THREE NEW SPECIES OF *UNIONICOLA* (ACARI UNIONICOLIDAE: UNIONICOLINAE) INHABITING FRESH WATER MUSSELS (UNIONACEA) IN SOUTHEAST ASIA

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ABSTRACT—Adults of three new species are described for the first time. ***Unionicola (Pentatax) thaiensis*** n. sp. is described from Thailand and resembles *U. bonzi* (Claparede) and *U. imamurai* Hevers. ***U. (Polyatax) heardi*** n. sp. is described from Thailand and resembles *U. scutigera* Viets, *U. neokoenikei* Viets and *U. japonensis* Viets. ***U. (Parasitatax) brandti*** n. sp. is described from Thailand and Laos and resembles *U. diversipes* Viets and *U. tumida* (Wolcott). These three new species were found in fresh water mussels.

INTRODUCTION

In the winter of 1979, the author examined the mussel holdings of the Academy of Natural Sciences of Philadelphia. In the winter of 1983, the author examined the mussel holdings of the United States National Museum (Smithsonian Institution). The mussels were preserved in alcohol, and the mites were preserved in situ. Three new species were encountered and are described here. The mussel hosts (Unionacea) have recently been monographed (Brandt 1974).

Holotypes and representative paratypes are deposited in the Canadian National Collections and Biosystematics Institute, Ottawa. Additional paratypes are retained in the author's collection.

Terminology for adult structures follows that used by Simmons and Smith (1984). Generic and subgeneric concepts are those of Cook (1974). Measurements are expressed in microns and in the format, mean (range). All bars on figures equal 100 microns (0.1 mm).

RESULTS AND DISCUSSION

Unionicola (Pentatax) thaiensis new species (Figs. 1-7)

DESCRIPTION — No conspicuous dorsal secondary sclerotization; small posterior apodemes on coxal plate IV; elongate posterior apodemes on coxal plates I and II; coxal plate IV nearly twice the size of coxal plate III (figs. 1 and 2); female genital field with 4 acetabular plates (fig. 6), two per side of genital opening; anterior female acetabular plates bearing 2-3 acetabula and a pair of large, inner spines each (fig. 6); posterior female acetabular plates bearing 3-5 (usually 3) acetabula and a single, inner, elongate setae (fig. 6); male genital field with a single pair of acetabular plates, each bearing 5 acetabula (fig. 5); capitulum small and not strikingly modified; serrate setae on palpal Fe (fig. 7); palpal Ta with two distinct prongs (fig. 7); male and female legs similar (fig. 4); claws of all legs with minute, dorsal, near distal clawlet (fig. 3).

MALE (4 specimens): Length including capitulum 625 (600-650); length of posterior coxal group 199 (185-210); genital field 130 (125-135) long, 123 (120-125) wide; dorsal lengths of pedipalp segments: Fe 101 (92-110); Ge 40; Ti 95 (90-100); Ta 54 (50-60); dorsal lengths of leg segments: leg I: TFe 100 (95-105); Ge 152 (145-160); Ti 119 (115-120); Ta 108 (100-120); leg IV: TFe 125 (115-130); Ge 181 (155-200); Ti 214 (190-230); Ta 180 (175-185).

FEMALE (4 specimens): Length including capitulum 720 (700-750); length of posterior coxal group 213 (200-220); genital field 173 (170-175) long, 214 (200-225) wide; dorsal lengths of pedipalp segments: Fe 110 (105-115); Ge 58 (55-60); Ti 95 (90-100); Ta 59 (55-65); dorsal lengths of leg segments: leg I: TFe 111 (105-115); Ge 168 (150-175); Ti 131 (130-135); Ta 123 (120-125); leg IV: TFe 125 (115-130); Ge 181 (155-200); Ti 214 (190-230); Ta 180 (175-185).

