

Two new species of *Nemesia* (Scrophulariaceae) from the southern Cape, South Africa

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ABSTRACT

Two new species of *Nemesia* Vent. are described from South Africa. *Nemesia fourcadei* is an annual with small white flowers, a yellow-orange pubescent palate, and violet lines at the base of the upper lip. It differs from the similar looking *N. lucida* Benth. by having larger flowers with a more prominent spur (mostly 3.5–4.5 mm long vs < 1.5 mm) and a pubescent palate. *N. fourcadei* is known from only two locations in the southern Cape. *N. elata* is a facultative perennial with white flowers, a lavender to purple reverse, and a white or very pale yellow palate. It is known only from the Langeberg and Outeniqua Mountains between Swellendam and Montagu Pass. It is closest to *N. fourcadei*, but differs from that species by its more robust habit, the absence of a boss inside the corolla tube at the base of the hypochile, and a spur that is violet to purple at the base.

INTRODUCTION

Nemesia Vent. is a genus of ± 62 species of annual and perennial herbs endemic to southern Africa (Steiner 2009). The last revision of the genus appeared in *Flora capensis* near the turn of the last century (Hiern 1904) with a partial revision for species occurring chiefly in KwaZulu-Natal, published more recently (Hilliard & Burt 1986), and new species continue to be described, especially from arid areas of the Northern Cape Province of South Africa (Steiner 2006, 2009). The purpose of this paper is to describe two new species from the southern Cape region of South Africa. The descriptions are based primarily on living material collected directly from the field or grown from field-collected seed.

Nemesia fourcadei K.E.Steiner, sp. nov., *N. lucidae* Benth. proxima, sed differt corollis maioribus, calcaribus longioribus et palato villosio, nec glabrato.

TYPE.—Western Cape, 3323 (Willowmore): De Vasselot Nature Reserve, at top of Groot River Pass, picnic site at entrance trail, 33°58.037'S 23°32.369'E, ± 215 m, (–DC), 13 Oct. 2002, Steiner 3981 (NBG, holo.; CAS, K, iso.).

Erect, annual herb, up to 420(–740) mm tall, simple or branching from base; lateral stems up to 260(–520) mm long, rectangular in cross section, corners ridged, sides up to 3.2 mm wide, mostly glabrous with a few, scattered, glandular hairs. *Leaves* decussate, mostly sessile to shortly petiolate; lamina ovate, 5–46 × 4–22 mm, glabrous or with a few sessile glandular trichomes on abaxial surface near base, veins impressed adaxially, 5-nerved abaxially, apex acute, base cuneate; margins sharply dentate; petioles flattened, up to 10 mm long, glabrous or with a few glandular trichomes. *Inflorescence* in short terminal racemes, these elongating up to 210 mm in fruit, glandular-pubescent; bracts alternate, sessile, lowermost leaf-like up to 17 × 10 mm, uppermost gradually reduced to ± 3.6 × 0.8 mm, narrowly lan-

