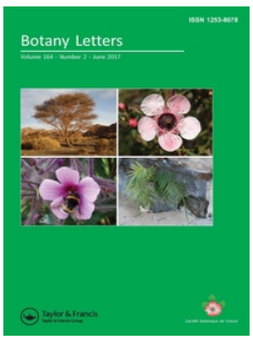

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Chorological and taxonomic notes on African plants, 2

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ABSTRACT

The taxonomy of complicated native African taxa, *Biscutella maritima* (Brassicaceae) and annual species of *Sesuvium* (Aizoaceae) is discussed. The distribution of *B. maritima* is widened to the most of the coastal areas of NE Algeria and N Tunisia. Morphological differences with regard to other North African members of *Biscutella* ser. *Biscutella* are reported to facilitate the identification of *B. maritima*. We propose to accept four annual *Sesuvium* species (instead of the one previously accepted species, *S. sesuvioides* sensu amplissimo) with different distributions in Africa: *S. digynum, S. hydaspicum, S. sesuvioides* s.str. and *S. nyasicum*. A delimitation key based on morphological and carpological characters is provided. Lectotypes of *S. digynum, S. digynum var. angustifolium, S. hydaspicum, S. nyasicum, Diplochonium sesuvioides (Sesuvium sesuvioides)* and *Trianthema polysperma* (synonym of *Sesuvium hydaspicum*) are selected. Other discussed taxa belong to the alien elements of the flora. *Atriplex semibaccata* (Amaranthaceae-Chenopodiaceae) is reported as a new species for Cape Verde. *Gaillardia* × *grandiflora* (Asteraceae) is discovered as a new species for Africa found in Morocco. *Prosopis velutina* (Fabaceae) is collected for the first time in Northern Africa (Morocco). *Mollugo verticillata* (Molluginaceae) is recorded as a new species for DR Congo. Its morphology, including seed ornamentation, is discussed in reference to other similar-looking Molluginaceae. Incidence of American species *Heterotheca subaxillaris* (Asteraceae) in North Africa is discussed. *Vernonanthura polyanthes* (Asteraceae) is recorded as a naturalized invasive species in eastern Zimbabwe. It seems to be the first documented discovery of this ergasiophyte in Africa.

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Africa; *Biscutella*; *Gaillardia*; *Heterotheca*; *Mollugo*; *Prosopis*; *Sesuvium*; *Vernonanthura*

Introduction

The article is the second contribution to the African vascular flora following the first article published recently (Sukhorukov et al. 2016). The major endeavour of this series is to provide new information about the systematics and chorology of native and alien species in Africa and to discuss taxonomically difficult or neglected taxa. In the present paper, we pay special attention to the disentangling of two native groups: *Biscutella maritima* (Brassicaceae) in North Africa and annual members of *Sesuvium* (Aizoaceae) over the entire continent. In addition, we report six alien taxa new to the flora of continental African countries and the Cape Verde archipelago.

Material and methods

The taxa under study are presented alphabetically within two sections, devoted to native and alien plants, respectively. Field investigations were carried out in Tunisia (*Biscutella*), Morocco (*Gaillardia*, *Heterotheca*, *Prosopis*), Cape Verde (*Atriplex*), Namibia (*Sesuvium*), and Zimbabwe (*Vernonanthura*). Along with this field work, comparative studies of herbarium material were undertaken in the following herbaria (acronyms when present are following Thiers (2016+)): ABH, BC, K, MA, P, herb. of the Faculty of Sciences of the Univ. of Bizerta (*Biscutella*); BM, H, K, LE, MW, MHA, WU (*Sesuvium*); BM, H, K, LE, MW, MHA (*Atriplex semibaccata*); and BM, BR, E, H, HUJ, K, LE, MW, MHA (*Mollugo verticillata*). Geographical areas follow Brummitt (2001).

The potential habitats of *Vernonanthura polyanthes* in Zimbabwe were identified by matching environmental covariates i.e., mean diurnal range (BIO2), isothermality (BIO3), temperature seasonality (BIO4), minimum temperature of coldest month (BIO6), precipitation of driest month (BIO14), precipitation of driest quarter (BIO17)

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(Hijmans et al. 2005) and aspect to species' presence data (Pearson et al. 2007) using the maximum-entropy method (MAXENT software, Version 3.3.3 K) (Phillips, Anderson, and Schapire 2006). Specifically, we used 75% of the species occurrence data for training the model while 25% of the data was set aside for testing the species distribution model. We then used the 10th percentile threshold to determine how well the species distribution model performed in estimating the suitable range of *V. polyanthes*. The species distribution model was significant ($p < 0.01$) and performed well with an Area Under Curve of more than 0.99.

Seeds sources from specimens of *Sesuvium* (Aizoaceae), *Mollugo* and related taxa from Molluginaceae were examined using a scanning electron microscope (JSM-6380, JEOL Ltd., Japan). The list of the specimens investigated is given below; for detailed studies on taxonomy and seed morphology of these and other species of *Mollugo* s.str. and related genera see Sukhorukov and Kushunina (2016a, 2017).

Glinus oppositifolius (L.) DC.: (1) SIERRA-LEONE, Kasanko, May 1951, *P. Adams 225* (K); 2) ANGOLA, Cuando-Cubango Province, March 1960, *E.J. Mendes 3155* (BM);

Hypertelis cerviana (L.) Thulin: NIGER, 19 March 1979, *J.E. Newdy 28165* (K);

Mollugo verticillata L.: (1) MALI, San, 29 June 1899, *A. Chevalier 1080* (BR0000017461016); (2) IVORY COAST, Port-Bouet, 3 March 1965, *Raynak 13568* (BR0000017461047);

Trigastrotheca pentaphylla (L.) Thulin: CAMEROON, Central Province, April 1976, *Westphal 9054* (BR0000017466109);

Pharnaceum exiguum Adamson: SOUTH AFRICA, Cape Province, 6 September 1952, *R.S. Adamson 4566* (BM);

Sesuvium digynum Welw.: (1) [ANGOLA] Mossamedes District [Namibe Province], 1859, *Dr. Welwitsch 2392* (K000076287); (2) ANGOLA, Mossamedes [Namibe Province], Iona, 23 September 1955, *E.J. Mendes 153* (BM);

Sesuvium hydaspicum (Edgew.) Gonç.: (1) [INDIA] Bombay [Mumbai], without date, *J.S. Law s.n.* (K000768354); (2) [SUDAN] Kordofan, Abu-Gerad, 25 September 1839, *Kotschy s.n.* (K000076285); (3) SUDAN, Khartoum, 22 November 1868, *Schweinfurth 836* (K); (4) SUDAN, Khartoum, 10 September 1962, *Pollet 34* (K);

Sesuvium nyasicum (Baker) Gonç.: (1) [MALAWI] Nyassa [Lake Malawi], Monkey Bay, August 1896, *A. Whyte s.n.* (K000076291); (2) South ANGOLA, 30 April 1909, *H·H.W. Pearson 2857* (K); (3) ZIMBABWE, [Mashonaland West province], Urungwe, 3 February 1958, *R. Drummond 6150* (K); (4) BOTSWANA, [Central district], 13 May 2004, *B. Farnington et al. 108* (K); (5) BOTSWANA, delta of Okawango river, 13 January 2010, *A. Heath and R. Heath 1865* (K);

Sesuvium sesuvioides (Fenzl) Verd.: (1) ANGOLA, Moçâmedes [Namibe], September 1859, *Welwitsch 2388* (BM) sub *S. brachyanthum* (nomen); (2) ANGOLA, Moçâmedes [Namibe], Praia Armelia, 28 December 1955, *E.J. Mendes 1172* (BM).

Results and discussion

Taxonomic notes on native taxa

Biscutella maritima Ten. (Brassicaceae) in North Africa

Contributors – Alicia Vicente, M. Ángeles Alonso, Ridha El Mokni, Mohamed H. El Aouni, Manuel B. Crespo

Biscutella maritima was described by Tenore (1811) from plants collected in Capri, near Naples (Italy), which showed lyrate leaves and appeared to be intermediate between *B. lyrata* L. and *B. raphanifolia* Poir. However, the name *B. maritima* was soon forgotten, and the two latter names continued to be cited for Italian specimens instead of *B. maritima* (cf. Guinea and Heywood 1964; Malinowski 1911; Pignatti 1982).

Monographic works carried out by Raffaelli (1990, 1991) on *B.* ser. *Biscutella* (≡ *B.* ser. *Lyratae* Malin.) revived the taxon *B. maritima* and solved the historical confusion, disregarding the presence of both *B. lyrata* or *B. raphanifolia* in Italy (including Sicily).

The typification of *B. lyrata*, a species originally described from Spain and Italy by Linnaeus (1771), was carried out by Raffaelli (1985a), who clarified the identity of this plant and restricted it to southern Spain, consequently dismissing it from the Italian flora. Our morphological and molecular results (Vicente, Alonso, and Crespo 2016) confirm the absence of *B. lyrata* in all North African floras. Although both species share an annual habit and lyrate leaves, mostly arranged in a rosette, the main diagnostic characters of *B. lyrata* are the broadly winged staminal filaments and the small (2–3 × 4–6 mm) silicles, neither of which are present in *B. maritima*.

Biscutella raphanifolia occurs in Algeria and Tunisia, and is characterized by lyrate leaves, profusely branched inflorescences, and median, often elongated nectaries (up to 0.4 mm long). Recent morphological and molecular studies (Vicente, Alonso, and Crespo 2016) supported the close relationship of *B. raphanifolia* to *B. algeriensis*, and therefore two varieties have been recognized, *B. raphanifolia* var. *raphanifolia* and *B. raphanifolia* var. *algeriensis* (Jord.) A.Vicente, M. A. Alonso & M. B. Crespo, which are linked by many morphologically transitional forms.

Raffaelli (1990) considered *B. maritima* to be the only lyrate-leaved species growing in Italy, to which he synonymized names such as *B. laxiflora* Presl ex Spreng., *B. erucifolia* Rchb., *B. lyrata* subsp. *maritima* (Ten.) Raffaelli and *B. lyrata* subsp. *laxiflora* (C.Presl) Raffaelli. In so doing he corrected some of his previous treatments for

those taxa (Raffaelli 1985b). After Raffaelli's revision, Guinea and Heywood (1993) and subsequent authors have accepted *B. maritima* as being present in Italy.

