Cheiridopsis alba-oculata (Aizoaceae: Ruschioideae, Ruschieae) — A new quartz-endemic from southern Namaqualand, South Africa

C. Klak a,⁎, N.A. Helme b, P.V. Bruyns a

a Bolus Herbarium, Department of Biological Sciences, University of Cape Town, 7701 Rondebosch, South Africa
b P.O. Box 22652, Scarborough 7975, South Africa

A B S T R A C T

Cheiridopsis alba-oculata Klak & N.A. Helme is a new species known from two populations in the Garies region of southern Namaqualand, where it appears to be restricted to patches of quartz-gravel. The species belongs to the Cheiridopsis–Odontophorus alliance because of its papillate leaves and the 9– or 10-locular fruits with large closing bodies. The isophyll and globose fruits with raised tops suggest that it is closely related to C. subg. Odontophoroides and Odontophorus. C. alba-oculata is geographically isolated in this group, whose other members are restricted to northern Namaqualand. C. alba-oculata resembles Cheiridopsis ponderosa and Cheiridopsis pilosula in its densely papillate leaves but is distinguished from them by its strongly keeled, apically toothed leaves.

⁎ Corresponding author.
E-mail address: Cornelia.Klak@uct.ac.za (C. Klak).

1. Introduction

Cheiridopsis N.E.Br., Ihlenfeldtia H.E.K. Hartmann and Odontophorus N.E.Br. are closely related genera in the Conophytum clade (Klak et al., 2013). They are all highly succulent, compact, caespitose perennials, only occasionally with longer shoots. Monographs exist for all three genera (Hartmann, 1976, 1992; Hartmann and Dehn, 1987) but several new species and subspecies have been described subsequently in Odontophorus and Cheiridopsis. In Odontophorus, Hartmann (1976) recognised Odontophorus angustifolius L. Bolus, Odontophorus marlothii N.E.Br. and Odontophorus namus L. Bolus. Subsequently, O. angustifolius subsp. protoparcoide S.A. Hammer (Hammer, 1994) and Odontophorus pusillus S.A. Hammer were described (Hammer, 1996). Cheiridopsis currently includes 32 species, including the insufficiently known Cheiridopsis nelii Schwantes (Hartmann, 2001) in three subgenera, C. subg. Cheiridopsis, C. subg. Aequifoliae H.E.K. Hartmann and C. subg. Odontophoroides H.E.K. Hartmann and H.E.K. Hartmann (Hartmann and Dehn, 1987). On the basis of differences in fruit structure, Cheiridopsis excavata L. Bolus and Cheiridopsis vanyzili L. Bolus were moved into a new genus, Ihlenfeldtia (Hartmann and Dehn, 1992). According to Hartmann (1992), the structure of the fruit of Ihlenfeldtia suggested a close relationship with Alonopsis Schwantes, Tanquana H.E.K. Hartmann and Vanheerdia L. Bolus ex H.E.K. Hartmann. This was not supported by molecular results (Klak et al., 2013), which re-affirmed the previous position of Ihlenfeldtia close to Cheiridopsis, corresponding to the similar anatomy of their leaves (Hartmann, 1992).

Odontophorus shares many characteristics with Cheiridopsis. These include the papillate epidermis of the leaves and the large, almost globose fruits. The toothed keels and margins of the leaves are common to Odontophorus and some species of Cheiridis subg. Odontophoroides (Hartmann, 2001). Odontophorus was distinguished from Cheiridopsis (Hartmann, 2001) by the much narrower valve wings (as opposed to the broader valve wings in Cheiridopsis). However, in the key to the subgenera of Cheiridopsis (Hartmann, 2001), “always narrow valve wings” distinguishes Cheiridopsis subg. Aequifoliae from C. subg. Odontophoroides (with valve wings as broad as expanding keels or broader). There is therefore considerable overlap in the width of the valve wings between Cheiridopsis and Odontophorus, rendering the current distinction between the two genera unclear. Similarly, the considerable homoplasy among characters of the fruit revealed for the first time in Klak et al. (2013) makes it doubtful whether Ihlenfeldtia is distinct from Cheiridopsis.

