

Biosystematic Studies
of Ceylonese Wasps, XIII:
A Monograph of the
Stizinae (Hymenoptera:
Sphecoidea, Nyssonidae)

KARL V. KROMBEIN

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Biosystematic Studies of Ceylonese
Wasps, XIII: A Monograph of the
Stizinae (Hymenoptera:
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ABSTRACT

Krombein, Karl V. Biosystematic Studies of Ceylonese Wasps, XIII: A Monograph of the Stizinae (Hymenoptera: Sphecoidea, Nyssonidae). *Smithsonian Contributions to Zoology*, number 388, 37 pages, 30 figures, 1984. Nine species are recorded from Sri Lanka, two belonging to *Stizus* Latreille and seven to *Bembecinus* Costa. One species of *Stizus* is widespread in the Oriental Region, the other occurs in the Indian subcontinent, Iran, and Mauritius; four species of *Bembecinus* are found both in Sri Lanka and India, and three species of *Bembecinus* apparently occur only in Sri Lanka. The following new species are described: *B. luteolus* and *B. knighti* from Sri Lanka, and *B. krameri* and *B. broomfieldi* from Sri Lanka and South India. Lectotypes are designated for *B. pusillus* (Handlirsch) and *B. proximus* (Handlirsch). No new synonymy is proposed.

The species of *Bembecinus* usually make unicellular nests, preferably in friable soil, and provision progressively with a wide variety of homopterous prey. Nesting, prey records, and natural enemies are discussed insofar as known for *B. comberi* (Turner), *B. luteolus*, *B. pusillus*, and *B. proximus*.

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Biosystematic Studies of Ceylonese Wasps, XIII: A Monograph of the Stizinae (Hymenoptera: Sphecoidea, Nyssonidae)

Karl V. Krombein

Introduction

The Nyssonidae constitutes one of the smaller families of Sphecoidea in the Ceylonese wasp fauna, and within that family the Stizinae with nine species is the largest. The other nyssonid subfamilies occurring in Sri Lanka are the Bembicinae with seven species, Gorytinae with six species, and the Nyssoninae and Alyssoninae with three species each. J. van der Vecht and I are working concurrently on the Ceylonese and South Indian Bembicinae, but the other subfamilies have not yet been reviewed.

There are only three genera of Stizinae in the entire world, *Stizus* Latreille, *Stizoides* Guérin, and *Bembecinus* Costa. *Stizus* and *Bembecinus* occur in Sri Lanka. *Stizoides blandinus* (Smith) occurs in South India, so eventually it may be found in Sri Lanka. To date we have collected only *Stizus rufescens* (Smith) at Trincomalee, and F. Keiser captured a specimen of *S. vespiiformis* (Fabricius) in Sri Lanka in 1953. It is probable that other of these large, strong-flying species occurring in South India will be found eventually in Sri Lanka.

The preceding number in my series "Biosystematic Studies of Ceylonese Wasps" is "XII: Behavioral and Life History Notes on Some Sphecoidea (Hymenoptera: Sphecoidea)," *Smithsonian Contributions to Zoology*, 387, 30 pages, 5 figures, 1984.

SYSTEMATICS.—Handlirsch (1892:183–200) provided keys for identification of Stizinae of the world (he considered that the subfamily consisted of *Stizus* only), but he had no specimens from Sri Lanka, did not have material of a number of species, and occasionally lumped two species under a single name, e.g., *S. pusillus* Handlirsch.

Bingham (1896:444) was the first to record a stizine wasp from Sri Lanka, a specimen from Pundaluoya that he misidentified as *S. prismaticus* (Smith); I have not seen this specimen but presume that most likely it was *B. pusillus*. Later, Bingham (1897:276–283) described and keyed the species of British India, Ceylon, and Burma. His treatment is also unreliable for most species because he misidentified some species. It is obvious from some of his descriptive remarks, e.g., *S. prismaticus*, that he had confused several species under a single name. The only other stizine he recorded from Sri Lanka was *S. rufescens* (Smith).

Turner (1912:337–338) described the first species from Sri Lanka, *S. comberi* (actually a *Bembecinus*), from Sigiriya.

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J. van der Vecht (1949) published an authoritative treatment of the seven species of *Bembecinus* occurring in Java and clarified some of the nomenclatural and systematic problems. Some years ago he sent me representatives of all the Javanese *Bembecinus*. None of these seven Javan species has been collected in Sri Lanka.

Bohart and Menke (1976:523–532) gave a detailed diagnosis of the Stizinae (which they considered of tribal rank), exhaustive descriptions of the three genera, and lists of the species and geographic range of all members of the group. They listed from Sri Lanka only *S. rufescens*, *S. vespiformis*, and *B. comberi*.

Xanthochroism (Krombein and Willink, 1950:700) is not exhibited by any of the Ceylonese species of *Bembecinus*. This is a phenomenon in which larger males of a species are much more yellow than smaller individuals. The increase in yellow maculations is not an extension of the basic pale color pattern, but replacement of normally black areas with a richer, darker shade of yellow. Some females exhibit xanthochroism but it is of much lesser extent than in the males. The phenomenon has been reported for several species in North and Central America and Madagascar, and in one species each in New Guinea and the Solomon Islands.

SPECIES GROUPS.—Handlirsch (1892) defined species groups in *Stizus* and placed both Ceylonese species in the *fasciatus* Group.

Beaumont (1954) redefined species groups for the Palearctic *Bembecinus*, which he designated as the *tridens*, *peregrinus*, and *discolor* Groups. The *tridens* Group occurs in all major zoogeographic regions, the *peregrinus* Group occurs also in the Oriental Region, and the *discolor* Group is known only from the Palearctic Region. The seven Ceylonese taxa belong to the *peregrinus* and *tridens* Groups.

Members of the *peregrinus* and *tridens* Groups are distinguished from those of the *discolor* Group in having the fore basitarsus of the female with parallel sides rather than having them diverge toward the apex, in almost always lacking yellow markings beneath the anterior ocellus and behind the eyes in both sexes, and in the lack of teeth on

the male sterna or their presence on the second, third, and sixth sterna rather than having a tooth on the second only.

Members of the *peregrinus* Group have closer and finer punctation on the sterna (Figure 28), the apical margin of the male sixth sternum is rounded out, the male cuspis is quite elongate, especially the slender digitate apex (Figures 13, 14), the hind femur of female is less than three times as long as wide (Figure 7), and the posterior surface of male hind femur has one or more setae toward the apex (Figures 15–18). These setae, if more than one, may vary in size, but all are characterized by having close carinules extending from base to apex and converging toward the latter. There is variability in the number of such setae, some species having only one or several as in *B. comberi* (Turner) (Figure 15) and *B. krameri*, new species (Figure 17), others having a row, and *B. peregrinus* (Smith) having the row of setae set in a groove (Figures 11, 18). J.R. Walther believes that these setae are modified tactile hairs. Occasionally, as in *B. comberi*, there may be associated with these setae several sensilla of a peg and pit type (Figure 16) that Walther believes may function either in gauging temperature and moisture, or in olfaction.

Members of the *tridens* Group usually have larger and more dispersed punctures on the sterna (Figure 27), the apical margin of the male sixth sternum is broadly emarginate, the male cuspis is not so elongate nor is its digitate apex as long (Figures 19–23), the female hind femur is more slender, at least three times as long as wide (Figure 8), and the posterior surface of male hind femur is not armed with specialized setae (Figure 12).

TREATMENT OF INDIVIDUAL TAXA.—The present contribution continues the format used in preceding papers on systematics in this series on Ceylonese wasps. The references cited beneath each species heading include the original description and those of any synonyms, any generic transfers, notes on type fixation when appropriate, and all other references citing the taxon.

Several paragraphs of discussion follow on such subjects as distribution, synonymy, type fixation

where required, and differentiating characters. Next are descriptions of the female and male. Finally there is a listing of the specimens examined arranged by province and district.

The 4- and 5-digit numbers with suffixes (in "Biology" section) are the field note numbers. Any specimens taken have been assigned the same number as the field note in which they are discussed.

Label data are given in full for the type series of all new species. Label data for specimens of previously described taxa have been consolidated insofar as possible. For example, one consolidated record under "8. *Bembecinus pusillus* (Handlirsch)" reads "13♀, 1♂, Colombo (includes Colpetty (103 Galle Road), Victoria Park and Colombo National Museum), 7 (2♀), 8 (♀) and 16 (4♀) Apr, 15 (2♀) May, 8 (♀) Jul, 25 (♂) and 26 (♀) Aug, 21 (♀) and 23 (♀) Nov, Halstead, Wijesinhe (USNM, San Francisco)." Following the number of specimens and locality are specific dates of collection except that the year is omitted. Dates are followed by names of collectors, except that only the name of the first collector is cited from a label bearing more than one name. Finally the depositories in which the specimens are located are cited in parentheses. The only abbreviation used is USNM (formerly United States National Museum collections deposited in the National Museum of Natural History, Smithsonian Institution); other depositories in parentheses are more fully identified in paragraphs 1 and 2, "Acknowledgments."

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additional biological notes on *Bembecinus* made during my absence from the country.

Application of names of two of the Ceylonese taxa was facilitated by the loan of the syntype series of two species described by Handlirsch: *M. Fischer*, Naturhistorisches Museum, Vienna, lent a pair of syntypes each of *Stizus proximus* Handlirsch and *S. pusillus* Handlirsch; and J. Papp, Természettudományi Múzeum Állattára, Budapest, lent the other syntype of *S. pusillus*. C. O'Toole, Hope Entomological Collections, University Museum, Oxford, England, lent the unique holotype of the Indian *S. reversus* Bingham, which proved not to be conspecific with any Ceylonese taxon. E. Diller, Zoologische Staatssammlung, Munich, West Germany, lent the unique holotype of *S. veniperdus* Lohrmann, which proved not to be conspecific with any Ceylonese taxon. C.R. Vardy, British Museum (Natural History), London, kindly compared a male of *B. comberi* with Turner's unique type.

L. Masner, Biosystematics Research Unit (Otagawa), sent a few Ceylonese *Bembecinus* from that collection. P.H. Arnaud, Jr., also sent a few Ceylonese *Bembecinus* from the California Academy of Sciences (San Francisco). G.R. Ferguson, Oregon State University, Corvallis (Oregon), sent for study specimens from India in that collection. J. van der Vecht, Putten, Netherlands, thoughtfully sent a few Ceylonese *Bembecinus* collected by the late F. Keiser, Naturhistorisches Museum, Basel, Switzerland.

I am grateful to W.J. Pulawski, California Academy of Sciences, San Francisco, for his comments on species groups in *Bembecinus* and on my key to the Ceylonese Stizinae.

J.R. Walther, Freie Universität, Berlin, West Germany, offered helpful interpretations of the sensilla on the hind femora of males of the *pergrinus* Group.

H.E. Evans, Colorado State University, Fort Collins, confirmed the identity of several larvae of *Bembecinus comberi* (Turner), *B. pusillus*, and *B. proximus*, and made helpful comments on several cocoons of the first species.

I am indebted to the following for identifications of the prey or putative parasites of several

species of *Bembecinus*: J.P. Kramer, Systematic Entomology Laboratory (SEL), Insect Identification and Beneficial Insect Introduction Institute, U.S. Department of Agriculture, Washington (Cicadellidae); R.J. Gagne and W.W. Wirth (SEL) (dipterous maggots); W.J. Knight (Cicadellidae, Membracidae, Flatidae) and P.S. Broomfield (Flatidae, Ricaniidae, Delphacidae, Cixiidae, Tropiduchidae, Dictyopharidae, Issidae, Membracidae) both of the British Museum (Natural History), London; R.G. Fennah, retired, Commonwealth Institute of Entomology, London (Tropiduchidae); and Yu. G. Verves, Kiev State University, USSR (Miltogramminae, Sarcophagidae).

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Mary-Jacque Mann and Susann Braden, Scanning Electron Microscope Laboratory, Smithsonian Institution (SI), made the micrographs that illustrate this contribution, and George L. Venable, Department of Entomology (SI), made up the plates.

Biology

No observations have been made on the nest and prey of *Stizus rufescens* (Smith) or *S. vespiformis* (Fabricius), the only Ceylonese representatives of the genus. However, it is presumed that they will make either a uni- or multicellular nest, and that the wasp will mass provision the cell with members of some family of Orthoptera. Various other species of *Stizus* have been reported to use Acrididae, Tettigoniidae, or Mantidae. The nesting behavior and prey preferences in *Stizus* are quite a contrast to those of *Bembecinus*, all of which have been reported as practicing progressive provisioning and usually using a wide variety of Homoptera within a single nest.

Evans (1955) contributed our most complete account of the behavior of *Bembecinus* in his de-

tailed study of the North American *B. neglectus* (Cresson). This included references to previously published accounts of other species. Members of the genus are unique in several aspects of their behavior, such as the practice of usually laying an egg on a pedestal of sand at the end of the cell before bringing in prey, making a temporary closure before bringing in the first prey, progressive provisioning of the nest by bringing in additional prey as the larva requires more food, preying upon a wide variety of homopterous families by at least some species, and the habit of both sexes of some species of clustering in relatively large numbers on foliage.

Evans noted that in *B. neglectus* the earth is thrown backward beneath the body by the front legs. Occasionally the excavated earth blocks the entrance and the wasp backs out of the burrow and disperses the spoil several centimeters from the entrance. The burrow is short, oblique, at an angle of 40° to 70° for 5–18 cm; the burrow diameter is 3–4 mm, and the cell averages 17 mm long by 10 mm high. Usually there is only a single cell in the nest, but he found four nests with two cells.

One egg hatched in two days in the laboratory. The first prey was brought into the cell before the egg hatched, and several observations suggested that additional prey were brought in during the next two or three days, when the larva was half grown. The larva attained full growth in another day and began to spin its cocoon. Evans noted that the cocoon was hard-walled, and that 5 or 6 small pores were located irregularly around the middle.

Bembecinus neglectus preyed almost entirely upon nymphal or adult leafhoppers (Cicadellidae) although two specimens of Dictyopharidae were found in one cell. From 10 to 15 leafhoppers were stored per cell, and usually an individual wasp preyed upon only one species of leafhopper. The nest was closed temporarily by packing in a small amount of sand from around the entrance after each specimen of prey was brought in. When the provisioning was completed, the entire burrow was filled in except on the rare occasions when

the wasp prepared a second cell, and filled in only the lower few centimeters to seal the first cell.