Biscutella maritima is an annual species with lyrate leaves and simple or short-paniculate inflorescences (Raffaelli 1990; Tenore 1811). Surprisingly, neither Tenore nor Raffaelli mentioned anything about the most useful diagnostic character for *B. maritima*: this species has very elongate medial nectaries, ranging from 0.5 to 0.8 mm long. This character, together with those diagnostic features described by Raffaelli, allows easy differentiation of *B. maritima* from both varieties of *B. raphanifolia*. Cosson (1887) is apparently the only author who referred to the length of the nectaries, which he considered to be variable among specimens of taxa in *B.* ser. *Biscutella*. However, his synthetic treatment of the North African taxa, based mostly on leaf morphology, resulted in broad taxonomic aggregates, and no diagnostic significance was attributed to nectary length.

Battandier (in Battandier and Trabut 1888) cited *B. maritima* among the six varieties included in *B. didyma* subsp. *lyrata* (L.) Nyman for the Algerian flora, this classification being mainly based on highly variable characters of silicles, such as the silicle size and type, as well as length and distribution of the indumentum. Moreover, in the light of the localities cited and according to the corresponding vouchers (e.g., P05438229!) it can be assumed that Battandier (in Battandier and Trabut 1888) was actually referring to specimens of *B. raphanifolia* var. *algeriensis*. In fact, Battandier and Trabut (1905) later cited *B. lyrata* and *B. raphanifolia* as the only representatives of *B.* ser. *Biscutella* in Algeria and Tunisia, though they assumed a high degree of morphological variability in the former. Similarly, Quézel and Santa (1962) referred to *B. didyma* (incl. *B. lyrata*, *B. apula* L., and *B. ciliata* DC.) and *B. raphanifolia* in the treatment they adopted for the Algerian flora.

From Quézel and Santa (1962) onwards, a similar treatment has been followed in many other works (Lindbert 1932; Maire 1967; Pottier-Alapetite 1979) and this misunderstanding regarding the lyrate-leaved annual plants in Tunisia has remained until today. In the most recent Tunisian flora, Pottier-Alapetite (1979) identified all the lyrate-leaved annual plants as *B. didyma* subsp. *lyrata*, a taxon with which she synonymized very different entities such as *B. algeriensis* or *B. maritima*. In the light of the foregoing, it is obvious that the real identity and circumscription of *B. maritima* has been traditionally misunderstood. For instance, in the most recent checklist of the Tunisian flora (Le Floc'h, Boulos, and Vela 2010), the arrangement was not different. All lyrate-leaved annual plants were included in *B. didyma* subsp. *lyrata* (L.) Nyman, which included *B. algeriensis* and *B. maritima* as synonyms.

Recent research on *B. raphanifolia* and *B. algeriensis* (Vicente, Alonso, and Crespo 2016) has clarified the taxonomic and phylogenetic relationships of both taxa and pointed out the presence of *B. maritima* in Tunisia. Previously, only Raffaelli and Ricceri (1989) had cited *B. maritima* s.str. in northeastern Tunisia (coastal areas between Cap Blanc, near Bizerte, and Kelibia), as *B. lyrata* subsp. *maritima* (L.) Raffaelli and *B. lyrata* subsp. *laxiflora* (C. Presl) Raffaelli.

In conclusion, according to our data (Vicente, Alonso, and Crespo 2016), only two species with lyrate leaves occur in Algeria and Tunisia: *B. maritima* and *B. raphanifolia* (with its two varieties, var. *raphanifolia* and var. *algeriensis*). This is in accord with previous data of Raffaelli and Ricceri (1989). These species clearly differ by both the inflorescence type (i.e., profusely paniculate in *B. raphanifolia* vs. simple racemose or shortly paniculate in *B. maritima*) and the length of the median nectaries (0.5–0.8 mm in *B. maritima* vs. up to 0.4 mm in *B. raphanifolia* s.l.). All previous claims on the presence of *B. lyrata* in North Africa, a species endemic to southern Spain, are to be disregarded and referred to either *B. maritima* or *B. raphanifolia*.

After the revision of living populations and vouchers housed in the herbaria ABH, BC, MA, K, P and herbarium of the Bizerta University, the distribution of *B. maritima* in North Africa is mapped and widened to most of the coastal areas of northeastern Algeria and northern Tunisia (Figure 1). It is important to note that the position of the localities in the map is approximate, because for most of them no coordinates or exact locations are found on the vouchers.

Biscutella maritima grows in humid and anthropogenically disturbed grasslands, roadsides, and open forests, at low elevations between 0 and 900 m a.s.l.

Examined specimens

ALGERIA: Constantine Ravine, grassy crevices of rocky slopes in the ravine, 4 May 1840, *M. Durieu* (P05438181!); Constantine Ravine, grassy slopes in rocky areas, 4 May 1840, *M. Durieu* (P05438258!); Road from Stora to Philippeville, and Constantine, slopes of Mansourah, 15 May 1853, *S. Choulette* (P05438288!, P05438293!, P05438858!); Bône, grasslands and waste places, 25 March 1867, *Tribout* (P04631527!, P04631793!, P04632007!, P05326058!, P05326059!); Constantine, Mansourah, in cultivated ground and grasslands, 8 May 1871, *E.G.Paris* (P05438277!); Constantine, March–April 1873, *V. Revoud* (P05438252!); S of Mahouna, 1882, *V. Reboud* (P05438193!); Bou Meçran forest in Oulad Dhia, 29–30 March 1884, *M. Letourneux* (P05438300!); Berrouaghia, May 1885, *J. A. Battandier* (P05438234!); Bône, in Bou Hamra, etc., March 1886, *Duroux* (P04719050!); St. Anne Hills, near Bône, 12 April 1890, *Huitfroy* (P05438177!); Constantine, Mansourah, in grasslands, May 1890, *Garrigues* (P05438185!); Ibidem, May 1890, *Garrigues* (P05438830!); Algiers, field of manoeuvres, May 1893, *Courzeille* (P04745868!); Bône Province, *M. Bernard* (P05438239!); Médea, *J.A. Battandier* (P05438223!).

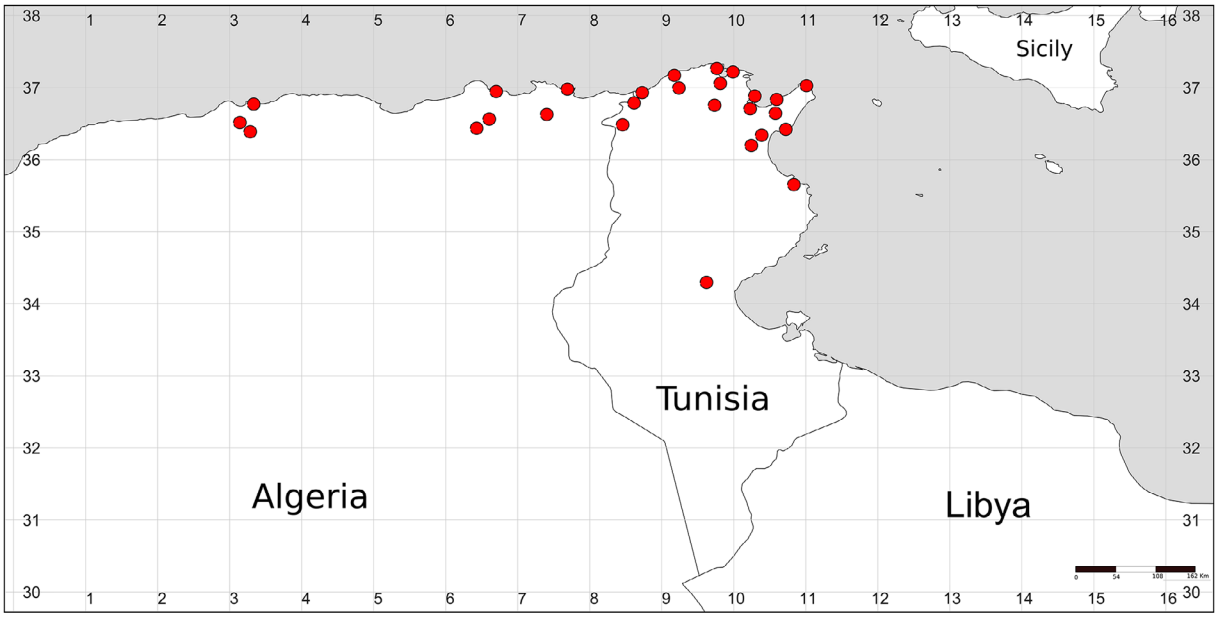

Figure 1. Distribution of *Biscutella maritima* in North Africa.

TUNISIA: Surroundings of Tunis, road to Carthage, 3 April 1864, *A. Lagrange* (P05438816!); Aïn Draham, 5 May 1881, *D. Robert* (P05438755!); Medjezel-Bab, 1881, *A. Reur* (P05438171!); Bord Toum, 28 November 1881, *M. Rouy* (P05438271!); Skhira, SE of Cap Serrat, 1881, *A. Reux* (P05438859! specimen on the right); Fort Sidi Hassan, Tunis, 5 May 1883, *M.M.E. Cosson et al.* (P05438758! middle specimen); Tebourba near Tunis, 6 May 1883, *M.M.E. Cosson et al.* (P05438758! specimen on the left); Cap-Bon, 17 May 1883 (P05438795!); Djebel Cheban, 20 May 1883, *M.M.E. Cosson et al.* (P05438843! specimen on the left); E of Menzelbou-Zelfa, 23 May 1883, *M.M.E. Cosson et al.* (P05438792!); Oued Zarga, 31 March 1884, *Doûmet-Adanson and E. Bonnet* (P05438269!, P05438812! specimen below on the left); Ghardimaou, 31 March 1884, *A. Letourneux* (P05438270!, P05438758! specimen on the right); Porto Farina, 5–6 April 1884, *A. Letourneux* (P05438843! specimen on the right); Ouechteta, valley of Oued El Hammam, 14 March 1887, *A. Letourneux* (P05438274!); Le Battant, 12 April 1888, *G. Barratte* (P05438818!, specimen on the left); Bordj Toum, 12 April 1888, *G. Barratte* (P05438173!); Sidi Chuega, 13 April 1888, *G. Barratte* (P05438811!, specimen on the right); Cap Zebib, 10 May 1888, *G. Barratte* (P05438174!, specimen on the left); Between La Marsa-Sidi Boussaid, 1888, *G. Barrate* (P05438817!); Bizerte, 1 June 1888, *M.M.E. Cosson, G. Barratte and Cl. Duval* (P05438756!); Tunis, road to Carthage, 20 April 1894, *L. Chevallier* (P04719051!); Tunis, March 1894, *Leclerc* (K!); Djebel Djeloud, in cultivated ground, April 1907, *C.J. Pitard* (MA44488!); Gafsa, sandy soils, April 1907, *C.J. Pitard* (BC05073!); Gafsa, in dry places, April 1908, *C.J. Pitard* (BC05055!); Korbous, in grasslands, March 1909, *C.J. Pitard* (MA44493!); Guengla, near Ferryville, waste places, 16 April 1932, *L. Faurel* (P04745936!, P04745940!); Tindja, near Ischkeul Lake, open grounds, 15 May 1932, *L. Faurel* (P04745944!); Surroundings of Tunis, April 1932, *M. Gougerot* (P05326065!); Aïn Draham, in cork oak forest, 850 m, 20 April 1938, *N. Douglas Simpson 38365* (K!); Maquis shrubland in Djebel Azouaz, near Nador de Bizerte, 17 March 1940, *R. Maire* (P04745945!); Bizerte, cultivated ground W from the Caroubier Hospital, 2 March 1957, *J. Raynal 1644* (P05438273!, P05438275!); Rouhia, 30 km from Rouhia to Maktar, 4 May 2002, *J.J. Aldasoro, O. Fiz, and V. Valcárcel* (MA724301!); Province Nabeul, near Oued Zid, 36° 31' 34" N, 10° 19' 04" E, 147 m, 2 April 2006, *R. Gonzalo and E. Sauquillo 388 K* (MA746967!); Province Nabeul, Takelsa, peninsula of Cap-Bon, 36° 46′ 35.7" N, 10° 35' 19.3" E, 81 m, 31 March 2009, *A. Quintanar et al. AQ3253* (MA797732!); Tabarka, 36° 57' 02" N 08° 48' 08" E, 10–20 m, 4 January 2015, *R. El Mokni* (Herb. Fac. Sci. Bizerta).

