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Buchnera hirsutorepens, a new species of prostrate Orobanchaceae from Zambia and the Democratic Republic of the Congo, along with a revised description of *Buchnera prorepens*

John K. Gibson[1], Mpande Sichamba[2] & Iain Darbyshire[1]

Summary. A new species of *Buchnera* L. is described, *Buchnera hirsutorepens*, from south-eastern Democratic Republic of the Congo, and central and eastern Zambia. *Buchnera hirsutorepens* is split from *Buchnera prorepens* Engl. & Gilg, which is also redescribed here, its range now encompassing Angola and Western Zambia. These two species are unique in the genus *Buchnera* in their prostrate habit and axillary flowers. They can be separated from each other by differences in indumentum of the inflorescence and leaves, bract shape, pedicel length and relative length of the corolla tube to the calyx. A distribution map of georeferenced specimen localities of the two species is provided, along with information on their habitat and ecology, and an evaluation of their conservation status based on IUCN guidelines and criteria.

Key Words. Africa, Red List assessment, Savanna, taxonomy, vicariance.

Introduction

Buchnera L. is a diverse genus of around 140 hemi-parasitic species in the tribe Buchnereae of the Orobanchaceae family (Nickrent 2020). Previously placed in the family Scrophulariaceae, it has been moved into an expanded Orobanchaceae, together with many other hemi-parasitic genera formerly in Scrophulariaceae, following extensive molecular work, and is one of the largest genera in the family (Wolfe *et al.* 2005; Bennett & Mathews 2006; APG III 2009; POWO 2024).

Our understanding of the taxonomy and ecology of *Buchnera* is limited, despite its global distribution and high diversity (Nickrent 2020). Species of *Buchnera* are generally hemi-parasitic, often facultatively so (Neumann *et al.* 1998), but there are few records of its role as a serious crop pest in agriculture or as an invasive species, and so there is a perceived lack of economic impact of the genus (Berner *et al.* 1997), which may have resulted in relatively little research on it. This is in comparison to other Orobanchaceae genera, such as *Orobanche* L. or *Striga* Lour., which include major invasive species and crop parasites (Parker 2013). *Buchnera* also has a challenging taxonomy, with its species often regarded as difficult to identify in the field (Weakley 2006).

The centre of diversity of *Buchnera* is in tropical Africa, particularly southern Democratic Republic of the Congo and Zambia, with only a small proportion of species in the Americas, Asia and Australia (Philcox 1965; Souza & de Paula-Souza 2016; Nickrent 2020; Fischer 2025; Fischer & Ilunga Wa Ilunga 2025). The *Flora Zambesiaca* account of Scrophulariaceae identified 49 species in its treatment of Zimbabwe, Zambia, Malawi, Mozambique, Botswana and the Zambezi Region of Namibia (Philcox 1990). One distinctive species in this treatment is *Buchnera prorepens* Engl. & Gilg, the type of which is from Angola. This species is unique in the genus in its prostrate habit and solitary axillary flowers. The distinctiveness of *B. prorepens* within *Buchnera* is emphasised by its position in the first key break of the *Buchnera* section of *Flora Zambesiaca* (Philcox 1990). *Buchnera prorepens* was described from Angola and has previously been recorded from western Angola to eastern Zambia and southeast Democratic Republic of the Congo, occurring on well drained grasslands and savannas. This is a region characterised by mesic savannas, with high rainfall but also high frequency of fire and low nutrient soils (Huntley 2023). This combination of factors has contributed to a diverse flora, often with unique morphological adaptations, such as those of geoxylic suffrutices, or "underground trees" (Meller *et al.* 2022).