Cheiridopsis is fairly widely distributed, from the district of Lüderitz South in Namibia to the western and central parts of the Western Cape in South Africa (Hartmann and Dehn, 1987). The highest diversity of seven species is found around Steinkopf (Hartmann and Dehn, 1987), where three of the four species of Odontophorus also occur (Hartmann, 1976). The southernmost record for Odontophorus is 14 km south of Springbok, along the road to Hondeklipbaai (O. marlothii). Ihlenfeldtia occurs slightly to the east, at the edge of northern Namaqualand and Bushmanland as far east as Pofadder. Although Cheiridopsis extends to the southern Cape, the diversity drops to 2 or 3 species per half degree
square. Most of the “southern species” belong to C. subg. Cheiridopsis (Hartmann and Dehn, 1987).

With only one species from each of these genera included by Klak et al. (2013) in their molecular analysis, we were unable to conclude whether Cheiridopsis, Ihlenfeldtia and Odontophorus were monophyletic as currently circumscribed and a more detailed molecular study of this group will provide better insight into generic and subgeneric boundaries among them (Powell et al., in prep.).

Recent generic treatments have favoured broader circumscriptions of genera (Klak et al., 2007; Klak and Bruyns, 2012, 2013) due to the high levels of homoplasy among many morphological characters (Klak et al., 2013). Below, we show that the new species could be placed equally well in Cheiridopsis subg. Odontophoroides or in Odontophorus. In view of the many shared morphological similarities between Cheiridopsis subg. Odontophoroides and Odontophorus, we predict that molecular data will lend further support to an enlarged generic concept of Cheiridopsis, including both Odontophorus and Ihlenfeldtia. We therefore describe the new species in Cheiridopsis subg. Odontophoroides.

2. Materials and methods

Morphological data on the new species came from herbarium material and observations in the field. All measurements are based on mature leaves, fresh flowering material and mature capsules. Collections at BOL, NBG and SAM were consulted.

3. Taxonomic treatment

Cheiridopsis alba-oculata Klak & N.A. Helme, sp. nov. Type: South Africa. Western Cape: Hondeklipbaai (3017), south of Bruinkop farm towards Spioenkop, (–DA), on loam with superficial quartz-gravel, 212 m alt., 26 Sep 2013, Klak 2308 (BOL, holo.; K, iso.).

Compact, tufted, succulent perennial to 100 × 300 mm, branches to 150 mm long, internodes 5–15 mm long, greyish ochre, rooting at nodes. Leaves all similar in shape, trigonous, widened and thicker subapically, 30–80 × 11–16 mm, connate basally into sheath 10–15 mm long, dull to brownish green, epidermis velvety, keel and margins dentate towards tips. Flowers solitary, 60–70 mm diam., pedicels 35 mm long with leaf-like bracts positioned near middle; calyx: lobes 5 or 6, subequal: petaloid staminodes yellow becoming white towards base, 30.0–3.3 × 1.5 mm, in many rows; filamentous staminodes few, slightly overtopping stamens; stamens 9 mm long, in many rows, filaments white, anthers yellow, only innermost filaments papillate towards base; ovary slightly raised on top, styles 9 or 10, green, 5–6.6 mm long, plumeose on inside, with coi lomorphic holonecty. Fruits erect, subglabose, 12–16 × 9–11 mm, top rounded with moderately raised rims but lower than basal part, basal part hairy, 9- to 10-locular, closing bodies large, blocking entire exit of locule, covering membranes undulate, slopes downwards towards centre of fruit and dentated around middle, rims bent upwards, without additional closing devices below covering membranes, keels brown black, parallel at base and later diverging apically, valve wing narrow and ending in awns. Seeds pear-shaped, 1.5 × 1.0 mm, light brown, smooth but colliculate in micropylar region. Flowering time: August–September.

