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A revision of the genus *Gymnetina* Casey, 1915 (Coleoptera: Scarabaeidae: Cetoniinae: Gymnetini)

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A revision of the genus *Gymnetina* Casey, 1915
(Coleoptera: Scarabaeidae: Cetoniinae: Gymnetini)

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A revision of the genus *Gymnetina* Casey, 1915
(Coleoptera: Scarabaeidae: Cetoniinae: Gymnetini)

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Abstract. The genus *Gymnetina* Casey (Coleoptera: Scarabaeidae: Cetoniinae: Gymnetini) is redescribed and revised. Three **new species** and one **new subspecies** are described: *G. borealis* Warner and Ratcliffe, *G. grossepunctata* Ratcliffe and Warner, *G. howdeni* Warner and Ratcliffe, and *G. cretacea sundbergi* Warner and Ratcliffe. *Gymnetina salicis* (Bates), **new status**, is removed from synonymy with *G. cretacea* (LeConte), and *G. alboscripta* (Janson) is transferred from *Gymnetis* MacLeay to *Gymnetina* becoming *Gymnetina alboscripta* (Janson), **new combination**. Redescriptions of previously known species, a key for identification, and illustrations of the six species are provided. A brief biogeographical analysis suggests that ancestral taxa dispersed northwards from Guatemala and Mexico to the southwestern United States.

*Few things indeed have I known in the way of
emotion or appetite, ambition or achievement,
that could surpass in richness and strength
the excitement of entomological exploration.*

— V. Nabokov

Introduction

Schenkling (1921) recognized seven tribes of Cetoniinae (Coleoptera: Scarabaeidae) in the *Coleopterorum Catalogus* (not including Trichiini and Valgini). Krikken (1984) redefined the subfamily to include twelve tribes. Five of these tribes occur in North America: Cetoniini, Gymnetini, Trichiini, Valgini, and Cremastocheilini (Ratcliffe 2002). The tribes not occurring in North America are: Xiphoscelidini (Africa and Madagascar), Stenotarsiini (Madagascar), Schizorhinini (Australia, Oriental), Goliathini (Africa, Oriental, Madagascar, two genera and three species in Mexico [if they are true Goliathini]), Diplognathini (Africa, Oriental), Phaedimini (Oriental), and Taenioderini (Oriental, Australia, Palearctic).

Depending on the source, the tribe Gymnetini is currently comprised of 24 genera in the New World (Krikken 1984), or 25 genera (Hardy 1975, 1987), or 27 genera (Krajcik 1998). The New World Gymnetini are distributed from the eastern and central United States south to Argentina (Blackwelder 1944). Keys to the tribes of Cetoniinae and subtribes of Gymnetini can be found in Krikken (1984).

Casey (1915) established the genus *Gymnetina* as a subgenus of *Gymnetis* MacLeay, 1819, to receive *Gymnetis cretacea* LeConte. *Gymnetina* was raised to generic level by Martínez (1949).

Methods

In order to ascertain species limits (both morphological and geographical), we examined 255 specimens of *Gymnetina* species from the research collections listed below. The collections and their acronyms (as given in Arnett et al. 1993) follow below; we have provided *ad hoc* codens for those not listed. The curators and/or collection managers who provided the material are also indicated.

- ADMC Alan Mudge collection (Jefferson, OR)
 AMIC Antonio Martínez collection then at Salta, Argentina (currently at CMNC) (A. Martínez)
 AMNH American Museum of Natural History, New York, NY (Lee Herman, Jr.)
 ASUT Arizona State University, Tempe, AZ (Aaron Smith)
 BCRC Brett C. Ratcliffe collection (Lincoln, NE)
 BMNH The Natural History Museum, London, England (Malcolm Kerley, Michael Bacchus, Max Barclay).
 CASC California Academy of Sciences, San Francisco, CA (Norman Penny, David Kavanaugh).
 CMNC Canadian Museum of Nature, Ottawa, CANADA (François Génier, Robert Anderson)
 CMNH Carnegie Museum of Natural History, Pittsburgh, PA (John Rawlins, Robert Davidson)
 CNCI Canadian National Collection of Insects, Ottawa, Canada (Jean McNamara)
 CUIC Cornell University Insect Collection, Ithaca, NY (James Liebherr, E. Richard Hoebeke)
 DNAC Donald N. Ahart collection (Glendale, AZ)
 DWSC Dan Sundberg collection (San Antonio, TX)
 ECDC University of California, Davis, CA (Steve Heydon)
 EMEC Essig Museum of Entomology, University of California, Berkeley, CA (Sheryl Barr)
 FMNH Field Museum of Natural History, Chicago, IL (Al Newton, Margaret Thayer)
 FWSC Frederick Skillman, Jr. collection (Pearce, AZ)
 FSCA Florida State Collection of Arthropods, Gainesville, FL (Paul Skelley)
 HAHC Henry & Anne Howden collection (now at CMNC)
 JMSC José Monzón collection (Guatemala City, Guatemala)
 JPHC J. Huether collection (Geneva, NY)
 LACM Los Angeles County Museum of Natural History, Los Angeles, CA (Brian Brown)
 MAMC Miguel A Morón collection (Xalapa, Mexico)
 MCZC Museum of Comparative Zoology, Harvard University, Cambridge, MA (Scott Shaw, David Furth, Phil Perkins)
 MNHN Museum National d'Histoire Naturelle, Paris, France (Jean Menier, Roger-Paul Dechambre).
 OSUC Ohio State University, Columbus, OH (Charles Triplehorn)
 PHSC Patrick Sullivan collection (Sierra Vista, AZ)
 RACC Richard Cunningham collection (Chino, CA)
 RHMC Ron H. McPeak collection (Battleground, WA)
 RLWE Richard L. Westcott collection (Salem, OR)
 RMBC Michael Brattain collection (Lafayette, IN)
 RMNH Nationaal Natuurhistorisch Museum, Leiden, Netherlands (Jan van Tol)
 SDMC San Diego Museum of Natural History, San Diego, CA (Rebecca Watts, David Faulkner)
 SEMC Snow Entomological Museum, University of Kansas, Lawrence, KS (Robert Brooks, Zack Falin)
 SMCC Scott McCleve collection (Douglas, AZ)
 UAIC University of Arizona, Tucson, AZ (Carl Olson)
 UCMC University of Colorado, Boulder, CO (Url Lanham)
 UCRC University of California, Riverside, CA (Doug Yanega)
 UNAM Universidad Nacional Autónoma de México, Mexico City, Mexico (Santiago Zaragoza)
 UNSM University of Nebraska State Museum, Lincoln, NE (Brett Ratcliffe)
 USNM U. S. National Museum of Natural History (currently at UNSM, Brett Ratcliffe)
 UVGC Universidad del Valle, Guatemala City Guatemala (José Monzón)
 WBWC William B. Warner collection (Chandler, AZ)
 ZMHU Museum für Naturkunde, Berlin, Germany (Manfred Uhlig, Joachim Schulze, Hella Wendt, Joachim Willers).
 ZSMC Zoologische Staatssammlung, Munich, Germany (Gerhard Scherer, Max Kuhbandner)

The generic and species descriptions were based on the following characteristics: length from apex of clypeus to apex of elytra; width across humeri; color and markings; interocular width (number of transverse eye diameters across the frons); form and sculpturing of the head, pronotum, mesepimeron, elytra, and pygidium; form of the antennae; armature of the protibia; form of the mesometasternal process; sculpturing and color of the abdominal sternites; and form of the male parameres. Punctures are considered simple unless otherwise noted. Ocellate punctures are ringed with a slightly different color tone.

Minute punctures are generally not seen with 12.5 X magnification, but are easily seen with 50 X magnification. Small punctures are easily seen with 12.5 X magnification and can be seen with the naked eye. Large punctures are easily seen without the aid of instruments. Sparse punctures are characterized by numerous puncture diameters between them. Punctures moderate in density have 3-5 puncture diameters between them. Dense punctures have only 1-2 puncture diameters between them or less.

The sex of *Gymnetina* specimens can usually be determined using external characters. The protibia in males is relatively slender, whereas in females the protibia is slightly broader. In lateral view, males have an abdomen slightly to distinctly concave, whereas in females the abdomen is flat to slightly convex. Lastly, the last abdominal sternite in males is sparsely to moderately punctate, but in females this sternite is densely punctate to rugopunctate.

For new species descriptions, label data is quoted verbatim, and a double slash (//) indicates a break between two labels. Geographical localities are arranged alphabetically by state and county for the U.S.A. and by state, province, or department for other countries and then alphabetically by locality within each political unit. Temporal data are provided, but these data should be used with caution because many specimens in old collections lack these data and because collecting events are not evenly distributed in space and time.

We use the phylogenetic species concept as outlined by Wheeler and Platnick (2000). This concept defines species as the smallest aggregation of (sexual) populations diagnosable by a unique combination of character states.

Gymnetina Casey, 1915

Gymnetina Casey 1915: 284 (as a subgenus of *Gymnetis*). Type species: *Gymnetina cretacea* (LeConte, 1863) by monotypy. Elevated to generic level by Martínez (1949).

Description. Scarabaeidae, Cetoniinae, Gymnetini. **Form:** Rhomboidal, robust, sides slightly tapering from humeri towards apex of elytra, dorsum nearly flat. Color black to dark reddish brown, shiny, with cretaceous spots or bands on, variably, pronotum, elytra, pygidium, mesepimeron, metepisternum, metacoxa, and abdominal sternites. Surface of pygidium with short setae. **Head:** Shape subrectangular, longer than wide. Clypeus broadly truncate, apical angles broadly rounded, sides constricted just before antennal insertion, frons weakly, longitudinally tumid at middle. Antenna 10-segmented. **Pronotum:** Shape subtrapezoidal, widest near base, gradually convergent to anterior angles, basomedian lobe strongly produced, lobe covering all but tip of scutellum. Sides margined, anterior and basal margins lacking bead. **Elytra:** Widest at base, posthumeral emargination distinct. Bead present on lateral margin. **Pygidium:** Surface concentrically rugulopunctate, nearly flat to weakly convex. **Venter:** Mesometasternal process short, ventral surface flat with respect to ventral axis of body, apex broadly rounded. Males with abdomen distinctly concave in lateral view. Females with abdomen flat to slightly tumescent; last sternite densely punctate to transversely rugulopunctate. **Legs:** Protibia usually tridentate in both sexes (teeth reduced to obsolete in males of *G. cretacea*), teeth variably spaced. Femora and meso- and metatibiae with dense fringe of black setae. Metatibia at apex with 3 rounded to subacute teeth and with 2 long, acute spurs in males, shorter spur with slightly rounded apex in females. **Parameres:** In caudal view, form of both together subrectangular, apices rounded, with small tooth apicolaterally.

Diagnosis. Species of *Gymnetina* are distinguished by a shiny, black surface with cretaceous spots or bands on, variably, the pronotal lateral margin, elytra, pygidium, mesepimeron, metepisternum, metacoxa, and abdominal sternites; subtruncate to truncate to rounded clypeal apex; frons weakly and longitudinally tumid at middle (lacking armature); tridentate protibia (teeth occasionally reduced); and a broad, flat, apically rounded mesometasternal process parallel to the ventral axis of the body. With the exception of some species of *Amithao* Thomson and *Halffterinetis* Morón and Nogueira, no other species of New World Gymnetini have cretaceous spots or bands on a black, shiny body surface. All other American Gymnetini have a velutinous body surface or are shiny with a different color and lacking white, chalky marks. *Gymnetina* species are easily distinguished from *Amithao* Thomson species because the apex of the clypeus is broadly subtruncate to truncate to rounded in *Gymnetina* species, while in *Amithao* species it is deeply emarginate. Males of *Halffterinetis gonzaloi* Morón and Nogueira are similarly colored to

Gymnetina species, with a black, shiny integument and cretaceous markings along the lateral pronotal margins and a cretaceous spot on each side of the pygidium. However, *Halffterinetis* species are smaller, lack a distinct mesometasternal process, and males lack apicolateral teeth on the parameres.

Distribution. Species of *Gymnetina* are known from the southwestern United States to Guatemala.

Key to the Species of Adult *Gymnetina* Casey, 1915

1. Pronotum and elytra with large, dense, mostly confluent punctures. Dorsal surface completely black. Guatemala ***G. grossepunctata* Ratcliffe and Warner, new species**
- Pronotum with minute to small punctures; if with punctures moderate in size then also with cretaceous bands along lateral margins. Elytra sparsely to moderately punctate on disc with punctures becoming denser on sides but never completely, coarsely punctate; cretaceous marks present or not. Mexico and USA **2**

- 2(1). Elytron with 2 large, round, cretaceous spots in transverse row just behind middle (Fig. 11a); rarely, spots reduced to a single, submarginal spot (Fig. 11b) or spots fused (Fig. 11c). Male with protibial teeth reduced to obsolete. Parameres (ventral view) lacking prominent tooth at base (Fig. 14) **3**
- Elytron with slender or broad, cretaceous band just behind middle (Fig. 25a); rarely broken into 2 irregular spots (Fig. 25b) or with small, cretaceous flecks or without cretaceous marks. Male protibial teeth not reduced. Parameres (ventral view) with distinct tooth at base (Fig. 28) .. **4**

- 3(2). Pronotum with broad, cretaceous band along lateral margins (Fig. 11). Mesepimeron usually with cretaceous spot. Pygidium with large, cretaceous spot either side of middle. SE Arizona, extreme SW New Mexico, and Chihuahua and Durango, Mexico ***G. cretacea cretacea* (LeConte)**
- Pronotum with slender, partial, cretaceous band along lateral margins (Fig. 15) or lacking cretaceous marks altogether. Mesepimeron never with cretaceous spot. Pygidium with or without cretaceous spot either side of middle. Doña Ana Co. New Mexico ***G. cretacea sundbergi* Warner and Ratcliffe, new subspecies**

- 4(2). Pronotum with broad, cretaceous band along lateral margins (Fig. 25). Elytron with broad, cretaceous, transverse band just behind middle. SE Arizona, SW New Mexico, and Chihuahua and Sonora, Mexico ***G. howdeni* Warner and Ratcliffe, new species**
- Pronotum with slender, cretaceous band along lateral margins (Fig. 1) or without any cretaceous marks. Elytron with slender, cretaceous, transverse band just behind middle or with a small, cretaceous fleck near lateral margin (rarely with 2 small flecks traversing elytron) **5**

- 5(4). Pygidium without cretaceous spots (Fig. 7). Central Arizona and New Mexico ***G. borealis* Warner and Ratcliffe new species**
- Pygidium with cretaceous spot either side of middle. Durango to Oaxaca, Mexico **6**

- 6(5). Mesepimeron usually with cretaceous spot. Elytron with slender, sinuate, transverse, cretaceous band just behind middle (band rarely broken). Males with cretaceous spot on posterolateral margin of sternites 1-4 (variably reduced) AND on anterior margin of sternites 2-5 either side of middle (variably reduced, but always with at least 1 spot). Southern Mexico ***G. alboscripta* (Janson)**
- Mesepimeron without cretaceous spot. Elytron with single, small, cretaceous spot near lateral margin just behind middle. Males with cretaceous spot on posterolateral margin of sternites 1-4 (variably reduced) but never with second set of cretaceous marks on sternites 2-5 either side of middle. Mexico ***G. salicis* (Bates)**

***Gymnetina alboscripta* (Janson, 1878), new combination**

(Fig. 1-4, 32, 41)

Gymnetis alboscripta Janson 1878: 301. Original combination. Holotype female examined by BCR at RMNH.

