A new species, males and immature stages of *Ancystropus*, with reference to apomorphic characters and their mode of development (Acarina: Spinturnicidae)

Kimito UCHIKAWA*

Department of Parasitology, Shinshu University School of Medicine, Matsumoto 390, Japan

(Received: September 8, 1989)

Key words: *Ancystropus*, a new species, males and immature stages of known species, evolution.

Abstract: *Ancystropus notopteris* sp. n. is described on the adult and immature stages. The males of all known species of *Ancystropus* except *A. leleupi* and the immature stages of *A. kanheri*, *A. eonycteris*, *A. zekeborii* and *A. taprobanius* are described or redescribed. Apomorphic characters of *Ancystropus* are evaluated, and are thought to have come out through sympatric speciations of mites on a few hosts independent of host speciations.

Ancystropus Kolenati, 1856, and *Meristaspis* Kolenati, 1857, in the Spinturnicidae Oudemans, 1902, are associated exclusively with Megachiroptera, or frugivorous bats. Females of these and other spinturnicid genera give birth directly to the protonymph that gives rise to the deutonymph and then to the adult, without leaving the host bat. Although it is important to define the morphology of all stages of these mites for systematic, ecological and faunal studies, earlier work particularly on *Ancystropus* has been based largely on females.

Morphological differences between males or immature stages of *Ancystropus* are not as marked as those between females, and several species of this genus sometimes share a given host bat with at least 2 species of the allied *Meristaspis*. This slowed the progress of classification of the males and immature stages, and caused some misidentifications. Thus Turk (1950) mistook the male of *Meristaspis lateralis* (Kolenati, 1856) for that of *Ancystropus taprobanius* (Turk, 1950) in his

original description of the latter (Rudnick, 1960). Prasad (1969) partially described the male of *A. taprobanius* under a different specific name (Domrow, 1972). Rudnick (1960) examined a single male of *Ancystropus aethiopicus* Hirst, 1923, in rather poor condition, and gave few morphological details. Dusbábek and Bergmans (1980) recorded 6 males of *A. aethiopicus* without mentioning morphology. *Ancystropus kanheri* Hiregaudar and Bal, 1955, *Ancystropus leleupi* Benoit, 1959, and *Ancystropus eonycteris* Delfinado and Baker, 1963, were previously known only from females. Only *Ancystropus zekeborii* Kolenati, 1856, was known from both sexes, its male having been well described by Rudnick (1960). No morphological data for differentiating immature stages were available.

I have examined numerous specimens of *Ancystropus* from various sources, and found all stages of a new species. The males of all other known species except *A. leleupi* have been correlated with their respective partner females. The immature stages of *A. kanheri*, *A. eonycteris*, *A. zekeborii* and *A. taprobanius* can now be defined morphologically. This

* 内川公人: 信州大学医学部寄生虫学教室 (〒390 松本市旭 3-1-1)

material is figured and described below with supplemental host records. Measurements are in μm , and setal nomenclature as in Domrow (1972).

MATERIALS AND METHODS

Skin and alcoholic specimens of frugivorous bats in the following museums were examined for spinturnicid mites in 1982: B. P. Bishop Museum (BBM), Honolulu; Field Museum of Natural History (FMNH), Chicago; American Museum of Natural History (AMNH), New York; US National Museum of Natural History, Smithsonian Institution (USNM), Washington, D.C.;

British Museum (Natural History) (BMNH), London; Natur-Museum Senckenberg (SMF), Frankfurt; and Rijksmuseum van Natuurlijke Historie (RMNH), Leiden. Mites were taken off with a fine needle and forceps from skin specimens of bats either with the naked eye or under the dissecting microscope, and were washed out in alcohol from alcoholic specimens of bats. The collection data for each host were taken directly from the museum label.

Mites were also taken as above from alcoholic specimens of bats collected by Dr. M. Harada in Thailand in 1979 and 1982, and Dr. T. Kobayashi, Dr. M. Harada and Dr. K. Maeda in Borneo in 1976 and 1979.

Figs. 1–4 *Ancystropus notopteris* sp. n., female.

1: dorsal view; *pn* 3–4, proteronotal setae 3–4; *pst*, poststigmal seta; *psc*, postscutal seta; *c*1–2, caudal setae 1–2. 2: ventral view; *gen*, genital seta; *v*1–3, ventral setae 1–3; *c*3, caudal seta 3; *ad*, adanal seta. 3: tritosternum. 4: gnathosoma, ventral view.

Dr. H. Suzuki provided mites taken from Thai frugivorous bats in 1978.

***Ancystropus notopteris* sp. n.**
(Figs. 1-10)

Female (Figs. 1-4). Two unfed and 1 partially fed specimens available.

Idiosoma widest at anterior level of peritremes and narrowed at anterior and posterior ends. Dorsal shield oval, with anterior projection, and bearing 10 pairs of pores and ornamentation (Fig. 1). Proteronotal seta 1 missing; seta 2 reduced to its vestigial base discernible close to seta 3; setae 3 and 4 and poststigmatal seta well-developed and long. Postscutal seta long; 3 pairs of caudal

setae including 1 pair situated ventrally on unfed specimens (Fig. 2) long. Tritosternum vase-like, with concave anterior margin (Figs. 2, 3). Sternal shield shell-shaped, widest at a level slightly behind sternal seta 2, striated faintly and bearing 3 pairs of strong sternal setae and 2 pairs of pores. Metasternal seta missing; genital seta and 3 pairs of ventral setae well-developed; adanal setae also strong (Fig. 2).

Legs as in Figs. 1 and 2; leg I thick and long, bearing a pair of strong claws and lacking pulvillus, not armed with hook or spur; a finely striated patch ventrally on anterodistal corner of femur, genu and tibia I (Fig. 2); basal anteroventral seta on tarsus I knob-like. Leg chaetotaxy after Evans

Table 1 Leg chaetotaxy for female of *A. notopteris* sp. n.

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	5	2-4/3-2	2-2/1, 2/1-1	2-2/1, 2/1-1	31
II	2	5	1-4/3-1	1-2/1, 2/1-1	1-1/1, 2/1-1	16
III	2	5	1-3/2-0	1-1/1, 1/1-1	1-0/1, 1/0-1	16
IV	1	5	1-3/1-0	1-1/1, 1/1-1	1-0/1, 1/0-1	16

Figs. 5, 6 *Ancystropus notopteris* sp. n., male.
5: idiosomal dorsum. 6: idiosomal venter and tip of chelicera; mts, metasternal seta; other symbols as in Fig. 2.

(1968) as in Table 1.

Gnathosoma as in Figs. 2 and 4.

Measurements for holotype and 1 paratype (both unfed): Idiosoma 840–810 long, 600–590 wide; dorsal shield 670–690 long, 420–400 wide; proteronotal setae 3, 4 and poststigmal seta 140–123, 120–102 and 120–100 long, respectively; postscutal seta 58–70 long; caudal seta 53–60 long; tritosternum 85–90 long (medially), 95–95 wide; sternal shield 147–155 long, 225–225 wide; sternal seta 3 75–70 long; genital seta 55–60 long; longest ventral seta 80–85 long; adanal seta 80–75 long; leg I 900–880 long, 230–220 wide (maximum); leg IV 690–690 long.

Male (Figs. 5, 6). Dorsal shield completely covering idiosoma caudally. Proteronotal setae 1 and 2 distinctly shorter than succeeding propodonotal and poststigmal setae (Fig. 5); a pair of postscutal setae and 2 pairs of caudal setae present (Fig. 6). Tritosternum broad and crescentic, its pos-

terior margin surrounding genital orifice. Sternogenital shield flask-shaped with broadly rounded posterior margin barely reaching to bases of genital setae, bearing 3 pairs of strong sternal setae and 2 pairs of pores. Metasternal and genital setae situated at almost the same level and stronger than 3 pairs of ventral setae (Fig. 6).

Leg I not as strong as in female and almost the same in shape as other legs; leg chaetotaxy as in female.

Spermadactyl sinuate, long, and emerging behind tip of movable digit (Fig. 6); other structures of gnathosoma as in female.

Measurements as in Table 2.

Deutonymph. Female- and male-deutonymphs clearly separable from each other morphologically.

