

## *Monoblastiopsis* (Dothideomycetes, Pleosporales, incertae sedis), a new genus from the Great Plains and Ozark Highlands

RICHARD C. HARRIS<sup>1</sup> & CALEB A. MORSE<sup>2</sup>

**ABSTRACT.** – *Monoblastiopsis* is described as a new genus and with two new species, *M. konzana* and *M. nigrocortina*. *Monoblastiopsis* seems to represent a previously unrecognized group of perithecioid lichenized Dothideomycetes distinguished by chlorococcoid photobiont, superficial ascomata, periphysate ostioles, fissitunicate asci and nonseptate ascospores. It is saxicolous, known only from calcareous substrates in Colorado, Kansas, Missouri, and Texas. Descriptions and illustrations are provided.

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### INTRODUCTION

The lichen flora of the grassland biome of central North America has received little attention relative to the size of this large, physiographically diverse region. Recent publications amount to a handful of floristic reports and ecological studies (*e. g.*, Malone & Tiffany 1978, Dunlap & Tiffany 1980, Jackson & Hopkins 1980, Eversman 1982, Wetmore 1985, Egan et al. 1995, 2002, Will-Wolf 1998), a few post-graduate theses (*e. g.* Cherney 1985, Morgan 2001), and several web-accessible species lists (*e. g.* De Vries & Wright 2005, Burchill 2007). Wetmore's (1967) treatment for the Black Hills remains the sole published account with keys to the flora of a part of the Great Plains. As on-going work adds stations for poorly known species (Knudsen & Morse in review) and yields finds new to North America and new to science (Harris & Ladd 2007, Wetmore in review), however, a flora is emerging that combines elements from the better documented floras of eastern and southwestern North America with taxa apparently endemic to the Great Plains. As knowledge of the lichens of the Great Plains grows, it seems increasingly probable that many of the taxa thought to be endemic to the Ozark ecoregion will turn out to be the easternmost part of a Great Plains distributional pattern.

While carrying out fieldwork in eastern Kansas in 2005, the second author gathered specimens of a species thought at the time to be referable to *Monoblastia* Riddle. Considered examination of the material by the first author revealed that the taxon differed from *Monoblastia* in several important aspects, and appeared to represent a previously unrecognized group of lichenized Dothidiomycetes. Additional collecting in the High Plains in eastern Colorado and western Kansas turned up a second species, clearly allied to the first, but slightly smaller in several respects and occupying a different substrate.

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## TAXONOMIC SECTION

*Monoblastiopsis* R.C. Harris & C.A. Morse, *gen. nov.*

MYCOBANK #511606.

*Monoblastia* Riddle *subsimilis* quoad ascomata perithecioides et ascosporas nonseptatas sed algis chlorococcoidibus, ascomatis globosis superficialibus, ostiolis periphysatis et ascosporis biseriatis differt.

