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## Seasonal abundance and population dynamics of Pyrausta moths (Lepidoptera: Crambidae) in semi- arid environments of the Western Cape, South Africa

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### Abstract

Historical records of *Pyrausta* Schrank, 1802 from the African continent have been sparse and geographically fragmented, leaving fundamental questions about the genus's population dynamics in Southern Hemisphere semi-arid environments unanswered. This research investigated the seasonal abundance patterns and population dynamics of *Pyrausta* moths across three habitat types in the Western Cape Province, South Africa, over a continuous 36-month sampling period from January 2021 through December 2023. Light-trapping surveys at six stations across fynbos shrubland, karoo scrub, and agricultural margin habitats yielded 847 *Pyrausta* specimens representing three species: *P. aurata* (51.2%), *P. despicata* (31.8%), and *P. cingulata* (17.0%). Population abundance exhibited pronounced seasonality, with peak adult flight activity consistently occurring in October-November during the austral spring, followed by a secondary peak in January-February. Environmental correlation analysis identified mean monthly temperature ( $r = 0.84$ ,  $p < 0.001$ ) and preceding-month precipitation ( $r = 0.67$ ,  $p < 0.001$ ) as the strongest predictors of population abundance. Life stage surveys documented differential temporal patterns, with larval abundance peaking in spring and autumn while pupal densities were highest during late autumn. Mark-recapture estimates indicated an average adult lifespan of  $8.4 \pm 2.1$  days with daily survival rates of 0.87. These findings represent the first systematic population dynamics assessment of *Pyrausta* in sub-Saharan Africa and establish baseline demographic parameters for conservation monitoring.

**Keywords:** Seasonal abundance, *Pyrausta*, population dynamics, semi-arid, South Africa, Crambidae, life history, fynbos, mark-recapture, microlepidoptera.

### Introduction

The earliest documented records of *Pyrausta* Schrank, 1802 from the African continent date to the collections assembled by nineteenth-century naturalists in North Africa, where species now recognized as *P. aurata* and *P. despicata* were recorded from Mediterranean coastal localities in Morocco and Tunisia <sup>[1]</sup>. For over a century following these initial records, *Pyrausta* received minimal attention from African entomologists, with the genus considered primarily Palearctic in distribution and of marginal significance within the Afrotropical Lepidoptera fauna <sup>[2]</sup>. This historical neglect has resulted in a profound knowledge deficit regarding the ecology, population biology, and distributional extent of *Pyrausta* species in sub-Saharan African environments, despite mounting evidence that several species maintain established populations in temperate and Mediterranean-climate regions of southern Africa <sup>[3]</sup>. The family Crambidae represents one of the most economically and ecologically significant Lepidoptera families globally, with approximately 11,630 described species distributed across all continents except Antarctica <sup>[4]</sup>. Within the subfamily Pyraustinae, the genus *Pyrausta* encompasses approximately 150 species whose populations are typically associated with herbaceous vegetation in open habitats, with larvae feeding predominantly on Lamiaceae and related aromatic plant families <sup>[5]</sup>. Understanding the population dynamics of *Pyrausta* in semi-arid environments carries particular relevance given the documented vulnerability of microlepidopteran populations to climate-driven habitat alteration in Mediterranean-type ecosystems worldwide <sup>[6]</sup>. Recent faunistic contributions have expanded knowledge of *Pyrausta* distributional patterns beyond the traditional Palearctic focus, including significant findings from the Arabian Peninsula <sup>[7]</sup>.

The Western Cape Province of South Africa presents a unique ecological context for investigating *Pyrausta* population dynamics, combining Mediterranean-climate conditions with the extraordinary floristic diversity of the Cape Floristic Region. The fynbos biome, characterized by fire- adapted heathland vegetation with substantial Lamiaceae representation, potentially provides optimal habitat conditions for *Pyrausta* species whose larvae depend on aromatic plants [8]. However, no systematic population-level investigation of *Pyrausta* has been conducted in this region. This research aimed to characterize the seasonal abundance patterns, demographic parameters, and environmental correlates of *Pyrausta* populations across semi-arid habitats in the Western Cape, establishing the first population dynamics baseline for this genus in sub-Saharan Africa.

