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THE ADERIDAE OF THE BATU CAVES, MALAYA (Coleoptera)

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Of the beetles collected from the Batu Caves, near Kuala Lumpur, Malaya, by H. E. McClure, a surprisingly large number belong to the family Aderidae. (This family has been cited most often in the literature as Euglenidae, Xylophilidae or Hylophilidae.) The species of the family are usually regarded as scarce to rare, although some have been taken in rather large numbers in North America and Africa. Champion has already described the most abundant species from the Batu Caves, as *Xylophilus troglodytes*. He had several specimens and was in some doubt as to whether it was truly cavernicolous. The collections made by McClure contain thousands of individuals of this species. If it is not a cavernicole, very large numbers enter the caves regularly. Four additional species, here described as new, were included in McClure's samples. I wish to acknowledge the diligence of Dr. McClure in obtaining such fine samples and to thank Dr. L. W. Quate for making them available for study. The specimens that were not mounted for study are being returned to the Bishop Museum for storage and recording of data. Holotypes and allotypes will be deposited in the Bishop Museum; sets of paratypes will be distributed to the British Museum (Natural History), U. S. National Museum, Museum National d'Histoire Naturelle in Paris and the collection of the author.

KEY TO SPECIES

1. Antennal segment 3 shorter than (♂) or subequal to (♀) 2. General color tan, elytra with a slightly irregular, darker, slightly postmedian band. Pubescence of upper surface double, of fine, short, decumbent setae underlain by a mat of very fine, short, appressed setae, which are directed obliquely laterally and medially at right angles to each other; this layer opalescent in some lights.....**Aderus mcclurei**
   Antennal segment 3 at least distinctly longer than 2, often much longer. Elytra not banded. Pubescence simple, directed backward on elytra 2
2. Intermediate antennal segments very long, nearly or quite 4× as long as wide. Piceous to black, palpi and tarsi luteous. Large, from 2.9 to 3.65 mm...**Euglenes troglodytes**
   Intermediate antennal segments not more than 2¼× as long as wide.....3
3. Sides of prothorax definitely concave. Brunnescent, head piceous, prothorax dark and elytra darkened beyond basal 1/4. Maxillary palpi luteous. Length from 2.0 to 2.4 mm..... **Euglenes malayanus**
   Sides of prothorax straight or very slightly convex or concave.....4
4. Eyes reaching to within 0.03 mm of hind margin of head (♂) or 0.05 mm (♀). Brunnescent, head piceous, prothorax dark, palpi and tarsi paler. Length from 2.4

to 2.85 mm.....**Euglenes batuensis**

Eyes separated from the sharply defined hind margin of the head by 0.04 mm (♂) or 0.10 mm (♀). Male with a tooth on inner margin of hind tibiae and spines on fore and hind trochanters. Black, palpi and tarsi paler. Length from 2.25 to 2.8 mm.....**Euglenes cephalicus**

Genus **Aderus** Westwood

Aderus Westwood, 1829, Zool. Jour. **5**: 57, pl. 41, fig. 4. Báguena Corella, 1948, Estudios sobre los Aderidae, Madrid: 78–82, fig. 16.