Female-deutonymph (Figs. 7, 8). Idiosoma constricted at basal level of postscutal setae (Fig. 7). Proteronotal setae 1 and 2 (2 lacking unilaterally, Fig. 7) shorter than

Table 2 Measurements (in μm) for adult males of the genus *Ancystropus*.

Species (n)		<i>A. notopteris</i> (5)	<i>A. kanheri</i> (5)	<i>A. eonycteris</i> (5)	<i>A. zeleborii</i> (1)*5	<i>A. taprobanius</i> (5)	<i>A. aethiopicus</i> (2)
Idiosoma	L	500–530	360–380	340–360	(350) 310–320	380–390	515–515
	W	430–450	310–320	300–310	(300) 260–280	300–320	415–430
Dorsal shield	L	480–490	340–360	330–340	(345) 300–310	350–360	490–505
	W	340–365	280–300	255–260	(280) 240–250	260–280	360–370
Proteronotal seta	1 L	7– 10	10– 14	15– 19	(20) 15– 23	Missing	20– 23
	2 L	10– 13	13– 15	22– 28	(22) 18– 20	24– 25	23– 25
	3 L	22– 25	18– 23	22– 25	(23) 20– 21	20– 22	28– 30
	4 L	30– 35	27– 30	35– 37	(28) 24– 25	30– 35	33– 37
	Seta 2–seta 3	33– 43	15– 23	15– 20	(25) 25– 33	36– 40	32– 35
Seta 3–seta 4		113–125	83– 90	75– 82	(67) 58– 63	55– 58	98–103
Poststigmal seta	L	27– 33	27– 33	31– 37	(35) 25– 29	30– 35	45– 45
Tritosternum	L	7– 8	9– 13	8– 8	(10) 7– 8	13– 15	15– 15
	W	70– 77	45– 49	40– 45	(48) 31– 41	43– 50	53– 55
Sternogenital shield	L	185–205	150–158	165–180	(158) 135–145	150–173	225–235
	W	160–180	123–125	116–125	(137) 108–118	113–128	150–160
Sternal seta 3	L	45– 52	20– 25	22– 27	(34) 35– 40	20– 23	43– 45
Metasternal seta	L	45– 50	22– 26	28– 30	(30) 32– 37	20– 25	45– 48
Leg I	L	550–580	360–390	390–420	(350) 320–330	400–420	510–520
	Maximum W	143–152	97–100	88– 98	(85) 86– 90	95– 98	137–140
Leg IV	L	470–540	330–350	360–380	(360) 310–320	370–400	500–510
Spermadactyl	L	85– 90	53– 55	ca. 35	ca. 35	More than 130	ca. 50

L: length, W: width, seta 2(3)–seta 3(4): distance between 2 setae.

* A single specimen taken from *Rousettus aegyptiacus*.

Figs. 7, 8 *Ancystropus notopteris*, sp. n., female-deutonymph.
7: dorsal view. 8: ventral view.

succeeding setae; setae 2 and 3 closer to each other than to other setae. Tritosternum invaginated laterally, with concave anterior and rounded posterior margins (Fig. 8). Sternal shield rounded pentagonal, and bearing 3 pairs of strong sternal setae. Opisthosomal setation on dorsum and venter as in unfed female although shorter.

Leg I much longer and thicker than other legs; leg chaetotaxy as in adult.

Measurements as in Table 3.

Male-deutonymph. Small, with normal leg I. Tritosternum square with concave lateral margins. Sternal shield with slightly convex posterior margin. Idiosomal and leg setations as in male. Metasternal and genital setae rather strong and situated on almost the same level.

Measurements as in Table 3.

Protonymph. Female- and male-protonymphs separable.

Female-protonymph (Figs. 9, 10). Propodosoma broadly rounded and hysterosoma narrowed. Dorsal shield entire. Proteronotal setae 2 and 3 relatively far apart (Fig. 9).

One pair each of postscutal and caudal setae dorsally on hysterosoma. Tritosternum roughly trapezoidal. Sternal shield rounded pentagonal and bearing slender sternal setae (Fig. 10). One pair of genital setae, 2 pairs of ventral setae and 1 pair of caudal setae present ventrally (Fig. 10).

Leg I thicker and longer than other legs; leg chaetotaxy as in Table 4.

Measurements as in Table 5.

Male-protonymph. Small, with rather slender leg I. Proteronotal setae 2 and 3 close to each other. Sternal shield with distinctly convex posterior margin. Other structures and chaetotaxy as in female-protonymph.

Measurements as in Table 5.

Materials examined. Holotype female, allotype male, 1 paratype female, 4 paratype males, 1 ♀ (partially fed, with legs I snapped off), 1 ♂ (damaged), 2 deutonymphs (=DN) and 2 protonymphs (=PN) *ex Notopteris macdonaldi*, Suva, Fiji Is., May 22, 1950 (FMNH 31252–31344); 1 PN *ex N. macdonaldi*, Colombo Cave, Suva, Fiji

Table 3 Measurements (in μm) for female-deutonymphs and, in parentheses, for male-deutonymphs of the genus *Ancyclostropus*.

<i>n</i>	Species				
	<i>A. notopteris</i> 1 (2)	<i>A. kanheri</i> 5 (3)	<i>A. eonycteris</i> 5 (5)	<i>A. zeleborii</i> 5 (5)	<i>A. taprobanicus</i> 2 (2)
Idiosoma					
	L 730 (?)	510-560 (380-420)	480-535 (380-410)	360-380 (355-350)	440-440 (400-410)
	W 570 (?)	370-420 (330-360)	400-440 (310-360)	310-320 (275-290)	350-370 (360-360)
Dorsal shield	L 560 (460-508)	430-490 (370-380)	460-480 (350-380)	340-350 (320-330)	390-400 (363-370)
	W 420 (330-370)	320-340 (280-290)	340-350 (260-280)	260-295 (240-253)	300-320 (285-290)
Proteronotal seta 1	L 15 (7- 8)	7- 11 (8- 10)	27- 35 (13- 15)	20- 28 (16- 20)	Missing
2	L 20 (10- 12)	13- 23 (12- 14)	40- 48 (20- 23)	20- 25 (17- 20)	27- 27 (23- 23)
3	L 43 (20- 23)	37- 45 (18- 20)	43- 50 (22- 25)	21- 27 (16- 20)	25- 28 (22- 23)
4	L 50 (30- 35)	35- 45 (30- 30)	50- 58 (32- 38)	27- 33 (20- 26)	38- 38 (35- 35)
Seta 2-seta 3	30 (35- 42)	20- 28 (20- 25)	28- 30 (21- 27)	23- 30 (23- 33)	35- 38 (35- 40)
Seta 3-seta 4	155 (93-105)	92-105 (78- 82)	85- 98 (73- 80)	55- 67 (55- 65)	60- 60 (50- 60)
Poststigmal seta	L 63 (30- 45)	45- 50 (31- 32)	50- 57 (33- 37)	40- 48 (28- 32)	40- 43 (34- 37)
Tritosternum	L 41 (30- 33)	35- 43 (28- 30)	45- 48 (28- 33)	30- 35 (20- 25)	35- 35 (33- 33)
	W 63 (55- 57)	45- 53 (38- 42)	50- 55 (40- 43)	45- 52 (35- 40)	43- 47 (43- 45)
Sternal shield	L 175 (218- ?)	140-175 (137-157)	195-207 (155-175)	130-160 (130-135)	145-183 (145-168)
	W 168 (165- ?)	130-175 (120-130)	145-165 (110-130)	128-150 (113-125)	113-140 (112-130)
Sternal seta 3	L 48 (35- ?)	22- 28 (20- 28)	28- 37 (20- 23)	40- 43 (30- 35)	18- 18 (17- 17)
Leg I	L 700 (570-600)	540-560 (400-405)	570-660 (400-435)	380-420 (320-340)	430-450 (420-420)
	Maximum W 208 (150-153)	148-155 (105-107)	150-178 (100-105)	135-158 (83-100)	125-128 (105-108)
Leg IV	L 620 (460-530)	450-470 (350-360)	480-510 (380-390)	340-380 (300-330)	400-420 (380-400)

Symbols as in Table 2.

Table 4 Leg chaetotaxy of protonymph (*A. notopteris*).

