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NOTE

Unexpected feeding behaviour of the cotton stainer *Dysdercus albofasciatus* (Hemiptera: Pyrrhocoridae) in baits of forensic samplings

Comportamiento alimentario inesperado de la chinche del algodón *Dysdercus albofasciatus* (Hemiptera: Pyrrhocoridae) en cebos de muestreos forenses

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Abstract

Dysdercus albofasciatus, Berg 1878 (Hemiptera: Pyrrhocoridae) is a phytophagous bug native to South America and present in Argentina, Brazil, Paraguay, and Uruguay. It is of economic interest as a pest of cotton *Gossypium* spp. and other Malvaceae. Last summer, in Buenos Aires province in Argentina, it has been spotted in forensic samples, rapidly colonising decomposing meat baits and feeding on them. In this article, we discuss possible causes that explain this opportunistic and occasional behaviour of *D. albofasciatus* when feeding on forensic baits during a prolonged dry period. This work is of great relevance since it presents the first record of this bug in forensic samples of decomposing meat baits, which it colonises rapidly and feeds on. In view of this curious record, we discussed the possible causes that could explain this behaviour. In this way, we analysed the climatic conditions of the region where the event was recorded. We were able to suggest that the high temperatures and lack of rainfall in the area generated water stress in the plants, which in this situation would have fewer resources available for their development and, consequently, would represent a food source of lower nutritional value for the bugs. In this case, the availability of

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a food resource rich in amino acids and with high humidity, such as decomposing meat bait, led to opportunistic and occasional feeding behaviour by *D. albofasciatus*.

Keywords: Forensic entomology; Opportunistic consumer; Plant bugs; Studies cases; Water stress.

Resumen

Dysdercus albofasciatus Berg 1878 (Hemiptera: Pyrrhocoridae) es una chinche fitófaga nativa de Sudamérica y presente en Argentina, Brasil, Paraguay y Uruguay. Tiene interés económico como plaga del algodón *Gossypium* spp. y otras Malvaceae. El verano pasado, en la provincia de Buenos Aires, Argentina, se ha observado estos individuos colonizando rápidamente cebos cárnicos en descomposición de muestras forenses para alimentarse de ella. En este artículo se discuten las posibles causas que explican este comportamiento oportunista y ocasional de *D. albofasciatus* al alimentarse de cebos forenses durante un periodo seco prolongado. Este trabajo es de gran relevancia ya que presenta el primer registro de este insecto en muestras forenses de cebos cárnicos en descomposición, a los que coloniza rápidamente y de los que se alimenta. Ante este curioso registro, discutimos las posibles causas que podrían explicar este comportamiento. Así, se analizaron las condiciones climáticas de la región donde se registró el hecho. Pudimos sugerir que las altas temperaturas y la falta de precipitaciones en la zona generaron estrés hídrico en las plantas, que en esta situación dispondrían de menos recursos para su desarrollo y, en consecuencia, representarían una fuente de alimento de menor valor nutritivo para los insectos. En este caso, la disponibilidad de un recurso alimenticio rico en aminoácidos y con elevada humedad, como son los cebos cárnicos en descomposición, propició un comportamiento alimentario oportunista y ocasional por parte de *D. albofasciatus*.

Palabras clave: Caso de estudio; Consumidor oportunista; Entomología Forense; Estrés hídrico; Insectos fitófagos.

Dysdercus albofasciatus Berg belonging to the Pyrrhocoridae (Hemiptera, Heteroptera), is a Neotropical species distributed in Argentina, Brazil, Paraguay, and Uruguay (Schaefer, 1998; Melo y Dellapé, 2013). This phytophagous bug feeds mainly on seeds, fruits and flowers of several species of Malvaceae (Stadler, Cappozzo, Mere, 1987). However, it can be found as a frequent pest on plants of economic interest such as cotton (*Gossypium hirsutum* L.), orange (*Citrus sinensis* L.), and *Tilia* sp. (Melo y Dellapé, 2013). Species of *Dysdercus* usually feed by piercing seeds to obtain nutrients and water, but, under water stress situations, they may get water from other parts of plants and even from other insects or conspecifics, carried out

mainly by females close to oviposition (Stadler, Cappozzo, Mere, 1987; Ricci y Margaría, 2022) as documented in *Dysdercus bimaculatus* (Stål) (Derr, 1980). Under water stress, gravid females can be predators for nitrogen nutrients and water, so they can occasionally appear together with predatory, scavenging, and necrophagous species of forensic interest (Schoenly, Beaver, Heumier, 1991).