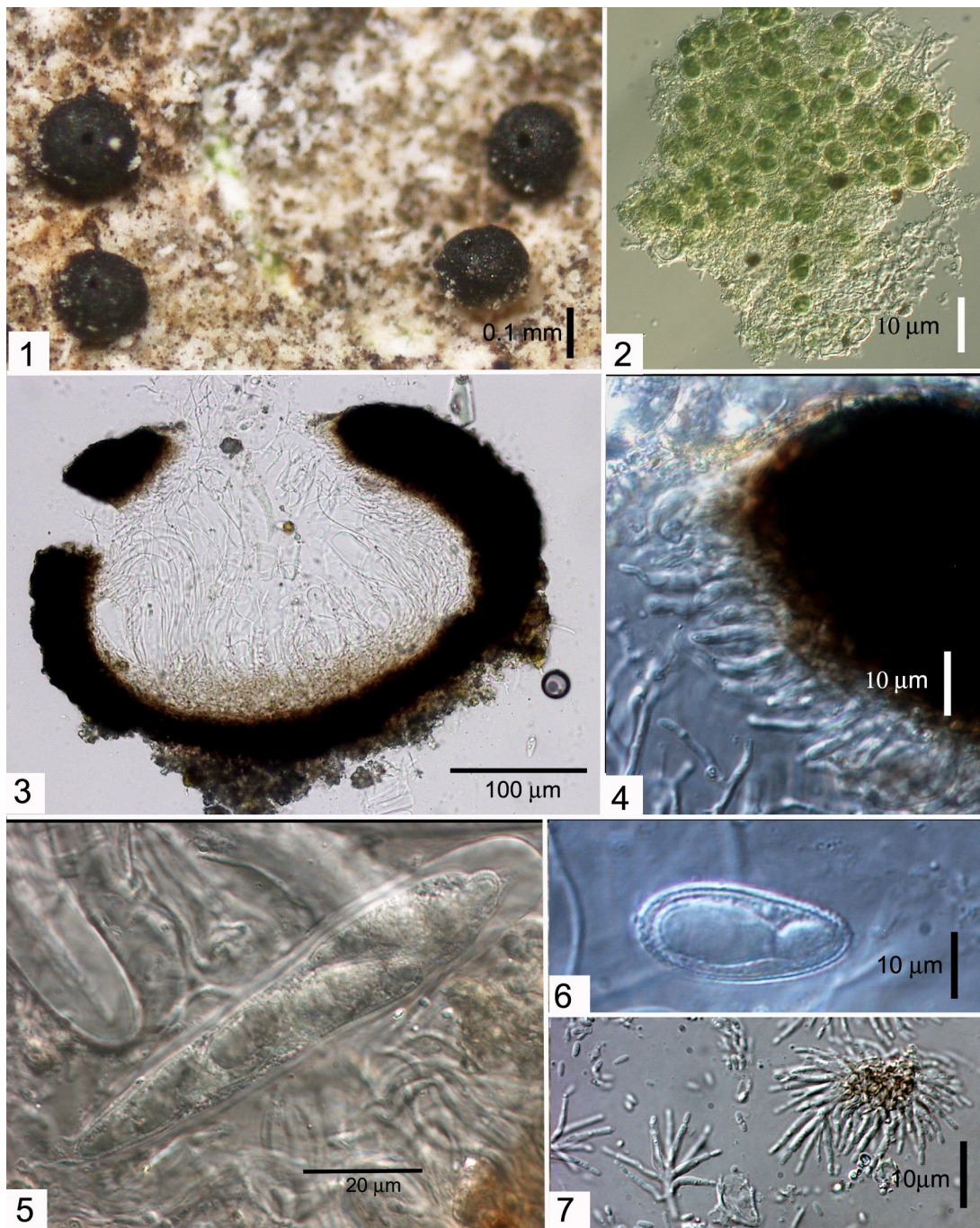
TYPE: *Monoblastiopsis konzana* R. C. Harris & C. A. Morse

Description. - **Thallus** not evident, immersed in rock (rock surface often with extraneous cyanobacteria). **Photobiont** chlorococcoid (fig. 2), mostly in discontinuous clumps, with  $\pm$  globose cells, 5–7  $\mu$ m in diameter. **Ascomata** globose, often constricted at base, sessile or semi-immersed, rarely forming shallow pits in limestone, black, slightly shiny, solitary or confluent (figs. 1, 8), with conspicuous, open or sunken ostiole with short periphyses (fig. 4); ascomatal wall entire, hard and brittle when dry, composed of a single layer, formed of irregular cells with dark brown extracellular pigment. **Interascal hyphae** slender, branched and anastomosed pseudoparaphyses? arising from a brownish base; gel I–. Asci cylindrical to  $\pm$  clavate, fissitunicate, thick-walled and with ocular chamber (fig. 5), with 8 spores. **Ascospores** nonseptate, colorless, ellipsoid to narrowly ellipsoid, without a halo, weakly ornamented at maturity (figs. 6, 9). **Pycnidia** globose, sessile or slightly immersed; pycnidial wall as in ascomata. **Conidiophores** branched (fig. 7). **Conidia** colorless, narrowly ellipsoid. **Chemistry** not studied but assumed to be nil.