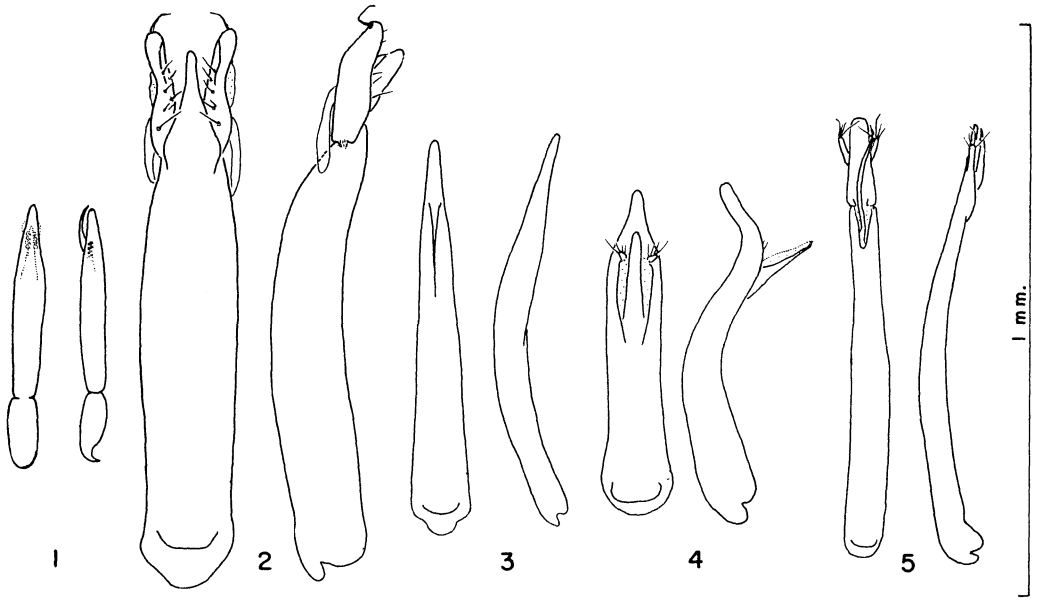
The species listed below fits perfectly in the genus *Aderus* as limited and redefined by Báguena Corella. It is the first so assigned from the Oriental region but many more species must exist in this fauna.

Aderus mcclurei Werner, n. sp. Fig. 1.

Tan, head darker and elytra with a slightly irregular, slightly postmedian darker band. Dorsal pubescence double; lower layer of very short, fine, appressed setae forming a sort of mat, individual setae directed obliquely laterally or medially at about 90° from each other; upper layer very inconspicuous, of sparse, slightly longer, decumbent setae, all directed posteriorly. Surface of head, pronotum and elytra with moderately dense, sharply defined but small punctures, those on elytra ca. 0.03 mm apart, those on head and pronotum a bit closer and finer. Length (total of lengths of head behind fronto-clypeal suture, prothorax and elytra) from 1.86 to 2.21 mm in ♂ and from 2.18 to 2.48 in ♀.

Holotype ♂: length 2.12 mm. Head 0.38 mm long to fronto-clypeal suture, 0.56 wide across eyes and 0.26 just behind, dominated by the large, prominent eyes, which are 0.36 × 0.27 mm, separated by 0.08 mm on front and excavated slightly at antennal insertions. Surface of eyes with short, dorsally directed, curved setae at the intervals, with facets ca. 0.03 mm across. Antennae inserted below middle of front, on a slightly protuberant area, their bases ca. 0.15 mm apart. Segments 4–11 short-ciliate, 4–10 triangular and only slightly flattened; 5–11 sharply truncate at base but bases obscured by setae. Measurements (in 0.01 mm, length over width, base to apex): 15/8, 5/6, 3/5, 15/10, 14/10, 13/10, 13/10, 13/9, 13/8, 13/8, 20/9. Last segment of maxillary palpi not unusually large, 0.18 mm across end.

Prothorax subquadrate, 0.41 mm long, 0.36 wide across base, 0.46 maximum and 0.28 across apex, with surface slightly irregular and with a pair of feeble basal projections at sides of scutellum. Elytra subparallel, slightly convex and with a distinct sub-basal transverse impression, 1.33 mm long, 0.59 wide across humeri, measured from where humeral angles are 45°, and 0.74 maximum. Narrow postmedian band angled forward near, then backward at suture, ca. 0.13 mm wide laterally and slightly wider medially. Meso- and metathorax shiny below, with deep punctures; abdomen also with some deep, narrow, slit-like punctures. Pubescence of underside simple. Separation of first 2 visible abdominal sterna obvious laterally, completely obsolete medially. Last visible sternum excavated across base, excavation extending under segment before it and almost as wide as sternum, sharply defined and lined with dense pubescence. Fore femora 0.41 × 0.10 mm; fore tibiae 0.38 × 0.05. Hind femora 0.64 mm long, with a sharp but fine ridge posteriorly on basal 1/2, this ending in a line of short, erect setae, barely raised above ridge. Tibiae almost



