NEW SPECIES OF ORIBATID MITE, *EREMAEOZETES ROGERSI* N. SP. (ACARI: ORIBATIDA) FROM SANDSTONE OUTCROPS IN GEORGIA, USA

BY H. SCHATZ[1], F.M. McALOON[2], and D.V. HAGAN[3]

(Accepted June 2006)

ACARI, ORIBATIDA
GEORGIA, USA
OUTCROPS
EREMAEOZETES
NEW SPECIES

SUMMARY: *Eremaeozetes rogersi* n.sp. (Acari, Oribatida, Eremaeozetidae) is described from specimens collected from a Pleistocene sandstone outcrop from the coastal plain of southern Georgia, USA (type locality). Additional material from Florida and Alabama was included into this study.

INTRODUCTION

The genus *Eremaeozetes* was erected by BERLESE (1913). SCHATZ (2001) published an extended diagnosis of the genus. Prior to this study, 31 species had been described from all tropical regions: six species from Africa (Angola, I. Pagalu, South Africa); nine from the Oriental Region (West Bengal, Indonesia, Singapore, Brunei, Philippines, South China); five from the Pacific region (New Guinea, Micronesia, West Samoa, Tahiti, Hawaii); nine from South America (Argentina, Brazil, Chile, Paraguay, Uruguay, Galapagos I.); and five from Central America (Mexico, Costa Rica, Antilles). Fossil *Eremaeozetes* have been recorded from Quaternary peat and lake settlements, and from Tertiary amber in the Dominican Republic (NORTON & POINAR, 1993, ELIAS, 1994). MARSHALL et al. (1987) mentioned an undescribed *Eremaeozetes* species from North Carolina. Apart from their report, no *Eremaeozetes* species from North America has been recorded until now.

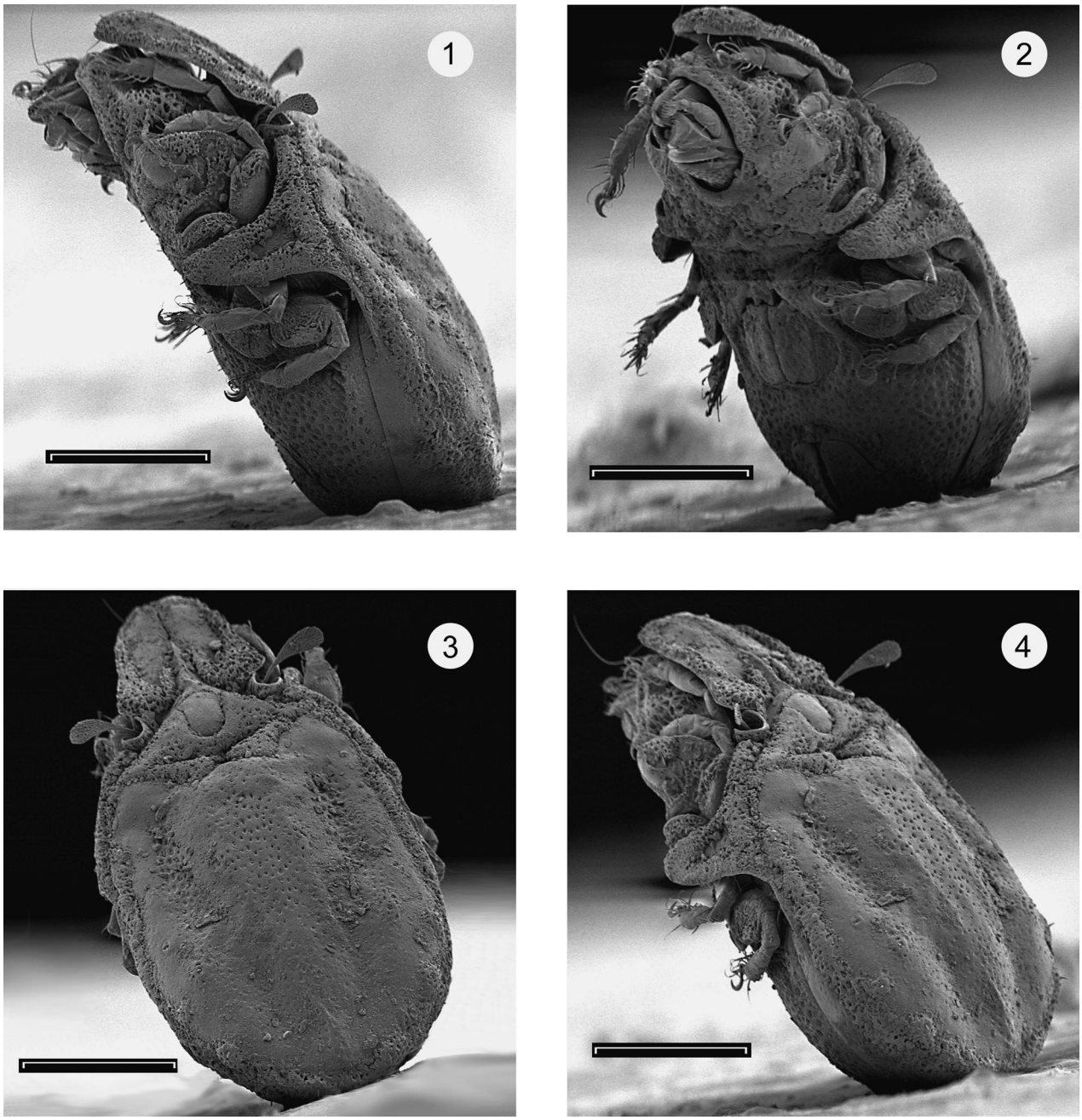
In this paper we describe a new species of *Eremaeozetes* collected from Pleistocene-aged sandstone outcrops in Georgia, USA. This species has also been found in Florida (collection R.A. Norton) and in Alabama (Canadian National collection).