Bembecinus comberi (Turner)

We made observations on two small aggregations of this species in Ekgal Aru Sanctuary Jungle on 10 and 11 June 1976 (notes 61076 A and B, and 61176 B) and 0.5 mi (0.8 km) NE of Kokmotte Bungalow, across the Moderagam Aru from Wilpattu National Park on 15 and 16 February 1979 (notes 21579 C–F, and 21679 D–H).

The Ekgal Aru aggregation consisted of only three females nesting at the side of a jeep trail through the jungle. I caught a preyless female (61076 A) at 1230 as it hovered low near its nest entrance in flat, bare ground littered with leaves. This burrow penetrated the dry hard soil at an angle of 80° to the horizontal for 4.8 cm. We found no cell after extensive digging in the area around the termination of the burrow.

I noted a second female (61076 B) fly into its nest about a meter away at 1230, but I could not see whether she was carrying prey. The wasp flew out a few minutes later, left the entrance open, and made a brief orientation flight, perhaps because I had disturbed some of the leaves. This burrow had a diameter of 13 mm and went into the ground at an angle of 30° for 5.3 cm where it was plugged. The burrow continued downward at 30° for 4 cm but at a right angle to the original axis. It ended in a horizontal cell containing an ovoid cocoon 14 mm long and 5.5 mm wide with only one pore at the middle and with attached homopterous fragments. At a distance of 5 mm from the cocoon was an ovoid cell 15 mm long and 12 mm wide containing two adult Homoptera, but we were unable to find an egg in the cell or on the prey. This was probably the third cell in order of construction for beneath it we found a third sealed cell containing a wasp larva that we lost subsequently and a number of Homoptera, some whole and some just fragments. The cells in order of construction contained the following prey or fragments thereof:

Cell 1

- 5 *Centrotus indicatus* Melichar (Membracidae)
- 1 *Leptocentrus* possibly *leucaspis* Walker (Membracidae)
- 3 *Gargara* species A (Membracidae)
- 1 *Gargara* species B (Membracidae)
- 2 *Ketumala thea* Ghauri (Flatidae)
- 3 *Stacota breviceps* Walker (Tropiduchidae)

Cell 2

- 1 *Gergithus cribratus* Melichar, 4 mm long (Issidae)
- 1 *Narayana pundaluoyana* Distant, 4.5 mm long (Issidae)
- 1 *Narayana fryeri* Distant, 5.0 mm long (Issidae)
- 1 *Sarima creata* Distant, 5.5 mm long (Issidae)
- 1 *Stacota breviceps* Walker, 5.0 mm long (Tropiduchidae)

Cell 3

- 1 *Gergithus complicatus* Distant, adult ♂, 5 mm long (Issidae)
- 1 *Centrotus indicatus* Melichar, adult ♀, 7 mm long (Membracidae)

P.B. Karunaratne found a third nest (61176 B) at the same site on the next day. At 1022 he noted the female flying with a green prey between her legs and protruding beyond her abdomen. The nest entrance was covered with a dry leaf and the wasp entered holding on to her prey. She left the burrow five minutes later, leaving the entrance open, and was captured by Karunaratne. In this nest the burrow had a diameter of 10 mm and penetrated the ground at an angle of 30° for 6 cm. We found three cells at that level, each with the entrance plugged with soil. The cell constructed first was at an angle of 90° from the burrow axis, 5.2 cm from it and contained a cocoon covered with light green prey fragments. The cocoon and diapausing larva were cut by the trowel. The second cell was 15 mm long and 12 mm wide and was to the right of the first cell at an angle of 70° to 80° to the burrow axis. It contained 10 prey, mostly whole but some fragmentary, and a cocoon with a dead diapausing larva. The cocoon was ovoid, 15 mm long and 6 mm wide at the middle, hard walled, with only one pore, and was constructed of sand grains held firmly and closely by silk and with prey fragments attached on the outside by a flimsy network of silken strands. The cell was at 30° to the left of the burrow axis and about 3 cm from it. This was the cell in which the wasp had placed the prey she brought into the nest at 1022. The cell contained a well-grown wasp larva and nine prey,

some whole and some fragmented. The cells in the order listed above contained the following prey or fragments thereof:

Cell 1

- 7 *Forculus viridis* Distant, fragments (Issidae)
- 1 *Stacota breviceps* Walker, fragments (Tropiduchidae)

Cell 2

- 1 *Ricania fenestrata* Fabricius (Ricanidae)
- 8 *Forculus viridis* Distant (Issidae)
- 1 Cicadellidae species, head only

Cell 3

- 5 *Forculus viridis* Distant, 11 mm long (Issidae)
- 2 *Gargara* species (Membracidae)
- 1 Membracidae species, tegmen only
- 1 *Eporiella?* species (Tropiduchidae)

The population near Kokmotte Bungalow was larger and apparently had emerged very recently because both sexes were present. There were two aggregations each in a damana (large, open, sparsely vegetated area) separated from each other by about 100 m of scrub jungle. At 1005 on 15 February I saw about 20 males flying low over the ground in irregular patterns and occasionally alighting on the ground. No females were present at that time and the males did not bother each other. Males were again flying the next day, but I never saw any of them attempt to mate with one of the nesting females.

Some females were just starting excavation of nests in flat areas. These were marked by a tumulus of fine sand and silt as much as 40 mm in diameter and 12 mm high surrounding the burrow entrance 8 mm in diameter. During the digging the female pushed excavated soil behind her for several minutes and then pushed it out of the burrow and scratched the soil backward beneath her to add to the spoil heap. I excavated three nests (21579 D, F, and G) on 15 February, all at an angle of 45° to the horizontal, and with burrow lengths ranging from 6.8 to 8.0 cm. None contained a cell. The sand was quite damp immediately below the surface.

Another female (21579 E) was digging her nest at 1443. The wasp stopped excavating at 1515 and pushed up damp sand from beneath to seal the entrance. The latter was still closed when I left at 1615, and I presume that the female of *B. comberi* may spend the night in her nest rather

than clustering in an aggregation on foliage. The plug at the entrance to this nest had been removed by 0854 the next morning, but it appeared that another plug had been pushed up several mm below the surface. The burrow was entirely open from 1022 through 1037, and remained open at 1117, 1131, 1143, 1149, 1201, and 1347. I excavated the nest at 1350 when the wasp still had not returned. The burrow went in at an angle of 45° for 4.5 cm, turned at a right angle, and continued downward for another 4 cm. There was no cell.

While the wasp was excavating the nest I captured a female miltogrammine fly (Sarcophagidae), *Protomiltogramma seniorwhitei* (Verves), as it perched on a grass stem nearby. This fly has been recorded as a probable parasite of *Sphex obscurus* (Fabricius) (see Krombein, 1984).

I saw female 21679 D enter an open burrow surrounded by the usual tumulus at 0958 on 16 February. She pushed up soil from beneath at 1001 for two minutes and then emerged to add this excavated soil to the spoil heap. The burrow was closed at 1022 and I noted no movement from within during the next minute. The burrow was open at 1037, and at 1117, 1131, 1149, 1201, and 1349, at which time I excavated the nest. The burrow went in at an angle of 45°. At 8 cm below the surface I found a plugged ovoid cell 20 mm long and 10 mm wide, located about 3 cm from the burrow axis. The cell contained a nearly full-grown larva and remains of adult Membracidae, *Leptocentrus* species; the larva had already spun together some prey fragments in a delicate silken shroud. The wasp had begun digging a new cell at a depth of 7 cm and this lateral burrow turned at a right angle from the burrow entrance for 4 cm. There was no prey or egg at the end of this burrow so presumably the cell was not complete.

The last female (21679 E) flew into her open burrow apparently without prey at 1010, emerged head first, re-entered head first, and repeated this sequence again during the next 3 minutes. She flew away after a brief orientation flight leaving the burrow entrance open. I did not see her return, but she flew out of the burrow at 1123

and returned in 2½ minutes. She left the burrow a minute later, made a brief orientation flight, and returned with a prey in 3½ minutes. She left a minute later without making an orientation flight. She did not return from 1150 to 1200. Her burrow was open when I returned at 1350 and I began to excavate it. I captured the wasp when she returned at 1356 with a paralyzed cicadellid, *Petaloccephala* species, 14 mm long. I found her cell at a depth of 8.5 cm about 4 cm from the burrow axis; it had a short temporary closure of damp sand. The cell was 12 mm long and 8 mm high. It contained five membracids 5–6 mm long (two *Coccoxerphus tuberculatus* Motschulsky and three *C. obscurus* Distant) and seven smaller membracids 2.0–2.5 mm long (five *Leptocentrus* sp. and two *Cryptaspidia piceola* Melichar). I was unable to find a wasp larva or egg in the cell.

I obtained two other prey records, a paralyzed flatid adult, *Ketumala* species, 7.5 mm long, from the top of a burrow, and a paralyzed adult cicadellid, *Acostemma prasina* Walker, 9 mm long, that was being transported by the female wasp. This wasp was being followed by a female miltogrammine fly, *Protomiltogramma seniorwhitei* (Verves). Also during one of my nest excavations I found an almost mature wasp larva in a cell not associated with any known burrow. The cell contained fragments of several cicadellids, *Kutara brunnescens* Distant.

There are several anomalies in the preceding account of *Bembecinus comberi* that differ from the usual behavior of this genus. First is the construction of at least three cells per nest; usually the nests are unicellular, or have two cells only occasionally. Next, a greater variety of homopterous prey is used, sometimes as many as 12 species belonging to four families in one 3-celled nest (61076 B); one cell in this nest contained six species belonging to three families. My failure to find an egg or larva in two cells (61076 B, cell 3 and 21679 E) is particularly disconcerting. *Bembecinus comberi* is the largest species of the genus in Sri Lanka, and its egg would presumably be at least 2.5 mm long. It is improbable that *B. comberi* would not lay an egg before storing prey, so failure to find the egg perhaps is due to observer

error. The next anomaly is the apparent habit of the female of spending the night in her nest (21579 E) rather than joining a cluster of both sexes on vegetation. The habit of leaving the nest entrance open while the wasp is away is unusual (61076 B, 21579 D, F, and G, 21679 D and E), although the entrance of one nest (61176 B) was covered by a leaf, possibly not placed there by the wasp. One female (21679 E) had constructed a temporary closure at the entrance of a partially stored cell. Such a closure has not been recorded previously for any other species of the genus. However, we found two nests of *B. pusillus* (Handlirsch) and one nest of *B. proximus* (Handlirsch) with such a plug at the entrance to incompletely stored cells, so it may be a more normal occurrence than believed previously. The cocoon of *B. comberi* has only one pore, whereas there are 5 or 6 scattered irregularly around the middle in *B. neglectus*.

It may be that some or all of these supposed anomalies are actually characteristic of members of the *peregrinus* Group to which *B. comberi* belongs. All of the *Bembecinus* observed by other authors belong to the *tridens* Group except for *B. gazagnairei* (Handlirsch) and *B. fertoni* (Handlirsch), which are members of the *peregrinus* Group. Fertoni (1908:556–557) published brief notes on the biology of *B. gazagnairei* and *B. fertoni*. The only peculiarity that he noted for those two species was that they nested in pre-existing cavities with a diameter of about a centimeter and depth of at least 6 cm, in hard, fine-grained limestone in Tebessa, Algeria. *Bembecinus fertoni* preyed upon one species of nymphal and adult Issidae and one species of adult Cicadellidae. Both of these species of *Bembecinus* plugged the burrows with sand after the cells were stored.

Bembecinus luteolus, new species

The only nesting activity that I observed was during January 1979, at Palatupana, Hambantota District, near the entrance to Yala National Park in the extreme southeast of Sri Lanka. The species was active near the seashore adjacent to the bungalow of the Wildlife and Nature Protec-

tion Society. Both sexes were found on flat or gently sloping sand on either the windward or leeward side of the dunes, but not on the dunes themselves. Both sexes visited for nectar the tiny flowers of two prostrate creepers, one of which was identified as a species of *Philanthus* (Euphorbiaceae).

I reached the beach area at 0805 on 20 January and noted no *Bembecinus* activity until 0840 when I saw a female sunning herself on the ground. By that time the sand was warm to the touch, whereas it had been cool when I reached the beach. At 0925 I saw a hunting female capture a tiny prey on the leaf of a small prostrate plant with fleshy, needle-like leaves arranged in a cluster. She flew to the sand a few centimeters away, curled her abdomen beneath her thorax and presumably stung the prey. Then she flew off a centimeter or two above the surface, and I lost sight of her.

At 1420 on the same date I found another female (12079 A) just beginning to burrow on slightly sloping bare sand. The slope was about 20° from the horizontal and the burrow went in at an angle of 30° to the slope. As she got deeper into the sand she brought out two or three loads of sand, scattered them backward beneath her, and then made short flights low to the ground around the burrow for three to four seconds. She was in the burrow about 20 seconds between each emergence to scatter sand from the entrance. As the burrow deepened she was excavating below for 30 to 40 seconds before bringing up sand. The spoil heap was flat, oval, about 40 mm wide and 60 mm long. The burrow entrance was about 4 mm in diameter. The wasp came to the burrow entrance five times and scattered sand. On the sixth exit she backed up 40 mm from the burrow to scatter the spoil heap over a wider area. By 1530 the wasp in scattering sand from the spoil heap had made a slightly depressed path about 2 mm deep near the entrance that widened gradually to 10 mm about 40 mm from the burrow. By 1600 the wasp was spending as much as 1¼, 2, and 2¾ minutes underground before backing to the surface with a single load of sand. At 1618,

after being below for 10¾ minutes, she came to the surface head first, scraping sand backward beneath her to close the burrow entrance. Presumably she deposited an egg in the cell during this protracted period below the surface. She then proceeded to scrape more sand over the burrow entrance though not filling the depression entirely. About 1½ minutes after appearing at the entrance she flew away without making an orientation flight.

