Three New Species and New Records of *Elmas* (Coleoptera: Staphylinidae: Xanthopygina) from South America with a Reanalysis of the Phylogenetic Relationships Among the Species of *Elmas*

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ABSTRACT Three new species of the xanthopygine staphylinid genus *Elmas* are described: *Elmas strigiformis* Ashe & Chatzimanolis (Brazil), *Elmas elassoides* Ashe & Chatzimanolis (Bolivia), and *Elmas similis* Ashe & Chatzimanolis (Brazil). The habitus and structural illustrations are provided for their recognition. Previously published keys for identification are modified to incorporate the new species. The phylogenetic relationships are reanalyzed based on addition of the three new species, revision and recoding of 32 previously used characters, deletion of *E. modesta* (known only from females) from the analysis, and addition of eight new characters. Phylogenetic analysis based on four xanthopygine outgroups and 19 species of *Elmas* yielded four equally parsimonious trees of length = 135, C.I. = 45, and R.I. = 74. Major results of the phylogenetic analysis are *Elmas* is robustly monophyletic; *E. strigella* and *E. strigiformis* are sister species, and together they are sister to all other known *Elmas* species; *Elmas elassos* is sister to *Elmas elassoides* + *Elmas similis*; *E. spinosus* is sister to the sister-group pair of *E. falini* + *E. gigas*; and *E. windorsi* and *E. costaricensis* are sister groups. New records of *Elmas lescheni* document the presence of *Elmas* in Colombia for the first time.

THE GENUS *Elmas* Blackwelder, 1952 comprises 17 species of relatively large (11–23 mm), black staphylinid beetles (Coleoptera: Staphylinidae). Known range of the genus is limited to the New World tropics from south central Nicaragua to southeastern Brazil and Bolivia (Ashe and Chatzimanolis 2003). However, specimens of *Elmas* are rare in collections; 12 of the 17 described species are known from 10 or fewer specimens, distribution of the genus and its included species are poorly known, and nothing is known about the habitat and natural history of *Elmas* (Ashe and Chatzimanolis 2003). The genus was recently revised by Ashe and Chatzimanolis (2003); they added 15 new species to the two previously described species, outlined the taxonomic history of the genus, and provided a preliminary phylogenetic analysis. Since this work was published, we have seen specimens of three undescribed species and specimens documenting the first records of *Elmas* from Colombia.

In this article, we describe three additional species from South America, reanalyze the phylogenetic relationships of the species of *Elmas* based on additional species and an expanded and reanalyzed character set, and provide the first records of the genus from Colombia.

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Materials and Methods

Dried specimens were first relaxed in warm soapy water, and apical abdominal segments containing the aedeagus were dissected from the abdomen. Mouthparts of selected individuals also were dissected for study and for scanning electron microscopy. The apical abdominal segments were cleared using 10% KOH, and the aedeagus was removed from the inside of the abdomen. Body structure, mouthparts, and aedeagi were studied using an Olympus SZ-60 dissecting microscope. Illustrations were made with a camera lucida on an Olympus SZH-10 dissecting microscope. Photographs were prepared using a Microptics ML-1000 Digital Imaging System. Relative width of the gula is given as a ratio of least width (narrowest transverse distance between the sulci):length (the distance along the gula midline from a line connecting the posterior tentorial pits to the anterior margin of the gula). Relative density of punctures on the head, pronotum, and elytra is expressed in terms of the average number of punctures in a transverse linear distance of 0.2 mm measured (with a eyepiece micrometer) in the middle of the anterolateral right quadrant of the appropriate body part (frons of head, pronotum, or right elytron). Terms for structural features follow Blackwelder (1936), Smetana and Davies (2000), and Ashe and Chatzimanolis (2003).

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Table 1. External differences between *E. elassoides* and *E. similis*

Character	*E. elassoides*	*E. similis*
Head punctures	Punctures small (about four to five punctures/0.2 mm) (Fig. 1)	Punctures medium sized (about three to four punctures/0.2 mm) (Fig. 2)
Antenna, color	Antenna black except article 8 yellowish brown and articles 9–11 pale yellow	Antenna black except 1/2–2/3 of articles 7–10 light yellowish brown and article 11 pale yellow
Pronotum, shape	Pronotum wider than long, width:length ratio = 1.21	Pronotum subquadrate, width:length ratio = 1.10
Pronotum, punctures, size	Pronotal punctures small (about six to seven punctures/0.2 mm) (Fig. 1)	Punctures medium sized (about four to five punctures/0.2 mm) (Fig. 2)
Pronotum, punctures, shape	Most punctures round, not elongated, some near posterior margin very slightly elongated in longitudinal or postero-lateral direction (Fig. 1)	Many punctures elongated in longitudinal or postero-lateral direction; elongated punctures especially prominent in posterior half (Fig. 2)
Elytra, punctures	Elytra with punctures small (about three to four punctures/0.2 mm)	Elytra with punctures moderate sized (about two to three punctures/0.2 mm)

Specimens used in this study were made available from the following institutions: Snow Entomological Collection, Division of Entomology, Natural History Museum and Biodiversity Research Center, University of Kansas (SEMC); Museo de Historia Natural, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogata (UNAB); and Canadian National Collection, Agriculture Canada, Ottawa, Canada (CNCI).

Ashe and Chatzimanolis (2003) presented a preliminary analysis of the phylogenetic relationships among the known species of *Elmas.* The analysis presented in this article is a refinement of that presented by Ashe and Chatzimanolis (2003), and it uses the same outgroups (*Plociopterus fetialis*, *Nordus fungicola*, *Xanthopygus callidus*, and *Xenopygus analis*). However, there are several differences between the analysis presented here and that published by Ashe and Chatzimanolis (2003). First, *E. modesta* is not included in this analysis. *E. modesta* is known only from two female specimens, and these are externally indistinguishable from specimens of *E. hanleyi.* We suspect that these two species are synonyms, but this cannot be confirmed until male specimens of *E. modesta* are discovered near the type locality of that species. Many characters in the data matrix are based on characters of the male copulatory organ, and these cannot be scored for *E. modesta.* Second, three new species are added to the analysis, *E. strigiformis*, *E. elassoides*, and *E. similis.* Third, character 6 of Ashe and Chatzimanolis (2003) (condition of the postmandibular carina) was deleted from the data matrix. We found that we could not consistently and accurately code the states of this character among all taxa. Finally, states for seven new characters (characters 5, 6, 7, 25, 28, 30, and 31) are added, and additional states are added to characters 19 and 37 (*Appendix* 1). The hypothesized homology statements for all states and coding of all characters were reviewed for all species in the analysis.

Homologous states of characters were hypothesized based on the criteria of position and special similarity (Remane 1956, Wiley 1981). Characters (38 total) and their hypothesized homologous states (*Appendix* 1) were written into a character by taxon matrix using WINCLADA version 0.9.9+ (BETA) (Nixon 1999) (Table 2) with inapplicable or unobserved characters coded as a question mark (?). Phylogenetic relationships were reconstructed using the heuristic search option of NONA version 2.0 (Goloboff 1993) spawned through Windclada (settings: max. trees to hold = 1000, replications = 100, starting trees per rep. = 10). All characters were equally weighted and unordered; character polarities were determined in the context of the phylogenetic analysis. Bootstrap analysis (Felsenstein 1985) based on 1,000 resampling replications was used to study the character support in the data set for hypothesized clades.

