METAMORPHOSIS

LEPIDOPTERISTS' SOCIETY OF AFRICA

Volume 29: 47–50

ISSN 1018–6490 (PRINT)
ISSN 2307–5031 (ONLINE)

Nectar plants, pollination and implications for dispersal corridors of the Critically Endangered *Callioratis millari* (Lepidoptera: Geometridae, Diptychinae)

Published online: 17 September 2018

Reinier F. Terblanche
Department of Conservation Ecology, Faculty of AgriSciences, University of Stellenbosch, South Africa.
E-mail: reinierf.terblanche@gmail.com

Abstract: Nectar plant visitations by adult *Callioratis millari* were observed, and photographic evidence is presented that *C. millari* is a pollinator of one of its nectar plants *Gnidia calocephala*. A means of identifying individuals of *C. millari* was discovered. Other lepidopteran visitors to *G. calocephala* are listed. Establishment of dispersal corridors populated by suitable nectar plants is discussed and recommended.

Key words: *Callioratis millari*, cycad moth, nectar plants, pollination, dispersal corridors

Citation: Terblanche, R.F. 2018. Nectar plants, pollination and implications for dispersal corridors of the Critically Endangered *Callioratis millari* (Lepidoptera: Geometridae, Diptychinae). *Metamorphosis* **29**: 47–50.

INTRODUCTION

Most adults of diurnal (and indeed some nocturnal) Lepidoptera feed from the flowers of nectar plants. In some cases a highly specialised pollination guild exists, for example the butterfly *Aeropetes tulbaghia* that pollinates a guild of 20 southern African plants representing eight genera and four families, and which include the striking and rare *Disa uniflora* (Johnson & Bond 1994, Johnson & Bond 1997, Johnson 2010). Many cases of nectar use and pollination are so specialised that pollination-driven diversification of the rich southern Africa flora has been evidenced (Johnson 2010). In general however, many Lepidoptera appear or are perceived to be quite catholic in their use of nectar sources, but too little information is available to make more valid conclusions. Use of nectar by adult Lepidoptera in South Africa may often not be seen as an important factor in their conservation "as long as there are some flowers around" (an exception is Edge 2008). Because many of the localised Lepidoptera in South Africa often depend on one or very few plant species the focus is even more on the host plants and where applicable the attendant ant species, leaving nectar source use a neglected aspect of the resource needs of endangered Lepidoptera.

Here the focus is on the nectar plants utilised by a Critically Endangered diurnal moth species, *Callioratis millari*. This most striking species of the Diptychini (Geometridae: Ennominae) is despite widespread campaigns and searches, still only known to exist at present at very restricted patches in the Entumeni Nature Reserve in KwaZulu-Natal, South Africa (Staude 2001; Sihvonen, Staude & Mutanen 2015). *C. millari* caterpillars in their early stages feed only on the Grass Cycad, *Stangeria eriopus* (Staude 2001).

Received: 20 February 2018
Published: 17 September 2018

MATERIALS AND METHODS

Measurements of plants were taken with steel measuring tape. Grid references and altitudes are taken on site with a GPS Garmin E-trex 20 ® instrument on WGS 84 setting. Map information were analysed and depicted on Google images with the aid of Google Earth Pro (US Dept. of State Geographer, MapLink/ Tele Atlas, Google, 2014, licenced software bought by the author). As a precaution owing to its precarious conservation status no specimens of *C. millari* were taken for microscopic work on the pollen. Because of the relatively large size of *C. millari* wing damage and small variations in wing patterns were used to distinguish individuals where practical. High quality and high-resolution photographic images were taken in the field with a Canon Camera EOS 5D Mark II, Macro Lens EF 100mm and Macro Twin Lite MT-24EX.

RESULTS

Nectar plants:

A female *C. millari* (Figs 1 & 2) was sometimes found and followed on 11, 12 April 2015, but was not seen on 13 April 2015. Weather conditions during all field days were warm, little wind and no/very few clouds). This female *C. millari* was repeatedly and only seen utilising nectar from flowers of *G. calocephala* (Shrubby White Pincushion) during this field session (Note: *Rabdosiella calycina* (Benth.) Codd was not flowering at the time at the specific spot). See Table 1 (page 54) for details.