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	4	1-4/2-1	1-2/1, 2/1-1	1-2/1, 2/1-1	25
II	2	4	1-4/2-1	1-2/0, 2/0-1	1-1/1, 2/1-1	15
III	2	4	1-3/1-0	1-1/0, 1/0-1	1-0/1, 1/0-1	15
IV	1	4	1-3/0-0	1-1/0, 1/0-1	1-0/1, 1/0-1	15

Figs. 9, 10 *Ancystropus notopteris*, sp. n., female-protonymph.
9: dorsal view. 10: ventral view.

Is., May 22, 1929 (USNM 260070-260079); 1♂, 1DN *ex Notopteris* sp., New Hebrides, date uncertain (SMF 21398-21404); 1♂ *ex Notopteris neocaledonica*, data uncertain (BMNH, no accession No.).

These specimens are deposited in the museums where they were taken, leaving 2 paratype males, 1 damaged male and female, 1 deutonymph and 1 protonymph from the FMNH bats in my collection.

Remarks. *Ancystropus notopteris* sp. n. is easily separable from all known congeners in all known stages.

The reduced proteronotal seta 2, long proteronotal setae 3 and 4 and poststigmatal seta, long postscutal seta, vase-like tritosternum,

shell-shaped sternal shield, missing metasternal seta, unarmed (hookless) leg I and femur IV bearing 1 ventral seta are specific characters for the female of the new species. Of these characters, the reduced proteronotal seta 2 and setation of femur IV are also found in *A. kanheri* and *A. leleupi*, and only the setation of femur IV in *A. aethiopicus*. The long postscutal seta occurs only in *A. taprobanius* and the new species.

Differential characters for the male and immature stages are summarized in the keys to species below.

One partially fed female had both legs I snapped off beyond the femur. Domrow (1972) found this type of damage in fed

females of *A. kanheri* and thought it suggestive that the mite was prehensile on the host bat. Thus the female of *A. notopteris* may have the same attaching habit as in *A. kanheri*.

Ancystropus kanheri
Hiregaudar and Bal, 1955
 (Figs. 11 and 17)

Male (Fig. 11). Proteronotal seta 3 slightly longer than seta 2. Postscutal seta thick and more than 15 long. Tritosternum thick, trapezoidal and with distinctly concave posterior margin (Fig. 11). Sternogenital shield broadly rounded posteriorly, not reaching to basal level of genital setae, and bearing 3 pairs of rather slender sternal setae. Metasternal and genital setae almost on the same level, and slightly longer than 3 pairs of ventral setae; 2 pairs of caudal setae on venter (Fig. 11); adanal setae smaller than caudal setae.

Leg chaetotaxy as in *A. notopteris*.

Spermadactyl weakly sinuate, short, and

emerging only slightly behind tips of chelae (Fig. 11).

Measurements as in Table 2.

Female-deutonymph (Fig. 17). Large. Idiosoma and dorsal shield oval. Proteronotal setae 3 and 4 much longer than seta 2. Postscutal seta (*ca.* 13 long) smaller than 3 pairs of caudal setae (more than 20 long). Tritosternum biconcave, trapezoidal and thick. Sternal shield broadly rounded posteriorly, not reaching to basal level of metasternal setae, and bearing 3 pairs of slender setae. Metasternal and genital setae subequal to sternal setae; 3 pairs of ventral setae shorter than genital setae and caudal setae.

Leg I cylindrical, thick and long; no prominent posterodistal projection on tarsus I; leg chaetotaxy as in adult.

Measurements as in Table 3.

Male-deutonymph. Smaller than female-deutonymph. Leg I slender and shorter than in female-deutonymph. Two pairs of caudal setae present. Sternal shield narrowed posteriorly and reaching to basal level of metasternal setae posteriorly. Idiosomal chaeto-

Figs. 11, 12 Male idiosomal venter, tritosternum and tip of chelicera.

11: *Ancystropus kanheri* Hiregaudar and Bal, 1955. 12: *Ancystropus eonycteris* Delfinado and Baker, 1963.

taxy as in male. Other structures and leg chaetotaxy essentially as in female-deutonymph.

Measurements as in Table 3.

Female-protonymph. Idiosoma oval. Dorsal shield entire. Proteronotal seta 2 much shorter than setae 3 and 4. One pair of postscutal setae, 2 pairs of caudal setae, 1 pair of genital setae and 2 pairs of ventral setae present as in *A. notopteris*. Tritosternum elongate trapezoidal. Sternal shield broadly rounded as in deutonymph.

Leg I thick and long; leg chaetotaxy as in *A. notopteris*.

Measurements as in Table 5.

Male-protonymph. Small. Leg I slender and shorter than in female-protonymph. Tritosternum distinctly shorter than in female-protonymph. Sternal shield narrowed posteriorly and extending posteriorly beyond bases of sternal seta 3 as in male-deutonymph. Other structures and setation essentially as in female-protonymph.

Measurements as in Table 5.

Materials examined. *Ex Rousettus leschenaulti*: 1♀, 1♂, 5DN, 3PN, Thum Khum Khoawong Kod, Banmi, Lopburi, Thailand, November 10, 1979; 1♀, 1♂, 1DN, 3PN, Bam Klui, Banmi, Lopburi, Thailand, November 11–12, 1979; 1♀, 3♂, 1PN Tapkuang Kangkoi, Saraburi, Thailand, November 18, 1979; 1♀, 4♂, 4DN, 11PN, Khao Tagra, Muang, Lopburi, Thailand, December 2, 1979. *Ex Eonycteris spelaea*: 1DN, Khoa Wong Kot, Thamai, Jhanthaburi, November 27, 1979. One ♂ without host record and misidentified as *Meristaspis mindanaoensis* Delfinado and Baker, 1963, in Uchikawa and Kobayashi (1978) (total: 4♀, 10♂, 11DN, 18PN).

All the above specimens are deposited in my collection.

Remarks. Prasad (1969) presented drawings of the tritosternum, sternogenital shield, sternal, metasternal and genital setae for *A. zeleborii* (p. 674, figs. 36–7). These are actually for *A. kanheri*. Domrow (1972) showed the setal formula of tibia II as 1–2/2–1, not counting an antero-dorsal seta (*ad*), but the real formula is 1–3/2–1 as in the other species of *Ancystropus*.

***Ancystropus eonycteris* Delfinado and Baker, 1963**

(Figs. 12 and 18)

Male (Fig. 12). Proteronotal setae 2 and 3 subequal to each other. Postscutal seta thick and more than 15 long, smaller than 2 pairs of caudal setae. Tritosternum rather thick, with concave posterior margin. Sternogenital shield pear-shaped, with rounded posterior margin, extending posteriorly beyond basal level of metasternal setae and barely reaching to basal level of genital setae, and bearing 3 pairs of rather weak sternal setae and 2 pairs of pores. Metasternal setae situated distinctly anteroexteriad from genital setae; and both setae thicker than sternal setae 3. Three pairs of ventral setae weak; adanal setae thinner than caudal seta. Leg chaetotaxy not as in *A. notopteris* but having 2 antero-ventral setae on femur IV (1–3/2–0) as in partner female.

Spermadactyl curved strongly, and fixed and movable digits accordingly projecting over spermadactyl (Fig. 12).

Measurements as in Table 2.

Female-deutonymph (Fig. 18). Large. Proteronotal setae well-developed; setae 2–4 thick and long. Poststigmatal seta also thick and long. Postscutal seta thick and *ca.* 15 long, smaller than 3 pairs of caudal setae. Tritosternum vase-like, with biconcave, posteriorly rounded margins (Fig. 18). Sternal shield truncate anteriorly and tapering, with concave lateral margins posteriorly, ending between genital setae, and bearing 3 pairs of rather slender sternal setae (Fig. 18). Metasternal and genital setae thicker than sternal and ventral setae.

Leg I thick, long, and cylindrical; leg chaetotaxy as in adult.

Measurements as in Table 3.

Male-deutonymph (Fig. 18). Smaller than female-deutonymph. Idiosomal setae much smaller than those of female. Two pairs of caudal setae present. Tritosternum square (Fig. 18). Sternal shield triangular posteriorly; postero-lateral margins not concave as in female-deutonymph (*cf.* Fig. 18). Other structures and leg chaetotaxy as in female-deutonymph.

Measurements as in Table 3.

Table 5 Measurements for female-protonymphs and, in parentheses, for male-protonymphs of the genus *Ancystropus*.