Annual members of *Sesuvium* (Aizoaceae) in Africa

Contributors – Alexander P. Sukhorukov, Irina V. Belyaeva, Alex Dreyer, Maria Kushunina

Among the Aizoaceae, *Sesuvium* is one of the most difficult genera with species demarcation far from resolved (Hernández-Ledesma et al. 2015). The genus comprises perennial and annual herbs with glabrous or papillate stems and (sub)opposite, sessile or short-petiolate leaves, axillary pink or mauve flowers with five perianth lobes, five to numerous stamens and circumscissile capsule containing several or numerous black seeds completely or partially (in perennial species) covered with a translucent or whitish one-layered aril, and with a crustaceous seed coat. Dry stems and leaves have stout, probably salt-accumulating warts (or salt crystals) on their surface, which are not visible in living

plants. The difference between perennial and annual species (besides life history) is considered to be in the sessile or stalked flowers. We found that the presence of prominent red glands at the tip of perianth segments is an additional diagnostic morphological character for the native African annual species. The type of photosynthetic carbon fixation is also different (C_3 in perennial and C_4 in annual representatives: Bohley et al. 2015).

Concerning the infrageneric taxonomy of annual African *Sesuvium*, two different points of view exist. The first opinion is that the annual members of *Sesuvium* in Africa and Asia comprise one widespread, morphologically variable *S. sesuvioides* (Fenzl) Verd. (e.g., Bohley et al. 2015; Hartmann 2002; Jeffrey 1961; Nazir 1973). Other authors accept three species differing mostly in seed characters: *S. hydaspicum* (Edgew.) Gonç., *S. nyasicum* (Baker) Gonç., and *S. sesuvioides* s.str. (Fenzl) Verd. (Craven 1999; Gonçalves 1978; Hargreaves 1995; Lebrun and Stork 2003). At the same time, molecular analysis (Bohley et al. 2015; Hassan, Thiede, and Liede-Schumann 2005b) clearly shows that *Sesuvium sesuvioides* in the broader sense is polyphyletic, and the placement of all African taxa into *S. sesuvioides* (Bohley et al. 2015) thus contradicts the molecular evidence.

Here we provide the first attempt to classify all annual African *Sesuvium* entities using five main characters, which can be observed in both flowering and fruiting stages: (1) presence of short semi-spherical papillae on the stem (visible under magnification); (2) leaf curvature (leaves flat or strongly conduplicate); (3) perianth length; (4) number of stamens; and (5) seed coat ornamentation. The papillate stem was mentioned, e.g., for *Sesuvium hydaspicum* (Oliver 1871; sub *Trianthema polyspermum* Hochst. ex Oliv.), but has never been used to distinguish among the annual *Sesuvium* species. Seed coat ornamentation appears to be the most reliable diagnostic character (Figure 2). The number of differences may be greater in living plants, but this requires extensive observations in nature.

Four annual African *Sesuvium* species are accepted in the present paper. However, some specimens from Cape Verde, Kenya and South Africa cannot be assigned to any of these species and need further investigation. Additionally, the generic status of annual *Trianthema salarium* Bremek., described from South Africa, is still unresolved, although the papillate stems and rugose seed ornamentation (Bremekamp 1933) suggest that it may well belong to *Sesuvium*. The geographical distribution of the taxa presented here is still fragmentary, because all fleshy Aizoaceae are difficult to dry and for this reason are generally under-collected.

Key to identification of the annual Sesuvium *species in Africa*

1. Stems and often leaves covered with small papillae (visible under higher magnification) and stout warts; leaves flat or slightly folded abaxially; stamens several to numerous; seeds with prominent wrinkles 2

1*. Stems without papillae (but usually with stout warts); at least medium and upper leaves conduplicate (strongly curved on abaxial side); stamens numerous with filaments concrescent in the lower part; seeds smooth. .....*S. sesuvioides*

2. Leaves lanceolate to ovate; perianth 8.5–11 mm long; stamens numerous (20–40); anthers ca. 0.8 mm long; seeds with indistinct or slightly raised wrinkles..... *S. digynum*

2*. Leaves oblong or ovate; perianth 6.0–8(8.5) mm long; stamens up to 25; anthers ca. 0.5 mm; seeds with wrinkles clearly raised.....3

3. Stamens 5–7; seed wrinkles all protrude up to 40 µm.....*S. hydaspicum*

3*. Stamens 10–25; seed wrinkles with major ones acute, often with whitish margins protruding up to 200 µm..... .....*S. nyasicum*

1. *Sesuvium digynum* Welw. in Oliver, Fl. Trop. Afr. 2: 586 (1871)

Lectotype (Sukhorukov, designated here): [ANGOLA], district Mossamedes [Namibe Province], freq.[uent] in dumetosis arenosis maritimis juxta ripas latera inter flum. Cotumbella et sivulum Cavaco pr. Benguela [frequent in disturbed sandy beachs near the river Cotumbella and Cavaco town close to Benguela], June 1859, *Dr. Welwitsch 2393* (BM001209558!).

≡*Sesuvium digynum* var. *angustifolium* Schinz, Bull. Herb. Boiss. 5 (Appendix 3): 74 (1897).

Lectotype (Sukhorukov, designated here): Reise der k.k. [kaiserlich-königlichen] Corvette Carolina, [ANGOLA], [Benguela Province] Benguela, inter frutices [between bush vegetation], 1857–[185]8, *Dr. Wawra 291* (LE!) upper right specimen.

≡*Sesuvium sesuvioides* (Fenzl) Kuntze var. *angustifolium* (Schinz) Gonç., Garcia de Orta: 13: 381 (1965);

≡*Halimus sesuvioides* (Fenzl) Kuntze var. *angustifolium* (Schinz) Hiern, Cat. Afr. Pl. 1(2): 414 (1898);

≡*Halimus sesuvioides* (Fenzl) Kuntze var. *welwitschii* Hiern, Cat. Afr. Pl. 1(2): 414 (1898).

Sesuvium digynum is reinstated here for the first time at the rank of species, although some explanations are needed to show the heterogeneity of the original sheets in K and BM. One of the specimens (K000076289) is labelled as '*Sesuvium digynum* var.?', but in fact belongs to *S. nyasicum* due to the clearly wrinkled seeds. The sheets with Welwitsch's collection numbers *2392* and *2394* originating from Mossamedes (now Namibe, Angola) are stored in both herbaria K (K000076287 and K000076288, respectively) and BM (without barcodes). They are of plants with glabrous stems (but with stout warts) and were used for the description of *Halimus sesuvioides* (Fenzl) Kuntze var. *welwitschii* (Hiern