Identification of individuals

The pattern of damage on the wings is diagnostic and was used to identify particular individuals. It was also noted on the second day 12 April 2015 when the same female *C. millari* was observed again she had added damage on the left hind wing (Fig. 2). Another diagnostic characteristic of that individual female was a little knob-like proximal extension of black of the post medial line on the left hind wing upper side visible when the forewings were amply shifted forward.

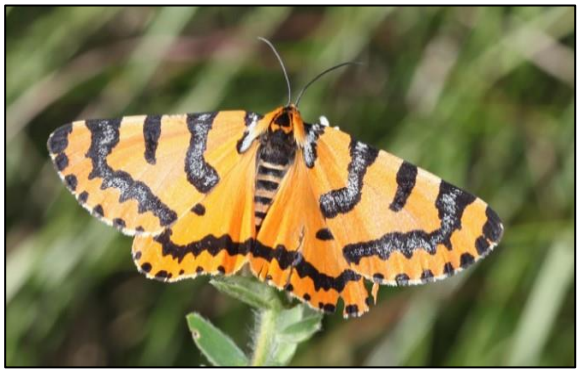

Figure 1 – *C. millari* female: ENR 11 April 2015. Wing damage and wing pattern was used to identify the individual.

Figure 2 – *C. millari* female ENR 12 April 2015. Confirmed as the same individual from wings damage and pattern, with some extra damage noted on the left hindwing.

Figure 3 – *C. millari* female: ENR 12 April 2015. Proboscis is straightened to obtain nectar from *G. calocephala* flowers.

Figure 4 – *C. millari* female ENR 12 April 2015. Proboscis inserted to obtain nectar from *G. calocephala* flower. The yellow anthers of the stamens are tight on the proboscis and the yellow pollen on the proboscis is clearly visible.

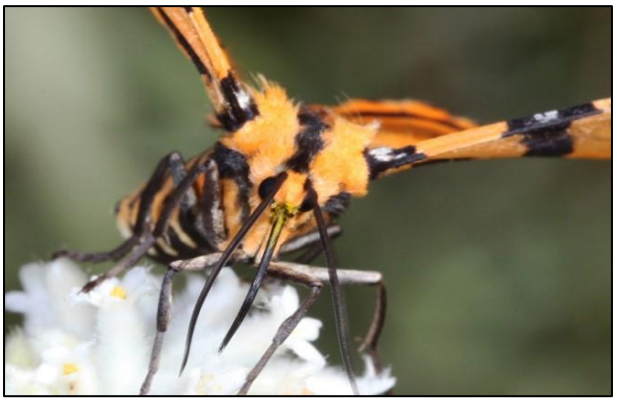

Figure 5 – *C. millari* female ENR 12 April 2015 obtaining nectar from another *G. calocephala* flower. Note yellow pollen on the proboscis from other visits to *G. calocephala* flowers.

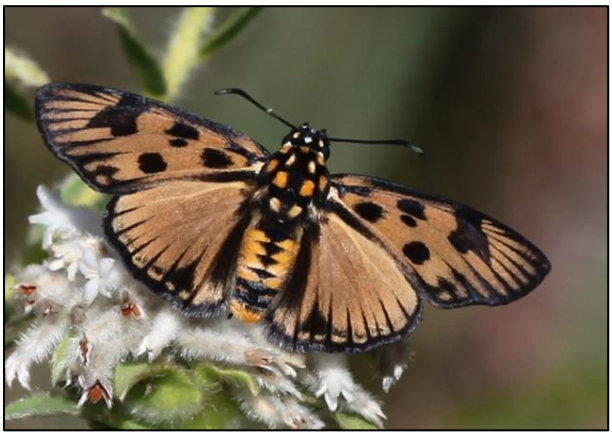

Figure 6 – *Abantis bicolor* **fe**male ENR 12 April 2015 is a rare highly endemic butterfly which also obtains nectar from *G. calocephala*.

