifics (notably females),and that females emit chemical cues signalling mating readiness (Teo 2022). These observations remain informal and scientifically unverified, as no published studies have characterised chemical defence or pheromonal mechanisms in this species. However, extensive chemical-ecology research on closely related pyrrhocorids, such as cotton stainers (*Dysdercus* spp.), and other Heteropterans demonstrates that volatile compounds commonly mediate both aggregation and mating behaviours (Aldrich 1988; Borges and Aldrich 1994; Mnguni and Heshula 2023; Wang et al. 2025). In these species, laboratory and field assays have confirmed that specific glandular secretions, including aldehydes, alcohols, terpenes, and other volatiles, act as aggregation or sex-attractant pheromones at low concentrations. Conversely, the same compounds can function as defensive or alarm signals at higher concentrations in different heteropteran species (Calam and Youdeowei 1968, Aldrich *et al*. 1987, Aldrich 1988, Farine *et al*. 1992; Aldrich *et al*. 1994; Borges and Aldrich 1994; Miller *et al*. 1997). Production and release of defensive scents from specialised glands is common across most Heteroptera (Mnguni and Heshula 2023). The oily secretions typically contain aliphatic aldehydes, alkanes, esters, ketoaldehydes, and other biosynthetically related compounds (Knight *et al*. 1984). Esters play a key role in the biosynthesis of aldehydes and ketoaldehydes, which serve as primary irritants, while alcohols and acids are commonly produced as byproducts, with aldehydes often corresponding to specific alcohol components (Knight *et al*. 1984).

Based on Teo's (2022) observations, we suggest that aggregation behaviour in *D. versicolor* could be influenced by pheromones, but further studies are needed to confirm this. If these semiochemicals are present, they could could contribute to conspicuous clustering on host plants or vertical structures, enhancing both reproductive success and communal protection. Combined with high reproductive output and host plant fidelity, these traits likely facilitate rapid population increases during dry summers or when fruiting hosts are abundant.

Outbreaks of *D. versicolor* frequently are associated with dry summers or the availability of fruiting hosts, with local populations particularly supported by mallow (*Malva* spp.) growing in orchards, roadsides, or nearby vegetation (Veens M pers. comm. 2024; Herbiguide 2025). ABC Gardening Australia (2016) notes that *D. versicolor* are particularly partial to plants in the mallow family (Malvaceae). Seasonal host-shifting behaviour was documented by Stahle (1981), who recorded fluctuations in *D. versicolor* numbers across a range of weed species as host palatability changed. This behaviour may explain why bugs can be abundant on particular weeds within orchards early in the season and then suddenly shift onto fruit once those weeds decline in quality and developing fruit becomes a more attractive resource. During winter, *D. versicolor* seek shelter in dark, shaded places such as under compost, timber, hedges, and fence palings, further aiding their survival and continuity across seasons (Fletcher 2007; iNaturalist 2025).

Distribution

D. versicolor was recorded across eastern and southern Australia, including Queensland, NSW, Victoria, South Australia, and Tasmania (French 1891, 1933; McKeown 1942; Evans 1943;). Within NSW, the insect occurs across coastal plains, tablelands, and western slopes, with records from Sydney, Orange, Tamworth, Griffith, Batlow, and the Riverina (iNaturalist 2025; Atlas of Living Australia 2025).

More recently, Veens (pers. comm. 2024) reported its scattered presence in Western Australia, mainly in apple orchards and other crops. This observation is supported by iNaturalist Geomodel predictions (Figure 9), which estimate potential occurrence based on spatial patterns of verified observations. Based on the Geomodel, scientists suggest that *D. versicolor* may now be present in parts of Western Australia, indicating a possible expansion from its historically absent range (iNaturalist 2025).

Citizen science data provide additional insights into distribution patterns. As of 24th November 2025, iNaturalist lists over 4,573 verified observations of *D. versicolor* across Australia with a notable increase in records since the last decade (Figure 10). Figure 11, derived from the Atlas of Living Australia, shows 4,229 verified records and illustrates spatial patterns of occurrence, complementing the iNaturalist data (Atlas of Living Australia 2025). These observations likely reflect a combination of heightened observer participation, climatic shifts, and reduced use of broad-spectrum insecticides under IPM programs (Dodds and Fearnley 2021, Veens M per. Comms. 2024). Overall, these records indicate that currently *D. versicolor* is widely distributed across major horticultural regions from Queensland to Tasmania, with evidence of a recent range expansion into Western Australia.

Figure 9. Distribution of *Dindymus versicolor* across Australia as per Geomodel (iNaturalist, accessed October 2025; Source: Harlequin Red Bug (*Dindymus versicolor*) · iNaturalist Australia.

