

## A new species of *Cooksonia* Druce, 1905 (Lepidoptera: Lycaenidae: Poritiinae) from western Zambia

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**Abstract:** A new species of *Cooksonia* Druce, 1905 from Zambia, *C. gardineri* sp. n. is added to the six species in the genus: *C. trimeni* Druce, 1905; *C. neavei* (Druce, 1912); *C. aliciae* Talbot, 1935; *C. nozolinoi* Mendes & Bivar de Sousa, 2007; *C. abri* Collins & Larsen, 2008; and *C. ginettae* Collins & Larsen, 2008. A key to the species is provided and diagnostic features are discussed.

**Key words:** Lepidoptera, Lycaenidae, *Cooksonia*, systematics, new species, Zambia.

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### INTRODUCTION

The genus *Cooksonia* Druce, 1905 belongs to the Tribe Pentilini Aurivillius, 1914; Subfamily Poritiinae Doherty, 1886; and Family Lycaenidae Leach, 1815. Other pentiline genera in the Afrotropical Region are *Durbania*, *Durbaniella*, *Durbaniopsis*, *Alaena*, *Ptelina*, *Pentila*, *Liptenara*, *Telipna*, *Ornipholidotos* and *Torbenia*. (Williams, 2018).

*Cooksonia* is a purely Afrotropical genus previously containing six species although Gardiner (2010) was of the opinion that *C. nozolinoi* was likely to be a synonym of *C. trimeni*. The pattern of *Cooksonia* consists of black bands and or spots (stria) on a mainly orange, pink-red and white background (umbrae). Their wing pattern & coloration together with their elongated fore-wing shape and large size for lycaenids, provide the genus with a superficial resemblance to certain day-flying moths and acraeines.

### MATERIALS AND METHODS

#### Morphological studies

The posterior half of the male abdomens were cut from specimens and soaked in 5% KOH over night. They were then cleaned of soft tissue in water in order to expose the genitalia and then transferred to 100% glycerol for observation, photography and storage. A MiniVID Microscope Digital Camera and a Leica M3Z stereomicroscope were used for imaging the dissections, both in natural position and dorso ventrally flattened. The images were processed in ToupView 3.7 and Adobe Photoshop 7.0 programs to

enhance and improve quality. Genital dissections were retained in glycerol vials pinned under the corresponding specimens. Male genital terminology largely follows Klots (1956) and Stempffer (1967).

#### Analysis and terminology

Wing pattern characteristics were analysed and compared using the pattern elements and homologs of the nymphalid ground plan (Schwanwitsch, 1924, 1926, 1949; Suffert, 1927; Nijhout, 1991). The terminology used follows Gardiner and Terblanche (2010).

#### Comparative material examined

*Cooksonia aliciae*: 1♂, Maiwale, Malawi 5.xii.1989: 5♂s, Chowe Village, Namwera road, nr Mangochi, Malawi, 21-23.xi.2000, A.J. Gardiner: 3♂s, 1♀ same data but 7-8.xii.2003: 1♀, fits this species, Mukuju River, Namtumbo Dist., Ruvuma Region, Tanzania, 24.x.2011, P. Hawkes & J. Fisher; *Cooksonia neavei rhodesiae*: 2♂s, Des Farm, Lusaka, Zambia, 18.xi.1993, I. Bampton: 1♀, Mpika, N. Prov. Zambia, 2.xi.2014, A.J. Gardiner. 1♂ Christon Bank, Zimbabwe 3.xi.1979, A.J. & M.W. Gardiner 4♂s, 1♀ same data but 9.xi.1980, M.W. Gardiner; 1♂, 1♀ same data but 9 & 12.xi.1987, A.J. Gardiner; 6♂s, 1♀ same data but 17.xi.1990, A.J. Gardiner; 1♂, 2♀s, same data but 19.xi.1997, A.J. Gardiner; 1♂, 1♀, same data but 6.xi.1999, A.J. Gardiner; 3♂s, Mazoe Citrus Estate Ranch, Zimbabwe, 15.xi.1987, A.J. Gardiner: 1♀, same data but 6.xi.1988; 1♂ same data but 26.xi.1989, 6♂s, Mt. Wedza, Zimbabwe, 10.xi.1991, A.J. Gardiner; 1♂ Mt. Wengesi nr. Chimanimani, Zimbabwe, 21.xi.1993, A.J. Gardiner; 1♂, 24 Athlone Ave, Harare, Zimbabwe, 16.xi.2014, S. Ndarama: *Cooksonia trimeni* 2♂s, 1♀, East Lumwana Mine, N.W. Prov., Zambia, 13, 18 & 24.xi.2003, A.J. Gardiner; 11 ♂s, 5 ♀s, same data but 26.x.2006; 1♂, Mundwiji Plain, 40km E. Mwinilunga, N.W.Prov., 28.x.2006, A.J. Gardiner.