Taxonomy

Elmas elassoides new species
(Figs. 1, 4–10)

Diagnosis. *E. elassoides* can be distinguished from *E. similis* by differences in shape of the paramere and number of sensory spinules on the paramere (Figs. 7 and 8), shape of the apex of the median lobe and position of medial teeth on median lobe (Figs. 4, 5, and 9). Differences in aedeagal features between these two species are not great and suggest close relationship. However, these two species are easily distinguished by differences in size of head punctures, antennal coloration, pronotal shape, size and shape of pronotal punctures, and size of elytral punctures (Table 1).

Description. Length 11.5 mm. Color black throughout. Head (Fig. 1) with postclypeus slightly deflexed ventrally in relation to frons, clypeus impunctate except for scattered punctures on anterior margin; medial area between antennae without distinct shallow longitudinal V-shaped groove; eyes large, length ≈3.2 times length of temples behind eyes; punctures small (≈4–5 punctures/0.2 mm), uniformly distributed, punctures more or less round, very close, margins of punctures virtually contiguous, distance between punctures 0.1–0.3 times average width of punctures, punctate surfaces shining. Middle of frons slightly depressed to form a very shallow pit, pit and short region posterior to pit impunctate, shining. Postmandibular

Table 2. Revised character by taxon matrix showing distribution of character states among species of *Elmas* and selected outgroup taxa

			11111	11111	22222	22222	33333	333
	01234	56789	01234	56789	01234	56789	01234	567
Plociopterus fetialis	11111	11122	11111	11111	11111	21121	13221	111
Nordus fungicola	11111	12111	11111	11111	11111	21121	12331	111
Xanthopygus callidus	13111	11111	11111	11111	11111	11121	11331	113
Xenopygus analis	11111	11111	11111	11111	11111	11121	13121	113
E. strigella	11112	11122	12222	21121	11222	22212	11332	121
E. strigiformis	11112	11122	12222	21121	11222	22212	11332	122
E. spinosus	22221	22222	22224	43322	33221	22111	24222	234
E. falini	23321	22222	22224	43322	31221	22111	24223	234
E. gigas	23321	22222	22224	43322	32221	22111	24223	234
E. lescheni	21211	22122	22224	42232	12221	22111	21111	162
E. brooksi	23311	22122	22224	32233	12221	22111	21121	162
E. elassos	21211	22122	22224	42232	11221	22111	23222	222
E. elassoides	22211	22122	22224	42232	11221	22111	23212	233
E. similis	22211	22122	22224	42232	11221	22111	23212	233
E. guianas	21211	22122	22223	32233	13221	22121	21331	122
E. windsori	22?11	22122	22224	42223	22221	22111	22111	152
E. panamaensis	22?11	22122	22224	42242	22221	22111	24123	142
E. hanleyi	22?11	22122	22224	43232	1?221	22111	22122	142
E. costaricensis	22311	22122	22224	42233	22221	22111	23211	153
E. esmeraldas	23311	22122	22223	32232	11221	22111	22121	154
E. patillas	23211	22122	22224	43243	22221	22111	24223	131
E. lambas	11111	22122	22224	32232	33221	22121	21122	121
E. hibbsi	21111	22122	22223	33333	33221	22111	23121	112

Missing and inapplicable data are coded "?".

carina present, prominent anteriorly and less prominent on base of head, replaced medially by large irregular punctures. Mentum broadly, shallowly, and uniformly arcuate around insertion of labium. Submentum subtruncate and slightly and broadly rounded medially, without large medial spinose process. Gular sulci slightly convergent from broad apex to broad medial area (least width:length ratio = 0.17). Maxillary palpus with apical segment dilated apically, apical width across oblique apex 2.0 times basal width; apex oblique, outer length ≈1.2 times inner length. Labial palpus with apical segment very greatly expanded apically, width across oblique apex 2.0 times width of base; apex oblique, outer length 1.2 times inner length. Mandibles with apex of left mandible flattened, obliquely truncate apically, and slightly twisted dorsally from horizontal plane of head. Antenna black except article eight yellowish brown and articles 9–11 pale yellow, articles 4–7 subquadrate, articles 8–10 slightly transverse.

Pronotum (Fig. 1) wider than long, width:length ratio = 1.21; antero-lateral angles obtusely rounded, lateral angles not subcariniform; superior lateral line extended to contact inferior lateral line, weak immediately before contact with inferior lateral line; punctures small (≈6–7 punctures/ 0.2 mm), numerous, uniformly distributed, very close, edges of punctures contiguous to virtually contiguous, distance between punctures 0.1–0.2 times width of punctures, most punctures round, not elongated, some near posterior margin very slightly elongated in longitudinal or postero-lateral direction, not coalesced into short, irregular longitudinal or postero-lateral furrows; ridges between punctures shining.

Elytra with punctures small (≈3–4 punctures/ 0.2 mm), individual punctures moderately well defined, edges contiguous to separated by up to 0.5 times width of punctures, at most only slightly elongated in longitudinal or postero-lateral direction, not coalesced into short, irregular furrows, punctate surface shining.

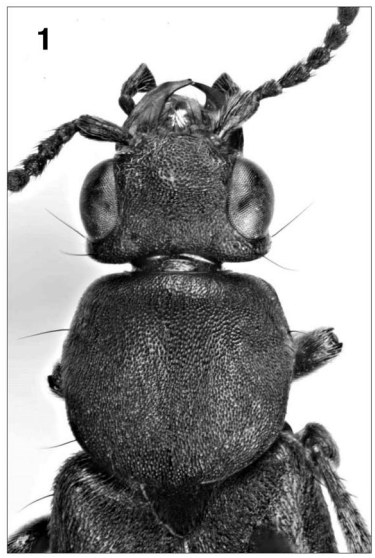
Anterior tarsal articles 1–4 uniformly covered with short, spatulate setae. Tarsal claws of middle and hind tarsi not modified, not slender or sharply curved near middle. Hind tibia slightly flattened, without longitudinal groove on external surface, medial area of tibia punctured similar to remainder of tibia with scattered setae and punctures.

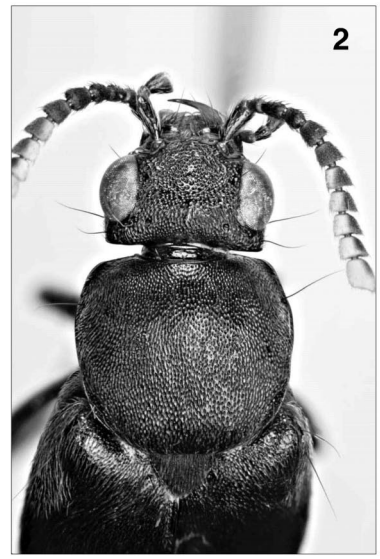
Abdominal terga III–V with moderate transverse impressions, tergum VI with very shallow transverse groove; microsculpture on III–VIII obsolete to absent distal to basal transverse ridges, surface shining.

Abdominal sterna III–V with shallow transverse impressions; microsculpture on III–V obsolete or absent distal to basal transverse ridges, surface shining; VI–VIII with obsolete wavy microsculpture.

Secondary Sexual Characters. Male: distal margin of tergum VII with very broad and shallow emargination (Fig. 10); distal margin of tergum VIII deeply emarginated (Fig. 10). Female: not known.

Aedeagus. As in Figs. 4–9. Paramere very broad and slightly expanded from middle to apex, apex broadly rounded and shallowly emarginate medially, with ≈17–20 black sensory spinules on each side, arranged in a broad band near apex and apico-laterally (Figs. 7 and 8); apical lobe narrowed to acutely rounded apex, dorsal surface with two widely separated medial teeth (Figs. 4–6 and 9).