MATERIAL AND METHODS

Sandstone outcrops in the southeastern US are ecologically significant formations that, along with the encompassing wiregrass, longleaf pine, and scrub oaks, create a unique habitat; one which contains several threatened and endangered plants and animals. The climate in the coastal plain region of southern Georgia and northern Florida is characterized as being humid-subtropical.

Oribatid mites from outcrops were collected at the Broxton Rocks Nature Preserve, Coffee County, southern Georgia, USA, from moss and lichen beds in soil depressions associated with sandstone rocks.

1. Institute of Ecology, Leopold-Franzens-University of Innsbruck, Technikerstr. 25, A-6020 Innsbruck, Austria, heinrich.schatz@uibk.ac.at
2. Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, Ct. 06269, michael.mcaloon@uconn.edu
3. Institute of Arthropodology and Parasitology, Georgia Southern University, Statesboro, Georgia, 30460-8042, dhagan@georgiasouthern.edu



FIGS. 1-4. — *Eremaeozetes rogersi* n. sp., scanning micrograph of adult with cerotegument: 1. — lateral view. 2. — lateroventral view. 3. — dorsal view. 4. — laterodorsal view (Bar: FIGS. 1-4: 100 μm).

Samples containing detritus, soil and lichen were collected by removing fragments of topsoil and vegetative material from various areas in the wiregrass habitat. Additional specimens from Florida and Alabama from previous collections (see below) were sent to us for study.

The following conventions of measurement are used. *Total length:* measured in ventral view from anterior edge of cusp to posterior edge of notogastral plate; *Width:* measured immediately posterior to the pteromorph-like projections. Conventions of setal terminology follow SCHATZ (2001). As in most *Eremaeozetes* species, the present specimens are covered by a layer of cerotegument. For a detailed study of the surface structures, the cerotegument of some specimens was removed (cf. SCHATZ 2001). Scanning electron microscopy was used in order to obtain three dimensional images adapting the techniques of WOOLLEY (1971).

Eremaeozetes rogersi n. sp.
(FIGS. 1-14)

DIAGNOSIS: The adult instar of the new species differs from its congeners by the following combination of character states: surface covered by thick layer of cerotegument, anterior notogastral margin projecting anteriad, notogastral surface with a weakly elevated central field and lateral lobes, all notogastral and ventral setae short and setiform, posteromarginal setae situated on small tubercles, sclerotized scale present anteriad of genital plates, legs monodactylous.