DISCUSSION. - At first *Monoblastiopsis* was thought to belong to the Monoblastiaceae Watson, similar to *Monoblastia* in nonseptate spores, differing in ascus type (not narrowly cylindrical with uniseriate spores), and similar to *Anisomeridium* (Müll. Arg.) M. Choisy in ascus type, differing in having nonseptate spores. However, the presence of a chlorococcoid photobiont (*Trentepohlia* in Monoblastiaceae), periphysate ostioles, and branched conidiophores suggested otherwise. The Thelenellaceae H. Mayrhofer have a chlorococcoid photobiont but differ from *Monoblastiopsis* in ascus type and in muriform ascospores. Verrucariaceae Zenker differ in lacking interascal hyphae at maturity, iodine reaction, and ascus type. The best fit may be with lichenicolous genus *Zwackhiomyces* Grube & Hafellner. The ascospores of the majority of species of *Zwackhiomyces* are 1-septate but Hoffmann & Hafellner (2000) include *Z. lecanorae* (Stein) Nik. Hoffmann & Hafellner with nonseptate ascospores. However, in addition to being lichenicolous, *Zwackhiomyces* differs in lacking periphyses and in having narrowly bottle-shaped conidiogenous cells.

If one examines some of the larger gene trees of fungi (e.g., Hibbett et al. 2007), one notes that differing photobionts seem to be indicative of lichenization events. With the thought that *Monoblastiopsis* might represent an unrecognized lichenization event, a broader search beyond the usual suspects (above) was undertaken. Nonseptate ascospores are unusual in ascomycetes with fissitunicate asci but are typical in the Botryosphaeriaceae Theiss. & P. Syd. Beyond the similarity in spore type, there seem to be some other similarities to suggest placing *Monoblastiopsis* in the Botryosphaeriales Schoch, Crous & Shoemaker: the ascus type is similar (compare Cannon & Kirk 2007, p. 44) and although the conidial anamorphs of Botryosphaeriaceae are mostly different from the microconidia of *Monoblastiopsis*, Cannon & Kirk (2007) write “[a] conidial spermatial morph is also present in some species” (we have not seen any description of these). Although there seem to be similarities with the Botryosphaeriaceae, inclusion of *Monoblastiopsis* in the Botryosphaeriaceae s. str. seems to be precluded by its lichenization, occurrence on rock, superficial ascomata, structure of the ascomatal wall (pseudoparenchymatous in *Botryosphaeria*) and presence of periphyses. Since, at this point, it seems only remotely possible that *Monoblastiopsis* could be referred to the order Botryosphaeriales, one is left with the relatively meaningless option of last resort “Pleosporales M. E. Barr, incertae sedis” or perhaps Botryosphaeriales, incertae sedis. The systematic disposition of *Monoblastiopsis* and whether it represents a unique lichenization event awaits molecular study.

The two species so far known differ morphologically, in substrate preference and in distribution.



**Plate 1.** *Monoblastiopsis konzana*. Morse 12339 & Barnard (holotype). **Figure 1.** Habit. **Figure 2.** Photobiont (extracted from rock with HCl). **Figure 3.** Ascoma cross-section. **Figure 4.**Periphyses. **Figure 5.** Ascus. **Figure 6.** Ascospore. **Figure 7.** Conidiophores and conidia.

KEY TO THE SPECIES

1. Asci broadly cylindrical to clavate with spores biserially to irregularly arranged; ostiole periphysate; photobiont chlorococcoid ..... 2
1. Asci narrowly cylindrical with spores uniseriately arranged; ostiole not periphysate; photobiont *Trentepohlia* ..... *Monoblastia*
2. Ascospores obtuse-ellipsoid, 19–29 x 8–13  $\mu\text{m}$ ; ascomata 0.2–0.5 mm in diameter, mostly solitary, not collapsed; asci with fewer than eight spores developing; pycnidia common ..... *M. konzana*
2. Ascospores narrow-ellipsoid 12–26 x 4.5–8  $\mu\text{m}$ ; ascomata 0.15–0.2 mm in diameter, often 2–5(–8) confluent, often collapsed and cup-like; asci with eight spores; pycnidia very rare....*M. nigrocortina*

*Monoblastiopsis konzana* R.C. Harris & C.A. Morse, *sp. nov.*

MYCOBANK #511607.

PLATE 1, FIGURES 1-7.

*Monoblastiopsis* ascomatis 0.2–0.35 mm diametro, plerumque solitariis et ascosporis ellipsoideis, 19–29 x 8–13  $\mu\text{m}$ .