Sally Bidgood (1948 – 2018), working in the herbarium at the Royal Botanic Gardens, Kew, had previously observed that *Buchnera prorepens* appears in two vicariant forms, dividing the species into western and eastern groupings. Here we interrogate this morphological difference further, identifying two distinct taxa via investigation of herbarium specimens and field photographs. The new species is morphologically similar

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[1] Science Directorate, Royal Botanic Gardens, Kew, Richmond, TW9 3AB, UK. e-mail: j.gibson2@kew.org
[2] Herbarium, Forestry Department, Division of Forest Research, P. O. Box 22099, Kitwe, Copperbelt Province, Zambia

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to *B. prorepens s.s.*, due to the presence of a tap root, prostrate habit and solitary axillary flowers. However, there are a significant number of differences that justify its treatment as a distinct taxon. Here, we provide a description of the novel taxon, *Buchnera hirsutorepens*, known from eastern and central Zambia and southern Democratic Republic of the Congo. We also provide a revised description of *B. prorepens s.s.*, which occupies the region from coastal Angola through to western Zambia (Map 1), the conservation status of both species and a distribution map.

Material and Methods

This work is based primarily on study of herbarium specimens of *Buchnera prorepens s.l.* from the Royal Botanic Gardens, Kew (K) (herbarium acronyms follow Thiers 2025) indicated by "!", and from consultation of specimens from other herbaria digitally. Specimens from BR, COI, G, HBG, LISC, M, NDO, P, S and W were seen digitally, indicated by "*". The *Flora Zambesiaca* treatment of *Buchnera* (Philcox 1990) was also consulted. Flowers were soaked in Aerosol OT 5% solution, prior to dissection, while other morphological characters were measured using dry material. Morphological descriptions are based on terminology in the *Kew Plant Glossary* (Beentje & Williamson 2016). Specimen coordinates were georeferenced in Google Earth (https://earth.google.com). The extinction risk (conservation) assessments for the two species follow the IUCN Red List categories and criteria (IUCN 2012) and the guidelines for their use (IUCN 2024). Extent of Occurrence (EOO) and Area of Occupancy (AOO) were calculated using the GeoCAT tool (https://geocat.iucnredlist.org/; Bachman *et al.* 2011), AOO using standard 2 × 2 km grid squares.

Taxonomic Treatment

Buchnera hirsutorepens *J.K.Gibson & I.Darbysh.* **sp. nov.** Type: Zambia, Mpika Distr., [11°50'30.12"S 31°28'3.072"E], 4 Feb. 1963, *D. B. Fanshawe* F.1963 (holotype K! [K004177386]; isotypes BR [BR0000019400488]*, NDO*).

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Buchnera prorepens sensu Philcox (1990: 98) pro parte, non Engl. & Gilg s.s.