Little information is available on the cadaveric community, but five trophic categories are recognised: (a) necrophagous, (Diptera, Coleoptera) which keep the decomposing carcass as food for their offspring; (b) necrophilous, which feed on the cadaveric fauna congregated on the carcass (Diptera, Formicidae, Heteroptera); (c) omnivores, which can feed on both the corpse and the arthropods that colonise it (Diptera, Coleoptera, Arachnida, Formicidae); (d) opportunists, which use the remains as a refuge (Heteroptera, Isopoda); (e) accidental, which find themselves randomly on the corpse (Orthoptera); (f) Heteroptera species have been found on carcasses as necrophiles, opportunists, and accidental (Arnaldos, García, Romera, Presa, Luna, 2005; Centeno, Gorosito, Chirino, 2012).

In order to study the phenology and life cycles of the most common necrophagous Diptera species (Calliphoridae) of forensic interest in the Province of Buenos Aires, two samplings were carried out between December 2021 and January 2022 in the Santa Catalina Municipal Nature Reserve, Lomas de Zamora, Buenos Aires, Argentina ($34^{\circ}46'48''\text{S}$ $58^{\circ}26'13''\text{W}$) (Fig. 1a-b). Pieces of rotting meat and liver used as baits were rapidly colonised mainly by calliphorids. However, among Diptera species, adults and nymphs of *D. albofasciatus* feeding on the same baits were also recorded (Fig. 1c).

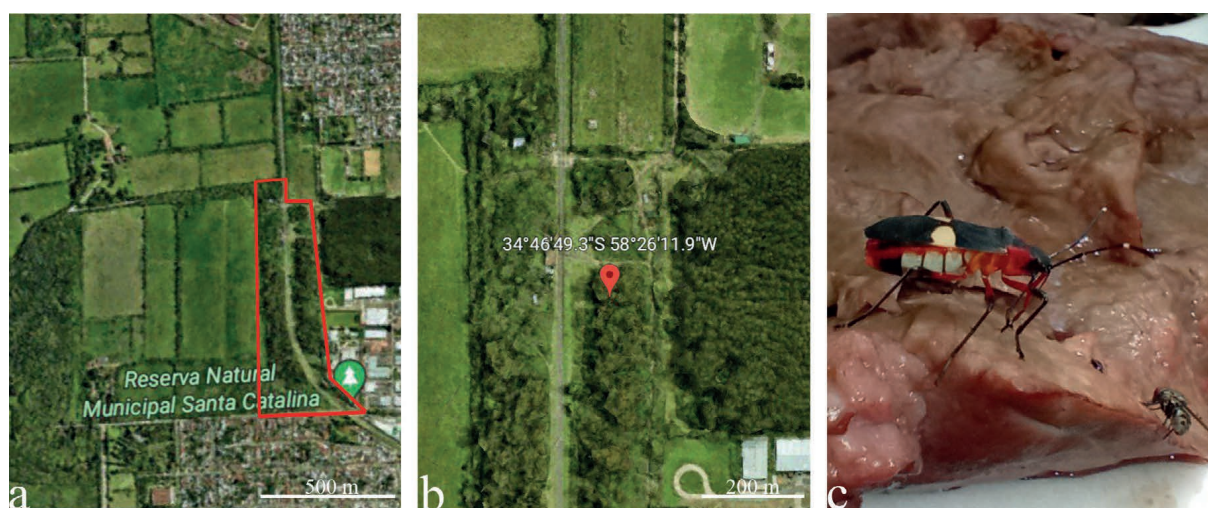


Figure 1. a) The Santa Catalina Municipal Nature Reserve. b) Sampling area inside the reserve. c) Adult of *Dysdercus albofasciatus* sucking on a decomposing liver bait.

The Argentine Republic is a country in South America characterised by various climate types due to its great territorial extension. The Buenos Aires Province (The Pampas) has a humid-warm climate, with an annual mean temperature between 12°C in winter and 20°C in summer. Precipitations have a Northeast–Southwest gradient, and rainfall occur throughout the year, ranked in 700–1,200 mm (Morello, Matteucci, Rodríguez, Silva, 2012). The region has long periods of drought followed by floods, which affect water availability. In recent summers, an anomaly in average maximum temperatures began to be recorded in Argentina, which started in summer 2018/2019 and became more pronounced, doubling in summer 2021/2022 and tripling in summer 2022/2023 (data obtained from the National Meteorological Service of Argentina; Fig. 2a). In the Province of Buenos Aires, this maximum temperature anomaly was accompanied by a decrease in precipitation. In December 2021, in the sampling area, the mean temperature showed positive anomalies, with extreme temperatures four degrees Celsius higher than the mean values of the 1961–2020 period (Fig. 2b). Likewise, precipitation was around 20–30 mm when historical monthly mean precipitation data are usually 120 mm (data obtained from the National Meteorological Service of Argentina; Fig 2c.).

