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A Revision of the Spider Genus *Liphistius* (Araneae, Mesothelae)

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ABSTRACT

The genus *Liphistius* is redefined to include those liphistiids with clavate trichobothria, a retrolateral apophysis on the male palpal tibia, and internal female genitalia consisting of a ventral receptacular cluster and a dorsal poreplate. Two species, *L. tonkinensis* Bristowe and *L. schensiensis* Schenkel, are transferred to *Heptathela*. As redefined, *Liphistius* includes 14 species known only from

eastern Burma, western Thailand, Malaysia, and Sumatra. Nine of these species are newly described: *L. lordae* from Burma, *L. bristowei* and *L. trang* from Thailand, and *L. yangae*, *L. langkawi*, *L. murphyorum*, *L. panching*, *L. tioman*, and *L. johore* from Malaysia. The males of *L. birmanicus* Thorell, *L. desultor* Schiödte, and *L. sumatranus* Thorell are described for the first time.

INTRODUCTION

Despite their pivotal position in the phylogeny of spiders (Platnick and Gertsch, 1976), the species of the family Liphistiidae have received relatively little attention from arachnologists. The only comparative survey of the group is now a half-century old (Bristowe, 1932), and is difficult to use because of its neglect of genitalic characters. Although several species of the genus *Heptathela* are described in recent papers (Gertsch, 1967; Haupt, 1979; Chen, Zhang, and Zhu, 1981; Wang and Ye, 1983; Zhu and Wang, 1983),

modern work on *Liphistius* (fig. 1) is limited to the studies of Kraus (1978) on genitalic morphology and of Murphy and Platnick (1981) on three Malaysian species.

In an attempt to fill in the gaps in our knowledge of *Liphistius*, the second author undertook three expeditions to southeast Asia. These were aimed primarily at discovering the males of several classical species known only from females (adult males are rarely found in nature, and are presumed to live for only a short time after reaching ma-

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FIG. 1. *Liphistius batuensis* Abraham, female from cave in Templar Park, Malaysia. Photograph by Dr. E. S. Ross.

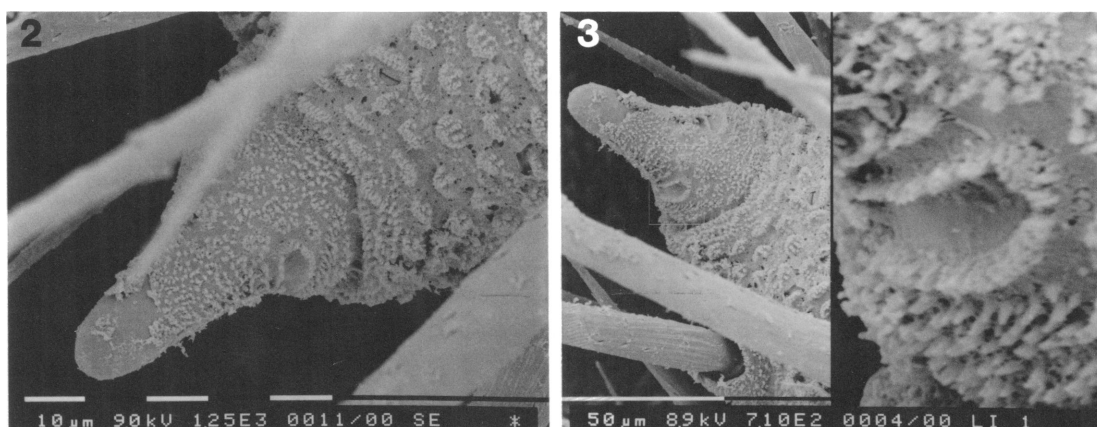
turity). All specimens were therefore captured alive and reared in the laboratory for as long as possible. This program has been extremely successful; not only were many missing or poorly represented males and females obtained, but the genus proved to be much more diverse than had previously been suspected. We have therefore attempted to examine all available specimens of the genus, and present here the results of a comparative survey of our own and older collections.

GENERIC LIMITS

Consideration of the variety of species now available indicates that problems exist with the traditional generic subdivision of the family, in which all species that retain the primitive number of eight separate spinnerets

were placed in *Liphistius* and those species in which the two posterior median spinnerets have become fused into a single structure were assigned to *Heptathela*. Obviously, this arrangement defines *Liphistius* only on the basis of a plesiomorphic feature, and as might be expected, the resulting group of species does not appear to be monophyletic. Murphy and Platnick (1981) suggested a possible synapomorphy for the genus, noting that (unlike *Heptathela*) specimens of *Liphistius* have a row of clavate trichobothria in addition to the filiform trichobothria normally found on the leg and palpal tarsi (Murphy and Platnick, 1981, figs. 5, 6).

We have found genitalic characters of both males and females which have the same distribution as do the clavate trichobothria. All the known males with such trichobothria have



FIGS. 2, 3. *Liphistius sumatranus* Thorell, female, spigot on anterior median spinneret. 2. Tip; note absence of an opening for a silk duct. 3. Base; note pair of slit sensilla (enlarged). Micrographs by Dr. F. A. Coyle.

a unique type of retrolateral apophysis on their palpal tibia, consisting of a short, sub-terminal ledge bearing several long, strong spines (as in fig. 7). Male *Heptathela*, by contrast, have no tibial apophysis at all, as is also the case for the more plesiomorphic mygalomorphs (such as the Atypidae, Antrodiaetidae, and Mecicobothriidae) and araneomorphs (such as the Hypochilidae, Hickmaniidae, Grandungulidae, and Thaiidae). Similarly, the known females with clavate trichobothria have internal genitalia of a type unique among spiders, with a ventral receptacular cluster originating from a large, heavily sclerotized poreplate (as in figs. 12, 13) carried on a posterior stalk. Female *Heptathela*, in contrast, have internal genitalia consisting of the type of "2+2" spermathecal arrangement (Gertsch, 1967, fig. 3) also found in the more plesiomorphic mygalomorphs and araneomorphs. Hence we restrict *Liphistius* here to those species with these three apparently synapomorphic characters.

As a result, two species currently placed in *Liphistius* must be removed from the genus. The first, described as *Liphistius tonkinensis* by Bristowe (1932), is based on a single male from northern Vietnam originally identified as *Liphistius birmanicus* Thorell by Simon (1908). Our examination of this specimen indicates that it lacks both clavate trichobothria and a palpal tibial apophysis. The pos-

terior median spinnerets are in some respects intermediate between those of *Liphistius* and typical *Heptathela*.

In *Liphistius*, both the anterior and posterior median spinnerets generally bear a distinctive, terminal spigot. In at least *Liphistius sumatranus* Thorell, the spigots on the anterior median spinnerets are vestigial, in that there is no opening at their tip through which silk can exit (figs. 2, 3; there are a pair of what appear to be slit sensilla near the base of the spigots; similar sensilla occur on the bases of at least some functional spigots on the other spinnerets; Dr. F. Coyle, personal commun.). A histological study of a female of *Liphistius desultor* Schiödt by Ms. J. Palmer (personal commun.) indicates that there is no silk duct in either anterior median spinneret. These results are in accordance with those of Millot, who reported (in Bristowe, 1932) that no silk glands supply the anterior median spinnerets of *L. desultor*, *Liphistius malayanus* Abraham, *Liphistius batuensis* Abraham, or *Heptathela kimurai* (Kishida).

Millot also indicated that the posterior median spinnerets are functional in some species (such as *L. desultor*) but not others (such as *L. batuensis*). The holotype of *L. tonkinensis* clearly falls into the latter category. Unlike all the species assigned below to *Liphistius*, which have long, narrow posterior median spinnerets, those of *L. tonkinensis* are short, triangular, and barely discernible as separate

elements. Moreover, they bear no spigots at all. Thus, these clearly vestigial spinnerets indicate that *L. tonkinensis* is more closely related to the species of *Heptathela* than to true *Liphistius*, and the species is here transferred to *Heptathela*.

The second species which seems not to belong in *Liphistius* was described from northern China by Schenkel (1953) as "*Liphistius* (*Heptathela*) *sinensis* (Bishop and Crosby) Var. *schensiensis* n. var." Schenkel placed *Heptathela* (which he misspelled) as a subgenus of *Liphistius* because he detected no significant differences between his single female specimen and *Heptathela sinensis* Bishop and Crosby except in spinneret number: he found eight, rather than seven, spinnerets. Subsequent authors (Gertsch, 1967; Bristowe, 1976) regarded the spinneret number as decisive and referred to the species as simply *Liphistius schensiensis* Schenkel. Unfortunately, we have not been able to locate Schenkel's specimen. His illustration indicates that the posterior median spinnerets are shaped like those of true *Liphistius*, but does not show whether terminal spigots are present. His illustrations do indicate, however, that the female genitalia extend far posterior of the level of the first pair of booklungs (i.e., they protrude over at least half the length of the second booklung plate). This is a feature which occurs in other Chinese *Heptathela*, but not in any known *Liphistius*. We are therefore reasonably confident that examination of the genitalia of Schenkel's specimen would indicate that it belongs to *Heptathela*, and here assign the species to *Heptathela*, rather than *Liphistius*, despite its retention of the plesiomorphic spinneret number.

As thus delimited, the two genera become allopatric, with *Liphistius* known only from eastern Burma, western Thailand, Malaysia, and Sumatra and *Heptathela* known only from eastern China, northern Vietnam, Japan, and the Ryukyu Islands.

NATURAL HISTORY

Although liphistiids have generally been considered rare, this is probably due only to the fact that little spider collecting has been done in southeast Asia. Most of the *Liphistius* specimens currently in collections (except for those from caves) were taken from road or

path cuts. Similar habitats occur on less accessible hills and mountains throughout the region; more thorough investigation of those habitats should widen known distribution ranges considerably and perhaps also reveal additional taxa.

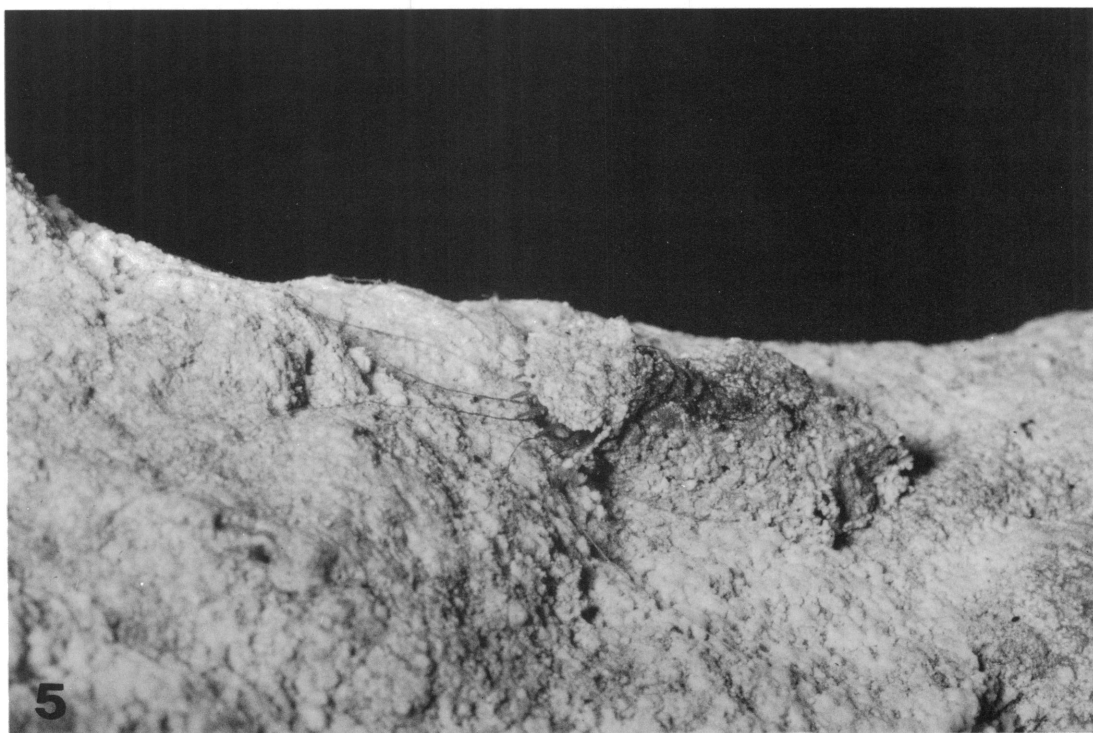
So far as known, all the species here placed in *Liphistius* build characteristic retreats with a trapdoor (hinged usually along its upper surface but occasionally along any of the other sides instead) and a radiating series of six to eight "fishing lines" on which the spider's tarsi rest when it is awaiting prey (figs. 4, 5; Abraham, 1923a, fig. 2, 1923b, pl. 1; Bristowe, 1975b, fig. 5; Bristowe and Tweedie, 1976, p. 165; Murphy and Platnick, 1981, figs. 3, 4).

Most commonly the tubular retreats are burrows that extend horizontally into banks for up to a foot. Burrow temperatures thus remain fairly stable and flooding is not a serious problem. Most burrows are found in shaded banks covered with moss or sparse vegetation, but others occur in dry, unshaded banks (even those facing south or southeast) or in banks with heavy or no vegetation. The burrows usually bend just behind the entrance, so that a stick cannot be inserted to their end and some digging must be done to extract the occupant.

There are two additional types of retreats constructed by species inhabiting caves or similar habitats, such as excavations under boulders. The first is a retreat made of earth and silk attached to the wall of a cave or rock (figs. 4, 5), often with a second escape door at its bottom. The second is a burrow found in loosely packed level or gently sloping soil that is entered vertically or at an angle (but not horizontally); it is probable that this type of burrow occurs only in habitats in which flooding is unlikely.

It should be noted that, so far as known, species of *Heptathela* construct similar retreats but do not have the "fishing lines"; thus if populations of the two species discussed above can be located in the future, their burrow structure may provide an additional test of their generic affiliation.

Egg sacs have been found in chambers at the ends of burrows in December, January, and February (Bristowe: *L. desultor*, *L. batuensis*) and July (the second author: *L. su-*



FIGS. 4, 5. *Liphistius batuensis* Abraham, female in retreat. 4. View showing seven "fishing lines." 5. View showing spider awaiting prey, with tarsi on "fishing lines." Photographs by Dr. E. S. Ross.

matranus). The sacs are made of thick silk and dirt and are 4–5 cm. across. Males of *L. sumatranus*, *L. tioman*, and *L. langkawi* have been taken in their burrows in July and August, often with their cast skins. Only rarely are specimens encountered outside their burrows; this has been observed in *L. langkawi* (three individuals), *L. bristowei*, and *L. tioman*, but it is possible that in these cases the spiders were disturbed by collecting and not evidencing normal behavior. Reared specimens did not trail out draglines while walking, although Bristowe (1976) indicated that silk is trailed when prey is attacked at the burrow entrance.

Several invertebrates parasitize *Liphistius*. The laelapid mite *Pelethiphis bristowei* Finnegan (1933) has been found in great numbers on *L. malayanus* at Klang Gates, Malaysia (Bristowe, 1932), and also occurs frequently and abundantly on *L. panching*. Most specimens of *L. birmanicus* taken at Maymyo, Burma, carried (often on their legs) from one to six red mites of the family Erythraeidae. We have also found nematodes in large numbers on living spiders as well as eating the remains of recently dead captive specimens (although it is not known whether the nematodes caused the deaths). Bristowe (1976) mentioned finding the larva of a pompilid wasp on the abdomen of one *L. desultor*.