Description. Length 18.0-24.4 mm; width across humeri 10.0-15.0 mm. Color of head, pronotum, and pygidium black, shiny. Pronotum on lateral margin with slender, cretaceous band, band occasionally broken. Mesepimeron black along anterior edge, cretaceous along posterior margin (entirely black in 1 female). Metepisternum black with partial or complete cretaceous ring along margins. Elytron dark reddish brown to piceous (rarely black), with transverse, slender, sinuous, cretaceous band behind middle extending almost entire width of elytron (Fig. 1), band rarely broken. Pygidium with large, subtriangular, cretaceous spot on each side, rarely spot reduced (absent in 1 female examined). Sternites 1-4 each with small to large, cretaceous spot or band on posterolateral margin; sternites 2-5 in males each usually with small to large, transverse, cretaceous spot or band on anterior margin either side of middle (Fig 2), some spots variably absent. Legs and venter black. **Head:** Lateral margins weakly elevated. Surface densely punctate on frons, clypeus moderate in density; punctures small to moderate on frons, moderate to large on clypeus, setigerous (when not abraded away); setae short, moderate in density, black. Occiput smooth, shiny. Frons with weak (sometimes obsolete), median, longitudinal swelling. Clypeus with apex broadly subtruncate, strongly reflexed, sides weakly constricted just before antennal insertion. Interocular width equals 4.8-5.0 transverse eye diameters (slightly larger in 1 female). Antenna with 10 segments, club slightly longer than antennomeres 1-7 in males, subequal in length to antennomeres 2-7 in females. **Pronotum:** Surface impunctate or sparsely, minutely punctate on central third, punctures becoming large (some ocellate) and moderate in density on lateral thirds where setigerous (when not abraded away); setae sparse, short, black. Mesepimeron dorsally and on anterior face with sparse to dense, mostly large, setigerous punctures; setae short, black. **Elytra:** Surface almost smooth on disc behind scutellum to about middle of elytra, elsewhere with punctures glabrous, moderate in size and density (some in discernable striae), punctures becoming dense and large (some ocellate) laterally; sides near lateral margins, apical umbone laterally, and apical angles finely rugose. Apical umbone pronounced. Apices subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous; setae very dense, short, black. In lateral view profile nearly flat. **Venter:** Setae brown to mostly black. Mesometasternal process flat on ventral surface, apex broadly rounded, anterior face oblique at about 45° to longitudinal axis of body. Abdominal sternites each with center sparsely and minutely punctate, lateral margins moderately to densely punctate; punctures mostly large with black setae. **Legs:** Protibia slender in males, broader in females, tridentate in both sexes, basal 2 teeth closer to one another than is apical tooth to median tooth. **Parameres:** In ventral view, base of each paramere with small but distinct, basally projecting tooth (Fig. 3-4).

Distribution (Fig. 32). This species has been found only in southern Mexico, and the type specimen was described from "Oaxaca." 25 specimens examined from AMIC, BCRC, BMNH, CNCI, FMNH, HAHC, MAMC, MNHN, PHSC, RMNH, UCMC, UNAM, ZMHU.

MEXICO (25): GUERRERO (1): Amula. HIDALGO (1): Real del Monte. MEXICO (1): Coatlinchan. JALISCO (1): Autln. MORELOS (2): Almolonga, Oacalco, No data. OAXACA (10): Juquila Mixes, Matias Romero, Mitla, Oaxaca, No Data. TABASCO (3): Paraiso. VERACRUZ (2): Catemaco, No Data.

NO DATA (4).

Temporal Distribution. March (3), May (1), June (4), July (3), September (1). Too few specimens have label data with the month of collection to indicate a reliable temporal distribution.

Diagnosis. *Gymnetina alboscripta* is distinguished by a pronotum with a slender, cretaceous band along lateral margins; elytra with a slender, cretaceous, transverse band just behind middle (Fig. 1); and mesepimeron usually with a cretaceous spot. Males, like those of *G. howdeni*, have a cretaceous spot on the posterolateral margin of sternites 1-4 (variably reduced) and on the anterior margin of sternites 2-5 either side of middle (variably reduced, but always with at least 1 spot). Unlike *G. howdeni*, they do not



Figures 1-4. *Gymnetina alboscripta*: 1-2) Dorsal and ventral views, respectively. 3-4) Dorsal and ventral views, respectively, of parameres. Note distinct tooth at base of paramere on ventral side (arrow).

have the broad, cretaceous bands on the pronotum and elytra. The single, large female from Hidalgo lacked the cretaceous spots on the pygidium, and so would not fit in our key, but it matches all of the other characters for *G. alboscripta*.

Gymnetina alboscripta differs from *G. salicis* by the presence of a cretaceous spot on the mesepimeron (absent in *G. salicis*) and by the presence on the elytra of a slender, sinuate, transverse, cretaceous band (Fig. 1) (elytra with single, small, cretaceous spot near lateral margin in *G. salicis*; Fig. 29). Males of *G. alboscripta* always have, even if reduced, a second, more median set of cretaceous spots on the abdominal sternites (Fig. 2), whereas *G. salicis* males never have a second set of these marks.

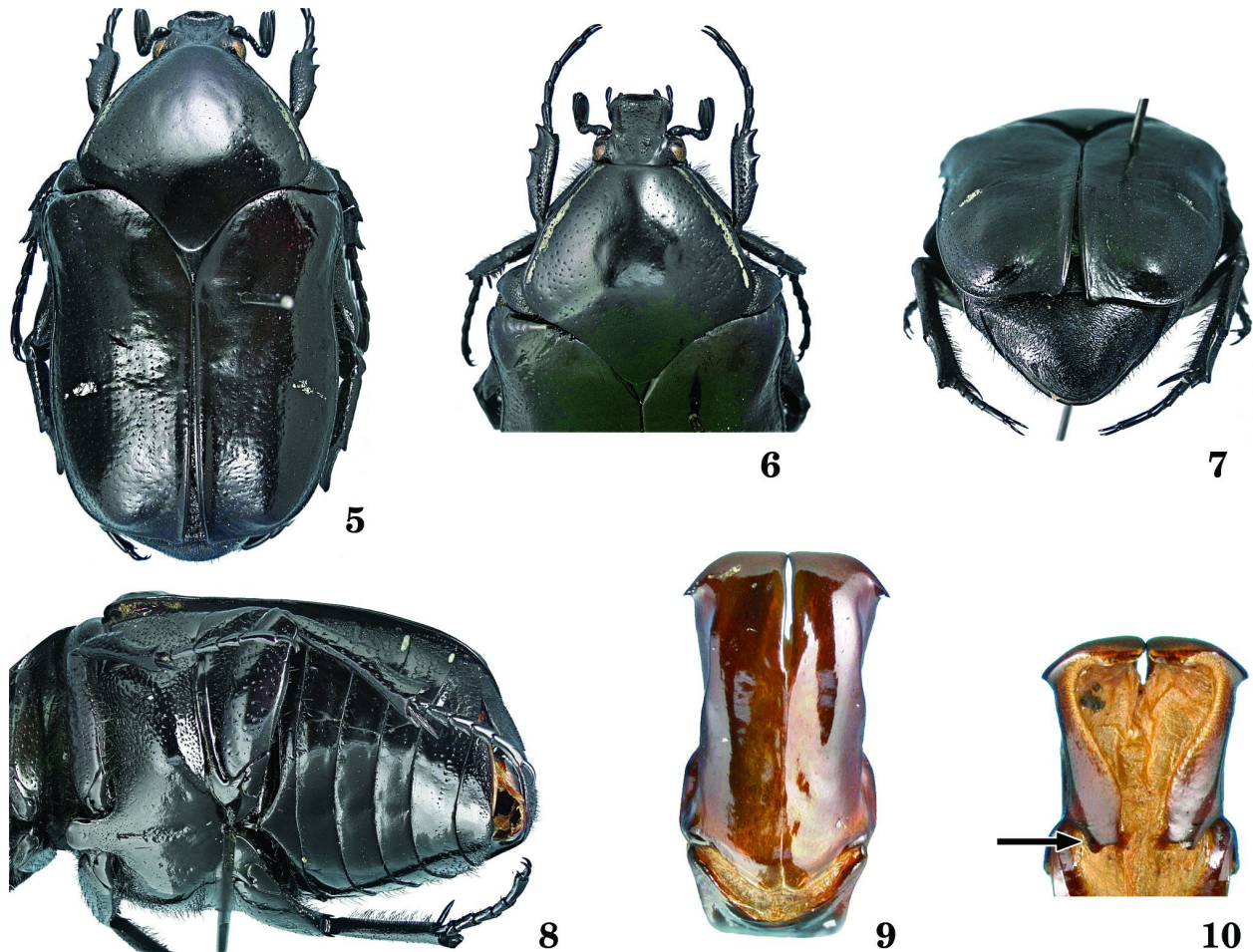
Biology. Nothing is known of the biology of this uncommon species. The Jalisco specimen was taken at 1700 m in pine/oak forests (Rivera and Garcia 2008).

Remarks. Bates (1888) transferred *Gymnetis alboscripta* to *Cotinis* Burmeister. Krajcik (1998) erroneously placed *G. alboscripta* in both *Cotinis* and in *Gymnetosoma* Martínez, and he included *G. salicis* (Bates) and *Amithao distigma* Schoch as junior synonyms. This species clearly belongs in the genus *Gymnetina* because of the traits characterizing this genus. The Jalisco specimen, taken at 1700 m, was erroneously identified as *G. cretacea* (Rivera and Garcia 2008), but there was a photograph that confirms its identification.

***Gymnetina borealis* Warner and Ratcliffe, new species**
(Fig. 5-10, 32)

Type Material. Holotype male, labeled “Oak Creek Canyon, Coconino Co., Ariz., July 20, 1970//*Gymnetis* cretacea, Det. M. DeLisle” and with our red holotype label. Allotype female labeled “Flagstaff, Ariz., 8-11-35” and with our red allotype label.

Paratypes labeled as follows: “White Mts. Ariz, DKDuncan Coll//September//D K Duncan Collection” (1 male); “base of Pinal Mts, Ariz//May, DKDuncan” (1 male); “Ariz. Oak Cr. Canyon 6000 ft, 25-VII-1936, Owen Bryant” (1 male); “Prescott Ariz, 8/10/62, R. C. Willis” (1 male); “Arizona VIII-5-1975, ex stock pond on road to Diamond Point lookout off of Control Rd. E of Payson, Gila county//Collector Don Ahart” (1 male); “Pinal Mts. Ariz., IX-19. 1935, Parker, Lot//F. H. Parker Collection, #13923” (1 female); “Sierra Ancha Mts Ariz//Sep DKDuncan” (1 female) “New Mexico. F. H. Snow.” (2 males); “Water Cyn. 21 Mi. E. (sic; actually west) Socorro, New Mex., Socorro Co., VIII-15-68, J. Doyen” (1 female); “Jemez Mts, VII-17,



Figures 5-10. *Gymnetina borealis*: 5-6) Dorsal views, showing reduced cretaceous pattern on pronotum, mesepimeron, and elytra as well as sparse, small punctures on pronotal disc. 7) Caudal view showing sculpturing and absence of markings. 8) Oblique ventral view showing broader apex of mesometasternal process and reduced cretaceous spots on sides of abdomen. 9-10) Dorsal and ventral views, respectively, of parameres. Note distinct tooth at base of paramere on ventral side (arrow).

N.M.//Jno. Woodgate Collector//J. W. Green Collection" (1 female); "20miSW. Silver City, New Mex., Grant Co., Aug. 1, 1996, D. W. Sundberg" (1 female). Paratypes with our yellow paratype labels.

Holotype and allotype deposited at UNSM. Paratypes deposited at ADMC, BCRC, CASC, DNAC, RMBC, SEMC, UAIC, UNSM, and WBWC.