NOTES — Holotype (male) (CNC type number 18684) from ANSP mussel lot A3646 from Maenam Mun, Ban Bao Yai, Burinam Province, Thailand, collected on 18 May 1971 by Dr. Bill Heard. The host was

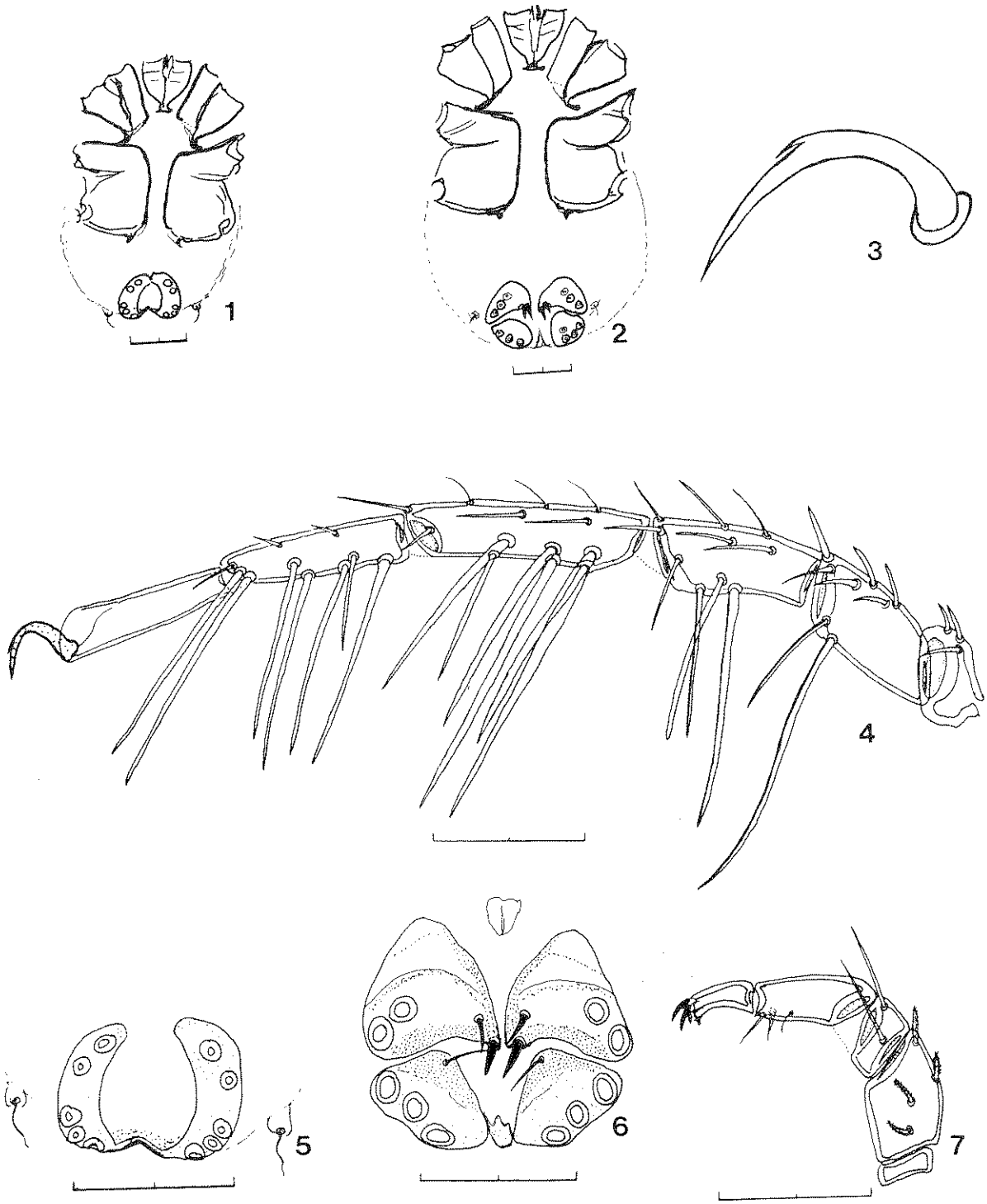


Fig. 1-7. *Unionicola (Pentatax) thaiensis* n. sp.: 1. male venter; 2. female venter; 3. claw of first walking leg; 4. male first walking leg; 5. male genital field; 6. female genital field; 7. lateral view of male palp.