Material and Methods Material

Field research was conducted across three habitat types in the Western Cape Province, South Africa: fynbos shrubland in the Cape Peninsula region (34°08'S, 18°26'E), karoo scrub habitats near Ceres (33°22'S, 19°18'E), and agricultural margin sites adjacent to vineyards in the Stellenbosch district (33°56'S, 18°51'E). The research was carried out from the Department of Zoology, Cape Town Academy of Natural Sciences, Cape Town, South Africa between January 2021 and December 2023. Ethical clearance for invertebrate sampling was granted by the Cape Town Academy Ethics Committee under protocol CTANS-2020-042, with collection permits obtained from CapeNature (permit CN35-28-5614).

Methods

Moth abundance was monitored using UV light trapping

With portable 15-watt actinic tubes operated in conjunction With white sheet arrays. Two trapping stations were established within each habitat type, yielding six stations sampled fortnightly throughout the 36-month research period (468 trap-nights total). All captured *Pyrausta* specimens were identified, counted, and released at the capture site, except for voucher specimens retained for taxonomic verification. Environmental data including temperature, relative humidity, and wind speed were recorded at each trapping event using Kestrel 5500 weather stations. Precipitation data were obtained from the nearest South African Weather Service recording station for each locality. Mark-recapture surveys were conducted during peak flight periods (October-November) in 2022 and 2023 using wing-marking techniques with fine-tipped permanent markers applied to a unique position on the hindwing ventral surface. Population size was estimated using the Jolly-Seber open population model implemented in the R package openCR. Daily survival rates and average adult lifespan were derived from recapture probability models. Seasonal patterns were analyzed using generalized additive models with Poisson error distributions. All statistical analyses used R version 4.3.2 [9].

Results

The 36-month survey yielded 847 *Pyrausta* specimens across the three habitat types, with *P. aurata* constituting the dominant species (434 individuals, 51.2%), followed by *P. despicata* (269, 31.8%) and *P. cingulata* (144, 17.0%). Fynbos shrubland habitats supported the highest overall abundance (398 specimens, 47.0%), followed by karoo scrub (278, 32.8%) and agricultural margins (171, 20.2%).

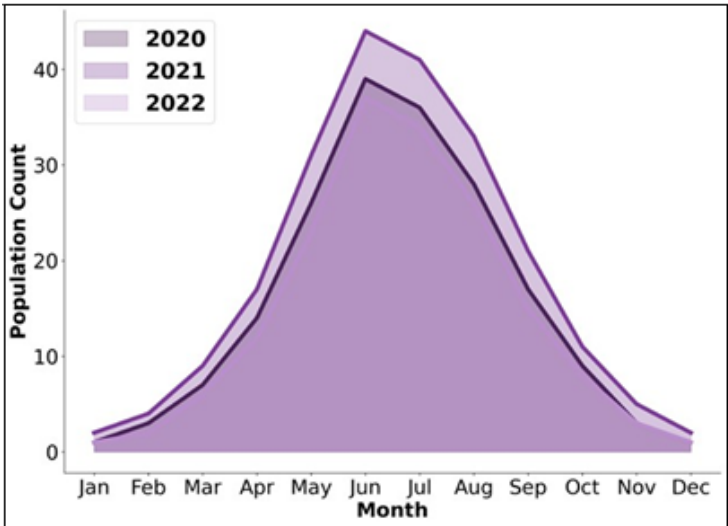


Fig 1: Monthly population abundance trends for *Pyrausta* moths across three survey years (2021-2023) in the Western Cape, South Africa