Figs. 1–3. *Elmas* species, dorsum of head and pronotum. 1, *E. elassoides* n. sp. 2, *E. similis* n. sp. 3, *E. strigiformis* n. sp.

Holotype. Male, with labels as follows: "Bolivia, Santa Cruz Department, 3.7 km SSE Buena Vista, Hotel Flora y Fauna, 400–440 m, 17° 29.949′ S 63° 33.162′ W, 3–9 November 2002, primary forest, FIT, BOL1L02–054"/[barcode label] "SM0386084"/ "Holotype *Elmas elassoides* Ashe and Chatzimanolis, desig. J. S. Ashe 2004." In the collection of the Snow Entomological Collection, Division of Entomology, Natural History Museum, University of Kansas, Lawrence, KS.

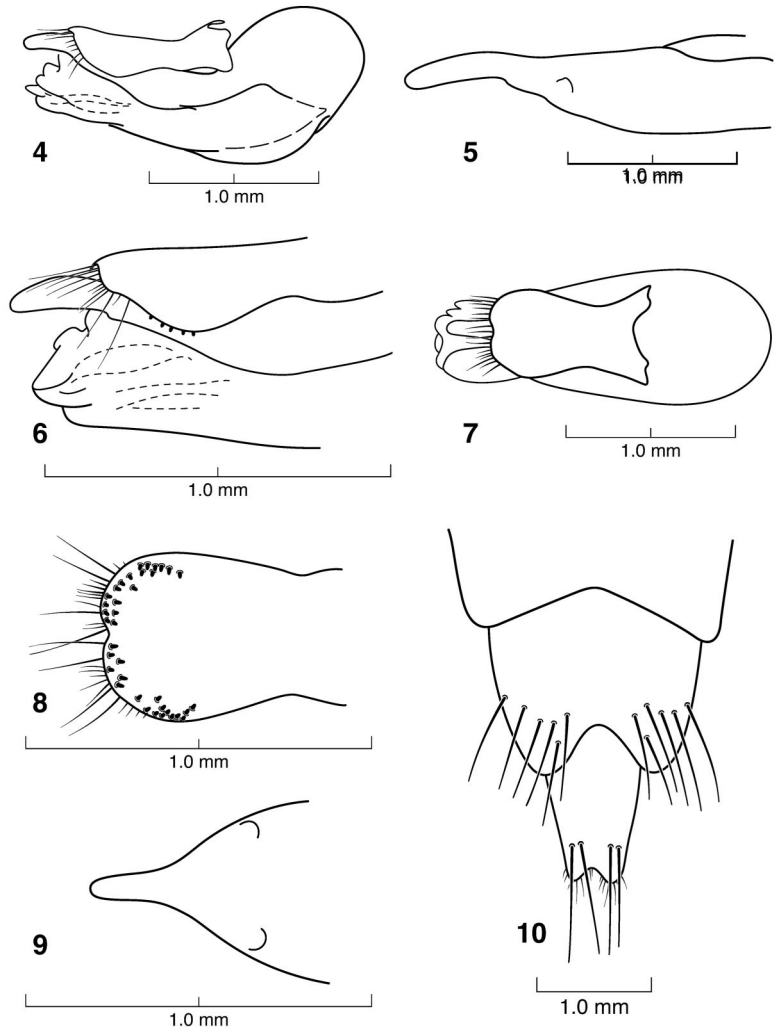
Paratypes. None, known only from the holotype.

Distribution. Known from elevations of 400–440 m in Bolivia.

Habitat and Habits. Not known. Collected in flight intercept trap placed in primary forest.

Elmas similis new species
(Figs. 2, 11–17)

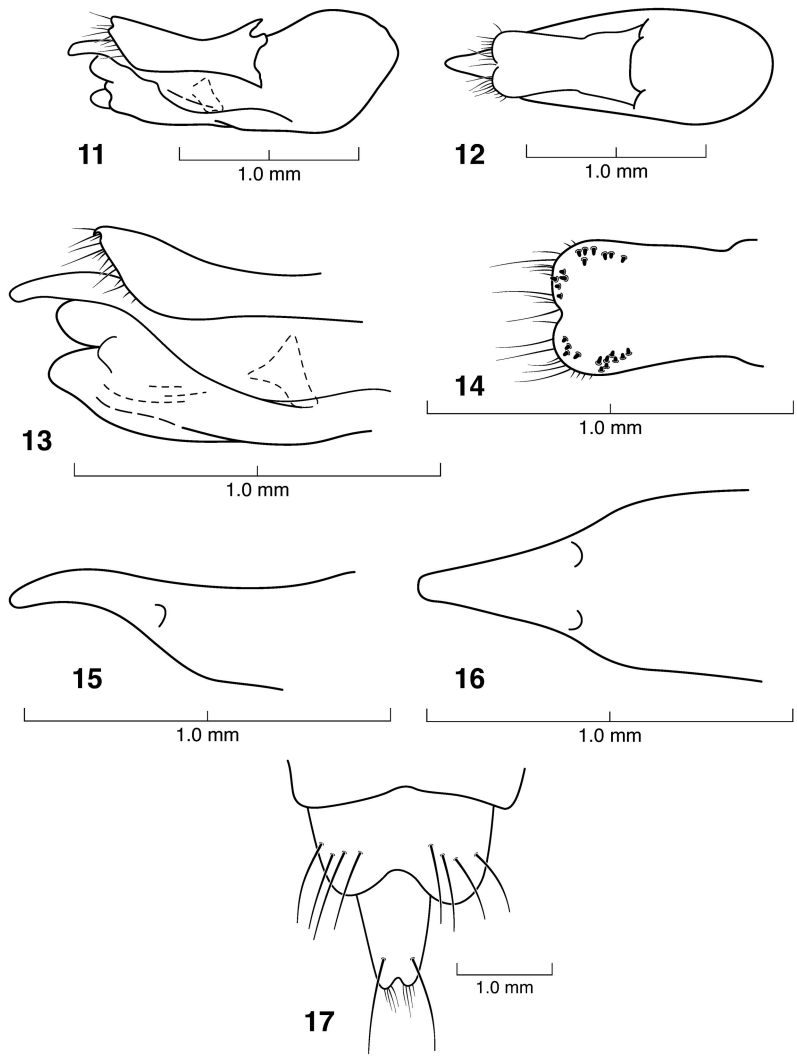
Diagnosis. *E. similis* can be distinguished from *E. elassoides* by differences in shape of the paramere and number of sensory spinules on the paramere (Figs. 12 and 14), shape of the apex of the median lobe, and position of medial teeth on median lobe (Figs. 15 and 16). Differences in aedeagal features between these two are not great and suggest close relationship.



Figs. 4–10. *Elmas elassoides* n. sp. 4, aedeagus, lateral aspect. 5, median lobe, detail. 6, apex of aedeagus, lateral aspect, detail. 7, aedeagus, dorsal aspect. 8, paramere, apex, showing sensory spinules. 9, median lobe, apex, dorsal aspect. 10, male abdominal sterna VII, VIII, IX.

However, these two species are easily distinguished by differences in size of head punctures, antennal coloration, pronotum shape, size and shape of pronotal punctures, and size of elytral punctures (Table 1).