ceolate to narrowly deltoid; base truncate, apex acute to acuminate; margins entire or rarely dentate; with occasional glandular trichomes; pedicels 7.5–8.0 mm long, ascending, dorsally canaliculate, elongating and becoming patent in fruit, densely glandular-pubescent. *Calyx* lobes 5, lanceolate, acute, spreading, sparsely glandular-pilose, upper lobe 3.1–3.6 × 0.7–0.9 mm, upper lateral lobes 3.0–3.5 × 0.8–0.9 mm, lower two lobes ± 3.0 × 1.0–1.4 mm. *Corolla* bilabiate, 7.6–13.2 × 6.9–10.4 mm, upper lip four-lobed, up to 11.3 × 10.4 mm, white with purple veining at base, just above corolla opening, reverse white or tinged with pink veining, two inner lobes erect, oblong to obovate, 2.7–3.5 × 1.6–2.1 mm, obtuse, bases strongly oblique, two outer lobes spreading-recurved, oblong, 3.1–4.0 × 2.1–2.5 mm, truncate or obtuse to emarginate, bases strongly oblique; lower lip oblong-ovate, 5.4–8.7 × 4.8–8.1 mm, emarginate, white with pale yellowish centre, reverse white with purple veining; base with centrally raised, bi-lobed palate; palate 1.2–1.4 × 1.6–2.0 mm, convex, divided by medial groove into two, raised, yellow-orange bosses; bosses densely pubescent with short white or yellow clavate trichomes on top, changing to shorter epidermal papillae on sides and front; corolla tube white with magenta to purple veining; hypochile (floor of corolla tube) 3.6–4.0 × 1.0–1.2 mm, densely covered with long, thinly stalked, clavate trichomes ± 0.1 mm long, varying from whitish to yellowish orange, with a central, raised, laterally compressed boss in basal half near spur entrance, visible on outside of corolla as a narrow medial invagination; boss 1.6–1.9 × 0.8–1.0 mm, base of boss and area surrounding spur entrance densely covered with yellow-orange trichomes; spur ± straight or curving downward slightly, (2.0–)3.0–4.5 mm long, pale greyish green to greyish yellow, containing pale yellow, clavate trichomes for nearly entire length, becoming less dense toward spur tip. *Stamens* 4, whitish, lying in shallow depression, ± 2.0 × 1.5 mm, in upper, inside surface of corolla tube; filaments of anticus pair (twisted into posticus position), 2.5–3.0 mm long, sigmoid, ± straight in middle, glabrous or with few scattered glandular trichomes, posticus pair 1.3–1.5 mm long, curving, glabrous or with few scattered trichomes; anthers 0.5–0.7 mm long, each pair strongly coherent; pollen white. *Ovary* oblong-

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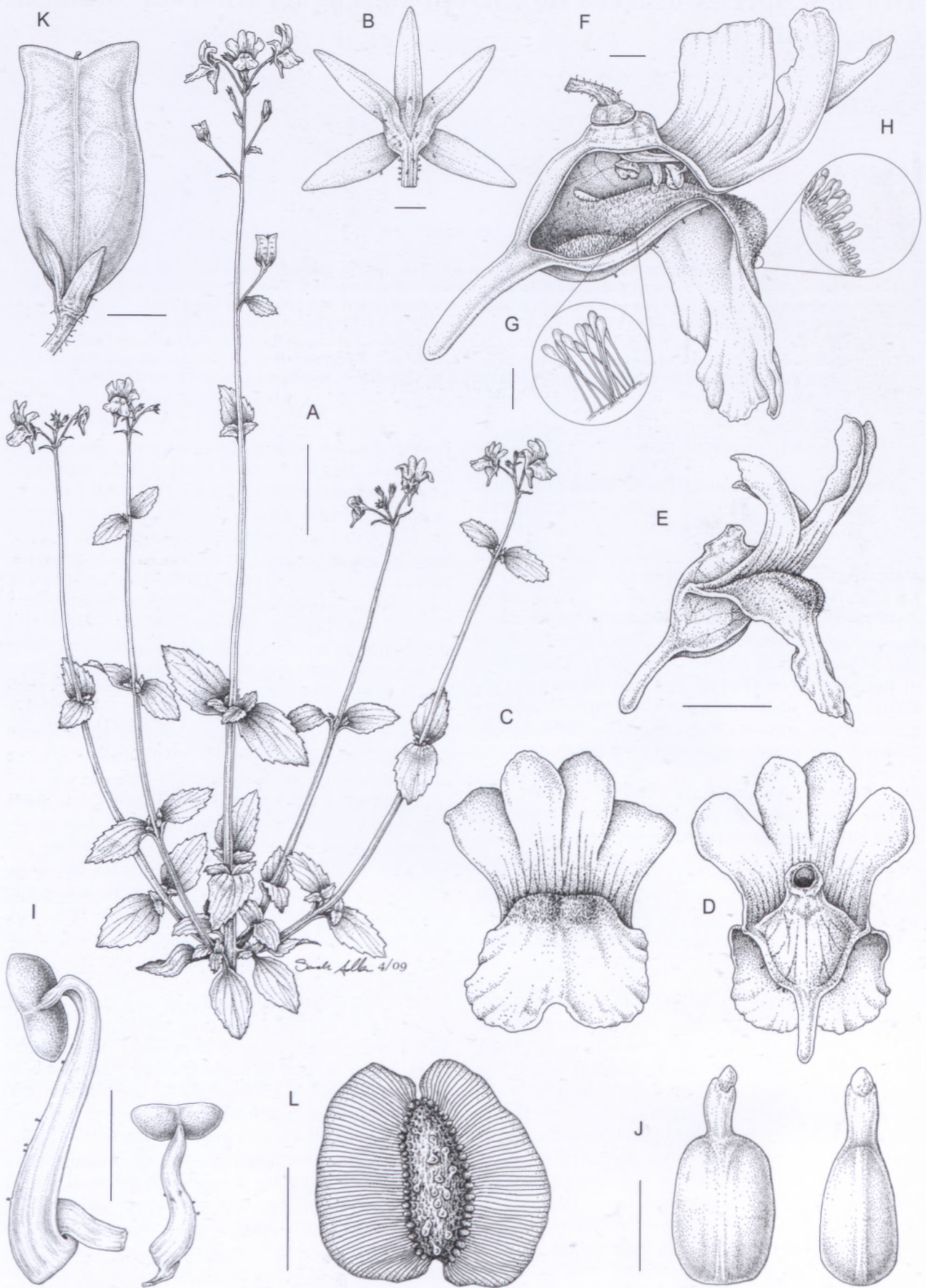


