INTRODUCTION OF THE CENTIPEDE *SCOLOPENDRA MORSITANS* L., 1758, INTO NORTHEASTERN FLORIDA, THE FIRST AUTHENTIC NORTH AMERICAN RECORD, AND A REVIEW OF ITS GLOBAL OCCURRENCES (SCOLOPENDROMORPHA: SCOLOPENDRIDAE: SCOLOPENDRINAE)[1]

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ABSTRACT: The centipede *Scolopendra morsitans* L., 1758, is recorded from North America and the continental United States based on an exogenous individual from Jacksonville, Duval County, Florida; it is also documented from Curaçao. The species has now been reported from all the inhabited continents, but the European citations — from France, Italy, Turkey (Istanbul), Russia/Georgia (Caucasus), and Armenia — are dubious. With extensive records from the interiors, well removed from ports, *S. morsitans* appears to be native to Australia and Africa, occurring throughout these continents except for most of Victoria, adjacent South Australia, and southwestern Western Australia in the former, and the Eritrean Highlands and Red Sea Hills in the latter; it also seems to be native to southern/southeastern Asia from Pakistan to New Guinea, southeastern China, Taiwan, and the Philippines. New World occurrences — extending from Florida, Mexico, and the Bahamas to Peru and northern Argentina — are sporadic and interpreted as introductions or possible misidentifications. While absent from the eastern Pacific, Tasmania, and New Zealand, *S. morsitans* occurs on many islands and archipelagos in the Atlantic, Indian, and western and central Pacific Oceans, apparently being indigenous to Madagascar and Sri Lanka, and introduced to the rest. However, occurrences on the Canary and Cape Verde Islands may represent rafting from Africa and thus natural range extensions.

KEY WORDS: *Scolopendra morsitans*, introduction, Florida (U.S.A.), Europe, Africa, Asia, Australia, New World, islands

Because of its moist, subtropical environments and its location as the southeasternmost Atlantic Coastal state, Florida is a haven for introduced organisms. Of 54 species in the arthropod class Diplopoda, Shelley (2001, 2002a, b) documented 12 exogenous Neotropical or Oriental species, one of which, *Myrmecodesmus digitatus* (Loomis, 1959) (Polydesmida: Pyrgodesmidae), he (Shelley 2004a) subsequently concluded is indigenous to the Gulf Coastal Plain. Additionally, there is at least one exogenous species in the family Rhinocricidae (order Spirobolida), tentatively assigned to the Neotropical genus *Eurhinocricus* Brölemann (Shelley and Edwards 2002), that is now established in the Keys, particularly in plant nurseries. Consequently, nearly one-fourth (22.2 percent) of the Floridian diplopod fauna is non-native.

In comparison to millipeds, the centipede fauna of Florida is poorly known. The introduced Palearctic scutigeromorph, *Scutigera coleoptrata* L., 1758,

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which is widespread in North America, surely occurs there, but the only order that has been investigated in depth is the Scolopendromorpha (Shelley and Edwards 1987, Shelley 2002c), which comprises nine species (Table 1) with the Neotropical chilopod *Rhysida longipes longipes* (Newport, 1845) (Scolopendridae: Otostigminae) being allochthonous. Shelley (2002c) did not regard it as established in Florida, but a recent sample from Hialeah suggests that reproducing populations may exist in Miami-Dade County (Shelley and Edwards 2004). We report here the discovery of a second introduced scolopendrid, *Scolopendra morsitans* L., 1758 (Scolopendridae: Scolopendrinae), in Duval County, which was intercepted once in quarantine in Philadelphia (Shelley 2002c). This is the first authentic record of *S. morsitans* from the continental United States and North America as a whole; previous citations from Big Springs, Howard County, Texas, and Texas, Florida, Georgia, New York, Kansas, Utah, and California in general (Cragin 1885; Underwood 1887; Daday 1889; Chamberlin 1911; Gunthorp 1913, 1921; Chamberlin and Mulaik 1941; and Kevan 1983) are misidentifications of other scolopendrids (Shelley 2002c). On July 30, 2004, John A. Smith, an inspector with the U.S. Department of Agriculture, discovered an individual of *S. morsitans* climbing the base of a peach tree outside a home in the Mayport area of Jacksonville, approximately 4.5 mi (7.2 km) south of Fort Caroline National Memorial; because it was found in a residential area well away from the Port of Jacksonville, *S. morsitans* must be considered a true introduction into northeastern Florida. The specimen was sent to the second author, where it was accessioned as Florida State Collection of Arthropods sample E-2004-5618, and then to the first author for determination. It exhibits the triangular spiracles characteristic of the Scolopendrinae and the diagnostic features of *Scolopendra* (the cephalic plate overlapping T1 and a prominent ventrodistal spur on the proximotarsus of each leg), but it lacks the procurved transverse sulcus on T1, sulci on the cephalic plate, and spines dorsally on the prefemora of legs 18-20. Consequently, it is not a juvenile of *S. alternans* Leach, 1813, which lacks the first feature but possesses the last two and occurs in Collier, Miami-Dade, and Monroe counties in south Florida (Shelley 2002c). There is a median suture on T21 [as in the Australian individual of *S. morsitan*s illustrated by L. E. Koch (1983:84, fig. 10)], seven ventral spines arranged in three rows (2, 3, 2) on the ultimate prefemur of the right leg, and nine spines arranged in five rows (2, 3, 2, 2, 1) on that of the left leg (Fig. 1), which are comparable to spine arrangements in individuals from Puerto Rico (Shelley 2002c:40, fig. 57). Likewise the size, 56.5 mm long and 5.7 mm wide, is consistent with *S. morsitans,* a small-bodied scolopendrid, and the specimen compares favorably with an authentic individual in the the first author's institution from Queensland, Australia, where *S. morsitans* is common (L. E. Koch 1983). Though not diagnostic, the antennae reach backwards to near midlength of T3, have 19 and 17 articles on the left and right ones, respectively, and the basal 5½ articles are sparsely hirsute. Its color is distinctly different from the two sympatric native scolopendrids — *S. viridis* Say, 1821 (generally greenish) and *Hemiscolopendra marginata* (Say, 1821) (bluish or blue-gray) (Shelley 1987, 2002c; Shelley and Edwards 1987; Hoffman and Shelley 1996): cephalic plate, forcipules, coxosternum, T1, S1 and S21, and 1st and ultimate legs orange; T2-19 pale yellow with prominent bluish-brown transverse bands along caudal margins comprising 20-40

percent of tergal lengths; T20 with narrow, interrupted caudal band constituting ca. 10 percent of tergal length; T21 completely yellow; S2-20 and associated legs generally yellowish and becoming progressively darker caudad.

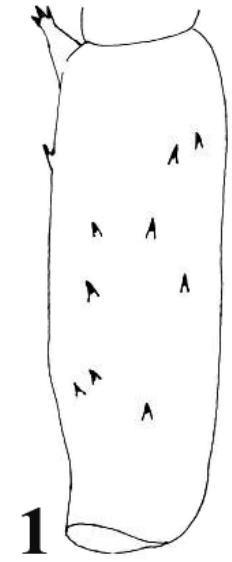

Fig. 1. Prefemur of left caudal leg of specimen of *S. morsitans* from Jacksonville, Florida, U.S.A., ventral view.