Description. Length 12–13 mm. Color black throughout. Head (Fig. 2) with postclypeus slightly deflexed ventrally in relation to frons, clypeus impunctate and surface shining except for a few scattered punctures along anterior margin; medial area between antennae without distinct shallow longitudinal V-shaped groove; eyes large, length ≈3.2 times length of temples behind eyes; punctures medium sized (≈3–4 punctures/ 0.2 mm), uniformly distributed, punctures more or less round, very close, margins of punctures virtually contiguous, distance between punctures 0.1–0.3 times average width of punctures, punctate surfaces shining. Middle of frons slightly depressed to form a very shallow pit, pit and short region posterior to pit impunctate, shining. Postmandibular carina present, prominent anteriorly, extended approximately one-third to one-half length of eye, replaced medially and posteriorly by large irregular punctures. Mentum broadly, shallowly, and uniformly arcuate around insertion of labium. Submentum with anterior margin slightly protruded as broad, obtuse triangular lobe, without large medial spinose process. Gular sulci hardly convergent from broad apex to broad medial area (least width:length ratio = 0.23). Maxillary palpus with apical segment dilated apically, apical width across oblique apex 2.0 times basal width; apex oblique, outer length ≈1.2–1.3 times inner length. Labial palpus with apical segment very greatly expanded apically, width across oblique apex 2.0 times width of base; apex oblique, outer length 1.2 times inner length. Mandibles with apex of left mandible flattened, obliquely truncate apically, and



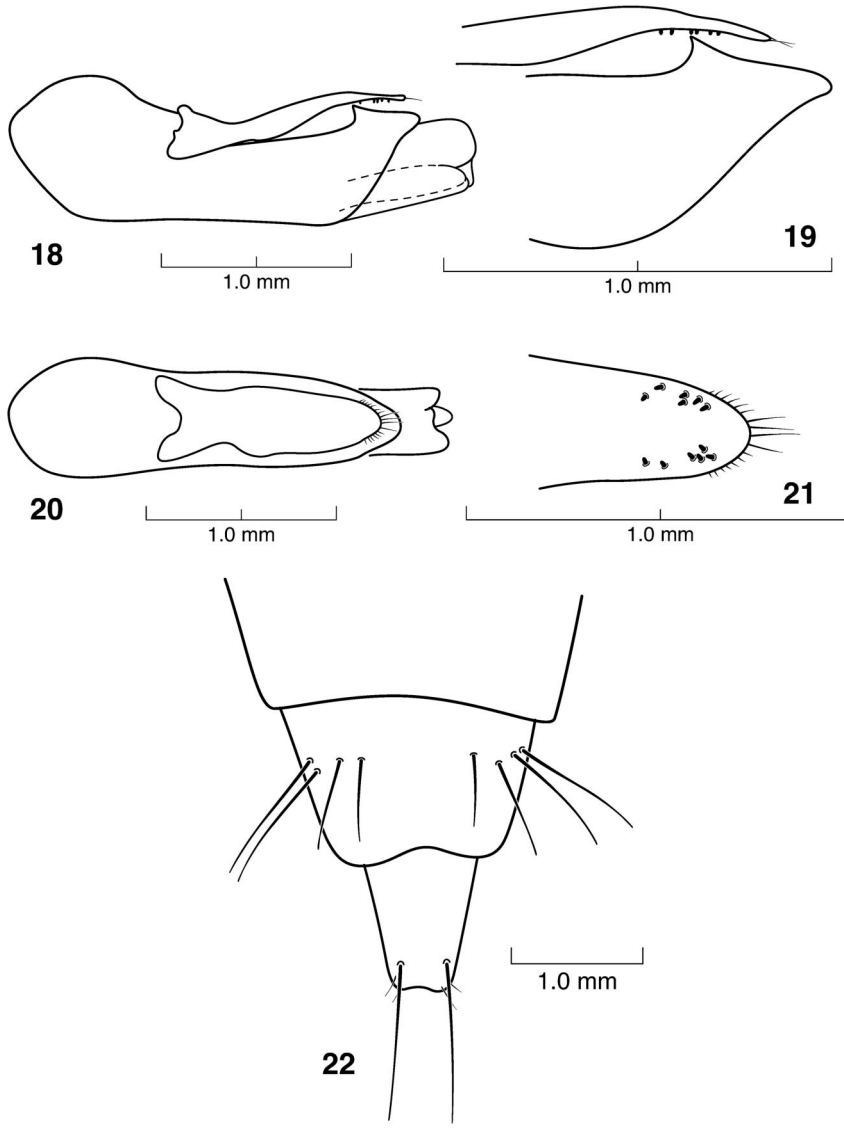
Figs. 11–17. *E. similis* n. sp. 11, aedeagus, lateral aspect. 12, aedeagus, dorsal aspect. 13, median lobe, lateral aspect, detail. 14, paramere, apex, showing sensory spinules. 15, apex of aedeagus, lateral aspect, detail. 16, median lobe, apex, dorsal aspect. 17, male abdominal sterna VII, VIII, and IX.

slightly twisted dorsally from horizontal plane of head. Antenna black except one-half to two-thirds of articles 7–10 light yellowish brown and article 11 pale yellow, articles 4–7 subquadrate, articles 8–10 slightly transverse.

Pronotum (Fig. 2) subquadrate, width:length ratio = 1.10; antero-lateral angles obtusely rounded, lateral angles not subcariniform; superior lateral line extended to contact inferior lateral line, weak immediately before contact with inferior lateral line; punctures medium sized (≈4–5 punctures/0.2 mm), numerous, uniformly distributed, very close, edges of punctures contiguous to virtually continuous, distance between punctures 0.1–0.2 times width of punctures, many elongated in longitudinal or postero-lateral direction, elongated punctures especially prominent in posterior half, not or only weakly coalesced into short, irregular longitudinal or postero-lateral furrows; ridges between punctures shining.

Elytra with punctures moderate sized (≈2–3 punctures/0.2 mm), individual punctures moderately well defined, edges contiguous to separated by up to 0.5 times width of punctures, at most slightly elongated in longitudinal or postero-lateral direction, not coalesced into short, irregular furrows, punctate surface shining.

Anterior tarsal articles 1–4 uniformly covered with short, spatulate setae. Tarsal claws of middle and hind tarsi not modified, not very slender or sharply curved near middle. Hind tibia slightly flattened, without longitudinal groove on external surface, medial area of tibia punctured similar to remainder of tibia with scattered setae and punctures.



Figs. 18–22. *E. strigiformis* n. sp. 18, aedeagus, lateral aspect. 19, median lobe, lateral aspect, detail. 20, aedeagus, dorsal aspect. 21, paramere, apex, showing sensory spinules. 22, male abdominal sterna VII, VIII, and IX.

Abdominal terga III–V with moderate transverse impressions, tergum VI with very shallow transverse groove; microsculpture on III–VIII obsolete to absent distal to basal transverse ridges, surface shining.

Abdominal sterna III–V with shallow transverse impressions; microsculpture on III–V obsolete or absent distal to basal transverse ridges, surface shining; VI–VIII with obsolete wavy microsculpture.

Secondary Sexual Characters. Male: distal margin of tergum VII with very broad and shallow emargination (Fig. 17); distal margin of tergum VIII deeply emarginated (Fig. 17). Female: without obvious secondary sexual characters.

Aedeagus. As in Figs. 11–16; paramere broad and slightly expanded from middle to apex, apex broadly rounded and shallowly emarginate medially, with approximately 9 to 10 black sensory spinules on each side, arranged in a broad band near apex and apicolaterally (Figs. 12–14); apical lobe narrowed to acutely rounded apex, dorsal surface with two widely separated medial teeth (Figs. 11, 13, 15, and 16).