Figs. 1–5. Aedeagus, in ventral view as it projects back from abdomen, and in left lateral view, drawn with the aid of a microprojector. 1, *Aderus mcclurei* Werner, n. sp., paratype; 2, *Euglenes troglodytes* (Champion); 3, *Euglenes batuensis* Werner, n. sp., paratype; 4, *Euglenes malayanus* Werner, n. sp., paratype; 5, *Euglenes cephalicus* Werner, n. sp., holotype.

straight.

Allotype ♀ : eyes noticeably smaller, 0.31×0.26mm, and more widely separated on front, by 0.18 mm. Antennae shorter than in ♂, differently proportioned and not ciliate. Measurements: 14/8, 6/5, 6/4, 9/6, 8/6, 8/6, 8/7, 8/8, 8/8, 8/8, 18/9. It is interesting to note that segment 3 is as long as 2 in the ♀, while it is much shorter in the ♂. Segments 4 to 10 not triangular. Base of last visible sternum not excavated. Hind femora like those of ♂.

The ♂ aedeagus (fig. 1) is rather small, simple, with fused portion of tegmen ventral as aedeagus points backward and with secondary gonopore apparently dorsal. A peculiar paired, internal structure near secondary gonopore, appearing as a pair of complete coils of about 4 turns each in dorsal view and as 4 rows of narrow plates in lateral view. There seems to be a separate apodeme at base of tegmen.

Holotype, ♂ (BISHOP 3159), Loc. 3, Penny Room, Cavern C, light trap, 8–XII–1959. Allotype, ♀ (BISHOP), same data. Paratypes: 30 ♂♂, 16♀♀, Caverns C and B, IX, XI, XII–1959. Many more specimens have been identified in the samples.

Genus **Euglenes** Westwood

Euglenes Westwood, 1829, Zool. Jour. **5**: 59, pl. 41, figs. 5, 6. Báguena Corella, 1948, Estudios sobre los Aderidae, Madrid: 64–67, fig. 13.

Because of its long antennae, *Xylophilus troglodytes* Champion fits in the genus *Euglenes*,

as redefined by Báguena Corella, fairly well. The other three species assigned to the genus in the present paper are so placed with some difficulty. *E. batuensis* and *malayanus* are similar to *troglodytes* in so many features that the three species must be closely related; *cephalicus* stands somewhat apart. All of the species assigned to *Euglenes* here may eventually be placed in another genus but are probably best placed here until the whole Oriental aderid fauna can be studied. *Hylophilus lucifugus* Heberdey, 1931, Archiv für Hydrobiologie, Suppl. **8**: 678–9, described from a cave near Fort de Kock, Sumatra, is probably related.

Euglenes troglodytes (Champion), NEW COMBINATION Fig. 2.

Xylophilus troglodytes Champion, 1916, Ent. Soc. London, Trans. **1916**: 30, pl. 2, fig. 18.

Black, rather slender, and with elytra slightly arched; palpi and tarsi flavescent, antennae often brunnescent. Antennae very long and slender, especially in ♂. Whole body covered with very fine, short, appressed cinereous pubescence, which gives the insect a gray cast, even macroscopically. Prothorax and elytra with moderately dense, sharply defined small punctures, which bear slightly longer setae at their anterior borders. Elytral punctures longitudinally oval, their setae barely reaching across them. Because of the denseness of the pubescence, the elytral punctures form small glabrous spots. Intervals finely but distinctly punctulate. Length from 2.93 to 3.19 mm in ♂, from 3.43 to 3.63 in ♀.

