

# The Charcoal Acrolophia

## *Acrolophia ustulata* (Bolus) Schltr. & Bolus

by William Liltved

**S**ince the discovery of this unusual orchid by Harry Bolus in December 1882, 'in sandy soil in the valley opposite "Farmer Peck's Hotel", on the Muizenberg' (335–400 m), *Acrolophia ustulata* has been found at only a few scattered sites ranging from the Cape Peninsula to between the Robinson and Outeniqua Passes in the Outeniqua Mountains (see Liltved & Johnson 2012, pp. 889–892). A recent prolific flowering event was observed in the mountains of Vogelgat Private Nature Reserve near Hermanus, in November and December 2014, in the second year after fire. A range of colour forms was observed and photographed, with plants measuring up to 90 mm tall (Figs A–E). This orchid occupies dryish fynbos habitats on scant, stony sandstone-derived soils at altitudes below 650 m (Fig F). *Acrolophia ustulata* is listed as 'Vulnerable' in the *Red List of South African plants* (Raimondo *et al.* 2009).

In 1924 the name *Acrolophia parvula* was proposed by the botanist Rudolf Schlechter for a specimen with olive-green flowers that he had found near Elim (122 m), west of Bredasdorp in December 1896. *Acrolophia parvula* has however since been synonymised under *A. ustulata*. The colour variant described by Schlechter is quite representative within the range of greenish to golden-yellow colour forms (Figs C–E) observed among typical dark-flowered populations of the species (Figs A and B).

The genus *Acrolophia* is centred in the Cape Floristic Region. Only two of the seven species, *A. cochlearis* and *A. micrantha*, have distributions extending beyond this region. In *Acrolophia* the bunches of thickened storage roots possess a whitish multilayered epidermis or velamen of dead cells. Leaf arrangement in the often-robust plants is distichous (in two fan-like rows on opposite sides of the stem). These are among the few terrestrial Cape orchids possessing leathery evergreen

leaves that persist throughout the year. In *Acrolophia* the smallest flowers are of thinnish to medium substance; range in colour from brown to white or pale rose; and in some species (e.g. *A. cochlearis*), from the ovary, may remain untwisted to present in an apparently upside-down or non-resupinate orientation. The lip usually bears callosities, including crests, ridges or lamellae. Small solitary bees (e.g. *Allodapula* and *Colletes*) are known pollinators and attracted to nectar produced in the spur of some species. Pollinaria comprising two pollinia, stipe and viscidium are removed together by the insect as it departs from the flower. The forwardly bent anther encloses the pollinarium in a lid-like operculum or anther cap. This anther cap in some species (e.g. *Acrolophia lamellata*) is conspicuously two-horned – the horns being small dark projections arising from either side of the anther cap. *Acrolophia* is characterised by flowering from the summit of the stem, and not basally, as in the closely related genus *Eulophia*. Hence, the name *Acrolophia* is derived from the Greek, *akros* = a summit + *lophos* = a crest alluding to the characteristic terminal inflorescence in this genus.

Although flowering in *Acrolophia* is mainly independent of fire, *A. ustulata* is a curious exception in this regard. Flowering occurs from September or October to December and the positive response to fire in this unique species is obvious. Field observations by various botanists (e.g. Jan Vlok), indicate that *A. ustulata* flowers for only three successive years after fire and that peak-flowering occurs in the second season post-fire. Plants previously observed by the author at Hermanus flowered for three successive years (1997–1999), producing a fresh leafy shoot yearly from the axillary buds subtended by the persistent green leaves below the previous year's dried inflorescence. The seemingly healthy plants then shriveled up and died.



**A and B:** *Acrolophia ustulata*. The typical dark-flowered form. Vogelgat Nature Reserve near Hermanus (24 November 2014). Photos: William Liltved.



C and D: *Acrolophia ustulata*. Golden-yellow forms at Vogelgat (24 November 2014). Photos: William Liltved.