<i>n</i>	Species	<i>A. notopterus</i>				<i>A. kanheri</i>				<i>A. eonycteris</i>				<i>A. zeleborii</i>				<i>A. taprobanus</i>			
		2(1)				5(5)				5(5)				5(5)				6*			
Idiosoma	L	680-	?	(?)		450-480	(380-410)			430-470	(380-410)			360-410	(340-370)			370-450			
	W	520-	?	(?)		390-395	(310-310)			360-390	(300-325)			300-340	(270-310)			320-360			
Dorsal shield	L	515-530	(450)			410-430	(360-380)			410-440	(355-370)			340-370	(310-345)			360-380			
	W	395-410	(330)			310-340	(270-290)			310-325	(260-270)			260-295	(230-260)			275-280			
Proteronotal seta 1	L	8-	8	(7)		8-	10	(8-10)		17-	22	(12-15)		18-	25	(15-20)		Missing			
2	L	10-	10	(6)		15-	22	(13-16)		28-	35	(20-23)		20-	23	(17-20)		20-24			
3	L	33-	35	(25)		28-	34	(18-23)		30-	39	(20-23)		18-	25	(17-23)		21-23			
4	L	33-	35	(27)		35-	43	(28-38)		40-	45	(32-37)		25-	30	(22-28)		35-35			
Seta 2-seta 3		70-	85	(45)		23-	25	(20-34)		28-	40	(20-33)		30-	35	(28-37)		43-45			
Seta 3-seta 4		98-	113	(85)		73-	88	(65-70)		70-	80	(60-67)		50-	65	(45-55)		40-45			
Poststigmatal seta	L	24-	30	(25)		38-	45	(33-38)		38-	45	(30-35)		33-	39	(30-35)		35-37			
Tritosternum	L	43-	45	(35)		45-	48	(25-28)		40-	43	(27-32)		27-	32	(25-28)		25-30			
	W	48-	50	(50)		35-	45	(32-45)		37-	42	(35-47)		37-	42	(30-35)		36-38			
Sternal shield	L	175-175	(193)			138-165	(140-158)			171-180	(160-175)			135-165	(128-160)			143-150			
	W	155-170	(175)			120-142	(108-120)			125-130	(110-122)			127-150	(112-152)			103-108			
Sternal seta 3	L	25-	35	(?)		22-	25	(23-24)		27-	32	(22-23)		38-	45	(33-40)		15-18			
Leg I	L	580-590	(540)			460-510	(390-400)			495-500	(390-410)			350-360	(300-330)			400-430			
Maximum W		160-170	(145)			135-140	(100-115)			145-155	(105-113)			120-133	(90-108)			110-115			
Leg IV	L	490-510	(430)			390-420	(340-370)			420-440	(350-370)			300-340	(290-310)			360-400			

Symbols as in Table 2. * Two different forms not available.

Female-protonymph. Dorsal shield entire, oval. Propodonal and poststigmal setae well-developed compared with other species. Tritosternum roughly transverse trapezoidal, almost as long as wide, with lateral invaginations. Sternal shield truncate anteriorly and triangular posteriorly; postero-lateral margins weakly concave. Idiosomal setation as in all the preceding species.

Leg I thick and long; leg chaetotaxy as in *A. notopteris* and *A. kanheri*.

Measurements as in Table 5.

Male-protonymph. Leg I slender. Other structures, idiosomal and leg chaetotaxy as in female-protonymph.

Measurements as in Table 5.

Material examined. *Ex Eonycteris spelaea*: 2♀, 18♂, 14DN, 13PN, Khoa Wong Kot, Thamai, Jhanthaburi, Thailand, November 27, 1979; 1♂, Paktongchai, Nakhon-rajassima, Thailand, November 22, 1979; 3PN, Tapkuang, Kangkoi, Saraburi, Thailand, November 18, 1979; 1PN, Amphoe Khok Pho, Pattani, Thailand, January 20, 1982; 1♀ from Thailand as recorded in

Uchikawa and Kobayashi (1978); 1♀, 5♂, 1DN, 3PN, Poring, Sabah, Borneo, April, 1979; 1♂, misidentified as *M. mindanaoensis* in Uchikawa and Kobayashi (1978). *Ex Rousettus leschenaulti*: 2♀, 2♂, 2PN, Mae Hongson, Thailand, July 31, 1978; 2♂, 2DN, 1PN, Bam Klui, Banmi, Lopburi, Thailand, November 12, 1979 (total: 6♀, 29♂, 17DN, 23PN).

All the above specimens are deposited in my collection.

***Ancystropus zeleborii* Kolenati, 1856**
(Figs. 13, 14 and 19)

Male (Figs. 13, 14). Small mites less than 350 long. Proteronotal seta 1 short, yet relatively well-developed; setae 2 and 3 subequal to each other. Idiosomal setation as in preceding species. Tritosternum small, thin and stretched capsule-like, with weak projections at postero-lateral corners. Sternogenital shield triangular posteriorly, reaching to bases of genital setae, very clearly striated on a specimen from type host (Ethiopian region)

Figs. 13, 14 Male idiosomal venter, tritosternum and tip of chelicera of *Ancystropus zeleborii* Kolenati, 1856.

13: Ethiopian specimen from *Rousettus aegyptiacus*. 14: Oriental specimen from *Rousettus leschenaulti*.

but not on all specimens from Oriental hosts (Figs. 13, 14), and bearing 3 pairs of strong setae. Metasternal and genital setae thick and almost as long as sternal seta 3. Adanal setae thinner than caudal setae.

Legs I and IV subequal in length to each other, but former thicker than latter; leg chaetotaxy as in *A. eonycteris*.

Spermadactyl strongly curved (Figs. 13, 14).

Measurements as in Table 2.

Female-deutonymph (Fig. 19). Small mites less than 400 long. Proteronotal setae subequal to one another. Idiosomal setation as in preceding species. Tritosternum square, wider than long (Fig. 19). Sternal shield similar to male sternogenital shield, broad, almost as wide as long, yet truncate anteriorly. Setae ventrally on idiosoma, inclusive of sternal setae, well-developed, rather thick and long. Of 3 pairs of caudal setae, posterior 2 pairs stout but shorter than metasternal and genital setae.

Leg I thick and cylindrical; 2 or, sometimes, 3 prominent protuberances discernible on anterior margin of coxa I (Fig. 19) unlike in other species; leg chaetotaxy as in adult.

Measurements as in Table 3.

Male-deutonymph. Smaller in all measurements than female-deutonymph. Leg I subequal in length to leg IV. A pair of slender adanal setae and 2 pairs of stout caudal setae present. Other structures inclusive of tritosternum, and setation on idiosoma and legs as in female-deutonymph.

Measurements as in Table 3.

Female-protonymph. Dorsal shield entire, oval. Idiosomal and leg chaetotaxy as in all the preceding species. Proteronotal setae 1–3 subequal to one another. Tritosternum and sternal shield almost the same in shape as those of deutonymph. Leg I distinctly thicker and slightly longer than leg IV; anterior margin of leg I armed with protuberances as in deutonymph.

Male-protonymph. Leg I slightly thicker than leg IV and both legs subequal to each other. Other structures and chaetotaxy essentially as in female-protonymph.

Female- and male-protonymphs not differing so markedly as in all the preceding species, so that some specimens remain unallocated to either sex.