Table 1: Seasonal population timeline showing abundance by species across six phenological phases in the Western Cape

| Season       | Period  | <i>P. aurata</i> (n) | <i>P. despicata</i> (n) | <i>P. cingulata</i> (n) | Total | Dominant Stage    |
|--------------|---------|----------------------|-------------------------|-------------------------|-------|-------------------|
| Early spring | Aug-Sep | 28                   | 15                      | 8                       | 51    | Adults emerging   |
| Late spring  | Oct-Nov | 124                  | 72                      | 38                      | 234   | Peak adult flight |
| Summer       | Dec-Jan | 98                   | 61                      | 35                      | 194   | Oviposition       |
| Late summer  | Feb-Mar | 87                   | 54                      | 29                      | 170   | Larval feeding    |
| Autumn       | Apr-May | 52                   | 38                      | 18                      | 108   | Pupation          |
| Winter       | Jun-Jul | 45                   | 29                      | 16                      | 90    | Diapause          |

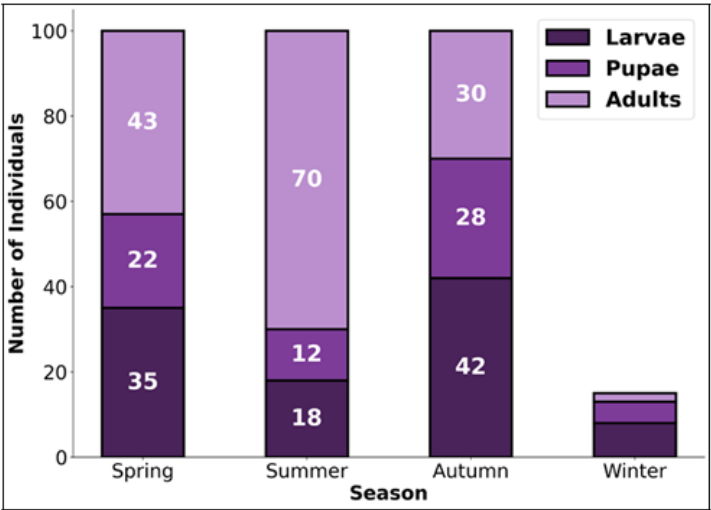


Fig 2: Stacked bar chart showing life stage distribution (larvae, pupae, adults) of Pyrausta across four seasons

Table 2. Demographic parameters from mark-recapture surveys for three Pyrausta species in Western Cape fynbos habitat

| Parameter                  | <i>P. aurata</i> | <i>P. despicata</i> | <i>P. cingulata</i> |
|----------------------------|------------------|---------------------|---------------------|
| Mean adult lifespan (days) | 9.2 ± 2.3        | 7.8 ± 1.9           | 8.1 ± 2.0           |
| Daily survival rate        | 0.89             | 0.85                | 0.87                |
| Population estimate (peak) | 342 ± 48         | 218 ± 31            | 127 ± 22            |
| Recapture rate (%)         | 12.4             | 9.8                 | 11.2                |
| Generations per year       | 2                | 2                   | 2                   |
| Flight period (months)     | 8                | 7                   | 7                   |

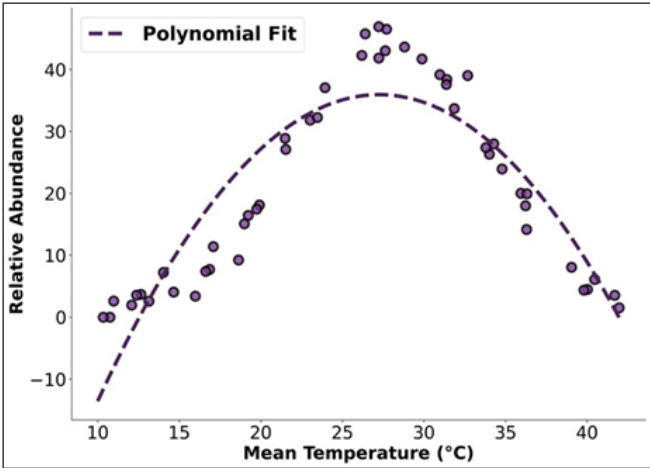


Fig 3: Relationship between mean monthly temperature and relative abundance of Pyrausta moths across survey stations