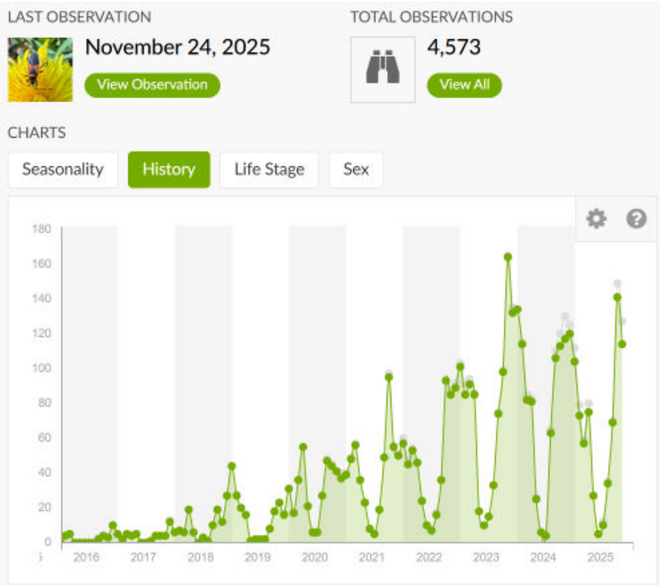

Figure 10. iNaturalist, Australia sightings of *Dindymus versicolor* (2016–2025), accessed November 2025; Source: https://www.inaturalist.org/taxa/424590-Dindymus-versicolor

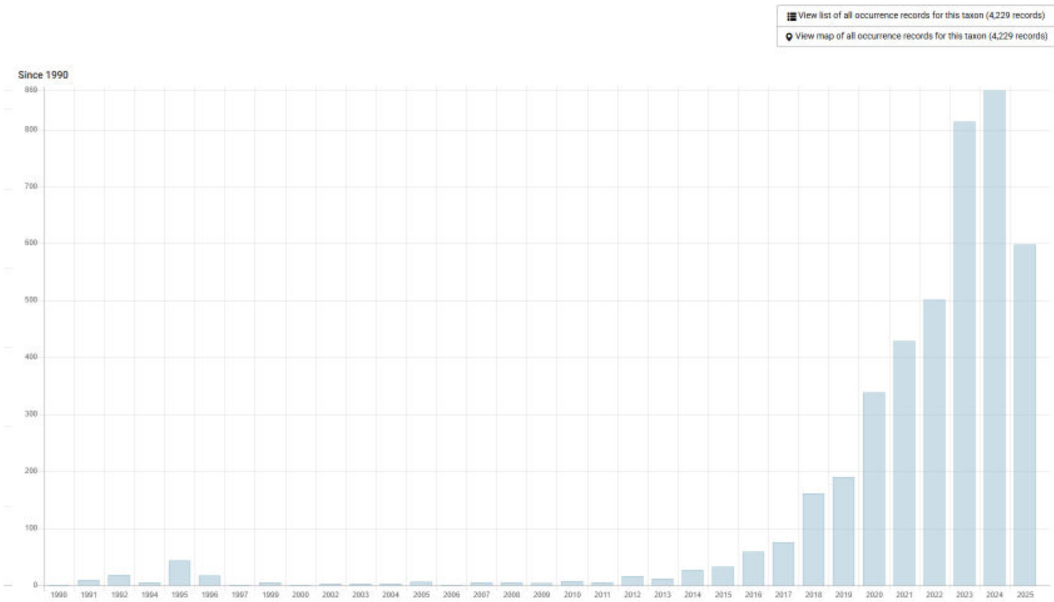

Figure 11. Occurrence records on Atlas of Living Australia since 1990- 2025, accessed November 2025; Source: *Dindymus versicolor:* Harlequin Bug | Atlas of Living Australia)

DAMAGE AND IMPORTANCE

Dindymus versicolor primarily causes cosmetic and superficial damage, but under high-density infestations, economic and aesthetic impacts can be significant. Both adults and nymphs cause damage by using their needle-like proboscis to pierce host tissues, feeding on leaves, shoots, and developing fruits. Unlike chewing pests, *D. versicolor* primarily sap-sucks tender plant parts, often causing wilting, reduced growth, and subtle depressions or browning of the underlying flesh, particularly in pome fruits such as apples and pears. Sometimes, these subtle feeding injuries are mistaken for boron cork or other nutrient deficiency disorders (Williams and Villalta 2000, Heidi 2012, Dodds and Fearnley 2021, Figure 12 and 13).