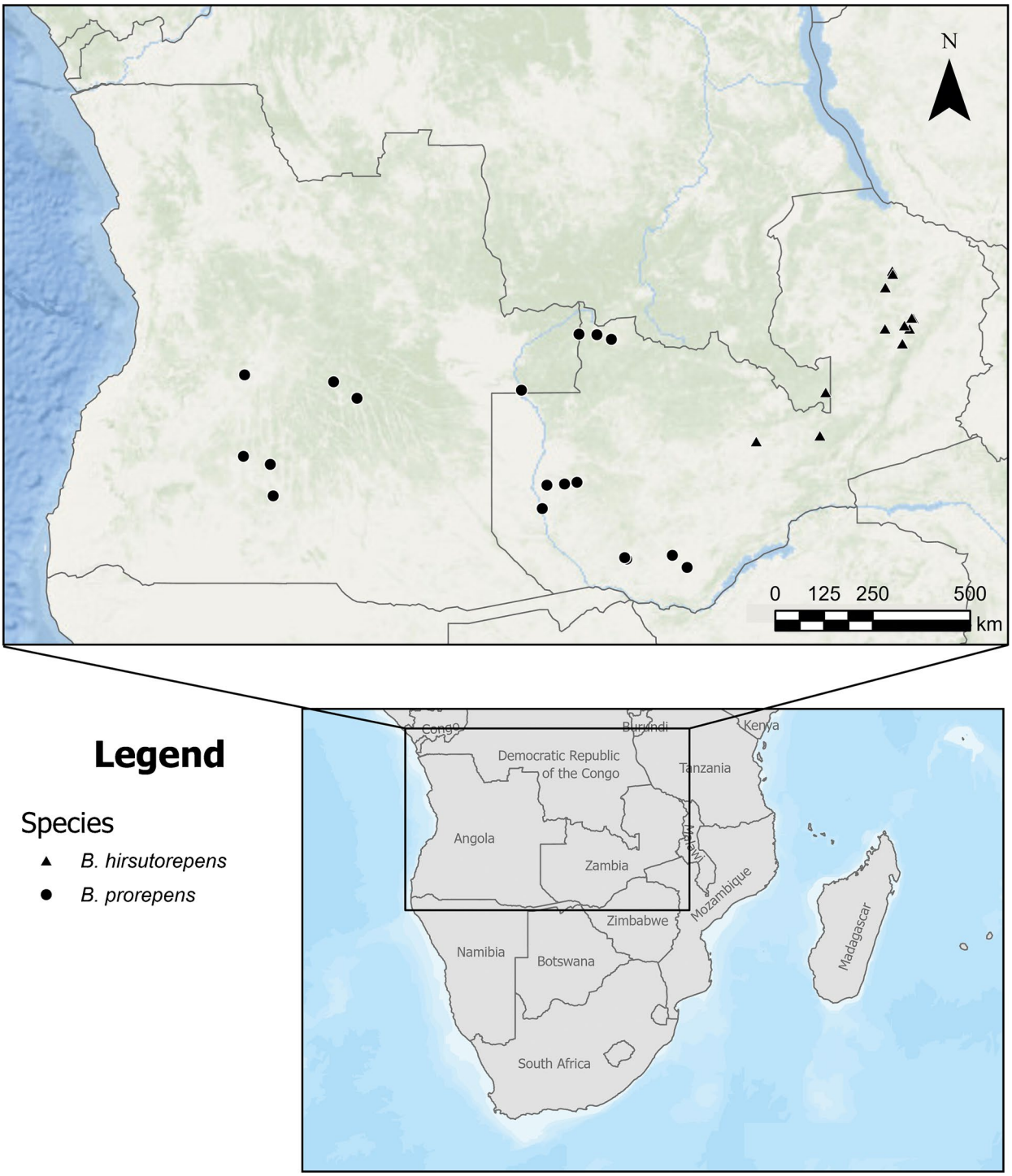
Prostrate, many stemmed *herb* arising from a woody tap root. *Stems* hirsute. *Leaves* opposite, oblanceolate to narrowly oblong-elliptic, 4 – 41 × 1 – 12 mm, sessile, base attenuate, margin entire, apex obtuse to acute, occasionally mucronate or rounded, surfaces hirsute or strigose, 1 – 3 nerved; distal leaves considered here as bracts. *Flowers* solitary in axils of leaf-like bracts throughout the majority of the stem, usually pedicellate, rarely sessile; pedicels (0 –) 0.5 – 2 mm long. *Bracts* 5 – 20 (– 30) × 0.8 – 4.5 (– 8) mm, oblanceolate or rarely narrowly oblong-elliptic, base attenuate, margin entire, apex acute to obtuse, rarely mucronate, surfaces hispid or hirsute; *bracteoles* 3.5 – 9 × 0.2 – 0.6 (– 1.2) mm, linear, apex acute, surfaces hispid or hirsute. *Calyx* 10-nerved; tube 4.2 – 6.8 mm long, shortly hirsute to densely so externally; lobes 1.3 – 4.6 × 0.3 – 1.4 mm, lanceolate, apex acute, hirsute externally. *Corolla* lilac; tube 7.5 – 12.6 mm long, 1.5 – 2 (>2) × longer than calyx tube, externally strigose or hirsute, trichomes often most dense adjacent to calyx lobes, glabrous at its base, internally hirsute, densely hispid at mouth; lobes 1.7 – 4.5 (– 6.8) × (0.9 –) 1.4 – 3.3 (– 6.1) mm, obovate to elliptic, glabrous, rarely hirsute or scabrid externally, rarely weakly hirsute on margin. *Stamens* 4, didynamous, inserted on corolla tube; filaments glabrous, shorter filaments 0.5 – 1 mm long, longer filaments 0.7 – 3 mm long; anthers 1.1 – 1.7 mm long. *Ovary* 0.8 – 1.9 mm long; style filiform, (0.5 –) 1.7 – 2.6 mm long; stigma narrowly oblong-elliptic, 0.9 – 1.5 mm long. *Capsule* c. 2.2 × 1.8 mm, obovoid to cylindrical, glabrous. Figs 1 & 2B.

