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PENSOFT

New records of four termite species in the genus *Embiratermes* Fontes, 1985 (Isoptera, Termitidae, Syntermitinae) from South America

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Abstract

Twelve new localities are reported for the following four *Embiratermes* species: *E. ignotus* Constantino, 1991; *E. latidens* (Emerson & Banks, 1957); *E. silverstrii* (Emerson, 1949); and *E. spissus* (Emerson & Banks, 1957). The new localities extend the distribution span from 940 km up to 1,800 km. *Embiratermes latidens* is recorded beyond Amazonia for the first time. The enteric valve armature for workers of these species is provided.

Keywords

Amazonia, Cerrado, Chaco, enteric valve armature, soldier

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Introduction

Engel and Krishna (2004) erected the termitine subfamily Syntermitinae to include four genera originally placed in the Nasutitermitinae. Constantino and Carvalho (2011) added 10 additional genera to the Syntermitinae including *Embiratermes* Fontes, 1985. The Syntermitinae is composed of 18 genera (Rocha et al. 2012) exclusive to the New World from northern Argentina and southern Brazil to southern Mexico. Fourteen *Embiratermes* species are described (Constantino 2020). Rocha et al. (2012) distinguished *Embiratermes* soldiers from other syntermitine genera by the former's frontal tube extending to the mandibles, elongate head capsule, and marginal mandibular teeth. *Embiratermes* are humus feeders whose workers key out as Group III soil feeders having vestigial molar ridges and sclerotized EVAs (Donovan et al. 2001). *Embiratermes* build earthen mounds, occupy earthen mounds of other termite taxa, or nest underground (RHS unpubl. obs.). Although the enteric valve armature (EVA) of syntermitine workers is, with the exception of *Silvestritermes*, of limited diagnostic value among genera, EVAs are useful for discrimination of most congenerics.

Collecting expeditions to French Guiana (2008 and 2010), Ecuador (2011), Paraguay (2012), Bolivia (2013), and Peru (2014) which in total yielded almost 5,700 colony samples, has produced many country records and numerous new termite species. In this study, I report new, widely disparate records of four available but uncommon *Embiratermes* species: *E. ignotus* Constantino, 1991; *E. latidens* (Emerson & Banks, 1957); *E. silverstrii* (Emerson in Snyder, 1949); and *E. spissus* (Emerson & Banks, 1957).

Methods

Termites were aspirated from foraging areas in soil and preserved in 85% ethanol. All samples are housed in the University of Florida Termite Collection (UFTC), Davie, Florida (Scheffrahn 2019a). Soldiers were photographed as multi-layer montages using a Leica M205C stereomicroscope controlled by Leica Application Suite v. 3 software (Figs. 1–4, A–C). The EVAs of all workers (Figs. 1–3D, 4E) and fore coxa of *E. spissus* (Figs 4D) were mounted on slides with PVA mounting medium (Bioquip Products, Inc.) and photographed with a Leica CTR 5500 compound microscope using bright field lighting and the same montage software. The *Embiratermes* locality map (Fig. 6) was prepared using ArcMap v. 10.7.1.

Results

Embiratermes ignotus Constantino, 1991

Figure 1

New records. FRENCH GUIANA – **Sinnamary** • rainforest; 05.0239, −053.0249; 61 m a.s.l.; XI.16.2010; J. Křeček leg.; 1 colony subsample [many soldiers and many workers with 7 workers of *Longustitermes manni* (Snyder, 1922)], UFTC no. FG665. PERU – **Ucayali** • farm area 5 km southwest Campoverde; −08.5019, −074.8462; 205 m a.s.l.; 29 May 2014; J. Chase, T. Carrijo, R. Constantino, J. Křeček, E. Kuswanto, J. Mangold, A. Mullins, T. Nishimura, R. Scheffrahn (CCCKKMMNS) leg.; 5 soldiers, many nymphs, and many workers, PU716.

Identification. In the comparison of the *E. ignotus* soldier with its morphologically nearest congener, *E. snyderi* (Emerson & Banks, 1957), Constantino (1992b: 335) stated that the latter "has proportionally longer nasus, more elevated in profile, wider head with more convex sides and less robust mandibles. All other [*Embiratermes*] species are much larger". The photographs of the *E. ignotus* soldier by Torres and Peña-Venegas (2018) also match those in my Figure 1.