TYPE: U.S.A. KANSAS. CHASE Co: 6.5 mi N, 2.5 mi W Strong City, Tallgrass Prairie National Preserve: N part, T18S R8E Section 7 SW $\frac{1}{4}$  & section 18 NW $\frac{1}{4}$ , 38.4908°N–38.4949°N 96.5872°W–96.5927°W, 1330–1400 ft, 8.xi.2005, *Morse 12339 & Barnard* (KANU 371963, holotype; KANU 371964, NY, isotypes).

DESCRIPTION. - **Ascomata** globose, sessile, rarely forming shallow pits in limestone, black, slightly shiny, solitary or 2(–3) confluent, 0.2–0.35 mm in diameter, with conspicuous, open or sunken ostiole with short periphyses; ascomatal wall entire, ca. 40–60  $\mu\text{m}$  thick. **Asci** cylindrical to  $\pm$  clavate, initially with 8 spores but only (2–)4(–6) spores maturing. **Ascospores** ellipsoid to  $\pm$  narrowly ellipsoid, weakly ornamented at maturity, 19-(24.7)-29 x 8-(10.5)-13  $\mu\text{m}$ . **Pycnidia** common, globose. **Conidia** ca 3 x 1.5  $\mu\text{m}$ .

ETYMOLOGY. - *Monoblastiopsis* refers to the superficial resemblance of members of the genus to *Monoblastia*. The epithet *konzana* is derived from an older name for the Kaw Indians, who once occupied the area in Kansas from which the species is presently known. The Kaw were removed from their land in the mid nineteenth century. Today, the Kaw Nation is headquartered in Kaw City, Oklahoma.

DISTRIBUTION AND ECOLOGY. - *Monoblastiopsis konzana* is presently known from the Flint Hills and Central Irregular Plains (Chapman et al. 2001) of eastern Kansas, from the White River Hills of the Ozark Highlands (Chapman et al. 2002) in Missouri, and from central Uvalde County, Texas, at elevations of 800–1400 ft (245–440 m). Both members of the genus are small and easily overlooked, and probably more common than collection records would suggest. Specimens of *M. konzana* have mostly been taken as admixtures with other species, however, so it remains difficult to make more than general comments about its ecology. All specimens examined for this study were from limestone. The type was collected in Flint Hills tallgrass prairie, from exposed outcrops of Permian Crouse, Funston, or Threemile limestones. Elsewhere in the Flint Hills, specimens were taken from limestone gravel atop weathered outcrops of the Beattie, Bader, or Crouse limestones, and from weathered boulders of Fort Riley Limestone, all of Permian age. Further east in Kansas, in the Osage Cuestas and Wooded Osage Plains of the Central Irregular Plains, the species has been found in open, second-growth riparian forest on shaded, east-facing outcrops of Pennsylvanian Plattsburg Limestone, in second-growth upland forest on shaded, south-facing outcrops of



Pennsylvanian Oread Limestone, and in prairie openings in disturbed sugar maple-basswood forest on boulders of limestone members of the Pennsylvanian Kansas City Group. The Missouri specimen was taken on shaded dolomite in oak-dominated hardwoods. The Texas specimen was collected from limestone of undetermined age in Tamaulipan thorn scrub at the northern edge of the Southern Texas Plains (Chapman et al. 2001). Associated species in exposed sites have included *Aspicilia contorta* (Hoffm.) Kremp., *Bagliettoa baldensis* (A. Massal) Gueidan & Roux, *Caloplaca atroalba* (Tuck.) Zahlbr., *C. variabilis* (Pers.) Müll. Arg., *Collema texanum* Tuck., *Kozarus thelommopsis* R. C. Harris & Ladd ined., *Lecanora valesiaca* (Müll. Arg.) Stizenb., *Leptogium apalachense* (Tuck.) Nyl., *Pachyphysis ozarkana* R. C. Harris & Ladd, *Peltula obscurans* (Nyl.) Gyel. var. *deserticola* (Zahlbr.) Wetm., *Phaeophyscia squarrosa* Kashiw., *Psora pseudorussellii* Timdal, *Rinodina bischoffii* (Hepp) A. Massal., and *Sarcogyne regularis* Körber. Associated species in shaded sites have included *Bacidia coprodes* (Körber) Lettau, *Caloplaca citrina* (Hoffm.) Th. Fr., *C. flavovirescens* (Wulfen) Dalla Torre & Sarnth., *Lecania perproxima* (Nyl.) Zahlbr., and *Verrucaria fayettensis* Servit.