Materials examined. *Ex Rousettus aegyptiacus*, the type host; 1♂, Temple Abusimbel, West Bank, Egypt, 1963 (RMNH 17668); 1♀, Travertijn Cave near Katana, Eastern Belg. Congo, 1956 (RMNH 16350). *Ex Rousettus leschenaulti*: 4♀, 10♂, 4DN, 2PN, Tapkuang Kangkoi, Saraburi, Thailand, November 18, 1979; 2♂, 3DN, Bam Klui, Banmi, Lopburi, Thailand, November 12, 1979; 1♂, 1PN, Tapkuang Kangkoi, Saraburi, Thailand, November 17, 1979; 1♀, 4♂, 2DN, 1PN, Khoa Wong Kot, Thamai, Jhanthaburi, Thailand, November 27–28, 1979; 2♀, 13♂, 15DN, 13PN, Khao Tagro, Muang, Lopburi, Thailand, December 2, 1979. *Ex Rousettus amplexicaudatus*: 1PN, Tapkuang, Kangkoi, Saraburi, Thailand, November 18, 1979. *Ex Rousettus spelaea*: 1DN, Khoa Wong Kot, Thamai, Jhanthaburi, Thailand, November 27, 1979. *Ex Acedoron jubatus mindanaoensis**: 1PN, Tuganay, Mindanao, Philippines, November 20, 1946 (FMNH 74916–74918). *Ex Dobsonia viridis champani**: 16♀, 4♂, 3DN, 7PN, Bais, Pagayaburan, Negros, Philippines, May 13–14, 1949 (FMNH 66303–66310); 1♀, Amoi, Santa, Caslina, Negros, Philippines, May 20, 1948 (FMNH 67859). *Ex Cynopterus sphinx*: 1♀, 4PN, Tapkuang Kangkoi, Saraburi, Thailand, November 18, 1979; 4♀, 3♂, 4DN, 18PN; Sakaerat Station, Nakhonrajasima, Thailand, November 20–21, 1979; 2PN, Amphoe Khok Pho, Pattani, Thailand, January 20, 1982; 4PN, Doi Chang Kieng, Chiang Mai, Thailand, February 2, 1982. *Ex Cynopterus brachyotis*: 2PN, Gomantong Cave, Sabah, Borneo, April, 1979. *Ex Cynopterus* sp.: 1♀, 1♂, 1DN, 7PN, Amphoe Na Ta Vee, Songkhla, Thailand, January 23–25, 1982. *Ex Ptenochirus jadori*: 4♀, Sama Is., Philippines, April 9, 1957 (SMF 87714); 2♀, Katanglad, Mindanao, Philippines, May 12, 1965 (SMF 33336–33337). *Ex Penthetor lucasi*: 2♂, 5DN, 8PN, Poring, Sabah, Borneo, April, 1979; 9♀, Selangor, Malaysia, September 16, 1953 (FMNH 109124–109138); 1♀, Fraser's Hill, Selangor, Malaysia, April 7–17, 1969 (AMNH 216743–216745); 1♂, 3PN, the same locality as above, October 8, 1969 (AMNH 233956); 3♀, Sarawak, Malaysia, June, 1950 (FMNH 109120–109178); 10♀, 1DN, 4PN, Malaya, 1950 (SMF 18352–18353, 18364–18371);

4♀, Kajang, Malaysia, date uncertain (BMNH 60·838–848); 1♀, Bukit Temedu, western part of Mts. Hose, Sarawak, Malaysia, date uncertain (BMNH 65·4155–4160). *Ex Aethalops alecto**: 23♀, 2♂, 1PN, Head Quarters, Kinabalu, Sabah, Borneo, August 12–18, 1976; 9♀, 7♂, 15DN, 23PN, the same locality as above, April, 1979; 3♂, 3DN, 4PN, Poring, Sabah, Borneo, April, 1979; 1♀, Mt. Kinabalu, Sabah, Borneo, date uncertain (BMNH 65·330); 1♀, Fraser's Hill, Selangor, Malaysia, January 3, 1973 (AMNH 216757–216759). *Ex Haplonycteris fischeri**: 1♂, 1PN, Mt. Katanglad, Mindanao, Philippines, October–November, 1967 (SMF 28767–28839). *Ex Alionycteris paucidentata**: 1♀, Mt. Katanglad, Mindanao, Philippines, date uncertain (BMNH 73·1790) (total: 100♀, 55♂, 57DN, 107PN).

The specimens taken from museum bats are deposited in the museums where they were taken, and others in my collection.

Remarks. *Ancystropus zeileborii* is the only species recorded from both the Oriental and Ethiopian regions. Rudnick (1960) re-described both sexes and noted that the surface of the sternal shield was marked with distinct broken transverse lines in both sexes. This is also confirmed in the present study on a male and a female from *Rousettus aegyptiacus*, the type host. These striations are never observed on the adult and immature specimens from Oriental hosts, suggesting a distinct geographical variation. It is also probable that Ethiopian specimens are slightly larger than Oriental specimens.

A. zeileborii, the smallest species of *Ancystropus*, seems to be most prevalent on Oriental hosts. It was found on 13 species of bats other than *R. aegyptiacus*. Of the 13 host bats, the 5 asterisked species are new hosts and the other 8 and some more species have already been recorded as hosts of *A. zeileborii* (Hiregaudar and Bal, 1956; Rudnick, 1960; Delfinado and Baker, 1963; Baker and Delfinado, 1964; Prasad, 1969, 1974; Domrow, 1972; Hill and McNeely, 1975; Cuy, 1979; Bhat *et al.*, 1983). It is necessary to confirm the relationship of *A. zeileborii* with such new hosts as *Acedoron jubatus*, *Haplonycteris fischeri* and *Alionycteris paucidentata* that yielded only a few specimens of this mite.

***Ancystropus taprobanus* (Turk, 1950)**

(Figs. 15 and 20)

Male (Fig. 15). Proteronotal seta 1 lacking; setae 2 subequal to or slightly longer than seta 3. A pair of postscutal and 2 pairs of caudal setae present as in all the preceding species. Tritosternum thick, rounded and sausage-like, with weak appendages on posterolateral corners (Fig. 15). Sternogenital shield caudally protuberant medially, barely reaching to basal level of genital setae, and bearing 3 pairs of weak sternal setae and 2 pairs of pores (Fig. 15). Metasternal, genital and 3 pairs of ventral setae also weak; adanal setae spiniform and short.

Legs relatively slender and long; leg chaetotaxy as in female as in Table 6.

Spermadactyl whip-like, very long.

Measurements as in Table 2.

Female-deutonymph (Fig. 20). Proteronotal seta 1 lacking; setae 2–4 well-developed; setae 2 and 3 far apart from each other. Postscutal seta well-developed as in female, more than 20 long; 3 pairs of caudal setae strong with 1st pair more than 30 long, and 2nd and 3rd pairs spiniform. Four pairs of ventral setae present as in female and unlike other species; 4th pair stronger than preceding setae, situated closer to caudal setae than to 3rd ventral seta. Tritosternum thick, and semicircular (Fig. 20). Sternal shield truncate anteriorly, tapering and ending bluntly or weakly protuberant posteriorly (Fig. 20), and bearing weak sternal setae. Metasternal, genital and ventral setae weak; adanal setae spiniform and short.

Leg I not markedly different from other legs in appearance; leg chaetotaxy as in adult.

Measurements as in Table 3.

Male-deutonymph. Only 2 pairs of caudal setae homologous with 1st and 4th pairs of female-deutonymph present as in other species. Leg I slightly thinner than in female-deutonymph. Other structures and setations essentially as in female-deutonymph.

Measurements as in Table 3.

Protonymph. Sexes difficult to discriminate.

Dorsal shield entire. Proteronotal seta 1 lacking; setae 2 and 3 subequal in length;

Figs. 15, 16 Male idiosomal venter, tritosternum and tip of chelicera.

15: *Ancystropus taprobanus* (Turk, 1950). 16: *Ancystropus aethiopicus* Hirst, 1923.Table 6 Leg chaetotaxy of male (*A. taprobanus*).

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	5	2-4/3-2	1-2/1, 2/1-1	1-2/1, 2/1-1	31
II	2	5	1-4/3-1	1-2/1, 2/1-1	1-1/1, 2/1-1	16
III	2	5	1-3/2-0	1-2/1, 2/0-1	1-1/1, 2/0-1	16
IV	1	4	1-3/1-0	1-2/1, 2/0-1	1-1/1, 2/0-1	16

Table 7 Leg chaetotaxy of protonymph (*A. taprobanus*).

	Coxa	Trochanter	Femur	Genu	Tibia	Tarsus
Leg I	2	4	1-4/2-1	1-2/1, 2/1-1	1-2/1, 2/1-1	25
II	2	4	1-4/2-1	1-2/0, 2/0-1	1-1/1, 2/1-1	15
III	2	4	1-3/1-0	1-2/0, 2/0-1	1-1/1, 2/0-1	15
IV	1	4	1-3/0-0	1-2/0, 2/0-1	1-1/1, 2/0-1	15

distances from seta 3 to setae 2 and 4 almost the same as each other. Tritosternum smaller but almost the same in shape as in deutonymph. Idiosomal setation as in other species. Other structures as in deutonymph.