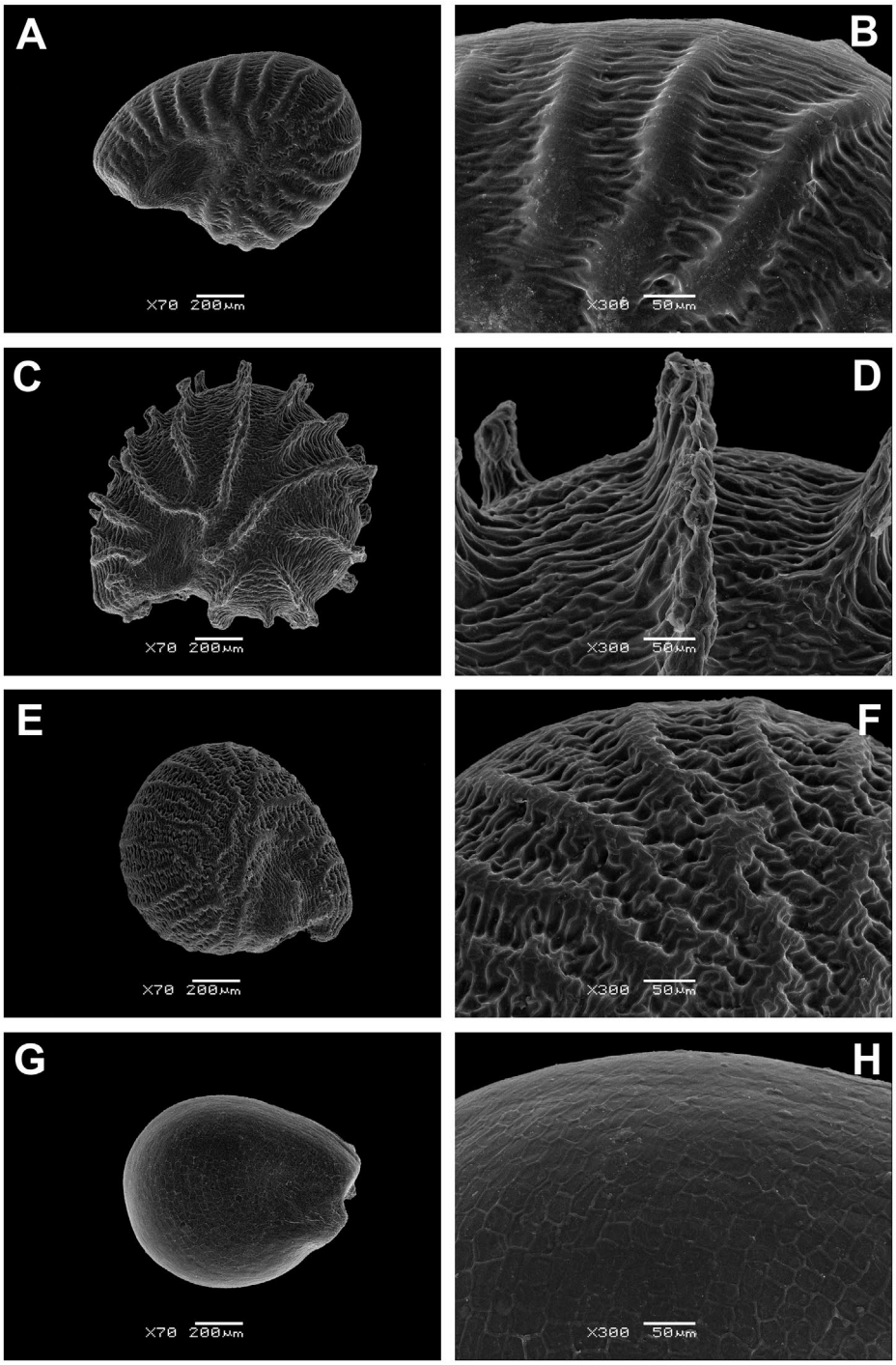

Figure 2. Seeds of *Sesuvium digynum* (A, B), *S. nyasicum* (C, D), *S. hydaspicum* (E, F), and *S. sesuvioides* (G, H). A, C, E, G: plan view of the seed (70×); B, D, F, H: ornamentation of the seed coat (300×). Origin of the material: *Sesuvium digynum*: Angola, Mossamedes [Namibe province], Iona, 23 September 1955, *E.J. Mendes 153* (BM); *S. nyasicum*: South Angola, 30 April 1909, *H·H.W. Pearson 2857* (K); *S. hydaspicum*: Sudan, Khartoum, 22 November 1868, *Schweinfurth 836* (K); *S. sesuvioides*: Angola, Moçâmedes [Namibe], September 1859, *Welwitsch 2388* (BM).

1898), but were not annotated by Hiern in the herbaria. Another sheet at BM (collection number *2393*) from Benguela (Angola) contains plant parts densely covered with papillae. Such variability of stem pubescence was mentioned in the protologue (Welwitsch in Oliver 1871). All Welwitsch's specimens kept at K and BM and labelled as *S. digynum* (except the sheet K000076289, which is *S. nyasicum*) have the largest perianth (8.5–11 mm) among all accepted annual species in the genus. Both localities (Benguela and Mossamedes) were mentioned in the protologue of *Sesuvium digynum* (Welwitsch in Oliver 1871), and we designate here as lectotype a specimen with papillate stems and leaves originating from Benguela.

Sesuvium digynum is often confused with *S. sesuvioides* s.str., which is also present in Angola and Namibia; however, the former is distinguished by flat leaves (except the uppermost leaves that may be folded), a larger

perianth and indistinctly wrinkled, glossy seeds. The differences in the seed surface between *S. sesuvioides* and *S. digynum* were first noted by Hiern (1898, sub *Halimus sesuvioides* and *Halimus sesuvioides* var. *angustifolium*, respectively), who recognized the presence of rugose seeds in *S. digynum* in contrast to *S. sesuvioides* s.str. (sub *Halimus sesuvioides* (Fenzl) Kuntze var. *sesuvioides*).

Sesuvium sesuvioides var. *angustifolium* (Schinz) Gonç. (or *Sesuvium digynum* var. *angustifolium* Schinz), a narrow-leaved variety, is synonymized here with *Sesuvium digynum*. The leaf shape is not a reliable character, since both the specimens of *S. sesuvioides* var. *angustifolium* and *S. digynum* often have narrow leaves on the uppermost branches. No other differences were mentioned by Schinz (1897), who validly described *S. digynum* var. *angustifolium* based on the opinion of Welwitsch in Oliver (1871), who noted the presence of narrow-leaved individuals. The lectotypes of both *S. digynum* and *S. digynum* var. *angustifolium* designated in the present article have densely papillate branches.

Sesuvium digynum was previously reported for Angola and Cape Verde (Gonçalves 1965; sub *Sesuvium sesuvioides* var. *angustifolium*), but the specimens from Cape Verde are different from the Angolan ones in having a shorter perianth and distinctly verrucose (not wrinkled) seeds. Their taxonomic status apparently needs further investigation. In our opinion, *S. digynum* is confined to Angola and Namibia (Figure 5). It has sometimes been omitted in floristic accounts (e.g. Craven 1999) or cited as *S. sesuvioides* var. *angustifolium* with no further taxonomic comments (e.g. Klaassen and Kwembeya 2013). In the herbaria visited, *S. digynum* was determined in the past as *S. sesuvioides* or as a hybrid *S. nyasicum* × *S. hydaspicum*.

Examined specimens

ANGOLA: Benguela [Benguela Province], 1857–[185]8, *Dr. Wawra 291* (LE!); district Mossamedes [Namibe Province], 1859, *Dr. Welwitsch 2392* (K000076287!) and *2394* (BM!, K!); [Huila Province], Humpata, September 1883, *H·H. Johnston s.n.* (K!); Mossamedes [Namibe Province], 27 April 1909, *H·H.W. Pearson 2889* (K!); [Benguela Province], Lobito, 1937, *H. Humbert 16100* (BM!); [Benguela Province], SE of Benguela, Rio Kaporolo, 1937, *H. Humbert 16164* (BM!); [Namibe Province], 50–60 km from Mossamedes [Namibe], 20 May 1937, *A.W. Exell and F.A. Mendonça 2141* (BM!); [Benguela Province], Cubal, 3200 ft., 30 November 1937, *P. Pittard 68* (BM!); Mossamedes [Namibe Province], Iona, 23 September 1955, *E.J. Mendes 153* (BM!); [Namibe Province], Dibala, 8 May 1963, *A. de Menezes 409* (K!); [Benguela Province], 20 km W of Benguela, Baia Azul, 1 April 1973, *P. Bamps and S. Martins 4372* (K!);

NAMIBIA: [Otjozonjupa Region], Okahanja, 1300 m, November 1907, *Dinter 302* (BM!, WU!); [Karas Region], Ariamsvlei, 17 May 1955, *B. de Winter 3577* (K!); [Erongo Region], Uis, 16 May 1976, *Oliver et al. 6699* (K!); Erongo Region, Brandberg, 18 May 2002, *H. Kolberg et al. 1228* (K!).

Figure 3. Reproductive shoot of *Sesuvium nyasicum*. Photographer – Helen Pickering.

2. *Sesuvium nyasicum* (Baker) Gonç., Garcia de Orta 13: 381 (1965). – Figure 3.

Bas.: *Trianthema nyasicum* Baker, Bull. Misc. Inf. Kew 128–129: 268 (1897).

Lectotype (Sukhorukov, designated here): [MALAWI] Nyassa [Lake Malawi], Monkey Bay, 1600 [ft.], August 1896, *A. Whyte s.n.* (K000076291!).

"*Sesuvium digynum* var.?" Welw. in herb. K (K000076289!).

Baker (1897) described *Trianthema nyasicum* as a glabrous perennial plant; however, the species in fact imitates perennials, and the branches are distinctly short-papillate. Although Baker's herbarium is incorporated in K, the lectotype is chosen following the suggestion of McNeill (2014), since no date, collection number and herbarium is indicated in the protologue of *Trianthema nyasicum* (Baker 1897).

Gonçalves (1970, 1978) reported the following distribution for *S. nyasicum*: Angola, Malawi, Mozambique, Tanzania, Zambia, and Zimbabwe. Subsequently it was reported from Namibia (Klaassen and Kwembeya 2013). We add here new records of *S. nyasicum* for Botswana (Figure 5). No collections from Mozambique, Tanzania and Zambia were seen in the herbaria visited, although the presence of the species in these countries is expected.

Examined specimens

ANGOLA: District Mossamedes [Namibe Province], 1859, *Welwitsch 2391* (K000076289!, as *Sesuvium digynum* var.); "South Angola", 30 April 1909, *H·H.W. Pearson 2857* (K!); Mossamedes [Namibe Province], 18 May 1937, *A.W. Exell and F.A. Mendonça 2094* (BM!);

BOTSWANA (new records): [Central District], Makgadikgadi, 9 March 1965, *H. Wild and R.B. Drummond 6821* (K!); [North-West District], Ngamiland, Odlakwe, 10 March 1961, *H.M. Richards 14642* (K!); [North-West District], Nokaneng, 11 March

1965, *H. Wild and R.B. Drummond 6865* (K!); [North-West District], delta of Okawango river, 19° 18.935" S, 22° 55.513" E, 13 January 2010, *A. Heath and R. Heath 1865* (K!); Central District, 20° 33' 8.94" S, 26° 4' 28.2" E, 13 May 2004, *B. Farnington et al. 108* (K!);

MALAWI: Nyassa [Lake Malawi], Monkey Bay, August 1896, *A. Whyte s.n.* (K000076291!, lectotype);

NAMIBIA: [Oshikoto Region], Ondangua, January 1896, *M. Rautanen 390* (H1332371!); [Oshikoto Region], Amboland, Ondongab, 1894, *Rautanen 560* (K); [Osgana Region], Ondangwa, 1936, *K. Hirn s.n.* (H1212151!); [Otjozondjupa Region], Grootfontein, 29 March 1955, *B. de Winter 2986* (K!); N Amboland, Ukualuthi, 20 May 1965, *S. Soini 30* (H1036323!); [Oshikoto Region], Ondangua, Oniipa, 22 February 1967, *S. Soini s.n.* (H1056325!); [Ohangwena Region, Helao Nafidi], Kwanyama, 4 April 1973, *R.J. Rodin 9208* (K!);

ZAMBIA: the only record so far is based on the photo kindly provided by Helen Pickering and taken in the Southern Province (17° 15' 19.73" S, 25° 51' 19" E).

ZIMBABWE: [Mashonaland West Province], Urungwe, 3 February 1958, *R. Drummond 6150* (K!); [Masvingo Province], Chiredzi District, Chitanga hill, 24 January 1971, *P.E. Taylor 72* (K!); [Matabeleland South Province], Insiza District, Filabusi, 8 February 1974, *S. Mavi 1527* (K!).