Pseudodon vondembuschianus ellipticus Conrad. Usually 1-4 mites occurred in each infested host. Additional specimens include paratypes from: *P. v. ellipticus* from: (1) ANSP mussel lot A3629 from Lam Khlong, Boribun, Ban Choho, Nakon Ratchasima, Nakon Ratchasima Province, Thailand, 15 February 1971 (Bill Heard); (2) ANSP mussel lot A3573 from Huai Chuang Lang, Ban Nong Sai, Udon Thani, Udon Thani Province, Thailand, 24 March 1971 (Bill Heard); *P. cambodjensis* (Petit) from: (1) ANSP mussel lot A3574 (same as type locality and date); (2) ANSP mussel lot A3616 from Maenam Mun, Ampoe Satuk, border of Burinam and Surin Provinces, Thailand, 16 March 1971 (Bill Heard); (3) ANSP mussel lot A3618 from Lam Nam Mun, Ampoe Phaimai, Nakon Ratchasima Province, Thailand, 29 January 1971 (Bill Heard); *Pilsbryoconcha exilis exilis* (Lea) from: (1) USNM mussel lot 786369 from station 2625, Klong Saen Saep, Minburi, Thailand, 15 May 1963 (R. Brandt); *P. e. compressa* (Martens) from: (1) ANSP mussel lots A3582 and A3634 from Lam Nam Mun, Ampoe Phaimai, Nakon Ratchasima Province, Thailand, 29 January 1971 (Bill Heard); (2) ANSP mussel lot A3655 from Lam Khlong, Boribun, Ban Choho, Nakon Ratchasima, Nakon Ratchasima Province, Thailand, 15 February 1971 (Bill Heard).

REMARKS — *U. thaiensis* is intermediate in morphology between *U. bonzi* (Claparede), which is widely distributed in Europe, and *U. imamurai* Hevers, which was considered conspecific with *U. bonzi* by Imamura (1953) and occurs in Japan. Hevers (1978) compared *U. bonzi* and *U. imamurai* and noted the key difference as the ratio of the dorsal lengths of the palpal tarsi versus tibias. The ratio in *U. bonzi* is 0.77, and the ratio in *U. imamurai* is 0.45. *U. thaiensis* has a ratio of 0.60 and is otherwise identical to *U. imamurai*. These three mites are holophyletic and may represent part of a cline. Sokolow (1931) described two similar, but larger, species from eastern Russia: *U. setipes* Sokolow and *U. rezvoi* Sokolow. The exact relationships of this potentially large group of mites remains unclear, and information on the group from areas east of Europe is scant.

Unionicola (Polyatax) heardi new species
(Figs. 8-18)

