

OCCURRENCE OF ERIOSEMA PYCNANTHUM IN THE FERRUGINOUS RUPESTRIAN FIELD (CANGA) AND ITS INTERACTION WITH DICHELOPS MELACANTHUS: A CASE STUDY IN ITAPECERICA, MG.

OCORRÊNCIA DE ERIOSEMA PYCNANTHUM EM CAMPO RUPESTRE FERRUGINOSO (CANGA) E SUA INTERAÇÃO COM DICHELOPS MELACANTHUS: UM ESTUDO DE CASO EM ITAPECERICA, MG

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[†] In Memoriam.

Abstract

Introduction: *Eriosema pycnanthum* is an endangered Fabaceae species with limited documentation in the scientific literature. In the region of Itapeçerica, Minas Gerais, Brazil, it is used by the local population as traditional medicine for the healing of skin wounds. **Objective:** To evaluate feeding activity and plant damage caused by *Dichelops melacanthus* (Heteroptera: Pentatomidae) on *E. pycnanthum*. **Methodology:** Sampling was conducted in 2017 in two periods: April–May and October–December. Distribution maps were constructed, and foliar tissues were subjected to histological analysis. Soil profile chemical analyses were also performed to characterize the study area. **Results:** Spatial overlap between *E. pycnanthum* and *D. melacanthus* was observed in the study area, with variations in the insect/plant ratio across the evaluated areas and periods. The highest infestation rates were recorded in October (A1=1.3; A2=1.1; A3=0.3), while the lowest occurred in May (A1=0.4; A2=0; A3=0). Insect density correlated positively with high temperatures approximately 28–29.5 °C. The stink bug exhibited opportunistic feeding behavior during the intervals between maize crop cycles, causing visible leaf damage. Histological analyses revealed necrotic regions, as well as disorganization of the mesophyll

and palisade parenchyma, which manifested externally as yellowish speckles on the leaf surfaces. **Conclusion:** *D. melacanthus* exhibits opportunistic feeding activity on *E. pycnanthum*, apparently influenced by seasonal and thermal factors. This interaction may represent an additional ecological pressure on this endangered species, highlighting the urgent need for conservation strategies targeting ironstone rupestrian grassland or *campos rupestres ferruginosos*, ecosystems.

Key words: ecology, cerrado, folk medicine, distribution.

Resumo

Introdução: *Eriosema pycnanthum* é uma Fabaceae em risco de extinção, pouco relatada na literatura científica. Na região de Itapeçerica- MG, é utilizada pela população local como medicamento para ajudar na cicatrização de feridas cutâneas. **Objetivo:** Avaliar a prática da fitofagia por *Dichelops melacanthus* (Heteroptera: Pentatomidae) sobre *E. pycnanthum*. **Metodologia:** As coletas foram realizadas em 2017 (abril – maio e outubro – dezembro), e foram confeccionados diferentes mapas de dispersão, além de análises histológicas dos tecidos foliares e análises químicas do perfil de solo. **Resultados:** Constatou-se sobreposição espacial entre *E. pycnanthum* e *D. melacanthus*, na área de estudo, com variações na razão inseto/planta entre as áreas e períodos avaliados. Os maiores índices de infestação ocorreram em outubro ($A1=1,3$; $A2=1,1$; $A3=0,3$), e os menores em maio ($A1=0,4$; $A2=0$; $A3=0$). A densidade de insetos correlacionou-se positivamente com temperaturas elevadas ($\approx 28-29,5$ °C). O percevejo exibiu comportamento alimentar oportunista nos intervalos do cultivo de milho, gerando danos foliares visíveis. As análises histológicas revelaram regiões necróticas, com desorganização do mesófilo e do tecido paliçádico, manifestadas externamente como pontuações amareladas nas superfícies foliares. **Conclusão:** *D. melacanthus* realiza fitofagia oportunista sobre *E. pycnanthum*, influenciada por fatores sazonais e térmicos. Essa interação gera uma pressão ecológica sobre a espécie vulnerável, evidenciando a urgência de estratégias de conservação para ecossistemas de campos rupestres ferruginosos.

Palavras-chave: ecologia, cerrado, medicina popular, dispersão.

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1. Introduction

The genus *Eriosema* (Fabaceae) comprises approximately 150 pantropical species associated mainly with tropical savannas and grasslands, and Brazil represents one of the main centers of diversity for the group in the Neotropics^{1,2}. Recent phylogenetic evidence indicates that *Eriosema* is a relatively recent savanna-adapted lineage whose diversification accompanied the expansion of open tropical vegetation, reinforcing its close relationship with seasonal and nutrient-poor environments¹. Despite this taxonomic and evolutionary relevance, current knowledge of the genus remains uneven, with most studies focusing on phylogeny, taxonomy, and broad ethnopharmacological aspects, while ecological information on individual Neotropical species remains limited².

The genus has also attracted pharmacological interest due to the presence of flavonoids, chromones, and other phenolic compounds associated with biological activities. However, this evidence is concentrated in a small number of species, predominantly African taxa, and should not be generalized to poorly studied Neotropical species without specific data². In the case of *E. pycnanthum*, the available literature is particularly scarce, highlighting a clear gap between the recognized diversity of the genus in Brazil and the ecological and biological information available for this species³.