Environmental correlation analysis revealed that mean monthly temperature was the strongest predictor of Pyrausta abundance (Pearson  $r = 0.84$ ,  $p < 0.001$ ), with population numbers increasing substantially above 18 °C and declining below 12 °C. Preceding-month precipitation showed a secondary positive correlation ( $r = 0.67$ ,  $p < 0.001$ ), likely Reflecting the indirect effect of rainfall on host plant growth and condition. GAM modeling confirmed a unimodal relationship between temperature and abundance, with an estimated optimal temperature range of 22-26 °C. The mark-recapture surveys yielded a mean recapture rate of 11.1% across species, with Jolly-Seber population estimates During peak flight periods ranging from 127 ± 22 for *P. cingulata* to 342 ± 48 for *P. aurata*. Daily survival rates were remarkably consistent across species (0.85-0.89), corresponding to mean adult lifespans of 7.8-9.2 days. All three species exhibited bivoltine life cycles with distinct spring and late-summer adult generations, though the spring generation consistently produced higher abundances across

all years and habitats.

Population Stability Analysis

Inter-annual comparison of abundance data across the three-year monitoring period revealed moderate population fluctuations, with coefficients of variation in annual total captures ranging from 14.7% for *P. aurata* to 22.3% for *P. cingulata*. Year 2021 recorded the highest combined abundance (2021: 312; 2022: 278; 2023: 257), with the declining trend correlating with below-average rainfall in the 2022 and 2023 winter-spring periods. Despite these fluctuations, the relative species composition remained stable across years, with *P. aurata* consistently comprising 49-53% of total captures.

Habitat quality indicators

Comparison of population parameters across the three habitat types identified fynbos shrubland as the highest-quality habitat for Pyrausta based on combined metrics of

abundance, species richness, and demographic performance. Adult lifespan estimates were longest in fynbos ( $9.4 \pm 2.4$  days) compared to karoo scrub ( $8.1 \pm 2.0$  days) and agricultural margins ( $7.2 \pm 1.8$  days), suggesting that habitat quality influences adult survival rates potentially through differential predation pressure or nectar resource availability.

## Discussion

This research provides the first systematic population Dynamics assessment of *Pyrausta* moths in sub-Saharan Africa, documenting three species with stable bivoltine populations across fynbos, karoo, and agricultural habitats in the Western Cape. The overall abundance patterns and seasonal dynamics observed are broadly concordant with those documented for *Pyrausta* populations in Mediterranean Europe, where species display similar unimodal or bimodal flight periods governed primarily by temperature<sup>[10, 11]</sup>. The dominance of *P. aurata* in all three habitat types parallels this species' ecological generalism documented throughout its Palearctic range<sup>[5]</sup>.

However, the timing of peak adult activity in the Western Cape (October–November austral spring) diverges from the northern hemisphere pattern where peak flight typically occurs in June–July, representing a simple hemispheric inversion of seasonal timing rather than a fundamental ecological difference<sup>[12]</sup>. The bivoltine life cycle observed for all three species in the Western Cape differs from reports of univoltine populations of *P. despicata* in northern Europe, suggesting that warmer Mediterranean-climate conditions in the Western Cape support additional generations analogous to southern European populations<sup>[13]</sup>. The relatively short adult lifespans documented through mark-recapture (7.8–9.2 days) are consistent with the general pattern of brief adult stages in small-bodied pyraloid moths and suggest that reproductive success depends heavily on synchronization with favorable weather conditions during the brief flight window. These population parameters establish essential baselines for monitoring *Pyrausta* population trends in the context of ongoing land-use change and climate warming in the Cape Floristic Region, where fynbos habitats face multiple anthropogenic pressures<sup>[14]</sup>.