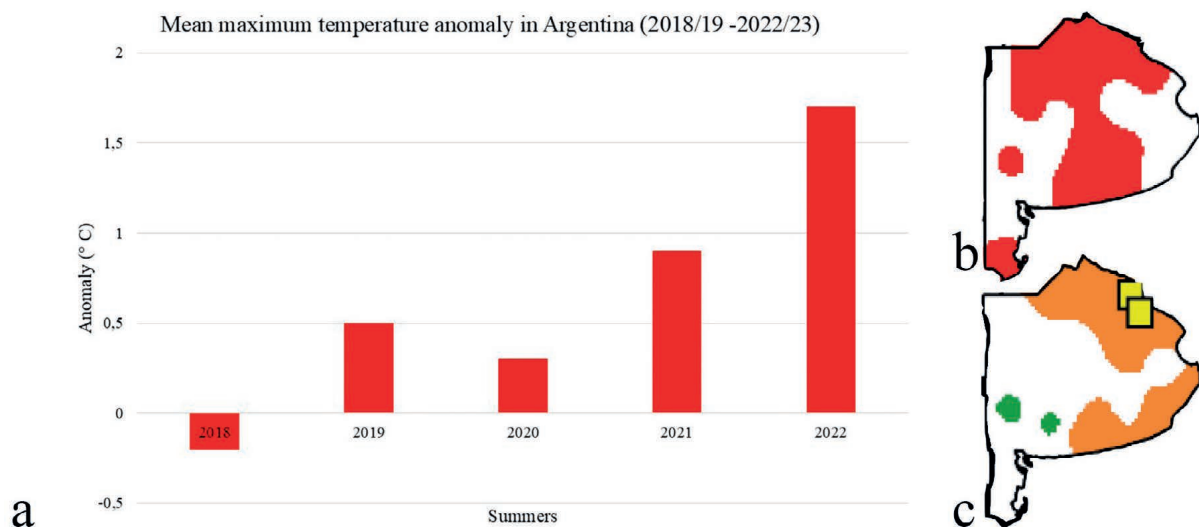


Figure 2. a) Historical mean maximum temperature anomaly for Argentinean summers between 2018/19 and 2022/23. Each red bar indicates the average deviation for Argentina from the climatological normal reference value 1991–2020. b) Average temperature anomaly in December 2021. Areas of the province with extremely high temperatures are shown in red. c. Precipitation anomaly in the province of Buenos Aires in December 2021. In green and brown, respectively, the areas with lower and higher percentages of precipitation than expected are indicated. Sectors with extreme drought records are shown in yellow, within which the reserve is located. Data obtained from the National Meteorological Service, the extreme values are for the period 1961–2020.

These higher temperatures associated with lower rainfall could have generated an environmental water stress that caused physiological and metabolic changes in plant phloem composition. Multiple studies have recorded physiological and morphological changes in plants by water deficit that lead to lower plant growth (as lower shoot/root ratio, biomass distribution, and leaf area), reducing the photosynthesis rate, increasing the photorespiration, delaying the flowering, and affecting crop productivity due to the closure of stomata to reduce water loss and evapotranspiration (Pirasteh-Anosheh, Saed-Moucheshi, Pakniyat, Pessarakli, 2016; Valverde-Otárola y Arias, 2020; Blicharz et al., 2021). On the other hand, in fruit-bearing plants, such as different cultivars of olive trees, the aerial parts and fruit production are the most affected by a significant drought (Di Vaioa, Marallo, Marino, Caruso, 2013). Thus, under environmental conditions of low rainfall and high temperatures, the plants would be under stress, generating few metabolic resources for themselves and reducing or cancelling their fructification.

As mentioned above, *D. albofasciatus* feeds mainly on flowers and seeds, parts of plants mostly affected by water stress, limiting the cotton stainer bug from accessing its natural food source. In addition, moisture is a relevant resource and weather condition for this bug. Therefore, we suggested that having access to water and amino acids resources (essential nutrients for protein formation), they preferred feeding by sucking some essential nutrients of the meat rather than poorly enriched Malvaceae fruits. Changes in feeding behaviour were also observed in zoophytophagous bugs with mixed feeding regimes, as *Orius laevigatus* Fieber (Hemiptera: Anthocoridae), which usually feed on aphids, whiteflies or lepidopteran eggs (Jacas, Urbaneja, García-Marí, 2008), but in the absence of these individuals, they can eat on different parts of plants such as pollen, sap, xylem, and mesophyll (Armer, Wiedenmann, Bush, 1998). Therefore, we suggest that similar behaviour occurs in *D. albofasciatus* due to resource scarcity in the surrounding plants. It would be interesting to test this feeding preference hypothesis by registering its long-term behaviour in the future and observing whether females deposit their eggs on this substrate. If it can be corroborated that *D. albofasciatus* has preferences for colonizing remains in early stages of putrefaction when resources are scarced, it could be considered as an opportunistic arthropod in forensic cases.

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