This gap becomes especially relevant because *E. pycnanthum* occurs in ferruginous rupestrian grassland (canga) ecosystems, also known as canga

environments, in Minas Gerais, Brazil⁴. These environments are characterized by nutrient-poor soils, strong edaphic filtering, high levels of endemism, and pronounced floristic heterogeneity over short spatial scales^{5,6}. Recent studies have demonstrated that ferruginous and quartzitic campo rupestre are not ecologically equivalent, as substrate composition strongly influences plant community structure and must be considered in conservation and restoration strategies^{6,7}. Furthermore, these ecosystems are among the most threatened in Brazil, particularly in the Iron Quadrangle region, where mining activities have caused extensive habitat loss and fragmentation^{8,9}.

Within this ecological context, plant-insect interactions may influence plant performance, recruitment, and population persistence, particularly in restricted and threatened habitats. *D. melacanthus* (Heteroptera: Pentatomidae), also referred to as *Diceraeus melacanthus* in recent literature¹⁰, is a polyphagous stink bug widely studied in agricultural systems^{11,12}. This species can exploit multiple food sources, including cultivated and non-cultivated plants, and may use alternative hosts to maintain populations across heterogeneous landscapes^{13,14,15}. Such ecological flexibility suggests that native plant species may act as alternative or opportunistic hosts, even when they are not primary reproductive hosts¹⁶.

However, no previous study has documented an association between *E. pycnanthum* and *D. melacanthus*. Therefore, information regarding the occurrence of this native species and its interaction with phytophagous insects

remains limited. Documenting the occurrence of *E. pycnanthum* in the central-western region of Minas Gerais and describing its ecological association with *D. melacanthus* contributes to the understanding of the species' natural history and expands knowledge on plant–insect interactions in threatened ferruginous rupestrine ecosystems.

Accordingly, this study aims to evaluate the ecological association between *D. melacanthus* and *E. pycnanthum* in the municipality of Itapeçerica, Minas Gerais, Brazil. We investigate how the dietary flexibility of this polyphagous stink bug may facilitate the use of vulnerable native hosts within anthropized transition zones. By doing so, this work seeks to assess whether agroecosystem-associated insects may represent an additional source of pressure on the endemic flora of ferruginous rupestrine grasslands, providing ecological information to support conservation and restoration strategies for this highly threatened ecosystem.

2. Methodology

Study area

The study was conducted in the municipality of Itapeçerica, Minas Gerais, Brazil, within ferruginous campo rupestre environments. Three sampling areas were selected based on the natural occurrence of *E. pycnanthum* and the observed presence of *D. melacanthus*. The selected areas were considered representative of the local ecological conditions and spatial distribution of the species. Geographic coordinates of the sampling areas were: Area 1: 20°47'28" S, 45°10'77" W Area 2: 20°47'28" S, 45°10'88" W Area 3: 20°47'27" S, 45°12'29" W Field collections were carried out in April, May, October,

November, and December 2017.

Occurrence mapping

Occurrence maps were constructed by integrating primary empirical data with historical records of *E. pycnanthum* in the state of Minas Gerais. Historical data were compiled from the Herbarium of the Federal University of Minas Gerais (BHCB) and literature records^{17,18,19,20,21}. Primary spatial coordinates of the locations where *E. pycnanthum* was recorded, alongside the concurrent incidence of *D. melacanthus*, were obtained *in situ* during the 2017 field surveys using a global positioning system receiver, GPS, Garmin, eTrex 10 model. The cartographic construction involved the systematic plotting of these georeferenced points into official cartographic bases and previously available species occurrence maps. Spatial alignment and visual correlation were executed through manual layering, allowing visualization of the spatial overlap between plant populations and insect occurrence zones."

Identification of botanical material

Plant specimens were collected and processed as botanical exsiccates. Identification was performed by specialists at the Herbarium of the Federal University of Minas Gerais (UFMG), where the material was deposited under voucher number BHCB 159402.

Insect species identification

Three adult insects were manually collected while feeding on the leaves and seeds of *Eriosema pycnanthum*. Field-collected specimens were preserved in

70% ethanol and subsequently identified using the taxonomic key by Grazia²² at the Laboratory of Insects and Disease Vectors of the Federal University of São João del-Rei, Centro-Oeste Campus, CCO/UFSJ.

Sample distribution and collection

Sampling was conducted across three areas, with a total of N = 54 individuals of *E. pycnanthum* evaluated across all sampling sites. The number of individuals per area varied according to natural occurrence and field conditions, and these plants were considered as biological replicates for the study.

The sampling design aimed to capture the spatial distribution and occurrence of *E. pycnanthum* populations, as well as the activity of associated insects. A total of 114 adult specimens of *D. melacanthus* were recorded throughout the sampling period. Among these, representative individuals (n = 3) were manually collected while actively feeding on leaves and seeds. Collected insects were preserved in a 70% ethanol solution for subsequent taxonomic identification.

All samplings were conducted under official environmental authorization (Permit No. 106146), in strict compliance with Brazilian legislation for biological sampling.

Histological analysis

Leaf samples were collected in triplicate from each of the three study areas over the 5-month evaluation period and stored in a 70% hydroalcoholic solution until processing. A total of 45 leaves per area were analyzed.

Additionally, a control group consisting of 15 leaves per area was collected from

individuals with no visible signs of insect feeding damage. These control samples were used for comparative anatomical analysis with leaves exposed to *D. melacanthus*.

The median region, including the midrib and margins, was isolated and processed using standard histological techniques. Samples were embedded in historesin (Leica), following the manufacturer's protocol. Sections of 4µm thickness were obtained and stained with toluidine blue in sodium borate²³.

Histological processing and observations were performed in triplicate to improve analytical consistency.