Holotype. Male. Length 22.6 mm; width across humeri 12.9 mm. Color entirely black, shiny, except for the following: pronotum on lateral margin with slender, cretaceous band (Fig. 6). Elytra dark reddish brown, each with small, transverse, cretaceous spot on sides above level of sternite 2 (Fig. 5). Metepisternum with cretaceous spot (dulled by grease) on anterior margin. Sternites 1-4 each with small, transverse, cretaceous spot on posterolateral margin (Fig. 8). Metacoxa with cretaceous spot (dulled by grease) on dorsal edge at front. **Head:** Lateral margins distinctly elevated. Surface moderately densely punctate; punctures moderate to large, with some minute setae on frons either side of middle. Occiput smooth, shiny. Frons with weak, median, longitudinal tumescence extending to base of clypeus. Clypeus with apex broadly truncate, strongly reflexed, sides distinctly constricted just before antennal insertion. Interocular width equals 4.7 transverse eye diameters. Antenna with 10 segments, club subequal in length to antennomeres 1-7. **Pronotum:** Surface moderately densely punctate except for disc which is impunctate to sparsely punctate; where dense, punctures mostly large, glabrous. Mesepimeron dorsally

and on anterior face rugopunctate, setigerous; setae black, short. **Elytra:** Surface punctate; punctures round, weakly ocellate, moderately large, glabrous, sparse near suture and becoming progressively denser towards lateral margin where weakly rugose. Apical umbone pronounced. Apices subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous (Fig. 7); setae short, dense, black. In lateral view surface weakly convex. **Venter:** Setae black. Mesometasternal process flat on ventral surface, apex broadly rounded, anterior face sloped at about 45° to longitudinal axis of body. Abdominal sternites each with moderately dense, large punctures along lateral margin; middle impunctate. **Legs:** Protibia tridentate, apical 2 teeth slightly closer to one another than is basal tooth to median tooth. **Parameres:** In ventral view, base of each paramere with small but distinct, basally projecting tooth (Fig. 9-10).

Allotype. Female. Length 20.3 mm; width across humeri 11.3 mm. As holotype except in the following respects: **Color:** Pronotum on lateral margin with cretaceous band broken. Elytra and pygidium reddish brown. Sternites 1-4 on right side and sternites 1-3 on left side each with small, transverse, cretaceous spot on posterolateral margin. **Head:** Frons and base of clypeus setigerous; setae sparse, short, reddish brown. Interocular width equals 5.6 transverse eye diameters. **Legs:** Protibia slightly wider.

Variation. Males (7 paratypes). Length 20.0-23.0 mm; width across humeri 10.5-13.0 mm. As holotype except in the following respects: **Color:** Pronotum on lateral margin with cretaceous band absent in 1 specimen. Elytra dark reddish brown and with short, transverse, cretaceous band and a small, irregularly shaped cretaceous spot in 2 specimens. Metepisternum completely cretaceous in 2 specimens (New Mexico). Sternites 1-3 with cretaceous spot in 1 specimen. Metacoxa on dorsal edge at front without cretaceous spot in 2 specimens. **Head:** Surface with sparse, short setae on frons in 2 specimens. **Elytra:** Surface moderately densely punctate near suture in 1 specimen. Apices acutely produced in 2 specimens (New Mexico). **Legs:** Protibia with teeth subequally spaced in 3 specimens.

Females (5 paratypes). Length 20.4-23.3 mm; width across humeri 11.3-13.2 mm. As allotype except in the following respects: **Color:** Pronotum on lateral margin with cretaceous band broader in 2 specimens (New Mexico). Elytra dark reddish brown and with short, transverse, cretaceous band and a small, irregularly shaped cretaceous spot in 3 specimens (New Mexico). Sternites 1-3 with cretaceous spot in 1 specimen and sternites 1-4 with cretaceous spot in 1 specimen. Metepisternum with cretaceous spot on anterior margin in 4 specimens. Metacoxa on dorsal edge at front with cretaceous spot in all specimens. **Head:** Frons lacking setae in 1 specimen (probably worn away). Interocular width equals 5.0-5.6 transverse eye diameters.

Etymology. From the Greek *boreios*, referring to northern. Hence, the northern *Gymnetina* in reference to this, the most northerly occurring *Gymnetina* species.

Distribution (Fig. 32). *Gymnetis borealis* occurs in the mountains of central Arizona and central and north central New Mexico. 14 specimens examined from ADMC, BCRC, CASC, DNAC, RMBC, SEMC, UAIC, UNSM, and WBWC.

UNITED STATES (14): ARIZONA (9): Coconino Co. (3): Flagstaff, Oak Creek Canyon. **Gila Co.** (4): Diamond Point Lookout east of Payson, Pinal Mountains, Sierra Ancha Mountains. **Navajo Co.** (1): White Mountains. **Yavapai Co.** (1): Prescott. **NEW MEXICO (5): Rio Arriba Co.** (1): Jemez Mountains. **Grant Co.** (1): Silver City. **Socorro Co.** (1): Water Canyon (21 mi. W of Socorro). **No Data** (2).

Temporal Distribution. May (1), July (3), August (5), September (3).

Diagnosis. *Gymnetis borealis* is distinguished by greatly reduced pronotal and elytral markings (Fig. 5) and a pygidium lacking cretaceous spots. This species is similar in general appearance to *Gymnetina salicis*, but, in addition to possessing cretaceous pygidial spots, the parameres in males of that species are proportionately longer and narrower than those of *G. borealis* (compare Figs. 9 and 30).

Biology. Nothing is known of the natural history of this uncommon species. It has been collected in mixed oak, juniper, and pine woodlands.

***Gymnetina cretacea cretacea* (LeConte, 1863)**

(Fig. 11-14, 32-34, 40)

Gymnetis cretacea LeConte 1863: 80. Original combination. Holotype at CMNH.

Description. Length 19.0-26.8 mm; width across humeri 10.0-14.7 mm. Color black, shiny, with cretaceous marks as follows. Pronotum on lateral margin with broad, cretaceous band, band rarely narrowed. Mesepimeron black along anterior edge, with or without variably sized cretaceous spot along posterior margin. Metepisternum and adjoining part of metasternum completely cretaceous. Elytra each with 2 nearly round cretaceous spots behind middle (Fig. 11a), spots rarely reduced to 1 lateral spot (Fig. 11b) or connected (Fig. 11c). Pygidium with large, subtriangular, cretaceous spot on each side. Sternites 1-4 each with small to mostly large, cretaceous spot on posterolateral margin (Fig. 12). Metacoxa with or without cretaceous spot on posterolateral corner and with or without cretaceous spot on dorsal edge at front. Legs and venter black. **Head:** Lateral margins strongly elevated. Surface densely punctate; punctures moderate to large, with a few (at most) minute, dark setae between eyes (when not abraded away). Occiput smooth, shiny. Frons with weak (sometimes obsolete), median, keel or longitudinal swelling. Clypeus with apex broadly subtruncate, strongly reflexed (weakly bilobed in anterior view), sides distinctly constricted just before antennal insertion. Interocular width equals 4.5-5.0 transverse eye diameters. Antenna with 10 segments, club in males subequal in length to antennomeres 1-7 in males, females with club slightly longer than antennomeres 2-7. **Pronotum:** Surface in males with punctures moderate in density and size, females with punctures slightly larger and denser; cretaceous band along lateral margin with sparse, minute, black setae in males, setae slightly longer in females (when not abraded away). Mesepimeron dorsally and on anterior face with mostly dense, large, setigerous punctures; setae short, black. **Elytra:** Surface punctate; punctures moderately dense, moderately large, many ocellate, glabrous; females usually with punctures denser; sides near lateral margins and apical angles finely rugose. Apical umbone pronounced. Apices subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous; setae dense, short, black. In lateral view, profile in males flat except near subapex where convex, nearly entirely flat in females. **Venter:** Setae black. Mesometasternal process flat on ventral surface, apex narrowly rounded, anterior face oblique at about 45° to longitudinal axis of body. Abdominal sternites in males each with sparse, small to moderately sized punctures laterally, nearly impunctate at center; females with entire surface moderately punctate, punctures moderate to large. **Legs:** Protibia slender in males, broader in females, tridentate in both sexes, apical 2 teeth closer to one another than is basal tooth to median tooth; teeth subequally spaced in females. **Parameres:** In ventral view, base of each paramere lacking small, basally projecting tooth (Fig. 13-14).

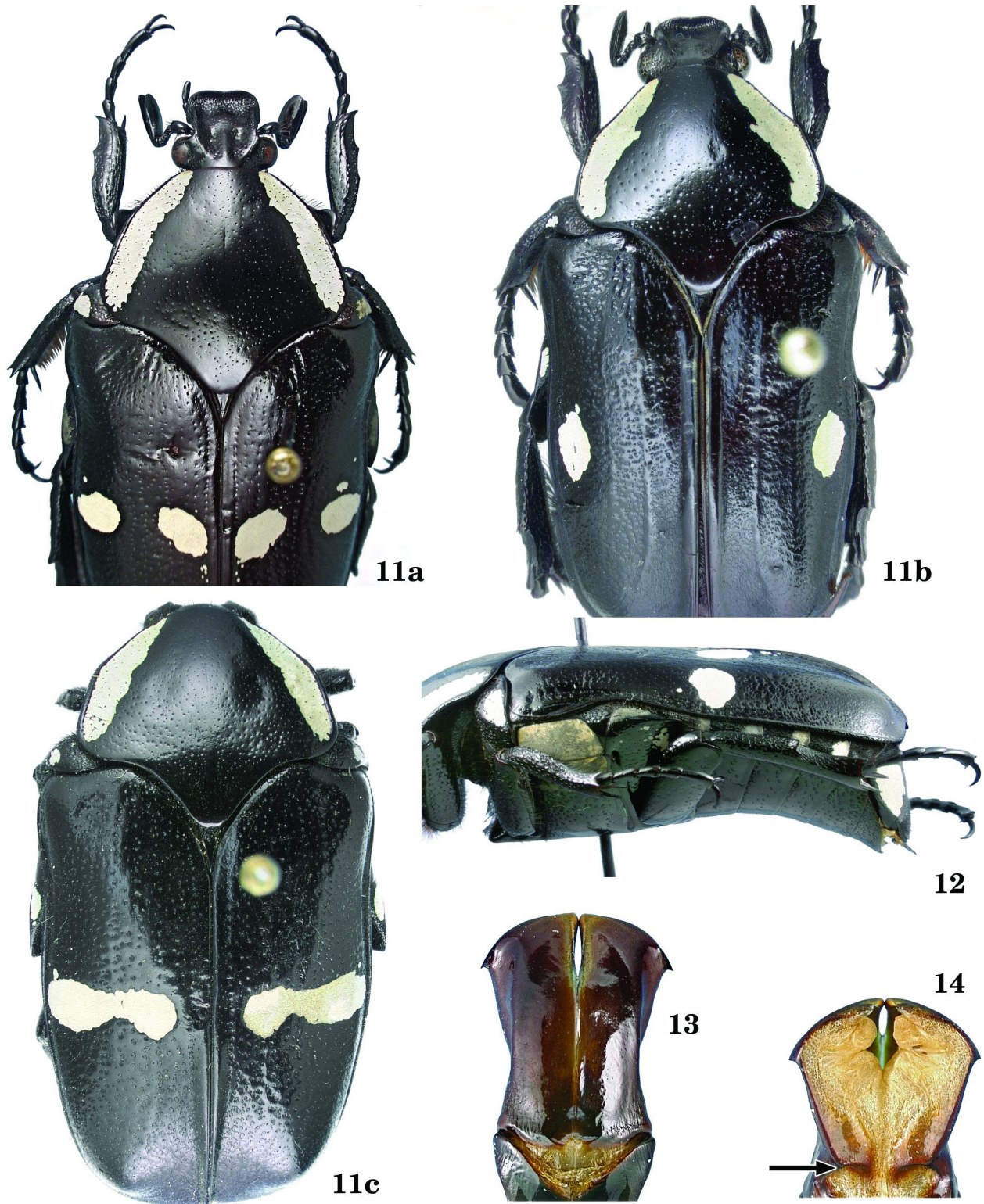
Distribution (Fig. 32). *Gymnetina cretacea cretacea* occurs in southeastern Arizona, southwestern New Mexico, and northern Mexico. The type was described from "Arizona". 65 specimens examined from ADMC, AMNH, ASUT, BCRC, BMNH, CASC, CMNC, CNCI, CUIC, DNAC, EMEC, FWSC, JPHC, LACM, MCZC, PHSC, RHMC, RLWE, SDMC, SMCC, UAIC, UCRC, USNM, WBWC, ZMHU.

MEXICO (2): SONORA (2): Old Hwy 16 (16.4 mi. NW of Yecora), Rancho Arriba (Highway 2 between Imuris and Cananea).

UNITED STATES (63): ARIZONA (59): Cochise Co. (20): Carr Canyon, Cave Creek Canyon, Chiricahua Mountains, Cochise Stronghold, East Turkey Creek, Fort Huachuca, Miller Canyon, Palmerlee, Portal, Ramsey Canyon, Southwest Research Station (Portal), Texas Canyon, Tombstone, No data. **Gila Co. (1):** Gila. **Pima Co. (10):** Box Canyon, Florida Canyon, Greaterville, Kitt Peak, Madera Canyon, Santa Rita Experiment Station. **Santa Cruz Co. (25):** Duquesne Road (0.8 mi. E Hwy 83), Highway 83 at turnoff to Patagonia Lake, Madera Canyon, Patagonia Mountains (west slope near Sycamore Canyon), Santa Rita Mountains, Sycamore Canyon, Tumacacori Park, No data. **No Data (3).** **NEW MEXICO (4): Hidalgo Co. (4):** Godfrey Place (Animas Mountains).

Temporal Distribution. March (1), June (1), July (29), August (31), September (1), October (1).