Embiratermes latidens (Emerson & Banks, 1957)

Figure 2

New records. BOLIVIA – **Santa Cruz** • Aguas Calientes; −18.4641, −059.4773; 240 m a.s.l.; 1.VI.2013; J. Chase, R. Constantino, J. Křeček, J. Mangold, A. Mullins, T. Nishimura, R. Scheffrahn (CCKMMNS) leg; 2 colony subsamples (3 soldiers and many workers), BO994, BO995. – **Beni** • N. San Pedro on Highway 9; −14.2126, −064.9403; 147 m a.s.l.; 29.V.2013; CCKMMNS leg; 4 colony subsamples (13 soldiers and many workers), BO537, BO538, BO539. PARAGUAY – **Amambay** • Cerra Cora; −22.6788, −055.9950; 293 m a.s.l.;

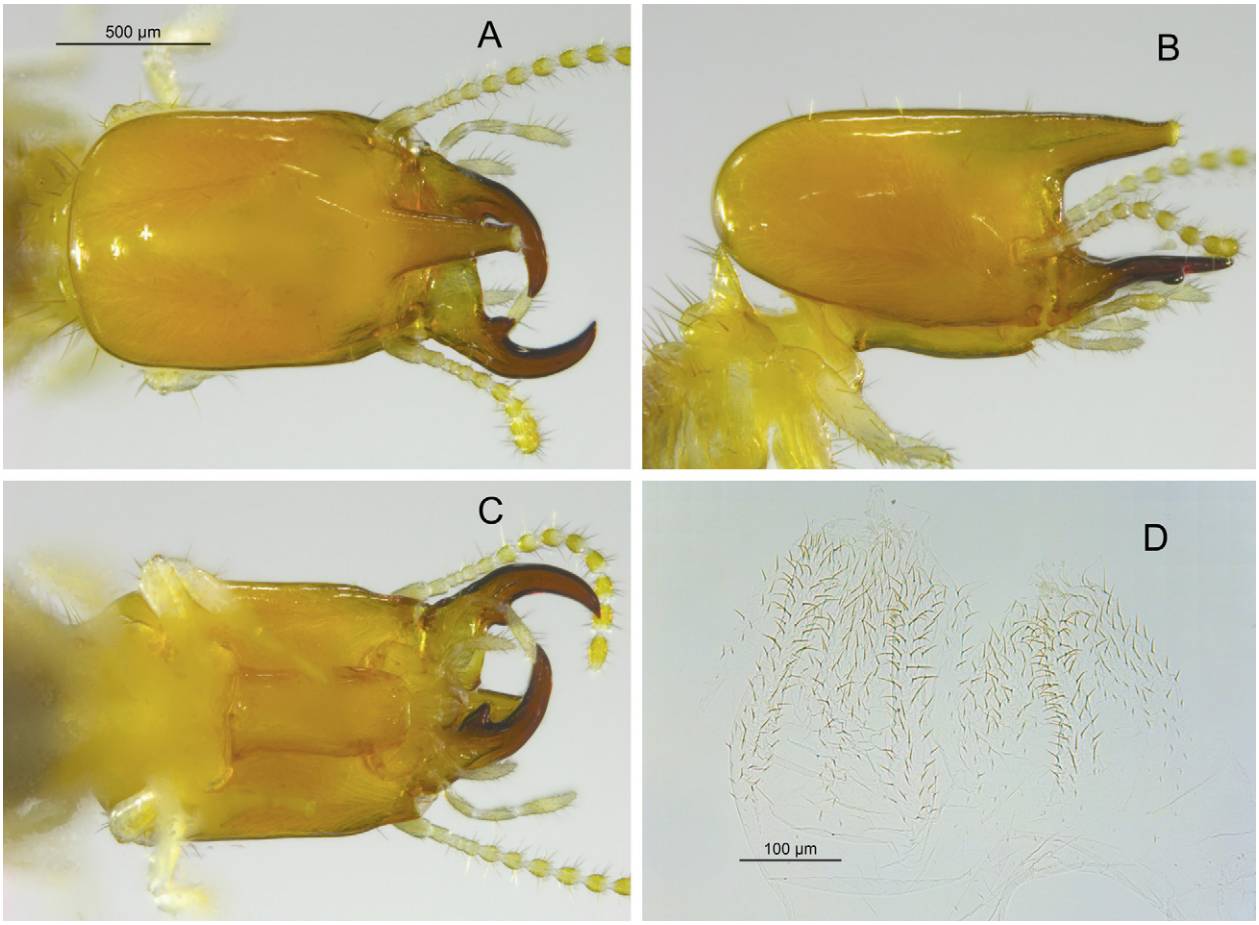

Figure 1. The *Embiratermes ignotus* soldier from Peru (PU716): (**A**) dorsal, (**B**) lateral, and (**C**) ventral aspects, and (**D**) the worker enteric valve armature.