Soil analysis

To ensure statistical replication for local soil characterization, a total of 10 independent soil replicates were randomly collected from each sampling area, totaling N = 30 samples. The material was analyzed at the Soil Analysis Laboratory of the Federal Institute of Minas Gerais (IFMG), Campus Bambuí/MG, following standardized procedures described in the Soil Analysis Methods Manual²⁴.

Statistical analysis

Statistical analyses were performed using GraphPad Prism® (version 8.0). Data normality for the insect/plant ratio and temperature variables was assessed using the Shapiro-Wilk test, confirming normal distribution across all sampling areas and periods (p > 0.05).

Based on these results, differences in the insect/plant ratio among sampling months within each area were evaluated using one-way analysis of variance, ANOVA, followed by Tukey's multiple-

comparison post hoc test when significant differences were detected

Spatial variation among sampling areas was also assessed using one-way ANOVA.

The relationship between insect density expressed as the insect/plant ratio, and temperature was analyzed using Pearson's correlation coefficient (r).

All analyses were conducted adopting a

significance level of $\alpha = 0.05$ ($p < 0.05$).

3. Results

Occurrence data obtained from the Herbarium of the Federal University of Minas Gerais (UFMG) were used to generate the distribution map of *E. pycnanthum* in Minas Gerais, Brazil (Figure 1).

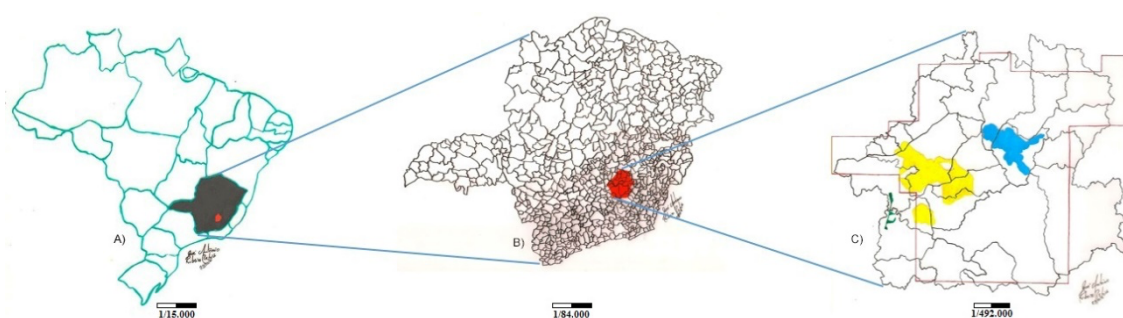


Figure 1: Geographic location of the Iron Quadrangle Geopark in the state of Minas Gerais, Brazil, and its spatial context within the study region. The main ferruginous rupestrian areas are highlighted: Serra da Gandarela (blue), Serra da Moeda (green), and Rola Moça (yellow).

The geographic distribution of *Eriosema* spp. in the Americas and Brazil, as well as

the occurrence areas of *E. pycnanthum* in Minas Gerais, are presented in Figure 2.

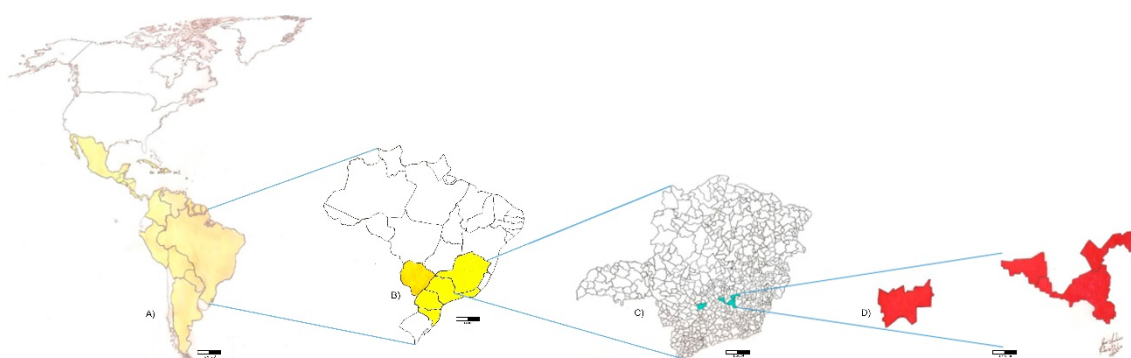


Figure 2 – Geographic distribution of *Eriosema* spp. in the Americas and Brazil, and occurrence areas of *E. pycnanthum* in Minas Gerais.

Three sampling areas were defined in the municipality of Itapecerica, Minas Gerais

(Figure 3). Area 1 is located near a road with adjacent agricultural activity. Area 2

is characterized by a gently sloping terrain with nearby eucalyptus vegetation and

agricultural use. Area 3 consists of open pasture areas with no shading.