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## Abbreviations

NHM: Natural History Museum, London.

GPC: Gardiner Private collection.

IZIKO: Iziko Museum, Cape Town

## DESCRIPTION OF NEW SPECIES

### Genus *Cooksonia* Druce, 1905

*Transactions of the Entomological Society of London* 1905: 256 (251–262). Type species: *Cooksonia trimeni* Druce, by monotypy.

### *Cooksonia gardineri* sp. n. (Figs 1A–H)

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**Holotype** ♂: Near Mongu, Western Province, Zambia, 15°20'36"N, 23°18'02"E, 1050m; 16.xi.2017; A. Gardiner leg.; NHM Prep. genit.

**Paratypes:** 14 ♂; 1 ♀: as for Holotype, deposited in GPC and IZIKO.

### Description of facies

#### Males (Figs 1A–F):

Because of the variability in the wing markings of the ♂s, the description below is based on the entire type series of 15 ♂s.

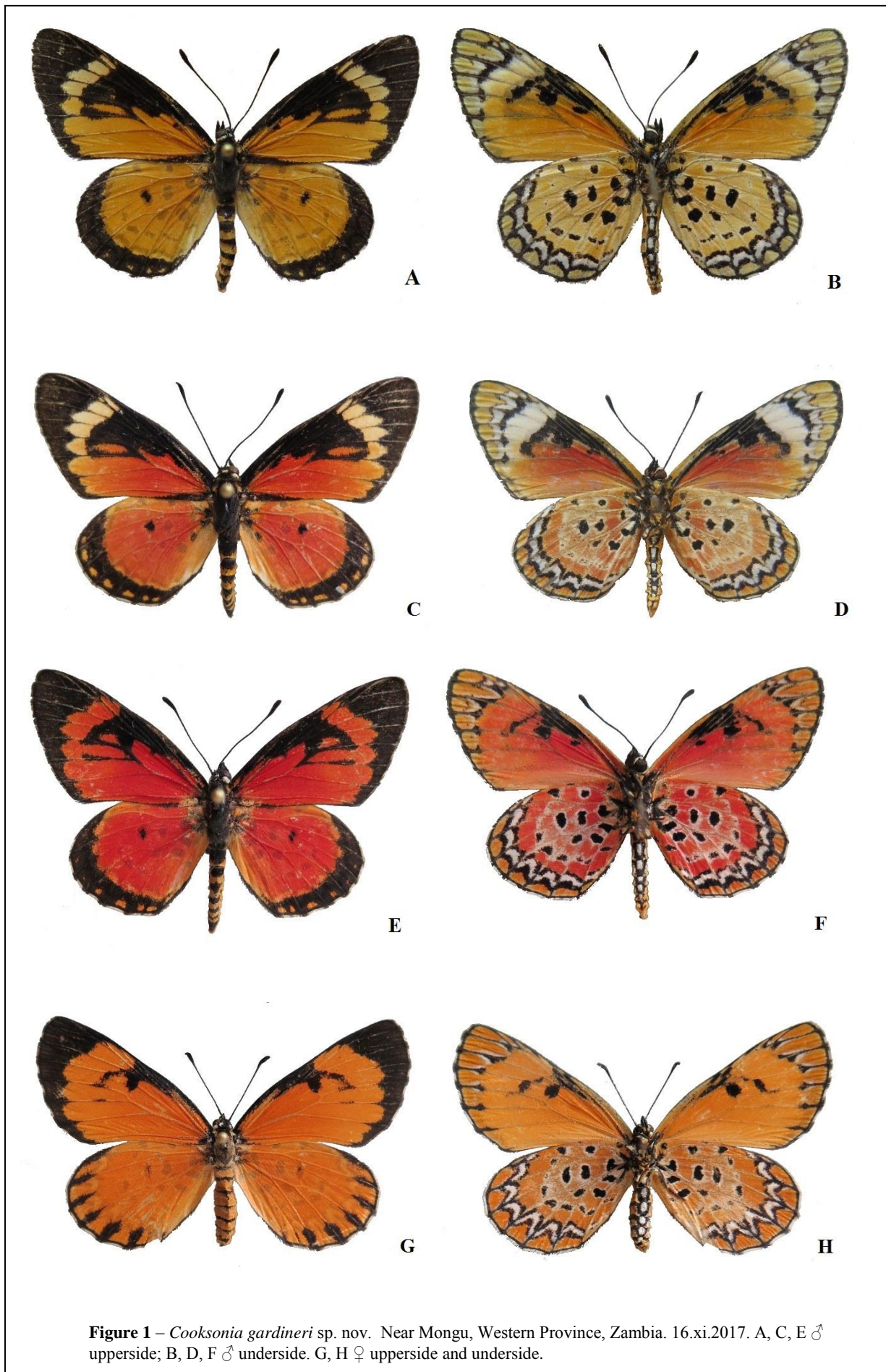
Wingspan: 35.1–45.5 mm. Forewing length: 17.6–23.4 mm, mean 21.2 mm. Antenna-wing ratio mean 0.47 (n = 15).

**Head** Eyes glabrous, frons and vertex black, posterior to vertex an elongated patch of light scales, near the eye these scales are light orange rest of patch white, below antenna until base of palp a broad white band next to the eye, at posterior edge of eyes band becomes black for a short distance then white before once again becoming black, for a short distance, until it reaches the light patch posterior to vertex. At junction of head and thorax and near base of wings a small patch of orange scales. Pedicel of antennae black; shaft black with some patches of white scales on ventral surface; club black with lighter brown bands between segments. Labial palpi: first segment dark, second with a patch of light orange scales ventrally remainder black; apical segment black.

**Thorax** Upper surface black, with a small patch of orange on either side of the thorax at the anterior end near the base of the forewings. Under surface black with large patches of orange and or whitish scales, along the midline dense orange scales, base of thorax with a large patch of white scales. Femur mostly black but with a patch of light orange at the posterior and apical end ventrally, tibia and tarsi of pro and meso legs dark while tibia and tarsi of meta leg dark dorsally but orange ventrally.

**Abdomen** Above mostly black but with an orange band towards the distal end, these bands broaden laterally, especially on 2<sup>nd</sup>–4<sup>th</sup> segments, and almost take up most of the width at the base of the sides of the abdomen. Ventral side of abdomen with black and white spots, each segment with a white patch at base surrounded by black distally and laterally, penultimate segment with no black but replaced with orange scales, last segment with a small patch of black remainder orange.