Additionally, high-value crops, including tomatoes, strawberries, and ornamental seed pods, may suffer aesthetic damage from feeding punctures, which reduces marketability rather than causing high yield loss (Leaf Root and Fruit Gardening Services 2023, Teo 2022). In gardens and urban landscapes, large aggregations on hibiscus, lilly-pilly, and other ornamentals are a concern due to visual damage, wilting tips, and the insect's characteristic odour

(DPI QLD 2000, Dodds and Fearnley 2021, Teo 2022).

Often, population surges are patchy within orchards or gardens, with some plants experiencing near-complete fruit damage while adjacent plants remain unaffected. Estimates suggest 10-30% fruit damage per hectare in apple orchards during worst-case years (Veens M pers. comm. 2024). Based on field observations, Veens notes that *D. versicolor* is seen mainly on apples, with the ANABP 01 (Bravo™) variety being particularly attractive and suffering high levels of damage. Cripps Pink (Pink lady™) apples also show noticeable feeding damage, and the bugs have been observed on citrus as well. Adults are highly mobile, and large-scale movement from surrounding non-crop vegetation or disturbed habitats can result in unpredictable and sporadic damage, similar to patterns observed in other polyphagous heteropterans (Larue and Johnson 1989; Ho and Millar 2001; Toscano and Stern 1976). These migrations may be triggered by senescence of native vegetation, mowing, or harvesting of nearby crops, emphasising that monitoring must account for both crops and adjacent non-crop hosts.

The broad host range, dispersal ability, and capacity to exploit both crops and ornamental plants underline the species potential to impact horticultural production, highlighting the need for ongoing monitoring and early management interventions. Non-crop vegetation, such as marshmallow weeds, may act as reservoirs, with population increases often observed following ground disturbance (Veens M pers. comm. 2024). Management guidance emphasises monitoring of nearby non-crop hosts and the timely removal of infested material to limit population build-up (Dodds and Fearnley 2021).

Figure 12. Mid-season feeding damage on Cripps Pink (Pink Lady™) caused by *Didymus versicolor* looks very similar to the symptoms of Boron cork disorder; Photo: Kevin Dodds, NSW DPIRD

Figure 13. *Dindymus versicolor* nymphs and their feeding damage on a maturing apple; Photo: Ralph Wilson, Wilgro Orchard, Batlow

DETECTION AND MANAGEMENT

Identification

Identification of *D. versicolor* is straightforward due to its vivid colouration and distinctive wing pattern. Nymphs are bright red and wingless, while adults display the characteristic black cruciform mark across the wings (Figure 3). Confusion with other red-and-black heteropterans, such as *D. rubiginosus*, may occur in mixed habitats, but the prominent contrast and frequent aggregation behaviour of *D. versicolor* make it relatively easy to recognise in the field.

Monitoring

Often, *D. versicolor* congregates in large, conspicuous numbers on vertical supports such as tree trunks, trellis and hail-net posts, and fence palings. These structures therefore act as effective early-warning sites for monitoring population activity in orchard settings (Dodds and Fearnley 2021, Dodds 2020). For example, in the Batlow district, juvenile bugs were observed clustering on hail-net posts just before harvest (Dodds 2020). Therefore, routine inspection of trellis posts, hail-net posts, fence palings, and other vertical supports, especially where they are in full sun, have cracks and crevices that provide shelter, or are located near host weeds, is highly recommended during late summer and early autumn when populations peak. The presence of large numbers (e.g., easily visible swarms) signals that population pressure is increasing and that cultural interventions (weed removal, debris removal) should be implemented before the high risk of fruit damage (Dodds and Fearnley 2021, Dodds 2020).

Monitoring can be more challenging in home gardens, particularly early in the season, due to the cryptic behaviour of *D. versicolor*. Adults often shelter in concealed locations and emerge primarily to feed in sunny conditions (Heidi 2012). As a result, populations may go undetected until they become numerous enough to cause visible damage, highlighting the importance of careful and regular inspection even in non-commercial settings.

Given the strong aggregation behaviour and the anecdotal evidence for pheromone-mediated attraction, there is potential for future development of pheromone-based monitoring tools. Identification of attractive semio-chemicals could enable the deployment of pheromone-baited traps for early detection or even attract-and-kill strategies, complementing cultural controls and enhancing integrated pest management approaches for this species. Sticky traps or beat sampling are typically unnecessary due to their conspicuous size and colouration, but targeted pheromone traps could provide a sensitive, species-specific tool in IPM programs.

Management

Active management and habitat modification are essential for controlling *D. versicolor* populations, as natural enemies alone generally are insufficient due to the species' physical and chemical defences, aggregation behaviour, and high reproductive potential. Therefore, effective management relies on a combination of monitoring, cultural practices, biological support, and selective chemical interventions, which together can reduce population pressures and prevent fruit damage.