FIGURE 1.—*Nemesia fourcadei*, Steiner 3981 (CAS, NBG): A, habit; B, calyx. C–H, corolla: C, front view; D, rear view; E, side view; F, side view partially cut away with sepals lobes removed; G, trichomes from hypochile; H, trichomes from palate. I, stamens, anticous (left), posticus (right); J, pistil: side view (left), posterior view (right); K, capsule; L, seed. Scale bars: A, 40 mm; B, F, I, J, 1 mm; C–E, 4 mm; G, H, 0.05 mm; K, 4 mm; L, 1 mm. Artist: Sarah Adler.



FIGURE 2.—*Nemesia fourcadei*. A, inflorescence. B, C, flower: B, front view; C, side view. D, capsules. Scale bars: all 2.5 mm.

ovate, laterally compressed; $1.5\text{--}1.8 \times 1.1\text{--}1.6$ mm; style $0.5\text{--}0.7$ mm long, compressed somewhat contrary to ovary, apex wider than base, lying between anther pairs with stigma facing away from corolla opening; stigma $\pm 0.1 \times 0.3$ mm. Capsules oblong-ovoid, laterally compressed contrary to septum, $12\text{--}18 \times 6.3\text{--}8.9$ mm, emarginate to bi-lobed, lobes widely diverging. Seeds winged, broadly ovate, $2.0\text{--}2.5 \times 1.8\text{--}2.5$ mm; wing $0.6\text{--}1.1$ mm wide, straw-coloured, membranous with numerous parallel, brownish veins encircling seed, except at ends, internal portion of seed elliptical, $1.5\text{--}1.9 \times 0.3\text{--}0.5$ mm, with dark brown, verrucate exotesta. Flowering time: August to November. Figures 1; 2.

Diagnostic features: *Nemesia fourcadei* is recognized by its white flowers with purple veining and a pale yellowish orange palate. It can be distinguished from the similar looking *N. lucida* by its larger flowers ($7.6\text{--}13.2$ mm vs < 7.5 mm long) with longer spurs (mostly $3.0\text{--}4.5$ vs < 1.5 mm), and by its relatively broader capsules (length/width: $1.7\text{--}2.0$ vs $2.4\text{--}3.5$). It also differs from *N. lucida* in having a pubescent palate. Molecular data from multiple collections of *N. lucida*, using several gene regions, suggest that the resemblance to *N. fourcadei* is only superficial, because the two species occur in different major clades (Steiner unpubl.). *N. fourcadei* groups in a clade containing mostly eastern summer rainfall species, whereas *N. lucida* groups with a clade containing mostly winter rainfall species (Steiner unpubl.). The superficial resemblance of their flowers may be because of convergence based on adaptation to small pollen-collecting bees or it may be the result of relaxed pollinator selection associated with the evolution of autogamy.

Etymology: this plant is named in honour of H.G. Fourcade, who actively collected in the Eastern Cape after he resigned from the Civil Service. His collection of *Nemesia fourcadei*, in addition to his many other collections, served as the basis for a checklist of the flora of George, Knysna, Humansdorp and Uniondale Districts (Fourcade 1941).