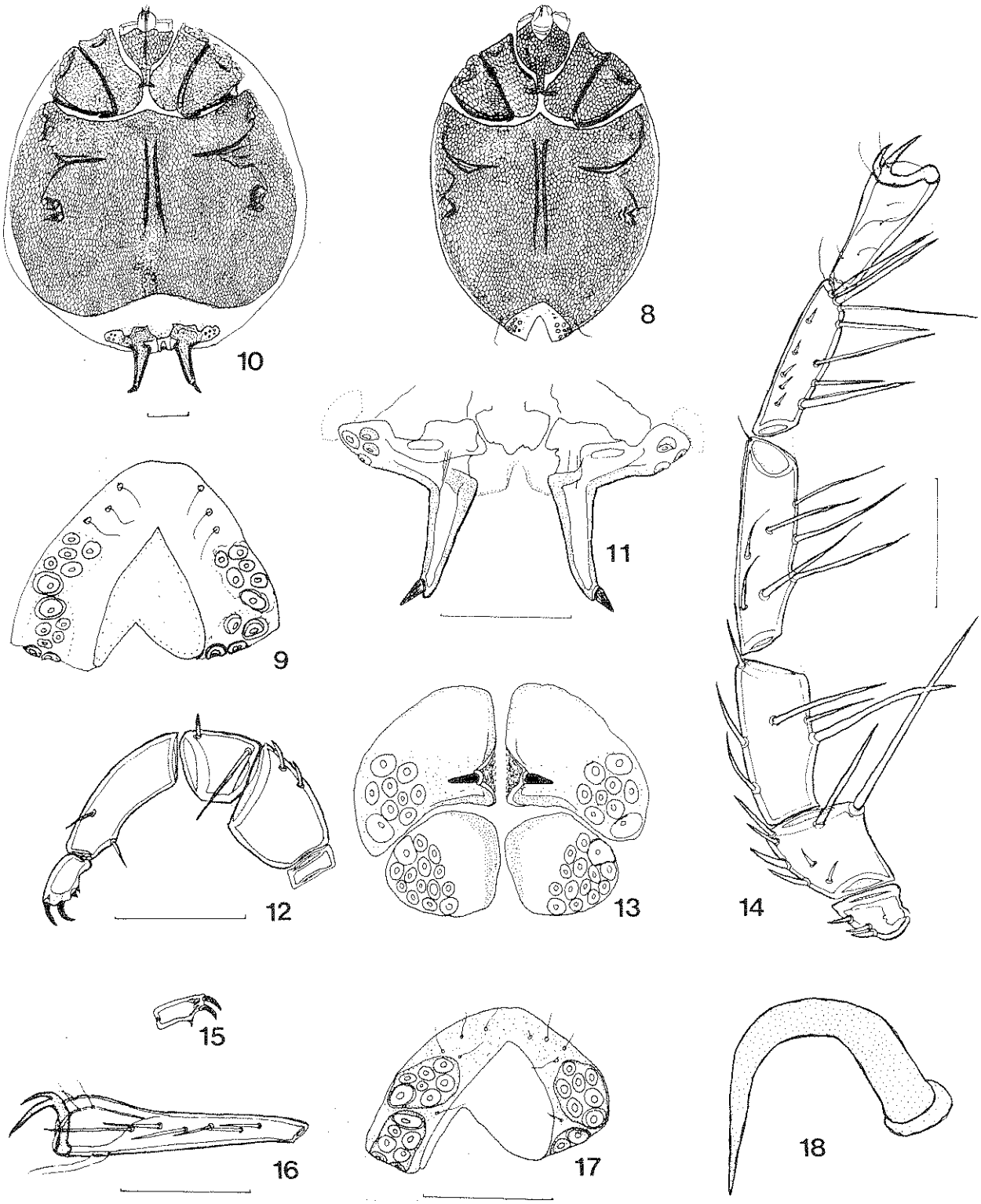
DESCRIPTION — Reticulate dorsal shield covers entire dorsum; coxal plate IV without distinct borders (figs. 8 and 10); all coxal plates reticulate; coxal plates I and II with distinct borders; capitulum small; female genital field with 4 plates, 2 on either side of the genital opening (figs. 11 and 13); anterior female acetabular plates with elongate, protruding flaps that appear as spinous structures (fig. 11); anterior female acetabular plates with a cluster of 7-9 acetabula, posterior female acetabular plates with a cluster of 9-14 acetabula (fig. 13); genital fields in both sexes posterior, and acetabular plates bearing each an enlarged acetabulum near the distal junction of the plates; male genital field with 2 acetabular plates, one on either side of the genital opening, with the plates joined anteriorly and posteriorly by chitinous bands (figs. 9 and 17); male acetabular plates with two clusters of acetabula, anterior cluster with 6-7 acetabula, posterior cluster with 6-7 acetabula; palpal Ta with 2 prongs (figs. 12 and 15); male and female legs similar (fig. 14); claws of the first and fourth pairs of walking legs deeply bifid (figs. 14 and 16); claws of the second and third pairs of legs simple and not bifid (fig. 18).

MALE (3 specimens): Length including capitulum 883 (850-900); length of dorsal shield 825 (800-850); length of posterior coxal group 625 (600-650); genital field 180 (160-200) long, 210 (200-220) wide; dorsal lengths of pedipalp segments: Ge 60; Ti 113 (110-115); Ta 43 (40-45); dorsal lengths of leg segments: leg I. TFe 162 (160-165); Ge 212 (210-215); Ti 168 (165-170), Ta 145 (140-150); leg IV: TFe 178 (175-180); Ge 260 (250-270); Ti 323 (320-325); Ta 248 (235-260).