Cultural and physical controls

Given the aggregation behaviour of *D. versicolor*, disruption of its preferred aggregation habitats is a key management strategy. Dodds and Fearnley (2021) emphasised that often damage severity is linked to "easy access to the trees via weed growth within the tree row and/or canopy, low-growing branches, nearby trellis posts or wires, and irrigation pipes." Therefore, we recommend practices including:

- Remove low-growing branches and canopy contacts that allow bugs to move easily from ground vegetation into the fruiting canopy.
- Keep vertical structures (trellis posts, net posts, irrigation pipes) clear of weeds or groundcover, as these act as aggregation and staging sites.
- Eliminate debris, timber stacks, and other shelter sources adjacent to orchard structures where bugs may gather prior to dispersal.
- Regularly remove or manage *Malva* spp. (mallow) and other known host weeds within and around orchard blocks to reduce favourable aggregation surfaces, thereby lowering the risk of *D. versicolor* population build-up (Dodds 2020; Dodds and Fearnley 2021).

Biological control

Natural predators of *D. versicolor* appear to be limited. Field observations suggest that garden spiders may feed on the eggs, praying mantises occasionally take nymphs, and birds or toads may opportunistically consume adults (Teo 2022). Also, anecdotal reports indicate that poultry and many bird species tend to avoid them, and there is an unverified historical claim of a fan-tailed cuckoo (*Cacomantis flabelliformis*) feeding on *D. versicolor* (Heidi 2012). The species' physical defences, aposematic colouration, tendency to aggregate, and high reproductive capacity likely contribute to the low predation pressure observed in the field. While encouraging generalist predators such as spiders, assassin bugs, mantids and other beneficial arthropods can support broader garden ecosystem balance, these predators alone are unlikely to suppress *D. versicolor* populations sufficiently to prevent fruit damage. Healey and Manners (2019) list several generalist predatory species, including assassin bugs, damsel bugs, glossy shield bugs, predatory shield bugs and pirate bugs as natural enemies of stick bug family pests more broadly, although these associations are not specific to *D. versicolor.*

Chemical control

Currently, there are no registered chemical treatments for *D. versicolor* management (Dodds 2020, Dodds and Fearnley 2021). Therefore, management relies heavily on preventive cultural practices and habitat manipulation. Low-toxicity products such as horticultural oils or pyrethrum may offer temporary suppression when applied carefully to exposed aggregations, but their efficacy is limited (Veens M pers. comm. 2024). In addition, mechanical removal or spraying clusters with a mixture of dishwashing detergent and water has been used successfully in gardens and small-scale plantings; the detergent blocks the insect's breathing tubes, and adding a small amount of vegetable oil can improve adherence (Heidi 2012).

Integrated pest management (IPM) strategies

Because *D. versicolor* populations fluctuate seasonally, prevention through habitat management is more sustainable than reactive chemical control. Current IPM strategies include:

- Regular weed management (particularly *Malva* spp.),
- Pruning to limit ground-to-canopy access,
- Timing existing sprays targeting other orchard pests (e.g. woolly apple aphid, mealybugs), exploring trap-crop potential.

CONCLUSIONS

D. versicolor exemplifies the ecological adaptability of Australia's native heteropterans. While primarily feeding on seeds and fruit, it may occasionally scavenge on other protein sources. Its feeding behaviour, aggregation tendencies, and rapid reproductive potential make it a native, opportunistic pest capable of causing localised or sporadic fruit damage when environmental conditions, host availability, and aggregation opportunities are favourable. Based on increasing reports of its presence and damage in orchards, gardens, and surrounding vegetation, we propose that *D. versicolor* incidences are becoming more noticeable and may require proactive management.

Based on the species conspicuous aggregation behaviour and likely chemical communication through pheromones, we suggest that semiochemicals may play a significant role in mediating both aggregation and mating. While anecdotal observations hint at males producing attractive compounds and females signalling mating readiness, no studies have yet formally characterised these pheromonal mechanisms in *D. versicolor*. Insights from related species indicate that such chemical signalling could be harnessed for monitoring, or even for attract-and-kill strategies, representing a promising tool for future IPM programs.

It is 135 years since the first Australian report by French (1891). However, much remains unknown about *D. versicolor*'s biology, seasonal abundance, population triggers, overwintering habitats, host plant interactions, and defensive behaviours. Home gardens and early-season populations are particularly challenging to monitor due to the bug's cryptic behaviour, making regular inspection and careful observation important. Targeted research into these areas, especially their behaviour, and chemical ecology, would provide critical knowledge to refine monitoring strategies, minimise unnecessary interventions, and support sustainable coexistence with productive horticulture. By combining careful monitoring, cultural practices, and an improved understanding of behaviour and chemical communication, IPM programs can more effectively mitigate damage while maintaining ecological balance and long-term orchard resilience.

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