**Wings** Upperside background colour varying from orange to red with the subapical band, opU3–8, varying from light yellow to red. Forewing: Od, O and Op fused to form a black border, narrow at space 1 and increasing in width to form a broad black apex, black extending along outer margin to base of wing, cells 9–12 black. Part of M<sup>1</sup>3 or M<sup>1</sup>4 fusing with D and often, but not always with M<sup>2</sup>4+5 and black of outer margin to form a large black discoidal patch. Light umbral area mU<sup>1</sup>3 always present to a varying degree and may even join opU3, when this occurs the black remains along the veins, mU<sup>1</sup>4 may also be present. Some black on inner margin, in 1a, from base to about 1 third and then narrowing. Cilia: black especially around areas of vein between veins there may be a patch of white cilia especially towards anal angle. Hindwing: Broad black border formed from Od and O, light orange-red spots formed from oU present as spots in border to a varying degree but oU1b & oU2 always present but at times very faint. Discal spot, D, present as a small but clear spot, M<sup>2</sup>1b may also be present as a black spot, some black at base of wing. Cilia: black around the veins, between veins a large patch of white cilia. Underside forewing: ground colour varying from an orange/red through to a yellow/orange and sometimes with white markings. Marginal border, Od, black, narrow. oU<sup>1</sup>1b–oU<sup>1</sup>7 from deep orange to light yellow, narrow at oU<sup>1</sup>1b and broadening to oU<sup>1</sup>7 except oU<sup>1</sup>6 which is noticeably broader than oU<sup>1</sup>5 and oU<sup>1</sup>7, oU<sup>1</sup> may be faintly bordered by O, to a varying extent, in some cases when O present then oU<sup>2</sup> visible as a paler, sometimes white, marking again variable in extent. Proximal border, Op3–Op8, present to a variable degree often forming a bold line especially from Op4–Op7 the black also normally extending up the vein to form triangular spots which may extend to join Od. The proximal border umbra, opU3–opU9, forming a relatively narrow band curving and touching outer margin, This band can vary in colour from being red and similar to rest of umbrae or distinctly paler being even almost white at times, opU1+2 joined with mU and this also merging with most of cell an orange-red colour normally darker towards and in the cell. M<sup>1</sup> only starting at 3, sometimes at 4 and forms a band of various width that joins the margin. Discal spot also coalesces with black of margin which on the outer edge of cell extends to M<sup>2</sup>5 and then carries on as a line down to base of wing, on the outer edge of this line, cell 12, yellow-orange or red. Cilia as in upperside, except a few more black scales between veins. Underside hindwing: with a striking array of bands and spots. Thin black marginal border Od1–Od7, the umbra oU<sup>1</sup>1b–oU<sup>1</sup>6 forms a band of pale yellow, red or a combination of these colors, separated from one another by the vein being black, outer edge curved in each cell to a varying degree and edged by the narrow black line of O which is also curved in each cell, sometimes even chevron shaped, this in turn is edged by oU<sup>2</sup>1b–oU<sup>2</sup>7 which is always white, this once again edged by the narrow black line of Op, unlike O the black of Op tends to be reduced at the veins and in the centre of the cell and may even be, rarely, broken at Op3, the band formed by O, oU and Op is distinctive with its



chevron shaped marks in each cell. The umbrae opU, mU and bU may either form a continuous background colour, light yellow to red or they may be separate to various degrees, opU is often seen as a separate clear colour while mU may be dusted with pale yellow/white, these paler scales often more noticeable around the spots formed from M<sup>1</sup>, D, M<sup>2</sup> & H. The median band, M<sup>1</sup>, forming a band of spots, or less often light marks, their size and presence variable but usually M<sup>1</sup>1c–4 & M<sup>1</sup>7 present, M<sup>1</sup>1b when present dislodged towards base so as to be more in line with M<sup>2</sup>1c. The discal spot, the second median dots M<sup>2</sup>1b+c, M<sup>2</sup>2, M<sup>2</sup>4+5, M<sup>2</sup>7, M<sup>2</sup>8 and H4+5 always present as dots together with some black at the base of the wing, M<sup>1</sup>1a may be present. Cilia as in upperside.