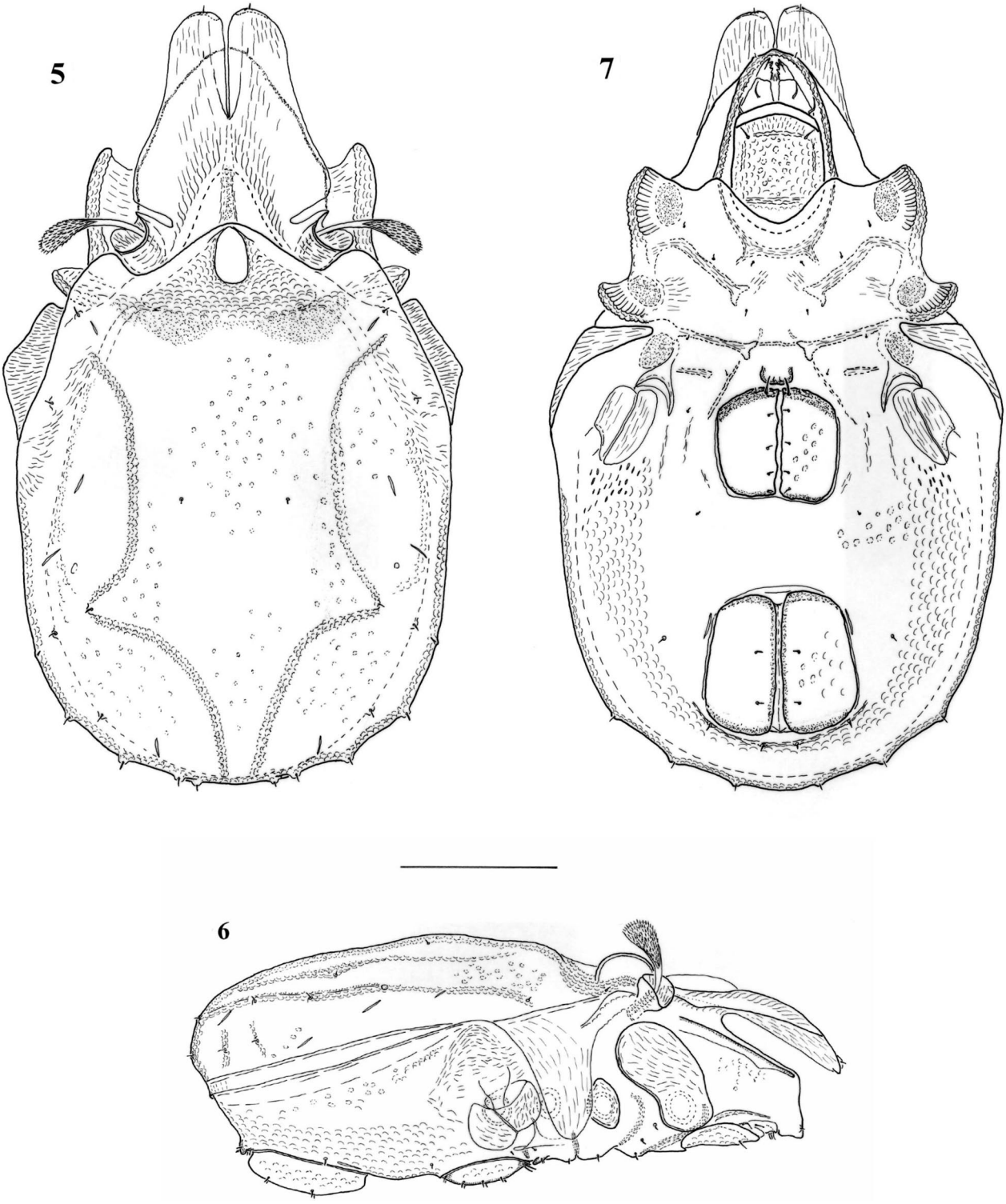
ADULTS (FIGS. 1-14): *Measurements*. Population from Georgia: females (n=14): 405-450 × 210-250 μm, males (n=15): 380-410 × 200-230 μm; specimens from Alabama: females (n=2): 375-380 × 200-203 μm, male (n=1): 355 × 185 μm; specimens from Florida: females (n=2): 380-400 × 198-200 μm, males (n=2): 360-380 × 185-190 μm.