Distribution and habitat: *Nemesia fourcadei* is an annual that comes up sporadically after winter rain and is not dependent on fire for germination. It is known from only three sites in the southern Cape, Witelsbos, the De Vasselot Nature Reserve, and Kareedouwkloof near Kareedouw (Figure 3). At Witelsbos, it was collected in grassy places on the margins of Southern Afrotemperate Forest, while at Groot River Pass it grew in a grassy opening on the edge of Garden Route Shale Fynbos (Mucina & Rutherford 2006). No habitat data was given for the Kareedouwkloof specimen.

Breeding systems: *Nemesia fourcadei* is facultatively autogamous. In cultivated individuals isolated from insects, every flower forms a capsule filled with seed. Flowers become progressively smaller once capsule formation begins and as the flowering season progresses, even when plants are supplied with sufficient moisture. The ability of this species to self-pollinate does not preclude the possibility of occasional outcrossing by small bees. The spurs of *N. fourcadei* do not secrete nectar, therefore pollen is the only potential food source for pollinators.

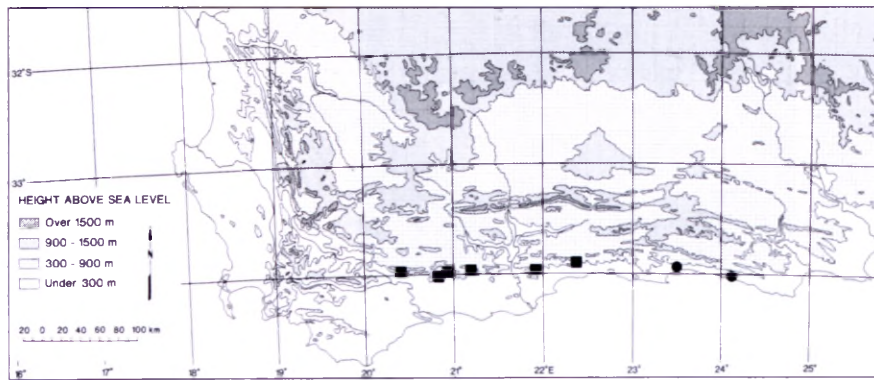


FIGURE 3.—Known distribution of *Nemesia fourcadei*, ●; and *N. elata*, ■.

Other specimens examined

EASTERN CAPE.—3324 (Steytlerville): Kareedowkloof, (–CD), Oct. 1930, *Fourcade s.n.* (NBG).

3424 (Humansdorp): Witelsbos, (–AA), Aug. 1921, *Fourcade 1415* (BOL, K, NBG, PRE, SAM).

***Nemesia elata* K.E.Steiner, sp. nov., *N. fourcadei* proxima, sed differt tubo corollae nec invaginato, basique calcaris violacea.**

TYPE.—Western Cape, 3321 (Ladismith): Garcia's Pass, 18.4 km N of Riversdale, N-facing slope in steep gorge below road, 33°57.731'S 21°13.443'E, ± 505 m, (–CC), 8 Oct. 2003, *Steiner 4061* (NBG, holo.; CAS, E, K, PRE, iso.).

Perennial herb or subshrub, up to 1 m tall; stems erect or decumbent, simple or branching; lateral stems up to 43(–80) mm long, rectangular in cross section with corners ridged, up to 4.9(–5.1) × 3.1(–5.1) mm, often fleshy, glabrous. *Leaves*, opposite, sessile to petiolate; lamina lanceolate to ovate, (7–)18–77(–87) × (4.7–)10–37(–45) mm, apex acute to acuminate, base cuneate; margins sharply dentate; veins impressed adaxially, 5–7-nerved abaxially, glabrous; petioles up to 20 mm long, canaliculate, decurrent, glabrous. *Inflorescence* of solitary alternate flowers, in lax, bracteate racemes, or subcorymbose, up to 480(–660) mm long, glabrous, developing long internodes in fruit; bracts alternate (occasionally opposite), sessile or with petioles up to 3 mm long, lowermost leaf-like, up to 62 × 32 mm, uppermost gradually reduced to 8.4 × 0.8 mm, narrowly lanceolate to linear, apex acute to acuminate, base truncate; margins entire or with a few widely spaced teeth, with occasional sessile glandular trichomes; pedicels 8–20 mm long, ascending, dorsally canaliculate, mostly glabrous, sparsely glandular-pubescent apically, elongating up to 23 mm and ascending in fruit. *Calyx* lobes 5, narrowly lanceolate, spreading, glabrous, upper lobe 2.7–3.6 × 0.6–0.7 mm, upper lateral lobes 2.8–3.6 × 0.7–0.8 mm, lower two lobes ± 2.9–3.1 × 0.8–0.9 mm, acute; margins scabridulous. *Corolla* bilabiate, (7.3–)9.2–12.0 × (6.5–)8.7–10.8 mm, upper lip white, reverse violet, with faint, grey-blue lines at base above corolla opening, four-lobed, up to 9.2 × 10.8 mm, two inner lobes oblong, 2.3–3.3 × 1.6–2.6 mm, obtuse, bases oblique, two outer lobes oblong, 4.2–4.8 × 2.5–3.0 mm, bases strongly oblique, rounded; lower lip widely obovate, obtuse to emarginate, 7.9–8.9 × 8.1–9.4 mm, white; base of lower lip with raised palate, 1.4–2.4 × 4.2–4.7 mm, convex,