Table 1. Representatives of the chilopod order Scolopendromorpha in Florida (*introduced species).

Family Scolopendridae
Subfamily Scolopendrinae
Scolopendra alternans Leach, 1813 – Collier, Miami-Dade and Monroe Cos.
**S. morsitans* L., 1758 – Duval Co.
S. viridis Say, 1821 – statewide
Subfamily Otostigminae
**Rhysida longipes longipes* (Newport, 1845) – Miami-Dade Co.

Family Scolopocryptopidae
Subfamily Scolopocryptopinae
Scolopocryptops nigridius McNeill, 1887 – Jackson Co.
S. sexspinosus (Say, 1821) – statewide

Family Cryptopidae
Subfamily Cryptopinae
Cryptops floridanus Chamberlin, 1925 – peninsular Florida from Alachua, Gilchrist, and Putnam counties southward.
C. leucopodus (Rafinesque, 1820) – statewide
Subfamily Plutoniuminae
Theatops posticus (Say, 1821) – statewide

Scolopendra morsitans, the fifth species described in *Scolopendra* L., 1758, was designated the type species in 1957 under the plenary powers of the International Commission on Zoological Nomenclature (Opinion 454), in response to the petition by Crabill (1955). The type locality is India, and the first author found the holotype, a dry specimen labeled *S. morsitans,* on a pin in the Linnaean Collection at the Linnean Society of London during a visit in 1997. According to Attems (1930*a*), there are some 48 synonyms, and four subspecies have been proposed: *S. m. scopoliana* C. L. Koch, 1841, described as a full species from Algiers, placed in synonymy under *S. morsitans* by Kohlrausch (1881), elevated to a subspecies (= "variety") by Kraepelin (1903), and retained in that status by Attems (1930*a*); *S. m. calcarata* Daday, 1891, from an unknown locality, which was placed in synonymy under *S. morsitans* by Kraepelin (1903) and retained in that status by Attems (1930a); *S. m. fasciata* Attems, 1930, from Angola, which was placed in synonymy by Würmli (1975); and *S. m. amazonica* Bücherl, 1946, from Manaus, Amazonas, Brazil. The first remains a subspecies that ostensibly occurs in Morocco, Algeria, and Tunisia, and was encountered as an introduction near Marseilles, France; *S. m. amazonica,* however, was elevated to full species status by Jangi (1959). The relative statuses of *S. morsitans* and *S. amazonica* have been extensively debated, and

like L. E. Koch (1983) and Lewis (2002), we accept the opinion of Würmli (1975, 1978), who investigated this matter and concluded that the names are synonymous. *Scolopendra morsitans (=S. amazonica)* is thus a widespread, cosmopolitan centipede that has now been recorded from all the inhabited continents, but much of its distribution is an artifact reflecting extensive human introductions. The species is abundant in Africa and Australia, occurring well inland and away from ports (Figs. 4-6), so we believe *S. morsitans* is native to these continents as did L. E. Koch (1983); these factors also apply to mainland southeast Asia from coastal Pakistan eastward (Fig. 5). Likewise, *S. morsitans* occurs throughout Taiwan and Indonesia, and is surely native there too although some localities may represent introductions. Records exist from only four islands in the Philippines, too few to draw a definitive conclusion, but we suspect that *S. morsitans* is also native to this archipelago, which lies between Taiwan and Indonesia. Its sporadic occurrence in the New World, primarily on islands and at ports or coastal locations, undoubtedly reflects human importations, and Shelley (2002c) cited ones from the West Indies, Mexico, and Central America. Numerous published records of *S. morsitans* exist in scores of papers, and it is timely to consolidate and map them. We therefore scoured the first author's personal library and present below a list of all records of *S. morsitans* that we know of in modern geopolitical terminology with old names in parentheses; states or provinces (in italics) are provided for certain countries, and islands in archipelagos are also italicized. We could not place some localities nor determine their modern names, and these are denoted by asterisks. Occurrences are mapped in Figs. 2-6, with specific localities indicated by dots and unsupplemented records from countries or islands in general, by triangles. Lewis (2001a) reexamined 13 of Chamberlin's specimens (1958) of *"S. morsitans"* from Bahrain and Iraq, and discovered that they were actually other species; he stated, "it seems very unlikely that *S. morsitans* occurs in Iraq and Chamberlin's records for that country should be disregarded." Lewis added that *S. morsitans* had not been reported from Israel, Lebanon, Jordan, Syria, Iraq, Iran, or Saudi Arabia and that the only reliable records from the Arabian Peninsula are from the coasts of Oman and Yemen (Lewis 1996). However, there are old literature reports from Syria in general (Brölemann 1904a) and the Elburz Mountains in northern Iran (Silvestri 1935), which are isolated and suspicious. No one knows how many and which records represent additional misidentifications; this would require reexamining all the samples that are scattered through major global repositories, a prohibitive amount of work. However, the Syrian, Iranian, and several other records, indicated by question marks (?) on figs. 4-5, are so disparate from areas where localities cluster that they likely reflect misidentifications or, at best, isolated, one-time importations. Consequently, the ensuing list and maps are undoubtedly imperfect and contain undetected errors, but we believe they constitute beneficial information for chilopodology. The list contains the few published records of *S. m. scopoliana* and is divided into regions of the world with countries arranged alphabetically; general range statements are provided first followed by specific localities, all documented with citations. For completion and historical interest we preface the list with prior overall range statements, none of which are truly accurate.

As shown in Figs. 2-6, *S. morsitans* has been reported from the six inhabited continents, but all the records from Europe and the Middle East are dubious at best, except those from Yemen and Oman (Fig. 4). In the New World, occurrences are sporadic and primarily from islands or coastal sites between the Tropics of Cancer and Capricorn, which suggest accidental human importations; localities on the Amazon River and tributaries in Brazil and Peru, like Manaus, also are ports and indicate the same. Pocock (1895a) recognized this and stated that the centipede was "artificially introduced" to Tamaulipas and Veracruz, Mexico. Records from the interiors of Colombia, Peru, Brazil, Paraguay, and Argentina are not verifiable and may or may not be accurate, but we accept them for now. Consequently, New World occurrences extend from Florida, central Mexico/southern Baja California, and the Bahamas to central Peru and northern Argentina, and we here newly record it from Curaçao. The only countries, territories, and major islands in the hemisphere from which *S. morsitans* has not been cited are Canada, Guatemala, Honduras, El Salvador, Nicaragua, Bolivia, Uruguay, and Chile, on the continents, and the British Virgin Islands, Saba, St. Martin, St. Eustatius, St. Lucia, Barbados, Grenada, Aruba, Bonaire, Margarita Island, and Trinidad, in the Caribbean.