As in mygalomorphs, adult females of *Liphistius* continue to grow and molt throughout their life. These spiders probably live for many years; specimens of *L. langkawi*, *L. sumatranus*, and *L. malayanus* reared for over two years showed little size change compared to the total range of variation in adult body size. Internal genitalia are often detectable even in very small specimens, although reproductive maturity is usually indicated by a substantial increase in the degree of sclerotization, particularly of the posterior stalk. Our laboratory rearings indicate that the entire sclerotized structure (posterior stalk, poreplate, and receptacular cluster) is shed with each molt; thus, cast skins of females can be identified to species just as readily as entire specimens. Spiders collected near the time of a molt show a separate set of sclerotized structures associated with each exoskeleton. On the assumption that sperm are stored in either the poreplate or (more

likely) the receptacular cluster, it seems likely that mated females will lose any stored sperm each time they molt and may thus be repetitive virgins. Some ontogenetic differences are detectable in genitalic structure (often the poreplate becomes proportionally smaller as the females age) but these differences are unlikely to be confused with interspecific variation.

ACKNOWLEDGMENTS

We are deeply indebted to the curators and collectors listed below, who made available many of the rare specimens on which this study is based, especially to Dr. M. Hubert, whose cooperation saved much time and effort traveling in Sumatra. Dr. F. A. Coyle and Ms. J. Palmer of Western Carolina University and Dr. E. S. Ross of the California Academy of Sciences generously allowed us to use their unpublished photographs, micrographs, and information. Dr. M. U. Shadab and Ms. R. Reiss of the American Museum of Natural History aided skillfully with illustration and manuscript preparation, respectively. We greatly appreciate the help with rearing specimens given at various times and places by Mssrs. Murphy and Chang of the University of Singapore and by D. Richman, C. Griswold, P. Craig, J. Sedgwick, G. Stone, and S. Townsend in the United States. The following were indispensable as guides in finding many of the specimens described below: R. Hussain and M. Nor, Langkawi Island; M. Nadchatram, Kuala Lumpur; O. B. Mohamad and M. B. Abdullah, Tioman Island; and especially the late W. S. Bristowe, without whose papers collecting would have been much more difficult. We thank Drs. F. A. Coyle, R. R. Forster, W. J. Gertsch, J. Haupt, and R. J. Raven for their comments on a draft of the manuscript.

ABBREVIATIONS

AMNH, American Museum of Natural History, New York
BMNH, British Museum (Natural History), London, Mr. P. Hillyard
BPBM, B. P. Bishop Museum, Honolulu, Dr. J. M. Tenorio
CAS, California Academy of Sciences, San Francisco, Dr. W. Pulawski
CJR, Dr. J. Reiskind, University of Florida, Gainesville

JAM, Mr. J. A. Murphy, Hampton, England
 MCSNG, Museo Civico di Storia Naturale, Genova, Dr. G. Arbocco
 MCZ, Museum of Comparative Zoology, Cambridge, Dr. H. W. Levi
 MNHN, Muséum National d'Histoire Naturelle, Paris, Dr. M. Hubert
 NUS, National University of Singapore, Mrs. C. M. Yang
 RNHL, Rijksmuseum van Natuurlijke Historie, Leiden, Dr. L. van der Hammen
 WCS, Mr. W. C. Sedgwick, Boston, Georgia
 ZMC, Zoologisk Museum, Copenhagen, Dr. H. Enghoff

LIPHISTIUS SCHIÖDTE

Lipistius Schiödte, 1849, p. 621 (type species by monotypy *Lipistius desultor* Schiödte).

Liphistius (emendation): Thorell, 1869, p. 13 (on Official List of Family and Generic Names in Zoology).

Anadiastothele Simon, 1903, p. 875 (type species by original designation *Anadiastothele thorelli* Simon, = *Liphistius sumatranus* Thorell). First synonymized by Bristowe, 1932, p. 1022.

DIAGNOSIS: *Liphistius* can be distinguished from *Heptathela* by the presence of clavate trichobothria on the tarsi and metatarsi of all legs and the palpal tarsi, by the presence of a retrolateral tibial apophysis on the male palp, and by the ventral receptacular cluster-dorsal poreplate construction of the internal female genitalia.

DESCRIPTION: Total length, excluding chelicerae, 9–37 mm. Carapace longer than wide, with low, rounded elevations radiating from thoracic groove to leg and palpal coxae; thoracic groove a deep pit situated at level of second coxal elevations; clypeus short, with long spines near midline, other spines along midline on and behind ocular tubercle. Eight or six (some specimens of *L. batuensis*) eyes on darkened, elevated tubercle wider than long; oval anterior lateral eyes largest, followed by oval posterior laterals, circular posterior medians, and tiny, circular anterior medians; anterior medians separated by at least their diameter, posterior medians separated by less than their diameter, laterals at edges of ocular tubercle, surrounding medians; median ocular quadrangle wider in back than in front and than long. Sternum longer than wide, with flat, strongly spined central portion (greatly narrowed anteriorly in males),

wide, weakly spined, steeply sloping lateral margins, and elongated posterior tip. Labium wider than long, fused to sternum, reflexed dorsoventrally. Endites longer than wide, with thick scopula anteromedially and roughened serrular area anterolaterally. Chelicerae bicolored, light, glabrous proximally, dark, bristled distally; single row of promarginal teeth between promarginal and retromarginal brushes of long, curved setae. Leg formula 4321; femora and more distal segments with numerous spines (grading into bristles) in three longitudinal rows dorsally and two longitudinal rows ventrally, weaker bristles interspersed between spine rows; filiform trichobothria in paramedian rows on tibiae, metatarsi, and tarsi; clavate trichobothria in median row on tarsi and metatarsi; three dentate claws, no claw tufts; tarsal scopulae present only in males, weak on anterior legs, strong on posteriors. Abdomen longer than wide, with 10 tergites bearing strong spines along their posterior margin and dark markings medially and laterally; soft cuticle with long bristles; two pairs of booklungs, each pair carried on distinct sternite; eight spinnerets, laterals multisegmented, with many lateral spigots, medians unisegmented, with single terminal spigot. Female palp with spines and trichobothria as on legs, with dentate claw. Male palp with retrolateral tibial apophysis consisting of subterminal ledge bearing strong spines, tarsus with large, spinose paracymbium and tripartite bulb. Internal female genitalia with posterior stalk, anterodorsal poreplate, and anteroventral receptacular cluster.

MISPLACED TAXA: See Generic Limits above.

DISTRIBUTION: Eastern Burma, western Thailand, Malaysia, Sumatra (fig. 6).

SPECIES GROUPS: Two species groups can be distinguished by the morphology of the internal female genitalia. In one group, containing the first nine species discussed below, the ventral receptacular cluster is narrow and confined to the central portion of the poreplate. In the second group, containing the remaining five species, the ventral receptacular cluster is wide, occupying a substantial portion of the width of the poreplate. Because it is possible that one of these conditions is just a modified form of the other, the monophyly of these species groups is not yet established.

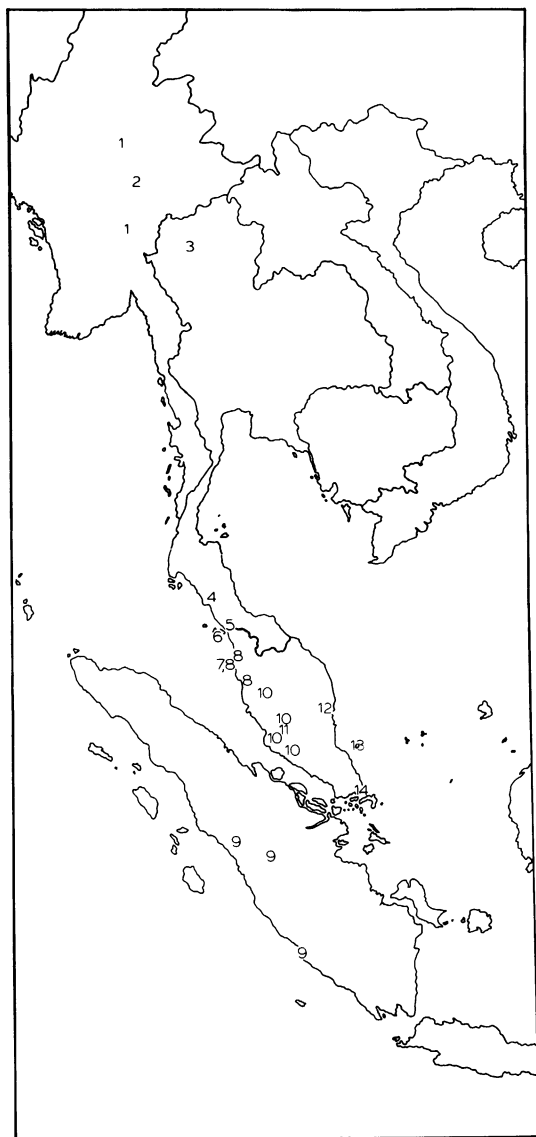


FIG. 6. Southeast Asia, showing known records of *Liphistius birmanicus* (1), *L. lordae* (2), *L. bristowei* (3), *L. trang* (4), *L. yangae* (5), *L. langkawi* (6), *L. murphyorum* (7), *L. desultor* (8), *L. sumatranus* (9), *L. malayanus* (10), *L. batuensis* (11), *L. panching* (12), *L. tioman* (13), and *L. johore* (14).

The order in which the species are treated within each group below is geographical, proceeding from the northwestern to the southeastern portions of the range of the genus.

All measurements presented below are in

millimeters. Abbreviations for eyes are standard for the Araneae; their diameters are measured transversely.

Liphistius birmanicus Thorell

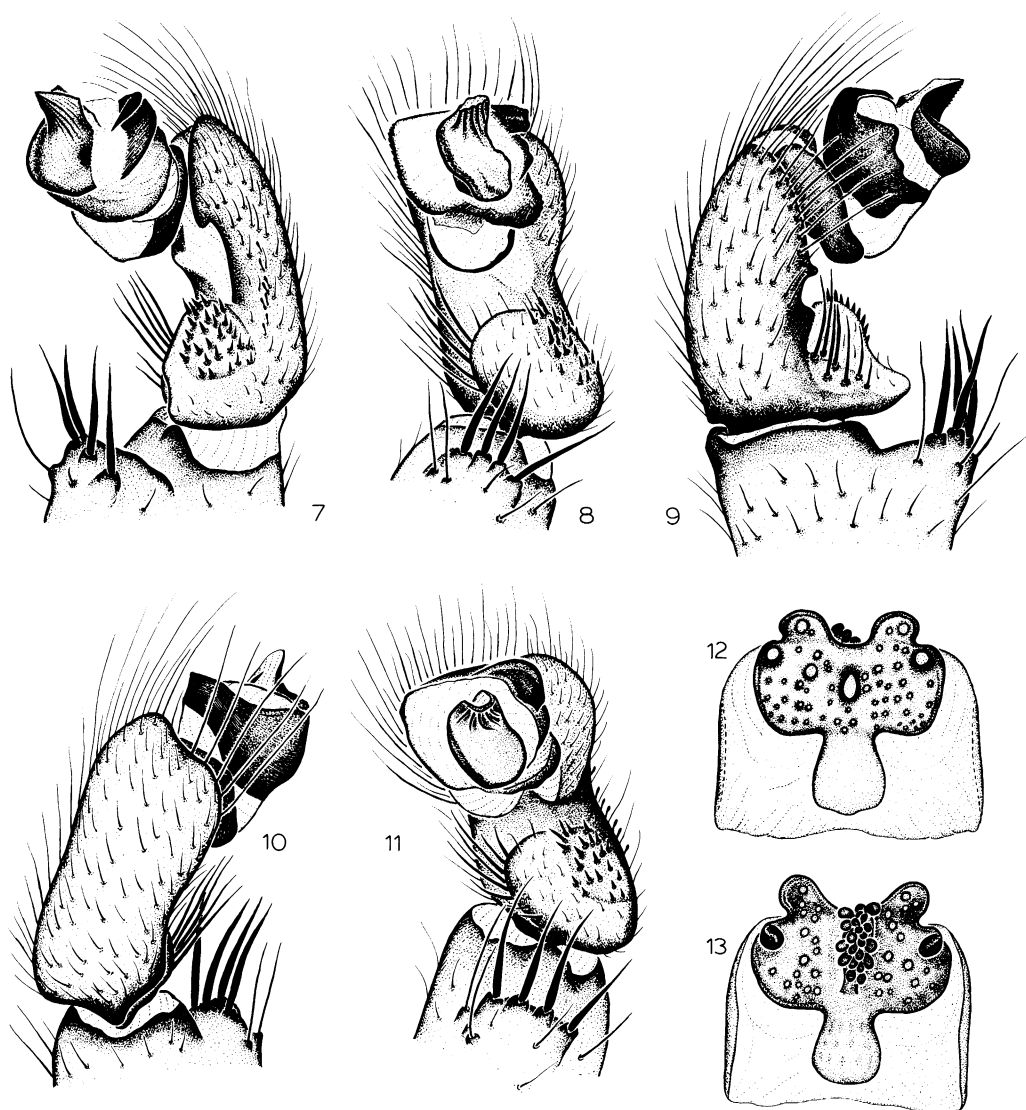
Figures 7–15

Liphistius birmanicus Thorell, 1897, p. 162 (female lectotype, here designated, from Yado, Kayah, Burma, in MCSNG, examined). Bristowe, 1932, p. 1025, figs. 6, 7b, 8d, 9a. Roewer, 1942, p. 145. Bonnet, 1957, p. 2548.

DIAGNOSIS: *Liphistius birmanicus* seems closest to *L. lordae* (in both of these Burmese species, the posterior stalk of the internal female genitalia is narrowed) but females can be distinguished by the presence of four rather than two anterior lobes on the ventral surface of the poreplate (figs. 12, 13). The male palp resembles that of *L. malayanus* but can easily be distinguished by the shorter, pointed tegular apophysis (fig. 11).

FEMALE (fig. 15): Total length, not including chelicerae, 12.1. Carapace 5.26 long, 4.08 wide, light yellow-brown with dark olive markings along anterior and lateral margins, in triangular patches posteriorly along each coxal elevation, between ocular tubercle and thoracic groove, and at bases of scattered, short setae. Ocular tubercle 0.61 long, 0.75 wide. Eye sizes and interdistances: AME 0.06, ALE 0.31, PME 0.20, PLE 0.22; AME–AME 0.10, AME–ALE 0.07, PME–PME 0.07, PME–PLE 0.06, ALE–PLE 0.02. MOQ length 0.36, front width 0.22, back width 0.47. Sternum 2.50 long, 1.78 wide, light yellow, slightly darker on steeply sloping margins. Labium 0.54 long, 1.19 wide. Endites 1.91 long, 1.14 wide. Chelicerae light yellow proximally, light brown distally; promargin with 11–13 teeth. Legs light yellow brown with irregular dark olive rings proximally and distally on femora and tibiae, proximally on coxae, metatarsi, and tarsi. Superior tarsal claws with three teeth on anterior legs, five on posteriors; inferiors with two tiny denticles.