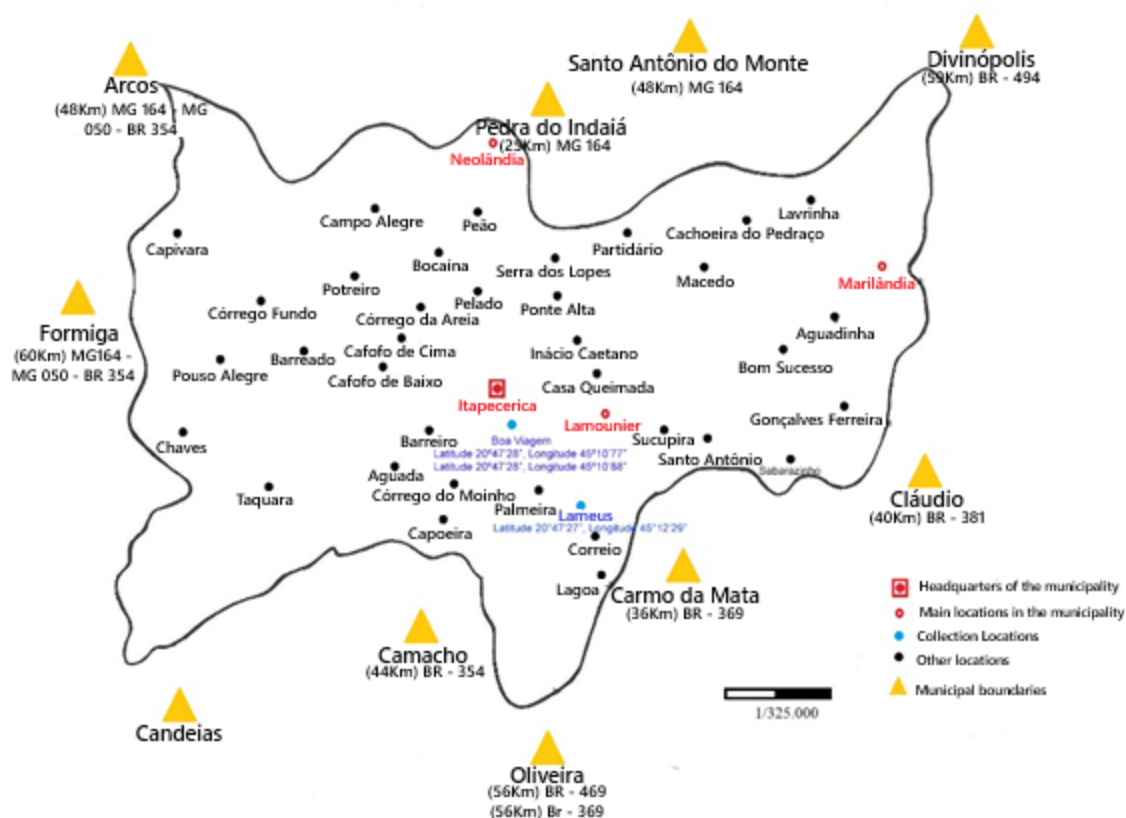


Figure 3 – Sampling areas in the municipality of Itapecerica, Minas Gerais, Brazil.

Soil analysis indicated a sandy texture and low organic matter content, with the following characteristics: pH 6.1, iron

content of 49.0 mg/dm³, magnesium 1.46 cmolc/dm³, and clay content of 14.4 g/kg (Table 1).

Table 1: Soil chemical and physical properties of the sampling areas.

Parameter	Unit	Value
pH (H ₂ O)	-	6.1
P (Mehlich)	mg/dm ³	0.6
K	mg/dm ³	102.0

Ca	cmol/dm ³	2.22
Mg	cmol/dm ³	1.46
Al	cmol/dm ³	0.00
H+Al	cmol/dm ³	0.96
Organic matter	dag/kg	0.29
Organic carbon	dag/kg	0.17
Fe	mg/dm ³	49.0
Mn	mg/dm ³	29.8
Zn	mg/dm ³	2.5
Sand	g/kg	58.0
Clay	g/kg	14.4
Silt	g/kg	27.6
Soil classification	-	Sandy

E. pycnanthum was observed in sandy, well-drained soils, predominantly in sloped areas. Individuals were distributed across the three sampling areas (Figure 3).

Georeferenced distribution data of sampling areas and occurrence records are shown in Figure 4.

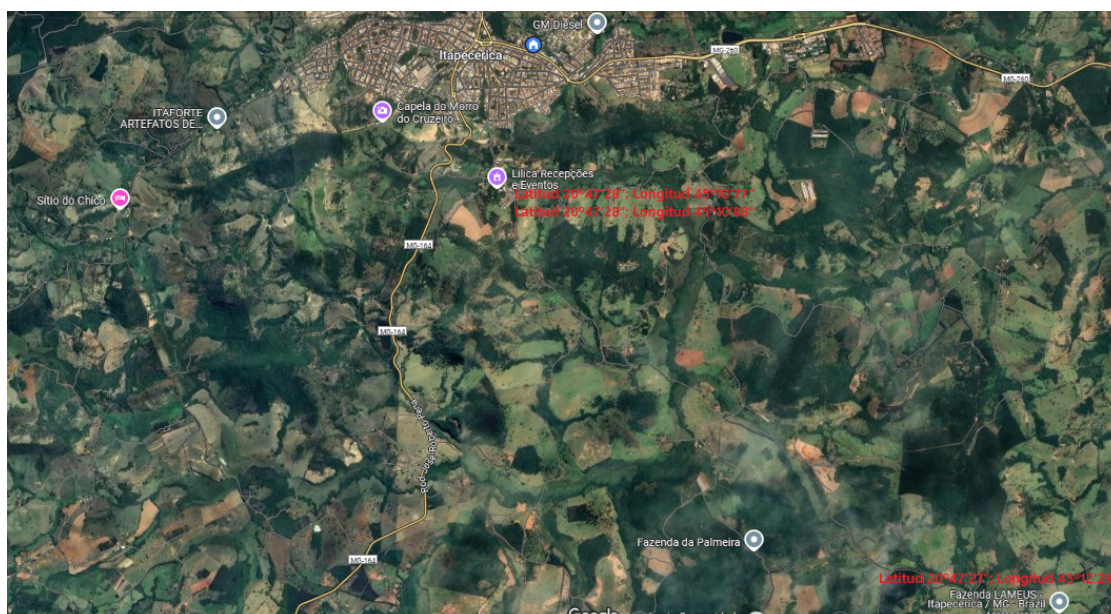


Figure 4 – Georeferenced distribution of sampling areas and occurrence records of *E. pycnanthum*.