white to pale greyish yellow, often bisected by thin grey line, densely pubescent with clavate trichomes, these transitioning distally to shorter, papillate, epidermal cells; hypochile 3.4–4.3 × 2.3–2.4 mm, V- to U-shaped in cross section with purple veining, densely covered with white clavate trichomes with long thin stalks ± 0.2 mm long, base of tube spurred, spur 3.4–4.1 mm long, projecting backwards and decurved in distal half, basal portion lavender to purple, distal half greyish green, glabrous outside, pubescent with white, clavate trichomes inside for ± half the length. *Stamens* 4, whitish, lying in shallow depression, 1.6–1.9 × 1.0–1.1 mm, in upper inner surface of corolla tube; anticous filaments (twisted into posticous position) 2.5–2.7 mm long, sigmoid, but ± straight in middle, glabrous, posticous filaments ± 0.8–0.9 mm long, ± straight except at base where they are strongly curved; anthers 0.6–0.8 mm long, each pair strongly coherent; pollen white. *Ovary*: oblong-ovoid, laterally compressed, 0.9–1.2 × 0.8–1.0 mm; style ± straight, slightly compressed contrary to ovary, lying between anther pairs; stigma oblong-ovate, 0.3 × 0.25 mm. *Capsules* solitary to subfasciculate, oblong in outline, laterally compressed contrary to septum, bivalvate, 8.0–13.0 × 4.7–6.3 mm, emarginate with two widely diverging acute tips. *Seeds* winged, broadly ovate, 1.9–2.2 × 1.9–2.1 mm, wing 0.4–0.7 mm wide, encircling seed except at ends, light brown, membranous with numerous parallel, brownish veins, internal portion of seed lanceolate in outline, 1.7–2.1 × 0.8–1.0 mm, with reticulate and verrucate, dark brown exotesta. *Flowering time*: (May–)August to December. Figures 4, 5.

Diagnostic features: *Nemesia elata* is recognized by its small flowers that are white with a violet to purplish reverse, with one or more faint greyish blue lines at the base of the upper lip and a densely pubescent white or very pale yellow palate. Although *N. elata* is perennial, it does not have a strong root system and may occasionally die back to the ground if conditions become too dry. It can be distinguished from *N. fourcadei* by its perennial habit, the absence of a narrow invagination of the corolla tube near the spur opening, and the presence of violet to purple on the lower half of the spur. It can resemble *N. melissifolia* Benth. in fruit, because of the development of long internodes and the quasifasciculate capsules of robust specimens (Hilliard & Burt 1986). However, that species is a bushy annual that has flowers with longer, narrower, acute spurs mostly 5–8 mm long, and a corolla tube with two bosses inside near the spur opening. *N. elata* is also similar to *N. diffusa* Benth., but that species is less robust, has a glandular-pubescent



FIGURE 4.—*Nemesia elata*, Steiner 4057 (CAS, NBG): A, habit; B, C, calyx, enlargement of calyx margin. D–I, corolla: D, front view; E, rear view; F, side view; G, side view partially cut away with sepal lobes partly removed; H, enlargement of trichomes from hypochile; I, enlargement of trichomes from palate. J, K, stamens: J, anticous; K, posticus. L, pistil: side view (left), posterior view (right); M, capsule; N, seed. Scale bars: A, 40 mm; B, G, 2 mm; C, 0.25 mm; D–F, M, 3 mm; H, I, 0.1 mm; J–L, N, 1 mm. Artist: Sarah Adler.