Holotype. Male, with labels as follows: "Brazil, Sinop. M. Grosso, x.1975, M. Alvarenga"/"Holotype *Elmas similis* Ashe and Chatzimanolis, des. Ashe and Chatzimanolis 2004." In the collection of the Canadian Nature Collection, Ottawa. Paratypes: five (four males, one female), all with locality label as above, four (three males and one female) in CNCI and one (male) in SEMC.

Distribution. Known from Brazil.

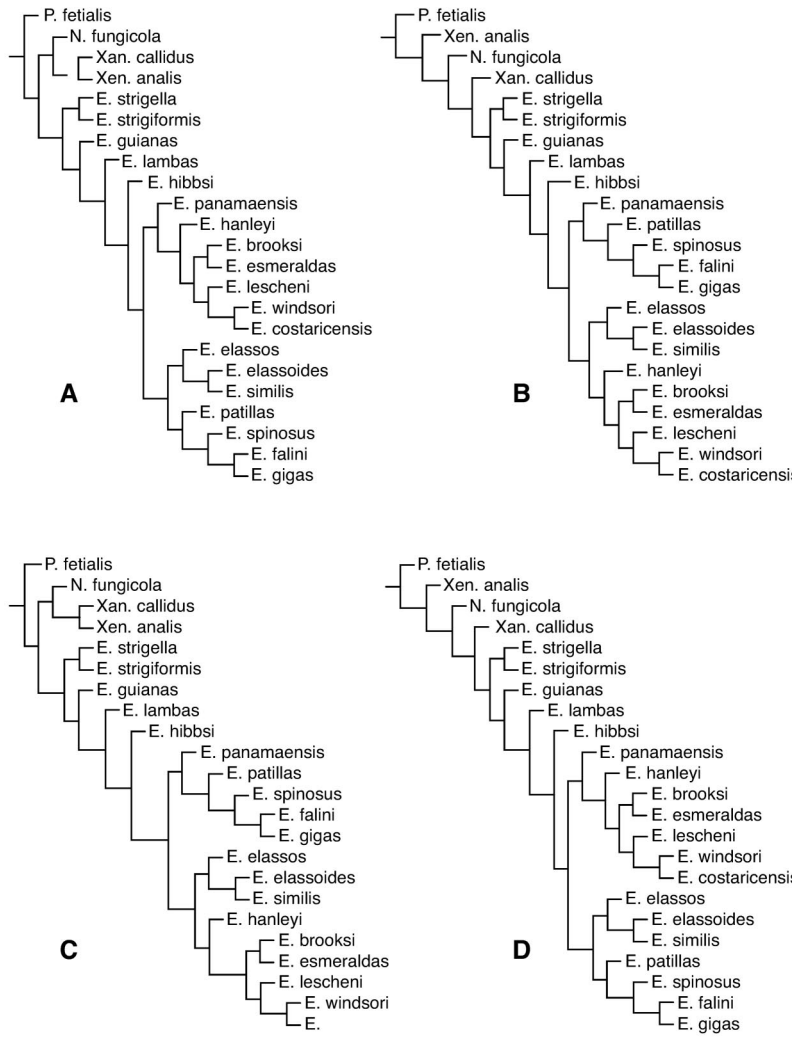


Fig. 23. (A–D) Phylogenetic relationships among *Elmas* species, four equally most parsimonious trees. Length = 135, C.I. = 45, R.I. = 74.

Habitat and Habits. Not known.

Elmas strigiformis new species
(Figs. 3, 18–22)

Diagnosis. *E. strigiformis* is very similar, and closely related, to *E. strigella.* These are the only known species of *Elmas* that have a band of metallic purple color on the lateral margins of the elytra as well as sharing a number of other unique characteristics (see key below). *E. strigiformis* can be distinguished from *E. strigella* by the combination of: slightly smaller size (body length 15–17 mm for *E. strigiformis*, 17–20 mm for *E. strigella*); apex of left mandible twisted ≈60° toward vertical in *E. strigiformis* (nearly 90° toward vertical in *E. strigella*); and the distinctive aedeagus of *E. strigiformis* (Figs. 18, 19, 20, and 21) (paramere apically emarginated in *E. strigella*, apically entire in *E. strigiformis*).

Description. Length 15–17 mm. Color black throughout with lateral margins of elytra metallic purple. Head (Fig. 3) with postclypeus in same plane as frons, punctation similar to remainder of head; medial area between antennae flat, without longitudinal V-shaped groove; eyes relatively small, length subequal to length of temples behind eyes; punctures medium size (≈3.0–3.5 punctures/0.2 mm), uniformly distributed, elongated in posterior or postero-lateral direction, coalesced into short, irregular, more or less longitudinally or postero-laterally directed grooves, ridges between grooves polished and shiny to faintly and irregularly reticulate. Middle of frons flat, without depressed area. Postmandibular carina present only near mandibular fossa and extended one-half to two-