Diagnosis. *Gymnetina cretacea cretacea* is distinguished from the similar *G. howdeni* by punctures at least moderate in density on the pronotum in both sexes (impunctate to sparsely punctate with minute to



Figures 11-14. *Gymnetina cretacea cretacea*: **11a-c)** Dorsal views, showing variations of creaceous pattern on pronotum, mesepimeron, and elytra as well as distinctive punctation on pronotum. **12)** Lateral view showing creaceous metepisternum, pygidial spot, flat mesometasternal process, single row of creaceous spots on sides of abdomen and distinct concavity of male abdomen. **13-14)** Dorsal and ventral views, respectively, of parameres. Note absence of tooth at base of paramere on ventral side (arrow).

small punctures in *G. howdeni*); the presence of 2, large, round, cretaceous spots on each elytron (rarely fused, Fig. 11c) instead of a transverse, cretaceous band as in *G. howdeni*; by an epimeron with nearly always a cretaceous spot as opposed to a black epimeron (rarely with a cretaceous fleck in *G. howdeni*); by the presence of cretaceous spots on the lateral margins of abdominal sternites 2-5 in the males (spots sometimes reduced but never with lateral *and* submedian, cretaceous spots as normally present in *G. howdeni* males); parameres more broadly expanded apically and, in ventral view, the base of each paramere lacking a distinct, basally projecting tooth (Fig. 14) that is present in *G. howdeni* (Fig. 28).

Biology. *Gymnetina cretacea cretacea* is found primarily in mesquite grassland habitats along the ecotone with Mexican oak woodland habitats (Fig. 36-40), but it occasionally occurs at slightly higher elevations in nearby oak woodland habitats (Fig. 33-34) where *G. howdeni* predominates. Some specimens have been collected while “gumming” on *Baccharis sarothroides* Gray (Asteraceae) along with *Euphoria sepulcralis rufina* (Gory and Percheron) and *Cotinis mutabilis* (Gory and Percheron) (F. Skillman, Jr. and D. Ahart, personal observations). Adults, like those of *G. cretacea sundbergi*, *G. howdeni*, and *G. salicis*, have been observed in tree holes (Fig. 43-44) where they presumably breed.

Remarks. This nominate subspecies of *G. cretacea* and the partially sympatric *G. howdeni* were previously placed under the single name of *G. cretacea*. Judging from specimens in collections, *Gymnetina cretacea cretacea* seems less abundant than *G. howdeni*.

Casey (1915) described *Gymnetina* as a subgenus of *Gymnetis*, with *G. cretacea* as its only included species. In the older literature, *Gymnetina cretacea* was placed in the genus *Gymnetis* (Leng 1920; Schenkling 1921; Blackwelder and Arnett 1974). *Gymnetina* was elevated to generic status by Martinez (1949), and the combination of *Gymnetina cretacea* was subsequently used by Hardy (1975), Deloya and Morón (1997), Krajcik (1998), and Sakai and Nagai (1998). Morón and Deloya (1991) reported this species from La Michilia in Durango, but this specimen is actually *G. salicis*. Sakai and Nagai (1998) illustrated “*G. cretacea*”, but their figure 1350-1 (Miller Canyon, AZ) is a male of *G. howdeni*, while their figure 1350-2 (no data) is a female of, possibly, *G. borealis*, both new species described herein.

Ritcher (1966) placed “*Gymnetis cretacia*” (sic) in a key to the then known larvae of U. S. Cetoniinae, but we have no way of knowing which species he had since there were no adult voucher specimens available for referral. Citing Ritcher (1966), Morón and Ratcliffe (1984) and Micó et al. (2001) placed *G. cretacea* into keys to the then known larvae of New World *Gymnetini*.

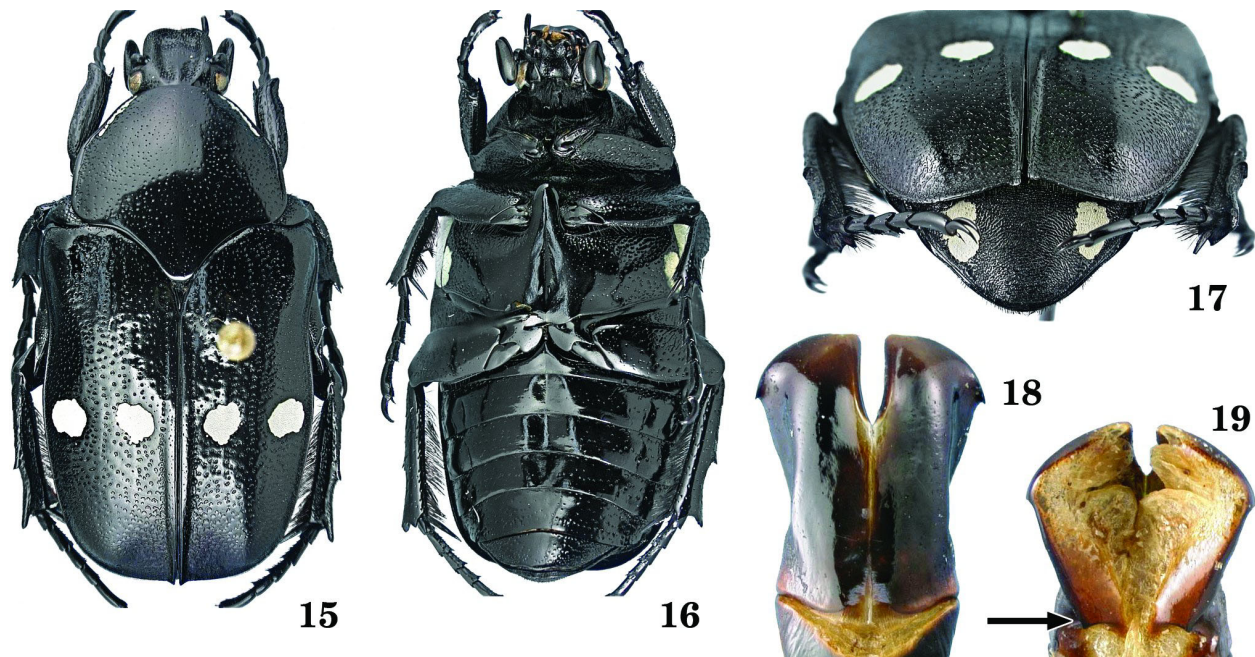
***Gymnetina cretacea sundbergi* Warner and Ratcliffe, new subspecies**

(Fig. 15-19, 32)

Type Material. Holotype male, labeled “USA. NM: Dona Ana Co., Aguirre Springs, Nat'l Rec Area, D. W. Sundberg Coll//reared from larva coll'd VII-2000 in rotten hollow of oak tree” and with our red holotype label. Allotype female labeled “N Mex DonaAna Co, Aguirre Spr. Rec. Area-Organ Mts, campground area, 8 Sept 1985” and with our red allotype label.

Paratypes labeled as follows: “NM, Dona Ana Co., Aguirre Springs, NRA 4 Jul 01, D. W. Sundberg” (1 male); “N.Mex: DonaAnaCo, Organ Mts, Aguirre Spgs. 23-VII-81, Olsen, Thomas” (1 male); “Aguirre Springs, ex pupa, 12-VI-09” (1 male); “NM, Dona Ana Co., Aguirre Springs, 13-14 Jul 96, D. W. Sundberg” (1 male, 2 females); “NM, Dona Ana Co., Dripping Springs Rec. Area, 12 Jul '01, Sundberg & Wolfe” (1 partial male); “Dona Ana Co., Aguirre Springs, NM, July 10, 2009, D. W. Sundberg” (1 male); “Dona Ana Co., Aguirre Springs, NM, larva collected. July 99, emrged. June 2000, D. W. Sundberg” (1 male); “Dona Ana Co., Aguirre Springs, NM, reared from larva, emrg'd June 2009, D. W. Sundberg” (1 male); “NM: Dona Ana Co., Aguirre Springs, June 26, 1997, D. W. Sundberg, ex pupal case” (1 male); “Dona Ana Co., Aguirre Springs, NM, emrged July 2001, D. W. Sundberg” (1 male); “NM: Dona Ana Co., Aguirre Sprgs., June 26, 1997, D.W. Sundberg, ex. pupal case” (1 male); “Dona Ana Co., Aguirre Sprgs., NM, emrged. July 2001, D.W. Sundberg” (2 males); “Dona Ana Co., Aguirre Sprgs., NM, July 10, 2009, D.W. Sundberg” (1 female). All paratypes with our yellow paratype label.

Holotype deposited at UNSM. Allotype and one male paratype deposited at WBWC. Remaining paratypes deposited at UAIC, DWSC, RMBC, and BCRC.



Figures 15-19. *Gymnetina cretacea sundbergi*: **15)** Dorsal view, showing reduced cretaceous pattern on pronotum as well as distinctive punctation on pronotum. **16)** Ventral view showing narrower apex of mesometasternal process and reduced cretaceous spots on sides of abdominal sternites. **17)** Caudal view showing sculpturing and markings on pygidium. **18-19)** Dorsal and ventral views, respectively, of parameres. Note absence of tooth at base of paramere on ventral side (arrow).

Holotype. Male. Length 22.0 mm; width across humeri 11.1 mm. Color black, shiny. Pronotum on lateral margin in anterior third with slender, broken, cretaceous band. Mesepimeron black, without cretaceous spot. Metepisternum and adjoining part of metasternum completely cretaceous (Fig. 16). Elytra each with 2 large, nearly round cretaceous spots just behind middle (Fig. 15). Pygidium with large, suboval, cretaceous spot on each side (Fig. 18). Sternites 1-4 each with small, cretaceous spot on posterolateral margin. Metacoxa without cretaceous spots. Legs and venter black. **Head:** Lateral margins strongly elevated. Surface densely punctate; punctures moderate to large, glabrous (setae abraded away?). Occiput smooth, shiny. Frons with weak, longitudinal swelling. Clypeus with apex broadly subtruncate, strongly reflexed (weakly bilobed in anterior view), sides distinctly constricted just before antennal insertion. Interocular width equals 4.7 transverse eye diameters. Antenna with 10 segments, club subequal in length to antennomeres 1-7. **Pronotum:** Surface with punctures moderate in density and size. Mesepimeron dorsally with mostly dense, large, setigerous punctures; setae short, black. **Elytra:** Surface punctate; punctures moderately dense, moderately large to large, many ocellate; sides near lateral margins and apical angles finely rugose. Apical umbone pronounced. Apices subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous; setae dense, short, black. In lateral view, surface in males flat except near subapex where convex. **Venter:** Setae black. Mesometasternal process flat on ventral surface, apex narrowly rounded, anterior face oblique at about 45° to longitudinal axis of body. Abdominal sternites each with sparse, small to moderately sized punctures. **Legs:** Protibia slender, presumably tridentate but basal tooth obsolete. **Parameres:** In ventral view, base of each paramere lacking small, basally projecting tooth (Fig. 19).

Allotype. Female. Length 23.1 mm; width across humeri 12.8 mm. As holotype except in the following respects: Pronotum black, lacking cretaceous band. Metepisternum cretaceous except at center base and adjoining part of metasternum where black. Elytral cretaceous spot near left margin with 3 small, ancillary spots; large spot near right margin with 1 small, ancillary spot. Pygidium black, lacking cretaceous spots. Sternites 1-3 each with small cretaceous spot on posterolateral margin. **Head:** Interocular width

equals 4.4 transverse eye diameters. Antenna with 10 segments, club slightly longer than antennomeres 2-7. **Elytra:** Surface punctate; punctures moderately dense, mostly large, many ocellate, glabrous, becoming denser on sides. **Pygidium:** In lateral view, surface weakly convex. **Venter:** Abdominal sternites each with moderately large, crescent-shaped punctures, punctures denser near lateral margins. **Legs:** Protibia broader, tridentate, teeth subequally spaced.

Variation. Males (13 paratypes). Length 18.7-24.9 mm; width across humeri 10.3-12.8 mm. As holotype except in the following respects: **Color:** Pronotum on lateral margin in anterior half with slender, short, cretaceous band in 2 specimens, totally black on remaining specimens. Metepisternum and adjoining part of metasternum completely cretaceous in 12 specimens, metasternum lacking any cretaceous mark in 1 specimen. Pygidium with small, cretaceous spot on each side in 11 specimens (spots very small in 6 of these) and lacking spots in other 2 specimens. Sternites 1-4 each with small, cretaceous spot in 11 specimens, 2 others with spot on sternites 1-3. **Head:** Frons as holotype in 9 specimens, with longitudinal swelling obsolete in 1 specimen. Interocular width equals 5.5-6.0 transverse eye diameters. **Pronotum:** Surface with punctures moderate to moderately dense. **Elytra:** Surface punctate; punctures moderately dense, moderately large to large, many ocellate, becoming denser on sides. **Venter:** Abdominal sternites each with sparse to moderately dense (especially on sides) punctures. **Legs:** Protibia as holotype in 2 specimens (basal tooth obsolete), with only apical tooth in 5 specimens (basal 2 teeth absent), and with 3 teeth in 3 specimens.

Females (3 paratypes). Length 19.4-24.5 mm; width across humeri 10.2-13.4 mm. As allotype except in the following respects: **Color:** Metepisternum entirely cretaceous in 2 specimens and cretaceous with small, black spot in other. Sternites 1-4 each with small, cretaceous spot on lateral margin. **Head:** Interocular width equals 5.0 transverse eye diameters.

Etymology. We take great pleasure in naming this subspecies in honor of Dan Sundberg, who collected most of the specimens.

Distribution (Fig. 32). *Gymnetis cretacea sundbergi* is found only in the Organ Mountains at the southern end of the San Andres mountain chain in south central New Mexico. This mountain habitat is surrounded by a sea of desert that isolates this population from any other. 18 specimens examined from BCRC, DWSC, RMBC, UAIC, UNSM, WBWC.

UNITED STATES (18): NEW MEXICO (18): Doa Ana Co. (18): Aguirre Springs National Recreation Area, Dripping Springs Recreation Area.

Temporal Distribution. June (5), July (12), September (1).