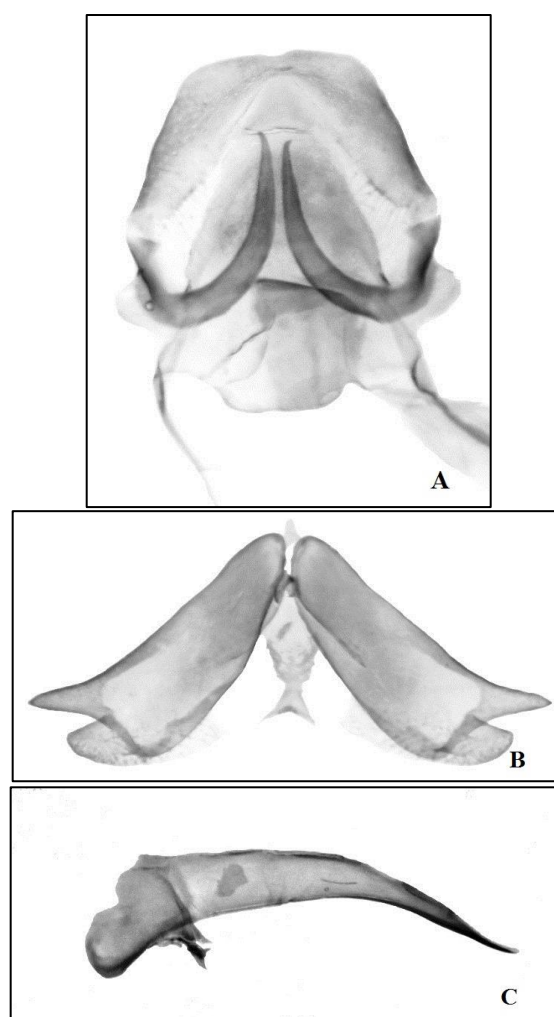
**Female** (Figs 1G, H): Description based on a single example. Larger than all ♂s captured. Forewing length 24.6mm, antenna-wing ratio 0.41.

Similar markings and pattern to male except: Upperside umbral colour more extensive and a deep orange. Forewing with outer margin more curved in shape, opU4–opU9 broader, a small dash mark only along vein at M<sup>1</sup>3, M<sup>1</sup>4 starts as a dashed mark but quickly narrows to form a narrow line with M<sup>1</sup>5+6 the remaining of M<sup>1</sup> coalescing with margin to form a broad margin which runs on the outer edge of cell and for about half its length, discal spot more noticeable as a spot but coalesces with the marginal mark. Hindwing with a narrow black margin, Od, and with noticeable black striae extending along the veins from margin inwards until the position of Op (just showing through from the underside), the discal mark small and faint. Underside similar to some of the males except: forewing no sign of O, opU4–opU9 broader, only M<sup>1</sup>4+5 present and D almost completely separated from marginal mark. Hindwing with umbra oU<sup>1</sup> & opU wider than in male and chevron marks made up of O, oU<sup>2</sup> & Op more angular. The white cilia between the veins in both upper and underside more noticeable.

**Genitalia** ♂ (Figs 2 A–C): Uncus almost trapezoidal in shape when flattened ventrally, the anterior margin almost straight, unlike *neavei* and *aliciae* (figured in Stempffer 1967) there is a slight depression in the centre of this margin, posterior margin with more of a square shaped bulge compared to that figured by Stempffer for *neavei* and *aliciae*; subunci long, curved, tapering regularly and slightly hooked at apex. Valves more of an elongated triangle than for those figured by Stempffer, apex with two processes the rounded one stockier and more similar to *neavei* than *aliciae*; aedeagus elongate, slightly curved and tapering from one side to a slightly curved point.