3. *Sesuvium hydaspicum* (Edgew.) Gonç., Garcia de Orta 13: 381 (1965).

Bas.: *Trianthema hydaspicum* Edgew., J. Proc. Linn. Soc. (Botany) 6: 203 (1862).

Lectotype (Sukhorukov, designated here): [PAKISTAN, Punjab], Multan, [without date], *Edgeworth 3019* (K000768355!).

The lectotype is selected in accordance with the protologue (Edgeworth 1862) where the location "basin of the Indus [river]" is mentioned.

≡*Trianthema polyspermum* Hochst. ex Oliv., Fl. Trop. Afr. 2: 588 (1871).

Lectotype (Sukhorukov, designated here): [SUDAN] Kordofan [Kurdufan], [Jebel] Abu-Gerad, 25 September 1839, *Kotschy s.n.* (K000076285!).

Edgeworth (1862) has provided a very detailed diagnosis of *Trianthema hydaspicum* Edgew. (≡*Sesuvium hydaspicum*) and compared it with *Sesuvium sesuvioides* (sub '*Diplochonium uvarioide*'; the epithet is an obvious typographic error). He considered these taxa as closely related, with the differences in the number of stamens (5–7 in *S. hydaspicum* and numerous in *S. sesuvioides*). No specimens were cited in the protologue, and we choose a lectotype from two authentic specimens in K.

We cannot agree with Gonçalves (1978), who reported *S. hydaspicum* from Angola, Botswana, Namibia, Zambia and Zimbabwe. In fact, the range of *S. hydaspicum* extends from India and Pakistan through the southern part of the Arabian Peninsula to West Tropical Africa (Nazir 1973; sub *Sesuvium sesuvioides*; Berhaut 1975; Kordofani, Gibreel, and Darbyshire 2015), and the specimens from southern Africa belong to other species, mainly *S. nyasicum* and *S. digynum*. Additionally, some specimens from Angola and Namibia labelled as *S. hydaspicum* are morphologically close to this species, but differ in having numerous stamens and smaller seeds. They need further investigation.

Sesuvium hydaspicum is the only annual species occuring in the arid parts of West, Northeast and East Tropical Africa (Figure 5). All reports of the presence of *S. sesuvioides* (Bohley et al. 2015; Boulos 1995; Gonçalves 1995a; Hartmann 2002; Hassan, Thiede, and Liede-Schumann 2005a; Jeffrey 1961; Merxmüller 1970; Verdcourt 1957) and *Trianthema polyspermum* (Keay 1954) in these regions as well as in Asia refer to *S. hydaspicum*. It also seems to be present in Senegal (Berhaut 1975).

Examined specimens

KENYA: [Kajiado County], Ewaso Ng'iro, June 1959, *Tweedie 1842* (K!); [Garissa County], Garissa city, 11 December 1960, *A.J. Wood 12135* (K!); Garissa [County], 10 May 1974, *J.B. Gillett and F.N. Gachathi 20563* (K!); [Isiolo County], Mado Gashi, 8 December 1977, *B. Stannard and M.G. Gilbert 848* (K!); [Turkana County], Turkana Lake, 2° 35' N, 36° 43' E, 20 August 1981, *M.G. Gilbert 6346* (K!);

MALI: [Tombouctou Region], Timbuktu, 10 August 1927, *O. Hagerup 255* (K!);

MAURITANIA: [Hodh Ech Chargui Region], Dhar Nema, 15 August 1961, *G. Popov 61–15* (BM!);

NIGER: [Agadez Region], Afasto, 4 October 1965, *G. Popov 104* (BM!);

SOMALIA: [Awdal Region], Lughaya, 5 January 1962, *C.F. Hemming 2364* (K!); [Awdal Region], Tokshi to Zeila, 26 January 1973, *P.R.O. Bally and R. Melville 16137* (K!);

SUDAN: [Al Qadarif state], Kordofan, [Jebel] Abu-Gerad, 25 September 1839, *Kotschy s.n.* (K000076285!, lectotype of *Trianthema polysperma*); Khartoum, 22 November 1868, *Schweinfurth 836* (K!); Jebel Aulia Dam [near Khartum], 17 December 1938, *A.C. Hoyle 317* (BM!); [Red Sea state], Port Sudan, 17 January 1957, *Popov 546* (K!); 12 km S of Khartoum, 23 August 1961, *J.K. Jackson 4306* (K!); Khartoum, 10 September 1962, *Pollet 34* (K!).

4. *Sesuvium sesuvioides* (Fenzl) Verdc., Kew Bull. 12(2): 349 (1957). – Figure 4.

Diplochonium sesuvioides Fenzl in Endl., Nov. Stirp. Dec.: 58 (1839).

Lectotype (Sukhorukov, designated here): [S Africa, in rupestribus ad Gaprium fluvium lateris coloniae occidentalis, alt. 500 ft., without date] [on the rocks near

Figure 4. Reproductive shoot of *Sesuvium sesuvioides*. Photographer – Barbara Schneider.

Garpia river close to the west of the colony] *Drège 2938* (K000076286!; iso – LE!);

≡*Halimum sesuvioides* (Fenzl) Kuntze, Revis. Gen. Pl. 1: 263 (1891).

The original sheets from Drège's collections from South Africa ("C. b. spei." [Caput Bonae Spei, or Cape of Good Hope] No. *2938*) kept at K and LE were identified by Ecklon as *Aizoon papulosum* (Ecklon and Zeyher 1837). This is not part of the original material seen by Ecklon and Zeyher prior to the description of *A. papulosum*, because the protologue contains a precise location of the new species ("In collibus Carro similibus ad Gauritzrivier … Swellendam" [in the Karroo hills near Gauritzrivier, Swellendam, South Africa]). According to the very clear description of *A. papulosum* (Ecklon and Zeyher 1837), the plant is a subshrub with the stem densely covered with papillae ("papulis pellucidis dense obsitum caule … suffruticoso …"), whereas the plant fragments on Drège's sheet (No. *2938*) are glabrous (but with stout warts imitating the soft papillae). *Aizoon papulosum* is a basionym for the accepted species *Galenia papulosa* (Eckl. & Zeyh.) Sond. (Harvey and Sonder 1862).

Probably the presence of warts on the upper parts of plants was the reason why Ecklon identified Drège's specimens (No. *2938*) as *A. papulosum*. Fenzl (Endlicher 1839) has revised these specimens, and some of them (erroneously labelled by Ecklon as *A. papulosum*) were used for the description of a new genus *Diplochonium* with one species *D. sesuvioides* Fenzl (Fenzl in Endlicher 1839). The diagnosis is very detailed and includes the most important diagnostic characters of the species (glabrous stem, conduplicate leaves and glossy seeds). Although Adamson (1962) and Hartmann (2002) indicated that the original material of *D. sesuvioides* might be kept in W, we could not find it there (many old specimens including sheets seen by Fenzl were probably lost in 1945). Drège's specimens (No. *2938*) were found only in K and LE. The most appropriate specimen for the lectotypification is the one in K. The sheet in LE contains several fragments that belong to two species

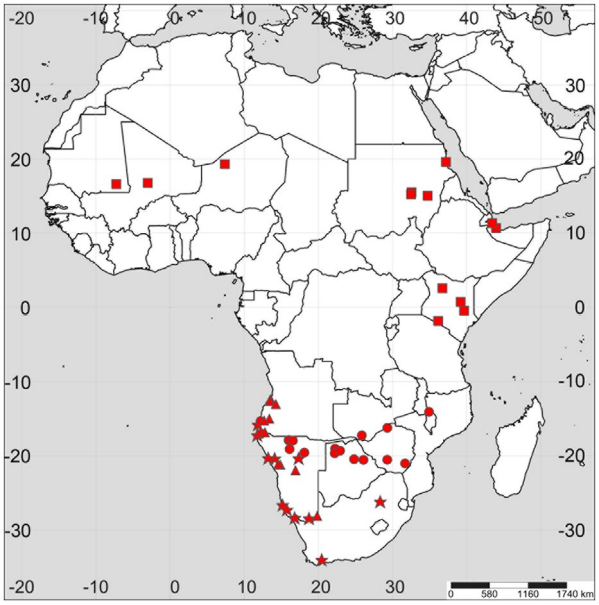

Figure 5. Distribution of *Sesuvium digynum* (triangles), *S. nyasicum* (circles), *S. hydaspicum* (squares), and *S. sesuvioides* (stars) in Africa.

(*S. sesuvioides* s.str. and *S. digynum*) and originate from different locations (Cape of Good Hope and Angolan province Benguela, collected by Drège and Dr. Wawra, respectively). Only one of them is labelled by Fenzl as *S. sesuvioides*. Others are also identified as *S. sesuvioides* including Wawra's specimens, but they are in fact *S. digynum*.

Verdcourt (1957) transferred *Diplochonium sesuvioides* to the genus *Sesuvium*. Hitherto the distribution of *S. sesuvioides* was not clear, and here we state for the first time that if treated in a narrow sense, as we do, its range is restricted to Angola, Namibia and South Africa (Figure 5).

Examined specimens

ANGOLA: Namibe Province (selected specimens): Mossamedes [Namibe], September 1859, *Welwitsch 2388* (BM!, sub *Sesuvium brachyanthum*); Mossamedes [Namibe], 23 April 1909, *H·H.W. Pearson 2150* (K!); Mossamedes [Namibe], mouth of river Kunene, 1951, *M.A. Pimentel Teixeira s.n.* (BM!); Mossamedes [Namibe], Praia Amelia [Amelia beach], 28 December 1955, *E.J. Mendes 1172* (BM!); Mossamedes [Namibe], Porto Alexandre [Tombwa], Espinheira, 12 February 1971, *J.A. de Souza 117* (K!);

NAMIBIA: [Kunene Region], Damaraland, May 1886, *Lindney s.n.* (K!); [Otjozondjupa Region], Hereroland [Waterberg], 1886, *H. Schinz 915* (K!); Namaqualand, Orange river, 28 December 1910, *H·H.W. Pearson 6027* (K!); [Karas Region], Warmbad, September 1931, *N.S. Pillans 6501* (K!); [Karas Region], Lüderitz, 5 March 1963, *de Winter and Hardy 7876* (K!); [Kunene Region] Torra Bay, 3 April 1963, *O.S. Hardy and B. de Winter*

1487 (K!); Southern Namib [Karas Region], Diamond area, Klinghardt Mountain, 20 April 1988, *C.J. Ward and M.K. Seely 10222* (K!);

SOUTH AFRICA: [Western Cape Province], Swellendam, [without date], *Drège 2938* (K000076286!, LE!); [Gauteng province], Kleinfontein, 24 October 1922, *Dinter 4151* (BM!).