SPECIMENS EXAMINED. - **U.S.A. KANSAS.** ANDERSON CO.: 1 mi N, 1.5 mi E Welda, University of Kansas Ecological Reserves, Welda Prairie Area Unit 3, T21S R20E Section 31 NE¼ NW¼, 38.1798°N 95.2552°W, 1040-1100 ft, 5.v.2005, *Morse 11208 & Freeman* (KANU); 1 mi N, 2 mi E Welda, University of Kansas Ecological Reserves, Welda Prairie Area Unit 3, T21S R20E Section 31 NE¼ NW¼, 38.1835°N 95.2555°W, 1040-1080 ft, 20.iv.2007, *Morse 15125 et al.* (KANU). DOUGLAS CO.: 1 mi N, 2 mi E Midland, University of Kansas Ecological Reserves: Bluff Field (unit #2201): Botany Bluff, T12S R20W Section 4 NW¼ of NW¼ of NW¼, 39.0437°N 95.2052°W, 1040-1060 ft, 2.iii.2008, *Morse 16265 & Logan* (KANU, NY). GEARY CO.: 4.25 mi S, 0.75 mi W Wreford, E side of Geary Co State Fishing Lake, T13S R5E Section 27 NE¼ NE¼, 38.8985°N 96.8546°W, 1230-1270 ft, 23.viii.2006, *Morse 13910a & Freeman* (KANU). LINN CO.: 2.75 mi W jct of KS Hwys 7 & 52 in Mound City, Dingus Natural Area, T22S R23E Section 15 NW¼ & Section 10 S½ SW¼, 38.1317°N-38.1408°N 94.8744°W-94.8758°W, 900-1010 ft, 7.v.2006, *Morse 12803* (KANU). RILEY CO.: 5 mi S, 2.25 mi W jct of KS Hwy 177-18 & US Hwy 24 in Manhattan, Konza Prairie Biological Station units 13E, 13F, & 14F in vicinity of Nature Trail, T11S R7E Section 12 N½ SE¼, 39.1074°N-39.1097°N 96.6025°W-96.6017°W, 335-350 m, 16.iii.2006, *Morse 12611 & Morse* (KANU). **MISSOURI.** OZARK CO.: Mark Twain National Forest, along ridge E of Waterhole Hollow, T24N R16W Section 5, 36°47'25"N, 92°43'55"W, ca 610 m, 19.v.2003, *Buck 44399* (NY). **TEXAS.** UVALDE CO.: ca 6 mi S Sabinal, 29.2072°N 99.4672°W, 800-830 ft, 23.iv.2003, *Morse 9204C* (KANU).

*Monoblastiopsis nigrocortina* R.C. Harris & C.A. Morse, *sp. nov.*

MYCOBANK #511608.