Leg chaetotaxy as in *Meristaspis* protonymph as in Table 7.

Measurements as in Table 5.

Materials examined. *Ex Rousettus leschenaulti*: 2DN, Thum Khum, Khoawong, Banmi, Lopburi, Thailand, November 10, 1979; 3♀, 3♂, Bam Klui, Banmi, Lopburi, Thailand, November 11–12, 1979; 3♀, 6♂, 3DN, Tapkuang, Kangkoi, Saraburi, Thailand, November 18, 1979; 2♂, 1DN, 3PN, Khoa Wong Kot, Thamai, Jhanthaburi,

Thailand, November 27–28, 1979; 3♂, 4PN, Khao Tagra, Muang, Lopburi, Thailand, December 2, 1979. *Ex Eonycteris spelaea*: 2♂, Khao Wong Kot, Thamai, Jhanthaburi, Thailand, November 28, 1979. *Ex Dobsonia inermis*: 1♂, Solomon Is., 1964 (BBM-BSIP 23728). Host and data uncertain (BBM): 1♂ (total: 6♀, 18♂, 6DN, 7PN).

Two males are in the BBM, and all the other specimens in my collection.

Remarks. Prasad (1969) presented accurate drawings for *Ancystropus rudnicki* Baker and Delfinado, 1964, a junior synonym of *A. taprobanius*, and noted that the spermadactyl was slender and curved toward its apex.

Domrow (1972) showed an aberrant proteronotal and leg chaetotaxy for *A. taprobanius* and thought that this mite was the only mobile member of the genus. The leg chaetotaxy of its protonymph is not the same as in other species of the genus but corresponds to that in *Meristaspis*, thus supporting Domrow (1972).

***Ancystropus aethiopicus* Hirst, 1923**
(Fig. 16)

Male (Fig. 16). Large mite more than

500 long. Proteronotal seta 3 longer than seta 2. Minute postscutal seta and 3 pairs of slender caudal setae present as in female unlike other species. Tritosternum a distorted rectangle, with irregularly convex anterior margin. Sternogenital shield much longer than wide, faintly striated, tapering from a level in front of bases of sternal setae 2 and extending to basal level of genital seta, and bearing 3 pairs of strong sternal setae. Metasternal seta situated anteriorly closer to sternal seta 3 than to genital seta; both metasternal and genital setae strong.

Legs long; leg chaetotaxy as in *A. notopterus* and *A. kanheri*.

Measurements as in Table 2.

Immature stages not available.

Materials examined. *Ex Epomops fraqueti*: 3♀, 2♂, Angola, 1954 (FMNH 81699–81711) (total: 3♀, 2♂).

Two females and 1 male are deposited in the FMNH, and 1 female and 1 male in my collection.

Remarks. The male of *A. aethiopicus* is exceptional among its congeners in having a pair of minute postscutal setae and 3 pairs of caudal setae.

Figs. 17–20 Tritosternum, sternal shield, metasternal and genital setae of female-deutonymph. 17: *Ancystropus kanheri* Hiregaudar and Bal, 1955. 18: *Ancystropus eonycteris* Delfinado and Baker, 1963; M—anterior part of male-deutonymph. 19: *Ancystropus zeleeborii* Kolenati, 1956, with coxae I showing characteristic protuberances (arrowed). 20: *Ancystropus taprobanius* (Turk, 1950).

Key to Males of *Ancystropus**(A. leleupi not available)*

1. Proteronotal seta 1 missing. Tritosternum thick, rounded and sausage-like. Sternogenital shield protuberant caudally. Spermadactyl long and whiplike. Trochanter IV with 4 setae. Genua and tibiae III–IV with 4 and 3 dorsal setae, respectively *A. taprobanius*
Proteronotal seta 1 present. Tritosternum, sternogenital shield, spermadactyl not as above. Trochanter IV with 5 setae. Genua and tibiae III–IV with 2 and 1 dorsal setae, respectively 2
2. Posterior margin of tritosternum weakly concave or almost straight. Sternogenital shield extending posteriorly beyond basal level of metasternal setae. Metasternal setae situated in front of genital setae. One or 2 ventral setae on femur IV. Spermadactyl curved strongly 3
Posterior margin of tritosternum surrounding genital orifice. Sternogenital shield broadly rounded posteriorly, and barely or not reaching to basal level of metasternal setae. Metasternal and genital setae almost on the same level. Only 1 ventral seta on femur IV. Spermadactyl sinuate, not curved strongly 5
3. Large mite more than 500 long. Postscutal seta minute and 3 pairs of caudal setae present. Tritosternum with straight posterior margin and lacking any protuberances on posterolateral corners. Sternogenital shield tapering from an anterior level to bases of sternal setae 2. Only 1 ventral seta on femur IV. Spermadactyl *ca.* 50 long *A. aethiopicus*
Smaller mite less than 400 long. Postscutal seta conspicuous and 2 pairs of caudal setae present. Tritosternum with protuberances on posterolateral corners. Sternogenital shield narrowed posteriorly from behind bases of sternal setae 3. Two ventral setae on femur IV. Spermadactyl *ca.* 35 long 4
4. Tritosternum stretched capsule-like. Sternogenital shield triangular behind sternal seta 3. Sternal, metasternal and genital setae thick and long *A. zeleborei*
Tritosternum with concave posterior mar-

gin. Sternogenital shield rounded behind sternal seta 3. Sternal, metasternal and genital setae slender *A. eonycteris*

5. Idiosoma less than 400 long. Tritosternum thick and trapezoidal, with concave posterior margin. Sternogenital shield pear-shaped. Sternal, metasternal and genital setae thin and short. Spermadactyl less than 50 long *A. kanheri*
Idiosoma more than 500 long. Tritosternum thin, broad and crescentic. Sternogenital shield flask-shaped. Sternal, metasternal and genital setae thick and long. Spermadactyl more than 80 long *A. notopectis* sp. n.

Key to Deutonymphs of Oriental *Ancystropus*

1. Proteronotal seta 1 missing. Tritosternum thick, roughly semicircular. Female- and male-deutonymphs bearing 4 and 2 pairs of ventral setae, respectively. Metasternal and genital setae minute *A. taprobanius*
Proteronotal seta 1 present. Tritosternum not as above. Female- and male-deutonymphs bearing 3 and 2 pairs of ventral setae, respectively. Metasternal and genital setae conspicuous 2
2. Sternal shield truncate anteriorly and narrowed posteriorly, reaching posteriorly to basal level of genital setae 3
Sternal shield rounded anteriorly and broadly rounded posteriorly, not reaching to basal level of genital setae 4
3. Small mite less than 400 and 350 long in female- and male-deutonymphs, respectively. Sternal shield almost as long as wide. Sternal setae thick and long. Two or 3 prominent protuberances on anterior margin of coxa I *A. zeleborei*
Medium-sized mite more than 480 and 380 long in female- and male-deutonymphs, respectively. Sternal shield distinctly longer than wide. Sternal seta rather slender and short. No protuberances discernible on anterior margin of coxa I *A. eonycteris*
4. Idiosoma less than 560 long in female-deutonymph. Metasternal seta present. Tritosternum with invaginated lateral margins in female-deutonymph, square in

male-deutonymph. Leg I *ca.* 550 and *ca.* 400 long in female- and male-deutonymphs, respectively *A. kanheri*
 Idiosoma more than 700 long in female deutonymph. Metasternal seta missing in female-deutonymph. Tritosternum trapezoidal in female- and male-deutonymphs. Leg I 700 and 570–600 long in female- and male-deutonymphs, respectively

..... *A. notopteris* sp. n.

Since leg chaetotaxy is the same in the deutonymph as in the adult regardless of sex, differences by species in leg chaetotaxy are omitted in the above key.