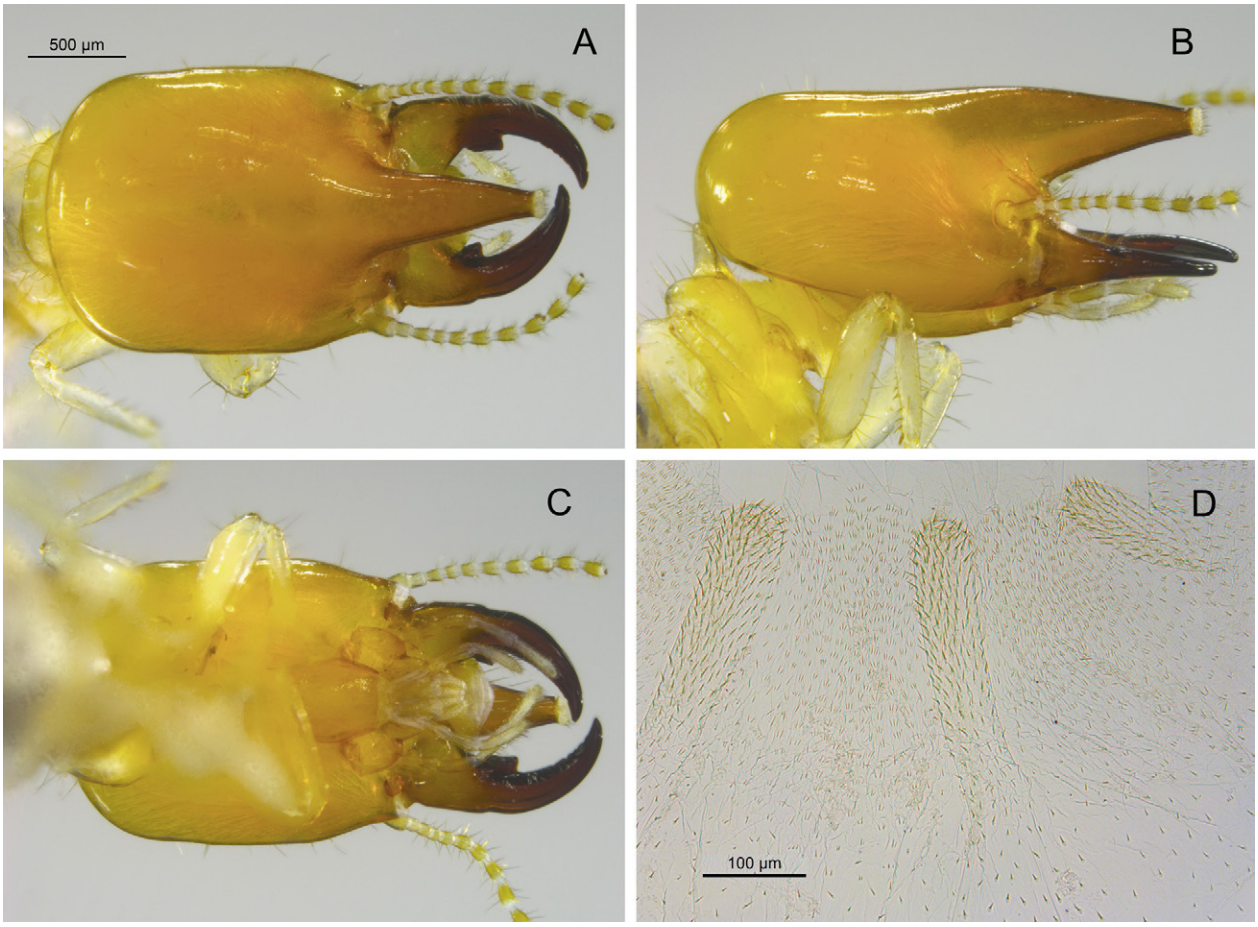

Figure 2. The *Embiratermes latidens* soldier from Bolivia (BO539): (**A**) dorsal, (**B**) lateral, and (**C**) ventral aspects, and (**D**) the worker enteric valve armature.