Diagnosis. This "eastern" population of *G. cretacea* is characterized by reduced maculation on the pronotum, mesepimeron, pygidium, and metacoxae and by its isolation in the Organ Mountains in Doña Ana County, NM.

Biology. Six specimens were reared from larvae or pupae taken in the rotten hollow of oak trees (label data). *Gymnetina cretacea cretacea*, *G. cretacea sundbergi*, *G. howdeni*, and *G. salicis* have all been collected from rotten tree holes, thus suggesting that *Gymnetina* species are tree hole breeders.

***Gymnetina grossepunctata* Ratcliffe and Warner, new species**

(Fig. 20-24, 32)

Type Material. Holotype male, labeled: "GUATEMALA, Sacatepéquez, Jocotenango, ± 1500 m, 23 iii 1997, 14°34.71 n 090°44.79w, Col. J. Monzón, COLECCION JOSE MONZON" and with our red holotype label. Allotype female, labeled "GUATEMALA, Sacatepéquez, Jocotenango, 1,545 m. 25 de ENERO 1998, 14.578957-90.746540, Col. José Monzón Sierra, COLECCIÓN J. MONZON" and with our red allotype label.

Paratypes labeled "GUATEMALA Guate., Mixco. Club La Montaña. 6 IV 1996, Col. K. E. Villatoro" (1 female) and "GUATEMALA, St. Rosa, Cuilapa, 4 II 1991, P. Fernandez" (1 female). Paratypes with our yellow paratype label.

Holotype (ex BCRC) deposited at UNSM. Allotype deposited at JMSC. Both paratypes deposited at UVGC.

Holotype. Male. Length 24.6 mm; width across humeri 13.5 mm. Color black, shiny (Fig. 20). Sternites 1-4 each with short, slender, cretaceous bands on posterolateral margin (Fig. 21). **Head:** Lateral margins elevated. Surface densely punctate; punctures moderate to large, setigerous from between eyes to apex of clypeus; setae moderate in density, short, black. Occiput smooth, shiny. Frons with weak, short, smooth, longitudinal swelling. Clypeus with apex broadly rounded, strongly reflexed, sides constricted just before antennal insertion. Interocular width equals 4.0 transverse eye diameters. Antenna with 10 segments, club slightly longer than antennomeres 1-7. **Pronotum:** Surface densely punctate (except for basomedian lobe which has a few, sparse punctures); punctures moderate to mostly large, mostly coalescing on either side of middle. Mesepimeron dorsally with punctures moderate in size and density, setigerous; setae short, black. **Elytra:** Surface coarsely, densely punctate (except behind basomedian lobe where punctures sparse); punctures large to mostly very large, mostly coalescing; sides near lateral margins and apical angles rugopunctate. Apical umbone pronounced. Apices weakly, subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous; setae dense, short, black. In lateral view, surface weakly convex. **Venter:** Setae black. Mesometasternal process flat on ventral surface, apex broadly rounded, anterior face oblique at about 45° to longitudinal axis of body. Abdominal sternites on lateral margins with punctures moderate in size and density, elsewhere sparsely punctate. **Legs:** Protibia slender, presumably tridentate but basal and median teeth indicated by a swelling only. **Parameres:** In ventral view, entire base of each paramere heavily sclerotized, basally projecting (Fig. 24).

Allotype. Female (Fig. 22). Length 26.0 mm; width across humeri 14.0 mm. The female allotype does not differ significantly from the male holotype except that the protibia is distinctly tridentate.

Variation. Female (2 paratypes). Length 23.0-24.0 mm; width 12.5-13.0 mm. The paratypes do not significantly differ from the allotype. The cretaceous markings on the abdominal sternites are obscured in one specimen due to a build up of body oils.

Etymology. This species is distinctive because of the coarse punctation of the pronotum and elytra, and so it is named to reflect this. From the Latin *punctura*, meaning a puncture, and the Latin *grossus*, meaning large or coarse.

Distribution (Fig. 32). *Gymnetina grossepunctata* occurs in Guatemala. 4 specimens examined from BCRC (donated to UNSM), JMSC, UVGC.

GUATEMALA (4): GUATEMALA (1): Mixco. SACATEPEQUEZ (2): Jocotenango. SANTA ROSA (1): Cuilapa.

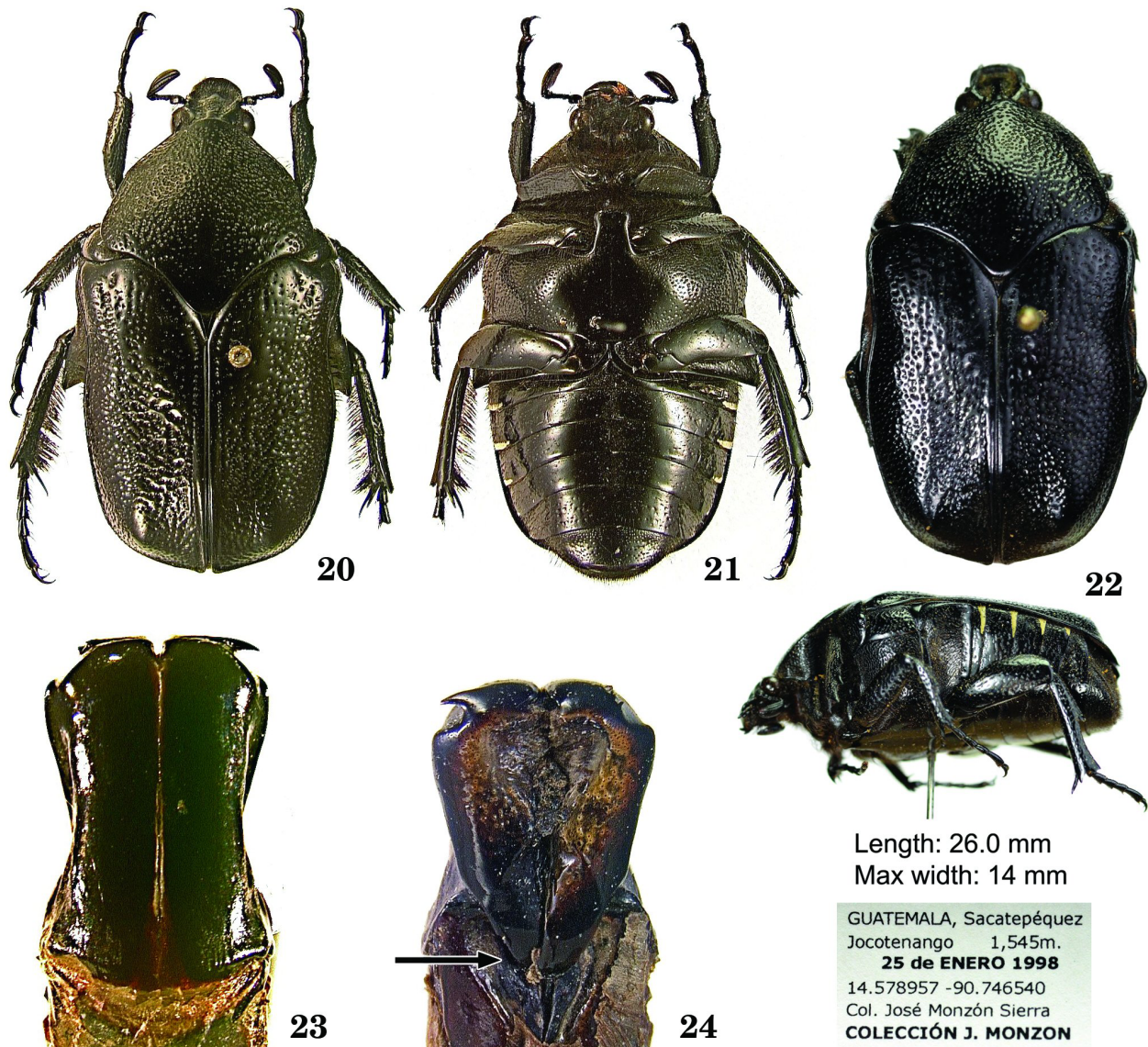
Temporal Distribution. January (1), February (1), March (1), April (1).

Diagnosis. *Gymnetina grossepunctata* is immediately recognizable by its coarse punctation on the pronotum and elytra, more rounded clypeal apex, cretaceous marks only on abdominal sternites 1-4, and the heavily sclerotized venter of the parameres (Fig. 24).

Biology. Nothing is known of the biology of this rare species.

***Gymnetina howdeni* Warner and Ratcliffe, new species**
(Fig. 25-28, 32-35)

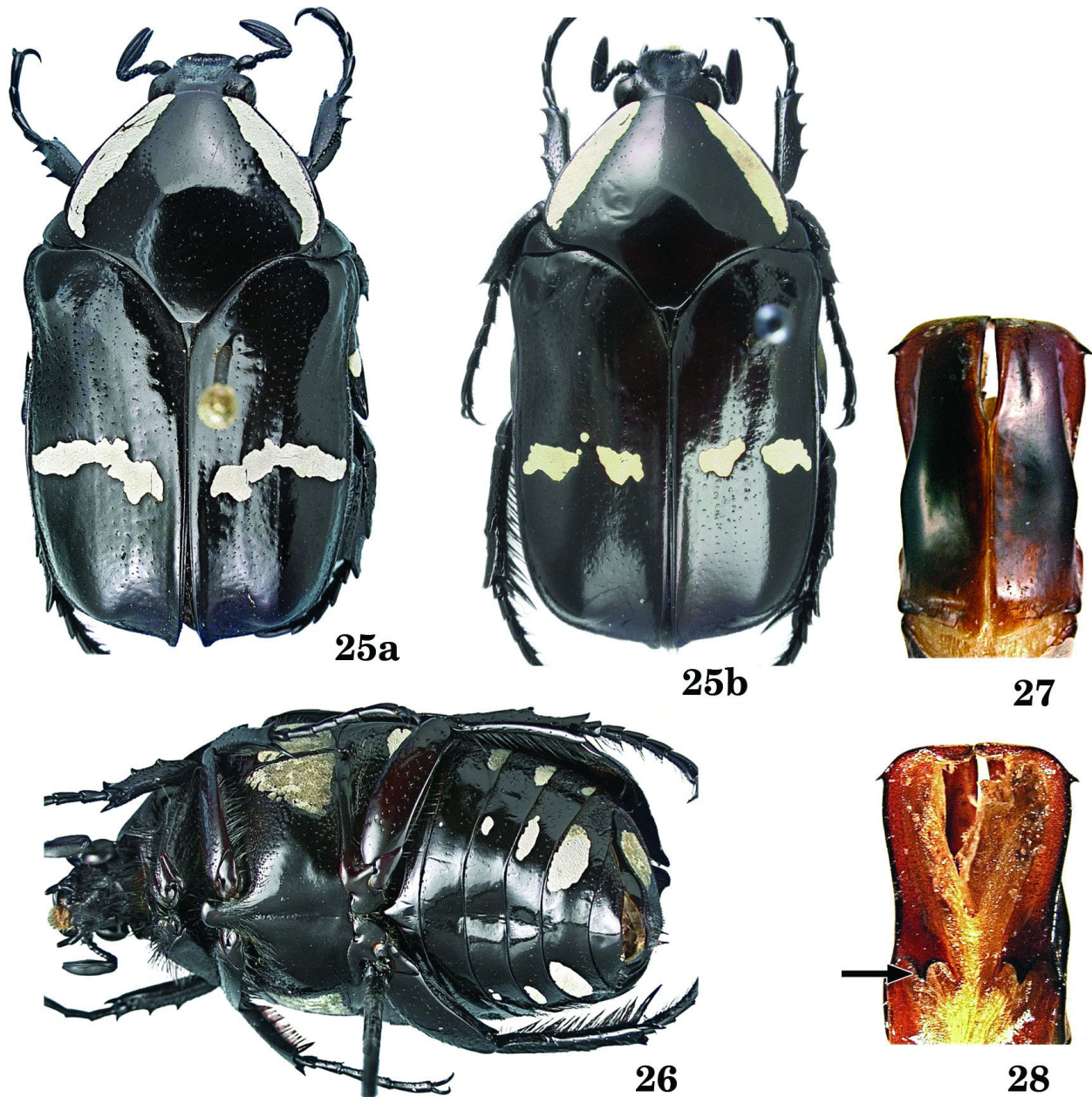
Type Material. Holotype male, labeled "Cochise Co. AZ., Aug. 8, 1987, Coll. Tom Ryan"; verso: "Gymnetis cretacea, Miller Canyon, Cochise Co., 8-8-87" and with our red holotype label. Allotype female, labeled



Figures 20-24. *Gymnetina grossepunctata*: 20-21) Holotype, dorsal and ventral views, respectively. 22) Dorsal and oblique view of allotype (image courtesy of J. Monzón). 23-24) Dorsal and ventral views, respectively, of parameres.

“USA; AZ; Cochise Co, Chiricahua Mts; Cave Creek, 31-VII-1975, RWL & BR Potts, Colls” and with our red allotype label.