The wasp returned at 1622 and landed on the ground a few meters from the entrance. She then flew around the nest a bit, landed, and did some more leveling from the area above the entrance. She left 2 minutes later. At 1628 she began a burrow about a meter from the entrance to her nest. The wasp was inside with the burrow closed at 1633. I placed the net over the burrow and probed with a blade of grass but could not dislodge the wasp. Later I sifted the sand with my fingers and the wasp flew out from a depth of about 2.5 cm below the surface. Her nest burrow was 15.5 cm long, but I lost the cell in a maze of roots in the damp sand about 8 cm beneath the surface.

Bembecinus luteolus is atypical, as is *B. comberi* (Turner), in that at least the female spends the night in a sleeping burrow in the sand rather than clustering with other individuals on a plant. Perhaps the constant strong breezes off the ocean have caused *B. luteolus* to develop this odd behavioral trait. The constant breezes also have a cooling effect on the sand surface, so that daily activity of *B. luteolus* is confined apparently to the period 0830 to 1630.

Bembecinus pusillus (Handlirsch)

P.B. Karunaratne made notes in 1975 on four nests (5375 A-C and 7575 A) in a pile of sand accumulated for building purposes at Papiliyana, Nugegoda, near Colombo. I found five nests in 1976 (61776 C, D, and 61976 A-C) at Gilimale, Induruwa Jungle, and captured two wasps flying with prey (61776 B and 61976 D) at the same locality.

Karunaratne observed 5375 A enter her nest with prey at 1345. The wasp emerged head first in a few minutes and began to kick sand backward to close the entrance. She was captured when this was completed. The burrow was 4 mm in diameter and went in at an angle of 30° to the horizontal. The temporary closure at the entrance was about 13 mm long and the burrow was empty for the next 38 mm. Karunaratne found six cicadellid prey, 4.5–6.0 mm long, placed horizontally at the end of the burrow with no indication of a cell, and no wasp egg or larva. The prey were identified as one adult ♂ *Platyretus marginatus* Melichar, and four adult ♀ and one nymph of *Hecalus apicalis* (Matsumura).

He saw 5375 B bring a brown prey to the nest at 1411. The prey was held venter to venter between the legs and the wasp continued to hold the prey while opening the nest entrance. She spent three minutes inside and then emerged head first, made a temporary closure as noted for 5375 A, and flew off. Karunaratne tried to dig up the nest on the following day but lost the burrow and recovered no prey.

Wasp 5375 C was digging her nest at 1410 about a meter distant from the nests of A and B. This burrow had a diameter of 4 mm and went in at an angle of 30°. A pebble rolled into the burrow while the wasp was digging and she dragged it out. Finally she remained inside for about three minutes, emerged at 1416 and then began to make a temporary closure as noted above. She then flew away and had not returned by 1810. Karunaratne was unable to find the cell when he dug up the nest the next day.

He observed 7575 A bring a green leafhopper to her nest at 1015 on July 5. She opened the nest entrance while continuing to hold the prey beneath her, and took it into the nest. She emerged in a few minutes head first, began to make a closure in the usual manner, and was then captured. The burrow was about 3 mm in diameter and penetrated the sand at an angle of 35°. The cell at the end of the burrow was quite small and contained two adult male cicadellids, *Nephottix nigropictus* (Stål), 4 mm long, and *N. virescens*

(Distant), 3 mm long. He was unable to find a wasp egg or larva.

The first nest (61776 C) I found at Gilimale was in sand at the edge of a path through the jungle. I saw the wasp enter her burrow at 1115 carrying a prey beneath protruding beyond her abdomen. The burrow was 5 mm in diameter, went in at an angle of 25° for 50 mm, terminated in a horizontal cell 5 mm long and 4 mm wide, and 2.5 cm below the surface there was a sand plug 1 cm thick sealing the cell entrance. The cell contained a half-grown wasp larva bearing a tiny dipterous maggot and 14 homopterous prey identified as follows:

- 1 adult *Nephottix* species, 4.5 mm long (Cicadellidae)
- 3 nymphs Cicadellidae species, 2.5–3.5 mm
- 8 adults *Matutinus* species, 3.0–3.5 mm (Delphacidae)
- 1 nymph Delphacidae species
- 1 nymph homopterous species

We saw the second wasp (61776 D) flying low toward her nest carrying prey beneath her. She opened the sealed burrow, took the prey in, and emerged in a few seconds to make a temporary closure, at which time we captured her. This nest was in sand mixed with rubble along the same path and went in at 20° for 26 mm. Then it turned at right angles and went downward for 26 mm at an angle of 30°. The horizontal cell was not plugged and was 5 mm long and 4 mm wide. It contained a loose wasp egg 2.2 × 0.6 mm long lying on its side, and an adult leafhopper, *Nephottix nigropictus* (Stål), 4 mm long.

We saw wasps 61976 A and B digging nests at 1110 and 1120 on 19 June. Wasp A backed to the surface every 20–25 seconds and scattered sand behind her without leaving the burrow. Occasionally she came onto the surface about 12 mm from the entrance to disperse the excavated sand farther over the spoil heap. She was frightened off, and when we dug the nest, we found that it had not been completed. Wasp B behaved similarly, remaining on the surface only a few seconds to scatter excavated sand over the spoil heap. She continued digging until 1140 when a second female entered the burrow. Both emerged in a few seconds and flew away. We dug up the burrow

but the nest had not been finished and there was no cell.

I found the last female 61976 C digging her nest at 1143. At 1155 she came out head first, walked over the spoil heap for a few seconds, and then re-entered head first. She continued to bring up sand at about 15 second intervals, occasionally emerging on the surface to scatter the excavated sand over the spoil heap. At 1228 she went back into the burrow, remained there for five minutes, came out head first and began to scratch sand backward to seal the entrance. She leveled the spoil heap during this process and pulled a dry grass blade across the entrance. She made several orientation flights within an area of several square meters during the closing process. Her burrow had a diameter of 4 mm and went in at an angle of 25° for 40 mm. The last 5 mm of the 40 mm was a sand plug at the cell entrance. The cell was abnormally large, 22 mm long and 11 mm wide. The wasp egg, 2.1 × 0.5 mm, was lying on its side at the end of the cell. There was no prey in the cell.

I captured two wasps flying with prey at Gili-male: 61776 B, 6.5 mm long, at 1045 on 17 June, with a paralyzed adult male cixiid, *Kirbyana* species near *pagana* Melichar, 3.5 mm long; and 61976 D at 1210 on 19 June, with a paralyzed female cicadellid, *Batracomorphus* species C, 5 mm long.

It appears that *Bembecinus pusillus* is atypical for the genus in that the egg is just placed on its side at the end of the empty cell instead of being placed obliquely or vertically on a low pedestal of earth.

Bembecinus proximus (Handlirsch)

We made biological observations on six females of this species, 31176 C at Mihintale, 21277 B at Weddagala, 21777 C and D at Hasalaka, and 12279 B and C at Angunakolapelessa.

The two nests at Hasalaka yielded the most information. They were constructed in a newly cleaned, flat, dirt road with scattered gravel on the surface and finer grains beneath. Both bur-

rows went downward at an angle of 30° to the horizontal for 7.5 cm and terminated in an almost horizontal cell 3.8 cm below the surface. The cells were 1 cm long and less than 1 cm wide. Wasp 21777 C, 7 mm long, flew in carrying a gray prey beneath her, venter to venter, and with the abdomen of the prey extending beyond that of the wasp. While holding her prey, the wasp opened the temporary closure at the burrow entrance and carried it in. She came out head first in 30 seconds, turned around, and went in again. She backed out in a few seconds and then kicked sand in backward to close the entrance, at which time she was captured. The temporary closure was very thin and there was also a thin, loose closure of sand at the entrance to the cell. The cicadellid prey were standing on their heads surrounding the egg, which was on a pedestal about 1 mm high and wide. The egg was slightly curved and 2.6 × 0.6 mm. The prey were identified as follows:

- 2 ♀ *Selenocephalus* species A, 6.5 and 7.0 mm long
- 1 ♂ *Batracomorphus* species A, 4.7 mm
- 2 ♀, 1 ♂ *Batracomorphus* species B, 4.3 and 4.7 mm

The nest of wasp 21777 D, a specimen 8 mm long, was about 15 cm from that of wasp C. She flew in with a very large prey, opened the entrance, and carried in the prey. She came out in a short time and closed the entrance, at which time we captured her. We found a wasp larva 3–4 mm long in the cell and a number of prey which were identified as follows:

- 6 ♀, 2 ♂ *Selenocephalus* species B, 6.1–7.5 mm long (Cicadellidae)
- 2 ♂ *Orthophagus* species, 10.2 and 10.5 mm (Dictyopharidae)

At Angunakolapelessa I caught wasp 12279 B, 7.5 mm long, at 1100, as she alighted at her open burrow entrance without prey. The nest was on a sand bank with a slope of 45° and the burrow entrance was 4 mm wide. We lost the burrow and cell but recovered a nymph 4.5 mm long of a species of Cicadellidae and an adult cicadellid, *Acostemma prasina* Walker, 9 mm long. At 1110 we captured wasp 12279 C, 7 mm long, as she alighted on the same bank. She was carrying her paralyzed tropiduchid prey, which has just been

described as *Paruzelia salome* Fennah.

On 12 February we captured wasp 21277 B, 8.5 mm long, nesting in a flat, sandy loam road. Her burrow went in at an angle of 30° to the horizontal for 3.8 cm, then turned at an angle for 1.3 cm. The horizontal cell was 3.8 cm from this angle and contained a large wasp larva, a number of prey 5–6 mm long, and some dipterous maggots. The prey were identified as follows:

- 1 *Selinocephalus* species (Cicadellidae)
- 2 *Batracomorphus* species (Cicadellidae)
- 2 nymphs, Hylicinae species (Cicadellidae)
- 1 *Stacota breviceps* Walker (Tropiduchidae)

Six acalyptrate dipterous maggots were 3.2–3.5 mm long, and one was 1.3 mm long; the family to which they belong could not be identified.

P.B. Karunaratne found wasp 31176 C, 7 mm long, nesting in a pile of sand at Mihintale. He excavated the nest but found neither cell, egg, nor prey.

Natural Enemies

Evans (1966:143) commented that no dipterous parasites had been recorded for any species of *Bembecinus*, that the mutillid wasp *Smicromyrme viduata* (Pallas) and the chrysidid wasps *Hedychrum chalybaeum* Dahlbom and *Holopyga chrysonota* (Förster) parasitized the European *B. tridens* (Fabricius), and that *Nysson dimidiatus* Latreille was a cleptoparasite of this same species of *Bembecinus*.

I collected a female miltogrammine (Diptera, Sarcophagidae), *Protomiltogramma seniorwhitei*

(Verves), following a prey-laden *B. comberi* (Turner) and another *P. seniorwhitei* as it perched on a grass stem near another nest of *B. comberi*. It is quite probable that if maggots of this dipterous gained access to a cell they would act as commensals rather than as parasites, for the mother wasp would supply enough food for her own larva and the maggots also due to her progressive provisioning behavior.

I found seven acalyptrate dipterous maggots, 1.3–3.5 mm long, in a cell of *B. proximus* (Handlirsch), together with a large wasp larva and six prey specimens. The maggots could not be identified, but it seemed likely that they were commensals inasmuch as the wasp larva was healthy and there was an abundance of prey. We also found a tiny dipterous maggot on a half-grown larva of *B. pusillus* (Handlirsch) and 14 prey in the cell; this dipterous also may have been a commensal rather than a parasite.

There is strong circumstantial evidence that the small *Nysson horni* Strand (probably a synonym or subspecies of *N. rugosus* Cameron) is cleptoparasitic on most of the Ceylonese *Bembecinus*. This *Nysson* is extremely abundant everywhere that the species of *Bembecinus* occur except *B. luteolus*, new species. Although I have never seen *N. horni* investigating *Bembecinus* nests, there are no other Nyssonidae common enough to serve as hosts for so abundant a cleptoparasite. I have examined carefully all *Bembecinus* prey and found no *Nysson* egg secreted beneath the wings as is the habit in the latter genus.

Subfamily STIZINAE

Key to the Ceylonese Species of Stizinae

(In this key and following descriptions, the ocular index is the distance between the eyes at the posterior ocelli divided by the distance between the eyes at the base of the clypeus, and denotes the degree of convergence of the eyes below.)

1. Large forms, 18–25 mm long; eyes only slightly closer below than above; ocular index 1.04 in female, 1.17 in male; ninth flagellar segment of male without a spinose projection at apex, tenth and eleventh segments not strongly concave beneath [Figure 26]; posterior surface of propodeum not concave. (**Stizus** Latreille) 2

- Smaller forms, 4.3–13.0 mm long; eyes converging strongly below; ocular index 1.8–2.7 in females, 2.0–3.4 in males; ninth flagellar segment of male with an apical spinose projection bearing a seta at apex, tenth and eleventh segments strongly concave beneath [Figure 25]; posterior surface of propodeum usually noticeably concave [Figure 29]. (*Bembecinus* Costa) 3
2. Ground color light red; head, thorax, and abdomen with yellow markings; wings slightly yellowish, marginal cell moderately infumated 1. *Stizus rufescens* (Smith)
- Ground color black, head, pronotum, forelegs and second through fifth (♀) or sixth (♂) abdominal segments darker red, almost chestnut, except for some blackish blotches on abdominal sterna; wings strongly infuscated 2. *Stizus vespiformis* (Fabricius)
3. Punctuation of sterna, particularly second and third, much finer and denser, usually separated by no more than half the diameter of a puncture [Figure 28]; apical margin of male sixth sternum rounded out; posterior surface of hind femur of male with one or several large setae toward apex and two tiny sensilla [Figures 15–17]; posterior surface of hind femur of female less than three times as long as wide [Figure 7]; cuspis quite elongate, especially the slender digitate apex [Figures 13, 14]. (*peregrinus* Group) 4
- Punctuation of sterna sparser and larger [Figure 27], many punctures especially in middle usually more than one diameter apart; apical margin of male sixth sternum broadly emarginate; posterior surface of hind femur of male without specialized setae [Figure 12], and that of female at least three times as long as wide [Figure 8]; cuspis shorter, especially the slender part of digitate apex [Figures 19–23]. (*tridens* Group) 5
4. Larger forms, females 9–13 mm, males 9–11 mm; ocular index 1.8–1.9 in female, 2.0–2.2 in male; thorax dark except usually with a small posterolateral pale spot on scutum and occasionally with a small spot on neck and a narrow band posteriorly on pronotum; bands on second to fifth terga scarcely broadened anteriorly in middle 3. *Bembecinus comberi* (Turner)
- Smaller forms, females 8–9 mm, males 7–8.5 mm; ocular index 2.3–2.4 in female, 2.3–2.5 in male; thorax with more pale maculations, pronotum with an apical band as well as lobes, larger posterolateral spot on scutum, and pair of spots on scutellum; bands on second to fifth terga with narrow triangular broadening anteriorly in middle 4. *Bembecinus krameri*, new species
5. Posterolateral margin of propodeum curved, but with a shallow to deep notch near apex [Figures 1–5] 6
- Posterolateral margin of propodeum curved, entire, not notched [Figure 6] 7
6. Smaller forms, females 4.3–6.8 mm, males 5.5–6.2 mm; second submarginal cell petiolate above; posterior surface of propodeum scarcely

concave [Figure 30], posterolateral margin rounded, not compressed except below strong subapical notch [Figure 3]; ocular index 2.1–2.3 in female, 2.3–2.5 in male; very brightly maculated with yellow or white, including spot on mesopleuron, lateral band on scutum and broad bands on scutellum and first five (♀) or six (♂) abdominal terga, last tergum of male (always) and female (usually) with a pale spot