29.V.2012; J. Chase, R. Hickman, J. Křeček, J. Mangold, A. Mullins, R. Scheffrahn leg.; 1 colony subsample (many workers), PA352. PERU – **Loreto** • Iquitos; −03.7481, −073.2472; 93 m a.s.l.; 29.III.2007; F. Julián Gómez leg.; 1 colony subsample (1 soldier and 3 workers), PE161. SURINAME – **Bokopondo** • Brownsberg; 04.983, −055.133; 67 m a.s.l.; 13.II.2010; P. Skelley leg.; 1 colony subsample (many soldiers, 4 nymphs, and many workers, SA367.

Identification. The illustration of the *E. latidens* soldier in the original description by Emerson and Banks (1957) show the broad base of the marginal teeth, especially in the left mandible as in Figure 2A. Soldiers are also adorned with "short hairs profusely scattered over head, nasus, and postmentum; dorsal surface of distal one-third of nasus and posterior portion of head almost bare" (Emerson and Banks 1957: 4, not visible in Fig. 2). The original measurements also agree with my material. Constantino (1992b) stated that *E. latidens* is very similar to *E. festivellus* (Silvestri, 1901), and the only known difference is the wider marginal tooth of the right mandible in *E. latidens*. When compared to the detailed drawing of *E. festivellus* by Fontes (1985), the *E. latidens* soldiers in my material have overall more robust mandibles, longer and thinner mandibular blades beyond the marginal teeth, slight indentations on the outer margins of the mandibles, and the nasus is parallel to the mandibles instead of diverging.

Embiratermes silverstrii (Emerson, 1949)

Figure 3

New records. PARAGUAY – **Concepcion** • private reserve forest, location 1; −23.0503, −056.7276; 151 m a.s.l.; 30.V. 2012; J. Chase, R. Hickman, J. Křeček, J. Mangold, A. Mullins, R. Scheffrahn (CHKMMS) leg.; 1 colony subsample (1 soldier and many workers), PA 556. • private reserve forest, location 2; −23.0503, −056.7206; 165 m a.s.l.; 30.V.2012; CHKMMS; 1 colony subsample (1 soldier and many workers), PA611.

Identification. The original description of *E. silvestrii* soldier by Emerson (1949) is lacking, as Emerson determined that it was misidentified as *Armitermes albidus* by Silvestri (1901; Snyder 1949). The illustration of the soldier in the redescription by Emerson and Banks (1957) shows the diagnostic mandibles and dentition. The mandibles have robust basal "shelves" with the middle of each shelf adorned with a narrow symmetrical tooth.

Embiratermes spissus (Emerson & Banks, 1957)

Figures 4, 5

New records. ECUADOR – **Orellana** • Yasuni station area, all trails; −00.6718, −076.3979; 223 m a.s.l.;