RECOGNITION. *Buchnera hirsutorepens* is similar to *B. prorepens* in the presence of a woody tap root, prostrate habit and solitary axillary flowers. The new species differs in its hispid or hirsute bract indumentum (vs bracts glabrous or with trichomes on margins, veins, and/or base of abaxial surface in *B. prorepens*); hispid or hirsute bracteole indumentum (vs bracteoles glabrous or rarely weakly hirsute especially at tip); hirsute or strigose leaf indumentum (vs leaves glabrous, or with trichomes on margins and/or veins); hirsute or strigose corolla tube indumentum (vs corolla tube glabrous apart from trichomes adjacent to calyx lobes); oblanceolate or rarely lanceolate bracts (vs bracts ovate, obovate or lanceolate, or rarely oblanceolate); pedicel length (0 –) 0.5 – 2 mm (vs pedicels (1.2 –) 2 – 4 (– 5) mm); shortly hirsute calyx tube and lobes (vs calyx tube villose and lobes glabrous or with trichomes only on lobe tips) and a corolla tube 1.5 – 2 (> 2) × longer than its calyx tube (vs corolla tube 2 – 3 × longer than calyx tube). See Table 1 for further differences.

DISTRIBUTION. Central and eastern Zambia and southeastern Democratic Republic of the Congo. Map 1.

ADDITIONAL SPECIMENS EXAMINED. ZAMBIA. Muchinga Prov.: Kanchibiya Distr.: Bwingi Mfuma, Mpika National Park, 11°30'S 31°4'E, 21 Jan. 1981, *R. M. Lawton* 2307 (K!); Mpika Distr.: Muchinga escarpment, Mukowonshi Mt, 45 km NNE of Mpika, [11°25'26.76"S 31°30'55.044"E], 18 Jan. 1972, *T. Pocs & J. & M. Kornas* 6630/L (K!); hills W of Great North Road, 45 km

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Map 1. Distribution of georeferenced herbarium specimens of *Buchnera prorepens* and *Buchnera hirsutorepens*.

NNE of Mpika, 11°30'S 31°38'E, 18 Jan. 1972, *J. Kornas* 926 (K!); Shiwang'andu Distr.: Shiwang'andu, [11°15'S 31°40'59.988"E], 4 June 1956, *E. A. Robinson* 1581 (K!); Chinsali Distr.: Machipara hill, Shiwa-Ngandu, [11°15'41.4"S 31°43'6.168"E], 16 May 1959, *H. M. Richards* 10694 (K!, BR*). **Central Prov.:** Kabwe Distr.: Mpunde 53 km NW from Kabwe, 14°6'S 28°6'E, 7 Dec. 1972, *J. Kornas* 2763 (K!); Mkushi Distr.: Fiwila rock,