3.1. Distribution and ecology

C. alba-oculata is known from two populations near Garies in southern Namaqualand, where it appears to be restricted to patches of quartz-gravel, in Namaqualand Heuweltjieveld (Mucina et al., 2006) and known colloquially as Hardeveld. This is a widespread vegetation type in Namaqualand. The habitat would, however, more correctly be described as an outlier of the Riethuis-Walleskraal Quartz Vygieweld (Mucina et al., 2006), which occurs only 30 km away, as it is structurally and floristically most similar to this unit. However, units smaller than 1 km in width, as is the case for most quartz patches, are typically unmapped in the South African vegetation map due to scale issues.

The underlying rock-type is gneiss, which has weathered into a sandy loam, overlain by large, white quartz-pebbles. Such patches of quartz occupy less than 2% of the total Hardeveld. The slopes may be slightly convex to slightly concave and are north-, west- or south-facing.

Associated common species include Antimima komkansica (L. Bolus) H.E.K. Hartmann, Dicrocaulon ramosulsum (L. Bolus) Ihlenf., Knersia diversifolia (L. Bolus) H.E.K. Hartmann & Liede and Monilaria chryssoleucia Schwantes (Aizoaceae), Didelta carnosa Aiton, Rhythopodium pumilum DC. (Asteraceae) and Euphorbia restituta N.E.Br. (Euphorbiaceae).

C. alba-oculata is locally common and is a conspicuous element of its habitat. Only two other species of Cheiridopsis, Cheiridopsis namaquensis (Sonder) H.E.K. Hartmann and Cheiridopsis denticulata (Haw.) N.E.Br., have been recorded in the same quarter degree square (3017DA) as C. alba-oculata (Fig. 1). However, the three species prefer different soils: C. namaquensis is mostly found in soils derived from shale, with the northern populations occurring on granites or quartzites, whereas C. denticulata prefers gently sloping, gravelly, gneissic soils.

A new species closely related to Jacobsenia vaginata was found nearby on more alkaline soils and the Sandveld to the west has yielded several new species, including Lampranthus procumbens Klak (Aizoaceae) and Ferraria ornata Goldblatt & J.C. Manning (Iridaceae) (Klak, 2003; Goldblatt and Manning, 2011). The nearest extensive quartz-fields are near Riethuis and Wallakraal, some 30 km to the north and near Komkans, some 70 km to the southeast. Othonna lepidocaulis Schltr. (Asteraceae), previously known only from Komkans and fields of quartz-gravel and stony hills on the northern Knersvlakte, some 80 km to the southeast, was also noted and the very small, rarely recorded Crassula multiceps Harv. (Crassulaceae) also occurs here. Thus, the smaller and more isolated patches of quartz-gravel where C. alba-oculata occurs show links to other quartz fields further north and to those further south as well but they include some endemic species such as C. alba-oculata.

The unscented flowers are typically open from 10 am to 5 pm and were visited by monkey beetles (Hoplini), horseflies (Tabanidae) and bee-flies (Bombylidae).

3.2. Diagnostic characters

Cheiridopsis and its sister genera Odontophorus and Ihlenfeldtia are distinguished from other genera in Ruscieae by papillate leaves and multi-locular fruits (8 to 18 locules) with large or rarely small (Ihlenfeldtia) closing bodies (Hartmann and Dehn, 1987).

Similarly, the diagnostic characters to distinguish the three subgenera of Cheiridopsis from each other as well as from Ihlenfeldtia and Odontophorus are mainly found in the leaves and fruits (Hartmann and Dehn, 1987; Hartmann, 1992).