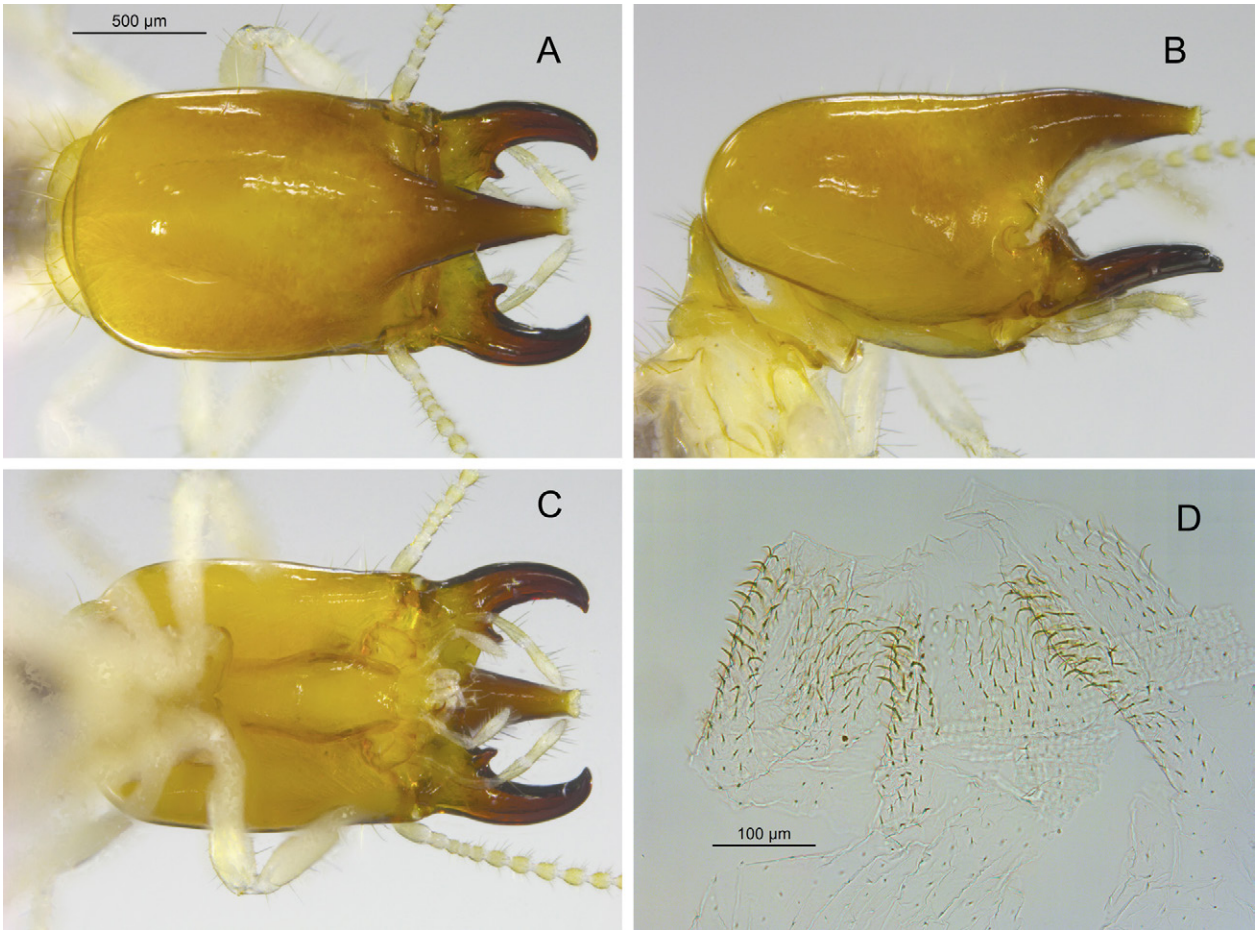

Figure 3. The *Embiratermes silvestrii* soldier from Paraguay (PA611): (**A**) dorsal, (**B**) lateral, and (**C**) ventral aspects, and (**D**) the worker enteric valve armature.

29.V.2011–2.VI.2011; J. Chase, J. Křeček, J. Mangold, A. Mullins, T. Myles, T. Nishimura, R. Setter, R. Scheffrahn leg.; 18 colony subsamples (79 soldiers and many workers); EC565, EC671, EC807, EC808, EC809, EC810, EC 811, EC1023, EC1052, EC1053, EC1287, E1288, EC1289, EC1366, EC 1367, EC1368, EC1369, EC1370. – **Loreto** • Rio Nanay; −03.7135, −073.2738; 84 m a.s.l.; 9.VI.1981; J. Křeček leg.; 2 colony subsamples (many soldiers and many workers), PU1067, PU1068. – **Huánuco** • Parque Nac. Tingo Maria; −09.3783, −076.0323; 1104 m a.s.l.; 31.V.2014; CCCKKMMNS; 2 colony subsamples (4 soldiers and many workers), PU903, PU906. VENEZUELA – **Amazonas** • Suromoni; 03.173, −065.675; 134 m a.s.l.; 28.VIII.1999; J. Hernandez leg.; 1 colony subsample (2 soldiers, 1 nymph, and many workers), SA211.

Identification. The illustration of the *E. spissus* soldier and measurements in the original description by Emerson and Banks (1957) agree with Figure 4A and B. Emerson and Banks (1957: 17) further noted that the "fore coxa with prominent conical projection along anterolateral surface about two-fifths of the distance from the distal end" (not illustrated by these authors) "is distinctive in that it is the only species in *Armitermes* [= *Embiratermes*] bearing a projection on the anterolateral surface of the fore coxa". This projection is shown in Figure 4D. Rocha et al. 2017 showed a "spiniform" projection on the fore coxa of the *E. festivellus* soldier but, unlike *E. spissus*, the marginal teeth of *E. festivellus* are bimodal (Sands 1957; Fontes 1985).