- 5. **Bembecinus luteolus**, new species
Larger forms, females 6.5–7.5 mm, males 5.5–7.5 mm; second submarginal cell strongly narrowed above, sometimes triangular but never petiolate; posterior surface of propodeum concave [cf. Figure 29], posterolateral margin compressed, notch weaker [Figures 4, 5]; ocular index 1.9–2.0 in female, 2.1–2.3 in male; not so brightly maculated with yellow or white, mesopleuron entirely dark, scutum with narrower lateral bands, scutellum with a pair of lateral spots only, and first, second, third and fifth abdominal terga with narrower bands, that on first sometimes divided, fourth, sixth and seventh (♂) terga not spotted or banded except fourth sometimes with a median spot apically
- 6. **Bembecinus broomfieldi**, new species
- 7. Eyes converging more strongly below, ocular index 2.6–2.7 in female, 3.2–3.4 in male; terga I–V, VI also in some males, with complete apical yellow bands 7. **Bembecinus knighti**, new species
Eyes converging less strongly below, ocular index not greater than 2.0 in female and 2.4 in male; not all of first five terga banded, usually only II and IV banded, but V occasionally in some males of *B. proximus* (Handlirsch) 8
- 8. Female with antennal socket equidistant from inner eye margin and base of clypeus; pale markings on abdomen white, second and fourth terga with apical bands, first with large spots narrowly interrupted on midline, third with an apical median spot and fifth with a pair of small lateral spots; clypeus black or entirely pale in female, always pale in male 8. **Bembecinus pusillus** (Handlirsch)
Female with antennal socket closer to inner eye margin than to base of clypeus; pale markings on abdomen yellow, first tergum with large spots narrowly separated on midline, second and fourth with apical bands, third always black, fifth usually with lateral spots, but in some males with a median spot also or rarely a complete band; clypeus always pale in both sexes except occasionally dark at extreme base in female 9. **Bembecinus proximus** (Handlirsch)

1. Stizus rufescens (Smith)

Figure 26

Larra rufescens Smith, 1856:349 [♀; Punjab, India.]
Stizus rufescens (Smith).—Cameron, 1890:245–246 [Barrackpore, India].—Handlirsch, 1892:138–139, pl. 2: fig. 14 [♀, ♂; Ceylon, East Indies, China]; 1895:994, 1041.—

Bingham, 1897:280 [India, Ceylon, Burma, China].—Dalla Torre, 1897:529 [listed].—Bohart and Menke, 1976:527 [listed].

The large size, predominantly red ground color, and non-concave posterior surface of the propodeum distinguish this species from the other known Ceylonese Stizinae.

Ground color predominantly light red, the following black: blotches on scutum and mesopleuron, transverse band on propodeal dorsum, blotches on posterior surface of propodeum, posterolateral spots on terga I–III and sterna II and III, and occasionally anterolateral spot on tergum II. Pale markings yellow, usually distributed as follows: basal two-thirds of mandible, labrum, clypeus, front to level of antennal insertion or as far as anterior ocellus, band on posterior eye margin, transverse posterior band on pronotum including lobe, postscutellum, upper half or more of mesopleuron, small spot above on metapleuron, most of lateral and posterior propodeal surfaces, large anterolateral spots or complete bands on terga I–VI or VII and on sterna I–V. Wings slightly yellowish, forewing with marginal cell infumated, veins amber.

Length, females 20–25 mm, males 20–22. Ocular index 1.04 in female, 1.17 in male; terminal flagellar segments of male in profile (Figure 26).

SPECIMENS EXAMINED.—EASTERN PROVINCE. *Trincomalee District*: 1♀, 2♂, Trincomalee, China Bay Ridge Bungalow, 0–100 ft (0–30 m), 16 and 17 May, Krombein et al. (USNM).

2. *Stizus vespiformis* (Fabricius)

Sphex vespiformis Fabricius, 1775:348 [♀; India orientali; lectotype in Copenhagen Museum]; 1782:447 [Malabar].—Christ, 1791:263 [listed].

Tiphia vespiformis (Fabricius).—Fabricius, 1787:278 [listed].—Gmelin, 1790:2740 [listed].

Larra vespiformis (Fabricius).—Fabricius, 1793:220 [listed]; 1804:219 [listed].—Pate, 1937:34 [cited as type-species of *Larra* Smith, 1856, not Fabricius, 1793].

Stizus vespiformis (Fabricius).—Jurine, 1807:178 [♂].—Le Peletier and Audinet-Serville, in Latreille et al., 1825:496 [listed].—Dahlbom, 1843–1845:154, 479 [♀, ♂].—Le Peletier, 1845:297 [♀].—Handlirsch, 1892:147–148 [♀, ♂; India, Ceylon, Mauritius; redescription]; 1895:1041 [listed].—Dalla Torre, 1897:534 [listed].—Bingham, 1897:277–278 [♀, ♂; India; redescription].—Gussakovskij, 1933:392 [♀; eastern Persia].—Vecht, 1961:53 [notes on lectotype; India, Ceylon].—Bohart and Menke, 1976:527 [India, Mauritius, Sri Lanka].

Stizolarra vespiformis (Fabricius).—Pate, 1937:62 [cited as type-species of *Stizolarra* Saussure, 1887].

We did not collect this species in Sri Lanka but

F. Keiser, Basel Museum, collected a specimen on flowers at Kuchchaveli, Trincomalee District, 4 July 1953 (Vecht, 1961). It is readily distinguished from *S. rufescens* (Smith) by the totally infuscated wings, the black thorax and abdomen except pronotum and basal and apical abdominal segments, and the absence of yellow markings on the head, thorax, and abdomen. The description that follows is based on specimens from South India.

Stizus vespiformis is known from the Indian subcontinent, Iran, and Mauritius.

Length 18–25 mm (♀), 17–18 mm (♂). Color black, the following darker red than in *S. rufescens*, almost chestnut: basal half of mandible, all of antenna and head except latter beneath, pronotum, scutum with a small anterolateral spot in Ceylonese specimen only, fore leg except coxa and trochanter, and abdominal segments two through five (♀) or six (♂) except for dark blotches on sterna. Wings infuscated.

3. *Bembecinus comberi* (Turner)

Figures 1, 7, 9, 13, 15, 16, 28, 29

Stizus comberi Turner, 1912:337–338 [♂; Sigiri, Ceylon].

Bembecinus comberi (Turner).—Lohrmann, 1943:191 [assigned to *tridens* group].—Bohart and Menke, 1976:530 [listed].

I examined the unique male type in the British Museum (Natural History) in 1976 but did not have material for comparison. My notes agree with specimens I collected subsequently. Colin R. Vardy of that Museum confirms that one of the males from Kokmotte listed below agrees very well with the type from Sigiri (recte Sigiriya).

Bembecinus comberi has the distinction of being the largest and darkest of the seven Ceylonese species of the genus. It is distinguished from all species except *B. krameri*, new species, by the finer, denser punctation of sterna II and III (cf. Figures 27, 28), the convex rather than broadly emarginate apical margin of male sternum VI, the presence on posterior surface of hind femur of a single large seta and two tiny sensilla (cf. Figures 9, 12), the more elongate apical section of the cuspis of the male genitalia (cf. Figures 13, 19), and the

relatively broader hind femur of the females (cf. Figures 7, 8).

This species and *B. krameri* are the only Ceylonese members of the *peregrinus* Group and the characters listed above distinguish them from the other Ceylonese species that belong to the *tridens* group. The eyes are more strongly convergent below in *B. krameri* than in *B. comberi*, the ocular index being 2.3–2.4 in females and 2.3–2.5 in males of the former species and 1.8–1.9 in females and 2.0–2.2 in males of *B. comberi*. The pale apical bands on terga are broadened in middle in *B. krameri* and scarcely broadened in *B. comberi*, and the former species has a pair of spots on the scutellum that are lacking in the latter. The size also distinguishes the two, *B. comberi* having females 9–13 mm and males 9–11 mm long, whereas those sexes in *B. krameri* are respectively 8–9 mm and 7.0–8.5 mm long.

Bembecinus comberi is known only from Sri Lanka, and is widely distributed at a few localities in the northern half of the Dry Zone from sea level to about 100 m, with an average rainfall of 1000–1700 mm.

FEMALE.—Length 9–13 mm. Black, the following white to ivory: Basal half of mandible, labrum, clypeus entirely or only narrow upper margin, median blotch on upper half or more of supraclypeal area, narrow stripe along inner eye margin halfway to level of anterior ocellus, scape and flagellar segments beneath, very narrow apical stripe or pair of spots on posterior margin of pronotum extending over medial half or two-thirds, tiny posterolateral spot on scutum, fore femur beneath, midfemur with narrow stripe beneath, anterior surface of fore and midtibiae, fore tarsi in varying extent anteriorly, occasionally middle segments of midtarsi, narrow apical bands on terga I–V slightly broadened in middle but always wider laterally, that on I frequently interrupted in middle, and triangular posterolateral spots on sterna II–V diminishing in size posteriorly. Wings clear, slightly infumated along anterior margin, stigma and costal vein black, other veins brown.

Ocular index 1.8–1.9; distance between antennal scrobe and base of clypeus 4.0 times as great

as that between scrobe and inner eye margin; ocellar area without longitudinal groove behind anterior ocellus.

Second submarginal cell strongly narrowed above but not triangular.

Median triangular area of propodeal dorsum with moderately large subcontiguous punctures arranged more or less in oblique rows laterally, the rows separated by about half the diameter of a puncture; posterolateral margin of propodeum with a deep notch below (Figure 1).

Tergum VI without a median impunctate strip; sterna II and III (Figure 28) with small close punctures among which are interspersed larger punctures.

MALE.—Length 9–11 mm. Coloration much as in female except clypeus and supraclypeal area usually entirely pale, only basal flagellar segments pale beneath, tarsi except basal segment pale, usually tergum VI with narrow apical band and sternum VI with small posterolateral triangular spot.

Ocular index 2.0–2.2; distance between antennal scrobe and base of clypeus 5.5 times as great as that between scrobe and inner eye margin.

Second submarginal cell and propodeum as in female; posterior surface of hind femur with one subapical seta and two sensilla (Figures 9, 15, 16).

Apical margin of sternum VI convex; basal half of sternum VII with strong median ridge; ventral aspect of genitalia (Figure 13), setae on cuspis and paramere shorter and sparser than in *B. krameri*.

SPECIMENS EXAMINED (all USNM except where noted).—NORTHERN PROVINCE. *Mannar District*: 6♀, 14♂, 0.5 mi (0.8 km) NE of Kokmotte Bungalow, Wilpattu National Park, 15 and 16 Feb (5♀, 13♂; 3♀ labeled 21579 D, F, G, and 1♂, 21579 C) and 21–25 May (1♀), Krombein et al.; 1♂, Ma Villu, Cashew Corp., 17–21 Feb, Krombein et al.

EASTERN PROVINCE. *Trincomalee District*: 1♂, Kanniya, 15 m, 10 Oct, Krombein et al.; 1♀, Trincomalee, China Bay, 0–30 m, 6–11 Oct, in Malaise trap, Krombein et al. *Amparai District*: 4♀, 1♀ Ekgal Aru Sanctuary Jungle, 9–12 Jun (61076 A and 61176 B), Krombein et al.

CENTRAL PROVINCE. *Matale District*: 1♂,

Sigiri(ya), Mar, Comber (London; type).

NORTH WESTERN PROVINCE. *Puttalam District*: 1♀, Puttalam, 23 Feb, Keiser (Basel).

4. *Bembecinus krameri*, new species

Figures 2, 10, 14, 17

This species and *B. comberi* (Turner) are the only Ceylonese representatives of the *peregrinus* Group. The distinctions between them and the other Ceylonese species and the differentiation between these two are discussed under the preceding species, *B. comberi*.

The species is named for J.P. Kramer who furnished identifications of some of the hompterous prey of *B. pusillus* (Handlirsch).

Within Sri Lanka *B. krameri* is known from only two localities in the northern half of the Dry Zone at altitudes of not more than 50 m and average rainfall of 1000–1700 mm. It occurs also in South India.

HOLOTYPE.—♀; Sri Lanka, Eastern Province, Trincomalee District, China Bay Ridge Bungalow, 0–100 ft (0–30 m) 13–17 May 1976, K.V. Krombein, P.B. and S. Karunaratne, D.W. Balasooriya (USNM Type 100854).

FEMALE.—Length 9.0 mm. Black, the following yellow: Labrum, clypeus, supraclypeal area, narrow stripe along inner eye margin halfway from antennae to anterior ocellus, scape and flagellum beneath, band on apical margin of pronotum narrowly interrupted in middle, pronotal lobe, small posterolateral spot on scutum, larger lateral spot on scutellum, fore- and midfemora beneath, fore- and midtibiae externally, hind tibia on basal half, fore tarsus except posterior edge of basitarsus, middle segments of mid- and hind tarsi, narrow apical bands on terga I–V, those on II–V produced anteriorly into a broadened triangular mark in middle, and posterolateral marks on sterna II and III, the latter smaller than former. Wings clear, anterior margin of forewing slightly infumated, stigma and veins brown.