Color and surface. Medium brown, with thick, patterned cerotegument covering major part of prodorsum, notogaster, ventral plate, gnathosoma and the afferent regions of the legs (FIGS. 1-4). Only sensilli, lenticulus, and posterior part of the interlamellar area uncovered. Anterior part of notogaster including humeral lobes and pteromorph-like projections covered with a broad ribbon of darker rugose cerotegumentary layers, forming a collar around posterior part of lenticulus. Beneath cerotegument notogastral surface similar in contour to that covered with cerotegumentary layer, but smoother in texture. After removal of cerotegument, surface appearing light brown and punctulate with small oval foveae.

Prodorsum (FIG. 5). Anterior part of prodorsum covered by large lamellae, rostrum visible by transparency, better in lateral or ventral view. Rostrum rounded, with a short and pointed apex dorsally. Tutorium terminating in a small cuspis. Lamellae long and broad blades, lamellar cusps reaching 20-30 μm anteriad of rostrum, anterior edges rounded, short apex curved ventrad. Cusps narrowly separated. Lateral edges of lamellae converging anteriad. Each cusp with an indistinct medial thickening dorsally, originating from the common base at prodorsum and leading anteriad. Interlamellar field containing indistinct and narrow V- like ridge, pointing anteriad towards the gap between cusps. No interlamellar apophysis.

Lamellar setae (*le*) situated on small tubercles on anterior edges of cusps, short (length 5 μm) and attenuating, directed anteriad. Rostral setae (*ro*) very short (length 2-3 μm) and attenuating, only visible in lateral or ventral view. No interlamellar setae or their insertions present. Bothridia large and directed posterolaterad, sensilli clavate, with thin stalk and broadened and flattened head, covered with small bristles. Total length of sensilli 60-65 μm, maximal width of head 10-12 μm.

Notogaster (FIGS. 5-6). Anterior notogastral margin projecting anteriad, forming an angle median at level of bases of sensilli. Humeral lobes large, subquadrangular. Ovular-shaped lenticulus situated close to anterior edge of notogaster, bulging. Light spot of lenticulus slightly elongated. Notogastral surface indistinctly sculptured with elevations and depressions; a semicircular hump surrounding depressed area posterior to lenticulus and running medially and tapering to a blunt point at posterior of notogaster. Medial hump forming an indistinct plateau; top of hump dorso-ventrally flattened. Hump sloping laterally into slight semicircular depressions



FIGS. 5-7. — *Eremaeozetes rogersi* n. sp. adult, cerotegument removed: 5. — dorsal view. 6. — lateral view, legs removed (except trochanter of leg IV). 7. — ventral view, legs removed (except trochanter of leg IV) (Bar: FIGS. 5-7: 100 μm).

on each side, circumscribed by lesser humps running parallel along each side. Pteromorph-like projections extending laterally and ventrad between legs II, III; distally tapering and curving inwards toward ventral plate, visibly longitudinally striated when cleared in lactic acid solution.

Notogastral setae arranged in ten pairs. Setae thin, all short (length 5-6 μm), smooth and attenuating, often hardly visible with cerotegumentary layer intact. Posteromarginal setae of rows *h* and *p* situated on small tubercles. Setae *lm* on central elevation. Lyrifissures *ia* situated anterior to setae *la*, lyrifissures *im* lateral to setae *lm*, lyrifissures *ip* between setae h_1 and h_2, lyrifissures *ih* lateral to setae h_3, and lyrifissures *ips* lateral to setae *lp*. Latero-abdominal glands (*gla*) posterior to lyrifissure *im*.

Lateral aspect (Fig. 6). Pedotectum I large, forming a broad scale, fixed posteriorly and ventrally and reaching dorsally to near bothridium. Pedotectum II a smaller scale, almost round, fixed posteriorly. Discidium large, with a ventral spine directed caudad. Posterodorsal of acetabulum IV a roof-like thickening present.