FEMALE (4 specimens): Length including capitulum 963 (900-1050); length of dorsal shield 883 (850-900); length of posterior coxal group 558 (500-600); genital field 188 (175-200) long, 265 (260-270) wide; dorsal lengths of pedipalp segments: Ge 63 (60-65); Ti 123 (115-130); Ta 41 (40-45); dorsal lengths of leg segments: leg I: TFe 158 (150-175); Ge 203 (180-230); Ti 164 (150-175); Ta 130 (120-140); leg IV: TFe 179 (165-195); Ge 278 (255-300); Ti 320 (295-350); Ta 239 (230-250).

NOTES — Holotype (male) (CNC type number 18685) from ANSP mussel lot A5428 from Mekong River, Ban Dan, island site #4, Ubon Province, Thailand, collected on 19 April 1973 by Dr. George Davis. The host mussel was *Hyriopsis bialatus* Simpson. In several instances a single host contained 6 mites on the mantle, foot and palps. Additional specimens include paratypes from: *H. myersiana* (Lea) from: (1) ANSP mussel lot A4431 from Mekong River, Ban Dan, Ubon Province, Thailand, 18 April 1973 (G. Davis); (2) ANSP mussel lot A3656 from Maenam Khwae Yai, Ben Nong Bua, Kanchanaburi, Kanchanaburi Province, Thailand, 10 April 1971 (Bill Heard).

REMARKS — *U. heardi* is holophyletic with *U. japonensis* Viets from Japan (Viets 1933, Imamura 1953a), *U. scutigera* Viets from India and Burma (Viets 1926) and *U. neokoenikei* Viets from Borneo (Viets 1957). *U. heardi* differs from *U. japonensis* in the structure of the palpal tarsus, and it much more



Figs. 8-18. *Unionicola (Polyatax) heardi* n. sp.: 8 male venter; 9. ventral view of male genital field; 10. female venter; 11. ventral view of female genital field; 12. male palp; 13. posterior view of female genital field; 14. male first walking leg; 15. distal segment (tarsus) of female palp; 16. tarsus of male fourth walking leg; 17. ventral view of male genital field; 18. claw of male third walking leg.

closely resembles the latter two species. *U. heardi* differs from *U. neokoenikei* in that it has distinctly bordered medial and posterior borders on coxal plates I and II. *U. heardi* closely resembles *U. scutigera*, but it is diagnosed by its larger size and the palpal tarsi versus tibias ratios. *U. scutigera* has a ratio of 0.45, and *U. heardi* has a ratio of 0.33. These 4 species collectively represent the subgenus *Polyatax* in Asia and illustrate evolutionary adaptive radiation with their closest non-Asian relative apparently being *U. serrata* (Wolcott) in North America (Wolcott 1898).

Unionicola (Parasitatax) brandti new species (Figs. 19-28)