Redescribed from a ♂ from Cavern C. Length 3.11 mm. Head 0.46 mm long, 0.69 wide across eyes and 0.41 behind. Eyes 0.41×0.33 mm, separated by 0.13 mm and deeply excavated for insertion of antennae. Intervals between eye facets with very short, curved, dorsally directed setae; facets ca. 0.03 mm across. Surface of head densely and coarsely punctulate, opaque, with plush-like pubescence. Front slightly bulged between antennae. Antennae very slender, not ciliate, individual segments from 3 to 10 almost parallel-sided, roughly sculptured; segment 1 barrel-shaped and 11 obliquely truncate from about middle. Measurements: 23/10, 8/8, 23/8, 28/8, 31/8, 33/8, 36/8, 33/8, 29/7, 33/8, 28/10. Last segment of maxillary palpi 0.35 mm across apex.

Prothorax subcampanulate, sides straight from base to widest portion at apical 1/3, 0.64 mm long, 0.49 wide across base, 0.59 maximum and 0.44 across apex. Basal angles with a small, rounded, well-defined impression dorsally; disc distinctly bulged; middle of base with a fringe of setae that are slightly longer than those on rest of surface. Elytra subparallel on basal 1/2, narrowing behind, 2.01 mm long, 0.84 wide at humeri and 0.95 maximum. Scutellum triangular, well set off from elytra. Metasternum broadly dished out in middle, with denser pubescence in this area, midline further excavated. Separation of first 2 abdominal sterna obsolete; last visible sternum flattened in middle but not otherwise modified. Fore femora rather slender, 0.84×0.18 mm, fore tibiae 0.72×0.08. Hind femora 1.15 mm long, with a very feeble, obtusely angled ventral expansion at apical 1/3, 0.26 mm wide at expansion; no long setae associated with this modification but some setae on ventral surface directed toward the angulation. Tibiae straight. Segment 1 of middle tarsi 0.46×0.08 mm, slightly curved, of hind tarsi 0.67×0.05, straight.

A ♀ from same locality, 3.20 mm long, eyes slightly smaller, 0.36×0.28 mm, and more widely separated, by 0.15 mm. Antennae almost as slender as in ♂ but shorter. Measurements: 23/10, 8/8, 17/8, 24/7, 23/6, 23/6, 22/6, 20/6, 18/8, 18/8, 23/9. Metasternum and last visible abdominal sternum not modified. Hind femora almost as in ♂. Tarsi shorter;

segment 1 of middle tarsi 0.36 × 0.06 mm and of hind tarsi 0.51 × 0.07.

The tegmen of the ♂ aedeagus (fig. 2) has what appear to be separate parameres, these bear many setae along their internal margins and single curved setae at the apex.

This was the most abundant species in all the samples from the caves, some containing hundreds of individuals from a single day of collecting.

Euglenes batuensis Werner, n. sp. Fig. 3.

Rich ferrugineous, head darker and palpi and tarsi obscurely paler; clothed with rather dense, closely appressed pubescence, much as in *troglodytes* but setae slightly coarser and golden in color; punctures on prothorax and elytra almost as in that species. In ♂ front tibiae bear a short, erect spur internally at apex and middle femora are bluntly spinose at sides of base of tibiae, especially below. Length from 2.54 to 2.61 mm in ♂, from 2.43 to 2.86 in ♀.