In the Old World, there is no recent evidence that *S. morsitans* occurs in Europe or the Middle East except for the sites in Yemen and Oman, which, being coastal, logically represent introductions. The species occurs throughout Africa except for the Eritrean Highlands in Eritrea and northern Ethiopia, its northern extension, the Red Sea Hills, of eastern Sudan and plausibly also southern Egypt, and the narrow coastal strip bordering the Red Sea in these countries (J. G. E. Lewis, pers. comm. to RMS) and the southwestern corner of South Africa, including the Cape Peninsula, where it is replaced by *Arthrorhabdus formosus* Pocock, 1891 (Lawrence 1936, 1938, 1955). The only species of *Scolopendra* that Brölemann (1901*a*, 1904*b*) and Lewis (1969*a*) recorded from Eritrea and adjacent areas were *S. valida* Lucas, 1840, and *S. mirabilis* (Porat, 1876), so we believe that *S. morsitans* is truly absent from this part of the continent. The other sizeable voids on the African map (Fig. 4) are the inaccessible central Sahara and the northwestern Democratic Republic of the Congo (DRC) and adjoining countries. However, outlying records from Mali and Chad document occurrence in the Sahara, and the preponderance of records from southern Sudan and eastern DRC suggest that the latter hiatus reflects inadequate collecting. Thus, excepting the Eritrean Highlands and Red Sea Hills, we believe *S. morsitans* can be expected throughout Africa, and the numerous records from deep in the interior, well removed from ports, indicate native occurrence on this continent. In Africa, therefore, *S. morsitans* is known from 33 of the 46 countries, being unrecorded from the Moroccan territory of "Western Sahara" and Mauritania, Guinea Bissau, Sierra Leone, Togo, Niger, Central African Republic, Eritrea, Djibouti, Equatorial Guinea, Congo, Bwanda, Burundi, and Malawi, with the absences from Eritrea and possibly also Djibouti considered real.

In Asia and Australia, *S. morsitans* extends from coastal Pakistan to the Ryu Kyu Islands (Okinawa), New Guinea (known only from Irian Jaya but surely also in Papua New Guinea), and Australia, where it is widespread but absent from the southwestern corner of Western Australia, the southeastern corner of South Australia, and essentially all of Victoria, except for the inner border area with New

South Wales and Melbourne, a major port, where the one recorded individual is an obvious human importation (L. E. Koch 1983, fig. 16 [map]) (Fig. 5). According to this author, it is absent from Tasmania and all of New Zealand, a conclusion that we accept although there are two records from New Zealand in general (Daday 1889, Würmli 1975). Many sites are in the interiors of India, Myanmar, Laos, and Australia, well removed from ports, so we believe the centipede is native here too; most Indonesian records probably also reflect indigenous occurrences. Widely disjunct records, detached from this continuous area, include the aforementioned Elburz Mountains in Iran, Beijing, China, and Japan in general, all denoted by question marks (Fig. 5). *Scolopendra morsitans* has been collected repeatedly on Taiwan, and occurrence on Okinawa is plausible both because of its proximity to Taiwan and because it is a small island where exogenous species typically abound. The records from Japan in general (Wood 1862, Chamberlin and Wang 1952) are nonspecific and could refer to any island or even the Ryu Kyus, and we arbitrarily place a question mark in central Honshu. The Beijing record (D. Wang and Mauriès 1996) could represent an introduced specimen, but we show it with a question mark because it is so disjunct. Khanna (2001) summarized Indian occurrences and reported *S. morsitans* from all the states, so we shade the entire country including Kashmir. However, *S. morsitans* may be absent from this area because of its high elevations, as other records suggest that it occurs primarily at lower altitudes. Kohlrausch (1881) did report it from "Himalaya" without further specification, implying high elevations, but the only other records from such heights are those of Khanna (2001 and references therein). The centipede has not been recorded from Nepal or Bhutan but is expected in border areas adjacent to India. Other than the dubious record from Beijing, it also is unknown from the Palaearctic part of Asia, north of the Himalayas, which includes seven countries — Tajikistan, Kyrgyzstan, Uzbekistan, Turkmenistan, Kazakstan, Russia, and Mongolia.

Scolopendra morsitans inhabits many islands in the Atlantic, Pacific, and Indian Oceans (Figs. 5, 6), and has been introduced to most of these including all those in Oceania (Shelley 2004*b*). It is surely indigenous to Sri Lanka, given its abundance in nearby southern India, and also Madagascar, where we shade the entire island (fig. 5) although most records are from coastal sites. It is probably introduced to the other Indian Ocean Islands — Andaman and Nicobar Islands, the Mascarenes, Seychelles, and Comoros — though those closest to Africa and Madagascar could result from rafting. In the Atlantic, *S. morsitans* has been recorded primarily from islands close to the African and South American continents — Fernando Noronha, the Canaries, and Cape Verdes; occurrence in Fernando Noronha must reflect human agency, but its presence in the last two could plausibly result from rafting from Africa, where the species is common. However, St. Helena is so far from the African mainland that its presence there must reflect human activity. Of interest is the fact that *S. morsitans* has not been recorded from the eastern Pacific Ocean; for example Shear and Peck (1992) do not cite it from the Galápagos nor does Shelley (2004*b*) record it from the Juan Fernández Islands, Easter and Pitcairn Islands, or Cocos Islands. While there are fewer islands and archipelagos in this vast area than in the western and central Pacific, some have seen enough human activity that *S. morsitans* may be encountered in the future.

Review of its Global Occurrences

PUBLISHED OVERALL RANGE CITATIONS: WORLDWIDE (Haase 1887 ["Territor. univ."]). VAST DISTRIBUTION (Silvestri 1895a). COSMOPOLITAN OR NEARLY COSMOPOLITAN (Bollman 1893; Kraepelin 1903; Attems 1907a, 1909a, 1910a, 1914, 1915, 1930a, 1934a; Chamberlin 1914a; Chelazzi 1977; Lawrence 1936, 1955; Lewis 1984; L. E. Koch 1983, 1984); "Kosmopolitisch über alle Länder der wärmeren und gemässtigten Zone verbreitet" (Attems 1914). WARM REGIONS (Kohlrausch 1881 ["in regionibus calidioribus terrarum omnium"]), (Attems 1930a, Chamberlin 1951, L. E. Koch 1983 [Tropics and warm parts of temperate zone]), (Bollman 1893, Chamberlin 1911, Brolemann 1932 [Common in tropical, subtropical, and temperate zones]). TROPICAL AND SUBTROPICAL (Pocock 1895a; Kraepelin 1903; Attems 1928, 1934a; Silvestri 1894, 1895b, 1935; Lawrence 1936; Bücherl 1939; Crabill 1960; Dobroruka 1969; Lewis 1969b, 1996; Würmli 1972), (Meinert 1886 ["all tropical regions, whence it is often brought alive in ships to more northern localities"]); particularly occurring in oriental and African regions (Kraepelin 1903).

NORTH AMERICA: USA: *Florida,* Duval County (present contribution). *MEXICO AND CENTRAL AMERICA:* MEXICO (Kohlrausch 1881, Brölemann 1909): *Baja California Sur;* San Jose del Cabo (Shelley 2002c). *Colima* (Brölemann 1904a). *Tamaulipas;* Tampico (Kohlrausch 1881, Pocock 1895a). *Veracruz* (Kohlrausch 1881, Pocock 1895a, Bollman 1893), Tuxpan (Shelley 2002c). *Yucatán;* Cayo Aremas (a small island NW Progresso) (Shelley 2002c). BELIZE: Belize City (Chamberlin 1921, Shelley 2002c). COSTA RICA: Banana River* (Shelley 2002c). PANAMA (Chamberlin 1921).