The species name '*ustulata*' is derived from the Latin, *ustus* = burn, *ustulatus* = charred, burnt, scorched, brown, and refers to the charcoal-black flowers. *Acrolophia ustulata* and *Disa lugens* var. *nigrescens* have both been referred to as 'black orchids'. They are the only orchids within the Cape Floristic Region to have a very peculiar dark matt brown to maroon-black floral coloration. The flowers in both taxa contain brown pigments that are not easily extracted by 70% ethanol and thus keep a significant amount of their original coloration when spirit-preserved. Flowers of other orchids in ethanol soon become translucent white or yellow, losing all traces of their original coloration. It is thus likely that blackish flowers contain anthocyanins which are polymerised or complexed with other plant phenolics, reducing their solubility. A study of the plant pigment chemistry of these dark-flowered orchids may identify novel compounds. The only other Cape orchids with any significant 'black' floral coloration are *Disa atricapilla*, which has shiny, dark maroon to blackish sepals, and *D. bivalvata* and *D. rufescens*, in which the lip and petals are dark purple to maroon-black. The short-lived perennial, *Nemesia bodkinii*, and the root-parasite, *Hyobanche atropurpurea*, are

among a few other Cape plant species with similarly coloured dark purple to blackish flowers.

In pondering the life-cycle of *A. ustulata*, Anthony Hall (1989) thought that 'a more likely hypothesis is that the aerial parts mostly took two post-fire years to develop from buried, long-lasting perennating (continuing from one growing season to the next) organs, such as protocorms nourished by a mycorrhizal fungus'. This view is supported by the observations of Greig Russell and the author who, in the Bolus Herbarium, examined numerous specimens on the type sheets collected by Harry Bolus in 1882 and 1883 (*Bolus 4848. MacOwan & Bolus 156*). It was revealed that some plants had flowered for more than one season, indicating that the species is not monocarpic (a perennial or annual plant, flowering or fruiting once and then dying). There were further signs that the aerial shoot arises from the tip of a well-developed subterranean stem or rhizome, growing up from an irregular to oval mass of tissue situated some 50–100 mm below the soil surface. No plant showed any sign of secondary growth developing at the level of the crown, although few-leaved secondary

spikes arise from axillary positions higher on the plant in seasons subsequent to the first flowering. It appears likely that the number of axillary meristems available for this type of growth is limited. This means that the aerial shoot has a life-span limited to three or four years before there are no longer any potential buds present, at which time the plant dies. Based on this expanded 'obligate reseeder' hypothesis, it is likely that the next generation of plants is wholly dependent upon the production and growth of new tubers, in the inter-fire period, from the seed of the present generation, and that failure in the production and subsequent germination of seed is likely to cause local extinction. This could account for the extirpation of this species at the type locality by Bolus as, in the 1882 and 1883 flowering seasons, he apparently removed virtually every plant that came into flower at the site on the Muizenberg (cf. Hall 1989). What is not currently known, is whether the seedlings of the next generation become established and produce photosynthetic above-ground parts by the time the surrounding fynbos vegetation has matured, or whether the development of plants before a fire is entirely





E: A golden-yellow form of *Acrolophia ustulata* at Vogelgat (24 November 2014). F: Craggy mountain terrain in the mountains of Vogelgat Private Nature Reserve near Hermanus – the habitat of the Charcoal Acrolophia (*A. ustulata*). Photos: William Liltved.

subterranean and holomycotrophic (having fungus-assisted nutrition only). It would also interest us to understand the role of the dark maroon or greenish-yellow flower coloration in the pollination of *A. ustulata*. We have not noticed the flowers being scented, but Hall (1989) described them as being ‘faintly sweet-scented’. Other orchids, such as *Cymbidium floribundum* from south China and Taiwan, also have brown and green-flowered forms, both of which attract pollinators very successfully. In the case of *A. ustulata*, however, the typically dark coloration merges the flowers cryptically into their post-fire surrounds. It is thus likely not the colour that attracts the pollinator, but some other quality in the flowers. In *C. floribundum* the plants are unscented to the human nose, but they do produce volatile substances similar or identical to the swarming or foraging pheromones of the Japanese honeybee, *Apis cerana* subsp. *japonica*, which in this orchid species act as the long-distance lure (cf. Russell 2003). We wonder whether there is perhaps a similar odourless semiochemical lure that operates in *A. ustulata*, or whether the faint sweet scent noted by Hall is itself a semiochemical or an attractant of food-seeking insects. Semiochemicals are defined as chemical substances produced by an organism and used in communication with, or to modify the behaviour of, another organism. The papillate midlobe of the lip in *A. ustulata* possibly

serves as a tactile alignment cue to induce the pollinating insect to enter the flower. Much work, however, remains to be done in solving the pollination mystery of the Charcoal Acrolophia.

#### READING

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