Paratypes with the following data: as holotype (4 males); “*Gymnetis cretacea*, Miller Cnyn. Cochise Co., Ariz. 7.21.85” (2 males); same data but 7.20.1985 (1 male); same data but VIII.19.86 (2 males); “USA, AZ, Cochise Co, Miller Canyon, 27-VI-87, John Ryan” (2 males); “Tucson, Ariz.” (1 male); “AZ: Cochise Co, Huachuca Mts., Palmerlee (Miller Cnyn.), VII-30-1989” (1 male); “7-28-1989-Chiricahua Mnts, off Pinery Cyn. Rd. 4 1/2 mi. fm. Jct. 181-42, AZ, D. Colby collector” (2 males); “7-28-1989-Chiricahua Mnts, off Pinery Cyn. Rd., Cochise County, 4 1/2 mi. fm. Jct. 181-42, AZ, D. Colby coll.-” (1 male); “AZ. Cochise Co Pinery cyn....., Chiricahua Mnts., 4 1/2 miles fm jct of 181 & 42., July 28 1989, D. Colby collector” (1 male); “USA:ARIZ:Cochise Co., Huachuca Mountains. Garden Cyn., 31°28’22”N, 110°21’07”W; July 12, 2009, R. H. McPeak & W. B. Warner” (1 male); “Madera Cyn., Santa Rita Mts., Pima Co., ARIZ, 25 VII 08” (1 male); “E. Turkey Creek, Chiricahua Mnts., Sept. 6th, 1967, B. S. Cheary” (1 male); “Ariz.//A. Fenyés collection” (2 males); “Chiricahua Mts, Ariz//July, DKDuncan” (1 male); “Chiric. Mts., Ariz., 7/12//Frederick Blanchard Collection” (1 male); “Huachuca Mts. 7.10.02, Ariz.” (1 male); “Ch. Mts. Ariz.,



Figures 25-28. *Gymnetina howdeni*: **25a-b)** Dorsal views, showing variation of cretaceous pattern on pronotum and elytra as well as sparse, small punctures on pronotal disc. **26)** Oblique ventral view showing double row of cretaceous spots on sides of male abdomen, pygidial spot, and more broadly rounded apex of mesometasternal process. **27-28)** Dorsal and ventral views, respectively, of parameres. Note distinct tooth at base of paramere on ventral side (arrow).

6600 ft, 7.16.1904" (1 male); "Santa Rita Mts., Ariz., 7.24, 1927, R. H. Beamer" (1 male); "Huachuca Mts., Ariz./Van Dyke Collection" (1 male); "Chiricahua Mts., Ariz., VII-1-1908// Van Dyke Collection" (1 male); "Chiricahua Mts., Ariz., VII-22-1908// Van Dyke Collection" (1 male); "Huach Mts, Ariz//Liebeck Collection" (2 males); "AZ: Cochise Co., Chiricahua Mts., Onion Saddle, 7600', 31°56N 109°16W//VII-1981, Hesperheide" (1 male); "Chiricahua Mts., 7-10-08, Cochise Co., Ariz./V.W. Owen Collector" (1 male); "Ariz., Cochise Co., Portal, J. Doyen, VII-20/22-1971" (1 male); "Arizona: Cochise Co., Miller Canyon, VII-12-1988" (1 male); "Madera Cn., Pima Co., Arizona//Dr. Lenczy, VII.1982" (1 male); "Cochise Co., Ariz., VII-7-1904//R. Hopping Collection" (1 male); "Cochise Co., Ariz., VII-7-1904" (1 male); "Cochise Co., Ariz."

(1 male); "Palmerlee, S. Ar., Riederman Col./Ehrman Coll., Carn. Mus. Acc. 7815" (1 male); "Chiricahua M., V-26-52. Ar./D.J. & J. N. Knull Collrs." (1 male); "USA: AZ: S. Cruz Co., Santa Rita Mountains, Madera Cyn, Roundup Trail, 26-VII-1985, R. K. Velten collector" (1 male); "Parker Cn., Cochise Co, Arizona/Dr. Lenczy, VIII. 1981" (1 male); "Az, Cochise Co, 24 mi. SW Portal, VII-21-1981, W. B. Warner/flying around dead standing walnut stump" (1 male); "Ramsey Canyon, Huachuca Mts. ARIZ, VII-28&29-1959, Nutting, Radford, Samuelson" (1 male); "USA: ARIZONA: Cochise County, Chiricahua Mountains, Southwestern Research Station, 8 km west of Portal, 6-VIII-1983, Paul H. Arnaud, Jr." (1 male); "Ariz., Cochise Co., Huachuca Mnts., Miller Cyn., 8-VIII-1999" (1 male); "AZ: Cochise Co., 8 mi S Sierra Vista, 26-VII-1988, Carr Canyon/William D. Shepard, leg." (1 male); "S. W. Research Sta., Chiricahua Mts., Ariz., 31-VII-66" (1 male); "Miller Canyon, 6000', Huachuca Mts., Cochise Co., Ariz, 23, 24 July 1976, F. T. Hovore, coll." (5 males); "394//Gymnetis cretacea ?//Cotinis alboscrypta Janson" (1 male); "2 mi. w. S.W.R.S., Chiricahua Mts., Ariz. vii-23-65//swept from *Quercus* sp./Collectors: J. H. Davidson J. M. Davidson M. A. Cazier" (1 male); "Ariz. Cochise Co., Portal SWRS, 8-VIII-1978//R. A. Cunningham Colr" (2 males); "USA: ARIZONA: Cochise Co., Huachuca Mts., 7000' elev., Reef Townsite, 1-Aug.-2010, 31°25'44"N 110°17'24"W, R.A. Cunningham Collector" (1 male); "VII-21, 1975, Ramsey Canyon, Cochise Co. AZ, P. Meyer coll." (2 males); "VIII-8-87 / Madera Cyn / Pima Co. Az." (1 male); "AZ: Santa Cruz Co., Santa Rita Mts., Cave Cr. Cn. 1731m, viii-8-78 McCleve" (1 male); "ARIZONA: GRAHAM CO., Galiuro Mts. Ash Cn., viii-16, 17-82 1600m, S.McCleve, C.E.Ball & D. Maddison" (1 male); "AZ: COCHISE CO, Huachuca Mts., Ramsey Canyon, Viii-10-85, P. Jump" (1 male); "AZ: Pima Co., Madera Canyon, July 27, 1982, D. N. Ahart" (1 male); "Madera Cyn. Ariz., Santa Rita Mtns., Aug. 5, 1961, R. G. Willis" (1 male); "AZ: Cochise Co., Huachuca Mts., viii-6-83, Peter Jump" (1 male, 1 female); "AZ: Sta. Cruz Co., Sta. Rita Mys., Madera Cn., viii-13-83, S. McCleve & R. S. Anderson" (1 female); "AZ: Cochise Co., Portal, viii-4-73, Peter Jump" (1 female); "AZ: COCHISE CO., Huachuca Mts., Copper Canyon, viii-18-85 / P.Jump" (1 female); "Ariz. Santa Cruz Co., Madera Cyn., Bog. Spr., 27-VIII-1974" (1 female); "Madera Canyon, Santa Cruz Co., Arizona, August 8-9, 1982, D. A. LaRue Collector" (1 female); "USA: ARIZONA: Cochise County, Chiricahua Mountains, s fork Cave Creek Canyon, 4-Aug-1983, Madeline M. Arnaud" (1 female); "Madera Cyn., Santa Cruz Co. Ariz. 4880 ft., IX-20-1963//V. L. Vesterby Collector" (1 female); "SWRS, Portal, Cochise Co., Ariz., VIII 10 1970//LD & MD Anderson Collectors" (1 female); "5 mi. w. Portal, Chiricahua Mts., Ariz., VIII-13-58//R. M. Bohart Collector" (1 female); "Ariz., Cochise Co., Cave Creek Canyon, Snowshed Trail No. 5246 Btwn. Jct. 426 & Cypress Saddle, 13 Aug. 1973, Oak-Pine-Juniper Woodland, SI & SL Frommer//Univ. Calif. Riverside Ent. Res. Museum, UCRC ENT 163325" (1 female); "Chiricahua Mts., Ariz., VII-1916//Van Dyke Collection" (1 female); "Chiricahua Mts., Ariz., VII-22-1908//Van Dyke Collection" (1 female); "Sunny Flat Camp, Chiricahua Mtns., Cochise Co., Arizona, July 29, 1963" (1 female); "S Fork Cave Creek, Chiricahua Mts, Cochise Co, Ariz., Aug. 11, 1962, Eric Fisher, coll." (1 female); "5 mi. N. Summerhaven, Santa Catalina Mts, Pima Co, Arizona, August 27, 1962, Eric Fisher collector" (1 female); "14th Sept. 57, Pinery Camp, So Wilcox, Ariz, Coll. G.H.S." (1 female); "S. W. Research Sta., Coch. Co., Chiri. Mts., ARIZ. VIII-15-65//L.D. Anderson Collector #44//COLEOPTERA, Assoc. Adult, #65-44, UCR Ent. Coll./Univ. Calif. Riverside, Ent. Res. Museum, UCRC ENT 163324" (1 female); "8-22-52, Madera Canyon//Santa Rita Mts., Southern Ariz., Robert J. Ford" (1 female); "Madera Canyon, Santa Rita Mtns., Ariz., VIII-22-1985, day flying//Robert E. Wagner Collector//Univ. Calif. Riverside, Ent. Res. Museum, UCRC ENT 163326" (1 female); "Ramsay (sic) Canyon, Huachuca Mts., Arizona, 8.16.52, Dr. J. A. Comstock" (1 female); "Aug 13. 1952, Madera Canyon, Santa Rita Mts//Southern Ariz., C. W. Kirkwood & R. H. Reid" (1 female); "AZ: Chiricahua Mts., John Hands Picnic Area, 27 VII 74" (1 female); "4 mi. S.W. Portal, Cochise co. Ariz., 5280' viii-16-1973, Cazier family" (1 female); "Canelas 17//cretacea Lec." (1 female); "Canelas//346" (1 female); "VIII-10-1987, Madera Cyn., Pima Co., Ariz." (1 female); "VIII-11-1987, Madera Cyn., Pima Co., Ariz." (1 female); "Arizona VII-22-1981, Santa Rita Lodge, Madera Cyn. Santa Cruz county. coll. Gordon Jones" (1 female); "Huachuca Mts., Ariz., 8.1.1927, R. H. Beamer" (1 specimen); "AZ Cochise Co., Ramsey Canyon [Huachuca Mts.], vii-21-1989, P.Mayer" (1 specimen); "AZ Pima Co., Madera Canyon [Santa Rita Mts.], vii-10-1987, D. Ahart" (1 specimen); "AZ Pima Co., Madera Canyon [Santa Rita Mts.], viii-8-1987, D. Ahart" (1 specimen); "AZ Pima Co., Madera Canyon [Santa Rita Mts.], vii-11-1987, D. Ahart" (1 specimen); "AZ Sta.Cruz Co., Santa Rita Lodge, Madera Cyn., vii-22-1981, G. Jones" (1 specimen); "ARIZ.S.RitaMts., Madera Canyon, VIII-7-1961//Collectors G.H.Nelson & Family//Flying Among Sycamores" (1 specimen); "ARIZONA: Cochise Co., Portal, 4-VIII-1973, J. Knull" (1 specimen); "ARIZONA: CochiseCo., Chiricahua Mtns., nr. Portal//D.J.Knull, 11-VIII-71, J.N.Knull" (1

specimen); "ARIZONA: Cochise Co., S. W. Res. Sta., 22-VII-1976, Lester L. Lampert" (3 specimens); "Arizona: Huachuca Mts. Sunnyside, Aug. 26 1973, K. Stephan leg." (1 specimen); "ARIZONA: Chiricahua Mts., Cave Creek Cnyn., Stewart Camp Ground 1-VIII-1975//Collector G. H. Nelson//In Hole of Oak Tree" (1 specimen); "ARIZONA: Huyachua (sic) Mts., Copper Canyon, S. end, 29-VII-1993, G. H. Nelson//Flying" (1 specimen); "ARIZONA: Chiricahua Mts., Cave Creek Cnyn., Stewart Cp. Gr., 14-VIII-1973//Collector G. H. Nelson//On Foliage Sycamore" (1 specimen); "ARIZ., Portal, S.W. Res. Sta., VII-26-1969//Collectors: D. Bray & D.E. Nelson" (1 specimen); "ARIZ.: Cochise Co., Southwestern Research Station nr. Portal, 2-VIII-1973, Rosenberg Collection" (1 specimen); "ARIZONA: Cochise Co., Huachuca Mts. 5700', Ramsey Can. 1-viii-93, B.&B. Valentine, colls." (1 specimen); "ARIZONA: Santa Cruz Co., Madera Canyon, 10-VIII-1978, L. L. Lampert, Jr." (1 specimen); "AZ, Chiricahua [sic] Mts. 9mi. Above Portal 1-VIII-75//Collector G.H. Nelson//Flying" (1 specimen); "ARIZONA: Chiricahua Mts., Cave Creek Cnyn., Stewart Cp. Gr., 3-VIII-1973//Collector G. H. Nelson" (1 specimen); "MEXICO: Sonora, MX 16, 3km W. of Yecora, 17-VII-2007, Skillman, Ribardo, Hildebrant" (1 male); "MEXICO: Chihuahua, San Rafael-Cuiteco Rd., 17°28.11'N, 107°56.597'W, 8 August 2007, 1870 m., Leg. David G. Furth: (1 male); "MEX: Sonora, San Luis Mnts., VII-25-88, Coll. D. Barker" (1 male); "Mojarachic, Chih, Mexico, 1938, 6900, I Knobloch" (1 female); "Guasaparis, Chihuahua, Mex., X-17-51//J. Marquis, M. Marquis Collectors" (1 female). All paratypes with our yellow paratype label.

Holotype, allotype, and two paratypes deposited at UNSM. Remaining paratypes deposited at ADMC, AMNH, ASUT, BCRC, CASC, CMNH, DNAC, DWSC, FSCA, FWSC, LACM, MCZC, RACC, RMBC, SEMC, SMCC, UAIC, UCRC, USNM, WBWC, ZMHU.