CARIBBEAN ISLANDS: WEST INDIES/CARIBBEAN ISLANDS/ANTILLES (Griffith and Pidgeon 1832; Newport 1845, 1856; Underwood 1887; Bollman 1893; Brölemann 1909). ANGUILLA (Shelley 2002c). ANTIGUA: Cambridge, Dickinson Bay, and Marmora Point (Shelley 2002c). BAHAMAS: *Eleuthera, Exuma* (Shelley 2002c). *New Providence;* Nassau (Chamberlin 1918). BARBUDA (Shelley 2002c). CAYMAN ISLANDS: *Grand and Little Cayman Islands* (Shelley 2002c). CUBA (Pocock 1893, Brölemann 1904a). CURAÇAO: Coral Specht, 3 km E Willemstad, 2 specimens, 8-15 November 1987, W. E. Steiner, J. M. Swearingen (National Museum of Natural History, Smithsonian Institution, Washington, DC, USA) **New Record.** DOMINICA: Roseau (Brölemann 1904a). DOMINICAN REPUBLIC (Pocock 1893): Azua, San Juan (Shelley 2002c). GRENADINES: *Bequia* (Shelley 2002c). GUADELOUPE: Basse Terre, Grande Terre (Demange 1981). HAITI: Jérémie, Grand Anse, St.-Marc (Pocock 1893, Chamberlin 1918). Port-au-Prince (Pocock 1893, Chamberlin 1918, Shelley 2002c). JAMAICA (Pocock 1893, Bollman 1893): *St. Andrews Par.* (Shelley 2002c). MARIE GALANTE (Demange 1981). MARTINIQUE (Brölemann 1904a, Shelley 2002c). MONTSERRAT (Shelley 2002c). NEVIS (Shelley 2002c). PUERTO RICO (Chamberlin 1918); San Juan (Shelley 2002c). ST.-BARTHÉLEMY (Pocock 1893). ST. KITTS (Pocock 1893, Bollman 1893, Chamberlin 1918, Shelley 2002c). ST. VINCENT (Brölemann 1904a, Shelley 2002c). TRINIDAD AND TOBAGO: *Tobago* (Newport 1845, 1856; Kohlrausch 1881; Bollman 1893). TURKS AND CAICOS ISLANDS: *Grand Turk, S. Caicos,* and *W. Caicos Islands* (Shelley 2002c). USVIRGIN ISLANDS: *St. Thomas* (Bollman 1893, Brölemann 1904*a*, Shelley 2002c). *St. Croix* (Shelley 2002c).

SOUTH AMERICA: ALMOST ALL SOUTH AMERICAN COUNTRIES (Bücherl 1939). GUYANA, SURINAM, AND FRENCH GUIANA (Guyanas) (Brölemann 1909). ARGENTINA (Brölemann 1909): Chaco (Silvestri 1895c). BRAZIL (Kohlrausch 1881, Brölemann 1909): *Amazonas* (Bücherl 1939, 1941); Manaus (Brölemann 1901b, 1903, 1904a, 1909; Chamberlin 1914a; Bücherl 1946, 1974; Chagas 2000; Schileyko 2002). *Bahia;* Salvador (Bücherl 1974). *Goias* (Bücherl 1939). *Mato Grosso* (Bücherl 1939, 1941). *Pará* (Bücherl 1939); Belém (Pará) (Brölemann 1902a, 1902b, 1904a, 1909; Chamberlin 1914a; Bücherl 1974; Schileyko 2002); Santarem (Chamberlin 1914a). *Paraiba,* Paraiba (Chamberlin 1914a). *Rio de Janeiro;* Rio de Janeiro (Bollman 1893, Chamberlin 1914a). *São Paulo* (Brölemann 1901c, Bücherl 1941); São Paulo (Bücherl 1974). COLOMBIA (New Granada) (Kohlrausch 1881, Bollman 1893, Brölemann 1909, Bücherl 1974): *Casanare;* Orocué (Attems 1903). *Cordoba;* Darien (Brölemann 1904a). Meta; Villavicencio (Attems 1903). ECUADOR (Campos-Rebeiro 1926): Rio Napo (Brölemann 1904a). FRENCH GUIANA: Cayenne (Bollman 1893, Brölemann 1904a). GUYANA: Demerara River (Newport 1845, 1856; Porat 1893; Bollman 1893). PARAGUAY (Brölemann 1909): Rio Apa (Silvestri 1895*c*). PERU: *Huanuco;* La Merced (Bücherl 1950). *La Libertad;* Huamachuco (Kraus 1957, Bücherl 1974). *Loreto;* Santa Elena (Kraus 1957). *San Martin;* Juanjui (Yanjui) (Kraus 1957, Bücherl 1974). SURINAM (Kohlrausch 1881, Underwood 1887, Jeekel 1952): Paramaribo (Bollman 1893). VENEZUELA (Brölemann 1909).

Fig. 2. Occurrences of *S. morsitans* in the New World. Dashed lines represent the Tropics of Cancer and Capricorn; the solid line represents the Equator. Dots, approximate locations of specific records; triangles, unsupplemented records from countries and islands in general. The dots off the Yucatan peninsula of Mexico and the tip of Brazil represent the records from Cayo Arema, and Fernando de Noronhá, respectively. The outlined area is enlarged in Fig. 3.

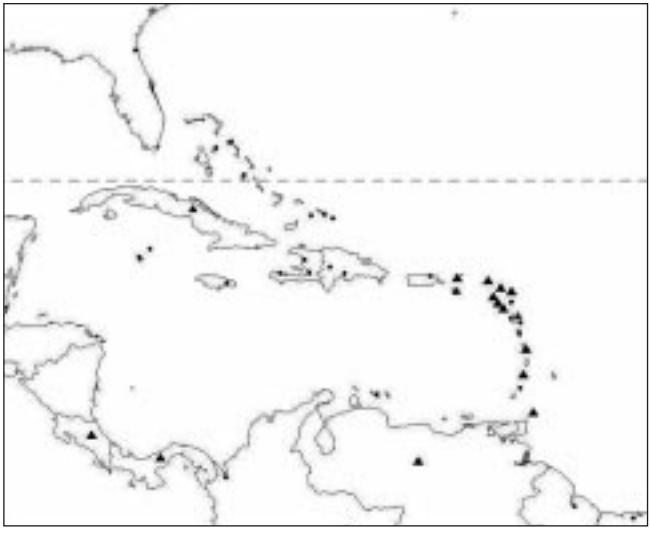

Fig. 3. Occurrences of *S. morsitans* on Caribbean Islands and neighboring areas. Lines and symbols as in Fig. 2.

ATLANTIC OCEAN ISLANDS

CANARY ISLANDS (Kohlrausch 1881, Brölemann 1909). CAPE VERDE ISLANDS (Porat 1893, Brölemann 1904a, Attems 1930a, Lewis 1969b): São Vicente (Lewis 1969b). FERNANDO NORONHA: Main island (Pocock 1890). ST. HELENA (Cook and Collins 1893, Attems 1907a).

EUROPE

PALAEARCTIC REGION IN GENERAL (Attems 1930a). ARMENIA: Jerevan (Erivan) (Brölemann 1909). FRANCE: discovered at ports with merchandise from exotic provinces (Brolemann 1930). Marseilles vicinity (Turk 1951). ITALY (Brölemann 1904a, Schileyko 1995). RUSSIA/GEORGIA: Caucasus (Daday 1893, Attems 1907b). TURKEY (Schileyko 1995): Istanbul (Kohlrausch 1881, Attems 1930a).