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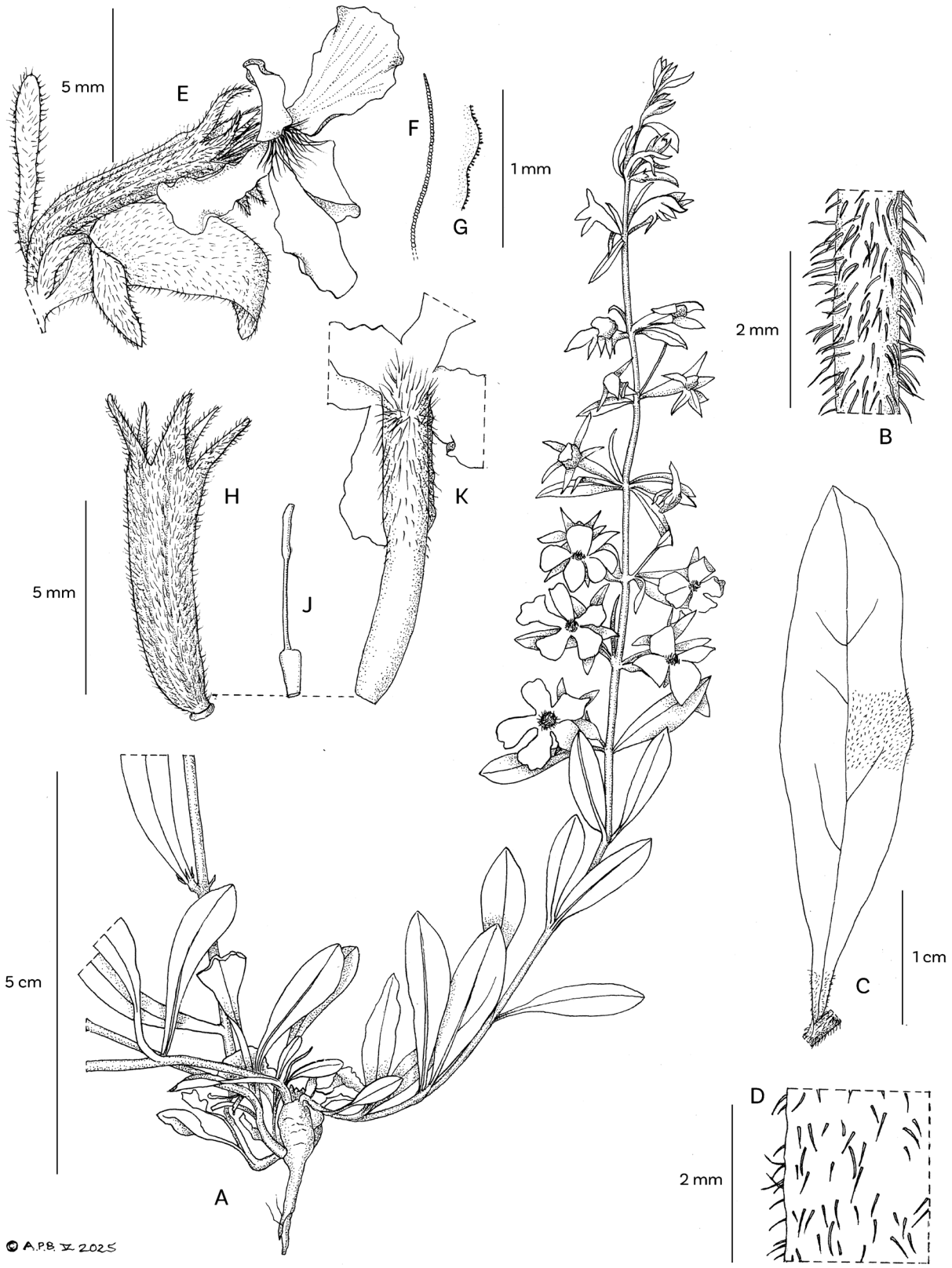


Fig. 1. *Buchnera hirsutorepens*. **A** habit (as on sheet); **B** stem indumentum; **C** leaf, adaxial surface, with indication of indumentum; **D** leaf indumentum; **E** flower, with bract and bracteole; **F** trichome, from corolla tube entrance; **G** petal margin; **H** calyx tube; **J** ovary, style and stigma; **K** corolla tube. **A** – **D** from *D. B. Fanshawe* F.1963 (holotype K), **E** – **K** from *E. Robinson* 2580 (K). DRAWN BY ANDREW BROWN.