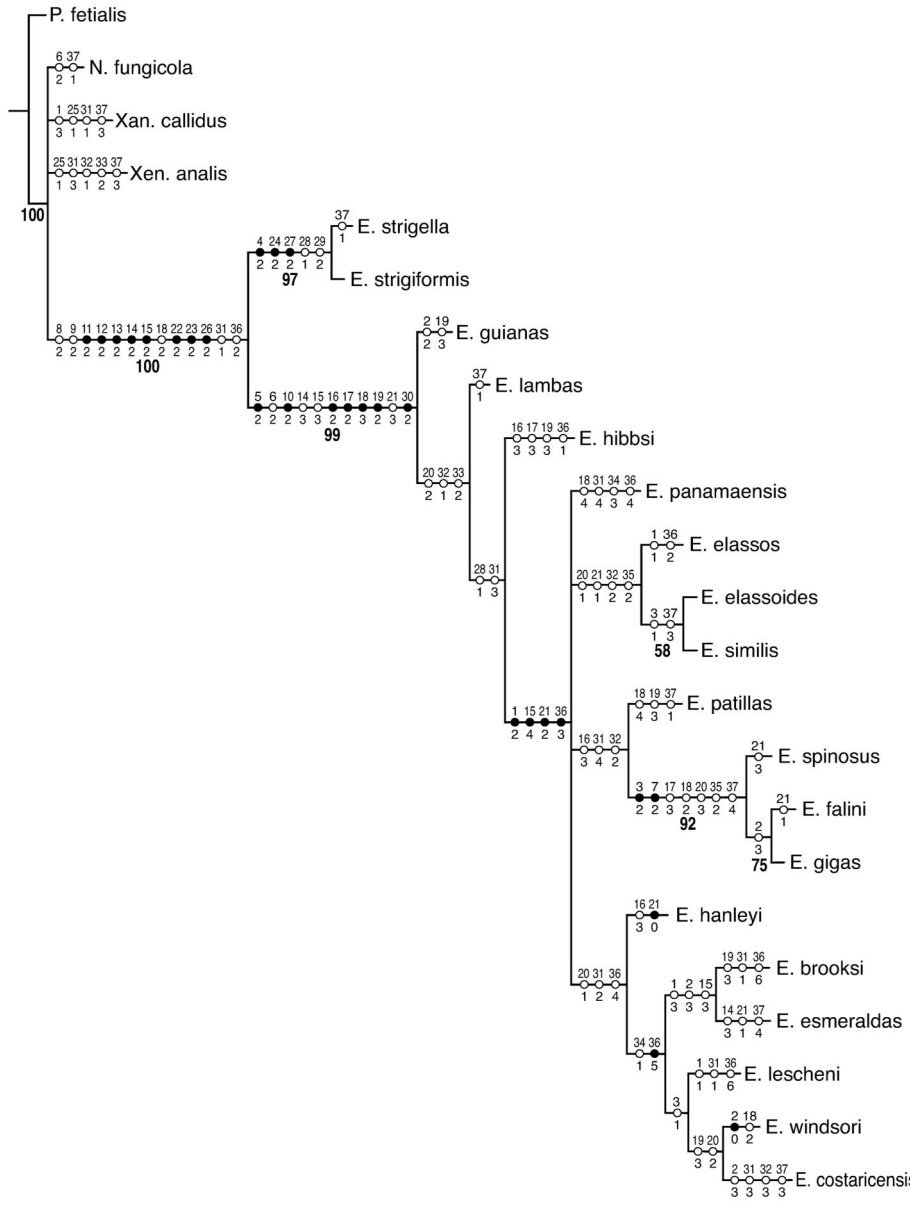


Fig. 24. Phylogenetic relationships among *Elmas* species, strict consensus of four equally most parsimonious trees with consistent character states plotted on consensus tree (black circles, unique character states; open circles, homoplasious character states). Bootstrap support of 50% or greater shown on appropriate branches.

thirds length of eyes, remainder of head beneath eyes rounded with dense irregular punctation. Mentum broadly emarginate medially. Submentum truncate, without medial spinose process. Gula moderately narrow medially (least width:length ratio = 0.15). Maxillary palpus with apical segment only slightly dilated apically, apical width 1.1–1.2 times basal width, length ≈2.5 times basal width. Labial palpus with apical segment subcylindrical, only slightly and very gradually dilated apically, apical width 1.2–1.3 times basal width, length 4.5 times basal width. Mandibles asymmetrical, left mandible flattened and twisted ≈60° toward vertical plane. Antenna black with light color (pale yellowish to whitish) limited to longitudinal band on posterior margins of segments 8–11, one-half to two-thirds of articles 8–11with light color, all of articles 5–10 longer than greatest width.

Pronotum (Fig. 3) distinctly longer than wide, width:length ratio = 0.86; antero-lateral angles very prominent and acutely delimited, forming angle of ≈90°, lateral angles subcariniform; superior lateral line extended to contact inferior lateral line; punctures

relatively large (≈2.5–3.0 punctures/0.2 mm), elongated in more or less longitudinal direction, irregularly coalesced into short irregular longitudinal grooves, narrow ridges between grooves polished and shining.

Elytra with punctures large (≈2.5–3.0 punctures/0.2 mm), irregularly confluent, surface shining. Lateral margins of elytra (epipleural area) with band of glossy metallic purple color.

Anterior tarsal articles 1–4 uniformly covered with spatulate setae. Tarsal claws of middle and hind tarsi very slender and sharply curved near middle. Hind tibia not flattened, without longitudinal groove on external surface, external surface uniformly setose.

Abdominal terga III–V with moderate transverse impressions; surface moderately to densely reticulate within impression and distal to transverse ridge on more posterior segments and moderately to obsoletely reticulate on distal half.

Abdominal sterna III–IV with moderate transverse impressions, V with faint transverse impression; surface of sterna reticulate at base with wavy, transverse reticulation distally, distal one-half to two-third shining.

Secondary Sexual Characters. Male: distal margin of tergum VII without emargination (Fig. 22); distal margin of tergum VIII slightly and broadly emarginated (Fig. 22).

Aedeagus. As in Figs. 18–21; paramere converging to rounded tip, with ≈5 large black sensory spinules on each side (Figs. 20 and 21); apical lobe broadly rounded with a single large medial tooth dorsally (Figs. 18 and 19).

Holotype. Male, with labels as follows: "Nova Teutonia, 27° 11′ S 52° 23′ W, Brazil, 300–500 m, Feb '71, Fritz Plaumann"/"Holotype *Elmas strigiformis* Ashe and Chatzimanolis, desig. J. S. Ashe 2004." In the collection of the Canadian Nature Collection, Ottawa. Paratypes: two males, with locality label as above, in CNCI and SEMC.

Distribution. Known from Brazil.

Habitat and Habits. Not known.

New Records of *Elmas lescheni* Ashe & Chatzimanolis

Seven specimens, Colombia: Amazonas, PNN Amacayacu San Martín, 3° 46′ S 70° 18′ W 150 m, Malaise 1 10/15/01 11/5/01 [15 October–5 November 2001], D. Chota Leg. M.2762 (one UNAB); Amazonas, PNN Amacayacu San Martín, 3° 46′ S 70° 18′ W 150 m, Malaise 11/5/01 11/19/01 [5–19 November 2001], D. Chota Leg. M.2763, (1 UNAB, 1 SEMC); same locality and collector, Malaise 1 12/3/01 12/17/2001 [3–17 December 2001], M.2769 (1 UNAB); same locality, Malaise 11/11/00 11/29/00 B. Amado Leg., M.1309 (1 KSEM); PNN Amacayacu Matamata, 3° 41′ S 70° 15′ W 150 m, Malaise 2 11/19/01 12/3/01 [19 November–3 December 2001, D. Chota Leg. M.2768 (1 UNAB); Cundinamarca, PNN Sumapaz Jardín Botánico, 3° 48′ N 73° 56′ W, 730 m, Malaise 1 4/02 1/24/02 [4–24 January 2002], H. Vargas Leg. M.3109 (1 UNAB).

These specimens were compared with the holotype and paratypes of *E. lescheni* in the Snow Entomological Collection and agree in both external structure and male copulatory structures with those specimens. The single specimen from Cundinamarca, PNN Sumapaz Jardín Botánico, 3° 48′ N 73° 56′ W, has integument that is slightly more shiny than the other specimens, but the aedeagus is indistinguishable from other specimens of *E. lescheni* from Colombia.

Key for Identification of *Elmas* species; Modified from Ashe and Chatzimanolis (2003) to Incorporate Species Described in This Paper

1. Pronotum distinctly longer than wide, width: length ratio 0.86–0.92; antero-lateral angles of pronotum prominent and acutely delimited, subcariniform (Fig. 4 in Ashe and Chatzimanolis 2003); punctures on head and pronotum conspicuously elongated in longitudinal or postero-lateral directions and coalesced into irregular longitudinal grooves; tarsal claws of middle and hind legs unusually elongate and slender and sharply curved near middle in lateral aspect (Fig. 113 in Ashe and Chatzimanolis 2003); lateral margins of elytra with band of purplish iridescence. Known only from Brazil 1A

   Pronotum slightly transverse, subquadrate or very slightly elongate (*only E. costaricensis* from Costa Rica, width:length ratio = 0.95, but other characters do not apply); antero-lateral angles of pronotum not prominent, obtusely rounded, not subcariniform (Figs. 1 and 2, 3 in Ashe and Chatzimanolis 2003); punctures on head and pronotum various but not uniformly elongated and coalesced into irregular furrows on both head and pronotum; tarsal claws of middle and hind legs similar to those of front legs, not unusually elongate and slender and not sharply curved near middle in lateral aspect; lateral margins of elytra without purplish iridescence 2

1A (1). Size smaller, length 15–17 mm; pronotum (Fig. 3) more elongate, width:length ratio 0.86; aedeagus with paramere entire, not emarginate apically (Figs. 20 and 21). . . . . *E. strigiformis*

   Size larger, length 17–20 mm; pronotum less elongate, width:length ratio 0.92; aedeagus with paramere distinctly emarginate apically (Figs. 117 and 118 in Ashe and Chatzimanolis 2003) . . . . . *E. strigella*

Couplets 2–11 in Ashe and Chatzimanolis 2003 –no change.