AFRICA

AFRICA IN GENERAL (Newport 1844). ALMOST THROUGHOUT THE AFRICAN CONTINENT (Kohlrausch 1881, Lewis 1969b, Lawrence 1975, Schileyko 1995, Chagas 2000). AFRICA EAST OF THE SAHARA (Lewis 1984). COASTAL REGION OF EAST AFRICA (Ribaut 1914). WEST AFRICA (Lewis 1969b). TROPICAL AND SOUTHERN AFRICA (Manfredi 1941). SOUTHERN AFRICA (Lawrence 1936, 1955). ALGERIA (Brolemann 1921, Lewis 1984): Alger (C. L. Koch 1847, 1863; Kraepelin 1903; Brölemann 1904a, 1921, 1931; Attems 1930a); Arzew, mountains nr. Boghar, Tlemcen (Brölemann 1904a); Batna, Oran (Attems 1902); Biskra (Brölemann 1904a, Lewis 1969b); Chrea Nat. Pk. (Brolemann 1931); Guelt es Stel (Lewis 1969b, 1984); Miliana (Brölemann 1904a, 1921, 1931); Cèdres Peak* (Attems 1902); Hamman Righa, Constantine, Kherata,* Quarzazate* (Lewis 1969b). ANGOLA (Lewis 1966, 1969b; Schileyko 2002): Southern Angola (Lawrence 1959). *Lunda Sul Prov.* (Chamberlin 1951). Benguela, Bié (Lewis 1969b); Luanda (Cook 1893, Cook and Collins 1893); Chimporo,* Rio Mbali* (Attems 1930b); Caquindo* (Attems 1930a, 1930c; Würmli 1975). BENIN: Dassari* (Demange 1972); Zagnanado (Brolemann 1926). BOTSWANA (Lawrence 1959): Kang, Lehutu, Kang-Kgokong,* Mookane,* Severelela-Kkakhea* (Attems 1909b); Okavango (Attems 1922); Ghanzi District, Molepolole, Kasane, Chukudukraal (Chukudu) near Kaotwe Pan, Tsotsoroga Pan,* Gemsbok Pan,* van Zyl's Cutting,* Damara Pan,* Titumi* (Lawrence 1936); Mashonoland (Lewis 1969b). BURKINA FASO: Ouagadougou and vicinity (Revault 1996). CAMEROON: Kumba (Dobroruka 1968); Bibundi,* Ekunda,* Kitta* (Porat 1894). CHAD: *Kanem Prov.* (Dobroruka 1968). CÔTE D'IVOIRE: Tiassalé (Brölemann 1904a). DEMOCRATIC REPUBLIC OF THE CONGO: "Congo" (Cook and Collins 1893). *Kivu* (Attems 1937). *Bandundu;* Lunda (Attems 1937). *Lower "Zaire";* Banana (Chamberlin 1927, Attems 1937). *Maniem;* Kasongo (Attems 1937), Malela (Chamberlin 1927). *South Kivu;* Uvira (Attems 1930b, Dobroruka 1968), Luvunge (on Rusizi R. between lakes Kivu and Tanganyika) (Attems 1937). *Upper "Zaire";* Bunia, Epulu R. (Dobroruka 1968); Garamba (Chamberlin 1927); Kulu (just south of Bondo) (Attems 1937). *Shaba (Katanga)* (Attems 1937); Kikondja (Attems 1937); Kiambi (Attems 1930b, 1937); Ankoro, Lukuga R. (Attems 1930b); Kateke riv. S of confl. with Lufira R., and Kabulumba, Kaulue N., Kanonga, Kaswabilenga, Kaziba, Kiamakoto/Kiwakishi, Kilwezi, Kipondo Riv., Mabwe, Masombwe, Mukana, all in Upemba National Park (Kraus 1958a). *Provinces Unknown;* Zambi* (Chamberlin 1927); Kalemi (Albertville), Kalelwé* (Attems 1930b); Gitega,* Muanda,* Mwema,* Urundi* (Attems 1937). EGYPT (Lewis 1969b): Alexandria, Cairo (Attems 1902); Aswan, Giza (Lewis 1984, 1967, 1985). ETHIOPIA: Ethiopia in general but not southern Ethiopia northeast of L. Turkana (L. Rudolph), between the Dawa River and L. Turkana/Omo River (Manfredi 1941, occurrences mapped by Lewis (1985, map 1)); Genalç River area of southern Ethiopia ("Alto Ganale Guddá") (Silvestri 1895a); "Magala re Umberto" (?"King Humbert's Place, believed to be on Wab Shebel R. ca. 20 km N present border with Somalia [R. Hoffman, *in litt.* to RMS]) (Silvestri 1896); headwaters region of Genalç River ("Galla") (Brölemann 1904*b*); Adaleh (Chelazzi 1977, incorrectly placed in Somalia). GABON: Lamboréné (Brölemann 1904a); near Ogooué R. (Brölemann 1904a, Chamberlin 1927). GAMBIA (Brölemann 1904a): Bathurst (Lewis 1969b). GHANA: Mole Game Res. (Attems 1909c, d). GUINEA: *Kouroussa Prov.* (Brölemann 1904a). Late* (Dobroruka 1968). KENYA (Manfredi 1941): Athi Plains (Pocock, 1896); Gongoni, on the coast but exact location unknown (Lawrence 1953); Mombassa (Lewis 1969b); Longopito, on southern bank of Ewaso Ng'iro R, exact location unknown but near Samburu National Reserve (Dobroruka 1973); Elolo, modern name unknown but located on northeast shore of L. Turkana (L. Rudolph) (Manfredi 1941); Lamu and Manda islands (Attems 1910a). LESOTHO (BASUTOLAND) (Brölemann 1904a, Lewis 1969b). LIBERIA (Lewis 1969b). LIBYA: Tarâbulus (Tripoli) (Brolemann 1921). MALI: Tassakante, near Tombouctou, Sikasso (Brölemann 1904a); Kayes (Brölemann 1904a, 1905). MOROCCO (Kraepelin 1903, Brolemann 1921, Attems 1930a, Lewis 1984): Tétouan (Attems 1902); Amizmiz, Asni, Rabat, Mazagan (El Jadida), Marrakech,