Holotype. Male. Length 24.4 mm; width across humeri 13.8 mm. Color black, shiny, with cretaceous marks as follows. Head with 4 minute, cretaceous flecks between eyes. Pronotum on lateral margin with broad, cretaceous band (Fig. 25a). Mesepimeron completely black. Metepisternum and adjoining part of metasternum completely cretaceous (Fig. 26). Elytra each with broad, transverse, cretaceous band (Fig. 25a), band rarely broken (Fig. 25b). Pygidium with large, subtriangular, cretaceous spot on each side. Sternites 1-4 each with transverse, large, cretaceous spot on posterolateral margin. Sternites 2-5 each with transverse, large, cretaceous spot on anterior margin either side of middle. Metacoxa with cretaceous spot on posterolateral corner and on dorsal edge at front. Legs and venter black. **Head:** Lateral margins moderately elevated. Surface densely punctate; punctures moderate to large, becoming small and dense near clypeal apex, glabrous. Occiput smooth, shiny. Frons with weak, median, longitudinal swelling. Clypeus with apex broadly truncate, strongly reflexed, sides distinctly constricted just before antennal insertion. Interocular width equals 3.8 transverse eye diameters. Antenna with 10 segments, club subequal in length to antennomeres 1-7. **Pronotum:** Surface with punctures moderate in density and size adjacent to cretaceous band, elsewhere with sparse, minute punctures. Mesepimeron dorsally and on anterior face rugulose next to posterior angle of pronotum (with minute, black setae) and with small, sparse, glabrous punctures elsewhere. **Elytra:** Surface punctate; punctures small, sparse on median half, becoming larger, slightly denser on lateral half and weakly rugose near lateral margin. Apical umbone pronounced. Apices subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous; setae dense, short, black. In lateral view, surface flat except near subapex where weakly convex. **Venter:** Setae black. Mesometasternal process flat on ventral surface, apex broadly rounded, anterior face oblique at about 45° to longitudinal axis of body. Abdominal sternites each with moderately dense, moderate to large punctures on lateral fourths, nearly impunctate at center. **Legs:** Protibia slender, tridentate, basal 2 teeth slightly closer to one another than is apical tooth to median tooth. **Parameres:** In ventral view, base of each paramere with small but distinct, basally projecting tooth (Fig. 28).

Allotype. Female. Length 25.5 mm; width across humeri 13.5 mm. As holotype except in the following respects: **Color:** Metepisternum with median margin black at center, not completely cretaceous. Sternites 1-3 each with small, cretaceous spot on posterolateral margin. Sternites 2-5 lacking transverse, cretaceous spot on anterior margin either side of middle. Metacoxa lacking cretaceous spot on posterolateral corner. **Head:** Interocular width equals 4.0 transverse eye diameters. Antenna with 10 segments, club slightly shorter than antennomeres 1-7. **Legs:** Protibia slightly broader.

Variation. Males (87 paratypes). Length 18.0-27.1 mm; width across humeri 9.5-14.7 mm. The male paratypes differ from the holotype as follows: **Color:** Head with minute, cretaceous flecks in only one specimen; remainder without cretaceous flecks on head. Elytra with broad, transverse, cretaceous band broken in three specimens (Fig. 25b). Sternites 1-3 or 1-4 each with transverse, small to large, cretaceous spot on posterolateral margin. Sternites 2-5 or 3-5 or 4-5 or only 5 each with small to large, transverse, cretaceous spot on anterior margin either side of middle. Metacoxa with or without cretaceous spot on posterolateral corner and on dorsal edge at front. **Head:** Interocular width equals 3.8-4.0 transverse eye diameters. **Pronotum:** Surface with punctures moderate in density and size adjacent to cretaceous band, elsewhere with sparse, minute to small punctures. **Elytra:** Surface with punctures small and sparse (most common) to moderately large and dense (rare) on median half, becoming larger, slightly denser on lateral half and weakly rugose near lateral margin. **Legs:** Protibia tridentate, basal 2 teeth slightly closer to one another than is apical tooth to median tooth or all teeth subequally spaced in a few specimens.

Females (33 paratypes). Length 20.5-28.1 mm; width across humeri 10.8-16.8 mm. The female paratypes differ from the allotype as follows: **Color:** Head usually lacking cretaceous flecks; 2 specimens with a large fleck on each lateral margin in front of eyes. Epimeron with small, cretaceous fleck in one specimen. Metepisternum completely cretaceous to cretaceous with median margin black to cretaceous with black spot at center. Elytra with transverse band broken at middle in 1 specimen (resulting spots are transverse, not round). Sternites 1-3 or 1-4 each with small (most common) to large, cretaceous spot on posterolateral margin. Metacoxa with or without cretaceous spot on posterolateral corner. **Head:** Interocular width equals 4.0-5.0 transverse eye diameters.

Etymology. We take great pleasure in naming this species in honor of our friend and colleague, Henry Howden (Ottawa, Canada), who first alerted us to the differences in the parameres of this new species and in recognition of his many contributions to scarab beetle exploration and discovery.

Distribution (Fig. 32). *Gymnetis howdeni* occurs in southeastern Arizona and northwestern Mexico. 123 specimens examined from ADMC, AMNH, ASUT, BCRC, CASC, CMNH, DNAC, DWSC, FSCA, FWSC, LACM, MCZC, RACC, RMBC, SEMC, SMCC, UAIC, UCRC, UNSM, USNM, WBWC, ZMHU.

MEXICO (7). CHIHUAHUA (3): Guasaparis, Mojrachic, San Rafael-Cuiteco Rd. DURANGO (2): Canelas. SONORA (2): San Luis Mountains, Yecora (3 km W).

UNITED STATES (115): ARIZONA (115): Cochise Co. (87): Carr Canyon, Cave Creek, Chiricahua Mountains, Copper Canyon, East Turkey Creek, Garden Canyon, Huachuca Mountains, John Hands picnic area, Miller Canyon, Onion Saddle, Palmerlee, Pinery Canyon, Portal, Portal (4 mi. SW), Portal (9 mi. N), Ramsey Canyon, Reef Townsite (Huachuca Mountains), Southwest Research Station, Sunny Flat Camp, Sunnyside, No data. **Graham Co.** (1): Ash Canyon (Galiuro Mountains). **Pima Co.** (10): Madera Canyon, Tucson. **Santa Cruz Co.** (15): Madera Canyon, Santa Rita Mountains. **No Data** (2).

NO DATA (1).

Temporal Distribution. May (1), June (2), July (53), August (48), September (3), October (1).

Diagnosis. Previously, this species was considered to be part of the variation in *G. cretacea*. Accordingly, we believe many additional specimens of *G. howdeni*, currently labeled as *G. cretacea*, reside in collections not included in this study. *Gymnetina howdeni* is distinguished from the similar *G. cretacea* by a pronotum that is largely impunctate or with sparse, minute to small punctures in both sexes, whereas *G. cretacea* has punctures at least moderate in density; the presence of a transverse, sinuous, cretaceous band on the elytra instead of 2 (rare) or 4 (common), large, round cretaceous spots as in *G. howdeni*; by an entirely black mesepimeron (a cretaceous fleck seen in only two specimens) as opposed to a mesepimeron nearly always with a distinct, cretaceous spot in *G. cretacea*; by the presence of lateral and submedian, cretaceous spots on the abdominal sternites in males (Fig. 26) (spots sometimes reduced but always with at least one submedian spot in addition to the lateral spots), whereas *G. cretacea* males have cretaceous spots only on the lateral margins of the abdominal sternites (spots sometimes reduced); and, in ventral view, the base of each paramere has a distinct, sclerotized, basally projecting tooth (Fig. 28) that is lacking in *G. cretacea* (Fig. 14).

While males of *G. howdeni* have both lateral and submedian, cretaceous spots on the abdominal sternites, the females have only the lateral spots. The marginal, broad, cretaceous bands on the pronotum and the transverse, broad, cretaceous bands on the elytra show little variation, although three male specimens had the elytral bands weakly broken into two irregularly transverse spots (Fig. 25b). All other cretaceous markings vary a little in size or are occasionally reduced.

Biology. WBW and several others have observed *G. howdeni* adults as they oriented to tree holes, and this species has been collected from tree holes in oaks (Fig. 43-44) as adults (label data and J. Cicero, personal communication to WBW) and as pupae (label data). Pupal cases in the UAIC are covered with the feces of moth larvae. Some Arctiidae and Lasiocampidae larvae spend the daytime hidden within tree holes and emerge at night to feed on the tree leaves. They deposit considerable quantities of feces in the tree holes that produces a rich humus in which *G. howdeni* apparently breeds.

Gymnetina howdeni is often sympatric with *G. cretacea*, but it tends to occur at higher elevations in oak or pine woodland (Fig. 33-35) or along riparian areas in juniper woodland habitat, whereas *G. cretacea* is more often captured in lower elevation oak and mesquite grasslands around the bases of the same mountain ranges (Fig. 36-39).

***Gymnetina salicis* (Bates, 1889), revised combination**

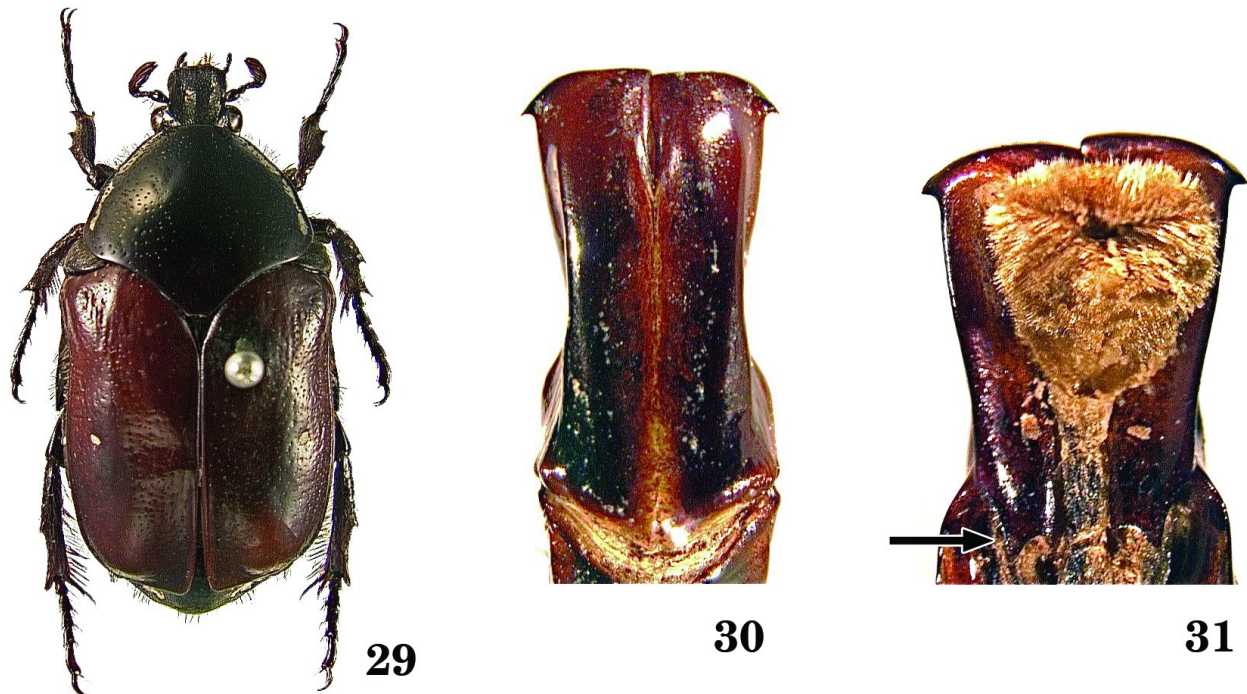
(Fig. 29-31, 32)

Cotinis salicis Bates 1889: 414. Original Combination. Lectotype (sex unknown) designated and examined by BCR at RMNH.

Amithao distigma Schoch 1898: 108. Synonym

Description (males; females remain unknown). Length 19.6-20.4 mm; width across humeri 9.4-12.1 mm. Color of head, pronotum, and pygidium black, shiny. Pronotum along lateral margin with slender, cretaceous band, band occasionally broken (Fig. 29). Mesepimeron and metepisternum black. Elytra reddish brown, shiny, usually with single, small, round to transverse, cretaceous spot on lateral edge of disc behind middle. Pygidium usually with a large, irregularly shaped, cretaceous spot near lateral edge at base on each side. Sternites 1-3 each with small, cretaceous spot on posterolateral margin. Legs and venter black to piceous. **Head:** Lateral margins weakly elevated. Surface densely punctate; punctures moderate to large, setigerous; setae short, moderate in density, brown. Occiput smooth, shiny. Frons with weak, median, longitudinal keel extending to base of clypeus. Clypeus with apex broadly subtruncate, strongly reflexed, sides distinctly constricted just before antennal insertion. Interocular width equals 4.8-5.0 transverse eye diameters. Antenna with 10 segments, club slightly shorter than antennomeres 1-7. **Pronotum:** Surface moderately densely punctate except for disc which is impunctate to sparsely punctate; where dense, punctures mostly large, setigerous (when not abraded away); disc with minute to small punctures; setae short, brown. Mesepimeron dorsally and on anterior face with sparse to dense, mostly large, setigerous punctures; setae brown, short. **Elytra:** Surface punctate; punctures round, moderately large, glabrous, sparse near suture and becoming progressively denser towards lateral margin where usually rugose. Apical umbone pronounced. Apices nearly right angled to subacutely produced. **Pygidium:** Surface concentrically rugulopunctate, setigerous; setae moderate in density, minute to short, brown. In lateral view, surface nearly flat in basal half, weakly convex in apical half. **Venter:** Setae black. Mesometasternal process flat on ventral surface, apex broadly rounded, anterior face nearly parallel (slightly oblique) to longitudinal axis of body. Abdominal sternites each moderately to densely punctate along lateral margin; punctures mostly large with brown to tawny setae. **Legs:** Femora and meso- and metatibiae with dense fringe of brown to tawny setae. Protibia tridentate, basal 2 teeth closer to one another than is apical tooth to median tooth. **Parameres:** In ventral view, base of each paramere with small, but distinct, basally projecting tooth (Fig. 30-31).

Distribution (Fig. 32). This rare species is known only from central Mexico, and the lectotype was collected near Mexico City. 11 specimens examined from CASC, MAMC, OSUC, RMNH, USNM, ZMHU, ZSMC.