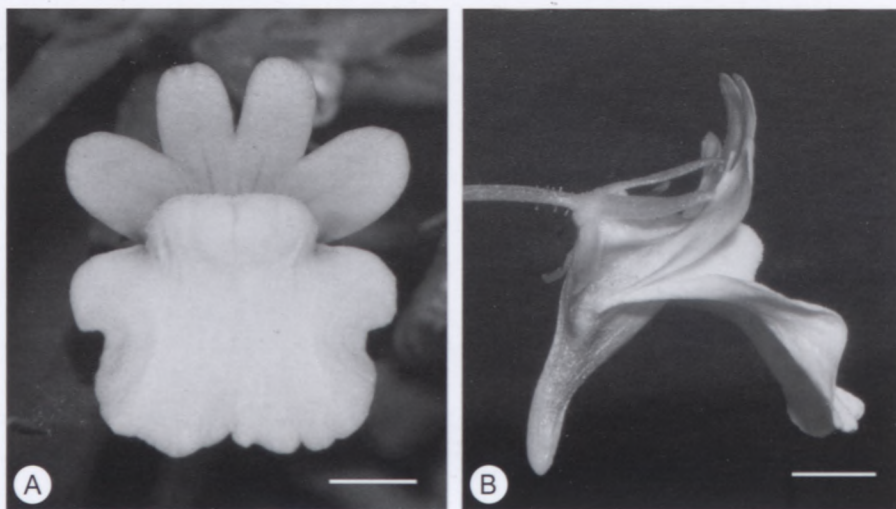


FIGURE 5.—*Nemesia elata*. A, B, flower: A, front view; B, side view. Scale bars: 2.5 mm.

calyx, and more prominent blue-purple lines that extend more than halfway into the corolla lobes on both front and back. This species was referred to as *Nemesia* sp. 2 in Goldblatt & Manning (2000).

Etymology: the epithet *elata* refers to the tall (lofty) stature of the species.

Distribution and habitat: *Nemesia elata* occurs in the Langeberg and Outeniqua Mountains from Swellendam to Montagu Pass, near George (Figure 3). It is found in openings in fynbos in moist sandy loam, especially on steep slopes in gorges and ravines between 250 to 750 m. It is most common after fire.

Breeding systems: *Nemesia elata* is facultatively autogamous. In cultivation, when pollinators are excluded, all flowers form capsules and set seed. The ability of this species to self-pollinate, however, does not preclude the possibility of occasional outcrossing by small bees or flies. The spurs of *N. elata* do not secrete nectar, but pollen may function as an attractive food source for pollinators.

Other specimens examined

WESTERN CAPE.—3320 (Montagu): Swellendam State Forest, Kliprivier (Hermitage) Gorge, $\pm 800'$, (–CD), 11 Oct. 1973, *Haynes 831* (PRE); Grootvadersbos, eastern part, 442 m, (–DD), 21 May 1983, *C.M. van Wyk 1211* (PRE). 3321 (Ladismith): Garcia's Pass, 16.5 km N of Riversdale, $33^{\circ}58.591'S$ $21^{\circ}13.168'E$, 545 m, (–CC), 7 Oct. 2003, *Steiner 4059* (NBG, CAS); Garcia's Pass, 18.4 km N of Riversdale, $S33^{\circ}58.623'$ $E21^{\circ}13.327'$, 505 m, (–CC), 20 Aug. 2004, *Steiner 4067* (NBG, CAS); Garcia's Pass, (–CC), Sep. 1908, *Phillips 312* (E, K); Cloete's Pass and Goliatsberg, up to 530 m, (–DD), 14 May 1915, *Muir 2028* (PRE). 3322 (Oudtshoorn): Outeniqua Montagu Pass on wet rocks, ± 688 m, (–CD), Oct. 1921, *Fourcade 1594* (K); mountains

at top of Montagu Pass, after fire, 750 m, (–CD), 5 Oct. 1985, *Vlok 1174* (PRE). 3420 (Bredasdorp): Grootvadersbosch (Eastern Part), (–BB), 6 Dec. 1953, *Taylor 1038* (PRE).

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