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Fig. 2. *Buchnera hirsutorepens* and *Buchnera prorepens* in habitat. **A** *Buchnera prorepens*, Dec. 2023 in the Western Province, Zambia. **B** *Buchnera hirsutorepens,* Feb. 2022 in Shiwa-Ngandu District, Zambia. PHOTOS: NICHOLAS WIGHTMAN.

Table 1. A comparison of diagnostic characters to separate *Buchnera hirsutorepens* and *Buchnera prorepens*.

Character	*Buchnera hirsutorepens*	*Buchnera prorepens*
Leaf, indumentum	hirsute or strigose	glabrous or with trichomes on margins or veins
Pedicel, length (mm)	(0 –) 0.5 – 2	(1.2 –) 2 – 4 (– 5)
Bract, indumentum	hispid or hirsute	glabrous or with trichomes on margins, veins, or base of underside
Bract, shape	oblanceolate or rarely narrowly oblong-elliptic	ovate, obovate or narrowly oblong-elliptic, rarely oblanceolate
Bracteole, indumentum	hispid or hirsute	glabrous, rarely weakly hirsute, especially at tip
Calyx tube, indumentum	shortly hirsute	villose
Calyx lobe, indumentum	hirsute	glabrous or with trichomes only on lobe tip
Calyx lobe, width (mm)	0.3 – 1.4 mm	0.2 – 0.5 (– 0.7)
Corolla tube to calyx tube length ratio	1.5 – 2 (> 2) × longer	2 – 3 × longer
Corolla tube, indumentum (external)	strigose or hirsute, glabrous at base	glabrous apart from trichomes around calyx lobes

[13°58'0.12"S 29°34'0.012"E], 3 Jan. 1958, *E. A. Robinson* 2580 (K!). **Northern Prov.:** Kasama Distr.: 5 km E of Kasama, [10°14'9.96"S 31°14'48.084"E], 11 Sept. 1960, *E. A. Robinson* 3826 (K!); Road past Chief Mwamba's village, [10°32'52.08"S 31°4'29.424"E], 25 Feb. 1962, *H. M. Richards* 16172 (K!); Misamfu Exp. Station. 8 km [5 miles] N of Kasama, [10°10'0.12"S 31°13'59.988"E], 7 Jan. 1967, *J. Anton-Smith* 181826 (K!, NDO*). **DEMOCRATIC REPUBLIC OF THE CONGO. Luapula Prov.:** Mupala, [12°58'0.0012"S 29°42'0"E], 1 Dec. 1986, *K. Kisimba & Y. Muzinga* 15 (BR*).

HABITAT & ECOLOGY. Open sandy and rocky habitats, often on hillsides, savannas; 1170 – 2000 m a.s.l.

CONSERVATION STATUS. *Buchnera hirsutorepens* has a relatively wide distribution but with few records, with a calculated AOO of 48 km^2 and EOO of 57,720 km^2. It is likely that some habitat has been lost due to conversion to agricultural land, but there still exist significant extents of intact suitable habitat within its large EOO. Further information on the population size and trend of this species, as well as its generation length, is yet needed to assess it under criterion A, C or D. Following the IUCN (2024) guidelines, *Buchnera hirsutorepens* should, therefore, be provisionally considered Least Concern [LC] despite its AOO being less than 500 km^2, as this is a minimal estimate based on few herbarium specimens.

Buchnera prorepens *Engl. & Gilg* (Warburg 1903: 368). Type: Angola, [15°22'24.7404"S 16°57'46.0152"E], 29 April 1900, 1300 m elevation, *H. Baum* 875 (holotype B destroyed; lectotype K! [K000379686], selected

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here; isolectotypes BR [BR0000006282943]*, G [G00014902]*, HBG [HBG511602]*, M [M-0106074]*, W [W19010006485]*, S [S10-36195]*).