Key to Protonymphs of Oriental *Ancystropus*

1. Proteronotal seta 1 missing, distance between setae 2 and 3 subequal to that between setae 3 and 4. Genua and tibiae III–IV with 4 and 3 dorsal setae, respectively *A. taprobanius*
 Proteronotal seta 1 present; distance between setae 2 and 3 distinctly shorter than that between setae 3 and 4. Genua and tibiae III–IV with 2 and 1 dorsal setae, respectively 2
2. Proteronotal seta 1 more than 15 long; setae 2 and 3 subequal 3
 Proteronotal seta 1 weak, less than 10; setae 2 much shorter than seta 3 4
3. Small mite less than 410 and 370 long, and leg I less than 360 and 330 long, in female- and male-protonymphs, respectively. Two or 3 prominent protuberances on anterior margin of coxa I
 A. zeleborii
 Medium-sized mite more than 430 and 380 long, and leg I *ca.* 500 and *ca.* 400 long, in female- and male-protonymphs. No protuberance on anterior margin of coxa I *A. eonycteris*
4. Medium-sized mite; dorsal shield 410–430 and 360–380 long, and leg I less than 510 and 400 long, in female- and male-protonymphs, respectively. Proteronotal seta 2 more than 13 long *A. kanheri*
 Large mite; dorsal shield more than 500 and 450 long, and leg I nearly 600 and 540 long, in female- and male-protonymphs, respectively. Proteronotal seta 2 weak, less than 10 long

..... *A. notopteris* sp. n.

Since the shape of the tritosternum and sternal shields and the nature of the sternal setae are almost the same as in the male-deutonymph, specific notice of these characters is omitted in the above key.

DISCUSSION

Studies of *Ancystropus* long concentrated on the conspicuous females, yet a precise evaluation of female key characters came as late as Domrow (1972). He reexamined females of all known species and showed the specific variations in proteronotal, hysterosomal, ventral and leg setations. Based on detailed observations, he included 6 species in the genus, relegating some earlier nominal species to synonymy. I follow his treatment of *Ancystropus*.

The female of the new species *A. notopteris* is close to *A. kanheri* and *A. leleupi* in sharing the same proteronotal and leg setations, but shows a new point in idiosomal setation, *i.e.* metasternal seta lacking. This is the one variation to be added to Domrow's observation on females of *Ancystropus*. Although the long postscutal seta is also a remarkable character of the new species, such a seta is found in the female of *A. taprobanius*.

The males have the same leg chaetotaxy as their respective partner females, but, unlike in females, the male proteronotal seta 1 is prominent in all species except *A. taprobanius* (that lacks this seta). The hysterosomal and ventral setations, inclusive of the metasternal seta, are the same in all males except *A. leleupi* (male unknown) and *A. aethiopicus* that bears inconspicuous postscutal setae and 3 pairs of caudal setae. Thus, adding to the proteronotal setae, there are 1 pair of poststigmatal setae, 1 pair of conspicuous postscutal setae, 2 pairs of caudal setae, 3 pairs of ventral setae, 1 pair of genital setae and 1 pair of metasternal setae on the male idiosoma. There is no exception even in *A. notopteris* that lacks the metasternal seta in the female and in *A. taprobanius* that bears 4 pairs of ventral setae in the female instead of 3 pairs of other species. The key characters other than proteronotal and leg setations for differentiating males of *Ancystropus* are idiosomal size, shape of

tritosternum and sternogenital shield, nature of sternal setae, nature and position of metasternal and genital setae, and shape and size of spermadactyl.

There is distinct sexual dimorphism in the deutonymphal stage of the Oriental species. The female- and male-deutonymphs are associated morphologically with their respective adults as pointed out by Rudnick (1960), but the proteronotal seta 1 and postscutal seta tend to be more conspicuous in female-deutonymphs than in adult females. *A. eonycteris* shows the most remarkable sexual difference among the 5 Oriental species in the size of the idiosoma and leg I and in the shape of tritosternum in this stage. Other specific characters for the deutonymph are those described above for the males. It is highly probable that the Ethiopian species, *A. aethiopicus* and *A. leleupi*, also have specific characters to differentiate them from one another and from the 5 Oriental species in the deutonymphal stage.

In the protonymphal stage, sexual dimorphism is apparent in the size of idiosoma and leg I in *A. notopteris*, *A. kanheri* and *A. eonycteris*, not so apparent in *A. zeheborei* and not discernible in *A. taprobanius*. Proteronotal setae 1-4, 1 pair of poststigmatal setae, 1 pair of postscutal setae, 2 pairs of caudal setae, 1 pair of genital setae and 2 pairs of ventral setae are present in all species, and proteronotal seta 1 is missing only in *A. taprobanius*. A common leg setation is shared by *A. notopteris*, *A. kanheri*, *A. eonycteris* and *A. zeheborei*, while the leg setation of *A. taprobanius* is the same as that in *Meristaspis* spp. Some other specific characters found in the more advanced stages are also observed in each species in the protonymphal stage.

In the female, serial changes were thoroughly evaluated by Domrow (1972). More advanced specialization of some characters of leg I and significant deficiency or reduction in proteronotal, ventral and leg setae were noted carefully through comparison of homologous characters of all the known species. On the basis of finding specimens of *Ancystropus* attached somewhat like ticks, their legs I and mouthparts being tightly embedded in the skin of the arm-pits of Malayan bats, and of *A. kanheri* with legs I

often snapped-off, Domrow (1972) thought there was a tendency in *Ancystropus* to change from tactile to prehensile life on the host. Thus the above serial changes in some homologous characters among *Ancystropus* females should not be treated independently, but as facets of one and the same tendency as suggested by Domrow (1972).

The female-deutonymphs resemble morphologically their respective females, yet specialization of proteronotal setae (especially 1 and 2) and legs I is far inconspicuous in the former, suggesting that there is a difference between the two stages in attaching habit and that the deutonymphal stage is preparatory for a remarkable sexual dimorphism in the adult stage. Related to this, prominent dimorphism in the protonymphal stage as in *A. kanheri*, *A. notopteris* and *A. eonycteris* might be indicative of conspicuous difference between both sexes in the advanced stages. The male, male-deutonymph and protonymph seem not to be specialized enough to have prehensile function, compared with congeneric females and corresponding stage of other spinturnicid genera. However, it is reasonable to estimate that the male, having direct contact with its partner female during mating, should have acquired some apomorphic characters in accordance with specialization of the female. The 3 types of spermadactyls found in the 6 species of the genus are thought to be one of such changes in response to specialization of proteronotal setae, leg I and/or physogastry of partner females, although mating behavior cannot be visualized clearly. The male of *A. taprobanius* (a species with many curious characters in the female and is proposed as the only mobile member of the genus by Domrow, 1972) has extraordinarily long and whip-like spermadactyls, while those of *A. eonycteris*, *A. zeheborei* and *A. aethiopicus* are provided with hooked or curved spermadactyls. The 3rd type of spermadactyls is found in *A. kanheri* and *A. notopteris* where they are not hooked but weakly sinuate and rather long. Since all female characters of *A. kanheri* and *A. notopteris* are similar to those of *A. leleupi*, the unknown male of *A. leleupi* is presumed to have the 3rd type of spermadactyls. Compared with cases of all spinturnicid mites, the sinuate and extraordinarily long

spermadactyls are thought to be an apomorphic state. The metasternal and genital setae arranged on the common level concomitant with the posteriorly shortened and rounded sternogenital shield are also thought to be derived characters found in only a few species. No other male character obviously associated with evolution of *Ancystropus* has yet been noticed. Thus the apomorphic characters are:

1. Pulvillus I absent (generic character in female only)
2. Genua and tibiae III–IV with 2 and 1 dorsal seta, respectively (all species other than *A. taprobanus* in all stages)
3. Proteronotal seta 2 reduced (*A. kanheri*, *A. notopteris* and *A. leleupi*, in female and, to a lesser extent, all other stages of the former two)
4. Metasternal seta absent (*A. notopteris* in female and female-deutonymph)
5. Three pairs of ventral setae (all species except *A. taprobanus* in female and female-deutonymph)
6. Basal anteroventral seta knob-like (all species except *A. taprobanus* and *A. aethiopicus* in female)
7. Only a single ventral seta on femur IV (*A. aethiopicus*, *A. leleupi*, *A. kanheri* and *A. notopteris* in adult and deutonymphal stages)
8. Leg I armed with (in female only): strong lateral and posteroventral hooks on distal 5 segments and a spur anteroventrally on genu and tibia (*A. zezeborii* and *A. aethiopicus*); small lateral hooks on distal 5 segments and a spur anteroventrally on genu and tibia (*A. eonycteris*); only a spur anteroventrally on genu and tibia (*A. leleupi* and *A. kanheri*); a finely striated patch anteroventrally on femur, genu and tibia (*A. notopteris*)
9. Spermadactyl extraordinarily long and whip-like, or sinuate (*A. taprobanus* and *A. kanheri*, *A. notopteris* and probably *A. leleupi*, respectively)
10. Sternogenital shield posteriorly shortened and rounded, and metasternal and genital setae arranged on a common level (*A. kanheri* and *A. notopteris*)
11. Sexual dimorphism obvious in proto-nymphal stage (*A. eonycteris*, *A. kanheri*

and *A. notopteris*)

Reduction of a ventral or anterolateral seta occurs concomitantly on trochanter and femur IV and on genu and tibia I in *A. taprobanus*. So setal reduction on femur IV of this species is not dealt with in the same way as in the other species in the above article 7.