Ocular index 2.4; distance between margin of antennal scrobe and base of clypeus 5.0 times as

great as that between scrobe and inner eye margin; ocellar area without longitudinal groove behind anterior ocellus.

Second submarginal cell strongly narrowed above but not triangular.

Median triangular area of propodeal dorsum less closely punctate than in *B. comberi*, and narrowly impunctate basally; posterolateral angle of propodeum with a deep notch below as in *B. comberi* (Figure 2).

Tergum VI without a median impunctate strip; sterna II and III with small close punctures and a few interspersed larger ones as in *B. comberi* (Figure 28).

ALLOTYPE.—♂; same label data as holotype (USNM).

MALE.—Length 7.0 mm. Coloration as in holotype except as follows: only basal half of clypeus pale; flagellum reddish beneath; posterolateral spot absent on scutum; tergum VI with a small pale spot near middle of apical margin; and sterna II–IV with posterolateral spots gradually decreasing in size.

Ocular index 2.4; distance between margin of antennal scrobe and base of clypeus 5.0 times as great as that between scrobe and inner eye margin.

Posterior surface of hind femur with several subapical setae.

Second submarginal cell strongly narrowed above but not triangular.

Apical margin of sternum VI convex; basal two-thirds of sternum VII of paratype with median ridge; ventral aspect of genitalia of paratype (Figure 14), setae on paramere and cuspis somewhat denser and noticeably longer than in *B. comberi*.

PARATYPES (all USNM).—2♀, 3♂, same label data as holotype. 1♀, same locality as holotype, but 0–30 m, 8–11 Oct 1977, K.V. Krombein, P. B. Karunaratne, P. Fernando, T. Wijesinhe, and M. Jayaweera. NORTHERN PROVINCE, *Mannar District*: 2♀, 0.5 mi (0.8 km) NE Kokmotte Bungalow, Wilpattu National Park, 21–25 May 1976, K.V. Krombein, P.B. and S. Karunaratne, and D.S. Balasooriya. 1♀, India, Coimbatore, May 1947,

P.S. Nathan (D.G. Shappirio collection). A pair of paratypes will be deposited in the National Museums of Sri Lanka, Colombo, and a female paratype in the British Museum (Natural History), London.

Female paratypes are 8–9 mm long, the color pattern is very similar except that the Indian specimen has more yellow on the tibiae and tarsi, and sternum IV also has a small triangular posterolateral mark, and the ocular index is 2.3–2.4. Male paratypes are 7.8–8.5 mm long, the color pattern is the same except that clypeus may be almost all yellow or almost all dark, the apical band on tergum I may be broadly interrupted in middle, and tergum VI and sternum IV may lack pale spots.

One specimen bearing the same label data as the holotype is excluded from the type series because it is a partial gynandromorph. The head is essentially female except that the left antenna has 12 segments as in a normal female, but the eleventh segment has the normal spinose projection of the male and the twelfth is concave beneath as in the male. The thorax appears to be entirely female and the fore tarsi bear the typical heavier spines of the female. The abdomen is male but tergum VIII has a median apical cleft and sternum VI is deformed apically.

5. *Bembecinus luteolus*, new species

Figures 3, 23, 24, 30

This is one of the most unusual species of Ceylonese *Bembecinus* in a number of details. It is the most extensively maculated with pale markings, and it is the smallest (♀, 4.3–6.8 mm and ♂, 5.5–6.2 mm). It is the only species with a petiolate second submarginal cell. It has denser silvery tomentum on the clypeus and mesopleuron than in the other species. The propodeum is most unusual in that the declivous posterior slope is scarcely concave and the posterolateral angle is rounded instead of being rather sharply compressed. The male genitalia (Figure 23) are also unusual in that the paramere and cuspis have

longer denser hair, the paramere is relatively narrower and the cuspis tapers gradually to the apex rather than having a digitate apical section.

It has been collected at only three localities in the most xeric parts of the extreme southeast and northwest where the average annual rainfall ranges from 860 to 1075 mm. Apparently it is very sporadic in appearance for I collected a single pair near the beach at Palatupana in March 1972, and searched unsuccessfully for it in the same area during trips in August 1972, February 1975, September 1977, and June 1978. In January 1979 we collected a good series of 20♀ and 9♂ near the beach, but it was not to be found in Palatupana on four subsequent trips during August and October 1980, and March and April 1981.

It is known so far only from localities on or near the sea coast of Sri Lanka. Its occurrence at Pesalai Beach on Mannar Island suggests that it may occur also on some of the islets of Adams Bridge linking Mannar to the narrow peninsula of southern India only 30 km to the west.

HOLOTYPE.—♀; Sri Lanka, Southern Province, Hambantota District, Palatupana, near Wildlife and Nature Protection Society Bungalow, 0–15 m, 20 Jan 1979, K.V. Krombein (USNM Type 100855).

FEMALE.—Length 6.8 mm. Black, pale markings on head and thorax light yellow, on abdomen creamy as follows: mandible except tip, palpi, labrum, clypeus, supraclypeal area, narrow stripe along inner eye margin extending two-thirds distance from antennae to anterior ocellus, antenna beneath, broad apical margin of pronotum and lobe, broad stripe along lateral margin of scutum, scutellum except narrow median emargination anteriorly, broad stripes on apical two-thirds or more of terga II–V, the anterior margins biemarginate but very shallowly and broadly so on II and III and more deeply and narrowly on IV and V, rounded spot on apical two-thirds of tergum VI, sterna II–V with posterolateral mark decreasing in size gradually on posterior sterna, those on II–IV joined by a very narrow apical stripe. Wings clear, costa, subcosta and stigma dark

brown, other veins lighter. Head and mesopleuron with dense appressed silvery tomentum.

Ocular index 2.1; distance between margin of antennal scrobe and base of clypeus twice as great as that between scrobe and inner eye margin; ocellar area with a shallow median groove behind anterior ocellus.

Second submarginal cell petiolate, the petiole about a third as long as height of triangular part of cell.

Median triangular area of propodeum with small punctures separated by half the diameter of a puncture or slightly more, base not impunctate; posterior surface of propodeum scarcely concave (Figure 30); posterolateral margin rounded rather than compressed and with a deep notch behind (Figure 3).

Tergum VI with sparser punctures than in other species and with a narrow median impunctate space on posterior half; sterna II and III with sparser and larger uniform punctures than in preceding species.

ALLOTYPE.—♂; same label data as holotype (USNM).

MALE.—Length 6.0 mm. Color and vestiture as in female except as follows: propodeum with a small median spot on dorsal surface, tergum VI with a broad apical band, tergum VII with apical spot, and sternum V with small, triangular, posterolateral spot.

Ocular index 2.4; distance from antennal scrobe to base of clypeus three times as great as distance between scrobe and inner eye margin; ocellar area with median groove stronger than in female.

Wings and propodeum as in female.

Apical margin of sternum VI broadly and shallowly emarginate; sternum VII without median ridge; ventral aspect of genitalia (Figure 23), paramere and cuspis with longer denser setae than in other species and paramere narrower, and cuspis tapered gradually toward apex; apex of aedeagus (Figure 24) with two rows of flattened teeth along ventral midline as in other species.

PARATYPES (all USNM).—1♀, 1♂, same label data as holotype. 18♀, 7♂, same locality as holo-

type but 0–50 ft (0–15 m), 18–21 Jan 1979, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, S. Siriwardane, and T. Gunawardane. 1♀, 1♂, Yala, Palatupana (= same locality as holotype), 8–10 Mar 1972, K.V. Krombein, P.B. Karunaratne. SOUTHERN PROVINCE, *Hambantota District*: 1♀, Bundala Sanctuary Circuit Bungalow, 5–50 ft (2–15 m), 22–24 Aug 1980, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, L. Jayawickrema, and L. Weeratunge. NORTHERN PROVINCE, *Mannar District*: 1♀, Pesalai beach, 19 Feb 1979, K.V. Krombein, T. Wijesinhe, S. Siriwardane, and T. Gunawardane. Two pairs of paratypes will be placed in the National Museums of Sri Lanka, Colombo, and one pair each in the British Museum (Natural History), London, and in the Rijksmuseum van Natuurlijke Historie, Leiden.

Female paratypes are 4.3–6.8 mm long, have an ocular index of 2.1–2.3, and show little color variation as follows: two lack the apical spot on tergum VI, several have a small median spot on dorsal surface of propodeum, and the mesopleural spot varies in size but is always present. Male paratypes are 5.5–6.2 mm long, have an ocular index of 2.3–2.5, and show little color variation as follows: median spot on propodeal dorsum may be absent, sternum VI may have a triangular posterolateral spot joined by a narrow apical stripe, and sternum VII may have an apical spot.

6. *Bembecinus broomfieldi*, new species

FIGURES 4, 5, 12, 22, 27

This is the fourth and last Ceylonese *Bembecinus* with a notch on the posterolateral margin of the propodeum, but it is weaker (Figures 4, 5) than in the preceding three species (Figures 1–3). It has sparser punctation on sterna II and III (Figure 27) and resembles *B. luteolus*, new species, in that respect rather than *B. comberi* (Turner) and *B. krameri*, new species. It is readily distinguished from *B. luteolus* by the reduced pale maculations, non-petiolate second submarginal cell, larger size, and strongly concave posterior surface of the propodeum.

Bembecinus broomfieldi has a wide distribution throughout most of the Dry Zone at altitudes of not over 100 m and with average annual rainfall of 860–1725 mm, but there is one specimen from the Wet Zone where the average annual rainfall is 3900 mm. The species occurs also in South India, from whence I have four males. They differ from the Ceylonese population in having white rather than yellow abdominal markings and in having a small, median, pale spot on apical margin of tergum IV, which is almost always lacking in Ceylonese specimens. However, the genitalia are identical.

The species is named for P.S. Broomfield who identified a number of homopterous prey of *Bembecinus*.

HOLOTYPE.—♀; Sri Lanka, Eastern Province, Trincomalee District, Trincomalee, China Bay Ridge Bungalow, 0–100 ft (0–30.5 m), 16 and 17 May 1976, K.V. Krombein, P.B. and S. Karunaratne, D.W. Balasooriya (USNM Type 100856).

FEMALE.—Length 6.5 mm. Black, the following yellow: palpi, labrum, clypeus except reddish median blotch on apical margin, supraclipeal area, narrow stripe along inner eye margin halfway from antennae to anterior ocellus, antenna beneath, apical band on pronotum and lobe, stripe laterally on scutum except at base, large round lateral spot on scutellum, small transverse bar on middle of postscutellum, spot on posterolateral angle of propodeum, fore- and midcoxae except base, fore- and midfemora beneath, outer surface of tibiae, tarsi except posterior edge of fore basitarsus, wide subapical band on tergum I narrowed in middle, apical bands on II, III, and V, those on II and III broadly and shallowly biemarginate anteriorly, that on V broad on lateral fourth and narrow on median half, posterolateral triangular spots on sterna II–V, decreasing in size posteriorly, those on II joined by a narrow apical band. Wings clear, veins brown.

Ocular index 1.9; distances subequal between antennal scrobe and base of clypeus and scrobe and inner eye margin; ocellar area without a median groove.

Second submarginal cell strongly narrowed above, triangular but not petiolate.

Median triangular area of propodeal dorsum with a narrow impunctate strip anteriorly, elsewhere with small, subcontiguous punctures; posterolateral angle of propodeum compressed and with a weak notch below (Figures 4, 5).

Tergum VI with a narrow impunctate strip on apical half; sterna II and III with larger, more separated punctures (Figure 27) than in *B. comberi* (Turner) (Figure 28).

ALLOTYPE.—♂; same locality as holotype but 0–30 m, 8–11 Oct 1977, K.V. Krombein, P.B. Karunaratne, P. Fernando, T. Wijesinhe, and M. Jayaweera (USNM).

MALE.—Length 5.8 mm. Color as in female except as follows: clypeus entirely pale and band on tergum I narrowly interrupted in middle.

Ocular index 2.3; distance from antennal scrobe to base of clypeus 1.8 times as great as distance from scrobe to inner eye margin; ocellar area without median groove.

Wings and propodeum as in female.

Apical margin of sternum VI broadly and shallowly emarginate; sternum VII with weak median ridge on basal half; ventral aspect of genitalia of paratype (Figure 22), lateral margin of paramere rounded outward slightly rather than slightly narrowed in middle as in following three species.

PARATYPES (all USNM except where noted (Oregon)).—3♀, same label data as holotype. **NORTHERN PROVINCE, Vavuniya District:** 2♀, Parayanalankulam, irrigation canal, 25 mi (40 km) N Medawachchiya, 100 ft (30 m), 20–25 Mar 1970, Davis and Rowe. **Mannar District:** 1♀, 0.5 mi (0.8 km) NE Kokmotte Bungalow, Wilpattu National Park, 22–25 May 1976, in Malaise trap, K.V. Krombein, P.B. and S. Karunaratne, and D.W. Balasooriya. **NORTH CENTRAL PROVINCE, Anuradhapura District:** 1♀, 1♂, Padaviya, 180 ft (55 m), archeological site, 20 May 1976, K.V. Krombein, P.B. and S. Karunaratne, and D.W. Balasooriya; 4♀, 3♂, Wildlife Society Bungalow, Hunuwilagama, 200 ft (61 m), 10–19 Mar 1970, Davis and Rowe. **CENTRAL PROVINCE, Kandy District:** 1♀, Has-

alaka Irrigation Bungalow, 5 mi (8 km) NW Mahiyangana, in Malaise trap, 30 Mar–9 Apr 1971, P. and P. Spangler. SABARAGAMUWA PROVINCE, *Ratnapura District*: 1♂, Gilimale, Induruwa Jungle, in Malaise trap, 2 Feb 1979, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, and T. Gunawardane. SOUTHERN PROVINCE, *Hambantota District*: 2♀, Palatupana, Wildlife and Nature Protection Society Bungalow, 0–10 m, in Malaise trap, 5–7 Oct 1980, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, L. Jayawickrema, and V. Gunawardane. SOUTH INDIA: 1♂, Karikal, Tanjore, Sep 1951, P.S. Nathan (K.V. Krombein collection in USNM); 2♂, Nilgiri Hills, Moyar Camp, 2900 ft (884 m), Apr 1954, P.S. Nathan (Oregon); 1♂, Tranquebar, Jul 1953, P.S. Nathan (Oregon). Two pairs of paratypes will be deposited in the National Museums of Sri Lanka, Colombo, and one pair in the British Museum (Natural History), London.