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Prostrate, many stemmed *herb* arising from a woody tap root. *Stems* glabrous to hispid. *Leaves* opposite, oblanceolate to narrowly oblong-elliptic, 5.5 – 19 (– 24) × 1.5 – 8 mm, sessile, base attenuate, margin entire, apex obtuse to acute, occasionally mucronate, surfaces glabrous or with trichomes on margins or veins, 1 – 3 nerved; distal leaves considered here as bracts. *Flowers* solitary in axils of leaf-like bracts throughout the majority of the stem; pedicels (1.2 –) 2 – 4 (– 5) mm long. *Bracts* 4.2 – 15 × 1.9 – 6.2 mm, ovate, obovate, narrowly oblong-elliptic or rarely oblanceolate, base attenuate, margin entire, apex acute or mucronate, rarely obtuse, surfaces glabrous or with trichomes on margins, veins, or base of abaxial surface; *bracteoles* (2.4 –) 3.6 – 7 (– 8) × 0.2 – 1 (– 1.5) mm, linear, apex acute, surfaces glabrous or rarely weakly hirsute especially at tip. *Calyx* 10-nerved; tube (2.3 –) 3.1 – 4.6 (– 5.6) mm long, villose externally; lobes 1.7 – 2.9 (– 3.4) × 0.2 – 0.5 (– 0.7) mm, lanceolate, apex acute, glabrous externally or occasionally with trichomes only on tips of lobes. *Corolla* lilac; tube 6.8 – 12.9 mm long, 2 – 3 × longer than calyx tube, externally glabrous apart from trichomes adjacent to calyx lobes, internally hirsute, densely hispid at mouth; lobes 1.8 – 4.8 × 1 – 3.5 mm, obovate to elliptic, glabrous or rarely weakly hirsute on margin. *Stamens* 4, didynamous, inserted on corolla tube; filaments glabrous, shorter filaments 0.2 – 1.3 mm long, longer filaments 1 – 1.5 mm long; anthers 1 – 1.3 mm long. *Ovary* 0.6 – 1.1 mm long; style filiform, (0.4 –) 2.5 – 3.2 mm long; stigma narrowly oblong-elliptic, 0.7 – 1.6 mm long. *Capsule* c. 2 × 1.8 mm, obovoid to cylindrical, glabrous. Fig. 2A.

DISTRIBUTION. Angola and western Zambia. Map 1.