	I	II	III	IV	Palp
Femur	3.67	3.62	3.53	4.38	3.04
Patella	1.55	1.69	1.69	1.96	1.51
Tibia	2.27	2.25	2.41	3.26	2.01
Metatarsus	2.09	2.23	2.77	4.53	—
Tarsus	1.21	1.33	1.57	2.43	1.98
Total	10.79	11.12	11.97	16.56	8.54



FIGS. 7-13. *Liphistius birmanicus* Thorell. 7. Palp, retrolateral view. 8. Palp, retroventral view. 9. Palp, ventral view. 10. Palp, prolateral view. 11. Palp, distal view. 12. Internal female genitalia, dorsal view. 13. Same, ventral view.

Abdomen 6.19 long, 5.20 wide, light brown with sternites and spinnerets brownish orange. Palpal claw with two denticles. Internal genitalia with narrow posterior stalk, four large anterior lobes on poreplate, and narrow median receptacular cluster (figs. 12, 13).

MALE (fig. 14): As in female, except for the following. Total length 9.5. Carapace 4.89 long, 4.21 wide, with most of pars cephalica

elevated and dark olive; clypeus transversely ridged. Ocular tubercle 0.72 long, 0.83 wide. Eyes sizes and interdistances: AME 0.05, ALE 0.39, PME 0.21, PLE 0.28; AME-AME 0.10, AME-ALE 0.11, PME-PME 0.08, PME-PL 0.09, ALE-PL 0.07. MOQ length 0.39, front width 0.20, back width 0.49. Sternum 2.30 long, 1.52 wide. Labium 0.50 long, 1.01 wide. Endites 1.44 long, 1.01 wide. Chelicerae with



14



15



16



17

FIGS. 14–17. 14, 15. *Liphistius birmanicus* Thorell. 16. *L. murphyorum*, new species. 17. *L. panching*, new species. 14, 16. Male. 15, 17. Female. Photographs by Mr. P. R. Craig.

12 promarginal teeth. Legs without distinct annulations. Superior tarsal claws of anterior legs with three or four teeth, of posteriors with five or six.

	I	II	III	IV	Palp
Femur	4.25	4.43	4.28	4.68	2.97
Patella	1.91	1.84	1.73	1.84	1.42
Tibia	2.95	3.33	3.45	4.46	2.88
Metatarsus	3.36	3.78	4.57	6.01	—
Tarsus	1.69	1.92	2.30	2.99	1.55
Total	14.16	15.30	16.33	19.98	8.82

Abdomen 5.15 long, 4.07 wide. Palp as in figures 7–11.

VARIATION: The lectotype female is considerably larger (total length 22.0) than the female from Maymyo described above, and has less distinct leg annulations; the internal genitalia are similar except that the posterior stalk is proportionally broader.

MATERIAL EXAMINED: BURMA: *Kayah:* Yado, elevation 1200–1300 m., 1885–1889 (L. Fea, MCSNG), 1f (lectotype). *Mandalay:* Maymyo, elevation 3500 feet, July 13, 1982

(W. Sedgwick), 2m, 5f as follows: 1m, matured Oct. 14, 1982, died Feb. 23, 1983 (AMNH); 1m, matured Oct. 23, 1982, died Dec. 29, 1982 (AMNH); 1f, died Oct. 15, 1982 (AMNH); 1f, molted Nov. 6, 1982, died Mar. 1, 1983 (AMNH); 1f, molted Jan. 27, 1983, died Feb. 14, 1983 (AMNH); 1f, molted Feb. 28, 1983, died Apr. 17, 1983 (AMNH); 1f, died May 1, 1983 (MCZ).

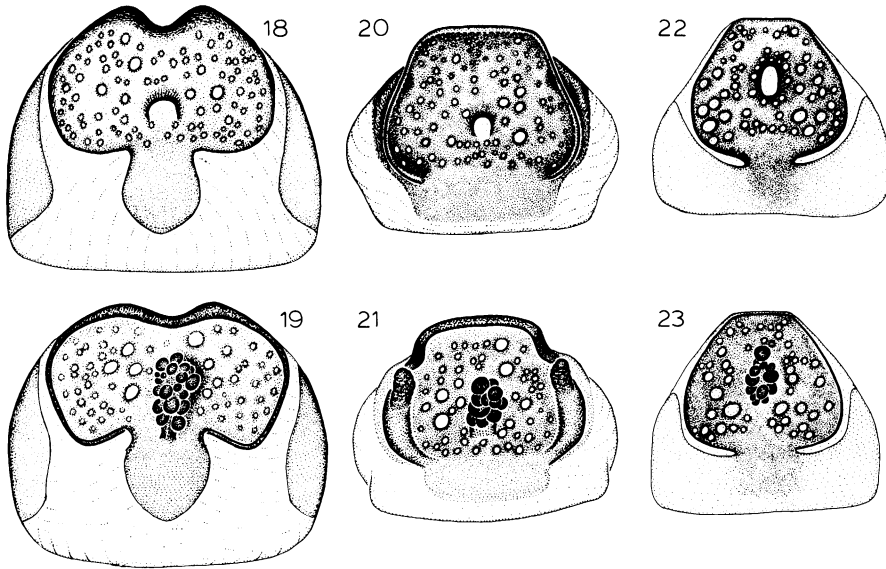
DISTRIBUTION: Known only from eastern Burma.

NATURAL HISTORY: Specimens were found up and down the sides of a gorge near Maymyo, some in relatively dry and others in relatively wet earth, in different soils from hard marl to soft red clay, facing west-northwest to south-southwest. Several burrows had double doors.

***Liphistius lordae*, new species**

Figures 18, 19

TYPE: Female holotype from a road cut at an elevation of 5000 feet west of Taunggyi



FIGS. 18–23. Internal female genitalia. 18, 19. *Liphistius lordae*, new species. 20, 21. *L. trang*, new species. 22, 23. *L. yangae*, new species. 18, 20, 22. Dorsal view. 19, 21, 23. Ventral view.

Mountain, Shan, Burma (collected July 15, 1982, died January 19, 1983; W. Sedgwick), deposited in AMNH.

ETYMOLOGY: The specific name is a patronym in honor of Ms. Pauline Lord, who greatly facilitated the second author's fieldwork, especially on this species.

DIAGNOSIS: *Liphistius lordae* seems closest to *L. birmanicus* but can be distinguished by the presence of two rather than four anterior lobes on the ventral surface of the poreplate (figs. 18, 19).

FEMALE: Total length, not including chelicerae, 13.7. Carapace 6.26 long, 5.33 wide, light brown with narrow dark markings along anterior and lateral margins, radiating from thoracic groove along posterior edges of coxal elevations, and forming W-shaped pattern behind ocular tubercle. Ocular tubercle 0.83 long, 0.93 wide. Eye sizes and interdistances: AME 0.06, ALE 0.43, PME 0.23, PLE 0.25; AME–AME 0.10, AME–ALE 0.23, PME–PME 0.12, PME–PLE 0.09, ALE–PLE 0.11. MOQ length 0.43, front width 0.23, back width 0.58. Sternum 3.19 long, 1.84 wide, light yellowish brown, slightly darker on steeply sloping margins. Labium 0.71 long, 1.40 wide. Endites 2.05 long, 1.35 wide. Che-

licerae light yellow proximally (except along anteromedian edge, where brown), brown distally; promargin with 14 teeth. Legs olive brown, darkened along spine rows, without distinct annulations. Superior tarsal claws usually with three teeth on anterior legs, four on posteriors; inferiors usually with two tiny denticles.

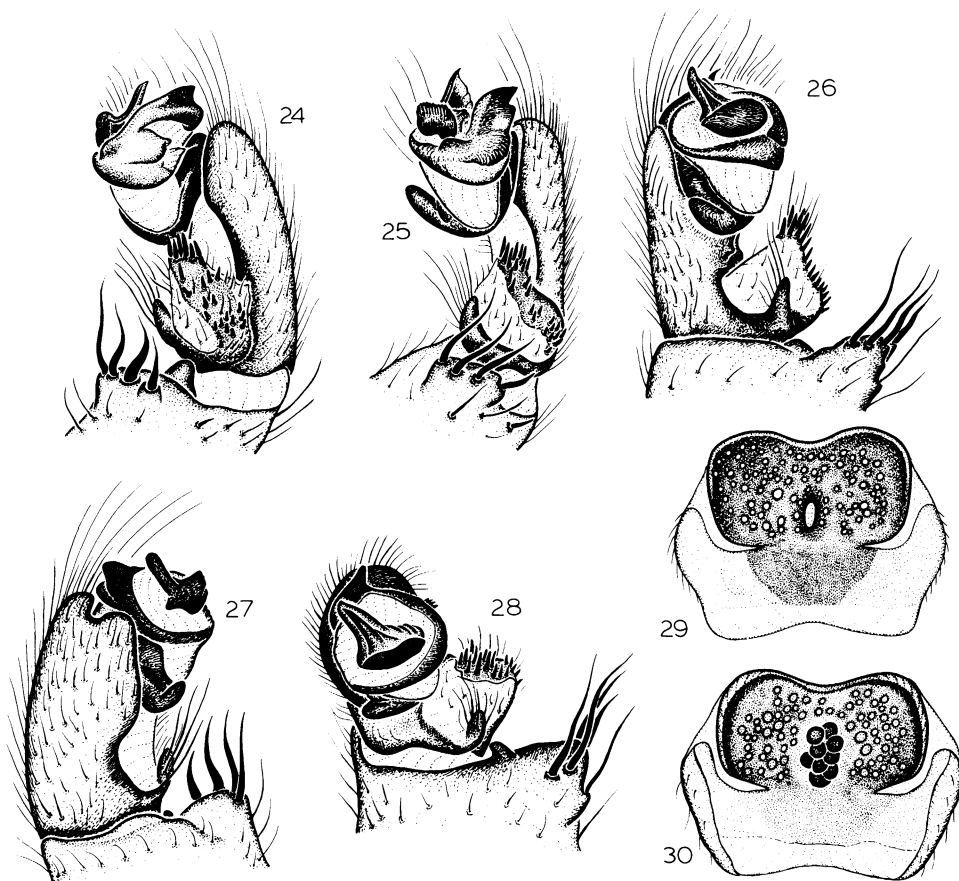
	I	II	III	IV	Palp
Femur	4.49	4.43	4.32	5.87	3.82
Patella	1.92	1.87	1.87	2.59	1.87
Tibia	2.63	2.61	2.76	3.85	2.59
Metatarsus	2.56	2.72	3.24	5.47	—
Tarsus	<u>1.44</u>	<u>1.55</u>	<u>1.90</u>	<u>2.68</u>	<u>2.79</u>
Total	13.04	13.18	14.09	20.46	11.07

Abdomen 7.27 long, 5.40 wide, light brown with sclerites light yellowish brown and spinnerets brown. Palpal claw with three denticles. Internal genitalia with narrow posterior stalk, two anterior lobes on poreplate, and narrow median receptacular cluster (figs. 18, 19).

MALE: Unknown.

OTHER MATERIAL EXAMINED: None.

DISTRIBUTION: Known only from eastern Burma.



FIGS. 24–30. *Liphistius bristowei*, new species. 24. Palp, retrolateral view. 25. Palp, retroventral view. 26. Palp, ventral view. 27. Palp, prolateral view. 28. Palp, distal view. 29. Internal female genitalia, dorsal view. 30. Same, ventral view.

***Liphistius bristowei*, new species**

Figures 24–30

Liphistius birmanicus (misidentification): Bristowe, 1975a, p. 166; 1976, p. 4 (Thailand record only).

TYPES: Male holotype from an elevation of 1100 m. on Doi Suthep mountain, Chiang Mai, Thailand (November 8, 1958; B. Degerbøl), deposited in ZMC, and female paratype from an elevation of 4000 feet at the type locality (collected May 21, 1981, died Aug. 18, 1982 after one molt; W. Sedgwick), deposited in AMNH.

ETYMOLOGY: The specific name is a patronym in honor of the late W. S. Bristowe, a

lifelong student of *Liphistius* who first recorded the existence of this species at the type locality.

DIAGNOSIS: Males resemble those of *L. langkawi* and *L. murphyorum* in having a ventral subtegular apophysis, but the apophysis is much shorter than in either of those species (figs. 24–28); females resemble those of *L. yangae* in having a broad, indistinctly limited posterior stalk and no anterior lobes on the poreplate, but differ in having the poreplate slightly invaginated anteromedially (figs. 29, 30).

FEMALE: Total length, not including chelicerae, 11.2. Carapace 6.85 long, 6.05 wide, light brown with narrow dark markings along

anterior and lateral margins and radiating from thoracic groove along posterior edges of coxal elevations. Ocular tubercle 0.94 long, 1.17 wide. Eye sizes and interdistances: AME 0.11, ALE 0.56, PME 0.33, PLE 0.33; AME-AME 0.09, AME-ALE 0.20, PME-PME 0.02, PME-PLE 0.06, ALE-PLE 0.06. MOQ length 0.55, front width 0.31, back width 0.67. Sternum 3.67 long, 2.38 wide, brown anteriorly and on gently sloping margins, lighter posteriorly. Labium 0.79 long, 1.81 wide. Endites 2.59 long, 1.60 wide. Chelicerae pale yellow proximally, dark brown distally; promargin with 10-12 teeth. Legs olive brown, without annulations, darkened along spine rows. Superior tarsal claws with three teeth except retroclaw of leg IV with four; inferiors with two tiny denticles.

	I	II	III	IV	Palp
Femur	4.77	4.68	4.66	6.05	4.14
Patella	2.12	2.16	2.27	2.70	2.33
Tibia	2.91	2.99	3.13	4.25	2.68
Metatarsus	2.81	3.13	3.83	6.20	—
Tarsus	<u>1.56</u>	<u>1.69</u>	<u>2.13</u>	<u>3.08</u>	<u>2.81</u>
Total	14.62	14.65	16.02	22.28	11.96

Abdomen 5.87 long, 4.14 wide, dark brown with sclerites and spinnerets brownish orange. Palpal claw with two or three teeth. Internal genitalia with broad posterior stalk fused to sclerotized sidepieces, sinuous anterior margin of poreplate, and narrow median receptacular cluster (figs. 29, 30).

MALE: As in female, except for the following. Total length 13.0. Carapace 6.62 long, 5.87 wide, with lateral margins and radiating marks dusky brown; clypeus transversely ridged. Ocular tubercle 0.84 long, 1.06 wide. Eye sizes and interdistances: AME 0.08, ALE 0.40, PME 0.27, PLE 0.32; AME-AME 0.09, AME-ALE 0.19, PME-PME 0.05, PME-PLE 0.09, ALE-PLE 0.07. MOQ length 0.47, front width 0.25, back width 0.60. Sternum 3.01 long, 1.98 wide, brown along raised spinose ridges outlining venter, lighter medially and on steeply sloping margins. Labium 0.54 long, 1.19 wide. Endites 2.12 long, 1.36 wide. Chelicerae brownish orange distally; promargin with 11 teeth. Retroclaw of leg III also with four teeth; inferior claws of legs II-IV with one denticle.

	I	II	III	IV	Palp
Femur	4.66	5.46	5.36	6.84	3.34
Patella	2.40	2.19	2.27	2.27	1.58
Tibia	3.91	3.78	4.17	5.40	3.71
Metatarsus	4.56	5.07	6.17	8.03	—
Tarsus	<u>1.80</u>	<u>2.81</u>	<u>3.17</u>	<u>3.74</u>	<u>1.81</u>
Total	17.33	19.31	21.14	26.28	10.44

Abdomen 6.91 long, 5.17 wide. Palp as in figures 24-28.