During field collections conducted in April and May 2017, *D. melacanthus* individuals were observed feeding on *E. pycnanthum*

in Areas 1 and 2, whereas no insects were recorded in Area 3 (Figure 5).



Figure 5 – *D. melacanthus* feeding on *E. pycnanthum* leaves and visual aspects of feeding damage.

In Area 1, 16 insects were recorded on 16

plants in April, resulting in an insect/plant

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ratio of 1.0. In May, 7 insects were observed on 18 plants, corresponding to a ratio of 0.4 (Table 2). In Area 2, 3 insects were recorded on 9 plants in April (ratio = 0.33), while no insects were observed in May (Table 2). In Area 3, no insects were recorded in April or May (Table 2). Across

all sampling periods, insect/plant ratios varied among months and areas (Table 2). The highest values were observed in October for Areas 1 (1.28) and 2 (1.11), while lower values were recorded in May and December.

Table 2 – Occurrence and prevalence of *D. melacanthus* on *E. pycnanthum* across sampling months.

Months	Area 1 (6 m ²)			Area 2 (45 m ²)			Area 3 (71 m ²)			
	n° insect	n° plant	Ratio	n° insect	n° plant	Ratio	n° insect	n° plant	Ratio	Temp. Common
April	16	16	1:1	3	9	0.33:1	0	19	00:1	29,5 °C
May	7	18	0.4:1	0	9	00:1	0	19	00:1	21,5 °C
October	23	18	1.28:1	10	9	1.11:1	6	19	0.31:1	28 °C
November	18	18	1:1	7	9	0.78:1	12	22	0.54:1	24,5 °C
December	6	19	0.31:1	2	10	0.2:1	4	25	0.16:1	22 °C

Microscopic analysis of leaf tissues revealed structural differences between control and infested leaves. Infested

samples showed cellular disruption and necrotic regions in the mesophyll tissue (Figure 6).

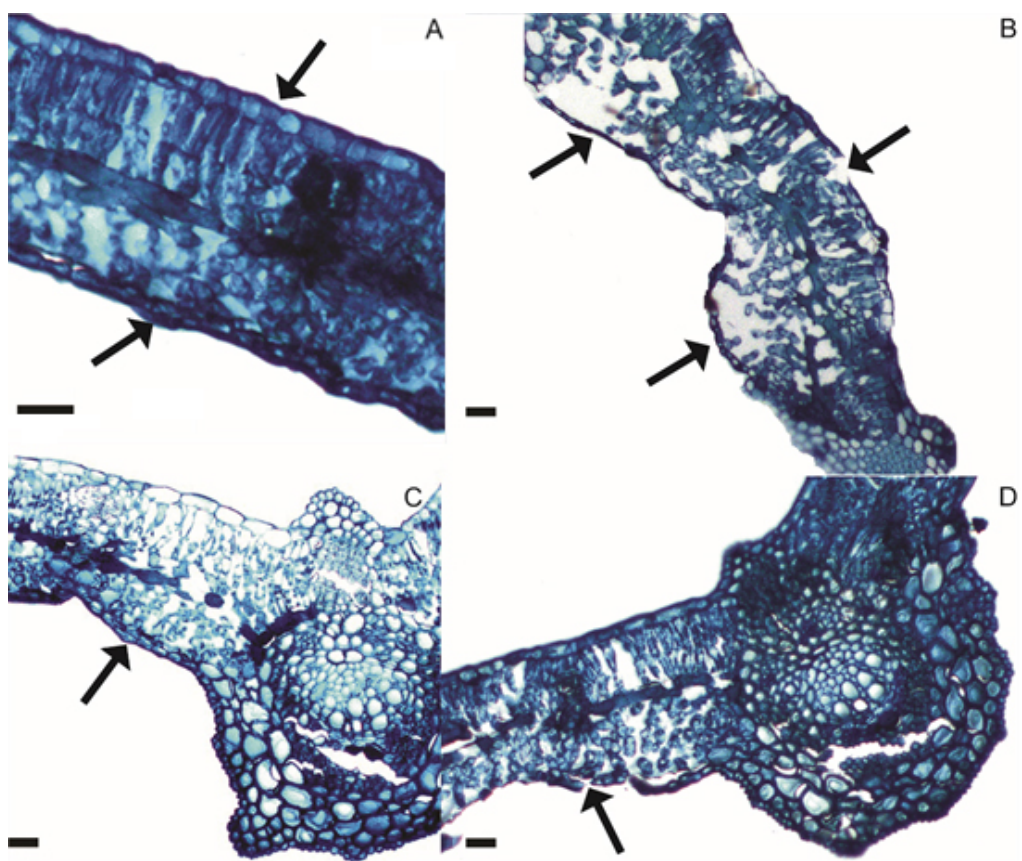


Figure 6 - Photomicrographs of *E. pycnanthum* leaves showing feeding damage caused by *D. melacanthus*. A) Control leaf mesophyll with normal epidermis; B) Infested leaf showing cellular necrosis and feeding site; C) Control midrib structure; d) Infested leaf showing tissue disruption. Scale bar: 100µm.