12. (7). Paramere of aedeagus very broad and expanded apically, apex broadly arcuate or broadly rounded and shallowly emarginate medially, with ≈15–17 black sensory spinules on each side arranged in broad band near apex and apico-laterally. Known only from Ecuador, Brazil and Bolivia 12A

Paramere of aedeagus more or less parallel-sided, not expanded and very broad apically, apex broadly rounded, truncate or broadly emarginate, with various numbers of black sensory spinules but always with a different arrangement of sensory spinules. Known from Ecuador, Peru and Central America 13

12A (12). Paramere of aedeagus with apex broadly arcuate laterally and shallowly emarginate medially, with ≈15–17 black sensory spinules on each side arranged in broad band near apex and apico-laterally (Fig. 25 in Ashe and Chatzimanolis 2003); aedeagus as in Figs. 23 and 24 in Ashe and Chatzimanolis 2003. Known only from Ecuador . . . . . *E. elassos*

Paramere of aedeagus with apex broadly rounded laterally and shallowly emarginate medially, with different arrangement of sensory spinules (Figs. 8 and 14); aedeagus as in Figs. 6 and 13. Known only from Brazil and Bolivia 12B

12B (12A). Pronotum subquadrate (Fig. 2), width: length ratio = 1.10; pronotal punctures (Fig. 2) medium sized (≈4–5 punctures/ 0.2 mm), many punctures elongated in longitudinal or postero-lateral direction, elongated punctures especially prominent in posterior half; paramere of aedeagus with ≈12–13 black sensory spinules on each side arranged in broad band near apex and apico-laterally (Fig. 14); apex of aedeagus evenly converging to acute apex from basal of dorsal spinose processes (Fig. 16) . . . *E. similis*

Pronotum wider than long (Fig. 1), width: length ratio = 1.21; pronotal punctures (Fig. 1) small (≈6–7 punctures/ 0.2 mm), most punctures round, not elongated (some near posterior margin very slightly elongated in longitudinal or postero-lateral direction); paramere of aedeagus with ≈18–19 black sensory spinules on each side arranged in broad band near apex and apico-laterally (Fig. 8); apex of aedeagus sharply converging to acute apex from distal of dorsal spinose processes (Fig. 9) . . *E. elassoides*

Couplets 13–15 in Ashe and Chatzimanolis 2003—no change.

Results and Discussion

Phylogenetic Analysis. Heuristic search in NONA produced four equally parsimonious trees (Fig. 23A–D) with a length of 135, consistency index of 45 and retention index of 74. A strict consensus tree of these four equally parsimonious trees is shown in Fig. 24, with bootstrap values that exceed 50% indicated on the appropriate branches of the consensus tree. Consistent characters that support clades are mapped onto the consensus tree (Fig. 24).

The genus *Elmas* is robustly hypothesized to be a monophyletic group with 100% bootstrap support for this hypothesis. The monophyly of the *Elmas* clade is supported by 13 characters, eight of which are uniquely derived (11-2; 12-2, 13-2, 14-2, 15-2, 22-2, 23-2, and 26-2).

Within *Elmas*, the clade comprising the sister pair of *E. strigella* and *E. strigiformis* is the sister group to all remaining known *Elmas.* This position is consistent with the phylogenetic position of *E. strigella* found by Ashe and Chatzimanolis (2003) with the addition of *E. strigiformis* to this analysis. The sister group relationship between *E strigella* and *E. strigiformis* is supported by five synapomorphies, four of which are unique to this lineage (4-2, 24-2, 27-2, and 29-2), and a bootstrap support of 97%. The remaining species of *Elmas* (*E. guianas–E. costaricensis* in Fig. 24) is robustly supported to be monophyletic by 11 synapomorphies, seven of which are unique to this lineage (5-2, 10-2, 16-2, 17-2, 18-2, 19-2, 30-2) and a bootstrap support of 99%. However, within this lineage, the clades are not strongly supported; only two clades, *E. elassoides* + *E. similis* and the clade comprising *E. spinosus* + *E. falini* + *E. gigas*, have a bootstrap support exceeding 50% (Fig. 24). However, within this lineage, *E. guianas* is sister to all remaining *Elmas* followed by *E. lambas* one node further up the tree. These two taxa also were found to be the basal branches in this lineage by Ashe and Chatzimanolis (2003), but their branching order was reversed. Among the remaining *Elmas* species, the branch bounded by *E. panamaensis* and *E. costaricenses* in the consensus tree is hypothesized to be monophyletic based on four unique synapomorphies (1-2, 19-4, 21-2, 36-3). This branch was also discovered by Ashe and Chatzimanolis (2003) with the exception that *E. hibbsi* also was included within that lineage. Within the lineage bounded by *E. panamaensis* and *E. costaricenses* in the consensus tree (Fig. 24) this analysis indicates four mostly weakly supported lineages: *E. panamaensis; E. elassos–E. similis*; *E. patillas* + the strongly supported lineage of *E. spinosus–E. gigas;* and, *E. hanleyi–E. costaricensis.* Among the phylogenetic relationships within this lineage, only the monophyly of the clade *E. spinosus* + *E. falini* + *E. gigas*, and the clade *E. windsori* + *E costaricensis* also were discovered by Ashe and Chatzimanolis (2003). The instability in these clades is indicative of the very few unique apomorphies that support these branches (Fig. 24).

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Appendix 1

Characters[1] and character states used in inferring phylogenetic relationships among species of *Elmas.*[2]

HEAD

0. Postclypeus: deflexed or not

1. Not deflexed in comparison to frons—in same plane as frons

2. Distinctly deflexed in comparison with frons

1. Postclypeus: punctation

1. Punctured similar to frons

2. Distinctly less punctured than frons

3. Glabrous and shining

2. Head: middle of frons with pit or not

1. Frons without medial pit or depression

2. Frons with slight depression or pit

3. Frons distinctly depressed to form a pit

3. Head: medial area between antennae

1. Not longitudinally depressed

2. Longitudinally depressed to form shallow V-shaped groove

4. Head: puncture shape and coalescence

1. Head punctures mostly round to slightly elongated

2. Head punctures elongated and coalesced into short irregular grooves

5. Head: microsetae in medio-lateral areas of epicranium

1. directed antero-medially or medially

2. directed posteriorly (contrasting in direction with microsetae at base of head and along inner margins of eyes that are directed anteriorly and anteromedially).