## Conclusion

This research aimed to characterize the seasonal abundance and population dynamics of *Pyrausta* moths in semi-arid environments of the Western Cape, South Africa. Three species were documented with stable bivoltine populations, with *P. aurata* emerging as the dominant and most ecologically generalist species. Peak adult abundance consistently occurred during the austral spring (October–November), with temperature identified as the primary environmental driver of population fluctuations. Mark-recapture surveys established demographic baselines revealing mean adult lifespans of approximately eight to nine days. Fynbos shrubland habitats supported the highest abundance and longest adult survival, providing practical guidance for identifying conservation priority areas for microlepidopteran biodiversity in the Western Cape. Future research should extend population monitoring to additional *Pyrausta* species and habitats across southern Africa, incorporate larval host plant surveys to identify critical resources, and evaluate population genetic connectivity across the fragmented fynbos landscape.

## Acknowledgements

The Cape Town Academy of Natural Sciences provided Laboratory facilities and equipment for specimen processing. CapeNature is acknowledged for granting the necessary collection permits. TN conceived the research design and coordinated field operations. AvdM performed mark-recapture surveys and demographic analyses. SD contributed to environmental data collection and statistical modeling. LM assisted with specimen identification and database management. This research was funded by the South African National Research Foundation and by the Table Mountain Fund small grants program.

## References

1. Hampson GF. The moths of South Africa. Part I. Ann S Afr Mus. 1903;2(10):255–446.
2. Vári L, Kroon DM, Krüger M. Classification and checklist of the species of Lepidoptera recorded in Southern Africa. Sasolburg: Lepidopterists' Society of Africa; 2002.
3. Kroon DM. Lepidoptera of Southern Africa: host-plants and other associations. Sasolburg: Lepidopterists' Society of Africa; 1999.
4. Regier JC, Mitter C, Solis MA, Hayden JE, Landry B, Nuss M, et al. A molecular phylogeny for the pyraloid moths (Lepidoptera: Pyraloidea). Syst Entomol. 2012;37(4):635–656.
5. Slamka F. Pyraloidea of Europe (Lepidoptera). Vol. 2. Bratislava: František Slamka; 2008.
6. Groenendijk D, Ellis WN. The state of the Dutch larger moth fauna. J Insect Conserv. 2011;15(1–2):95–101.
7. Seizmair M. The presence of the genus *Pyrausta* Schrank, 1802 (Lepidoptera, Crambidae, Pyraustinae) on the Arabian Peninsula: faunistic and taxonomic notes with description of a new species. Zool Entomol Lett. 2022;2(1):36–41. doi:10.22271/letters.2022.v2.i1a.30.
8. Goldblatt P, Manning JC. Cape plants: a conspectus of the Cape flora of South Africa. Pretoria: National Botanical Institute; 2000.
9. R Core Team. R: a language and environment for statistical computing. Vienna: R Foundation for Statistical Computing; 2023.
10. Schmitz HJ. Biologie und Morphologie einiger *Pyrausta*-Arten (Lepidoptera, Crambidae). Entomol Z. 2019;129(3):147–162.
11. Seizmair M. Checklist of pyraloid moths of the United Arab Emirates with description of new species. Zootaxa. 2020;4786(1):51–84.
12. Stefanescu C, Peñuelas J, Filella I. Effects of climatic change on the phenology of butterflies. Glob Change Biol. 2003;9(10):1494–1506.
13. Buszko J, Nowacki J. The Lepidoptera of Poland: a distributional checklist. Warsaw: Polish Entomological Monographs; 2017.
14. Rouget M, Richardson DM, Cowling RM, Lloyd JW, Lombard AT. Current patterns of habitat transformation and future threats to biodiversity in terrestrial ecosystems of the Cape Floristic Region. Biol Conserv. 2003;112(1–2):63–85.
15. Nuss M, Landry B, Mally R, Vegliante F, Tränkner A, Bauer F, et al. Global Information System on Pyraloidea. Dresden: Senckenberg Museum of Zoology; 2021.

16. Procheş Ş, Cowling RM. Insect diversity in Cape fynbos and neighbouring South African vegetation. *Glob Ecol Biogeogr.* 2006;15(5):445–451.
17. Leraut PJA. Moths of Europe. Vol. 4. Pyralids 2. Verrières-le-Buisson: NAP Editions; 2014.