**PLATE 2, FIGURES 8-9.**

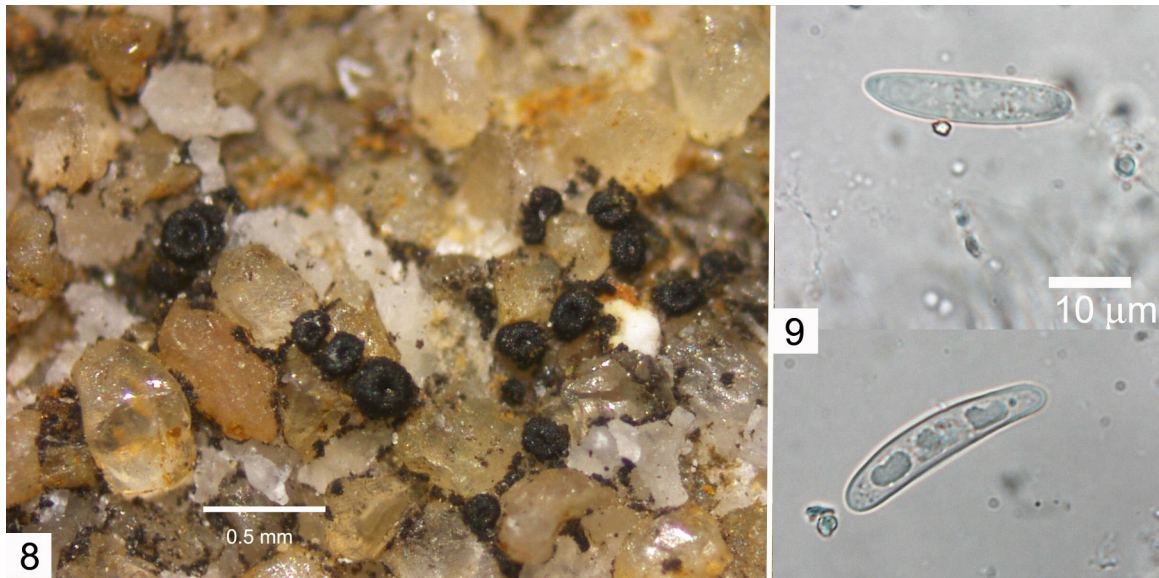
Similis *Monoblastiopsis konzanae* sed ascomatis minoribus aggregatis, saepe collapsis, ascosporis anguste ellipsoideis, 12-26 x 4.5-8 µm et pycnidiiis rarissimis.

TYPE: U.S.A. COLORADO. KIT CARSON CO: ca 4 mi E of Flagler, Flagler Reservoir Wildlife Management Area, N end of reservoir along dam, T9S R50W Section 3 NW¼ SW¼, 39.2931°N 102.9584°W, 4710 ft, 3.x.2007, *Morse 15804* (KANU 377380, holotype; COLO, KANU 377381, NY, isotypes).

DESCRIPTION. - **Ascomata** ± globose, sessile, black, slightly shiny, solitary or often 2-5(-8) confluent, especially in cracks in sandstone, 0.15-0.2(-0.3) mm in diameter, often collapsing and cup-like with age, with conspicuous, open or sunken ostiole with short periphyses; ascomatal wall entire, ca. 20-30 µm thick. **Asci** cylindrical to ± clavate, initially with 8 spores. **Ascospores** narrowly ellipsoid, weakly ornamented at maturity, 12-(18.5)-26 x 4.5-(6.1)-8 µm. **Pycnidia** very rare (only one found). **Conidia** ca 4 x 1.5 µm.

ETYMOLOGY. - The specific epithet *nigrocortina* (*nigro*- "black", *cortina* "kettle") honors Black Kettle (d. 1868), Chief of the Southern Cheyenne, one of several Native America tribes who occupied the area from which the species is presently known. Black Kettle struggled to secure peace between the Cheyenne and Euro-American settlers of the Great Plains and to maintain some independence for his people. The type specimen was collected approximately 60 mi (96 km) northwest of the site of the Sand Creek Massacre, where in 1864 some 200 Southern Cheyenne were killed when members of the Third Colorado Volunteers under John Chivington attacked their settlement. Black Kettle escaped this attack,

moving survivors to reservation lands in present-day Oklahoma. He and his wife, Medicine Woman Later, were killed by members of the 7th Cavalry under George Custer during the Washita Massacre.



**Plate 2.** *Monoblastiopsis nigrocortina*. **Figure 8.** Habit (Kansas, Ford Co., *Morse 13956b & Freeman*). **Figure 9.** Ascospores (Kansas, Logan Co., *Morse 12340a & Freeman*).