OTHER MATERIAL EXAMINED: One young female taken with the paratype (AMNH).

DISTRIBUTION: Known only from northwestern Thailand.

NATURAL HISTORY: The female specimens occurred in a well-shaded bank of clay and marl facing east-southeast.

***Liphistius trang*, new species**

Figures 20, 21

TYPE: Female holotype from an elevation of 100 m. in Krachong Forest, near Trang, Thailand (July 2, 1962; E. S. Ross and D. Q. Cavagnaro), deposited in CAS.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

DIAGNOSIS: *Liphistius trang* is a distinctive species easily distinguished from all others by the lateral lobes at about half the length of the poreplate (fig. 21).

FEMALE: Total length, not including chelicerae, 11.0. Carapace 4.75 long, 4.11 wide, light yellow with dark brown markings along anterior margin, in triangular patches laterally on coxal elevations (but not reaching margins), and in W-shaped pattern behind ocular tubercle. Ocular tubercle 0.79 long, 0.90 wide. Eye sizes and interdistances: AME 0.06, ALE 0.38, PME 0.24, PLE 0.33; AME-AME 0.10, AME-ALE 0.16, PME-PME 0.04, PME-PLE 0.05, ALE-PLE 0.09. MOQ length 0.44, front width 0.23, back width 0.52. Sternum 2.75 long, 1.58 wide, light yellow, slightly darker on produced anterior margin and gently sloping sides. Labium 0.65 long, 1.22 wide. Endites 1.80 long, 1.19 wide. Chelicerae yellowish orange proximally, mottled brown distally; promargin with 9-10 teeth. Legs yellow with brown annulations proximally and distally on femora, tibiae, and tarsi, proximally on patellae and metatarsi. Su-

perior tarsal claws with two teeth on anterior proclaws, three on posterior proclaws and anterior retroclaws, four on posterior retroclaws; inferiors usually with two tiny denticles.

	I	II	III	IV	Palp
Femur	3.80	3.85	3.71	4.70	3.17
Patella	1.87	1.73	1.69	2.27	1.90
Tibia	2.30	2.45	2.52	3.49	2.18
Metatarsus	2.27	2.57	3.08	4.71	—
Tarsus	1.19	1.26	1.81	2.16	2.27
Total	11.43	11.86	12.81	17.33	9.52

Abdomen 5.98 long, 5.07 wide, light yellow with sclerites and spinnerets orange. Palpal claw with two teeth (and proximal denticle of claw of left palp). Internal genitalia with short, wide posterior stalk fused to sclerotized sidepieces, two lateral lobes on ventral surface of poreplate, and narrow median receptacular cluster (figs. 20, 21).

MALE: Unknown.

OTHER MATERIAL EXAMINED: None.

DISTRIBUTION: Known only from southwestern Thailand.

***Liphistius yangae*, new species**

Figures 22, 23

TYPE: Female holotype from Kaki Bukit, Perlis, Malaysia (December, 1938), deposited in NUS.

ETYMOLOGY: The specific name is a patronym in honor of Mrs. Yang Chang Man, Scientific Officer of the Zoological Reference Collection of the National University of Singapore, who made the only known specimens of the species available for study.

DIAGNOSIS: Females resemble those of *L. bristowei* but have a triangular poreplate with a transverse anterior margin (figs. 22, 23).

FEMALE: Total length, not including chelicerae, 10.8. Carapace 6.41 long, 5.53 wide, yellow with dark markings around all margins, radiating from thoracic groove along posterior edges of coxal elevations, and in inverted T-shaped figure behind ocular tubercle. Ocular tubercle 0.83 long, 0.98 wide. Eye sizes and interdistances: AME 0.06, ALE 0.49, PME 0.31, PLE 0.34; AME-AME 0.10, AME-ALE 0.22, PME-PME 0.05, PME-PLE 0.05, ALE-PLE 0.10. MOQ length 0.48, front width 0.23, back width 0.66. Sternum 2.99

long, 2.30 wide, pale yellow, slightly darker on gently sloping margins. Labium 0.35 long, 1.33 wide. Endites 2.13 long, 1.51 wide. Chelicerae yellow proximally (except at middle), orange distally; promargin with 12-13 teeth. Legs with femora yellow, more distal segments brownish orange, without annulations. Superior tarsal claws with three teeth; inferiors with two tiny denticles.

	I	II	III	IV	Palp
Femur	4.64	4.75	4.60	5.77	4.21
Patella	2.16	2.27	2.27	2.41	1.62
Tibia	2.74	2.93	2.81	4.57	2.81
Metatarsus	2.92	2.97	3.30	5.80	—
Tarsus	1.44	1.58	1.73	2.63	2.70
Total	13.90	14.50	14.71	21.18	11.34

Abdomen 5.13 long, 3.95 wide, yellow with sclerites and spinnerets light orange. Palpal claw with two teeth. Internal genitalia with narrow posterior stalk indistinctly fused to broad, lightly sclerotized, anterolaterally produced base, triangular poreplate with recurved ventral margin bearing no lobes, and narrow median receptacular cluster (figs. 22, 23).

MALE: Unknown.

OTHER MATERIAL EXAMINED: Thirteen (mostly young) females taken with the holotype (NUS, AMNH).

DISTRIBUTION: Known only from northern Malaysia.

***Liphistius langkawi*, new species**

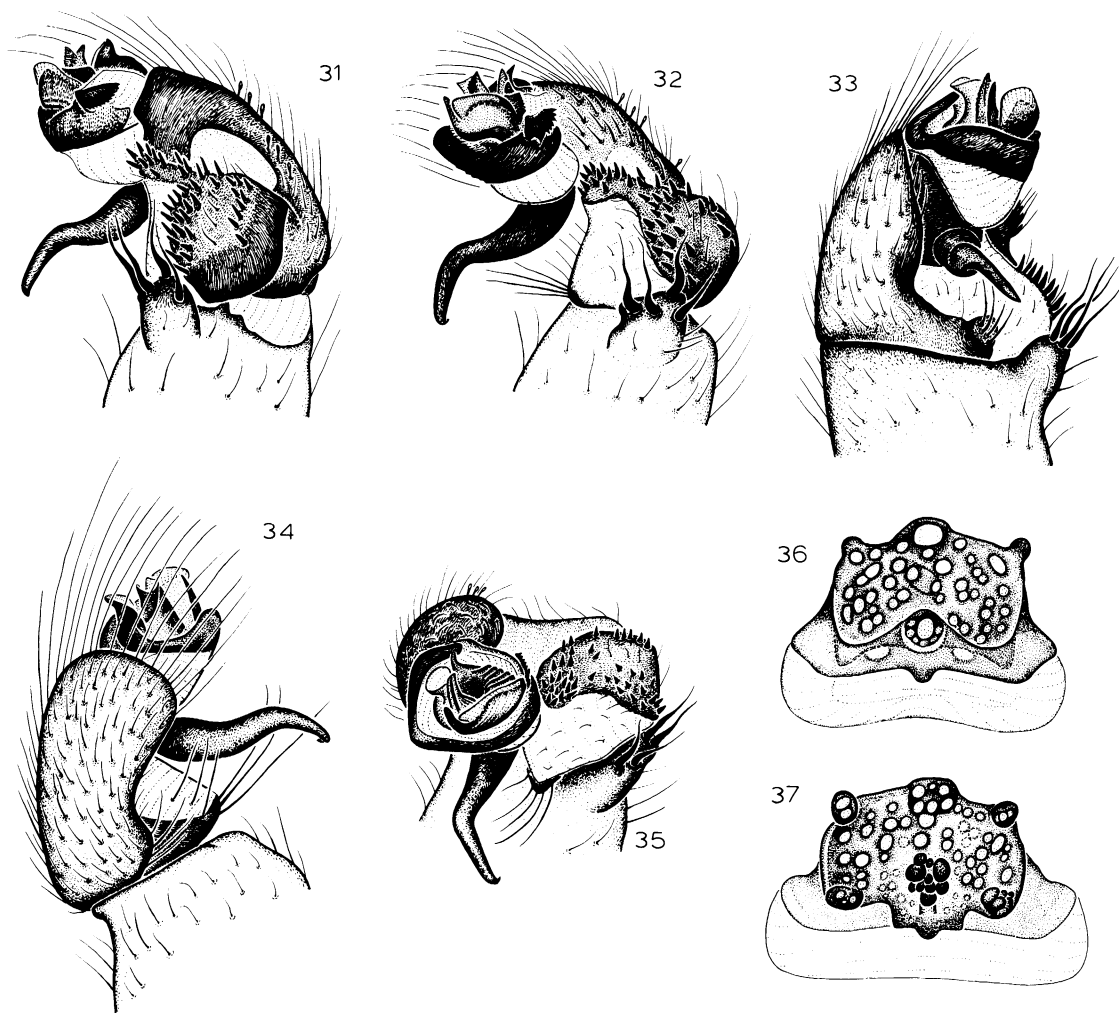
Figures 31-37

TYPES: Male holotype and female paratype from a cave 5 km. east of Pekan Kuah, Langkawi Island, Kedah, Malaysia (collected June 9, 1981; male died Aug. 19, 1981; female molted March 13, 1982, died May 17, 1982; W. Sedgwick), deposited in AMNH.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

DIAGNOSIS: Males can be distinguished easily from those of all other species by the extremely long ventral subtegular apophysis on the palp (figs. 31-35), females by the presence of three anterior and two posterior lobes on the poreplate (figs. 36, 37).

FEMALE: Total length, not including chelicerae, 9.0. Carapace 3.76 long, 3.31 wide,



FIGS. 31–37. *Liphistius langkawi*, new species. 31. Palp, retrolateral view. 32. Palp, retroventral view. 33. Palp, ventral view. 34. Palp, prolateral view. 35. Palp, distal view. 36. Internal female genitalia, dorsal view. 37. Same, ventral view.

yellow but so covered with olive brown markings that base color shows only in pair of semicircular marks immediately behind ocular tubercle, large W-shaped mark outlining pars cephalica, large semicircle around thoracic groove, and pair of small marginal spots between coxae III and IV. Ocular tubercle 0.47 long, 0.58 wide. Eye sizes and interdistances: AME 0.04, ALE 0.25, PME 0.16, PLE 0.17; AME–AME 0.07, AME–ALE 0.07, PME–PME 0.03, PME–PLE 0.03, ALE–PLE 0.03. MOQ length 0.31, front

width 0.15, back width 0.36. Sternum 1.91 long, 1.47 wide, yellow, slightly darker anteriorly and on gently sloping margins. Labium 0.48 long, 0.96 wide. Endites 1.40 long, 0.83 wide. Chelicerae pale yellow proximally, brown distally; promargin with 9–10 teeth. Legs light yellow with olive brown annulations proximally and distally on femora, tibiae, metatarsi, and tarsi, and proximally on patellae. Superior tarsal claws with two or three teeth; inferiors with one or two tiny denticles.

	I	II	III	IV	Palp
Femur	2.88	2.96	2.84	3.83	2.48
Patella	1.34	1.33	1.33	1.51	1.25
Tibia	1.76	1.81	1.94	2.59	1.57
Metatarsus	1.88	1.87	2.27	3.71	—
Tarsus	1.15	1.12	1.22	1.51	1.69
Total	9.01	9.09	9.60	13.15	6.99

Abdomen 4.98 long, 3.89 wide, light gray with sclerites light orange and spinnerets light brown. Palpal claw with two tiny denticles. Internal genitalia with broad posterior stalk fused to laterally expanded sidepieces, three anterior and two posterior lobes on poreplate, and narrow median receptacular cluster (figs. 36, 37).

MALE: As in female, except for the following. Total length 7.5. Carapace 4.07 long, 3.47 wide, without anterior semicircular or small posterior light spots; clypeus ridged, pitted. Ocular tubercle 0.64 long, 0.71 wide. Eye sizes and interdistances: AME 0.03, ALE 0.32, PME 0.17, PLE 0.26; AME-AME 0.07, AME-ALE 0.05, PME-PME 0.07, PME-PLE 0.05, ALE-PLE 0.04. MOQ length 0.30, front width 0.13, back width 0.39. Sternum 1.80 long, 1.22 wide. Labium 0.40 long, 0.70 wide. Endites 1.33 long, 0.86 wide. Cheliceral promargin with 10 very weak teeth. Legs with annulations scarcely distinguishable on tarsi, metatarsi, and distal portions of tibiae. Superior tarsal claws with four teeth except three on posterior proclaws; inferiors without discernible denticles.

	I	II	III	IV	Palp
Femur	3.87	3.99	3.90	4.46	2.27
Patella	1.48	1.53	1.73	1.61	1.22
Tibia	2.88	3.09	3.50	4.21	2.30
Metatarsus	3.17	3.67	4.82	6.48	—
Tarsus	1.64	1.99	2.02	2.98	1.55
Total	13.04	14.27	15.97	19.74	7.34

Abdomen 3.42 long, 2.56 wide. Palp as in figures 31–35.

OTHER MATERIAL EXAMINED: One male and seven females taken with the types, and subsequent histories as follows: 3f, died June 10, 1981 (AMNH); 1m, molted June 10, 1981, died July 23, 1981 (AMNH); 1f, molted Nov. 30, 1981, and Feb. 26, 1982, died May 17, 1982 (AMNH); 1f, molted Mar. 13, 1982, died May 31, 1982 (AMNH); 1f, molted Mar.

13, 1982, died Aug. 25, 1982 (MCZ); 1f, died Apr. 30, 1982 (AMNH).

DISTRIBUTION: Known only from a cave on Langkawi Island, Malaysia.

NATURAL HISTORY: The “fishing lines” radiating from the burrows were longer in relation to the size of the trapdoor than in any other species except *L. tioman*; those of the male found in its burrow were short compared to those of the females. Burrows were found in loosely packed earth on a horizontal or slightly sloping plane; in some cases the burrow proceeded vertically into the earth, twisting slightly, whereas in other cases it penetrated the earth on a horizontal plane. Many small white millipedes and crickets occur in the cave. Four specimens spent the following periods of time (in months) between molts from the time they were first collected: 3, 6, 2, 4; 3, 4, 8, 4; 3, 4, 4, 4; and 2, 4, 3, 3, 5.