Statistical analysis indicated that the insect/plant ratio data did not significantly deviate from normality across all sampling areas, according to the Shapiro–Wilk test, $p > 0.05$, supporting the use of parametric tests. Temporal analysis revealed significant variation in insect occurrence among months in Areas 1 and 2 (one-way ANOVA, $p < 0.05$), while no significant differences were observed in Area 3 ($p > 0.05$). These results indicate that insect occurrence was not uniform over time and varied depending on the sampling area.

Spatial comparison also showed significant differences among areas (one-way ANOVA, $p = 0.0084$), with higher

insect/plant ratios observed in Area 1 compared to Area 3. This suggests heterogeneity in insect distribution across the studied environments.

Pearson correlation analysis between insect/plant ratio and temperature showed a positive relationship ($r = 0.8497$), although not statistically significant ($p = 0.0689$). This indicates a tendency for increased insect occurrence at higher temperatures, but without sufficient statistical support to confirm a direct association.

Overall, the statistical results demonstrate significant temporal and spatial variation in insect occurrence, while the relationship with temperature remains

suggestive but inconclusive.

Table 3 – Statistical analysis of insect/plant ratio and environmental variables.

Analysis	Variables	Test	Statistic	p-value	Interpretation
Normality	Ratio - Insect/Plant (A1, A2, A3)	Shapiro-Wilk	A1: $W = 0.8854$; A2: $W = 0.9266$; A3: $W = 0.9100$	A1: $p = 0.3346$; A2: $p = 0.5735$; A3: $p = 0.4677$	Data followed a normal distribution ($p > 0.005$)
Temporal variation	Ratio vs months	One-way ANOVA	A1: $F(4,10) = 5.21$; A2: $F(4,10) = 4.65$; A3: $F(4,10) = 2.48$	A1: $p = 0.0241$; A2: $p = 0.0312$; A3: $p = 0.1145$	Significant temporal variation in Areas 1 and 2.
Spatial variation	Ratio vs areas	One-way ANOVA	$F(2,12) = 7.34$	$p = 0.0084$ (A1 vs A3)	Significant differences among áreas; higher values in Area 1 compared to Area 3.
Climate interaction	Ratio vs temperature	Pearson correlation	$R = 0.8497$	$p = 0.0689$	Positive correlation not statistically significant.

4. Discussion

According to Grear (1970)¹⁷ and Miotto (1988)¹⁸, Latin American countries host occurrence sites for different *Eriosema* species, covering a wide geographic range. In Brazil, the genus is distributed across several states, with Minas Gerais representing a major center of occurrence^{17,18,21}. Recent syntheses reinforce this pattern, indicating that Brazil concentrates much of the Neotropical diversity of the genus and that *Eriosema* represents a relatively recent lineage adapted to savanna environments, with diversification linked to the expansion of open tropical vegetation^{1,21}.

This broader evolutionary context supports the interpretation that *E. pycnanthum* is associated with open, seasonal, and nutrient-poor environments. Although traditionally considered restricted to the Quadrilátero

Ferrífero region³, the records obtained in Itapeceirica suggest that its distribution may extend beyond previously recognized limits, including ecotonal zones between Cerrado and Atlantic Forest.

This interpretation is consistent with current knowledge of campo rupestre ecosystems. These environments are characterized by high environmental heterogeneity, strong edaphic filtering, and nutrient-poor soils, which shape plant establishment and species turnover at fine spatial scales^{22,25}. Ferruginous and quartzitic substrates are not ecologically interchangeable, as substrate composition directly influences floristic structure and ecological dynamics^{6,7}.

In this context, temperature plays an important role in insect ecology, influencing the survival, development, and behavior of pentatomids²⁶. Although no significant correlation was detected, a

positive trend between temperature and insect occurrence was observed, particularly in Area 1. This indicates that temperature alone does not determine insect distribution. Instead, it may interact with other factors, such as host availability and landscape structure. Together, these results suggest that *D. melacanthus* responds to a combination of thermal conditions and resource predictability in heterogeneous environments.

The statistical analyses reinforce this interpretation. The observed temporal differences indicate that insect occurrence is structured by seasonal resource pulses rather than stochastic variation. Importantly, these differences coincide with periods of agricultural transition, suggesting that seasonal resource dynamics may be a key driver of insect behavior.

Spatial differences were also evident. The higher insect prevalence in Area 1 suggests that proximity to agricultural environments may increase resource availability and favor insect persistence. This pattern is consistent with the absence of insects in Area 3 and their concentration in Areas 1 and 2, reinforcing the role of landscape context in structuring insect distribution.

The seasonal and spatial patterns observed here align with the current understanding of *D. melacanthus* as a polyphagous species associated with dynamic agroecosystems²⁷. Studies indicate that non-crop plants may function as alternative or transitional resources, allowing insects to persist during periods of low availability of primary hosts^{13,14}.

In agricultural systems, crop succession and seasonal planting promote host-

switching behavior by creating temporary resource gaps²⁸. In maize-based systems, these gaps may lead polyphagous insects to exploit alternative hosts, including native vegetation¹². The association with *E. pycnanthum* observed here is therefore consistent with opportunistic phytophagy rather than a primary host relationship.

From the plant's perspective, this interaction is not neutral. Histological analyses revealed tissue damage, including epidermal disruption and necrosis, consistent with the feeding mechanism of pentatomids, which inject enzymatic saliva into plant tissues^{29,30,31,32}. Such damage may impair physiological processes, including photosynthesis and water balance. Although not directly quantified, repeated herbivory may reduce plant fitness and potentially affect survival and recruitment in small or spatially restricted populations.

In ferruginous campo rupestre ecosystems, where environmental conditions are already restrictive, such additional stress may have amplified effects on plant performance^{25,33}. Although the present study does not quantify population-level impacts, the combination of field observations, histological damage, and statistical patterns suggests that this interaction may influence plant fitness.