Holotype ♂: length 2.61 mm. Head of same general conformation as in *troglodytes*, 0.46 mm long, 0.61 wide across eyes and 0.31 behind. Eyes 0.38×0.29 mm, separated on front by 0.05 mm. Antennal segments 3 to 10 broadest near apex, those from 3 to 11 truncate at base; 11 obliquely truncate from basal 1/3. Measurements: 15/10, 6/8, 12/9, 15/9, 18/9, 18/9, 15/9, 15/9, 13/9, 13/9, 20/10. Last segment of maxillary palpi 0.28 mm across apex. Prothorax similar to that of *troglodytes* but pits at basal angles poorly developed and middle of base very broadly and rather feebly lobed; 0.56 mm long, 0.42 wide across base, 0.50 maximum and 0.38 across apex. Elytra also similar to those of *troglodytes* but with a noticeable sub-basal transverse impression, which is interrupted by the elevated suture, 1.59 mm long, 0.73 wide across humeri and 0.84 maximum. Metasternum not modified. Last visible abdominal sternum with a feeble median flattening. Visible abdominal sterna 1 and 2 with only a very feeble indication of separation. Fore femora 0.56×0.15 mm, fore tibiae 0.54×0.06. Hind femora similar to those of *troglodytes*, 0.77×0.20 mm. Segment 1 of middle tarsi 0.26×0.05 mm, of hind tarsi 0.33×0.05.

Allotype ♀: length 2.83 mm. Eyes smaller, 0.36×0.26 mm, and much more widely separated, by 0.13 mm. Antennae slightly shorter but of similar proportions. Measurements: 15/9, 8/8, 10/5, 13/5, 13/5, 13/6, 13/6, 10/8, 10/8, 10/8, 18/10. Hind femora with a feeble indication of ♂ modification. Segment 1 of middle tarsi 0.23×0.05 mm, of hind tarsi 0.33×0.05.

The aedeagus of the ♂ (fig. 3) consists of a simple, tapered tube, with no indication of separate parameres and no obvious indication of a secondary gonopore or penis, although both structures must be present.

Holotype ♂ (BISHOP 3160), Loc. 3, Penny Room, Cavern C, light trap, 8–XII–1959. Allotype ♀, (BISHOP), same data. Paratypes: 8 ♂♂, 20 ♀♀, Caverns C and B, 21 from light trap, VIII, IX, XI and XII–1959. A few specimens remain in the samples.

Euglenes malayanus Werner, n. sp. Fig. 4.

Of same general aspect as *batuensis* but smaller and darker, and with sides of prothorax definitely concave and disc without deep punctures. Head and prothorax piceous; base of elytra brunnescent, remainder dark. Palpi luteous, legs and antennae ferrugineous. Pubescence much as in *batuensis* but slightly sparser and shorter. Elytral punctures small; as a result elytral pubescence quite uniform, not marked by small glabrous areas at

punctures. Length from 1.97 to 2.18 mm in ♂, from 2.04 to 2.39 in ♀.

Holotype ♂: length 2.18 mm. Head 0.40 mm long, 0.51 wide across eyes and 0.38 behind. Eyes 0.27×0.19 mm, quite widely separated, by 0.19 mm. Antennae very similar to those of *batuensis*. Measurements: 15/8, 6/5, 10/6, 13/6, 13/6, 12/6, 12/6, 12/7, 10/8, 9/8, 17/8. Last segment of maxillary palpi 0.28 mm across apex. Prothorax laterally constricted at about middle, 0.46 mm long, 0.40 wide across base, 0.36 at constriction, 0.38 maximum anteriorly and 0.28 across apex. Elytra with a very feeble transverse impression, otherwise almost as in *batuensis*, 1.32 mm long, 0.56 wide across humeri and 0.69 maximum. Last visible sternum very broadly dished out medially. Fore femora slightly bowed, 0.54 ×0.13 mm; fore tibiae slightly excavated internally near apex, 0.46×0.05 mm. Hind femora as in *troglodytes* and *batuensis*, 0.68 mm long. Segment 1 of middle tarsi 0.23×0.05 mm, of hind tarsi 0.29×0.04, slightly downcurved.

Allotype ♀: length 2.36 mm. Eyes approximately as in ♂, 0.26×0.20 mm, and separated by the same distance, 0.19 mm. Antennae shorter. Measurements: 13/6, 6/5, 9/5, 10/5, 10/5, 9/5, 9/6, 9/6, 8/8, 8/8, 14/8. Last visible abdominal sternum not dished out. Anterior femora and tibiae straight and slender; posterior femora as in ♂. Segment 1 of middle and hind tarsi almost as in ♂.