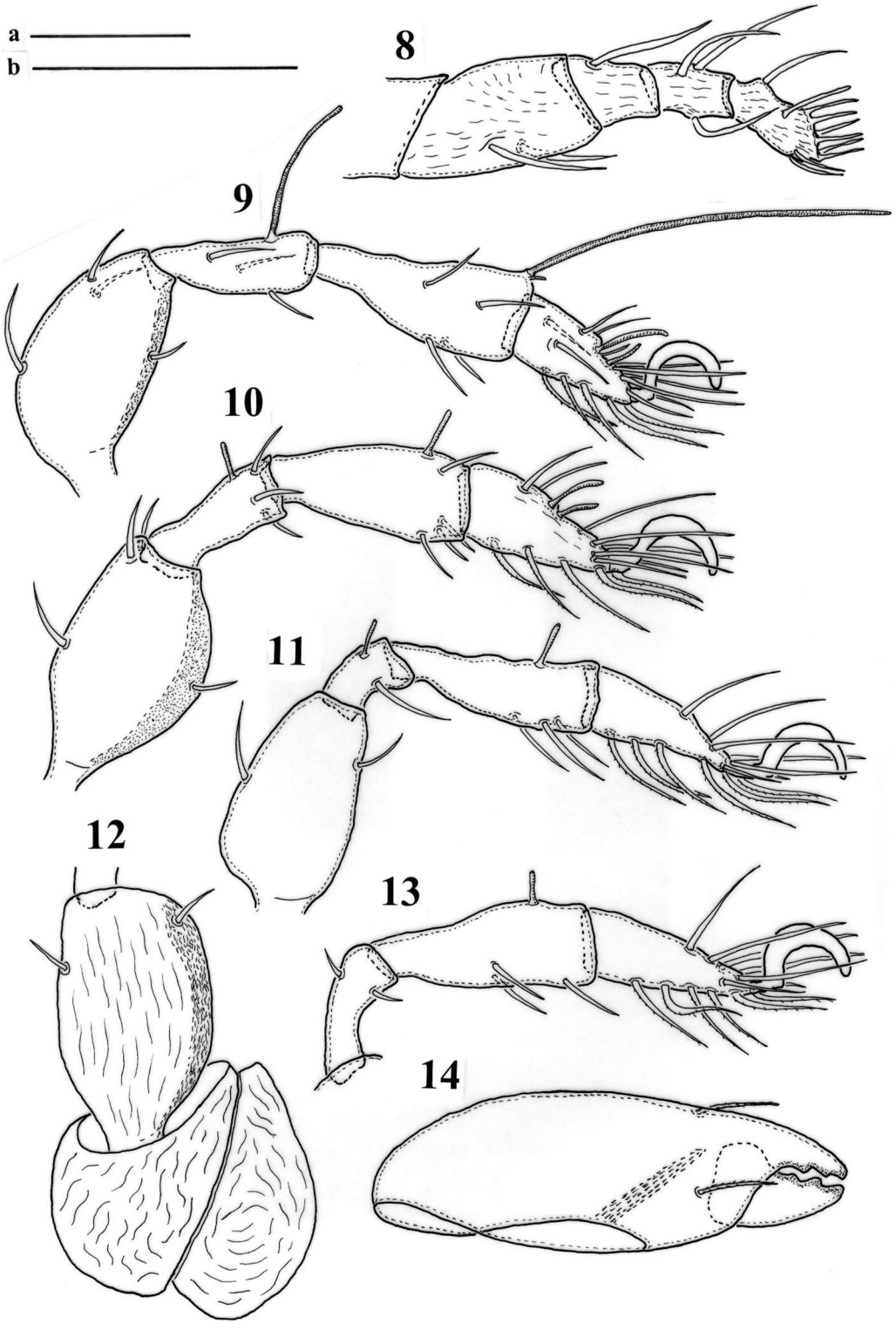
Gnathosoma (Fig. 7). Subcapitulum diarthric, mentum large (75 × 50 μm), surface foveate, distally and proximally with a transverse ridge each. Subcapitular setae attenuating, almost spiniform, setae *h* straight, length 8 μm, setae *m* and *a* curved proximad, length 12 μm each. Chelicerae (Fig. 14) of chelate-dentate type, size (n=6): 90-95 × 35-40 μm, length of movable digit 37-40 μm. Setae *cha* inserted paraxially near dorsal margin, directed anteriad, setae *chb* inserted abaxially lateral to movable digit, directed anteriad, length of cheliceral setae 12-16 μm. Trägårdh's organ tapering anteriad. Palps (Fig. 8) with long femur and long tarsus, setal formula (solenidion in parentheses): 0-2-1-3-9 (1).