ADDITIONAL SPECIMENS EXAMINED. ANGOLA. Benguela Prov.: Benguella [Benguela] country of the Ganguellas and Ambuellas, s.d., *J. Gossweiler* s.n. (K! [K004177400]); Benguella [Benguela], country of the Ganguellas and Ambuellas, s.d., *J. Gossweiler* s.n. (K! [K004177401]); Benguella [Benguela], country of the Ganguellas and Ambuellas, s.d., *J. Gossweiler* s.n. (K! [K004177404]). **Bengo Prov.**: Bela vista, [7°48'34.488"S 13°49'55.776"E], 26 March 1974, *R. Dechamps* 1621 (K!). **Huíla Prov.**: Vila da Ponte [Capelongo], [14°27'36"S 16°16'48"E], 22 Sept. 1905, *J. Gossweiler* 2006 (K!, COI*, LISC*); Forte Princesa Amelia [Capelongo], [14°27'36"S 16°16'48"E], 26 Sept. 1905, *J. Gossweiler* 2015 (COI*); Forte Princesa Amelia [Capelongo], [14°27'36"S 16°16'48"E], Sept. 1905, *J. Gossweiler* s.n. (COI* [COI00006999]); Cuchi, [14°39'S 16°54'E], Dec. 1906, *J. Gossweiler* 3979 (LISC*); **Moxico Prov.**: Confluence of Cuito and its 1st tributary, the Kalua river, c. 65 km SSW of Munhango, 12°44'35"S 18°21'20"E, 25 Feb. 2016, *D. J. Goyder* 8349 (K!); Confluence of Cuanavale River with its 1st tributary c. 3.5 km S of source lake, c. 115 km SSE of Munhango, 13°7'28"S 18°53'58"E, 10 March 2016, *D. J. Goyder* 8451 (K!); **ZAMBIA.** S.l., s.d., *H. Lynes* 390 (BR*). **North-Western Prov.**: Mwinilunga Distr.: Mwinilunga aerodrome at edge of woodland and plain, [11°39'10.08"S 24°25'44.22"E], 30 Nov. 1937, *Milne-Redhead* 3447 (K!); Source of Isongela river, near Matonchi, [11°38'23.64"S 24°0'49.248"E], 18 Feb. 1975, *S. S. Hooper & C. C. Townsend* 172 (K!); Mwinilunga airstrip, [11°39'10.08"S 24°25'44.22"E], 16 May 1986, *D. Philcox, G. Pope, S. M. Chisumpa & E. N. Ngoma* 10313 (K!); Kambamba, on road E of Mwinilunga town, 11°45'32.04"S 24°45'43.992"E, 17 April 2010, *J. Timberlake, M. Bingham & A. Cunningham* 5841 (K!, P*); Chavuma Distr.: Angola-Rhodesia border, 1 km [1 mile] E of Shingi village 11.3 km [7 miles] N of Shingi village, Chavuma, [12°56'9.6"S 22°41'17.376"E], 14 Oct. 1952. *A. Angus* 632A (K!); Zambezi Distr.: 16 Oct. 1953, *W. Gilges* 207 (K!). **Southern Prov.:** Kalomo Distr.: Kalomo [17°01'21.1"S 26°30'13.3"E], 1947, *J. D Martin* JDM. 765 (NDO*); Sichifulo controlled hunting area, [16°44'34.8"S 26°9'59.616"E], 23 May 1962, *B. L. Mitchell* 14/80 (P*, BR*); About 6.5 km [4 miles] from Machili on fire tower/Malavwe road, [16°47'46.14"S 25°4'5.98"E], 15 Dec. 1962, *W. R. Bainbridge* 651 (P*, NDO*). **Western Prov.**: Mongu Distr.: 19.3 km [12 miles] NE of Mongu, [15°7'30.36"S 23°16'28.128"E], 10 Nov. 1959, *R. B. Drummond & A. J. Cookson* 6275 (K!); 88.5 km [55 miles] from Mongu on Mankoya road near turnoff to Ndanda dispensary, [15°3'40.32"S 23°57'54.252"E], 19 Nov. 1959, *R. B. Drummond & A. J. Cookson* 6613 (K!); Barotseland, Barotse plain, [15°40'0.12"S 23°10'0.012"E], 26 Nov. 1964, *W. C. Verboom* 1231 (K!); Looma, Nanganda, 15°6'S 23°41'E, 21 Dec. 1993, *M. G. Bingham* 9886 (K!, P*); Sesheke Distr.: Machili, [9°2'17.5992"S 31°48'22.1472"E], 6 Oct. 1960, *D. B. Fanshawe* F5824 (K!).

HABITAT & ECOLOGY. Grasslands and savannas, often on bare sand; 1060 – 1625 m a.s.l.

CONSERVATION STATUS. *Buchnera prorepens* has a relatively wide distribution but with few records, with a calculated AOO of 64 km^2 and EOO of 807,918 km^2. It is likely that some habitat has been lost due to conversion to agricultural land, but there still exist significant extents of intact suitable habitat within its large EOO. Further information on the population size and trend of this species, as well as its generation length, is yet needed to assess it under criterion A, C or D. Following the IUCN (2024) guidelines, therefore, *B. prorepens* should be provisionally considered Least Concern [LC], despite its AOO being less than 500 km^2,

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as this is a minimal estimate based on few herbarium specimens.

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Declarations

Conflicts of interest The authors declare no conflicts or competing interests.

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