Female paratypes are 6.5–7.5 mm long, have an ocular index of 1.9–2.0, and differ only slightly in color pattern as follows: clypeus varies in extent of dark markings to entirely black, and band on tergum I is frequently divided in middle. Male paratypes are 5.5–7.5 mm long, the ocular index is 2.1–2.3, and the color in Ceylonese males varies as follows: the thoracic markings are reduced in size in one specimen, and one specimen has a tiny median spot at apex of tergum IV. In the Indian paratypes the abdominal markings are white rather than yellow, all have a small median spot on apical margin of tergum IV, the band is complete on tergum I in three specimens, and one specimen has a small, round, lateral spot on tergum VI.

7. *Bembecinus knighti*, new species

FIGURE 21

This is the first of three species of *Bembecinus* that are separated at once from the four preceding species because the posterolateral angles of the propodeum are not notched (cf. Figures 1, 6). It

is easily separated from *B. pusillus* (Handlirsch) and *B. proximus* (Handlirsch) because the first five or six (some males) terga have complete apical yellow bands whereas the latter two species have spots rather than bands on two terga and either the third or fourth tergum is completely black. Also, the eyes are more strongly convergent below in *B. knighti* than in the other two species.

Bembecinus knighti is known from only a short series of both sexes from near sea level at Palatupana in the Dry Zone where the average annual rainfall is only 860 mm.

The species is named for W.J. Knight, who identified a number of homopterous prey of *Bembecinus*.

HOLOTYPE.—♀; Sri Lanka, Southern Province, Hambantota District, Palatupana, Wildlife and Nature Protection Society Bungalow, 2–5 Feb 1975, K.V. Krombein, P.B. Karunaratne, P. Fernando, and E.G. Dabrera (USNM Type 100857).

FEMALE.—Length 8.3 mm. Black, the following yellow: palpi, extreme base of mandible, labrum, clypeus, supraclypeal area, narrow stripe along inner eye margin extending halfway to anterior ocellus, antenna beneath, band on apical margin of pronotum and lobe, lateral stripe on scutum except at base, round lateral spot on scutellum, band across middle of postscutellum, tiny spot above on mesopleuron, stripe on posterolateral angle of propodeum, fore coxa except base, small spot at apex of midcoxa, fore- and midfemora beneath, all of fore- and midtibiae except small spot on inner surface, outer surface of hind tibia except apex, all tarsi, broad median band on tergum I with anterior margin broadly and shallowly emarginate, apical bands on terga II–V, shallowly and broadly biemarginate on anterior margin, and triangular posterolateral spots on sterna II–IV decreasing in size on successive segments, those on II joined by a narrow apical band. Wings clear, veins light brown.

Ocular index 2.6; distance between antennal scrobe and base of clypeus 4.0 times as great as distance between scrobe and inner eye margin; ocellar triangle without a median groove.

Second submarginal cell strongly narrowed above but not triangular.

Median triangular area of propodeal dorsum narrowly impunctate anteriorly, elsewhere with small, somewhat separated punctures in middle, becoming subcontiguous laterally; posterolateral edge of propodeum compressed below but not notched.

Tergum VI with a narrow median impunctate strip on apical two-thirds; sterna II and III with larger, more separated punctures than in *B. comberi* (Turner).

ALLOTYPE.—♂; same label data as holotype (USNM).

MALE.—Length 7.5 mm. Color as in female except as follows: basal two-thirds of mandible pale; stripe on scutum extending farther basad; mesopleuron with two spots, a smaller below upper; tergum VI with apical band; and sterna II–V with triangular posterolateral spots joined by a narrow apical stripe.

Ocular index 3.2; distance between antennal scrobe and base of clypeus 6.0 times as great as distance between scrobe and inner eye margin; ocellar area without median groove.

Wings and propodeum as in female.

Apical margin of sternum VI broadly and shallowly emarginate; sternum VII with median ridge on basal half; ventral aspect of genitalia of paratype (Figure 21), outer margin of paramere narrowed at middle, cuspis relatively longer than in *B. pusillus* and *B. proximus*.

PARATYPES (all USNM).—2♂, same label data as holotype. 3♀, same locality but 0–50 ft (0–15.5 m), 18–21 Jan 1979, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, S. Siriwardane, and T. Gunawardane. A pair of paratypes will be deposited in the National Museums of Sri Lanka, Colombo, and a female paratype in the British Museum (Natural History), London.

Female paratypes are 7.7–8.7 mm long, the ocular index is 2.6–2.7, and the mesopleural spot is lacking in two specimens. Male paratypes are 6.8–7.4 mm long, the ocular index is 3.2–3.4, and both lack mesopleural spots, a band on tergum

VI and apical bands on sterna II–IV, and sternum V is dark.

8. *Bembecinus pusillus* (Handlirsch)

FIGURES 19, 25

Stizus pusillus Handlirsch, 1892:46 [♂ from Andaman Islands, ♀ from Malacca and Java]; 1895:978, 1035 [lists ♀, ♂ from Burma, Borneo, and Sumatra].—Bingham, 1897:283 [description condensed from Handlirsch, 1892].—Dalla Torre, 1897:529 [listed].

? *Stizus prismaticus* (Smith).—Bingham, 1896:444 [Pundaluooya; probably a misidentification of *B. pusillus*].

Bembecinus pusillus (Handlirsch).—Vecht, 1949:306 [brief note].—Bohart and Menke, 1976:532 [listed, Indonesia].

Handlirsch noted in his original description that he was describing this species from a male from Andaman Islands and a female from Malacca, both in the Vienna Museum, and a female from Java in the Budapest Museum. I have examined all three specimens and find that each belongs to a different species. I have selected the male as lectotype. It bears the locality label "Tlason./Anda/manen/Post II, 1878" and an identification, "pusillus/det. Handlirsch." It agrees in the color pattern, ivory maculations, and genitalia with the Ceylonese males described below. The female from Java is a specimen of *B. reversus* (Smith), and the female from Malacca is apparently an undescribed species.

Bembecinus pusillus and the following species, *B. proximus* (Handlirsch), are distinguished from the other Ceylonese species of the genus in lacking a notch or emargination on the compressed posterolateral margin of the propodeum (cf. Figures 1, 6). The Ceylonese populations of the two species are easily separated because both sexes of *B. pusillus* have white to ivory maculations on the abdomen rather than bright yellow. Both species have a pair of pale spots on the first abdominal tergum, and the second and fourth have pale apical bands, but the third tergum has a median pale spot in *B. pusillus* and is all black in *B. proximus*. Furthermore, in the female of *B. pusillus* the antennal socket is equidistant from the inner

eye margin and the base of the clypeus, whereas in *B. proximus* it is closer to the base of the clypeus than to the inner eye margin.

Bembecinus pusillus and *B. proximus* share the distinction of being the most widely distributed species of *Bembecinus* within Sri Lanka, although *B. pusillus* is somewhat less common than *B. proximus*. The present species occurs in both the Dry Zone and the Wet Zone from sea level to about 2200 m and with average annual rainfall ranging from 965 to 3900 mm. I have seen the species also from South India, Orissa, Deesa, Nepal, and the Andaman Islands.

The Ceylonese population has white to ivory maculations but the pale maculations of Indian specimens range from white to ivory to yellow.

FEMALE.—Length 6.3–7.6 mm. Black, the following white to ivory: palpi, labrum except a median basal spot of variable extent, clypeus rarely, part of supraclypeal area rarely, narrow short line along inner eye margin from upper margin of antennal socket halfway to anterior ocellus, antenna beneath, narrow apical margin of pronotum and lobe, narrow band on posterior two-thirds of lateral margin of scutum, spot on lateral fourth of scutellum, band on median half of postscutellum, narrow band on posterolateral margin of propodeum, apices narrowly of coxae, band beneath on fore- and midfemora, basal half of outer surface of tibiae, anterior half or more of fore tarsal segments, a pair of broad subapical spots on first abdominal tergum sometimes joined on midline, apical bands on second and fourth terga with broadly and shallowly biemarginate anterior margins, band on second wider, small median triangular spot on third tergum at apex, small round lateral spot on fifth tergum, and posterolateral triangular spots on second to fourth sterna decreasing in size posteriorly. Wings clear, veins brown.

Ocular index 1.9–2.1; distance between margin of antennal scrobe and inner eye margin subequal to that between scrobe and base of clypeus; ocellar area without median groove behind anterior ocellus.

Second submarginal cell strongly narrowed

above, triangular or almost so, but not petiolate.

Median triangular area of propodeal dorsum narrowly impunctate anteriorly except at sides, elsewhere with small punctures ranging from subcontiguous to separated by half the diameter of a puncture; posterolateral angle of propodeum rounded, not notched.

Tergum VI without narrow impunctate median space but extreme apex impunctate; sterna II and III with sparser and larger punctures than in *B. comberi* (cf. Figure 27).

MALE.—Length 5.8–7.5 mm. Color as in female except as follows: most or all of clypeus and supraclypeal area, stripe along inner eye margin occasionally extending downward to base of clypeus, lateral stripe on scutum variable in extent but never reaching base, usually all tibiae externally, spots on tergum V sometimes extended toward middle to form a band, spots on sternum II rarely united by a narrow apical band, and sternum V usually with small, posterolateral, triangular spot.

Ocular index 2.3–2.4; distance between antennal scrobe and base of clypeus 1.7–2.0 times distance between scrobe and inner eye margin.

Second submarginal cell and propodeum as in female.

Apical margin of sternum VI broadly and shallowly emarginate; sternum VII without a median ridge; ventral aspect of genitalia (Figure 19), outer margin of paramere narrowed at middle, its apex more narrowly rounded than in *B. proximus*, cuspis shorter than in *B. knighti*.

SPECIMENS EXAMINED (all USNM except where noted).—NORTHERN PROVINCE. *Vavuniya District*: 1♀, Parayanalankulam, irrigation canal, 25 mi (40 km) NW Medawachchiya, 100 ft (30 m), 20–25 Mar, Davis et al. *Mannar District*: 1♀, 0.5 mi (0.8 km) NW Kokmotte Bungalow, Wilpattu National Park, 21–25 May, Krombein et al.; 1♀, Olraithoduvai, 15 ft (4.6 m), 10 mi (16.2 km) NW Mannar, 5 Nov, in Malaise trap, Hevel et al.; 6♀, 1♂, Pesalai Beach, 19 Feb, Krombein, et al.

NORTH CENTRAL PROVINCE. *Anuradhapura District*: 1♂, Padaviya, Irrigation Bungalow, 180 ft (55 m), 18 May, in Malaise trap, Krombein et al.; 1♂,

Wildlife Society Bungalow, Hunuiwilagama near Wilpattu National Park, 200 ft (61 m), 10–19 Mar, Davis et al., 3♂, Panikka Wila Bungalow, Wilpattu National Park, 1 Nov, Krombein et al. *Polonnaruwa District*: 2♀, 1♂, Pimburettawa, 13 mi (21 km) S Mannampitiya, 1850 ft (564 m), 9–12 Nov, Flint et al.

EASTERN PROVINCE. *Trincomalee District*: 8♀, 1♂, Trincomalee, China Bay Ridge Bungalow, 0–100 ft (0–30 m), 27–31 Jan (5♀), 26 Feb (♀), 13–17 May (♀), 8–11 Nov (♀, ♂), Krombein et al.; 1♂, Nilaveli, 18 and 19 Nov, Kosztarab et al. *Batticaloa District*: 3♀, Madura Oya, Punani, 500 ft (152 m), 9–14 Jun, P.B. Karunaratne (Ottawa). *Amparai District*: 3♀, Panama, Radella Tank, 50 ft (15 m), 14 Jun, Krombein et al.

CENTRAL PROVINCE. *Kandy District*: 2♀, 3♂, Kandy, Udawattakele Sanctuary, 2100 ft (640 m), 16–31 Aug (2♂), 1–17 Sep (♀), 1–3 Oct at black light (♀), 27 and 28 Oct (♂), S. Karunaratne, Krombein et al. *Nuwara Eliya District*: 1♀, Hakgala Natural Reserve, 6 and 7 Feb, Krombein et al.

WESTERN PROVINCE. *Colombo District*: 12♀, 2♂, Colombo (includes Colpetty (103 Galle Road), Victoria Park, Colombo National Museum), 7 (2♀), 8 (♀) and 16 (4♀) Apr, 15 (2♀) May, 8 (♀) Jul, 25 (♂) and 26 (♂) Aug, 21 (♀) and 23 (♀) Nov, Halstead, Wijesinha (USNM, San Francisco); 4♀, Nugegoda, Papiliyana, 3 and 4 May (3♀; 5375 A, 5475 A, B), 5 Jul (♀; 7575 A), P.B. Karunaratne; 2♀, Gampaha Botanic Garden, 4 Mar, 24 May, Krombein et al., Messersmith et al.; 6♀, 1♂, Labugama Reservoir, 400 ft (122 m), 9 May (6♀), 11 Jul (♂), Krombein et al.; 4♀, 8♂, Ratmalana near airport, 50 ft (15 m), 13 Jan (♂), 6 June (4♀, 7♂); 1♂, Padukka, Arakawila Jungle, 10 Dec, P.B. Karunaratne.

SABARAGAMUWA PROVINCE. *Kegalla District*: 1♀, 4♂, Kitulgala, Makande Mukalana, 3 and 4 Feb, Krombein et al. *Ratnapura District*: 9♀, 4♂ Gilimale, Induruwa Jungle, 2 Feb (♂), 5–7 Feb (♀), 7 and 8 Mar (♂ in Malaise trap), 16–19 Apr (2♀, 1 in Malaise trap), 17–21 Jun (5♀, 2♂; 1♀ in Malaise trap; 3♀, 61776 B–D), 10 Oct (♀ in Malaise trap), Krombein et al. 2♂, Rajawaka, 20 Jun, Krombein et al.; 1♀, Panamure, 500 ft (152 m), 15–21 Oct,

Flint et al.; 1♂, Pubbarapotha, Katupat Oya, 400 ft (122 m), 14 Oct, Flint et al.; 2♂, Uggalkaltota, 31 Jan–5 Feb, 23–26 Jun, Davis et al., Krombein et al.