This host-switching behavior may represent an adaptive response to temporally variable environments, where selection favors insects capable of exploiting transient resources. Such flexibility allows persistence in heterogeneous landscapes, particularly those influenced by agriculture²⁸. The use of *E. pycnanthum*, therefore appears to be a transient strategy linked to resource

availability rather than a stable ecological association.

Ferruginous campo rupestre ecosystems are highly threatened by mining and land-use change^{7,25}. In this context, agroecosystems may act as sources of ecological pressure beyond cultivated areas, influencing plant-insect interactions in adjacent natural habitats.

For species such as *E. pycnanthum*, which may have restricted distribution and specific habitat requirements, additional stress from opportunistic herbivory may become ecologically relevant, particularly in fragmented environments.

Some limitations must be acknowledged. The study is constrained by its restricted spatial scale, short sampling period, and lack of experimental manipulation, which limit causal inference and long-term ecological interpretation. Future studies should incorporate broader spatial sampling, experimental approaches, and long-term monitoring.

Overall, the results indicate that the interaction between *D. melacanthus* and *E. pycnanthum* is shaped by seasonality, landscape context, and resource availability. These findings highlight the importance of considering plant-insect interactions within coupled natural and agricultural systems, particularly in threatened ecosystems.

5. Conclusion

The interaction between *E. pycnanthum* and *D. melacanthus* in the Itapeçerica region reflects a context-dependent ecological relationship shaped by seasonal dynamics and landscape structure. The overlap between both

species during maize off-season periods suggests that agricultural cycles may promote opportunistic host use by this polyphagous insect, extending its activity into native vegetation.

From a plant perspective, the observed herbivory is not neutral. Leaf damage associated with feeding results in tissue necrosis and structural disruption, which may impair physiological performance and potentially affect plant fitness in natural populations.

These findings highlight a previously underexplored pathway by which agroecosystems may indirectly influence plant-insect interactions in ferruginous campo rupestre ecosystems, reinforcing the ecological vulnerability of native species occurring in anthropized landscapes.

Future studies should investigate the long-term population-level effects of herbivory on *E. pycnanthum*, as well as the role of landscape configuration in mediating these interactions, particularly under scenarios of increasing environmental disturbance.

6. Declaration of conflict of interest

The authors declare that there is no conflict of interest.

7. Acknowledgements

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8. References

1. Cândido ES, Vatanparast M, Vargas W, Bezerra LMPA, Lewis GP, Mansano VF, et al. Molecular phylogenetic insights into the evolution of *Eriosema* (Fabaceae): a recent tropical savanna-adapted genus. **Bot J Linn Soc.** 2020;194(4):439–59. doi:10.1093/botlinnean/boaa059.
2. Ateba SB, Njamen D, Krenn L. The genus *Eriosema* (Fabaceae): from ethnopharmacology to an evidence-based phytotherapeutic perspective. **Front Pharmacol.** 2021;12. doi:10.3389/fphar.2021.641225.
3. Fortunato RH. Systematic relationships in *Rhynchosia* (Cajaninae-Phaseoleae-Papilionoideae-Fabaceae) from the Neotropics. In: Herendeen PS, Bruneau A, editors. *Advances in legume systematics*. Kew: Royal Botanic Gardens; 2000. p. 339–54.
4. Fernandes GW, Barbosa NPU, Alberton B, Barbieri A, Dirzo R, Goulart F, et al. The deadly route to the collapse of ecosystems: mining impacts on rupestrine grasslands. **Biodivers Conserv.** 2018;27:2587–603. doi:10.1007/s10531-018-1556-4.
5. Caminha-Paiva DVM, Gomes J, Cunha-Blum MJP, Alves D, Rosa JC, Santiago D, et al. Floristic mosaics of the threatened Brazilian campo rupestre. **Nat Conserv Res.** 2022;7(1):10–8. doi:10.24189/ncr.2022.004.
6. Fernandes GW, Ramos L, Paiva DC, Cunha-Blum J, Gomes VM, Negreiros D. Floristic composition and edaphic relationships in ferruginous campo rupestre reference ecosystems. **J Mt Sci.** 2024;21:719–33. doi:10.1007/s11629-023-8333-x.
7. Carmo FF, Kamino LHY. Controversies and hidden risks in biodiversity offsets in critically threatened canga ecosystems in Brazil. **Oryx.** 2023;57(1):63–71. doi:10.1017/S0030605322000333.
8. Nascimento ATA, Mendes IV, Gonçalves RM, Ferreira HLS, Santos EMF, Silva ACS, et al. Atlantic forest and ferruginous rocky grasslands environmental offsetting in Minas Gerais, southeastern Brazil: between legalism and ecological ineffectiveness. **Desenvolv Meio Ambiente.** 2025;66:82–95. doi:10.5380/dma.v66i.97252.
9. Barão KR, Ferrari A, Grazia J. Phylogenetic analysis of the *Euschistus* group (Hemiptera: Pentatomidae) suggests polyphyly of *Dichelops* with the erection of *Diceraeus*. **Austral Entomol.** 2020;59:770–83. doi:10.1111/aen.12489.
10. Michelotto MD, Crosariol-Netto J, Freitas RS, Duarte AP, Busoli AC. Transgenic maize: effect on target and non-target pests. **Nucleus.** 2013;1(1):67–82. doi:10.3738/nucleus.v0i0.903.
11. Slansky F Jr, Panizzi AR. Nutritional ecology of seed-sucking insects. In: Slansky F Jr, Rodriguez JG, editors. *Nutritional ecology of insects, mites, spiders and related invertebrates*. New York: Wiley; 1987. p. 161–75.
12. Panizzi AR, Lucini TL. The overlooked role of weed plants affecting pest stink bug bioecology in the Neotropics. **Arthropod Plant Interact.** 2022;16(1):1–14. doi:10.1007/s11829-021-09879-5.