**DISTRIBUTION AND ECOLOGY.** - *Monoblastiopsis nigrocortina* is presently known from the Western High Plains ecoregion, and along the eastern edge of the Southwestern Tablelands and western edge of the Central Great Plains (Chapman et al. 2001) of western Kansas and eastern Colorado, at elevations of 2480–6240 ft (755–1901 m). Like its congener, however, the species is probably more common and more broadly distributed than collection records would suggest. All specimens examined for this study were from calcareous substrates. On coarser sandstones, *M. nigrocortina* is clearly associated with the cementing material, rather than the sand grains themselves. The type was collected from coarse, poorly cemented, sandstone riprap boulders of unknown provenance, but probably of the Tertiary Ogallala Formation. Elsewhere, the species has been found rarely on mortarbed boulders of the Ogallala Formation, and more frequently on sandstone boulders and outcrops. Three specimens were taken from coarse-grained sandstones of the Ogallala Formation or of unknown provenance and one from fine-grained sandstone assumed to be Jurassic or Triassic in age. Two specimens were collected from aging concrete blocks. Associated species have included *Acarospora strigata* (Nyl.) Jatta, *Caloplaca crenulatella* (Nyl.) H. Olivier, *C. pratensis* Wetmore ined., *Candelariella aurella* (Hoffm.) Zahlbr., *Collema coccophorum* Tuck., *C. fuscovirens* (With.) J. R. Laundon, *Lecanora crenulata* Hook., *L. dispersa* (Pers.) Sommerf., *Polysporina simplex* (Davies) Vězda, *Psorotichia schaeferi* (A. Massal.) Arnold, *Rinodina bischoffii* (Hepp) A. Massal., *Sarcogyne dakotensis* H. Magn., *S. similis* H. Magn., and *Staurothele elenkinii* Oksn.

**SPECIMENS EXAMINED.** - **U.S.A. COLORADO.** EL PASO CO.: 1.5 mi S, 2.5 mi W Ramah, W and N side of Ramah Reservoir State Wildlife Area, T11S R61W Section 10 S½ SW¼ & Section 15 N½ NW¼, 39.0957°–39.1024°N 104.2189–104.2106°W, 6180–6240 ft, 4.x.2007, *Morse 15832b* (KANU). LINCOLN CO.: 1.25 mi S, 1.5 mi E Karval, S side Karval Reservoir State Wildlife Area, T15S R55W Section 25 N½ SE¼ NW¼ & N½ SW¼ NE¼, 38.7151°N 103.5079°W, 5000–5080 ft, 5.x.2007, *Morse 15968 & Ladd* (KANU, NY). **KANSAS.** FORD CO.: S side Dodge City, near Ford Co Rodeo and Fair Grounds along Arkansas River, T26S R25W Section 35 SE¼ NW¼, 37.7460°N 100.0268°W, 2480 ft, 23.viii.2006, *Morse 13956b & Freeman* (KANU). HAMILTON CO.: 3.5 mi N, 3.5 mi W Syracuse, S side Hamilton Co State Fishing Lake and Wildlife Area, T23S R41W Section 21 SW¼ SE¼ & Section 28 NE¼, 38.0229°N–38.0320°N

101.8198°W–101.8225°W, 3320–3360 ft, 9.x.2007, *Morse 16119a* (KANU). LOGAN CO.: 17.5 mi S, 8 mi W Oakley, Smoky Valley Ranch (TNC preserve), T13S R33W section 33 SW¼ & T14S R33W Section 5 N½, 38.8742°N–38.8694°N 100.9994°W–100.0116°W, 2780–2850 ft, 10.xi.2005, *Morse 12430a & Freeman* (KANU). MORTON CO.: 6.5 mi N, 2 mi W of N edge of Elkhart, Cimarron National Grasslands in vicinity of Point of Rocks, T34S R43W Section 12 N½ SE¼, 37.1038°N–37.1036°N 101.9383°W–101.9410°W, 3430–3540 ft, 27.vi.2006, *Morse 13361b & Freeman* (KANU); ca 5 mi N, 6 mi W of N edge Elkhart, Cimarron National Grasslands, T34S R43W Section 17 SE¼, 37.0869°N 102.0128°W, 3560–3590 ft, 27.vi.2006, *Morse 13393e & Freeman* (KANU). SHERMAN CO.: 10.25 mi S, 2.75 mi W jct of KS Hwy 27 & US Hwy Business 24 in Goodland, NW side Sherman Co State Fishing Lake and Wildlife Area, T10S R40W Section 15 W½ NW¼ & Section 16 NE¼ NE¼, 39.1850°–39.1887°N 101.7778°–101.7823°W, 3620–3680 ft, 27.vi.2007, *Morse 15590b & Elliott* (KANU).

#### ACKNOWLEDGMENTS

We thank Othmar Breuss and Sabine Huhndorf for reviewing the manuscript. We thank R. Buchanan and R. S. Sawin (Kansas Geological Survey) for help in characterizing substrates. The second author's fieldwork was made possible through an anonymous contribution to the McGregor Herbarium endowment.

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