UVA PROVINCE. *Badulla District*: 1♂, Ulhitiya Oya, 15 mi (24 km) NNE Mahiyangana, 5 and 6 Sep, Krombein et al. *Monaragala District*: 18♀, 9♂, Angunakolapelessa, 100 m, 21–23 Jan (4♀, 4♂ in Malaise trap), 27 and 28 Mar (2♀, 1♂; 1♀, 1♂ in Malaise trap), 17–19 Jun (12♀, 4♂; 2♀, 2♂ in Malaise trap), Krombein et al.; 1♀, 1♂, Mau Aru, 10 mi (16.2 km) E Uda Walawe, 100 m, Krombein et al.; 1♀, Nilgala, 1–14 Jul, P.B. Karunaratne (Ottawa); 1♀, Inginiyagala, 3 Sep, Keiser (Basel).

SOUTHERN PROVINCE. *Hambantota District*: 1♀, 1♂, Palatupana, WLNPS Bungalow, 0–50 ft (0–15 m), 18–21 Jan (♂), 2–6 Feb (♀), Krombein et al.

9. *Bembecinus proximus* (Handlirsch)

FIGURES 6, 8, 20

Stizus reversus Smith.—Cameron, 1890:246–247, pl. 10: fig. 1 [misidentification].

Stizus proximus Handlirsch, 1892:45–46 [♂, ♀; “species orientalis”]; 1895:977, 1035 [listed].—Bingham, 1897:283 [brief description].—Dalla Torre, 1897:529 [listed].—Turner, 1917:182 [records specimens from Anamalai Hills, South India, and Cocos Islands].

Bembecinus proximus (Handlirsch).—Vecht, 1949:306 [brief notes].—Bohart and Menke, 1976:532 [listed].

Handlirsch noted in his original description that the species was based on a pair from the Oriental Region identified as *Stizus reversus* Smith by Cameron. Later, Handlirsch (1895:977) recorded a female from Burma, and noted that *S. proximus* would become a synonym of *S. reversus* if Smith's species was actually identical. He noted in his systematic-geographic table (1895:1035) that the type series of *S. proximus* came from India. Bingham did not see *S. proximus* and provided only a brief color description taken from Handlirsch (1892). Vecht (1949) in his notes on Indo-Australian species suggested that the male should be selected as lectotype. Cameron (1890:247) had noted variation in the quantity of

yellow on the abdomen and legs, so undoubtedly he confused several species under what he misidentified as the Indonesian *Stizus reversus*.

The syntype series consists of a single pair in the Vienna Museum, each bearing only one label, "proximus/det. Handl." Inasmuch as the specimens were sent to Handlirsch by Cameron, it is probable that they were captured by Rothney at Barrackpore near Calcutta. Both agree very well in morphological characters with the extensive series of *B. proximus* that I have assembled from many localities in Sri Lanka and from several localities in South India. The syntypes have the pale markings more of a creamy color than the more intense yellow of Ceylonese specimens, and the paired spots on the first tergum are somewhat larger. Specimens from South India also have creamy markings. I have selected the male syntype as the lectotype.

As noted in the discussion of the previous species, *B. pusillus* (Handlirsch), these two taxa are distinct from all other Ceylonese *Bembecinus* except *B. knighti* in lacking a notch or emargination on the posterolateral angle of the propodeum (cf. Figures 1, 6). *Bembecinus proximus* and *B. pusillus* are distinguished readily from each other, as noted in the discussion of the latter species.

Bembecinus proximus and *B. pusillus* are the most widely distributed species of the genus within Sri Lanka, and the former is more abundant than the latter. The present species occurs in both the Dry Zone and the Wet Zone from sea level to 700 m, and in areas with average annual rainfall ranging from 965 to 3900 mm. I have seen the species also from South India and Bengal.

FEMALE.—Length 6.7–9.4 mm. Black, the following yellow: palpi, labrum, clypeus except occasionally extreme base, supraclypeal area varying from entirely yellow to entirely black, narrow stripe along inner eye margin extending upward halfway between antennae and anterior ocellus and sometimes downward to base of clypeus, band on apical margin of pronotum and lobe, lateral stripe or posterolateral spots on scutum, spot on lateral fourth of scutellum, band on median half or third of postscutellum, stripe of var-

iable length on posterolateral angle of propodeum, apex of fore coxa, stripe beneath on fore and midfemora, stripe on outer surface of fore and midtibiae, spot at base of hind tibia, fore and midtarsi except posterior edge of basitarsi, wide subapical spots on tergum I sometimes very narrowly separated on midline, apical band on tergum II broadly and shallowly biemarginate on anterior margin, narrow apical band on tergum IV on median half or two-thirds, small oval posterolateral spot on tergum V, and triangular posterolateral spots on sterna II–IV diminishing in size on successive sterna, those on II sometimes connected by a narrow apical band. Wings clear, veins brown.

Ocular index 1.8–1.9; distance between antennal scrobe and inner eye margin 1.3 times distance between scrobe and base of clypeus; ocellar area without median groove behind anterior ocellus.

Second submarginal cell strongly narrowed above but not petiolate.

Median triangular area of propodeum narrowly impunctate anteriorly except at sides, mostly subcontiguously punctate elsewhere; posterolateral propodeal margin rounded, not notched (Figure 6).

Tergum VI with narrow median impunctate strip; sterna II and III with larger more scattered punctures than in *B. comberi* (cf. Figures 27, 28).

MALE.—Length 6.7–8.3 mm. Color as in female except as follows: supraclypeal area entirely pale except rarely very narrowly at side, stripe along inner eye orbit extending to base of clypeus, posterolateral spot on scutum rarely lacking, band on postscutellum sometimes reduced to a small median spot, hind tarsus usually pale except apical segment; tergum V sometimes with a median spot and occasionally lateral spots joined by an apical band, and sternum V with a triangular posterolateral spot, which is occasionally tiny.

Ocular index 2.3–2.4; distance between antennal scrobe and base of clypeus 2.0–2.5 times distance between scrobe and inner eye margin.

Second submarginal cell and propodeum as in female.

Apical margin of sternum VI broadly and shallowly emarginate; sternum VII with median ridge on basal half; ventral aspect of genitalia (Figure 20), outer margin of paramere narrowed at middle, its apex more broadly rounded than in *B. pusillus*, cuspis shorter than in *B. knighti*.

SPECIMENS EXAMINED (all USNM except where noted).—**NORTHERN PROVINCE.** *District Unknown:* 1♀, Pudavaikaddu, 2 Jul, Keiser (Basel). *Jaffna District:* 3♀, 1♂, Kilinochchi, 24–27 Jan, 80 ft (24 m), Krombein et al. *Mannar District:* 5♀, 2♂, 0.5 mi (0.8 km) NE Kokmotte Bungalow, Wilpattu National Park, 50–100 ft (15–30 m), 22 and 23 Jan (3♀, 2♂), 15 and 16 Feb (1♀), 22–25 May (1♀ in Malaise trap), Krombein et al.

NORTH CENTRAL PROVINCE. *Anuradhapura District:* 1♀, Kalkudiya Pokuna, Mihintale, 11 Mar, P.B. Karunaratne (31176 C); 1♂, Padaviya Archeological site, 60 m, 11–14 Oct, Krombein et al.; 1♂, Ritigala Natural Reserve, 24 and 25 Feb, Krombein et al.

EASTERN PROVINCE. *Trincomalee District:* 14♀, 26♂, China Bay Ridge Bungalow, 0–100 ft (0–30 m), 27–31 Jan (2♀, 7♂), 25–50 ft (8–15 m), 26 Feb (3♀, 1♂), 0–100 ft (0–30 m), 13–17 May (6♀; 1 in Malaise trap), 0–30 m (0–9 m), 8–11 Oct (3♀, 18♂; 3♂ in Malaise trap), Krombein et al. *Amparai District:* 8♀, 7♂, Ekgal Aru Sanctuary Jungle, 100 m, 19–22 Feb (1♀, 5♂), 9–11 Mar (7♀, 2♂), Krombein et al.

CENTRAL PROVINCE. *Matale District:* 1♀, Sigiriya, 18 Jun, Krombein et al. *Kandy District:* 1♂, Ambacotta, 13 Dec, Keiser (Basel); 2♀, Hasalaka, 17 Feb, P.B. Karunaratne (21777 C and D); 5♀, Thawalamtenne, 21 Mar (1♀ in Malaise trap), 740–760 m, 16–18 Sep (4♀), Krombein et al.; 15♀, 1♂, Kandy (includes Udawattakele Sanctuary, Lady Blake's Drive, Lady Horton's Drive, Roseneath, Pitakanda), 8–11 Feb (1♀); 25 Mar (6♀ in Malaise trap); 19 June (1♀); 5–15 (1♀), 13 (1♀), and 20–30 Jul (1♀); 16–31 (1♀) and 20 Aug (1♂);

30 Sep (1♀); 1–3 Oct (1♀); 16 Dec (1♀), S. Karunaratne, Keiser, Krombein et al., Spangler et al. (USNM, Basel); 1♀, Peradeniya Central Agricultural Center, 25 May, Halstead (San Francisco).

NORTH WESTERN PROVINCE. *Kurunegala District:* 1♀, Badegamuwa Jungle, 24–27, Krombein et al.

WESTERN PROVINCE. *Colombo District:* 2♀, Papiliyana, Nugegoda, 17 May and 24 Nov, P.B. Karunaratne; 1♀, Kohugala, Nugegoda, 6 Jun, Krombein et al.; 3♂, Labugama Reservoir Jungle, 2–4 Feb (1♂), 110 m, 29 Oct (2♂), Krombein et al.

SABARAGAMUWA PROVINCE. *Kegalla District:* 1♀, Kitulgala, Makande Mukalana, 3 and 4 Feb, Krombein et al. *Ratnapura District:* 1♀, Uggalkal-tota, 23–26 Jun, Krombein et al.; 11♀, 8♂, Gilimale, Induruwa Jungle, 2 (1♀, 2♂) and 5–7 Feb (4♀), 7 and 8 (6♀, 4♂; 3♀ in Malaise trap) and 13–15 Mar (2♂), Krombein et al.; 8♀, 16♂, Sinharaja Jungle, 2 mi (3.2 km) S of Weddagala, 8–12 Feb (5♀, 16♂; 1♀ is 21277 B, 1♂ at black light, 1♂ at extrafloral nectary of *Macaranga dignya*), 16–21 Jun (3♀), Krombein et al.

UVA PROVINCE. *Monaragala District:* 1♀, Mau Aru, 10 mi (16 km) E of Uda Walawe, 100 m, 24–26 Sep, Krombein et al.; 9♀, Angunakolapelessa, 100 m, 21–23 Jan (2 are 12279 B and C, 1 in Malaise trap), 27 and 28 Mar (1 in Malaise trap), Krombein et al.; 1♀, Okkampitiya, 1–10 Dec, P.B. Karunaratne (Ottawa).

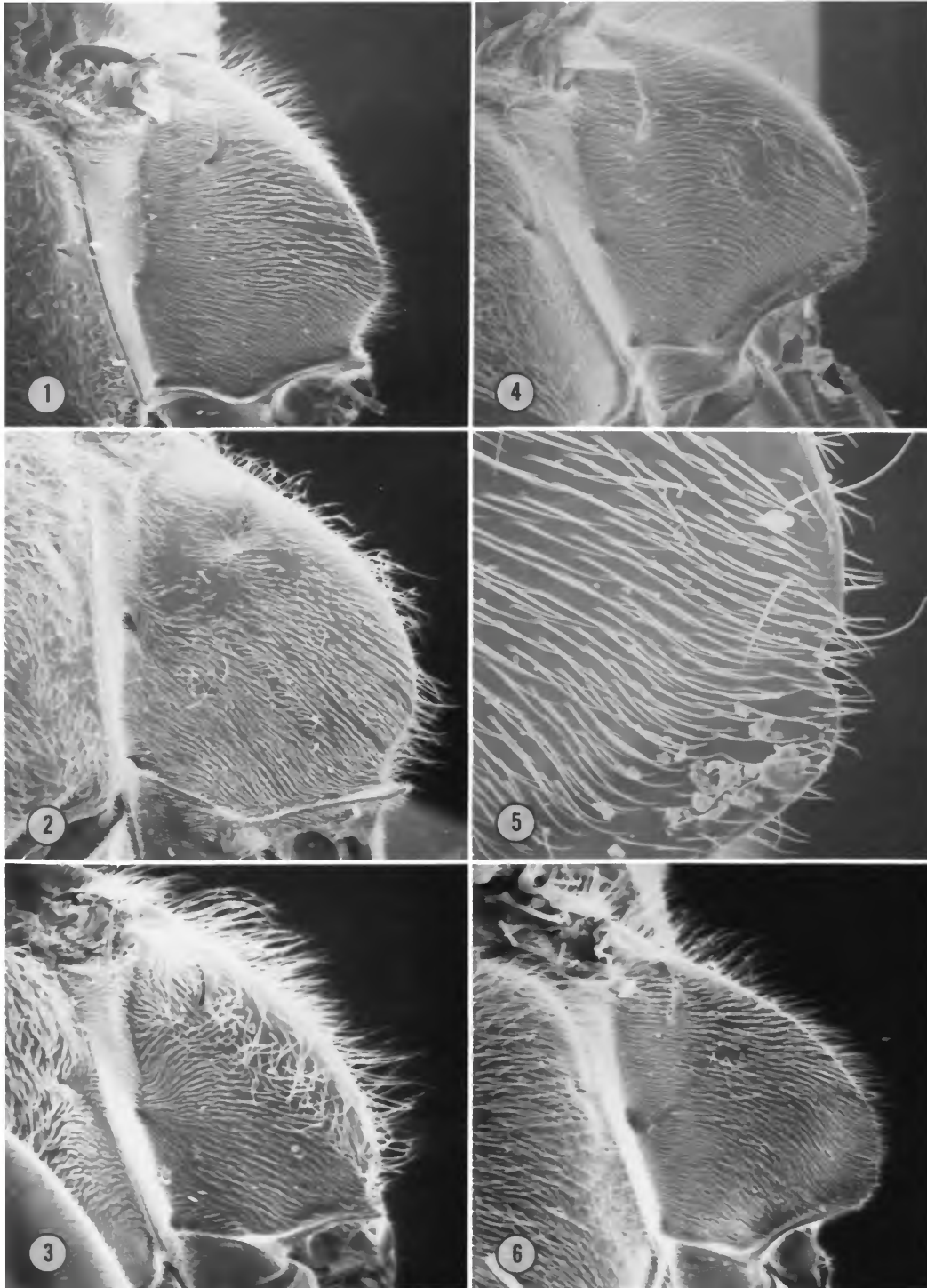
SOUTHERN PROVINCE. *Galle District:* 1♀, Kottawa Forest, 23 Oct, Robinson et al.; 19♀, 4♂, Sinharaja Jungle, Kanneliya section, 11–16 Jan (12♀, 2♂; 7♀ in Malaise trap), 11 and 12 Mar, 500 ft (152 m) (1♀, 2♂), 13–16 Aug (2♀), 2–5 (1♀) and 6–12 Oct, 400 ft (122 m) (3♀), Krombein et al. *Hambantota District:* 1♀, Yala, 22 Oct, Keiser (Basel); 2♀, Palatupana tank, 15–50 ft (4–15 m), in Malaise trap, 18–20 Jan and 3 and 4 Feb, Krombein et al.