Other visitors to *G. calocephala*:

Abantis bicolor (Trimen), *Acraea natalica* Boisduval, *Acraea petraea* Boisduval, *Belenois zochalia zochalia* (Boisduval), *Borbo borbonica borbonica* Boisduval, *Coeliades forestan forestan* (Stoll), *Papilio nireus lyaeus* Doubleday and *Precis octavia sesamus* (Trimen).

DISCUSSION

The primary cause of biological diversity loss is habitat degradation and loss (Primack 2006). Detailed vegetation studies have described suitable habitat for threatened butterfly species in South Africa (Terblanche *et al.* 2003, Edge *et al.* 2008, Bazin & Edge 2015, Edge 2016). Corridors are important to link habitat patches of metapopulations in Africa but landscape fragmentation and multiple ownership is an obstacle to planning such corridors for butterfly conservation. These corridors or linkages improve the chances of survival of otherwise isolated populations (Samways 2005). How wide should corridors be? The answer to this question depends on the conservation goal and the focal species (Samways 2005). For an African butterfly assemblage this is about 250 m when the corridor is for movement as well as being a habitat source (Pryke & Samways 2001). Hill (1995) found a figure of 200 m for dung beetles in tropical Australian forest. In the agricultural context, and at least for some common insects, even small corridors can play a valuable role (Samways 2005). Much more research is needed to establish the minimum effective width of grassland corridors in South Africa. Corridors have a number of advantages related to dispersal and gene flow by avoiding isolation of subpopulations. However, corridors could also have potential drawbacks, for example creating gene flow where none has occurred naturally in the past and also as reservoirs for pathogens or introduced species (Pullin 2002). Although lot of research remains to be done, in general corridors are assumed to be of considerable conservation value. During this survey of the nectar use of *C. millari* at the ENR it became clear that it needs to have regular access to nectar and and utilises nectar plants in the grassland adjacent to the forest edge. Corridors with sufficient nectar plants could be vital for the local dispersal of this species and ultimately the resilience of the metapopulation. Importance of grassland next to forest has been confirmed in this study.

CONCLUSIONS

A network of grassland corridors between forest patches and adjacent to forest patches is of considerable value for the conservation of *C. millari*, also as shown here, in terms of nectar plant use and local dispersal. Corridors and linkages are very important for the conservation of insect diversity (Samways 1994; Pryke & Samways 2001) and the possible dispersal behaviour with regard to localised and often threatened Lepidoptera in South Africa should be investigated in more detail. Hopefully the present note will stimulate further research on the possible use of nectar plants in conservation corridors and networks of threatened Lepidoptera in Africa. It is also shown above, in practice, that amateur lepidopterists have an important role to play to gain distribution data and also in saving rare localities of localised butterflies.

A very important consideration that emerges from the present studies on *C. millari* is the conservation of the grassland adjacent to the forest. Another study that also highlighted the conservation of the grassland adjacent to forest is a study on the fruit-feeding butterflies of the Dlinza and Entumeni forests where species richness was less at areas where the grassland was poorly conserved, even though most of the fruit-feeder species use trees as host plants (Forrester, 2011).

ACKNOWLEDGMENTS

The author is most grateful to KZN Wildlife for allowing access to work at the Entumeni Nature Reserve. The Brenton Blue Trust is thanked for making funds available to support the fieldwork of the *C. millari* project.

LITERATURE CITED

ARIANOUTSOU, M. & GROVES, R.H. (eds). 1994. Plant-animal interactions in Mediterranean-type ecosystems. Kluwer Academic, Dordrecht, Netherlands.

BAZIN, E.A. & EDGE, D.A. 2015. The ecology and conservation of *Thestor brachycerus brachycerus* (Trimen, 1883) – an aphytophagous miletine butterfly from South Africa. *Journal of Insect Conservation* **19(2)**: 349-357.

EDGE, D.A. 2008. Adult behaviour of *Orachrysops niobe* (Trimen) (Lepidoptera: Lycaenidae). *Metamorphosis* **19(3)**: 116-126.