Liphistius murphyorum, new species

Figures 16, 38–44

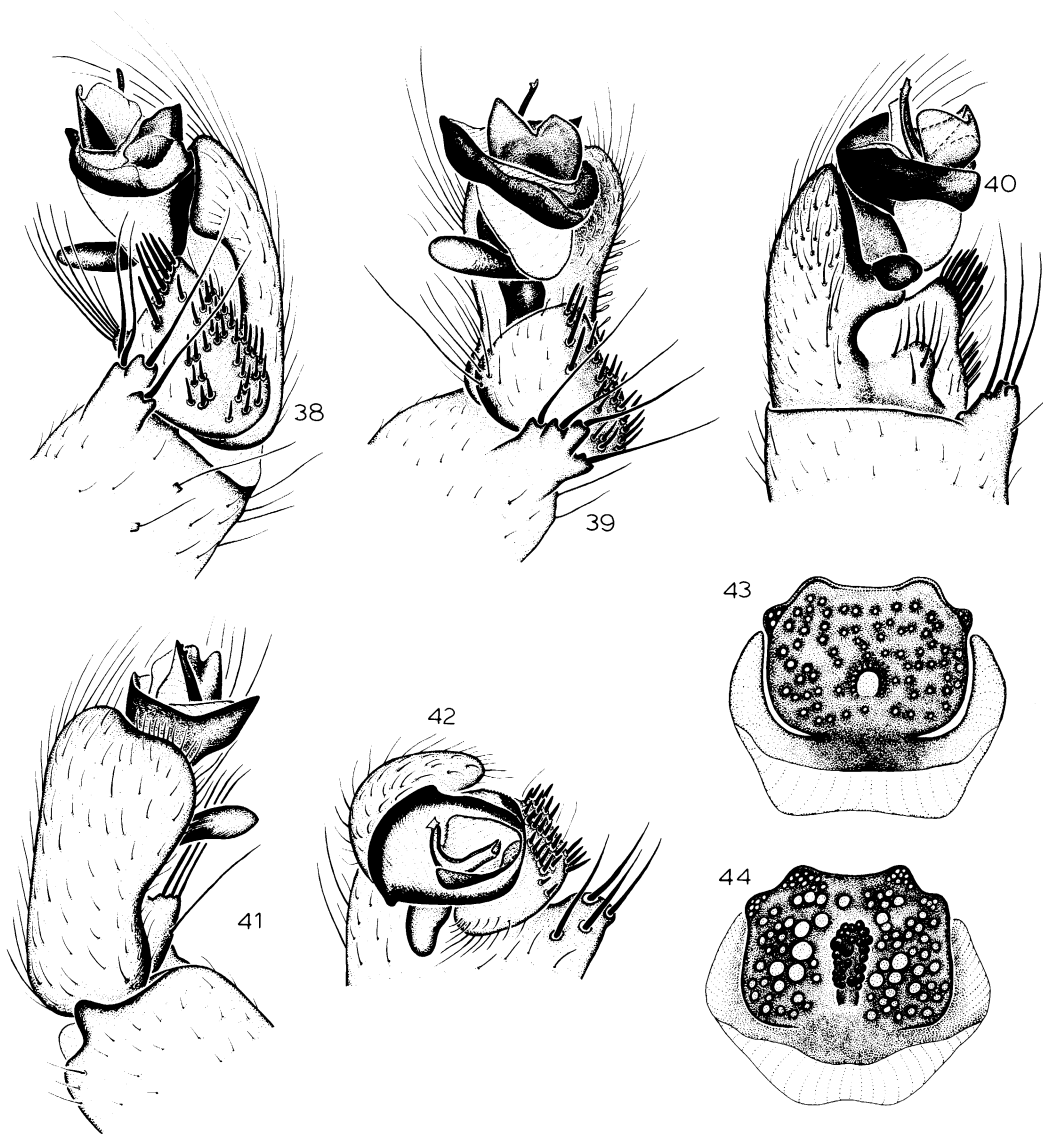
Liphistius desultor (misidentification): Murphy and Platnick, 1981, p. 51, figs. 7, 10, 13, 16, 19 (male only).

TYPE: Male holotype and female paratype from Penang Island, Penang, Malaysia (July 20, 1982; male matured Oct. 28, 1982, died Mar. 6, 1983; female molted Sept. 30, 1982, killed June 6, 1983; W. Sedgwick), deposited in AMNH.

ETYMOLOGY: The specific name is a patronym in honor of John and Frances Murphy of Hampton, England, who obtained the first known male of the species.

DIAGNOSIS: Males resemble those of *L. langkawi* in having a ventral subtegular apophysis, but the apophysis is much shorter than in that species (figs. 38–42); females can be easily distinguished from those of all other species by the presence of four small lobes on the anterior margin of the poreplate (figs. 43, 44).

FEMALE: Total length, not including chelicerae, 12.2. Carapace 6.16 long, 5.06 wide, yellow with dark olive markings around margins, extending toward thoracic groove along posterior edges of coxal elevations, and along midline immediately behind ocular tubercle.



FIGS. 38–44. *Liphistius murphyorum*, new species. 38. Palp, retrolateral view. 39. Palp, retrovental view. 40. Palp, ventral view. 41. Palp, prolateral view. 42. Palp, distal view. 43. Internal female genitalia, dorsal view. 44. Same, ventral view.

Ocular tubercle 0.76 long, 0.88 wide. Eye sizes and interdistances: AME 0.06, ALE 0.39, PME 0.27, PLE 0.33; AME–AME 0.06, AME–ALE 0.19, PME–PME 0.03, PME–PLE 0.05, ALE–PLE 0.05. MOQ length 0.43, front width 0.18, back width 0.57. Sternum 2.96 long, 1.80 wide, yellow, slightly darker on raised anterior margin and steeply sloping sides. Labium 0.79 long, 1.45 wide. Endites

2.19 long, 1.35 wide. Chelicerae pale yellow proximally, brown distally; promargin with 11 teeth. Legs light yellow with olive brown annulations proximally and distally on femora, tibiae, metatarsi, and tarsi, and proximally on patellae. Superior tarsal claws with three teeth on anterior legs, four or five on posteriors; inferiors with two to five denticles (higher numbers anteriorly).

	I	II	III	IV	Palp
Femur	4.68	4.68	4.68	5.15	3.82
Patella	2.23	2.23	1.87	2.48	1.78
Tibia	2.86	2.95	3.10	4.25	2.48
Metatarsus	2.62	3.02	3.67	5.51	—
Tarsus	1.46	1.55	1.91	2.64	2.59
Total	13.85	14.43	15.23	20.03	10.67

Abdomen 6.59 long, 4.14 wide, light brown with sclerites and spinnerets brownish orange. Palpal claw with one or two tiny denticles. Internal genitalia with short, broad posterior stalk fused to long, sclerotized sidepieces, four small anterior lobes on poreplate, and narrow median receptacular cluster (figs. 43, 44).

MALE (fig. 16): As in female, except for the following. Total length 10.6. Carapace 5.11 long, 4.25 wide; clypeus transversely ridged. Ocular tubercle 0.79 long, 0.86 wide. Eye sizes and interdistances: AME 0.04, ALE 0.37, PME 0.23, PLE 0.28; AME-AME 0.07, AME-ALE 0.16, PME-PME 0.02, PME-PLE 0.04, ALE-PLE 0.05. MOQ length 0.36, front width 0.15, back width 0.48. Sternum 2.20 long, 1.51 wide. Labium 0.43 long, 0.83 wide. Endites 1.66 long, 1.11 wide. Tarsi and metatarsi almost entirely olive brown. Inferior tarsal claws bare.

	I	II	III	IV	Palp
Femur	4.37	4.57	4.40	5.26	2.63
Patella	1.93	1.87	1.91	2.16	1.58
Tibia	3.34	3.42	3.67	4.75	2.87
Metatarsus	3.46	4.21	4.87	6.44	—
Tarsus	1.87	1.94	2.27	3.02	1.56
Total	14.97	16.01	17.12	21.63	8.64

Abdomen 5.00 long, 3.02 wide. Palp as in figures 38–42.

OTHER MATERIAL EXAMINED: MALAYSIA: *Penang*: Penang Island, June 7, 1976 (W. Sedgwick, AMNH), 1f, July 1977 (E. W. Classey, JAM), 1f, July 20–22, 1982 (W. Sedgwick, MCZ), 3f, collected July 20, 1982, died July 30, 1982 (W. Sedgwick, AMNH), 1f, collected July 20, 1982, killed June 6, 1983 after one molt (W. Sedgwick, AMNH), 1f, collected July 20, 1982, molted and died July 1, 1983 (W. Sedgwick, AMNH), 1f, collected July 20, 1982, died July 5, 1983 (W. Sedgwick, AMNH), 1f; W. side, Penang Hill, collected Aug. 1979, matured Oct. 26, 1979,

died Dec. 24, 1979 (J. and F. Murphy, AMNH), 1m.

DISTRIBUTION: Known only from Penang Island, Malaysia.

Liphistius desultor Schiödte

Figures 45–53

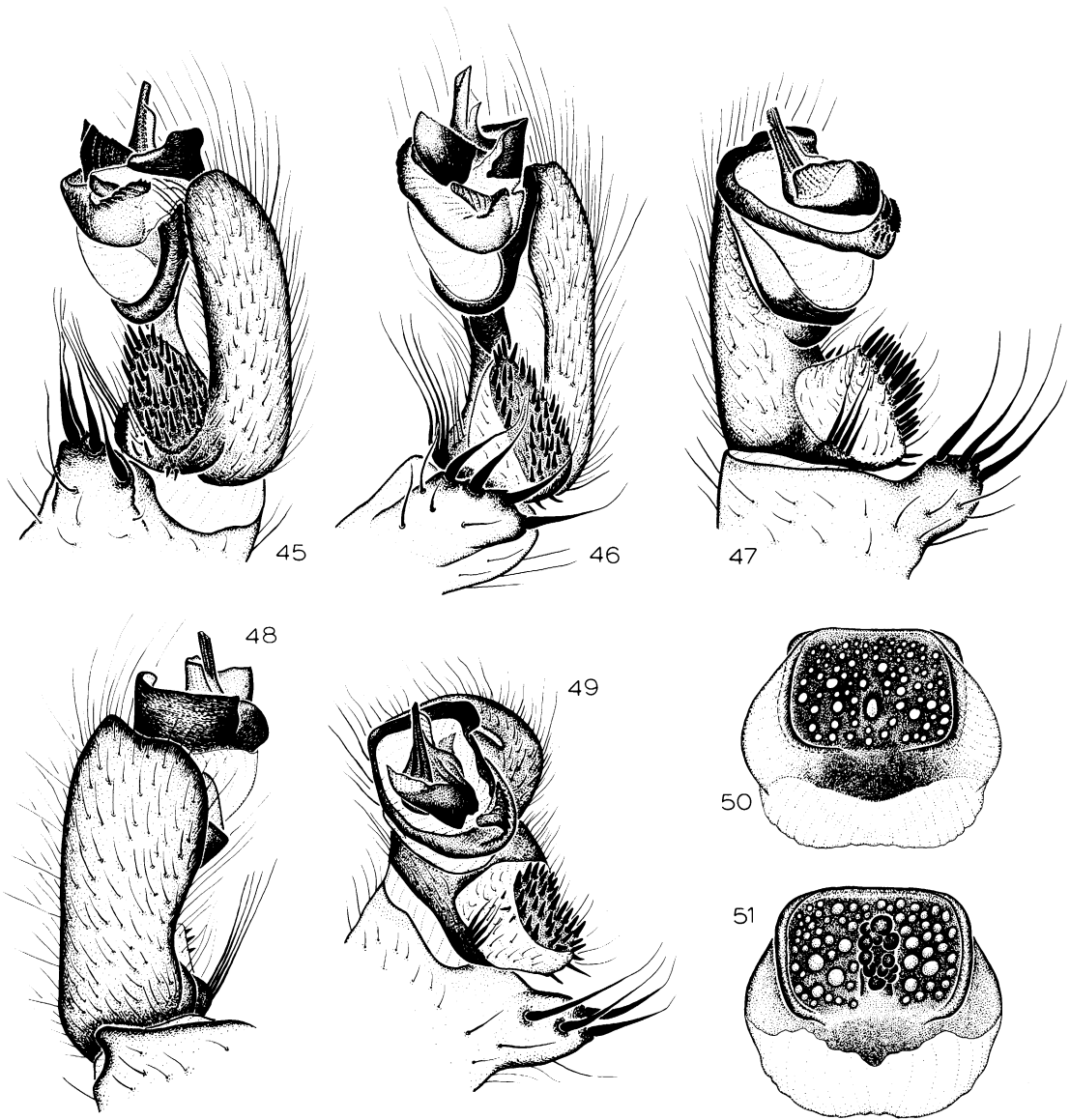
Liphistius desultor Schiödte, 1849, p. 621, figs. 1–7 (female holotype from Penang Island, Penang, Malaysia, in ZMC, examined). Roewer, 1942, p. 145.

Liphistius mammillanus O. P.-Cambridge, 1875, p. 249, figs. 1–3 (female holotype from Penang Island, Penang, Malaysia, in BMNH, examined). First synonymized by Hasselt, 1880, p. 186.

Liphistius desultor: Hasselt, 1880, p. 186. Britton, 1932, p. 1025, figs. 1, 5a, 7b, 8a; 1976, p. 2, pl. 1, figs. 2, 4. Bonnet, 1957, p. 2548. Murphy and Platnick, 1981, p. 51, figs. 1–6, 22, 23 (female only; male = *L. murphyorum*, new species). *Liphistius batuensis* (misidentification): Kraus, 1978, p. 237, figs. 2–4 (male only).

DIAGNOSIS: This species seems closest to *L. sumatranus*, the other large species with bicolored legs. Males can be distinguished by the longer embolus and longer spines of the retrolateral tibial apophysis (figs. 45–49), females by the squared poreplate (figs. 50, 51).

FEMALE (fig. 53): Total length, not including chelicerae, 28.2. Carapace 14.62 long, 12.46 wide, orange with narrow black margins and few scattered black markings at bases of setae in lines radiating from thoracic groove to ocular tubercle and coxal elevations. Ocular tubercle 1.91 long, 1.94 wide. Eye sizes and interdistances: AME 0.14, ALE 0.97, PME 0.50, PLE 0.67; AME-AME 0.24, AME-ALE 0.50, PME-PME 0.12, PME-PLE 0.12, ALE-PLE 0.11. MOQ length 0.99, front width 0.50, back width 1.12. Sternum 8.08 long, 3.46 wide, dark brown, slightly lighter on raised anterior surface, much lighter on margins opposite (and under) coxae I. Labium 1.94 long, 3.13 wide. Endites 5.36 long, 3.38 wide. Chelicerae orange proximally, dark brown distally; promargin with 11–12 teeth. Legs with trochanters and femora orange, more distal segments dark brown. Superior tarsal claws with two teeth (and often additional ventral denticle); inferiors with one or two denticles.



FIGS. 45-51. *Liphistius desultor* Schiödt. 45. Palp, retrolateral view. 46. Palp, retroventral view. 47. Palp, ventral view. 48. Palp, prolateral view. 49. Palp, distal view. 50. Internal female genitalia, dorsal view. 51. Same, ventral view.

	I	II	III	IV	Palp
Femur	10.76	10.72	10.36	13.60	9.42
Patella	5.98	5.62	6.44	6.70	4.82
Tibia	6.84	6.76	7.92	10.44	6.04
Metatarsus	6.26	6.96	8.14	12.50	—
Tarsus	2.56	3.06	3.16	4.40	5.94
Total	32.40	33.12	36.02	47.64	26.22

Abdomen 12.82 long, 11.30 wide, light brown with tergites, sclerites, and spinnerets orange. Palpal claw with two or more denticles. Internal genitalia with broad posterior stalk fused to sinuous sclerotized sidepieces, followed posteriorly by unsclerotized portion, without anterior lobes but with thickened an-

terior margin on poreplate, and narrow median receptacular cluster (figs. 50, 51).

MALE (fig. 52): As in female, except for the following. Total length 23.26. Carapace 11.16 long, 9.94 wide, light brown, glabrous, with darker margins. Ocular tubercle 1.44 long, 1.69 wide. Eye sizes and interdistances: AME 0.11, ALE 0.77, PME 0.44, PLE 0.59; AME-AME 0.16, AME-ALE 0.28, PME-PME 0.11, PME-PL 0.18, ALE-PL 0.12. MOQ length 0.74, front width 0.38, back width 0.99. Sternum 5.15 long, 3.28 wide, olive brown. Labium 0.97 long, 1.84 wide. Endites 3.96 long, 2.16 wide. Femora olive brown, distal segments darkened. Superior tarsal claws with three or four teeth; inferiors with two teeth.