Figures 29-31. *Gymnetina salicis*, dorsal view. **30-31** Dorsal and ventral views, respectively, of parameres. Note distinct tooth at base of paramere on ventral side (arrow).

MEXICO (11). DISTRITO FEDERAL (2): Mexico City. DURANGO (2): Durango (26 mi. W), Reserva Biosfera La Michilia. NO DATA (7).

Temporal Distribution. June (1), July (2), December (2). Too few specimens have label data with the month of collection to indicate a reliable temporal distribution.

Diagnosis. *Gymnetina salicis* is similar to *G. borealis* in size and in its reduced cretaceous markings but may be separated immediately from that species by its cretaceous pygidial spots and longer, narrower parameres, whereas the pygidium in *G. borealis* lacks cretaceous spots and has comparatively stout parameres.

Gymnetina salicis differs from *G. alboscripta* by the absence of a cretaceous spot on the mesepimeron (present in *G. alboscripta*) and by the presence on the elytra of a single, small, cretaceous spot near lateral margin (Fig. 29) (a slender, sinuate, transverse, cretaceous band (Fig. 1) present in *G. alboscripta*). Males of *G. salicis* never have a second set of cretaceous spots on the abdominal sternites, whereas *G. alboscripta* always do, even if reduced (Fig. 2).

Biology. Nothing is known of the life history for *G. salicis*. Bates (1889) indicated the type was found in decayed willow trees, and *G. cretacea cretacea*, *G. cretacea sundbergi*, and *G. howdeni* have also been found in tree holes (Fig. 43-44). Females remain unknown to us.

Nomenclature. Ratcliffe (2004) designated the male specimen in the Leiden museum (RMNH) as a lectotype even though there were some slight discrepancies between Bates' description in the *Biologia* and that specimen. Bates indicated the specimen he described was uniformly shiny black, with a strigulose pygidium, 20 mm in length, and a male. The specimen designated is shiny black with reddish brown elytra, is missing the entire abdomen (with a cotton plug instead), and is also 20 mm in length. In his description, Bates did not state whether he had a single specimen or more, although he listed only one male specimen from near Mexico City (the same data as on the lectotype). One of the labels on the Leiden specimen does say "co-type." Ratcliffe (2004) did not find other syntypes of *Cotinis salicis* at London or

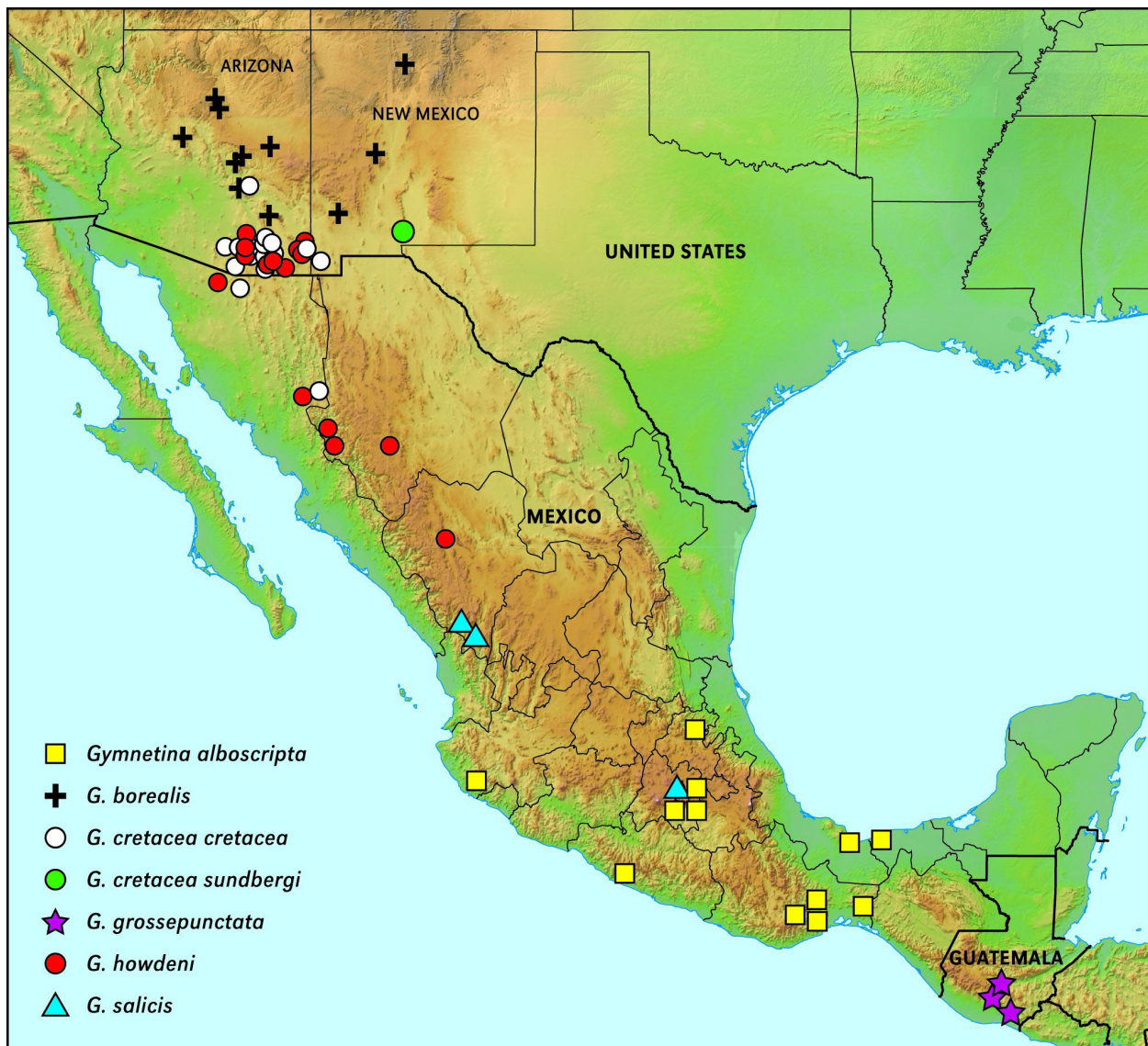


Figure 32. Distribution map for *Gymnetina* species.

Paris where most of the Bates material resides. In view of all of the above, Ratcliffe thought best to fix the name by designating the Leiden specimen as the lectotype since other specimens in a putative type series were not located.

Schürhoff (1934) placed *Amithao distigma* Schoch in synonymy with *Cotinis salicis* and stated *C. salicis* actually belonged in the genus *Gymnetina*. Blackwelder (1944), Blackwelder and Arnett (1974), and Goodrich (1966), apparently unaware of Schürhoff (1934), all listed *G. salicis* as a junior synonym of *Gymnetis alboscripta*, but these are two different species. Accordingly, we here revise the most recent combination by moving this species once again to *Gymnetina*. The photograph of “*Gymnetina cretacea*” from Suchil, Durango in Morón et al. (1997) is actually of a specimen of *G. salicis*.

Biogeography

Members of the Gymnetini are highly diverse in South America. After the formation of the isthmus of Panama, ancestral taxa in the Gymnetini began their northward dispersal into Central America, Mexico, and the United States. Webb (1978, 1985) provided an excellent analysis of this inter-American biotic exchange. The interval from 2.5-1.5 MYBP shows an extensive movement of savanna-adapted mammal

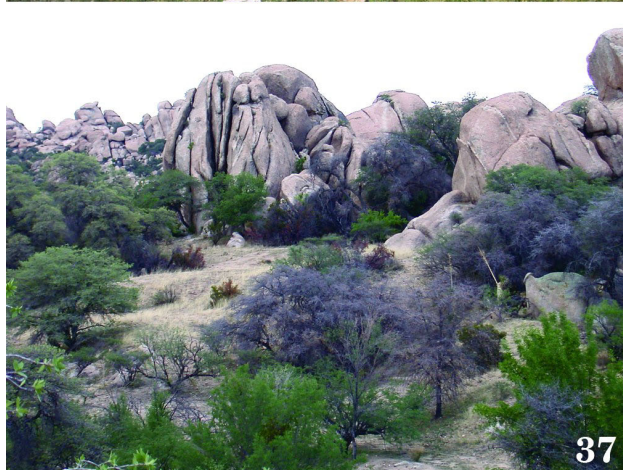
faunas from south temperate to north temperate latitudes and vice versa. All of the animals that are known to have dispersed between the Americas in the late Tertiary were tolerant of, or specifically adapted to, savanna woodland habitats as are, seemingly, the species of *Gymnetina* today. The savanna elements were not incidental parts of the interchange but represent the vast majority of the taxa involved. The extent of savanna adaptations among the land mammals of the interchange indicates the presence of a uniformly nonforested corridor or a moving mosaic of such habitats between South America and North America.

The distribution of *Gymnetina* species (Fig. 32) is similar to that of the northern group of species of *Hologymnetis* Martínez, another genus within the Gymnetini, and *Xyloryctes thestalus* Bates, a rhinoceros beetle (Dynastinae: Oryctini). The biogeography of *Hologymnetis* species was reviewed by Ratcliffe and Deloya (1992) and *Xyloryctes thestalus* by Ratcliffe (2009) and pertinent parts are briefly reviewed here to understand the similar distribution of *Gymnetina* species.

Howden (1966) observed that the scarabaeoid fauna of North America was well established before the Pleistocene. Lacking fossil evidence for *Gymnetina* species, we must rely upon data from present and paleodistributions of other plants and animals and ecological factors to formulate a model to best explain the current distribution of these beetles. Species of *Gymnetina* are today found in mesic to xeric habitats from Mexico and Guatemala northwards to the southwestern United States. Based on his analysis of the entomofauna, Halffter (1976) formulated several different dispersal patterns to explain the present distribution of various taxa in the physiographically complex Mexican Transition Zone. The distribution of *Gymnetina* species coincides well with Halffter's "Typical Neotropical Dispersal Pattern". In this pattern, South American elements penetrated into the Mexican Transition Zone after the formation of the Panamanian land bridge and after most of the elevation of the Mexican Plateau. As ancestral *Gymnetina* species spread northward, they used as their principal expansion route from Central America the mountains of Oaxaca and the Sierra Madre Occidental, which funneled dispersal to the west and north, respectively, where *Gymnetina* species occur today.

The Sierra Madre Occidental runs parallel to the Pacific coast from its junction with the Transverse Volcanic Belt in Nayarit and Jalisco states to the U.S.-Mexican border. Dispersal into Arizona and New Mexico of species ancestral to present day *Gymnetina* species was probably enabled by the temperate corridor of the Sierra Madre Occidental prior to the formation of desert barriers during the Pleistocene glaciations. Paleoenvironmental reconstructions indicate that pine/oak forests and temperate vegetation dominated the Sierras and the Transverse Volcanic Belt in Mexico and were present also in New Mexico (Galloway 1970; Messing 1986; Harris 1988). Similar dispersal patterns (wherein the cordilleras are used as pathways) can be seen in several species of *Canthon* Hoffmannsegg, *Dichotomius* Hope, and *Onthophagus* Latreille (Scarabaeinae); *Diploaxis* Kirby and *Isonychus* Mannerheim (Melolonthinae); *Parabyrsopolis* Ohaus and *Chrysina* Kirby (Rutelinae); *Ancognatha* Erichson, *Cyclocephala* Dejean, *Tomarus* Erichson, *Strategus* Kirby, and *Phileurus* Latreille (Dynastinae); *Hologymnetis* Martínez (Cetoniinae); and *Trox* Fabricius (Trogidae) (see Howden 1966, Morón 2006 a-b, and Ratcliffe and Deloya 1992) as well as numerous other invertebrates, vertebrates, and plants.

Research by Toledo (1982) illustrated that there were successive perturbations in plant and animal communities during the recurring Pleistocene glaciations and interglacials as these organisms responded to cool-dry, cool-wet, or warm-dry climatic cycles. One of these perturbations was the formation or expansion of deserts. According to the research of Axelrod (1950, 1958) and Findley (1969), extensive desert areas appeared in the Sonoran or Chihuahuan regions in the Pleistocene. The fossil evidence indicates that an extensive pine-oak savanna existed prior to desert formation in what is now northern Mexico and southern Arizona when the climate was cooler and wetter (Rogers 1976). Tree lines became lower in elevation (perhaps by as much as 1,000 m during the Wisconsin glaciation 12,000-10,000 years BP; Martin and Mehringer 1965; Wells 1979; McDonald 1993), and temperate forest became established in semiarid regions of the southwestern United States. Expansion of *Gymnetina* species northward through the Sierra Madre Occidental as far as Arizona and New Mexico was facilitated by pre-Pleistocene suitable habitat and climate. With the formation of major deserts, *Gymnetina* species became isolated on more humid and equable mountain islands surrounded by a sea of desert in northern Mexico and the southwestern United States. These deserts now form impassable barriers to further dispersal. These fragmented and isolated mountains are where we find most of the *Gymnetina* species today.



Figures 33-38. Habitats for *Gymnetina* species: **33-34)** Madera Canyon, Santa Cruz Co., AZ. **35)** Cave Creek Canyon, Cochise Co., AZ. **36-37)** Dragoon Mts., Cochise Co., AZ. **38)** Patagonia Mts., Santa Cruz Co., AZ.



Figures 39-44. Habitats for *Gymnetina* species: **39)** Huachuca Mts., Cochise Co., AZ. **40)** Oak woodland, east slope of Patagonia Mts. near Locheil, Santa Cruz Co., AZ. **41)** Just southeast of Oaxaca, Mexico, habitat for *Gymnetina alboscripta*. **42)** *Baccharis sarothroides*, Santa Cruz, Co., AZ. **43-44)** Oak trees and tree holes in which *Gymnetina* species breed. Carr Canyon, Cochise Co., AZ.

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