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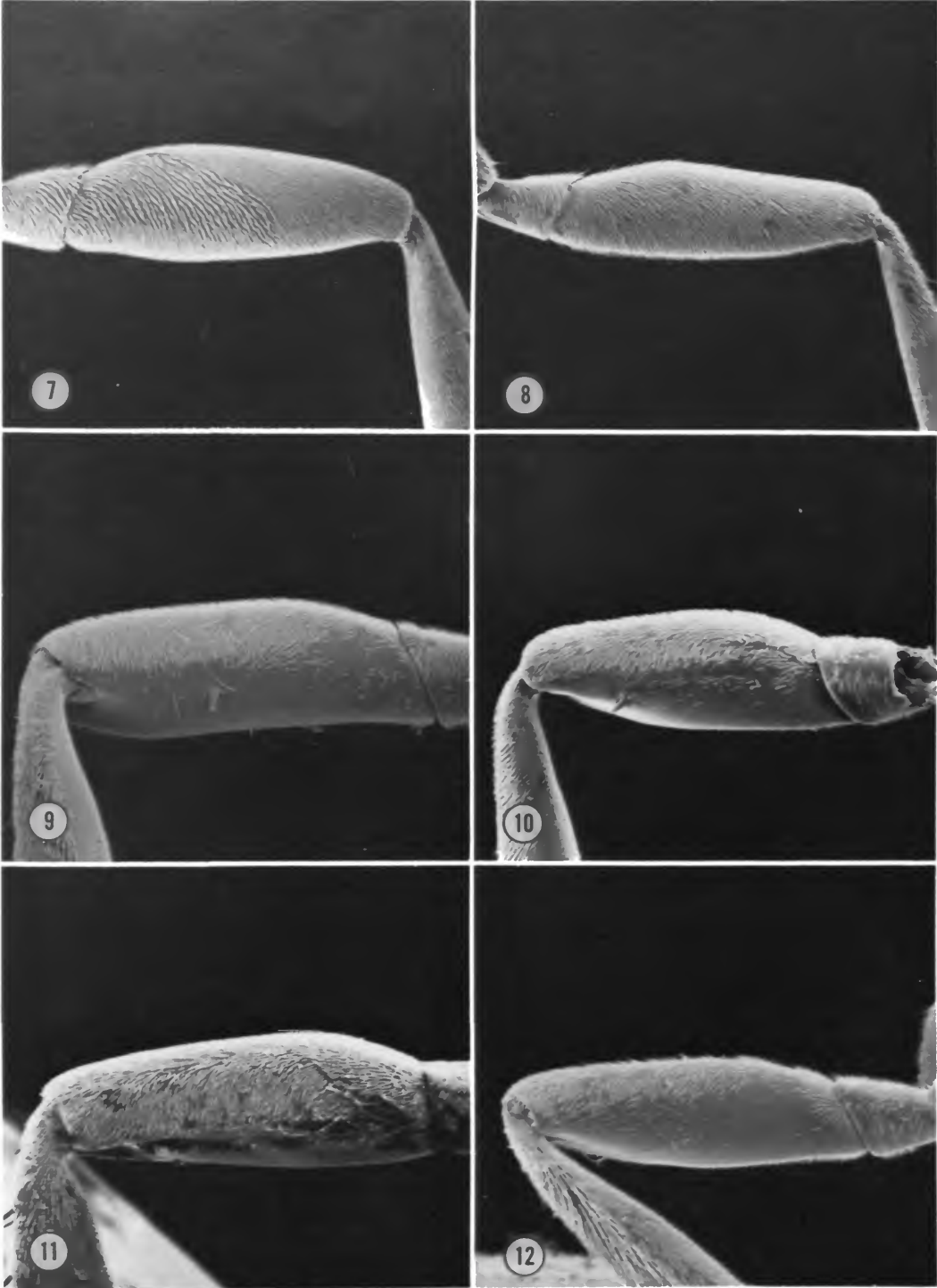
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FIGURES 1-6.—Lateral surface of propodeum, *Bembecinus* species: 1, *B. comberi* (Turner), $\times 36$; 2, *B. krameri*, new species, $\times 50$; 3, *B. luteolus*, new species, $\times 68$; 4, *B. broomfieldi*, new species, $\times 50$; 5, *B. broomfieldi*, new species, $\times 228$, to show small notch more clearly; 6, *B. proximus* (Handlirsch), $\times 43$.

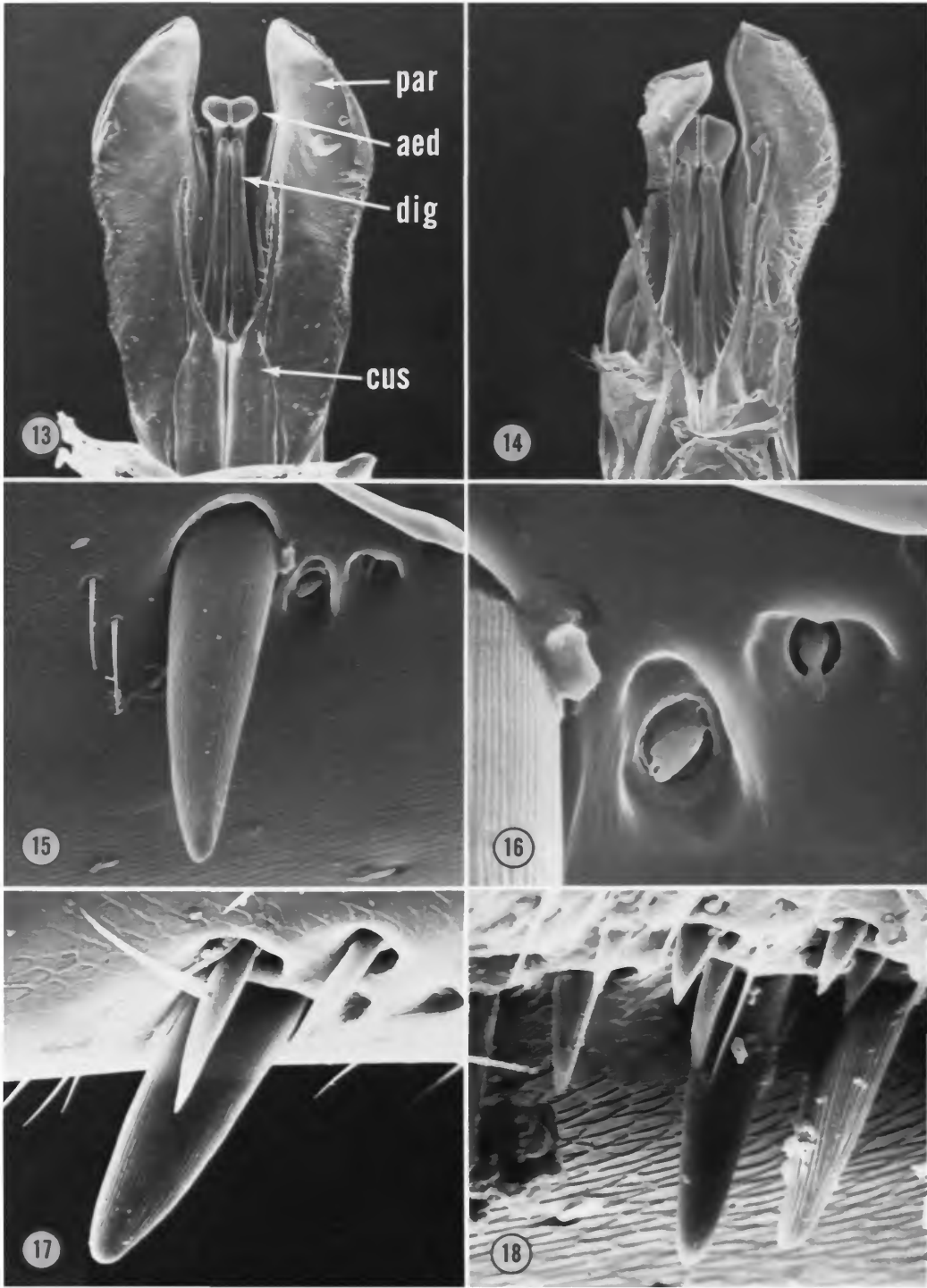


FIGURES 7-12.—Posterior surface of hind femur, *Bembecinus* species: 7, ♀ *B. comberi* (Turner) × 36; 8, ♀ *B. proximus* (Handlirsch), × 38; 9, ♂ *B. comberi* (Turner), × 41, note large seta toward apex; 10, ♂ *B. krameri*, new species, × 46, note large seta toward apex; 11, ♂ *B. peregrinus* (Smith) from Greece, × 35, note row of large setae in groove near apex; 12, ♂ *B. broomfieldi*, new species, × 55, note absence of subapical seta.



FIGURES 13, 14.—Ventral surface, ♂ genitalia, *Bembecinus* species: 13, *B. comberi* (Turner), × 46 (par = paramere, aed = aedeagus, dig = digitus, cus = cuspis); 14, *B. krameri*, new species, × 64.

FIGURES 15–18.—Modified setae on posterior surface of hind femur, ♂ *Bembecinus* species: 15, *B. comberi* (Turner), × 506; 16, *B. comberi* (Turner), × 1380, sensilla of pit and peg type; 17, *B. krameri*, new species, × 690; 18, *B. peregrinus* (Smith) from Greece, × 690, only part of row of setae (cf. Figure 11).



FIGURES 19-23.—Ventral surface, ♂ genitalia, *Bembecinus* species: 19, *B. pusillus* (Handlirsch), × 63; 20, *B. proximus* (Handlirsch), × 71; 21, *B. knighti*, new species, × 71; 22, *B. broomfieldi*, new species, × 66; 23, *B. luteolus*, new species, × 78.

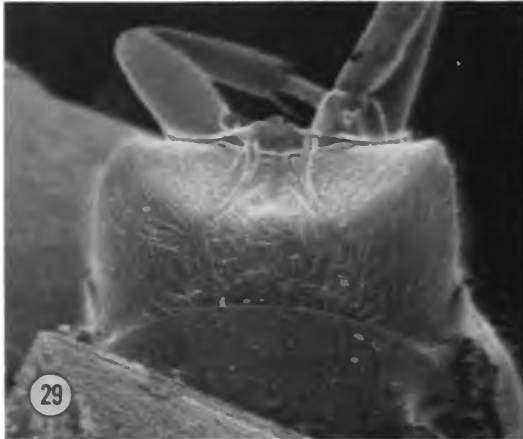
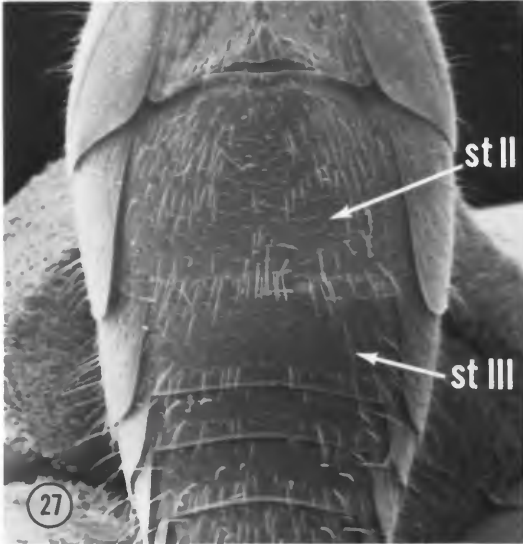
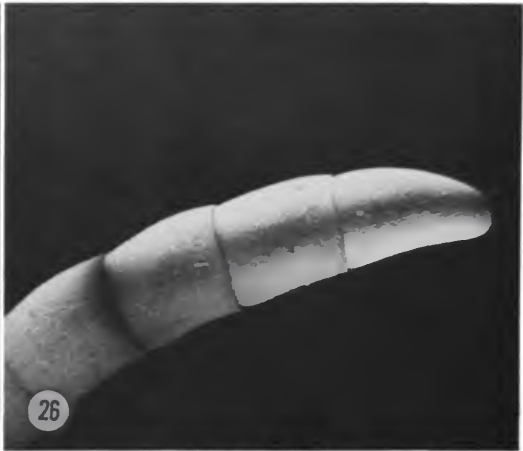
FIGURE 24.—Apex of aedeagus, ♂ *B. luteolus*, new species, × 587.



FIGURES 25, 26.—Lateral aspect, apical segments of antenna: 25, *Bembecinus pusillus* (Handlirsch), × 101; 26, *Stizus rufescens* (Smith), × 35.

FIGURES 27, 28.—Some abdominal sterna, *Bembecinus* species: 27, *B. broomfieldi*, new species, × 33 (st II = second sternum, st III = third sternum); 28, *B. comberi* (Turner), × 18.

FIGURES 29, 30.—Hind part of thorax showing relative concavity of posterior surface of propodeum, *Bembecinus* species: 29, *B. comberi* (Turner), × 24; 30, *B. luteolus*, new species, × 41.



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