Enteric valve armature. The EVAs herein show two distinct forms. The EVAs in *E. ignotus* (Fig. 1D) and *E. silvestrii* (Fig. 3D), have three longer pads covered with several dozen setae-like spines interspersed by three shorter and wider fields covered with similar spines. The longer pads in *E. ignotus* are composed of thinner spines, while the longer pads in *E. silvestrii* are covered with thicker spines. Both species are among the smallest species in the genus (soldier head widths 0.78–0.85 mm). The EVAs in *E. latidens* (Fig. 2D) and *E. spissus* (Fig. 4E) are composed of three finger-like pads of the three lengths covered with 80–100 minute spines interspersed by three shorter and wider fields covered with even more minute spines. The wider fields in *E. latidens* are composed of groups (double, triple, quadruple) spines, while the wider fields in *E. spissus* are covered with singleton spines. These two species are among the largest in the genus (soldier head widths 1.55–1.77 mm).

Distribution. All the known localities of the four *Embiratermes* species in the study are given in Figure 6 taken from the coordinates in Table 1.

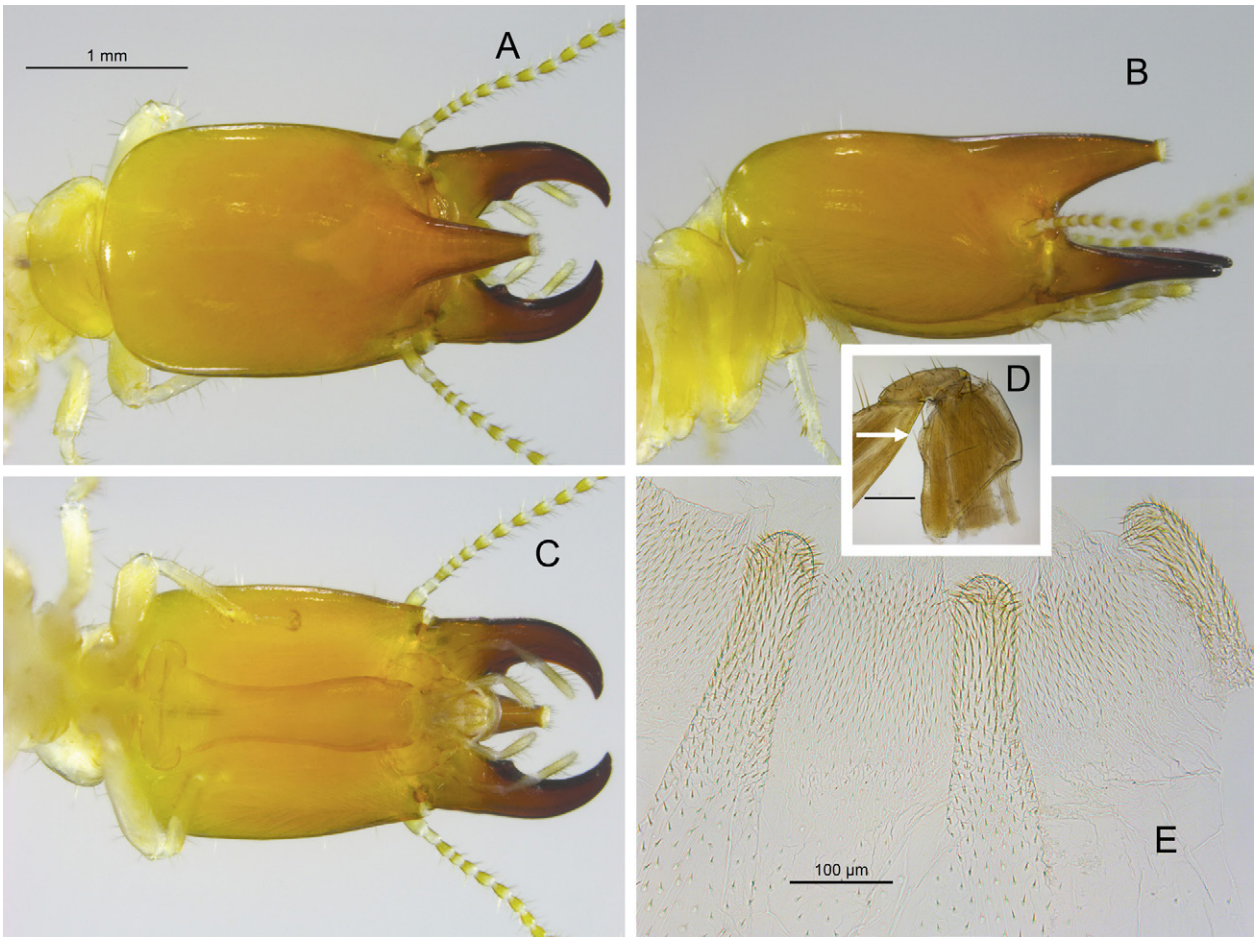

Figure 4. The *Embiratermes spissus* soldier from Ecuador (EC809): (**A**) dorsal, (**B**) lateral, and (**C**) ventral aspects, (**D**) lateral view of antero-lateral lobe of the fore coxa (arrow, bar = 200 µm), and (**E**) the worker enteric valve armature.