### Diagnosis

The background colour of this species varies considerably from a light orange to bright red with various combinations. On the upperside it does not have a white apical tip. In general appearance it is closest to *C. neavei* and *C. trimeni*. In the male its upperside forewing median patch in size is in-between that of *neavei* and *trimeni* and the band formed by this and the black tip,



**Figure 2** – *Cooksonia gardineri* sp. nov. ♂ genitalia: A – uncus and subunci; B – valves; C – aedeagus.

opU, is distinct as a band like in *neavei* but noticeably narrower. The underside is more similar to *trimeni* due to on the hindwing the narrowness of Op, on the forewing underside D coalesces with the margin while in *trimeni* it forms a separate spot. In the female the upperside forewing does not have the broad apical tip of *trimeni* while the median band, M<sup>1</sup>, is very narrow, almost a line, compared to the broad band of *neavei*. The hindwing upperside does not have the broad dark margin as in *neavei* and is more similar to some specimens of *trimeni*, the discal spot is always evident in *trimeni* but in this female specimen almost absent.

### Key to the *Cooksonia* species

1. Underside hindwing with distinctive stria and umbrae ..... 2  
Underside hindwing without distinctive stria and umbrae, apart from a few markings almost plain on the underside ..... *C. ginettae* Collins & Larsen
2. Hindwing underside Op distinctive and larger than oU<sup>2</sup> forming a broad band ..... 3  
Hindwing underside Op narrow smaller than oU<sup>2</sup> and oU<sup>2</sup> forming a chevron shaped line in each cell, .....  
.... 4

3. Upperside forewing apical tip white  
..... *C. aliciae* Talbot  
Upperside forewing apical tip black  
..... *C. neavei* Druce
4. Underside forewing with O well developed allowing for oU<sup>1</sup>, oU<sup>2</sup> and Op to be easily distinguished as bands .... *C. abri* Collins & Larsen  
Underside forewing with O either absent or if present faint or only present in a few cells hence no distinctive bands, even Op may be weak or absent ..... 5
5. Hindwing underside with the black line formed by O distinctly bent inwards in most cells, particularly noticeable on inner edge making the line distinctly undulating. Forewing underside M<sup>14</sup> & M<sup>15</sup> present ..... *C. gardineri* sp. nov.  
Hindwing underside with the black line, O, almost straight particularly on the outer edge with oU<sup>1</sup> occasionally and in particular the female protruding slightly into oU<sup>2</sup>. Forewing underside M<sup>14</sup> & M<sup>15</sup> absent or very faint ..... 6
6. Hindwing upperside with a broad black margin formed from Od and O  
..... *C. nozolinoi* Mendes & Bivar de Sousa  
Hindwing upperside with the margin formed from Od and O of various extent ..... *C. trimeni* Druce  
(Note: this is the only criteria which separates *nozolinoi* from *trimeni* and this feature does seem to be variable in *trimeni*)

### Habitat and behaviour

Personal communication with Alan Gardiner “this species was found in short Miombo on deep Kalahari sands, unlike *trimeni* which is in tall wet Miombo. It seems to be the lowest flying of the *Cooksonia* even sitting on grass stems less than a metre from the ground, which I have never seen in *trimeni*, *neavei* and *aliciae*, to a height of 2–3 metres. Males were seen flying from about 9–10 am one to two metres above the ground defending their territories. Flight very similar to a day flying moth. Males would settle on grass or twigs and display by opening their wings. As the day progressed they remained settled on their perch in the typical *Cooksonia* behavior. Their behavior is very reminiscent of some of the *Alaena* and this leads me to believe the two genera are closely related.”

### Distribution

*C. gardineri* sp. n. is only known from the type locality but is likely to be more widespread in Western Zambia and may even occur in the Eastern parts of Angola.

**Etymology:** The species name recognises the collecting efforts of the Gardiner family, particularly the late Mike Gardiner and his son Alan.

### DISCUSSION

It is of interest that a new species is being added to this small but distinct genus. Dr Gardiner comments: “The colonies are often localised, even though the species may

have wider distributions, and their often sedentary habits make them difficult to locate. In addition, when they are flying their superficial appearance to *Acraea* and day flying moths may decrease their detectability as they may be mistaken for members of these groups”.

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