Aedeagus of ♂ (fig. 4) rather broad but pointed at apex, slightly sigmoid in lateral view and bearing 2 small structures probably equivalent to the parameres of *troglodytes*, each of which bears 4 setae.

Holotype ♂ (BISHOP 3161), Loc. 9, Cavern C, 5–IX–1959. Allotype ♀ (BISHOP), Cavern C, 27–X–1959. Paratypes: 29 ♂♂, 15 ♀♀, Cavern C, taken in every month from VII to XII, 8 from light trap. Many more individuals remain in the samples.

Euglenes cephalicus Werner, n. sp. Fig. 5.

Black, palpi luteous and coxae, trochanters and tarsi rufescent; covered with brownish pubescence similar to that of *batuensis*. Differs from other species in having eyes well separated from hind margin of head and in having hind margin very sharp. Head and abdominal sterna distinctly and evenly punctured. In ♂ front and hind trochanters spinose, fore tibiae with a short spine at apex and hind tibiae with an excavation and tooth near base of flexor surface. Length 2.24 in the single known ♂, from 2.38 to 2.81 in ♀.

Holotype ♂: length 2.24 mm. Head 0.41 mm long, 0.47 wide across eyes and 0.36 behind. Surface densely and finely punctured, with shiny intervals. Eyes 0.28×0.19 mm, separated by 0.14 mm across front and by 0.05 mm from hind margin. Antennae almost as in *batuensis* but ciliate. Measurements: 10/6, 6/5, 14/8, 14/8, 17/8, 17/8, 17/8, 15/8, 14/7, 14/7, 23/8. Last segment of maxillary palpi 0.22 mm across apex. Prothorax rather stout, with sides slightly convex, 0.46 mm long, 0.37 wide across base, 0.41 maximum and 0.30 across apex. Surface much as in *troglodytes* but with no trace of pits at posterior angles and with no fringe of setae across base. Elytra with a very feeble indication of a transverse impression, 1.37 mm long, 0.58 wide at humeri and 0.74 maximum; surface quite densely punctured, punctures longitudinally oval and sharply defined, intervals finely punctulate; pubescence sparse enough that punctures produce no noticeable bare spots. Underside densely and finely punctured throughout. Separation of visible abdominal sterna 1 and 2 indicated only feebly, on the sides. Last visible sternum not modified. Fore femora 0.46 ×0.13 mm; fore tibiae 0.35×0.05, with a short, erect spine internally at apex. Hind femora 0.56 mm long; hind tibiae with base shallowly excavated on flexor surface, excavation

ending in a short tooth at 0.18 mm from base. Both fore and hind trochanters produced into short spines at outer apical angle.

Aedeagus (fig. 5) very slender, with apex flattened; the 2 small parameres bear 4 setae each, as in *malayanus*.

Allotype ♀: length 2.81 mm. Eyes 0.29×0.23 mm, separated by 0.20 mm from each other and by 0.10 mm from hind margin of head. Antennae not ciliate; measurements 15/8, 6/6, 13/5, 12/5, 12/6, 12/7, 12/8, 12/8, 10/9, 10/9, 19/9. Tibiae and trochanters not modified.

Holotype ♂, (BISHOP 3162), Black Cascade, Cavern C, 18–X–1960, 2½ hrs. Allotype ♀ (BISHOP), Cavern C, 20–X–1959. Paratypes: 8 ♀♀, Cavern C, III, IV, V, IX, X, XII; 3 from light trap. No other specimens found in the samples.

RECENT LITERATURE ON PACIFIC INSECTS

DIPTERA

(Continued from page 118)

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Liu, E. P. and C. S. Chen. 1959. A preliminary report on the study of the hibernation of *Anopheles hyrcanus* var. *sinensis* in Chia-Hsing, Chekiang. *Ibid.*: 75–84, 3 figs. (English summary).

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