Concerning the lateral and ventral armature of female leg I, modified and conspicuous lateral setae as observed in *A. taprobanus* (as well as in *Meristaspis* spp.) might have been changed to such conspicuous lateral and ventral hooks and spurs as in *A. zezeborii*, which might gradually have regressed to the degree noticed in *A. notopteris* that bears only a finely striated patch ventrally on anterodistal corner of femur, genu and tibia I. Accordingly, in the article 8, the latter is thought to be in the more advanced state. The bulky hook found posterodistally on tarsus I of *A. kanheri* is thought to be an exceptional and purely specific character incompatible with homologous structure of other spinturnicid species.

It is important to know where such apomorphic characters have come out in accordance mainly with the specialization of females. To find a clue to this problem, ecology of all members of *Ancystropus*, inclusive of behavioral habits, distributional patterns, host ranges and restricted locations on hosts, should be studied thoroughly. Only fragmentary knowledge on host relations is available at present, yet, using it, an attempt to interpret the above problem is made below.

A. aethiopicus, *A. leleupi*, *A. eonycteris*, *A. kanheri* and the new species *A. notopteris* may be restricted to a few hosts, but records are few. Contrary to this, *A. zezeborii* and, to a lesser extent, *A. taprobanus* have repeatedly been recorded from various hosts, suggesting their host ranges are wide. Accordingly, no established host relationship of *Ancystropus* is deducible from host record analyses. On the other hand, some bats are remarkable as hosts of 2 or more species of *Ancystropus*. *Rousettus leschenaulti* (Hiraga and Bal, 1956; Hill and McNeely, 1975; Bhat *et al.*, 1983; the present study), *Rousettus amplexicaudatus* (Cuy, 1979), *Rousettus stresemanni* (Domrow, 1972) and *Cynopterus brachyotis* (Hill and McNeely,

1975) have been recorded as hosts of the 3 *Ancystropus* species, *A. taprobanus*, *A. zeleborii* or *A. eonycteris* (only on *C. brachyotis*) and *A. kanheri*. *Eonycteris spelaea* was the host of *A. taprobanus*, *A. zeleborii*, *A. eonycteris* and *A. kanheri* in the present study and of the first 3 species in Hill and McNeely (1975), though the relations of some mites with this bat must be confirmed. *Rousettus aegyptiacus* is the type host of *A. zeleborii* and *A. leleupi* (Benoit, 1959; Rudnick, 1960). Although some false records might be included, there are many other examples of synhospitality by 2 *Ancystropus* species. Further, all the above host bats are parasitized by *Meristaspis lateralis* together with their respective *Ancystropus* mites.

A tendency of heavy synhospitality of *Ancystropus* and simultaneous occurrence of its relatives on some *Rousettus* and others might have been realized through either secondary establishment or successive speciations of mites on a given host. Combinations of the synhospitolic mites recorded above indicate that mites with different spermadactyl types such as *A. taprobanus* with extraordinarily long and whip-like spermadactyls, *A. zeleborii* and *A. eonycteris* with hooked ones and *A. kanheri* or *A. leleupi* with sinuate ones occur far more often than combinations of mites with the same spermadactyl type, suggesting behavioral differences among synhospitolic males. Provided the change in the formation of spermadactyls is related to the specialization of partner female as thought before, the females of synhospitolic mites are thought to have acquired sympatric speciation through habitat or behavior segregation on a given host. On the other hand, data supporting transfer and secondary establishment of *Ancystropus* mites on any host have so far not been clearly shown. Thus, successive speciations independent of host speciations should not be neglected in thinking of evolution of mites, incorporating this into a discussion of host phylogeny, within the genus *Ancystropus*. This is a warning to some parasitologists who are ready to use endo- and/or ecto-parasites merely as labels in evolutionary analyses of their hosts, without investigating biological properties of parasites.

ACKNOWLEDGEMENTS

I sincerely thank Dr. R. Domrow, Queensland Museum, Brisbane, for reading a typescript of the present paper and Ms. M. Yamamoto for typing it.

Partial financial support was provided by Overseas Scientific Research Grant Nos. 57041019 and 58043013 from the Ministry of Education, Science and Culture of Japan (Contribution No. Ac18).

REFERENCES

- Baker, E. W. and M. D. Delfinado (1964): Spinturnicidae of South East Asia and the Pacific region. *Pac. Insects*, **6**: 571-591.
- Benoit, P. L. G. (1959): Un nouveau spinturnicide sur chauves-souris frugivores du Congo belge (Acarina-Mesostigmata). *Rev. Zool. Bot. Afr.*, **59**: 106-108.
- Bhat, H. R., S. M. Kulkarni and A. C. Mishra (1983): Records of Mesostigmata, Ereyetidae and Pterygosomidae (Acarina) in Western Himalayas, Sikkim and Hill Districts of West Bengal. *J. Bombay Nat. Hist. Soc.*, **80**: 91-110.
- Cuy, L. S. (1979): Synopsis of Philippine Spinturnicidae (Acarina: Mesostigmata). *Kalikasan, Philipp. J. Biol.*, **8**: 162-172.
- Delfinado, M. D. and E. W. Baker (1963): Mites of the family Spinturnicidae from the Philippines (Acarina). *Pac. Insects*, **5**: 905-920.
- Domrow, R. (1972): Acari Spinturnicidae from Australia and New Guinea. *Acarologia*, **13**: 552-584.
- Dusbábek, F. and W. Bergmans (1980): Spinturnicid mites from some Nigerian bats (Acarina, Spinturnicidae). *Bull. Zool. Mus. Univ. Amsterdam*, **7**: 65-72.
- Evans, G. O. (1968): The external morphology of the post-embryonic developmental stages of *Spinturnix myoti* Kol. (Acari: Mesostigmata). *Acarologia*, **10**: 589-608.
- Hill, J. E. and J. A. McNeely (1975): *The Bats and Bat's Parasites of Thailand*, 1-87.
- Hiregaudar, L. S. and D. V. Bal (1956): Some ectoparasites of bats from India. *Agra Univ. J. Res. (Sci.)*, **5**: 1-134.
- Prasad, V. (1969): Bat mites (Acarina: Spinturnicidae) mainly from South-East Asia and the Pacific region. *Acarologia*, **11**: 657-677.
- Prasad, V. (1974): Parasitic mesostigmatic mites from Nepal (Acarina: Mesostigmata). *Orient. Insects*, **8**: 63-70.
- Rudnick, A. (1960): A revision of the mites of the family Spinturnicidae (Acarina). *Univ. Calif. Pub. Entomol.*, **17**: 157-283.
- Turk, F. A. (1950): Studies of Acari. IV. Parasitic mites from mammalian hosts obtained in

Ceylon. *Parasitology*, **40**: 36-76.

Uchikawa, K. and T. Kobayashi (1978): A contribution to the ectoparasite fauna of bats in Thailand II. Blood-sucking Acari (Argasidae, Spinturnicidae and Macronyssidae). *Contr. Biol. Lab. Kyoto Univ.*, **25**: 249-254.

摘 要

コウモリダニ科 *Ancystropus* 属の1新種と
未記載齢期および本属の新形質と
その形成様式

Ancystropus 属の1新種 *A. notopteris* を全発育齢期(雌, 雄, 第2若虫, 第1若虫)に基づいて記載した. 本属の全既知種のうち *A. leleupi* を除く5種について, 雄の再記載(1種)または記載を行った. 東洋区に分布する *A. kanheri*, *A. eonycteris*, *A. zeleborii* および *A. taprobanius* の若齢期を記載した. *Ancystropus* 属の新形質を評価し, 新形質が本属ダニ類の同所性種形成に伴って出現したものと考えた.