	I	II	III	IV	Palp
Femur	9.50	9.50	9.64	11.74	6.30
Patella	4.54	5.40	4.60	5.04	3.59
Tibia	7.90	8.36	8.56	10.80	6.62
Metatarsus	8.76	9.80	12.28	15.70	—
Tarsus	<u>3.82</u>	<u>3.82</u>	<u>4.40</u>	<u>5.61</u>	<u>3.31</u>
Total	34.52	36.88	39.48	48.89	19.82

Abdomen 10.58 long, 6.40 wide, with dark brown tergites and light brown spinnerets. Palp as in figures 45-49.

VARIATION: Young females have annulated legs as in most other species; the striking contrast between the femora and the more distal segments appears only after a body length of over 20 mm. is reached. Similarly, (at least) penultimate males have the coloration of fully grown females, but become entirely dark-legged as adults.

MATERIAL EXAMINED: MALAYSIA: *Kedah*: Kedah Peak, Jan. 1932 (W. S. Bristowe, BMNH), 1f. *Penang*: Penang Hills, Penang Island, no date (van Teylingen, ZMC), 1f (type), no date (BMNH), 1f (type), Apr. 9, 1959, elevation 2500 feet, on tarmac road (H. T. Pagden, BMNH), 1f, Feb. 21, 1960, elevation 500 feet (H. T. Pagden, BMNH), 1f, Jan. 1961 (W. S. Bristowe, H. T. Pagden, BMNH), 3f, Aug. 31, 1963 (H. T. Pagden, RNHL), 1f, Nov. 1974 (W. S. Bristowe, BMNH), 4f, June 1976 (W. Sedgwick, WCS), 2f, July 1977 (E. W. Classey, JAM), 1f, June 6, 1981 (W. Sedgwick, AMNH), 2f (1 young), July 20, 1982 (W. Sedgwick, MCZ), 1f, July 20, 1982, molted Oct. 24, 1982, died Dec. 10, 1982 (W. Sedgwick, AMNH), 1m, July

20, 1982, died Mar. 12, 1983 (W. Sedgwick, AMNH), 1f (young), July 20, 1982, molted Mar. 25, 1983, died Apr. 10, 1983 (W. Sedgwick, AMNH), 1f; Telok Bahang, Penang Island, Feb. 28, 1963 (M. A. Liefstinck, RNHL), 1f. *Perak*: Maxwell's Hill, Taiping, June 5, 1981, died Apr. 1, 1982 (W. Sedgwick, AMNH), 1f, June 5, 1981, died July 16, 1981 (W. Sedgwick, AMNH), 1f, July 24, 1982, died Jan. 5, 1983 (W. Sedgwick, AMNH), 1f.

DISTRIBUTION: Known only from Penang Island and nearby mainland localities in northern Malaysia.

NATURAL HISTORY: It is not known how (or if) *L. desultor* and *L. murphyorum* differ in habitat. The "fishing lines" of larger burrows (3 inches in diameter) are often shorter (only 1 or 2 inches long) than those of smaller burrows.

Liphistius sumatranus Thorell

Figures 2, 3, 56-62

Liphistius desultor (misidentification): Hasselt, 1882, p. 38, figs. 1-3. Simon, 1892, p. 63, figs. 70-72.

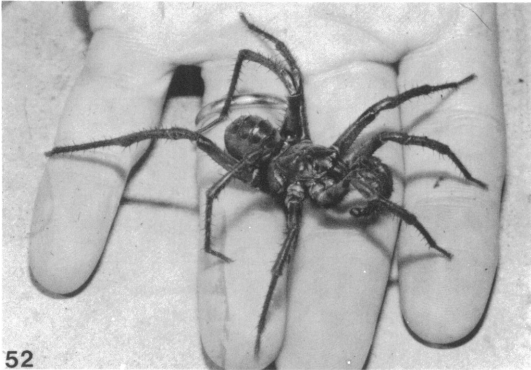
Liphistius sumatranus Thorell, 1890, p. 27 (female holotype from Silago, Sumatra, in RNHL, examined). Bristowe, 1932, p. 1025, figs. 7c, 8b; 1976, p. 2, figs. 1, 3. Roewer, 1942, p. 145. Bonnet, 1957, p. 2549.

Anadiastothele thorelli Simon, 1903, p. 875, figs. 1029-1031 (female holotype from Benkolen, Sumatra, in MNHN, examined). Bonnet, 1955, p. 307. First synonymized by Bristowe, 1976, p. 4.

Liphistius thorelli: Bristowe, 1932, p. 1022. Roewer, 1942, p. 145.

DIAGNOSIS: This species seems closest to *L. desultor* but can be distinguished by the shorter embolus and shorter spines of the retrolateral tibial apophysis (figs. 56-60) of males and the rounded poreplate and massive posterior stalk (figs. 61, 62) of females. Also, the carapace of *L. desultor* females is bright orange, like the femora, whereas in *L. sumatranus* females the carapace is dark.

FEMALE: Total length, not including chelicerae, 22.8. Carapace 11.02 long, 10.58 wide, light brown with scattered lighter patches across pars cephalica and darkened anterior and lateral margins. Ocular tubercle 1.48 long, 1.55 wide. Eye sizes and interdistances: AME



52



53



54



55

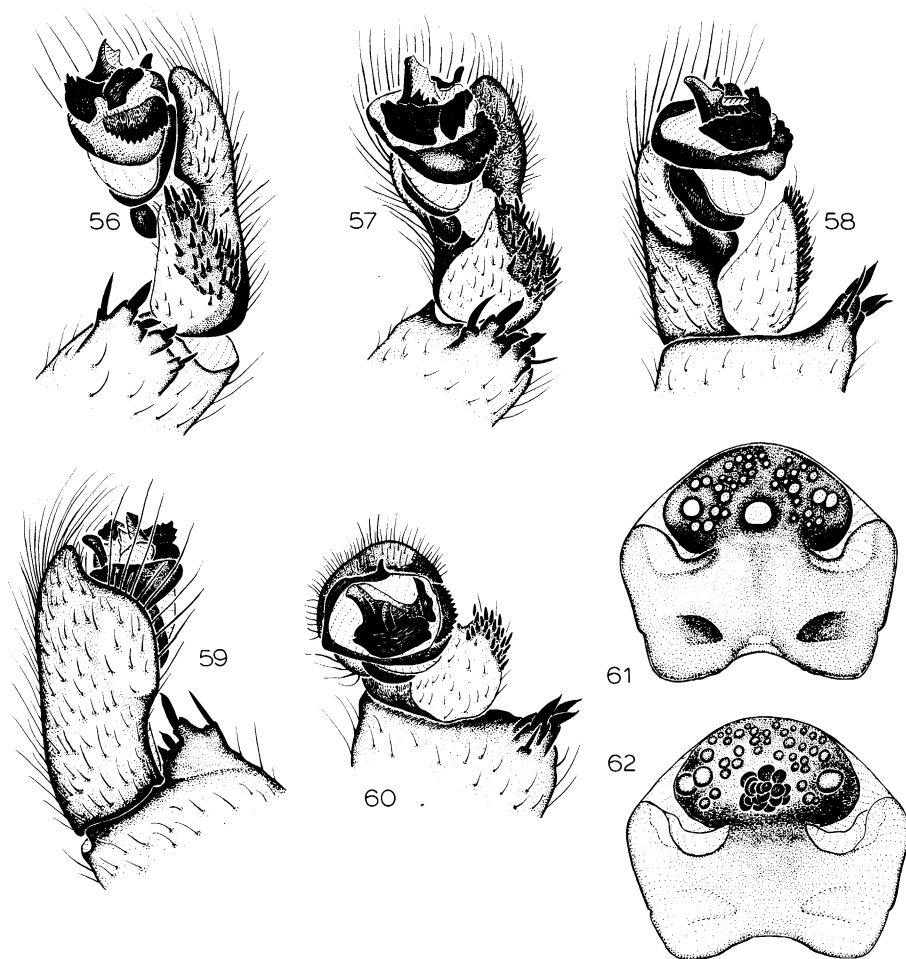
FIGS. 52–55. 52, 53. *Liphistius desultor* Schiödte. 54, 55. *L. tioman*, new species. 52, 54. Male. 53, 55. Female. Photographs by Mr. P. R. Craig.

0.11, ALE 0.63, PME 0.40, PLE 0.49; AME–AME 0.14, AME–ALE 0.25, PME–PME 0.07, PME–PLE 0.12, ALE–PLE 0.16. MOQ length 0.72, front width 0.36, back width 0.86. Sternum 6.34 long, 2.63 wide, light brown anteriorly, tan posteriorly and on steeply sloping margins. Labium 1.43 long, 2.23 wide. Endites 4.39 long, 2.54 wide. Chelicerae light yellow proximally, with scattered dark markings distally; promargin with 11 teeth. Legs with femora (except at brown distal tips) orange, other segments brown. Superior tarsal claws with two teeth; inferiors with one tooth.

	I	II	III	IV	Palp
Femur	8.78	8.74	8.50	11.02	7.84
Patella	4.14	4.21	4.19	5.11	3.84
Tibia	5.40	5.51	5.76	7.63	5.04
Metatarsus	4.82	5.40	6.46	9.94	—
Tarsus	2.50	2.59	3.17	3.89	5.36
Total	25.64	26.45	28.08	37.59	22.08

Abdomen 11.02 long, 8.56 wide, brownish gray with sclerites and spinnerets brownish orange. Palpal claw with two denticles. Internal genitalia with massive posterior stalk, short oval poreplate, and narrow median receptacular cluster (figs. 61, 62).

MALE: As in female, except for the following. Total length 13.18. Carapace 7.34 long, 6.84 wide, pars cephalica almost entirely light brown. Ocular tubercle 1.04 long, 1.15 wide. Eye sizes and interdistances: AME 0.09, ALE 0.53, PME 0.32, PLE 0.31; AME–AME 0.06, AME–ALE 0.20, PME–PME 0.09, PME–PLE 0.08, ALE–PLE 0.12. MOQ length 0.55, front width 0.25, back width 0.72. Sternum 3.60 long, 2.16 wide. Labium 0.65 long, 1.22 wide. Endites 2.70 long, 1.51 wide. Cheliceral promargin with 12 teeth. Legs uniformly brown. Superior tarsal claws with three or four teeth on anterior legs, four or five on posteriors; inferiors with two denticles.



FIGS. 56-62. *Liphistius sumatranus* Thorell. 56. Palp, retrolateral view. 57. Palp, retroventral view. 58. Palp, ventral view. 59. Palp, prolateral view. 60. Palp, distal view. 61. Internal female genitalia, dorsal view. 62. Same, ventral view.

	I	II	III	IV	Palp
Femur	5.65	7.19	7.18	8.28	4.07
Patella	2.59	3.04	3.25	3.55	2.16
Tibia	4.07	5.24	5.74	7.06	4.21
Metatarsus	4.48	6.36	7.96	9.80	—
Tarsus	2.30	3.01	3.17	4.36	2.34
Total	19.09	24.84	27.30	33.05	12.78

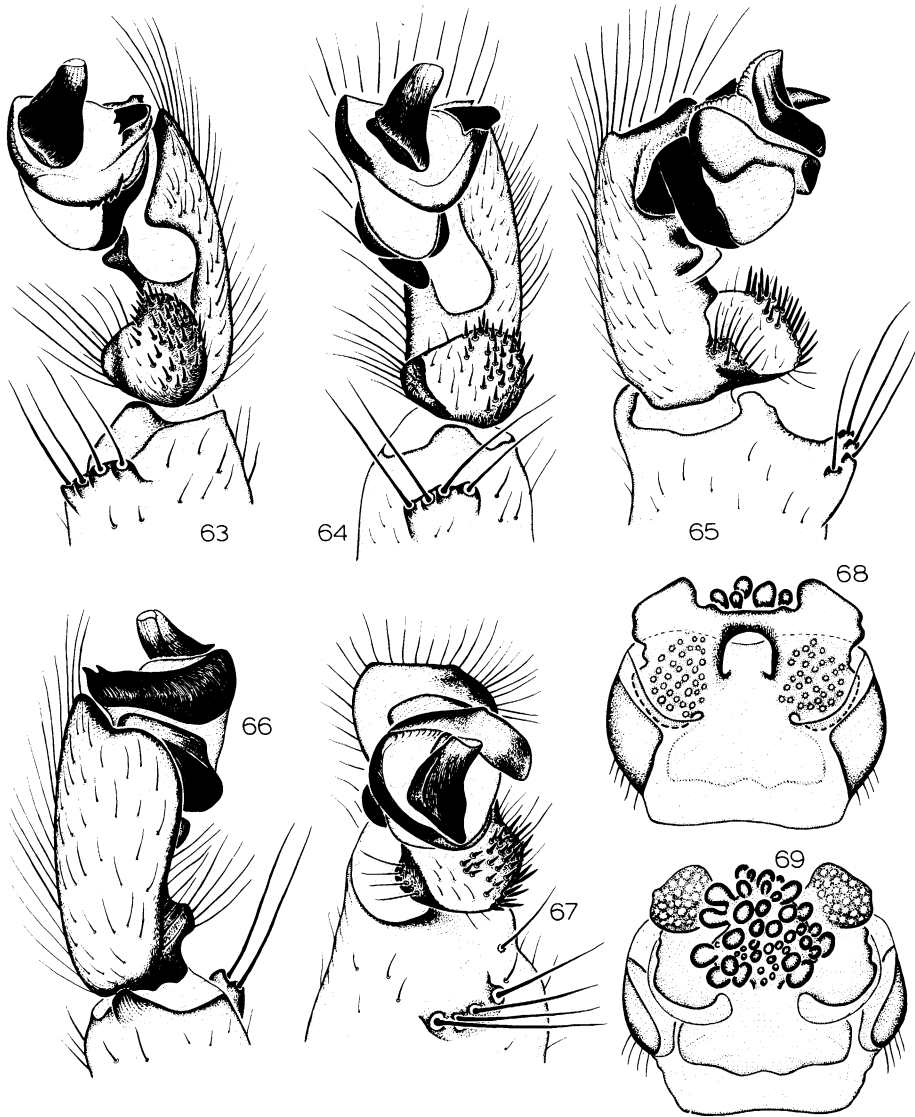
Abdomen 5.69 long, 3.71 wide. Palp as in figures 56-60.

VARIATION: As in *L. desultor*, penultimate males have bicolored legs like those of females but gain darkened femora in their final molt.

MATERIAL EXAMINED: SUMATRA: Benkolen (MNHN), 1f (type); Bukit Tinggi, elevation 3000 feet, Dec. 1974 (W. S. Bristowe, BMNH), 1f, July 14, 1981 (W. Sedgwick, AMNH, MCZ, NUS, MCSNG, Otago Museum), 3m (matured through Nov. 22, 1981), 33f (6 young; matured through Feb. 18, 1983); Palupuh and Kota Baru, near Bukit Tinggi, Dec. 1974 (W. S. Bristowe, BMNH), 3f (1 young); Silago (RNHL), 1f (type).

DISTRIBUTION: Known only from western Sumatra.