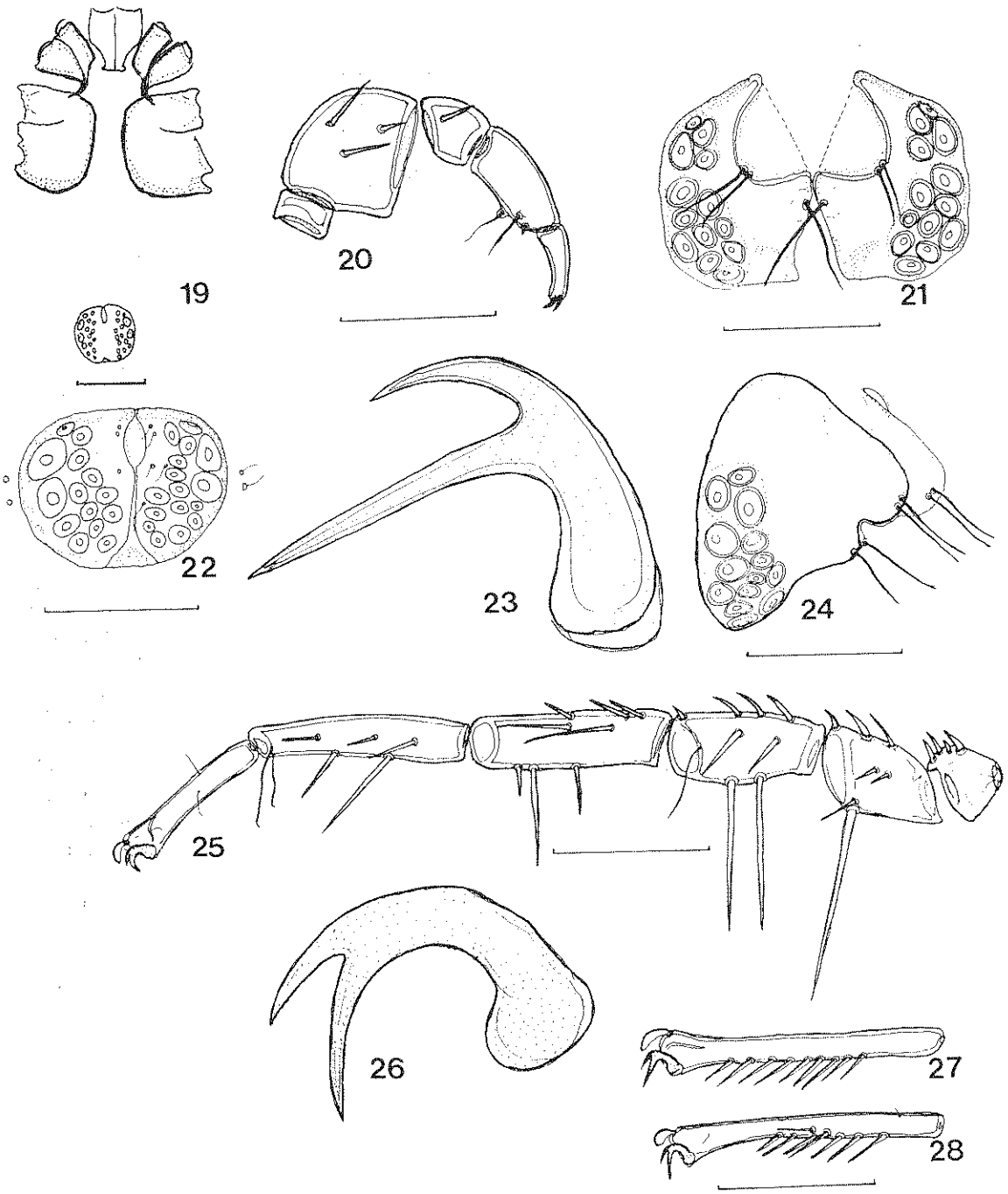
DESCRIPTION — No dorsal secondary sclerotization apparent; capitulum slightly enlarged; coxal plates III and IV fused together and only slightly longer than wide (fig. 19); coxal plate IV without an apparent posterior apodeme; coxal plates I and II with a moderately long posterior apodeme; female genital field with 2 acetabular plates, one on either side of the genital opening, each bearing 10-16 acetabula and an enlarged medial and anterior flap with two hair-like setae and a smaller, more posterior, flap with a single seta (figs. 21 and 24); male genital field with 2 acetabular plates, one on each side of the genital opening and joined anteriorly and posteriorly by a chitinous band (fig. 22); male acetabular plate with 11-16 acetabula; male and female acetabular plates with a pair of enlarged acetabula distally; palpal Ta moderately elongate with a pair of prongs distally (fig. 20); male and female legs similar (fig. 25); a slightly inflated, distal seta dorsal to claws at the end of each walking leg (figs. 25, 27 and 28); claws of walking legs large and bifid, with the dorsal clawlet nearly half as long as the ventral clawlet (figs. 23 and 26); Ta of leg IV straight with setae lined up in a ventral row (figs. 27 and 28).

MALE (3 specimens): Length including capitulum 833 (800-900); length of posterior coxal group 252 (230-270); genital field 123 (110-130) long, 188 (175-210) wide; dorsal lengths of pedipalp segments: Ge 64 (63-65); Ti 98 (87-108); Ta 58 (55-62); dorsal lengths of leg segments: leg I: TFe 140 (135-145); Ge 178 (170-190); Ti 185 (175-200); Ta 142 (130-155); leg IV: TFe 190 (175-200); Ge 255 (250-265); Ti 342 (335-350); Ta 243 (235-250).