Common to these three genera are the papillate leaves (Hartmann, 2001), which, however, show differences in the shape and density of the papillae (Hartmann and Dehn, 1987). The leaves in C. alba-oculata are densely papillate (Fig. 2A), as found in Cheiridopsis pilosula and Cheiridopsis speciosa of C. subg. Odontophoroides and also in Odontophorus. C. alba-oculata cannot be confused with any member of C. subg. Cheiridopsis, since all members of the latter are heterophyllous (the first pair of leaves is shorter than the second pair). The other two subgenera of Cheiridopsis, as well as Odontophorus and Ihlenfeldtia, are isophyllous (both pairs of leaves are of the same length). In addition, the leaves are 30–80 mm long in C. alba-oculata, whereas they never exceed 50 mm in Odontophorus (Hartmann, 2001). Although the leaves in C. pilosula and Cheiridopsis ponderosa (both C. subg. Odontophoroides) may also reach 70–120 mm long (Hartmann, 2001), the leaves of C. pilosula lack teeth (Hartmann and Dehn, 1987) and, although the leaves of C. ponderosa may have tiny teeth near the apex, the keels are rounded. This contrasts with the leaves of C. alba-oculata, which are distinctly keeled with often quite prominent teeth along the keels and
margins towards their tips (Fig. 3A), a feature also found in C. subg. Odontophoroides and in Odontophorus.

It is uncommon for species of Cheiridopsis or Odontophorus to have distinctly two-coloured petaloid staminodes (white in the lower third and yellow in the two upper thirds). The flowers in both populations of C. alba-oculata are bi-coloured (Fig. 3A). This is otherwise known in C. pilosula, C. denticulata and Cheiridopsis caroli-schmidtii (Dinter & A. Berger) N.E.Br., which all include populations with unicoloured petaloid staminodes.

All 14 species of Cheiridopsis subg. Cheiridopsis have mostly decumbent capsules. The other two subgenera, as well as Odontophorus, have predominantly erect capsules and this is also true of C. alba-oculata.

Fig. 1. Distribution of Cheiridopsis alba-oculata.
The new species shares with Odontophorus and Cheiridopsis the large closing bodies (Fig. 3B), whereas they are always small in Ilhnenfeldtia (Hartmann, 1992). In addition, in terms of the shape of the fruits, the almost globose, rounded tops of C. alba-oculata (Fig. 3B) are most similar to those of C. subg. Odontophoroides and of Odontophorus. In addition, the lower parts of the fruits are densely hairy. Although Hartmann (1976) suggested that the papillate (hairy) fruits of Odontophorus are one of the main characteristics separating this genus from Cheiridopsis, similarly hairy fruits are also found in C. ponderosa S.A. Hammer and in C. pilosula L. Bolus, where the papillae are shorter. Hartmann (2001) also used this character in the key to separate the genera Cheiridopsis (“base of capsule rough”) from Odontophorus (“base of capsule velvety”). However, species with “velvety” fruits such as C. ponderosa are nevertheless still included in Cheiridopsis. In addition, the terms “velvety” and “rough” are difficult to quantify and intermediates exist, as in the case of C. pilosula. The fruits of the new species can only be confused with members of Odontophorus or C. subg. Odontophoroides, but none of these occurs so far to the south.

The seeds are smooth and pear-shaped in the new species (Fig. 2B), characteristics encountered in both Cheiridopsis and Odontophorus, both of which may also have more papillate seeds (Hartmann and Dehn, 1987; Hartmann, 2001). The papillate seeds in C. pilosula (Hartmann and Dehn, 1987) distinguish this species from C. alba-oculata.

3.3. Etymology

The epithet “alba-oculata” is derived from the Latin albus = white and oculus = eye and alludes to the white centre of the flowers.

3.4. Conservation status

The species is known only from two discrete locations, 3 km apart. The two populations cover a total area (area of occupancy; AOO) of less than 5 ha. The total number of plants is estimated at between 500 and 1000. No significant threats were observed and, although the area is grazed by small livestock (mainly sheep), the plants did not appear to be affected by grazing. According to IUCN 3.1 criteria (IUCN, 2001) the species is classified as VU D1.

3.5. Additional specimens seen

South Africa — Northern Cape: 3017 (Hondeklipbaai): 30 km west of Garies, farm Soutfontein 436, along the Outeep River, (– DA), 20 Aug. 2013, on quartz-gravel, 135 m alt., N.A. Helme 8058 (BOL, NBG).

Acknowledgements

The authors received funding from the National Research Foundation (NRF) as an incentive grant for rated researchers. The curators of BOL, NBG and SAM are thanked for permission to examine specimens.

References