New records of alien taxa with notes on their taxonomy

Atriplex semibaccata R.Br. (Amaranthaceae-Chenopodiaceae)

Contributor – Alexander P. Sukhorukov

Distribution and habitat

This species is native to Australia (Wilson 1984). It has been cultivated as a fodder plant elsewhere in the tropics and has become naturalized in many parts of the world. *Atriplex semibaccata* is reported from many countries in northern, eastern and southern Africa (Brenan 1954; Greuter, Burdet, and Long 1984; Visser et al. 2009; APD 2016). It is a species well adapted to arid conditions and prefers rocky places, and sometimes can be encountered on saline soils. Here we present the first record of *A. semibaccata* from the Cape Verde archipelago, where it seems to be rare (it was not found by AS on the arid Boa Vista and Sal islands in 2015 and 2016).

Taxonomic notes

Hitherto only one species of *Atriplex*, *A. halimus* L., was reported from the Cape Verde archipelago, probably as an alien (e.g., Chevalier 1935; Martins 2002). Now it is widespread on both arid Sal and Boa Vista islands on waste ground mostly in the sandy coastal areas (pers. obs. by AS). The specimen of *A. semibaccata* from Cape Verde was found in P among the unidentified collections of *Atriplex*. It is easily recognized by its shrubby habit, ascending shoots, narrow (lanceolate) leaves and the reddish, swollen lower half of the bract-like covers enclosing the fruit.

Examined specimens (new record):

CAPE VERDE: Santiago Island, Achada Baleia, reboisement au bord de mer [reforested area near the sea], 20 May 1987, *J. Lebrun 63145* (P05250596!).

***Gaillardia* × *grandiflora* Van Houtte (Asteraceae)**

Contributor – Filip Verloove

Distribution and habitat

Gaillardia × *grandiflora* (Figure 6) is a spontaneous and fertile hybrid between two North American species that are widely cultivated as ornamentals outside their native ranges: *G. aristata* Pursh and *G. pulchella* Foug. It easily establishes wherever planted and thrives well in any kind of xeric habitat. As such, it has naturalized in coastal dunes in Belgium (Verloove 2006) and is increasingly often observed as a weed in North America as well (Turner and Watson 2007). In 2012, a small population was found on the exposed, gravelly banks of the Ksob river near Essaouira in Morocco. There seem to be no previous records of this genus from North Africa (e.g., Dobignard and Chatelain 2011; Greuter 2006+).

Figure 6. Inflorescences of *Gaillardia×grandiflora*. Photographer – Filip Verloove.

Taxonomic notes

This hybrid arose in a garden in Belgium around 1857 (Van Houtte 1857). Morphologically, it is much closer to *G. aristata*, a perennial with often entirely yellow ligules, while *G. pulchella* is an annual with usually bicolored ligules. *G.×grandiflora* is larger and more vigorous than either parent species and tends to have outer involucral bracts that are relatively enlarged and loosely imbricate, compared with those of *G. aristata* (Turner and Watson 2007).

The plants recently found in Morocco closely resemble *G. aristata*, but differ in some minor features, e.g., slightly smaller achenes with shorter pappus scales.

Examined specimens (new record)

MOROCCO: Essaouira, oued (river) Ksob near bridge of P2201 road, exposed river margin, on gravel, scattered individuals, prolifically self-seeding, 10 June 2012, *F. Verloove 12589* (BR!, dupl. TAI, L).

***Heterotheca subaxillaris* (Lam.) Britton & Rusby (Asteraceae)**

Contributor – Filip Verloove

Distribution and habitat

Heterotheca subaxillaris (camphorweed) is native to Mexico and the southern half of the USA. Although it is considered a very weedy species there (Semple 2006), it is rarely recorded outside of its native range. In Israel, however, *H. subaxillaris* was introduced for sand dune

stabilization in the 1970s and subsequently escaped. Since then it is an invasive species that is rapidly infesting cultivated and non-cultivated ecosystems such as orchards, nature resorts, range land, open fields, waste grounds, roadsides and railroad embankments (e.g., Dafni and Heller 1982; Tuvia 1998). More recently it was also reported from Morocco, more precisely from the area between Meknés and Rabat, as well as Rabat and Khémisset (Pyke et al. 2008), where it was found growing in abundance in 2006. This record apparently passed unnoticed, since *H. subaxillaris* is not reported for Morocco by Dobignard and Chatelain (2011), nor is it included in Euro+Med Plantbase for that country (Greuter 2006+).

In the herbarium of the Botanic Garden of Meise, Belgium (BR), an unidentified composite collected in Sidi Slimane in 1990 is identified as *Heterotheca subaxillaris*. This new locality is in the same province (Kénitra) as those reported by Pyke et al. (2008) and seems to be the earliest known collection. This record sheds some new light on the invasion history of this weed in northern Africa.

Taxonomic notes

Heterotheca subaxillaris is a morphologically variable species that has been treated as either three species or as a single polymorphic species (Semple 2006). Pyke et al. (2008) were aware of this variability and referred to the Moroccan plants as *H. subaxillaris* s.l., including *H. latifolia* Buckley and *H. psammophila* B. Wagenknecht. The latter two species are now accepted as *H. subaxillaris* subsp. *latifolia* (Buckley) Semple (Semple 2006). The specimen from Sidi Slimane has outer and mid phyllaries with an apical tuft of several coarse, scabro-strigose hairs, a feature associated with subsp. *subaxillaris*.

Examined specimens (new record)

MOROCCO: Kenitra, Sidi Slimane, 200 m, boisement [afforestation], plante aromatique, fleur jaune vif [aromatic plant with bright yellow flowers], 16 November 1990, *J. Lewalle 132/6* (BR!; sub 'cf. *Erigeron* s.lat. (*Jasonia*??)'). Duplicates have been sent to F, CM, C, MBM, GENT, L and LE.

***Mollugo verticillata* L. (Molluginaceae)**

Contributors – Alexander P. Sukhorukov, Maria Kushunina

Distribution and habitat

Mollugo verticillata is the only species of the genus in its recent circumscription (Thulin et al. 2016) present in Africa. It is native to North and South America, where it is a common weed (Bogle 1970; Vincent 2003). The earliest record from Africa is from Angola (Cazanga island, 1853, *Welwitsch 2411*, K). Later it was collected in Mali (San, 1899, *A. Chevalier 1080*, BR000017461016) and Ghana (Aburi, 1909, *G. Anderson* 35, K). Recently, the species was also reported from Cape Verde, Senegal and Sierra-Leone (APD 2016; Gonçalves 1995b; Keay 1954). *Mollugo verticillata* prefers disturbed areas, and in arid climates is restricted to wet places, e.g., river banks. Here we report this species for DR Congo. Further records from tropical Africa are to be expected. Its presence in North Africa is also possible due to findings in the Iberian Peninsula (Gonçalves 1990) where it is sometimes incorrectly (duplicates in the herbaria H! and HUJ!) labelled as *Mollugo cerviana* (L.) Ser., now *Hypertelis cerviana* (L.) Thulin (Thulin et al. 2016).

Taxonomic notes

Mollugo verticillata is often confused with other African Molluginaceae. The specimens we re-identified in the herbaria visited were often labelled as other annual taxa with similar whorled leaves and axillary inflorescences, *Glinus oppositifolius* (L.) DC., *Hypertelis cerviana* (L.) Thulin (formerly *Mollugo cerviana*) or annual *Pharnaceum* species (e.g., *P. exiguum* Adamson). We assume that a great number of such misidentifications led Hooker (1849) to consider *M. verticillata* as a 'West African plant'.

In doubtful cases, the seed ornamentation is the most valuable character for plant identification in *Molluginaceae* (Sukhorukov and Kushunina 2016a, 2016b, 2017). The seeds are reticulate in *Hypertelis cerviana* and *H. umbellata* (Forssk.) Thulin, smooth in *Pharnaceum* (Figure 7), and smooth or marginally ridged in *M. verticillata* (Figure 8). *Glinus* species (except some populations of *G. setiflorus* Forssk.) are distinguished by seeds with large arillate outgrowths. Additionally, South African species of *Pharnaceum* have prominent lacerate stipules (Adamson 1958) and glossy biconvex seeds with wing-like margins (Sukhorukov et al., in prep.). Interestingly, *Trigastrotheca pentaphylla* (L.) Thulin (ex-*Mollugo pentaphylla*; Thulin et al. 2016), a common weed in tropical Africa, is never confused with *M. verticillata*, which also has whorled leaves. These taxa can easily be distinguished from one another on the basis of inflorescence structure (stalked and branched inflorescence in *T. pentaphylla* and axillary flower clusters in *M. verticillata*).

In its native range, *M. verticillata* is morphologically heterogeneous, especially in the tropics (Sukhorukov and Kushunina 2017; Thulin et al. 2016), but the species composition was studied only for territory of the Galápagos Islands (Howell 1933). At least several taxa from the *Mollugo verticillata* aggregate were described from South America in the past. They differ in leaf shape and length (Saint-Hilaire, Jussieu, and Cambessedes 1829; Seringe 1824) or life history (Thulin and Harley 2015), but the species named by Seringe were never examined in detail. Almost all African *M. verticillata* specimens have small linear to narrowly oblong leaves, except one specimen from Ghana (NE of Kete Krachi, 2