Oued Tensift R., Fedhala,* Boulhaut,* Gorges de l'Oued,* Haute-Reraya,* Vallée de la Reraya,* Tiffsourme* (Brolemann 1945); E. of Mogodon* (Lewis 1969b). MOZAMBIQUE (Kohlrausch 1881): *Cabo Delgado;* Mecufi, Pemba (Lewis 2001b). *Maputo* (Lewis 2001b). *Zambezia;* Mopeia, on Cuacua (Quaqua) R. (Attems 1896); Kasumbadedza, exact location unknown but on the Zambezi R. (Lawrence 1953). NAMIBIA (Lawrence 1975): "Hereroland" (a former homeland ca. 320 km N Windhoek) (Attems 1928); Omaruru, Swakopmund (Attems 1922); Okahandja (Attems 1909b); Windhoek (Attems 1909b, 1922). NIGERIA (Schileyko 2002): Northern Nigeria (Lewis 1969b, 1972); Southern Nigeria (Lewis 1969b); 31 localities named and mapped by Lewis (1978, fig. 2). Jos (Dobroruka 1968, Lewis 2001b); Kabwir (Lewis 2001b); Lake Chad (Lewis 2003); Malam Fatori, on western shore of Lake Chad (Lewis 1972, 1978); Pai River Game Res. (Lewis 2001b); Sokoto (Lewis 1978); Zaria (Lewis 1968, 1969b, 1970, 1978, 2003). SENEGAL (Lewis 1969b): Baraff/* (Demange 1985); Bignona Forest nr. Tabi, Linguère, Missira, Niokolo, Road to Kolda, Vélingara (Demange 1982); Saint Louis vicinity (Brölemann 1904a). SOMALIA (Manfredi 1941, occurrences mapped by Chelazzi [1977:71, fig. 1] and Lewis [1985, map 1]): "Frequent in humid southern zones near Juba (Giuba) and Webi Shabeelle (Uebi Scebeli) rivers, also present on the coast as far north as Xaafuun" (Hafun) (Chelazzi 1977); Brava, a tiny seaport just south of Muqdisho (Mogadishu) (Silvestri 1897, Chelazzi 1977); Lugh/Lugh Ferrandi, a site on the Juba (Giuba) R. just below 4º N (R. Hoffman, *in litt*. to RMS) (Silvestri 1897); Scioa* (Brölemann 1904b); Jawhar (Giohar) (Manfredi 1933 [cited as "Villaggio Duca degli Abruzzi] Chelazzi 1977); Muqdisho (Mogadishu), Gelib*, Obbia* (Chelazzi 1977); Bardera,* Alessandra,* Dante,* Cardero,* Lugh Dolo,* Siccome* (Manfredi 1933). SOUTH AFRICA (Attems 1930a, Chagas 2000): "All parts of South Africa, from Hereroland (in Namibia) to the Transvaal" (Attems 1928). "Found throughout South Africa except extreme southwestern corner, including Cape Peninsula, territory immediately bordering it, and the narrow coastal strip affected by winter rains" (Lawrence 1936). Central and Northern Transvaal, Mpumalanga, northern Cape, and KwaZulu-Natal Provs. (Lawrence 1959). Murchison Range, Transvaal, and Cape Prov. (Lewis 1969b). South of Orange River (Lawrence 1975). *Gauteng;* Pretoria (Lewis 1969). *KwaZulu-Natal;* Zululand (Lawrence 1955, Lewis 1969b); Mazimba Hill* (Attems 1934a); Mseleni, exact location unknown but near Ubombo (Attems 1934b); Nagana,* Umtalose Station* (Lewis 1969b). *Limpopo:* Murchison Range (Lewis 1969b). *Limpopo/Mpumalanga;* 11 sites in Kruger Nat. Pk. (Lawrence 1966). *Mpumalanga;* Kruger Nat. Pk., Malelane Camp (Attems 1934a). *Northern Cape;* Namaqualand (Attems 1909b; Lawrence 1936, 1938, 1955; Lewis 1968); Kuruman (Lewis 1969b); Steinkopf (Attems 1909b). *Western Cape;* Karoo (Attems 1907a); Cape of Good Hope (Kohlrausch 1881, Brölemann 1904a), but Lawrence (1936, 1938, 1955) stated that *S. morsitans* was absent from the Cape Peninsula, an opinion that we accept. *Province(s) Unknown;* Deelfontein,* Schoonard Rydenburg* (Lewis 1969b). SUDAN (Attems 1910b, Schileyko 2002, occurrences mapped by Lewis (1985, map 1)]: Northern and southern Sudan (Lewis 1969b). *Bahr el Ghazal;* Rumbek (Lewis 1966); Yirol (Lewis 1967, 1968). *Central;* Disa Forest Res. nr. Roseires (Lewis 1966, 1967). *Darfur;* Kulme (Lewis 1967). *Equatoria;* Gondokoro (Attems 1910a, Lewis 1967). *Khartoum;* Khartoum (Lewis 1965, 1966, 1967, 1968, 1969b, 1984). *Kordofan;* Abu Gubeiha, Rashad (Lewis 1966, 1967). *Upper Nile;* Gabt-el-Maghadid (Flower 1900; Lewis 1967, 1968); Ghrab el Aish (Attems 1909c, Lewis 1967); Malakal, Paloich (Lewis 1966, 1967, 1968). *Province Unknown;* Khar Attar* (Attems 1910b, Lewis 1967). TANZANIA: "Tanganyika" (Brölemann 1904a, Kraus 1958b, Lewis 1969b). "West Tanganyika" (Attems 1930*b*). *Kilimanjaro;* Mt. Kilimanjaro (Attems 1896); Ngorongoro Crater (Brölemann 1904a). *Morogoro;* Morogoro (Lawrence 1953). *Mwanza;* Mwanza (Attems 1937). *Pwani;* Bagamoyo (Attems 1896, Lawrence 1953); Dar-es-Salaam (Dobroruka 1968, Lawrence 1953). *Rukwa;* Nyonga (Attems 1930b, 1937). *Tanga;* Tanga (Attems 1909e); Usambara Mts. (Attems 1909c). *Pemba I.;* Chake Chake (Attems 1910b). *Fundu I. (near Pemba)* (Attems 1910b). *Zanzibar I.;* Zanzibar (Kohlrausch 1881, Attems 1896, Brölemann 1904a, Lewis 1969). *Province unknown;* Mangasini* (Lawrence 1953). TUNISIA (Brolemann 1921): Tunis (Attems 1902, 1930a; Kraepelin 1903; Brölemann 1904a; Lewis 1969b, 1984); Makthar region* (Dobroruka 1968). UGANDA (Manfredi 1941): Katongo (Kraus 1958a). ZAMBIA (Chamberlin 1927): Kabwe, Kafwi (Kraus 1958a); Lochinvar Nat. Pk. (Dobroruka 1968); Ngwezi Station* (Dobroruka 1969); Victoria Falls (Lewis 2001b). ZIMBABWE (RHODESIA) (Chamberlin 1927, Lewis 1969b): Masvingo (Fort Victoria), Gweru (Gwelo), Mica Hills near Hwange (Wankie) (Lawrence 1936); Mutare (Umtali) (Lewis 1969b); Bulawayo (Lewis 2001b); Great Zimbabwe Nat. Mon. (Great Zimbabwe Ruins), nr. Masvingo and Lake Mutirikwi Rec. Pk. (Lewis 2001b). UNKNOWN COUNTRY: Schumbala-Tal* (Attems 1909c).

ARABIAN PENINSULA

OMAN: Salalah (Lewis 1996). SYRIA (Brölemann 1904a). YEMEN: Aden vicinity (Lewis 1996); Shaykh Uthman (Lewis and Wranik 1990).