Ventral region (Fig. 7). Apodemes I complete and fused medially, apodemes II and III as well as sejugal apodemes medially incomplete. Anterior to genital plates a well-developed sclerotized scale present, directed posteriad, 14-20 μm wide, surrounded laterally and anteriorly by ridges, latter seeming to connect sejugal apodemes medially and leading from inner tip of each sejugal apodeme posteriad towards lateral edges of genital plates. Epimeral setal formula 3-1-2-2, all setae attenuating, very short (length 2 μm). Anogenital setae attenuating. Genital plates with 6 pairs of setae, setae g_2 laterad of g_1, setae g_1 longer (length 10 μm) than other genital setae (3-5 μm); 1 pair of aggenital setae (length 2 μm), 2 pairs of anal setae (length 5 μm) and 3 pairs of adanal setae (length 5 μm) present. Adanal setae ad_1 and ad_2 situated on tubercles on a small ridge posterior to anal plate, setae ad_3 lateral to anal plates. Adanal lyrifissures (*iad*) adjacent and parallel to anal plates, level with their anterior third.

Legs (Figs. 9-13). All legs monodactylous with strong claws. Length (with claws) 150-180 μm (35-45 % of body size). Setal formula of legs (trochanter to tarsus, solenidia in parentheses): leg I 0 - 4 - 3 (1) - 4 (2) - 16 (2), leg II 0 - 4 - 3 (1) - 4 (1) - 13 (2), leg III 0 - 2 - 1 (1) - 3 (1) - 13, leg IV 0 - 2 - 2 - 3 (1) - 13. Femora with a strong ventral thickening, especially femora II and IV with a blade-like keel, trochanter IV with a large ventral scale. Length of solenidion ω_1 on tarsus I 14 μm, solenidion φ_1 on tibia I very long (70-75 μm), inserted on a large distal projection which also bears the solenidion φ_2, the latter short (length 6 μm). Length of solenidion σ on genu I 30 μm.

Sexual dimorphism, eggs. Females larger, some of them bearing one or two eggs. Dimensions of eggs (n=3): 130-145 × 60-80 μm, shape oval to elliptical, surface alveolate. Apart from adult size, no external sexual dimorphism could be observed.

Material examined. USA. Georgia: Coffee Co., Broxton Rocks Nature Preserve, sandstone outcrops, coll. F.M. McAloon; 15 Jan 1999. Ex: fern ally *Selaginella* mixed with *Cladonia christantella* lichen along a shaded pine forest/sandstone outcrop ecotone (756 adults). Florida: Baker Co., Olustee, Osceola National Forest, coll. F.A. Bennett, 10 Oct. 1974. Ex: litter under shrub oaks (2 adults, from collection R.A. Norton), Putnam Co., Hollister/Robert's Ranch, coll. E. Milstrey, 18 Apr. 1985. Ex: skirt around gopher-tortoise burrow (2 adults, from collection R.A. Norton). Alabama: Baldwin Co., Bon Secours N.W.R., Pine beach Trail, 30°14,8'N, 87°49,8'W, 13 Mar. 1994, coll. V. Behan. Ex: moss, reindeer moss and other lichens on sand (3 adults, from Canadian National Collection).



FIGS. 8-14. — *Eremaeozetes rogersi* n. sp. adult: 8. — pedipalp. 9. — leg I, femur — tarsus. 10. — leg II, femur — tarsus. 11. — leg III, femur — tarsus. 12. — leg IV, trochanter and femur. 13. — leg IV, genu — tarsus. 14. — chelicera. All appendages in abaxial aspect (Bar a — FIG. 8: 20 μm, Bar b — FIGS. 9-14: 50 μm).