13. Queiroz AP, Gonçalves J, Silva DM, Panizzi AR, Bueno AF. *Diceraeus melacanthus* development, feeding preference and oviposition on different food sources. **Rev Bras Entomol.** 2022;66(4):e20220038. doi:10.1590/1806-9665-RBENT-2022-0038.
14. Borges M, Michereff MFF, Laumann RA, Santana GT, Castro BS, Silva CC, et al. Influence of pigeon pea on oviposition behaviour of *Diceraeus melacanthus*. **Arthropod Plant Interact.** 2023;17(1):77–89. doi:10.1007/s11829-022-09932-x.
15. Bueno NM, Baldin ELL, Canassa VF, Ribeiro LP, Lourenção AL, Koch RL. Characterization of antixenosis and antibiosis of corn genotypes to *Dichelops melacanthus*. **Gesunde Pflanz.** 2021;73(1):67–76. doi:10.1007/s10343-020-00529-z.
16. Grear JW. A revision of the American species of *Eriosema*. **Mem N Y Bot Gard.** 1970;20(3):1–98.
17. Miotto STS. Leguminosae-Faboideae: tribo Phaseoleae - subtribo Cajaninae. Flora Ilustrada do Rio Grande do Sul. Porto Alegre: Instituto de Biociências; 1988.
18. Fortunato RH, Polhill RM, Verdcourt B. Proposal to correct the conservation of *Eriosema*. **Taxon.** 2003;57(4):817–8. doi:10.2307/1555052.
19. Cândido ES, Fortuna-Perez AP, Bezerra LMPA, Aranha Filho JLM. A new species of *Eriosema* from Minas Gerais, Brazil. **Phytotaxa.** 2014;178(3):229–32. doi:10.11646/phytotaxa.178.3.11.
20. Cândido ES, Vargas W, Bezerra LMPA, Mansano VF, Vatanparast M, Lewis GP, et al. Taxonomic synopsis of *Eriosema* in Brazil. **Phytotaxa.** 2019;416(2):91–137. doi:10.11646/phytotaxa.416.2.1.
21. Grazia J. Revisão do gênero *Dichelops* (Heteroptera, Pentatomidae). **Iheringia Ser Zool.** 1978;53:3–119.
22. Vidal BC. Acid glycosaminoglycans and endochondral ossification: microspectrophotometric evaluation and macromolecular orientation. **Cell Mol Biol.** 1977;22(1):45–64.
23. Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA). Manual de métodos de análise de solo. 3a ed. Brasília: EMBRAPA; 2017.
24. Cândido ES, Fortuna-Perez AP, Filho JLMA, Bezerra LMPA. *Eriosema* in southeastern Brazil. **Rodriguésia.** 2014;65(4):885–916. doi:10.1590/2175-7860201465406.
25. Fernandes GW, Arantes-Garcia L, Barbosa M, Barbosa NPU, Batista EKL, Beiroza W, et al. Biodiversity and ecosystem services in the campo rupestre: a roadmap for sustainability. **Perspect Ecol Conserv.** 2020;18(4):213–22. doi:10.1016/j.pecon.2020.10.004.
26. Chocorosqui VR, Panizzi AR. Temperature influence on the nymphal biology of *Dichelops melacanthus*. **Semina Cienc Agrar.** 2002;23(2):217–20. doi:10.5433/1679-0359.2002V23N2P217.
27. Panizzi AR, Bueno AF, Silva FAC. Insetos que atacam vagens e grãos. In: Hoffmann-Campo CB, Corrêa-Ferreira BS, Moscardi F, editors. Soja: manejo integrado de insetos e outros artrópodes-praga. Brasília:

Embrapa; 2012. p. 335–420.

28. Corrêa-Ferreira BS, Panizzi AR. Percevejos da soja e seu manejo. Brasília: Embrapa; 1999.
29. Nava DE, Delmar H. Feeding behavior and salivary enzymes in pentatomids. **Neotrop Entomol.** 2009;38(2):213–9. doi:10.1590/S1519-566X2009000200006.
30. Sosa-Gómez DR, Moscardi F. Retenção foliar diferencial em soja provocada por percevejos (Heteroptera: Pentatomidae). **An Soc Entomol Bras.** 1995;24(2):414–20. doi:10.37486/0301-8059.v24i2.1042.
31. Coimbra SM, Silva JJ, Chocorosqui VR, Panizzi AR. Danos de *Dichelops melacanthus* em trigo. **Cienc Rural.** 2005;35(6):1243–7. doi:10.1590/S0103-84782005000600003.
32. Gomes MFR, Salvadori JR, Pereira PRVS, Panizzi AR. Injúrias de percevejos pentatomídeos em plântulas de milho. **Cienc Rural.** 2011;41(1):1115–9. doi:10.1590/S0103-84782011005000081.
33. Tameirão LBS, Caminha-Paiva D, Negreiros D, Veloso MDM, Berbara RLL, Dias LE, et al. Role of environmental filtering and functional traits for species coexistence in a harsh tropical montane ecosystem. **Biol J Linn Soc.** 2021;133(2):546–60. doi:10.1093/biolinnean/blaa181.