NATURAL HISTORY: Specimens were found in firm sandy soil at one locality and in hard-



FIGS. 63–69. *Liphistius malayanus* Abraham. 63. Palp, retrolateral view. 64. Palp, retroventral view. 65. Palp, ventral view. 66. Palp, prolateral view. 67. Palp, distal view. 68. Internal female genitalia, dorsal view. 69. Same, ventral view.

packed red clay at another. Females reach 37 mm. in length.

Liphistius malayanus Abraham

Figures 63–69

Liphistius malayanus Abraham, 1923b, p. 770, pl. 1, figs. 1a, b (female holotype from Gunong

Ansi, Negri Sembilan, Malaysia, in BMNH, examined); 1929, p. 671, figs. 1–16. Bristowe, 1932, p. 1022, figs. 2, 5b, 7b, 8e. Roewer, 1942, p. 145. Bonnet, 1957, p. 2548. Schiapelli and Gerschman, 1962, p. 72, pl. 2, figs. 5, 6. Murphy and Platnick, 1981, p. 47, figs. 8, 11, 14, 17, 20, 24, 25.

Liphistius batuensis (misidentification): Kraus, 1978, p. 237, figs. 5–9 (female only).

DIAGNOSIS: Males can be distinguished by the large embolus (fig. 63) and broadly rounded tegular apophysis (fig. 67), females by the anterolateral expansions of the poreplate (figs. 68, 69).

FEMALE: Total length, not including chelicerae, 19.0. Carapace 9.50 long, 9.22 wide, dark brown with blackened anterior and lateral margins. Ocular tubercle 1.17 long, 1.25 wide. Eye sizes and interdistances: AME 0.13, ALE 0.50, PME 0.31, PLE 0.33; AME-AME 0.10, AME-ALE 0.19, PME-PME 0.12, PME-PL 0.12, ALE-PL 0.16. MOQ length 0.70, front width 0.37, back width 0.76. Sternum 5.40 long, 2.56 wide, dark brown with light brown margins. Labium 1.41 long, 2.34 wide. Endites 3.71 long, 1.98 wide. Chelicerae orange proximally, dark brown distally; promargin with 14 teeth. Legs brown, ventral surfaces of tibiae lightest. Superior tarsal claws with three teeth; inferiors usually with only one tooth.

	I	II	III	IV	Palp
Femur	7.64	7.64	7.44	9.56	6.70
Patella	3.64	3.90	3.89	4.50	3.25
Tibia	4.69	4.54	4.93	6.19	4.39
Metatarsus	4.69	4.79	5.54	8.86	—
Tarsus	2.16	2.25	2.99	3.53	4.43
Total	22.82	23.12	24.79	32.64	18.77

Abdomen 10.22 long, 7.70 wide, brownish gray with sternites and spinnerets brownish orange. Palpal claw with three or four teeth. Internal genitalia with wide posterior stalk, two anterolateral expansions on poreplate, and wide median receptacular cluster (figs. 68, 69).

MALE: As in female, except for the following. Total length 16.9. Carapace 9.64 long, 7.78 wide, olive brown with pars cephalica darkened and clypeus transversely ridged. Ocular tubercle 1.19 long, 1.26 wide. Eye sizes and interdistances: AME 0.14, ALE 0.56, PME 0.36, PLE 0.38; AME-AME 0.11, AME-ALE 0.27, PME-PME 0.12, PME-PL 0.15, ALE-PL 0.13. MOQ length 0.63, front width 0.39, back width 0.83. Sternum 4.61 long, 2.18 wide. Labium 0.83 long, 1.71 wide. Endites 3.38 long, 1.94 wide. Cheliceral promargin with 11–14 teeth. Superior tarsal claws with five to seven teeth.

	I	II	III	IV	Palp
Femur	7.42	7.19	7.70	9.36	5.47
Patella	3.10	3.74	3.69	3.96	3.13
Tibia	5.94	5.72	5.76	6.84	5.76
Metatarsus	6.98	8.06	9.14	12.52	—
Tarsus	3.16	3.53	4.08	5.18	2.99
Total	26.60	28.24	30.37	37.86	17.35

Abdomen 7.92 long, 5.40 wide. Palp as in figures 63–67.

MATERIAL EXAMINED: MALAYSIA: no specific locality, 1960 (S. T. Waid, AMNH), 1m. *Negri Sembilan*: Gunong Angsi, Apr. 1918, elevation 2000–2700 feet (NUS), 1f, Dec. 1922, elevation 2500 feet (F. Norris, BMNH), 1f (type). *Pahang*: Cameron Highlands, July–Aug. 1951 (P. H. A. Sneath, BMNH), 3f, July–Aug. 1951 (J. A. L. Cooke, AMNH), 3f (2 young), June 3–4, 1981 (W. Sedgwick, AMNH, MCZ), 5f. *Selangor*: Fraser's Hill, no date, elevation 4000 feet (H. C. Abraham, NUS), 1f (young), no date (W. S. Bristowe, AMNH), 1f (young), Nov. 1928, elevation ca. 4000 feet (G. W. Sworder, BMNH), 1m, 1f, same date (G. W. Sworder, NUS), 1f (young), Aug. 1933, elevation 4000 feet (G. W. Sworder, NUS), 1f, Feb. 15, 1974 (W. Sedgwick, MCZ), 2f, June 6–8, 1976 (W. Sedgwick, AMNH), 2f (young), June 1, 1981, male died July 8, 1983 (W. Sedgwick, AMNH), 1m, 2f, Kepong, Mar. 1949 (B. In-soll, AMNH), 1f; Klang Gate Reservoir, 6.75 mi. from Kuala Lumpur, June 4, 1959, under walls of tunnel (AMNH), 1f; Klang Gates, Kuala Lumpur (W. S. Bristowe, AMNH), 1f (young), Dec. 1974 (W. S. Bristowe, BMNH), 1f.

DISTRIBUTION: Known only from central Malaysia.

NATURAL HISTORY: One specimen, a male, was kept in captivity for more than two years, molting after six months, again after another seven months, and becoming adult after an additional 11 months. Another specimen molted after seven months and again after nine additional months. The spiders were found in hard decomposed granite and soft clay (Fraser's Hill). Burrows as short as 1.5 inches were found, sometimes with a concealed back door. Females reach 35 mm. in length.

NOTE: For his study of *Liphistius* genitalia, Kraus (1978) used specimens from the frequently mislabeled Roewer collection that were identified as *L. batuensis* and were said to be from the Batu Caves. Murphy and Platnick (1981) indicated that the illustrations and scanning electron micrographs published by Kraus could not actually be of *L. batuensis* and identified them as being of *L. desultor*. Thanks to the courtesy of Dr. Kraus, we have been able to examine the gold-coated genital specimens from which the micrographs were taken. The male palp is that of a true *L. desultor* (and not of *L. murphyorum*, males of which were misidentified as *L. desultor* by Murphy and Platnick); the female genitalia are those of a *L. malayanus*. Hence it appears that both specimens are mislabeled and were erroneously identified in these earlier papers.

Liphistius batuensis Abraham

Figures 1, 4, 5, 70–76

Liphistius batuensis Abraham, 1923a, p. 15, figs. 1–9 (male and female syntypes from Batu Caves, Selangor, Malaysia, in BMNH, examined). Britton, 1932, p. 1022, figs. 3, 5c, 7a, 8c. Roewer, 1942, p. 145. Bonnet, 1957, p. 2548. Murphy and Platnick, 1981, p. 47, figs. 9, 12, 15, 18, 21, 26, 27.

DIAGNOSIS: Males of this species can be recognized by the short, erect tegular apophysis (figs. 70, 71), females by the short, wide, medially narrowed poreplate (fig. 75).

FEMALE: Total length, not including chelicerae, 9.6. Carapace 6.12 long, 5.64 wide, light brown with darkened anterior and lateral margins. Ocular tubercle 0.79 long, 0.86 wide. Eye sizes and interdistances: AME 0.03, ALE 0.39, PME 0.25, PLE 0.24; AME–AME 0.06, AME–ALE 0.12, PME–PME 0.04, PME–PLE 0.08, ALE–PLE 0.05. MOQ length 0.48, front width 0.12, back width 0.55. Sternum 2.54 long, 1.76 wide, pale orange, lighter on steeply sloping margins. Labium 0.47 long, 0.86 wide. Endites 2.23 long, 1.08 wide. Chelicerae yellow proximally, light orange distally; promargin with 10–11 teeth. Legs uniformly light tan. Superior tarsal claws with three teeth on anterior legs, four on posteriors; inferiors with two to four tiny denticles.

	I	II	III	IV	Palp
Femur	4.80	4.93	4.54	5.62	3.98
Patella	2.27	1.91	2.26	2.25	2.05
Tibia	3.16	3.24	3.27	4.50	2.97
Metatarsus	2.99	3.26	3.85	5.76	—
Tarsus	1.44	1.55	1.84	2.46	2.75
Total	14.66	14.89	15.76	20.59	11.75

Abdomen 4.43 long, 3.67 wide, light brown with light orange sclerites and spinnerets. Palpal claw with two or three teeth. Internal genitalia with broad posterior stalk indistinctly fused to short, wide, medially constricted poreplate, and wide median receptacular cluster protruding far anterior of poreplate (figs. 75, 76).

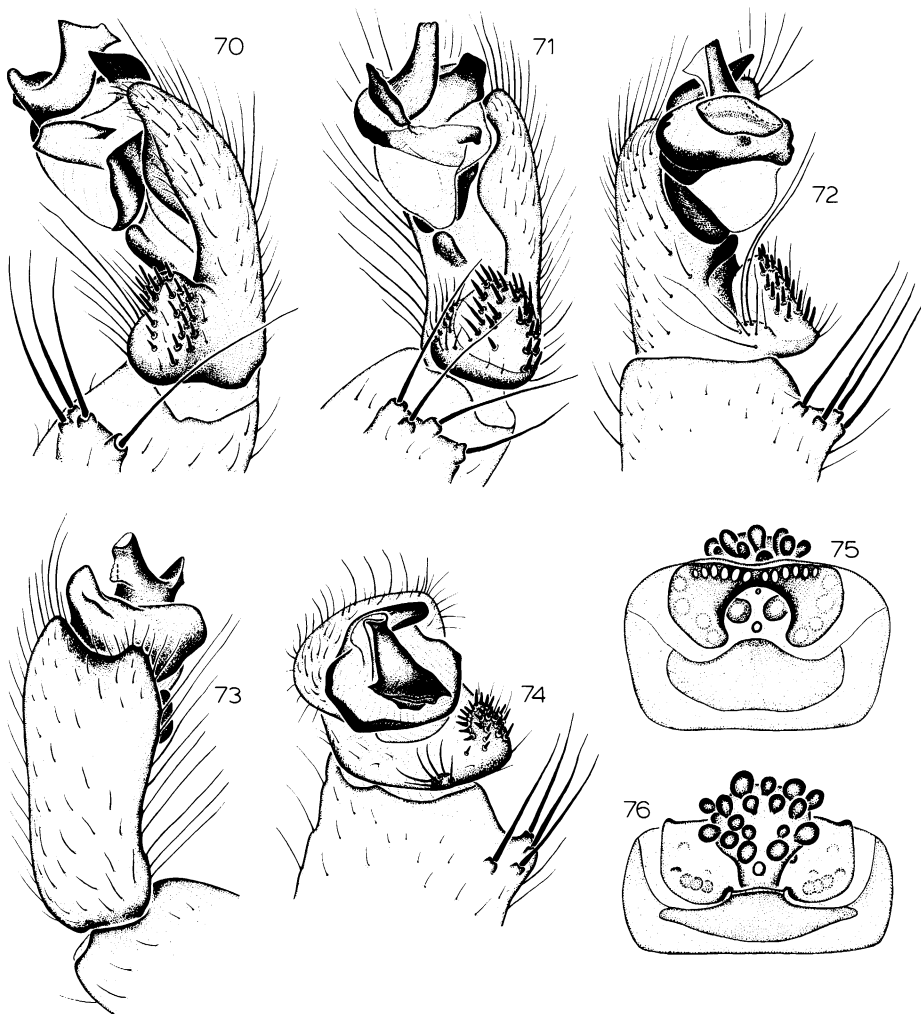
MALE: As in female, except for the following. Total length 9.6. Carapace 5.27 long, 4.81 wide, with clypeus transversely ridged. Ocular tubercle 0.72 long, 0.92 wide. Eye sizes and interdistances: AME 0.04, ALE 0.46, PME 0.24, PLE 0.29; AME–AME 0.08, AME–ALE 0.09, PME–PME 0.04, PME–PLE 0.04, ALE–PLE 0.03. MOQ length 0.38, front width 0.16, back width 0.53. Sternum 2.45 long, 1.51 wide. Labium 0.43 long, 1.04 wide. Endites 1.71 long, 1.04 wide. Cheliceral promargin with nine teeth.

	I	II	III	IV	Palp
Femur	5.40	5.33	5.40	6.23	3.31
Patella	2.16	2.12	2.23	2.09	1.62
Tibia	3.79	4.15	4.70	5.87	3.22
Metatarsus	4.32	4.90	5.90	8.14	—
Tarsus	1.91	2.23	2.59	2.92	1.51
Total	17.58	18.73	20.82	25.25	9.66

Abdomen 4.75 long, 2.91 wide. Palp as in figures 70–74.

VARIATION: Some specimens from each of the two caves in which this species is known to occur have one or both of the anterior median eyes reduced or absent. In those cases where the anterior median eyes are completely obliterated, the remaining eyes appear as two triads separated by spine-bearing cuticle. There seems to be no correlation between size and the degree of eye reduction. Young females have poreplates that are much more angularly shaped than are those of larger and older specimens.

MATERIAL EXAMINED: MALAYSIA: *Selangor*: Batu Caves, 6 mi. from Kuala Lum-



FIGS. 70-76. *Liphistius batuensis* Abraham. 70. Palp, retrolateral view. 71. Palp, retroventral view. 72. Palp, ventral view. 73. Palp, prolateral view. 74. Palp, distal view. 75. Internal female genitalia, dorsal view. 76. Same, ventral view.

pur, elevation 300 feet (including "Cavern A," Cavern C," the "Dark Cave," and the "Penny Room," ca. 1500 feet from cave entrance), Nov. 1921-Jan. 1922 (H. C. Abraham, NUS), 1f, Dec. 1921-Jan. 1922 (H. C. Abraham, BMNH), 1m, 1f (types), no date (H. C. Abraham, BMNH), 1f (young), 1930 (W. S. Bristowe, BMNH), 9f (3 young), no date (W. S. Bristowe, AMNH), 1f, Jan. 16, 1960 (AMNH), 2f (young), May 12, 1960 (L. B. Lint, H. T. Pagden, BMNH), 2f, Sept. 16, 1960 (J. L. Gressitt, BPBM), 3f (1 young),

Apr. 4, 1963 (M. A. Lieftinck, RNHL), 1f, Jan. 1973 (W. S. Bristowe, BMNH), 4f, June 28, 1975 (J. Anderson, J. Reiskind, CJR), 1f; Gua Anak Takun, limestone cave in Templar Park, 12 mi. NW Kuala Lumpur, elevation 120 m., June 13, 1962 (E. S. Ross, D. Q. Cavagnaro, CAS), 2f (young), June 28, 1976 (W. Sedgwick, AMNH), 2f (1 young), July 25, 1982, molted Sept. 26, 1982 (W. Sedgwick, AMNH), 1f (young).