Figure 5. Live habitus of *Embiratermes spissus* foragers and nest carton immediately after lifting a stone from the forest floor at Yasuní, Ecuador.

Table 1. Literature and UFTC localities for *Embiratermes*.

Species	Country	Locality	Latitude	Longitude	Elev. (m)	Ref. or UFTC no.
E. ignotus	Colombia	Leticia	-4.1200	-69.9400	95	Torres and Peña-Venegas 2018
E. ignotus	Brazil	Brazil Belem	-1.4500	-58.5000	85	Constantino 1992a
E. ignotus	Brazil	Porto Velho	-9.4510	-64.3760	122	Rocha et al. 2017
E. ignotus	Brazil	Japurá River	-1.8500	-65.4500	64	Constantino 1991
E. ignotus	French Guiana	Rain forest	5.0239	-53.0249	61	FG665
E. ignotus	Peru	Campoverde	-8.5019	-74.8462	205	PU716
E. latidens	Peru	Iquitos	-3.7481	-73.2472	93	PE161
E. latidens	Bolivia	N. San Pedro	-14.2126	-64.9403	147	BO537-539
E. latidens	Bolivia	Aguas Calientes	-18.4641	-59.4773	240	BO994-995
E. latidens	Paraguay	Cerra Cora	-22.6788	-55.9950	293	PA352
E. latidens	Suriname	Brownsweg	4.9830	-55.1330	43	SA367
E. latidens	Brazil	Rio Autaz	-4.6700	-59.4200	54	Emerson and Banks 1957
E. latidens	Brazil	Humaitá	-7.5100	-63.0300	56	Constantino 1992b
E. latidens	Brazil	Serra dos Carajás	-6.2800	-50.5900	274	Constantino 1992b
E. latidens	Brazil	Tucuruí	-3.7700	-49.6600	18	Constantino 1992b
E. latidens	Brazil	Ji-Paraná	-10.8800	-61.9300	141	Constantino 1992b
E. silvestrii	Paraguay	Private Reserve Forest	-23.0503	-56.7276	165	PA556, 611
E. silvestrii	Brazil	Grande Sertão Veredas	-15.0870	-45.8280	740	Rocha et. 2012
E. silvestrii	Brazil	Hidrolandia	-17.0200	-49.2400	828	Cunha et al. 2006
E. silvestrii	Brazil	Taquaruçu	-10.2700	-48.1700	630	Rückamp et al. 2012
E. silvestrii	Brazil	Cuiabá	15.5000	-56.0000	214	Emerson and Banks 1957
E. spissus	Brazil	Careiro	-3.8300	-60.3800	20	Rebelo 2012
E. spissus	Brazil	Porto Trombetas	-1.6700	-56.4500	37	Acioli and Oliveira 2010
E. spissus	Brazil	Reserva Ducke	-2.9700	-59.9300	110	Dambros 2010
E. spissus	Guyana	Itabu Creek	1.7000	-57.9170	261	Emerson and Banks 1957
E. spissus	Ecuador	Estación Yasuní	-0.6720	-76.3980	223	EC808-811
E. spissus	Peru	P.N. Tingo Maria	-9.3783	-76.0323	1104	PU903, 906
E. spissus	Peru	Iquitos, Rio Nanay	-3.7135	-73.2738	82	PU1067-1068
E. spissus	Venezuela	La Esmeralda	3.1730	-65.6750	126	SA211