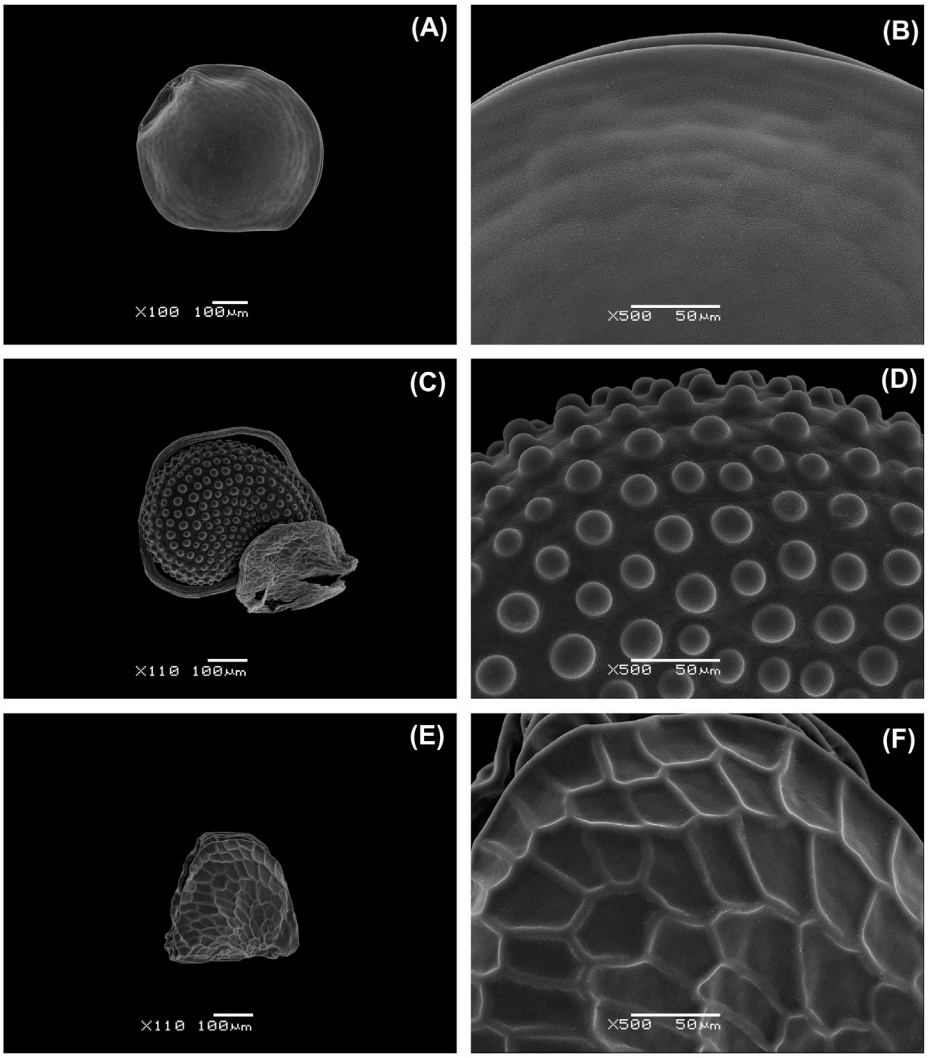

Figure 7. Seeds of *Pharnaceum exiguum* (A, B), *Glinus oppositifolius* (C, D), and *Hypertelis cerviana* (E, F). A, C, E: plan view of the seed (110×); B, D, F: ornamentation of the seed coat (500×). Origin of the material: *Pharnaceum exiguum*: South Africa, Cape province, 6 September 1952, *R.S. Adamson 4566* (BM); *Glinus oppositifolius*: Angola, Cuando-Cubango province, March 1960, *E.J. Mendes 3155* (BM); *Hypertelis cerviana*: Niger, 19 March 1979, *J.E. Newdy 28165* (K).

January 1955, *J.K. Morton 1495*, K) with obovate leaves. The plants with narrow leaves are mostly known from the tropical Americas, while the populations from temperate North America are usually characterized by broad (obovate or broadly spatulate) leaves (Vincent 2003; AS, pers. obs.). The prominence of concentric ridges on the seed surface is another variable character and does not correspond with leaf shape. The majority of African specimens have ridged seeds, but some of them are smooth or only with small grooves. Such seeds are present in the authentic specimens of *Mollugo chevalieri* Hutch. & Dalz. (Figure 8, C–D), a species described from Mali and deemed to be native to West Tropical Africa (Hutchinson and Dalziel 1927), but later synonymized with *M. verticillata* (Keay 1954).

Below we provide the first records of *Mollugo verticillata* for the flora of DR Congo (collected twice in the same region and erroneously identified as *M. cerviana*) as well as a list of all specimens seen at BM, BR and K (and some of them re-identified) for all other African countries. The distribution of *M. verticillata* based on the specimens cited (Figure 9) is clearly more extensive than previously thought (e.g., APD (African Plants Database; version 3.4.0 2016; Lebrun and Stork 2003).

Examined specimens

DR CONGO (new records): [Kwilu Province] Kikwit, Kiyaka, 30 July 1958, *Hardy 2* (BR0000017461061!); [Kwilu Province] Kikwit, Bulungu, Talus, bord de la rivière [river bank], 21 April 1976, *L. Pauwels 5592* (BR0000017457804!).

ANGOLA: Cazanga island, October 1853, *Welwitsch 2411* (K!);

BENIN: Oueme, Bonou, 12 March 1998, *P. Houngnon 5609* (BR0000017461054!);

CAPE VERDE: Santiago island, Praia, Achada Grande, 30 November 1955, *L.G. Balbosa 5804* (LISC – photo!); Maio Island, Morrinho, 11 November 1964, *Malato-Beliz and Guerra 241* (LISC – photo!); Maio Island, Vila do Maio to Monte Vermelho, 11 March 1982,

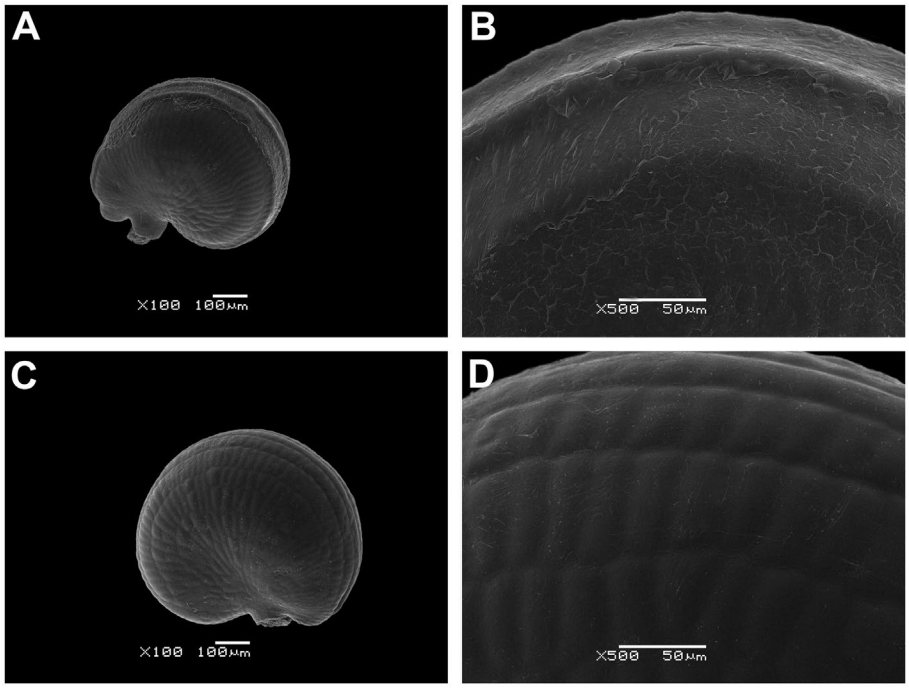

Figure 8. Seeds of *Mollugo verticillata* with ridged (A, B) and almost smooth (C, D) surface. A, C: plan view of the seed (100×); B, D: ornamentation of the seed coat (500×). Origin of the material: A, B: Cote d'Ivoire, Port-Bouet, 3 March 1965, *Raynak 13568* (BR0000017461047); C, D: Mali, San, 29 June 1899, *A. Chevalier 1080* (BR000017461016, labelled as *M. chevalieri*).

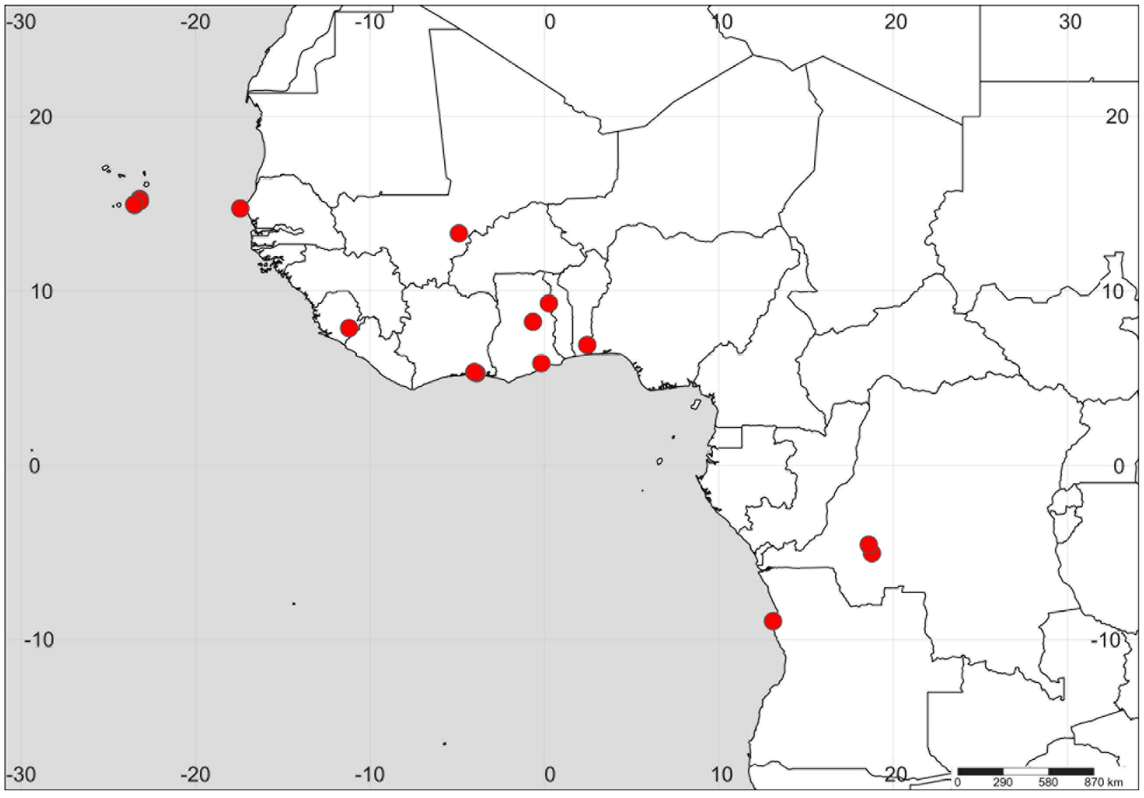

Figure 9. Distribution of *Mollugo verticillata* in Africa.