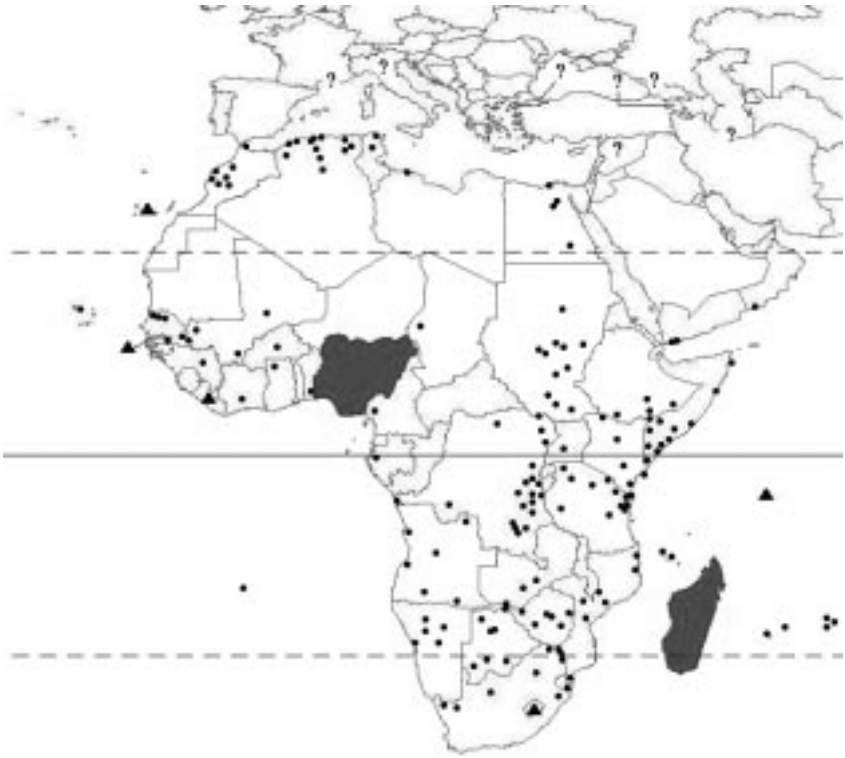

Fig. 4. Occurrences of *S. morsitans* in Africa, the Middle East, Europe, and the eastern Atlantic and western Indian Oceans. Question marks, dubious records, likely misidentifications or isolated, transient importations; lines and other symbols as in Fig. 2. Nigeria and Madagascar are shaded to reflect occurrences throughout these countries. Records in the Atlantic Ocean (north to south): general record from the Canary Islands; São Vicente, Cape Verde Islands; and St. Helena. Indian Ocean records (north to south): general record from the Seychelles; Njazidja and Nzwani, Comoro Islands (between Mozambique and Madagascar); and, east of Madagascar, Reunion, Mauritius, and Rodrigues and associated islands.

ASIA (including Indonesia, New Gunea. Philippines, Taiwan, and Japan): ASIA IN GENERAL (Chagas 2000). "HIMALAYA" IN GENERAL (Kohlrausch 1881), not plotted in fig. 5. BANGLADESH (Pocock 1892, Khanna 2001): Ganges R. (Brölemann 1904a). BRUNEI (Würmli 1975). CAMBODIA: South Cambodia (Würmli 1975). CHINA (Newport 1845, 1856; Kohlrausch 1881; Kraepelin 1903; D. Wang and Mauriès 1996): *Beijing;* Beijing (D. Wang and Mauriès 1996). *Yunnan:* Jinshui Co. nr. Yan Dong (cave) (Lewis 2001a). Hong Kong (Kohlrausch 1881, Würmli 1975). INDIA (Linnaeus 1758): *All Provinces except West Bengal* (Khanna 2001 and references therein; Indian records also cited by Kohlrausch (1881), Jangi (1959), Lewis (1966)). *West Bengal;* Calcutta (Würmli 1975). *Andaman and Nicobar Islands* (Khanna 2001). INDONESIA: *Amboina* (believed to refer to Ambon Island and other islands in the Molucca Sea [the "Moluccas"]) (Silvestri 1894, Chamberlin 1920, Würmli 1975). *Ambon* (Attems 1927). *Aru Islands* (Attems 1915); Aru I. (Attems 1914); Trangan I. (Chamberlin 1920). *Bali;* Singaraja (Attems 1932); Pafdangbai* (Lewis 2001b). *Borneo* (Würmli 1975); Banjermasin (Würmli 1975); Wa Katin* (Attems 1927). *Flores* (Attems 1914); Ende, Maumere, Sikka (Pocock 1894, Chamberlin 1920). *Halmahera* (Chamberlin 1920); Bruiyn* (Silvestri 1894); Patani, Soah Konorah* (Attems 1897). *Irian Jaya (Dutch New Guinea)* (Chamberlin 1914b, 1920, 1944a). *Java* (C. L. Koch 1847, 1863; Daday 1889; Brölemann 1904a; Attems 1914; Würmli 1975); Batavia Bay,* Purmerend* (Chamberlin 1939, 1944b); Bogor (Buitenzorg) (Chamberlin 1914b); Labuhan (Attems 1909). *Kei*

Islands (Silvestri 1894; Attems 1914, 1915, 1927; Chamberlin 1920); Grand-Kei* (between Warka* and Waor*) (Ribaut 1912); Petit-Kei,* Langgur* (Ribaut 1912). *Kepulauan Banda* (Chamberlin 1920). *Lombok;* Ekas Bai, Selong, Swela (Attems 1930d). *New Guinea in general (uncertain whether Irian Jaya [Dutch New Guinea] or Papua New Guinea)* (Haase 1887, Silvestri 1894, Attems 1915). *Nias;* Lelemboli* (Silvestri 1895b). *Nila* (Attems 1927). *Nusa Penida* (nr. Bali) (Lewis 2001b). *Selayar* (Pocock 1894, Attems 1914, Chamberlin 1920). *Sulawesi* (Attems 1914, Würmli 1975); Tempe (Pocock 1894). *Sumatra* (Daday 1889); Atjeh (Attems 1932); Padang (Würmli 1975). *Sumba* (Würmli 1972). *Sumbawa;* Sumbawa Besar, Wawo (Attems 1930d). *Terangan,** Ngaiguli* (Ribaut 1912). *Ternate* (Attems 1897, Chamberlin 1920). *Teun* (Attems 1927). *Timor* (Chamberlin 1920). IRAN: Takht-e-Soleyman Peak, Elburz Mountains (Silvestri 1935). JAPAN (Wood 1862, Chamberlin and Wang 1952): Ryu Kyu Islands (Attems 1914, Würmli 1975); Okinawa (Pocock 1895b). LAOS: Luang Prabang Mts. (Brölemann 1904a, Attems 1938); Savannakhet (Attems 1938). MALAYSIA (Brölemann 1909): Bukit Kuching, Perlis (Verhoeff 1937). *Sarawak;* Baram River (Attems 1897). MYANMAR (Pocock 1892, Attems 1914): Arakan, Yoma (Würmli 1975); Bhamo (Brölemann 1904a); Yangon (Rangoon) (Kohlrausch 1881). PAKISTAN: Karachi (Brölemann 1904a). PHILIPPINES (Attems 1914, Y. Wang 1955a): *Luzon;* Alabang (nr. Manilla) (Y. Wang 1962); Manila (Brölemann 1904a, Würmli 1975). *Mindanao* (Y. Wang 1951, 1962). *Mindoro* (Brölemann 1904a). *Panay* (Y. Wang 1951, 1962). SINGAPORE (Kohlrausch 1881, Brölemann 1904a). SRI LANKA (Kohlrausch 1881, Pocock 1892, Brölemann 1904a): Kandy (Würmli 1975). TAIWAN (Takakuwa 1940a, b; Y. Wang 1955a; Mitsuo 1993; Chao and Chang 2003): Chanhua (Y. Wang 1955b); Hualien (Y. Wang 1956); Kaosuing (Takao), Kagi,* Yantempo* (Würmli 1975); Chi-Hsi Tseng,* Chi-Kuo Siang,* Chia-Yi Hsien* (Y. Wang 1955b). *Lan Yu Islets* (Y. Wang 1955a). *Jinmen Dao I. (Quemoy)* (Y. Wang 1963). THAILAND (Kohlrausch 1881, Daday 1889, Brölemann 1904a): Krung Thep (Bangkok) (Brölemann 1904a). VIETNAM: *Nin Thung,* 17 km W Phan Rang (Schileyko 1995); *Kohinhina or Nam-bo* (Schileyko 1992); Annam Mts., Haiphong, Hanoi, Ho Chi Minh City (Saigon), Tonkin (Brölemann 1904a); Buon Me Thuot, Nha Trang, Ninh Hoa, Vinh (Attems 1938); Ca Mau, Da Lat (Attems 1953). *Fai Tsi Long Archipelago:* Dongkko I. (Schileyko 1995). **SOUTH CHINA SEA ISLANDS:** TIZARD BANK (Attems 1953).