6. Head: eye size in relation to size of temples behind eyes

1. Eyes relatively small, temples behind eyes ≈0.5 times length of eye

2. Eyes very large, temples behind eye <0.25 times length of eye

7. Submentum: medial spine or not

1. Without medial spine

2. With prominent medial spine

8. Antenna: shape of articles 5–11

1. Round

2. Distinctly and strongly flattened

9. Antenna: articles 5–10

1. Not looking "serrate" (anterior and posterior margins of article subequal in length)

2. Looking "serrate" (anterior margin longer than posterior margin)

MOUTHPARTS

10. Mandibles: lateral aspect

1. More-or-less straight in lateral aspect

2. Deflexed ventrally in an angle of 25–30° ca. one-fourth to one-third distance from base to apex

11. Mandibles: shape in apical half

1. Right and left similar, mandibles more-or-less symmetrical

2. Mandibles asymmetrical, right mandible acutely pointed, left mandible flattened and blade-like

12. Maxillary palpus: apical segment

1. Asetose

2. With numerous small setae (as in Ashe and Chatzimanolis 2003, Fig. 62)

13. Labial palpus: apical segment

1. Asetose

2. With numerous small setae (as in Ashe and Chatzimanolis 2003, Fig. 106)

14. Maxillary palpus: apical segment

1. Not dilated apically

2. Slightly dilated apically (apex lass than 1.2 times wider than base)

[1] Characters numbered starting at "0" to correspond to numbering of characters in data matrix (Table 2) and as used by phylogenetic analysis program NONA.

[2] Character states within each character in this table are not listed in any particular order. Relative plesiomorphy and apomorphy of states is estimated within the context of the phylogenetic analysis, and the plesiomorphic condition is not necessarily the first state listed. We have, therefore, purposefully not labeled the first state as "0" because this designation is, by convention, usually taken to indicate the plesiomorphic state. Thus, the relative order of states within each multistate character should not be interpreted as a hypothesis of transformation direction or polarity.

3. Moderately dilated apically (apex 1.3–1.6 times wider than base)
4. Strongly dilated apically (apex 1.7–2.0 times wider than base or more)

15. Labial palpus: apical segment
1. Not dilated apically
2. Slightly dilated apically (apex <1.3 times wider than base)
3. Moderately dilated apically (apex 1.4–1.6 times wider than base)
4. Strongly dilated apically (apex 1.7–2.0 times wider than base or more)

16. Maxillary palpus: apical segment
1. Not oblique apically; inner and outer lengths subequal
2. Slightly oblique apically; outer length 1.1–1.3 times length of inner marginal length
3. Strongly oblique; outer length 1.4 or greater times length of inner marginal length

17. Labial palpus: apical segment
1. Not oblique apically; inner and outer lengths subequal
2. Slightly oblique apically; outer length 1.1–1.3 times length of inner marginal length
3. Strongly oblique; outer length 1.4 or greater times length of inner marginal length

18. Left mandible: apex
1. Sharp
2. Broadly rounded (as in Ashe and Chatzimanolis 2003, Figs. 5 and 34, 103, 119)
3. Obliquely truncate (as in Ashe and Chatzimanolis 2003, Figs. 42 and 51, 60, 89)

LEGS

19. Hind tibia: flattened or not
1. Not flattened
2. Slightly flattened
3. Distinctly flattened

20. Hind tibia: longitudinally grooved or not
1. Without longitudinal groove
2. With narrow, short longitudinal groove
3. With broad, long longitudinal groove

21. Hind tibia: structure of longitudinal groove
1. Fully setose
2. Narrowly asetose
3. Broadly asetose

22. Tarsomeres of middle and hind tarsi: flattened or not
1. Not flattened
2. Slightly to strongly flattened

23. Tarsomere one of middle and hind tarsi: elongate or not
1. Not as long as next three combined
2. As long or longer than next three combined

24. Tarsal claws: middle and hind tarsi
1. Short and uniformly curved
2. Long and sharply curved near middle (Ashe and Chatzimanolis 2003, Fig. 114)

THORAX

25. Prosternum: basisternum
1. With pair of prominent setae
2. Without pair of prominent setae

26. Elytra: setae
1. Without patch of setae on lateral margin directed medially to posteromedially
2. With patch of setae on lateral margins directed medially to posteromedially

27. Elytra: lateral purple iridescence
1. Without lateral purplish iridescence
2. With lateral purplish iridescence

28. Pronotum: medial longitudinal asetose area
1. Absent
2. Present

29. Prontoum: antero-lateral angles
1. Not strongly angulate and cariniform
2. Strongly angulate and cariniform

30. Pronotum: Setae on lateral and postero-lateral margins of elytra
1. Directed medially or antero-medially
2. Virtually all directed posteriorly or postero-medially

AEDEAGUS: PARAMERE

31. Paramere: distribution of sensory spinules
1. In a longitudinal row on each side (as in Ashe and Chatzimanolis 2003, Figs. 12 and 56, 86)
2. Primarily in a band along anterior margin (as in Ashe and Chatzimanolis 2003, Figs. 30 and 67, 123)
3. In a band along anterior margin and along each side (as in Ashe and Chatzimanolis 2003, Figs. 25 and 74)
4. Uniformly distributed on disk of lobes of parameres (as in Ashe and Chatzimanolis 2003, Figs. 39 and 94, 100)

32. Paramere: condition of apex in dorsal aspect
1. Parallel-sided or slightly converging apically (as in Ashe and Chatzimanolis 2003, Figs. 12 and 67, 80, 110)
2. Distinctly expanded apically (as in Ashe and Chatzimanolis 2003, Figs. 25 and 39, 48, 99)
3. Distinctly converging to tip (as in Ashe and Chatzimanolis 2003, Figs. 56 and 117)

33. Paramere: condition of apical margin
1. Broadly rounded (as in Ashe and Chatzimanolis 2003, Fig. 118)
2. Truncate or subtruncate (as in Ashe and Chatzimanolis 2003, Figs. 12 and 25, 30)
3. Pointed (as in Ashe and Chatzimanolis 2003, Fig. 56)

34. Paramere: apical margin emarginate or not
1. Entire (as in Ashe and Chatzimanolis 2003, Figs. 56 and 86, 122)
2. Slightly and broadly emarginate (as in Ashe and Chatzimanolis 2003, Figs. 30 and 67, 110)
3. Deeply and narrowly emarginate (as in Ashe and Chatzimanolis 2003, Figs. 81 and 94, 117)
4. Broadly and deeply emarginate (as in Ashe and Chatzimanolis 2003, Figs. 39 and 48, 99)

35. Paramere: lateral aspect of apex
1. Narrowed or parallel-sided from base to apex (as in Ashe and Chatzimanolis 2003, Figs. 14 and 22, 57, 84, 118)
2. Distinctly broadened in lateral aspect (as in Ashe and Chatzimanolis 2003, Figs. 26 and 108)

AEDEAGUS: MEDIAN LOBE

36. Medial Lobe: dorsal teeth

1. Without dorsal teeth (as in Ashe and Chatzimanolis 2003, Fig. 76)

2. Present as a single medial tooth or carina (as in Ashe and Chatzimanolis 2003, Figs. 58 and 82, 118)

3. Present as two widely separated teeth or carinae (as in Ashe and Chatzimanolis 2003, Figs. 39 and 48, 100, 111)

4. United medially into U- or V-shaped carina (as in Ashe and Chatzimanolis 2003, Figs. 68 and 95)

5. United medially into transverse semilunulate carina (as in Ashe and Chatzimanolis 2003, Figs. 19 and 124)

37. Medial Lobe: apex

1. Broadly rounded (as in Ashe and Chatzimanolis 2003, Fig. 117)

2. Slightly narrowed to broad sub-acute apex (as in Ashe and Chatzimanolis 2003, Figs. 95 and 100, 124)

3. Strongly narrowed to acute apex (as in Ashe and Chatzimanolis 2003, Figs. 19 and 25)

4. Subtruncate or slightly emarginate (as in Ashe and Chatzimanolis 2003, Figs. 39 and 48)