FEMALE (4 specimens): Length including capitulum 1263 (1200-1300); length of posterior coxal group 300 (280-310); genital field 198 (180-210) long, 245 (220-260) wide; dorsal lengths of pedipalp segments: Ti 110 (100-115); Ta 68 (60-70); dorsal lengths of leg segments: leg I: TFe 189 (150-210); Ge 233 (175-275); Ti 254 (175-295); Ta 164 (140-180); leg IV: TFe 266 (200-300); Ge 363 (250-425); Ti 455 (310-525); Ta 285 (250-300).

NOTES — Holotype (male) (CNC type number 18686) from ANSP mussel lots A3653 and A3781 from Khlong Chonprathan, Ban Chonprathan, Phet Buri Province, Thailand, collected on May 1971 by Dr. Bill Heard. The host mussel was *Uniandra contradens rustica* (Lea). Usually one or two mites occurred on the gills of each infested host. Additional specimens include paratypes from: *P. v. ellipticus* (ANSP mussel lot A3768) from Maenam Mun, Ampoe Satuk, border of Burinam and Surin Provinces, Thailand, 16 March 1971 (Bill Heard); *Physunio eximius* (Lea) from: (1) ANSP mussel lot A3619 from Lam Se Bai, Ampoe Amnat Charoen, Ubon Ratchathani Province, Thailand, 29 April 1971 (Bill Heard); (2) ANSP mussel lots A3612 and A3652 from Maenam Mun, Ampoe Tha Thum, Surin Province, Thailand, 31 January and 14 April 1971, respectively (Bill Heard); *Trapezoideus exolescens exolescens* (Gould) (ANSP mussel lot A4432) from Mekong River, Ban Dan, Ubon Province, Thailand, 18 April 1973 (G. Davis); *T. misellus* Morelet (= *T. exolescens* in Brandt 1974) (ANSP mussel lot A3260) from Khong Town, Ban Nuah near sports club, Khong Island, Laos, 23 March 1972 (G. Davis); *Ensidens ingallsianus* (Lea) from: (1) ANSP mussel lot A3638 from Maenam Mun, Ban Pring, Ampoe Tha Thum, Surin Province, Thailand, 14 April 1971 (Bill Heard); (2) ANSP mussel lot A3577 from Lam Nam Mun, Ampoe Phaimai, Nakon Ratchasima Province, Thailand, 11 July 1971 (Bill Heard). The latter two records represent only a single mite each from a large number of inspected mussels in each lot and may be considered as incidental.

REMARKS — *U. brandti* is apparently holophyletic with *U. diversipes* Viets from India and Burma (Viets 1926) and *U. tumida* (Wolcott) from North America (Wolcott 1898) and Thailand (Vidrine, unpublished data). *U. brandti* is distinctly different from *U. tumida*, especially in claw structure and flap structure on the female genital acetabular plates. However, *U. brandti* is remarkably similar to *U. diversipes*, but *U. brandti* has far fewer acetabula per plate and a pair of distinctly larger acetabula on each plate. *U. brandti* is only slightly smaller than *U. diversipes*, and in many characters, the two species are nearly identical. Additional members of the subgenus *Parasitatax* are known from Asia. *U. thienemanni* Viets was described from Borneo (Viets 1957) and is common in several mussel species in Thailand and Laos (Vidrine, unpublished data). *U. uchidai* Imamura and *U. arcuata* (Wolcott) have been reported from Japan (Imamura 1953b). With 6 species in this subgenus (only 8 are known in all), Asia has the greatest assemblage of mites in this taxon.



Figs. 19-28. *Unionicola (Parasitatax) brandti* n. sp.: 19. male venter; 20. male palp; 21. female genital field; 22. male genital field; 23. claw of male fourth walking leg; 24. lateral view of female genital field; 25. male first walking leg; 26. claw of male first walking leg; 27. tarsus of male fourth walking leg; 28. tarsus of male fourth walking leg.

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