L.G. Barbosa 13948 (LISC – photo!); Santiago Island, Achada de S. Felipe, 10 November 1988, *C. de Matos 6360* (LISC – photo!);

GHANA: Aburi, 20 December 1909, *G. Anderson 35* (K); Zabzugu road, Oti river, 9 April 1953, *J.K. Morton 9061* (K!); Yeji, river sandbank, 12 April 1964, *J.B. Hall 1226* (K!);

IVORY COAST: Port-Bouet, sand dunes near sea, 3 March 1965, *Raynak 13568* (BR0000017461047!, K!); the same place, 28 July 1967, *G.J.H. Amshoff 388*

(BR000017461030!, H1141483!); Abijan, roadside, 11 July 1967, *R.A. Cheke 3* (K!);

MALI: [Segou Region], San, 29 June 1899, *A. Chevalier 1080* (BR0000017461016!; K000232030!);

SENEGAL: [Dakar], Hann, August 1950, *R.P. Berhaut 1110* (BR17461009!);

SIERRA-LEONE: [no precise location] sand on cliff above wharf, 10 November 1931, *F.C. Deighton 2287* (K!); Kenema (Nongowa), weed in waste place, 24 November 1952, *F.C. Deighton 5879* (K!).

Prosopis velutina Wooton (Fabaceae)

Contributor – Filip Verloove

Distribution and habitat

Prosopis velutina (velvet mesquite) is native to a relatively small area in North America: the Sonoran Desert and the neighbouring areas in the southwestern USA and adjacent parts of Mexico. Its pods are an important source of human and animal food, and the trees provide fuel and small timber. For that purpose the species was introduced in many warm-temperate and subtropical parts of the world. It thrives particularly well in the Mediterranean region. However, it is recorded as an invasive weed throughout its native range and everywhere where it has been introduced, and is no longer recommended for any further introductions (Pasiecznik, Harris, and Smith 2004).

Prosopis velutina is adapted to very hot and dry conditions and is able to naturalize, for instance, along dry riverbeds (Pasiecznik, Harris, and Smith 2004). In exactly this type of habitat it was found as an escape from cultivation in Zagora in Morocco in 2012, apparently for the first time in North Africa (cf. APD (African Plants Database; version 3.4.0 2016; Greuter 2006+). A future wider naturalization is predictable. Invasive behaviour of *P. velutina* has been reported from Australia (e.g., Van Klinken and Campbell 2001) and South Africa (e.g., Zimmermann 1991).

Taxonomic notes

Prosopis is a taxonomically complex genus and, as a result of hybridization, species boundaries are blurred. Many claims of invasive *P. velutina* in fact refer to hybrids of this species with *P. juliflora* (Sw.) DC., *P. pallida* (Humb. & Bonpl. ex Willd.) Kunth and/or *P. glandulosa* Torrey. Hybridization has further enhanced invasiveness (e.g., Shackleton et al. 2014). The plants found in Zagora, however, in all characters seem to correspond with 'pure' *P. velutina*. It is distinguished from *P. farcta* (Banks & Sol.) J.F.Macbr., the only native species of *Prosopis* in North Africa, in being a small tree (vs. shrub-like) with internally villous petals (vs. glabrous petals) and long, compressed pods up to 20 cm or more long (vs. short and inflated pods ca. 5 cm long in *P. farcta*). Both have dense short pubescence on the vegetative parts, unlike most of the other widely cultivated species of *Prosopis*.

Examined specimens (new record)

MOROCCO: Zagora, oued (river) Drâa, roadside, rough ground and dry riverbed, scattered plants, escaped from cultivation, 18 June 2012, *F. Verloove 9947* (BR!).

Vernonanthura polyanthes (Spreng.) A.J.Vega & Dematt. (Asteraceae)

Chrysocoma phosphorica Vell., *Eupatorium polyanthes* Spreng., *Vernonanthura phosphorica* (Vell.) H.Rob., *Vernonia polyanthes* Less.

Contributors – Christopher Chapano, Munyaradzi Davids Shekede, Alfred Maroyi

Distribution and habitat

Vernonanthura polyanthes (Figure 10) is a shrub indigenous to Bolivia and Brazil (Vega and Dematteis 2010). This new record of *V. polyanthes* in Zimbabwe is to date the only record of the species established outside its native range. No existing herbarium specimens of *V. polyanthes* collected in Zimbabwe or neighbouring countries could be traced, although Hyde et al. (2016, sub *Vernonanthura phosphorica*) reported the introduction of the species in Mozambique in the 1990s to enhance honey production, as is the case in Brazil where *V. polyanthes* is a well-known honey plant pollinated by honey bees (Lorenzi 2000).

During recent fieldwork in the eastern part of Zimbabwe we came across populations of *V. polyanthes* around the towns of Chimanimani, Chipinge and Mutare, where it has become established, naturalized and invasive (definitions for naturalized and invasive are after Blackburn et al. 2011). In Zimbabwe, *V. polyanthes* blooms from June to August, and then produces copious wind-dispersed fruits. It is common in disturbed areas, along roadsides, in secondary vegetation, pine plantations, dry forest and riparian forest margins at elevations ranging from 345 to 1710 m a.s.l. It has been recorded as a dominant understory species in disturbed indigenous forests and commercial pine plantations. We estimated the target distribution of *V. polyanthes* in Zimbabwe through correlating observed occurrences of the species to environmental covariates, i.e., bioclimatic variables (Hijmans et al. 2005) and aspect (Figure 11). Considering the weedy status of *V. polyanthes* in its native range (Randall 2012), its invasiveness in Zimbabwe (present investigation) and its easy dispersal by wind (Ishara and Maimoni-Rodella 2011), the species is likely to become invasive in other African countries.

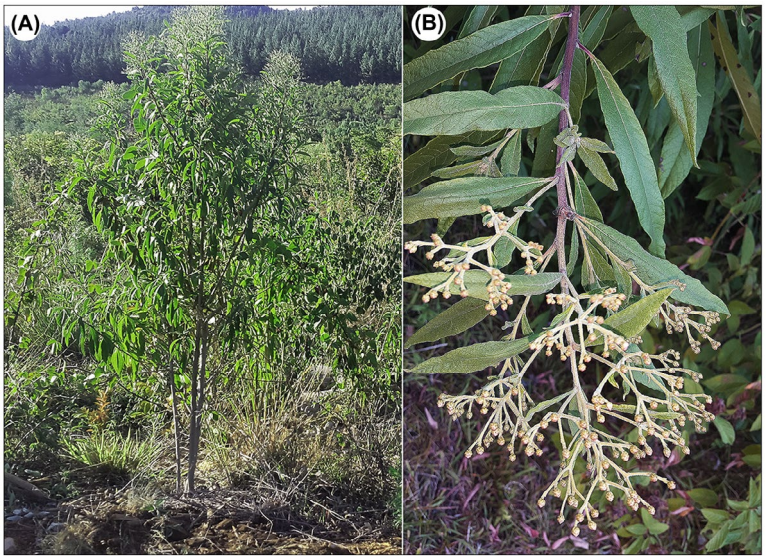

Figure 10. Vegetative and reproductive morphology of *Vernonanthura polyanthes*. A: general view; B: inflorescence. Photographs were taken in eastern Zimbabwe by Christopher Chapano.

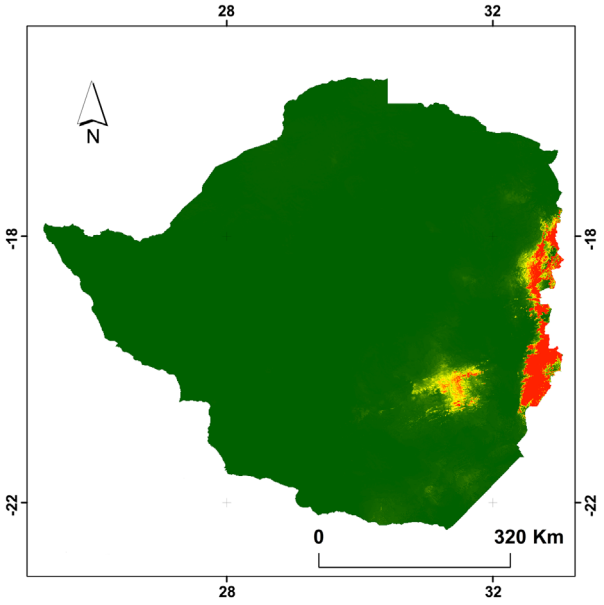

Figure 11. The target distribution of *Vernonanthura polyanthes* in Zimbabwe modelled using maximum-entropy approach. Green – low habitat suitability, red – high (0.89) habitat suitability.

Taxonomic notes

The genus *Vernonanthura* H.Rob. was established with *Baccharis brasiliana* L. as the type by Robinson (1992), who separated the representatives of *Vernonia* Schreb. sect. *Lepidaploa* (Cass.) DC. subsect. *Paniculatae* Benth. into this new genus. In its present circumscription, *Vernonanthura* comprises 70 species with a shrubby or tree-like habit. Its centre of diversity is in South America, especially in southeastern Brazil (Robinson 1992). *Vernonanthura polyanthes* (basionym *Vernonia polyanthes* Spreng.) was known under the name *Vernonanthura phosphorica* (Vell.) H.Rob. (Robinson 1992), a name based on *Chrysocoma phosphorica* Vell. Recent revision by Vega and Dematteis (2010) showed that an earlier name *Eupatorium polyanthes* (Sprengel 1826) has priority over *Chrysocoma phosphorica* (Vellozo 1829) when choosing the specific epithet for *Vernonanthura polyanthes*.

Examined specimens (new records)

ZIMBABWE: Eastern Highlands, Mutare district, Bvumba area, along road to Leopard Rock Hotel, edge of the pine plantation, 32° 43' 48.1940" S, 19° 05' 14.9820" E, 1618 m, 6 June 2016, *C. Chapano, T. Mhunduru, V. Haurovi 1540* (K, SRGH!); Chimanimani, along scenic road from Cashel Valley to Chimanimani, 2 km after Cashel shop, close to a stream, 32° 46' 23.6889" S, 19° 31' 53.1948" E, 1165 m, 7 June 2016, *C. Chapano, T. Mhunduru, V. Haurovi 1543* (K, SRGH!); Chimanimani, Tandai Forest Area, along scenic road, within pine plantation, 32° 48' 33.2081" S, 19° 37' 00.2712" E, 1516 m, 7 June 2016, *C. Chapano, T. Mhunduru, V. Haurovi 1546* (K, SRGH!); Chimanimani, close to turn-off to Chief Chikukwa's homestead along scenic road, 32° 55' 20.2617" S, 19° 42' 46.1016" E, 1214 m, 7 June 2016, *C. Chapano, T. Mhunduru, V. Haurovi 1548* (K, SRGH!).

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Disclosure statement

No potential conflict of interest was reported by the authors.

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