DISTRIBUTION: Known only from the Batu and Templar Park caves in central Malaysia.

NATURAL HISTORY: This species is known from only two caves, both near Kuala Lumpur. The populations in both caves seem much reduced by collecting, and we hope that additional collecting will be discouraged until the populations can build up again. Bristowe (1952) indicated that both retreats attached to a wall and true burrows are found in the Batu Caves, where the principal food is a cave grasshopper. Some of the retreats attached to the wall of the Templar Park Cave were made of dry earth and silk, whereas others had the silk compounded with a very wet clay. Some retreats had an escape hatch at the bottom, others did not.

***Liphistius panching*, new species**

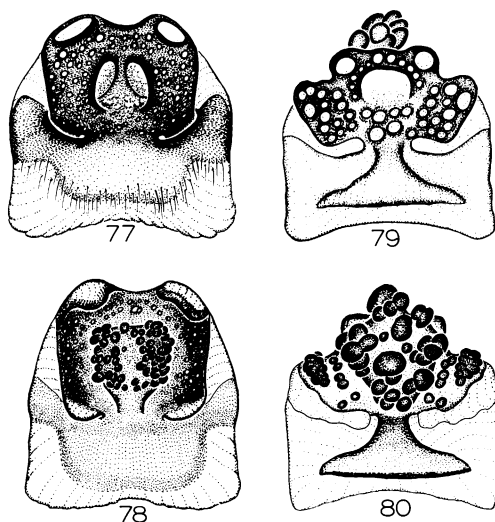
Figures 17, 77, 78

TYPE: Female holotype from Gua Panching, a cave 24 km. north of Kuantan, Pahang, Malaysia (collected July 31, 1982, died Oct. 18, 1982; W. Sedgwick), deposited in AMNH.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

DIAGNOSIS: Females resemble those of *L. tioman* in having elongated openings on the poreplate leading into the receptacular cluster, but can be distinguished by the produced anterolateral lobes on the poreplate (figs. 77, 78).

FEMALE (fig. 17): Total length, not including chelicerae, 20.8. Carapace 10.04 long, 8.00 wide, dark brown with anterior half of pars cephalica darkened. Ocular tubercle 1.19 long, 1.27 wide. Eye sizes and interdistances: AME 0.10, ALE 0.54, PME 0.37, PLE 0.31; AME-AME 0.11, AME-ALE 0.28, PME-PME 0.09, PME-PLE 0.07, ALE-PLE 0.09. MOQ length 0.72, front width 0.30, back width 0.82. Sternum 4.75 long, 2.68 wide, light brown with steeply sloping margins and posterior tip lighter. Labium 1.31 long, 2.17 wide. Endites 3.31 long, 2.21 wide. Chelicerae orange proximally, dark brown distally; promargin with 11 teeth. Legs dark olive brown, with femora lightest. Superior tarsal claws with three teeth on legs I-III, four on leg IV; inferiors with two denticles on legs I-III, three on leg IV.



FIGS. 77-80. Internal female genitalia. 77, 78. *Liphistius panching*, new species. 79, 80. *L. johore*, new species. 77, 79. Dorsal view. 78, 80. Ventral view.

	I	II	III	IV	Palp
Femur	7.42	7.34	7.28	9.27	6.24
Patella	3.39	3.46	3.60	3.82	2.38
Tibia	4.59	4.82	5.26	6.75	4.58
Metatarsus	4.54	4.89	5.90	4.68	—
Tarsus	2.30	2.17	2.88	4.09	4.34
Total	22.24	22.68	24.92	28.61	17.54

Abdomen 9.80 long, 7.77 wide, grayish brown with orange sternites and brown spinnerets. Palpal claw with four denticles. Internal genitalia with sinuous posterior stalk, large poreplate with elongate median openings and produced anterolateral lobes, and wide receptacular cluster (figs. 77, 78).

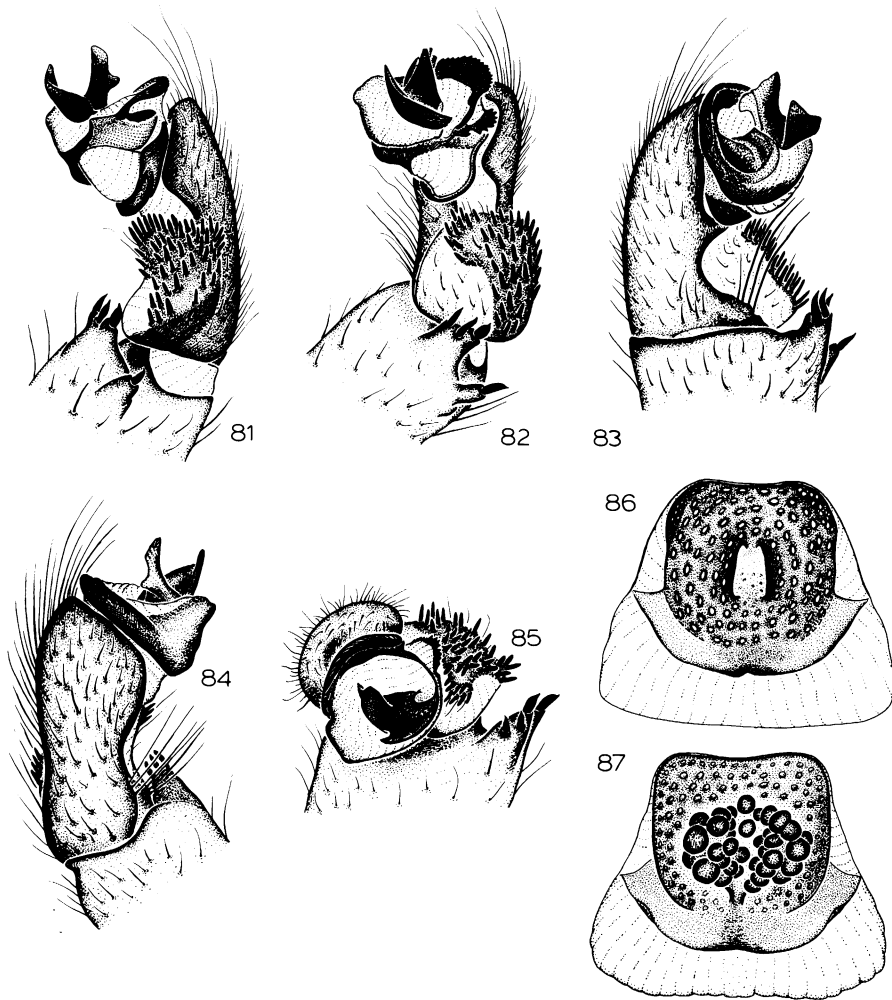
MALE: Unknown.

VARIATION: Young females have the two openings into the median receptacular cluster completely separated by a median piece of the poreplate.

OTHER MATERIAL EXAMINED: The following specimens from the type locality: May 29, 1981 (W. Sedgwick, AMNH), 3f (2 young); May 29, 1981, died Nov. 31, 1981 (W. Sedgwick, AMNH), 1f; July 31, 1982 (W. Sedgwick, AMNH), 1f (young).

DISTRIBUTION: Known only from the Panching Cave in eastern Malaysia.

NATURAL HISTORY: Specimens were found



FIGS. 81–87. *Liphistius tioman*, new species. 81. Palp, retrolateral view. 82. Palp, retroventral view. 83. Palp, ventral view. 84. Palp, prolateral view. 85. Palp, distal view. 86. Internal female genitalia, dorsal view. 87. Same, ventral view.

in three different habitats near the entrance to Panching Cave: (1) in very hard limestone of which the hill itself is composed (some burrows were very short, only 2 or 3 inches long, although others were much longer); (2) a nearby vertical dirt bank of loosely packed earth; and (3) at the mouth of the cave in loose dry earth at planes varying from nearly horizontal to almost 45° (some burrows extended back under stones, others went down vertically into the earth, and still others proceeded horizontally).

***Liphistius tioman*, new species**

Figures 54, 55, 81–87

TYPES: Male holotype and female paratype from an elevation of 2600 feet on Tioman Island, Pahang, Malaysia (collected July 29, 1982; male died Mar. 6, 1983, female died Oct. 14, 1982; W. Sedgwick), deposited in AMNH.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

DIAGNOSIS: Males can easily be distin-

guished from those of other species by the divided retrolateral tibial apophysis (fig. 82), females by the boat-shaped posterior stalk, squared poreplate, and long openings to the wide receptacular cluster (figs. 86, 87).

FEMALE (fig. 55): Total length, not including chelicerae, 15.4. Carapace 6.84 long, 6.48 wide, orange with dark brown markings covering pars cephalica (except for two pairs of paramedian light ovals occupying space between ocular tubercle and thoracic groove) and marginal half of each side of pars thoracica. Ocular tubercle 1.05 long, 1.21 wide. Eye sizes and interdistances: AME 0.06, ALE 0.55, PME 0.30, PLE 0.36; AME–AME 0.14, AME–ALE 0.18, PME–PME 0.09, PME–PLE 0.10, ALE–PLE 0.09. MOQ length 0.54, front width 0.27, back width 0.68. Sternum 3.67 long, 2.27 wide, light brown, darkest at juncture of main body and gently sloping margins. Labium 0.94 long, 1.82 wide. Endites 2.81 long, 1.64 wide. Chelicerae orange proximally, brown distally; promargin with 11 teeth. Legs yellow with wide brown annulations proximally and distally on femora, tibiae, metatarsi, and tarsi, proximally on patellae. Superior tarsal claws with two teeth; inferiors with two denticles on legs I and II, one on leg III, and none on leg IV.

	I	II	III	IV	Palp
Femur	5.74	5.76	5.77	7.20	4.43
Patella	2.25	2.27	2.54	3.09	2.55
Tibia	3.54	3.71	3.97	5.26	3.25
Metatarsus	3.42	3.71	4.64	6.91	—
Tarsus	1.55	1.84	2.19	2.87	3.17
Total	16.50	17.29	19.11	25.33	13.40

Abdomen 9.00 long, 5.62 wide, light brown with scattered yellow spots, sclerites and spinnerets brownish orange. Palpal claw with two denticles. Internal genitalia with wide, semicircular posterior stalk indistinctly separated from large, squared poreplate with pair of long openings into wide receptacular cluster (figs. 86, 87).

MALE (fig. 54): As in female, except for the following. Total length 10.3. Carapace 6.23 long, 6.01 wide, light brown, anterior pair of paramedian light spots obliterated, clypeus transversely ridged. Ocular tubercle 0.97 long, 1.15 wide. Eye sizes and interdistances: AME 0.03, ALE 0.56, PME 0.25, PLE 0.46; AME–

AME 0.09, AME–ALE 0.16, PME–PME 0.06, PME–PLE 0.09, ALE–PLE 0.05. MOQ length 0.45, front width 0.15, back width 0.57. Sternum 3.26 long, 1.87 wide. Labium 0.58 long, 1.01 wide. Endites 2.12 long, 1.18 wide. Chelicerae yellow proximally, light brown distally. Legs without distal metatarsal and proximal and distal tarsal annulations. Inferior tarsal claws with one denticle.

	I	II	III	IV	Palp
Femur	5.80	5.98	5.96	7.21	3.89
Patella	2.23	2.61	2.25	2.77	2.11
Tibia	4.38	4.43	4.66	5.84	3.85
Metatarsus	4.54	5.08	5.87	7.88	—
Tarsus	2.21	2.39	2.81	3.08	2.04
Total	19.16	20.49	21.55	26.78	11.89

Abdomen 4.61 long, 3.13 wide. Palp as in figures 81–85.

OTHER MATERIAL EXAMINED: One male and seven females collected with the types and with subsequent histories as follows: 1f, died July 29, 1982 (AMNH); 1f, died Sept. 1, 1982 (AMNH); 1f, died Oct. 17, 1982 (MCZ); 1f, molted Nov. 9, 1982, died Apr. 15, 1983 (AMNH); 1m, matured Nov. 18, 1982, died Apr. 15, 1983 (AMNH); 1f, died Feb. 1, 1983 (AMNH); 1f, died Apr. 11, 1983, after one molt (AMNH); 1f, died Apr. 24, 1983 (AMNH).

DISTRIBUTION: Known only from Tioman Island, Malaysia.

NATURAL HISTORY: Specimens were found high on Tioman Island under a series of 30-foot boulders which overhang caverns called Gua Sinah and Gua Panah (liphistiids were first recorded from Gua Sinah by Bullock, 1966). The walls of the overhung caverns are as barren as cave walls. Spiders were found in all three retreat types, in dry clay and silk retreats on rocks (similar to those in figs. 4, 5), in burrows in the ground (as in *L. langkawi*), and in a typical vertical, moss-covered bank some distance from the caverns. The “fishing lines” were quite long for the size of the burrows, radiating up to 15 inches from the trapdoor. Neither the size of the trapdoor nor the length of the “fishing lines” correlated exactly with the size of the inhabitant. The species was not found at likely looking sites at lower elevations.

***Liphistius johore*, new species**

Figures 79, 80

TYPE: Female holotype from jungle floor at Sungai Rengit, Pengarang, Johore, Malaysia (December 19, 1961; K. J. Kunchuna), deposited in BPBM.

ETYMOLOGY: The specific name is a noun in apposition taken from the type locality.

DIAGNOSIS: Females can be easily recognized by the anterolaterally shortened poreplate (figs. 79, 80).

FEMALE: Total length, not including chelicerae, 11.6. Carapace 5.15 long, 4.00 wide, light orange with light brown markings along anterior and lateral margins, in triangular patches extending from lateral margins along posterior edges of coxal elevations, and forming anterior W-shaped and posterior Y-shaped marks on pars cephalica. Ocular tubercle 0.70 long, 0.77 wide. Eye sizes and interdistances: AME 0.05, ALE 0.34, PME 0.22, PLE 0.26; AME-AME 0.05, AME-ALE 0.13, PME-PME 0.03, PME-PLE 0.05, ALE-PLE 0.04. MOQ length 0.39, front width 0.16, back width 0.47. Sternum 2.59 long, 1.62 wide, yellow with gently sloping margins lighter. Labium 0.54 long, 1.11 wide. Endites 1.84 long, 1.08 wide. Chelicerae pale yellow proximally, orange distally; promargin with 11-12 teeth. Legs pale yellow with slightly darker annulations distally on femora, proximally and distally on tibiae, and proximally on metatarsi and tarsi. Superior tarsal claws with four teeth; inferiors with three denticles on anteriors, two on posteriors.

	I	II	III	IV	Palp
Femur	3.96	3.82	3.60	4.78	3.70
Patella	1.84	1.82	1.62	2.16	1.55
Tibia	2.28	2.34	2.52	3.60	2.20
Metatarsus	2.23	2.41	2.97	4.80	—
Tarsus	<u>1.08</u>	<u>1.22</u>	<u>1.46</u>	<u>1.87</u>	<u>2.01</u>
Total	11.39	11.61	12.17	17.21	9.46

Abdomen 5.76 long, 4.61 wide, pale orange with sclerites and spinnerets yellow. Palpal claw with four denticles. Internal genitalia with triangular posterior stalk, anterolaterally shortened poreplate, and wide receptacular cluster protruding anterior of poreplate (figs. 79, 80).

MALE: Unknown.

OTHER MATERIAL EXAMINED: None.

DISTRIBUTION: Known only from southern Malaysia.

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