INDIAN OCEAN ISLANDS: COMORO ISLANDS: *Njazidja (Grande Comore)* (Brölemann 1904a). *Nzwani (Anjouan)* (Attems 1910b). MADAGASCAR (Kohlrausch 1881): Lac Ihotray, Itampolo,* Mahafaly,* Miary* (Demange 1969); Antananarivo (Tananarive) (Brolemann 1922); Ankazoabo, Antsiranana (on Baie de Diégo Suarez), Maevatanana, Morondava, Tamatave, Tulléar* vic. (Brölemann 1904a); Behara (Brölemann 1904a, Lawrence 1960); Tuléar (Brölemann 1904a, Lawrence 1960); Fiherenana, Soalala, Tsimanampetsotsa, Andrahomana,* Sambirano-Mahilaka* (Lawrence 1960). MASCARENE ISLANDS: *Île Cocos* (beside Rodrigues) (Lewis and Daszak 1996; Lewis 2002, 2003). *Île aux Sables* (beside Rodrigues) (Lewis 2002). *Mauritius (Île de France)* (Brölemann 1904a); Black River Aviaries, Pigeon Wood, Tamarin (Lewis 2002); Cape Malheureux, Petite Rivière (Verhoeff 1939, Lewis 2002). *Rodrigues* (Brölemann 1909, Lewis 2003); hill west of Port Mathurin (Lewis 2002). *Réunion* (Brölemann 1904a). SEYCHELLES (Schileyko 1995).

AUSTRALIA AND NEW ZEALAND: AUSTRALIA: Capital Territory and all states except Tasmania and, essentially, Victoria (new records, published localities, and associated references summarized by L. E. Koch [1983]). NEW ZEALAND (Daday 1889, Würmli 1975), but L. E. Koch (1983) stated that *S. morsitans* is absent from this country, an opinion that we accept.

PACIFIC ISLANDS (new records, published localities, and associated references summarized by Shelley 2004*b*): COOK ISLANDS, FEDERATED STATES OF MICRONESIA, FIJI, FRENCH POLYNESIA, GUAM, KIRIBATI, NEW CALEDONIA, NORTHERN MARIANNA ISLANDS, PAPUA NEW GUINEA (BOUGAINVILLE), REPUBLIC OF THE MARSHALL ISLANDS, SOLOMON ISLANDS, TONGA, TUVALU, WESTERN SAMOA. Additionally, Ribaut (1923) cited *S. morsitans* from Koné, New Caledonia, in a reference that Shelley (2004b) did not have access to.

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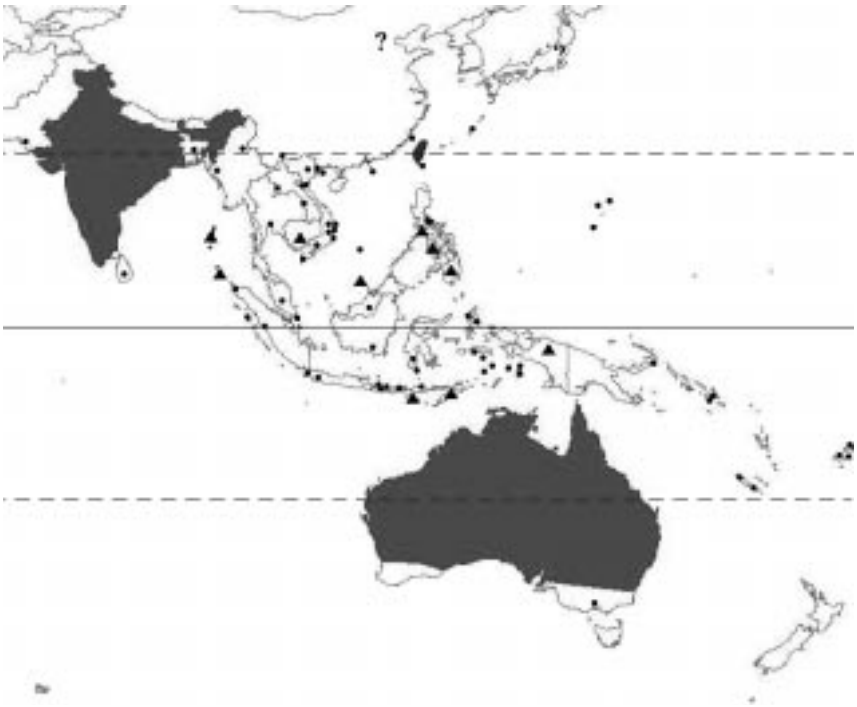

Fig. 5. Occurrences of *S. morsitans* in Asia, Australia, the Indian Ocean, and the western Pacific Ocean. Lines and symbols as in Figs. 2, 4. All of India and Taiwan, and most of continental Australia, are shaded to reflect occurrences throughout these areas.

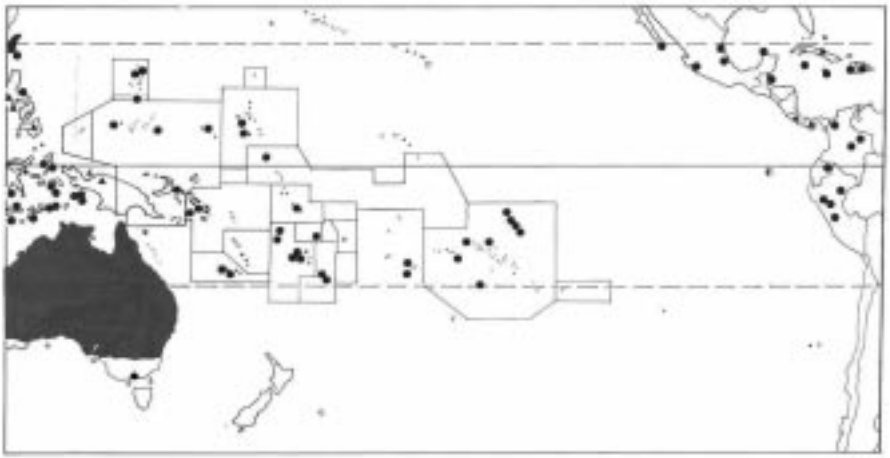

Fig. 6. Occurrences of *S. morsitans* in Asia, Australia, and Pacific Islands. Lines and symbols as in Figs. 2, 4. Most of continental Australia is shaded to reflect widespread occurrence throughout this area.

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