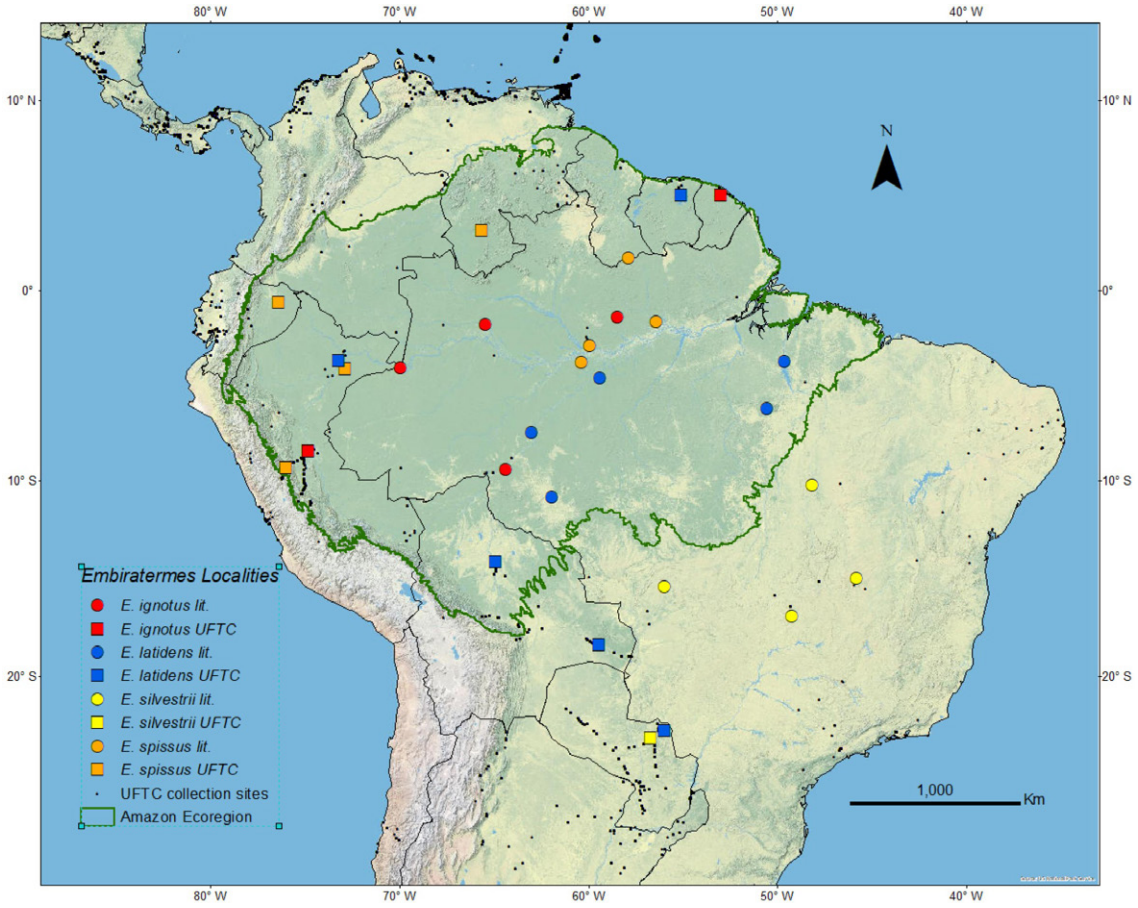

Figure 6. Locality map of four *Embiratermes* species included herein from the literature and the University of Florida termite collection.

Discussion

The ranges of four *Embiratermes* species are greatly expanded (Fig. 6). *Embiratermes ignotus* (maximum new range expansion, MNRE, is 940 km) and *E. spissus* (MNRE 1,800 km) are known only from Amazonia, while new localities herein expand the range of *E. latidens* (MNRE 1,500 km) from Amazonia into the Chaco. *Embiratermes silvestrii* (MNRE 1,100 km) ranges across the Chaco and Cerrado biomes but does not extend into Amazonia. The elevational range extension for *E. spissus* from 269 m in Guyana to 1104 m in Peru (Table 1) is also noteworthy.

Newly identified range extensions of *Embiratermes* and other South American termites (e.g., *Eucryptotermes hagenii* (Müller,1873) (Godoy et al. 2018), *Dentispicotermes cupiporanga* Bandeira & Cancello, 1992 (Issa and Scheffrahn 2020), or *Termes hispaniolae* (Banks, 1918) (Scheffrahn 2020) are usually in the range of 1,000 km. This exemplifies 1) the lack of termite collecting expeditions to some regions, and/or 2) field surveys that are limited to small area transects (e.g., Dahlsjö et al. 2020; Palin et al. 2011) the latter of which often do not include termite-rich microhabitats (e.g., wood, mounds, aerial nests; Scheffrahn 2019b).

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