EDGE, D.A. 2016. Vegetation associated with the critically endangered butterfly *Chrysoritis dicksoni* (Gabriel, 1947) (Lepidoptera: Lycaenidae: Aphnaeinae) at Witsand, Western Cape Province. *Metamorphosis* **27**: 66–77.

EDGE, D.A., CILLIERS, S.S. & TERBLANCHE, R.F. 2008. Vegetation associated with the occurrence of the Brenton blue butterfly. *South African Journal of Science* **104**: 505–510.

FORRESTER, W.S. 2011. Fruit-feeding butterfly assemblages at Dlinza and Entumeni Nature Reserves, KwaZulu-Natal: a quantitative biodiversity study. Dissertation for Master of Environmental Sciences, North West University, South Africa (unpublished).

JOHNSON, S.D. 2010. The pollination niche and its role in the diversification and maintenance of the southern African flora. *Philosophical Transactions of Royal Society of London Biological Sciences* **365(1539)**: 499–516.

JOHNSON, S.D. & BOND, W.J. 1994. Red flowers and butterfly pollination in the fynbos of South Africa. In: Plant-animal interactions in Mediterranean-type ecosystems. Arianoutsou, M. & Groves, R.H. (eds). pp. 137–148. Kluwer Academic, Dordrecht, The Netherlands.

JOHNSON, S.D. & BOND, W.J. 1997. Evidence for widespread pollen limitation of fruiting success in Cape wild flowers. *Oecologia* **109**: 530–534.

PRYKE, S.R. & SAMWAYS, M.J. 2001. Width of grassland linkages for the conservation of butterflies in South African afforested areas. *Biological conservation,* **101**: 85–96.

SAMWAYS, M.J. 1994. Insect conservation biology. Chapman & Hall, London.

SIHVONEN, P., STAUDE, H.S. & MUTANEN, M. 2015. Systematic position of the enigmatic African cycad moths: an interactive approach to a nearly century old problem (Lepidoptera: Geometridae, Diptychini). *Systematic Entomology*. [Volume and pages?]

STAUDE, H.S. 2001. A revision of the genus *Callioratis* Felder (Lepidoptera: Geometridae: Diptychinae). *Metamorphosis* **12**: 121–156.

TERBLANCHE, R.F., MORGENTHAL, T.L. & CILLIERS, S.S. 2003. The vegetation of three localities of the threatened butterfly species *Chrysoritis aureus* (Lepidoptera: Lycaenidae). *Koedoe* **46(1)**: 73–90.

Table 1 – Nectar plant species of particular importance to *Callioratis millari* and its conservation

Plant species, plant family and common name	**Conservation status of plant species**	**Importance of the plant species to *Callioratis millari***	**Importance of *Callioratis millari* to the plant species**
Gnidia calocephala (C.A.Mey.) Gilg THYMELAEACEAE Shrubby White Pincushion	*Least Concern (IUCN) Foden & Potter (2005), Raimondo *et al.* (2009). *Endemic to South Africa, confined to Eastern Cape and KwaZulu-Natal Foden & Potter (2005)	*C. millari* utilises nectar from flowers of *G. calocephala* repeatedly on many occasions. In the event of being used as nectar source occurrence of *G. calocephala* may be part of dispersal corridors for *C. millari*	*C. millari* appears to be an important pollinator of *G. calocephala* at forest margins where both the moth and *G. calocephala* occur.
Rabdosiella calycina (Benth.) Codd LAMIACEAE Upland Fly Bush	*Least Concern (IUCN) Foden & Potter (2005), Raimondo *et al.* (2009). *Not endemic to South Africa but confined to E. Cape, Free State, KwaZulu-Natal, Mpumalanga, Limpopo, Lesotho and Swaziland	*C. millari* was observed utilising nectar from flowers of *R. calycina* repeatedly. Occurrence of *R. calycina* may be part of dispersal corridors for *C. millari.*	Unknown, most likely to be pollinator of *Rabdosiella calycina* but not evidenced.