The alcohol-preserved holotype (type locality: Broxton Rocks Nature Preserve, Coffee County, Georgia, USA, 31°43,2'N, 82°51,0'W), and paratypes from the same site are deposited at the National Museum of Natural History, Washington, D.C. Additional paratypes in the University of Connecticut Biological Collections, Storrs, Connecticut.

Remarks. The new species belongs to the "*Eremaeozetes-reticulatus* group" (Schatz, 2003), an *Eremaeozetes* species group with longitudinal ridges on the notogaster separating a central field and lateral lobe-like extensions, a medial ridge on the posterior part of the notogaster, a scale anterior to the genital plates, and monodactylous legs. This combination of character states is also present in *E. araucana* Monetti, Oppendisano and Fernandez, 1994 (Argentina), *E. lineatus* Mahunka, 1985 (Mexico, Lesser Antilles), *E. louisae* Schatz, 2003 (South Africa), *E. machadoi* Mahunka, 1989 (Angola, South Africa), *E. nasutus* Schatz, 2003 (South Africa), *E. reticulatus* Balogh, 1958 (Angola, I. Pagalu), and *E. sabinae* Schatz, 2000 (Hawaii). In *E. rogersi* n. sp. the projecting fields and ridges are more weakly expressed than in any other species of this group. The new species is morphologically similar to *E. lineatus* Mahunka, 1985, but it differs from the latter in having a broader and weaker central hump on the notogaster, setae *lm* situated on this elevation, and a smaller sclerotized scale anterior to genital plates. Among other congeners with a sclerotized pregenital scale the species *E. acutus* Covarrubias, 1967 (Chile), *E. darwini* Schatz, 2000 (Galapagos I.), and *E. roguini* Mahunka, 1998 (Lesser Antilles, Costa Rica, Cocos I.) are without projecting fields or ridges on notogaster. The new species differs from the other *Eremaeozetes* species by the characters described herein.

The specimens found in Alabama, Florida, and Georgia are considered conspecific. A minor difference is the slightly smaller body size of the specimens from Alabama and Florida.

Derivatio nominis. The new species has been named in honor of Dr. George A. Rogers, Professor Emeritus and distinguished naturalist, Georgia Southern University, Statesboro, Georgia.

Acknowledgements

Dr. Roy A. Norton, Syracuse, New York, and Dr. Valerie M. Behan-Pelletier, Ottawa, Ontario, kindly sent specimens from Florida and Alabama to one of us (HS) for examination. The authors also wish to thank Dr. John D. Spooner, Aiken, South Carolina and Frankie Snow, Douglas, Georgia for their guidance and assistance at the collection site in Georgia. Funding was provided in part by The Nature Conservancy of Georgia.

REFERENCES

Berlese (A.), 1913. — Acari Nuovi, Manipoli VII -VIII. — Redia (Firenze), **9**:92.

Elias (S. A.), 1994. — Quaternary Insects and Their Environments. — Smithsonian Institution Press, Washington D.C., p. 34.

Marshall (V.G.), Reeves (R.M.) & Norton (R.A.), 1987. — Catalogue of the Oribatida (Acari) of Continental United States and Canada. — Memoirs of the Entomological Society of Canada, **139**, 418 pp.

Norton (R.A.) & Poinar (G.O.), 1993. — Reassessment and new records of oribatid mite fossils from tertiary neotropical amber. — Acarologia, **34**: 57-68.

Schatz (H.), 2001. — *Eremaeozetes capensis* n. sp. (Acari: Oribatida: Eremaeozetidae) from South Africa. — International Journal of Acarology, **27**: 101-106.

Schatz (H.), 2003. — On some species of *Eremaeozetes* Berlese 1913 (Acari Oribatida Eremaeozetidae) from South Africa. — Tropical Zoology (Firenze), **16**: 113-131.

Woolley (T.A.), 1971. — Scanning electron microscopy of oribatid mites. — Proceedings of the 3rd International Congress of Acarology (Prague): 55-60.