The Tetranychoid Mites of Taiwan (Acarina: Prostigmata)*

Shôzô EHARA

Biological Institute, Faculty of Education
Tottori University, Tottori

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Until quite recently, only several records of tetranychoid mites were available for Taiwan. In 1934 a mite infesting sugar cane in Taiwan was referred to *Tetranychus exsiccator* Zehntner by Takano. In his list of Taiwan mites and ticks Kishida (1935) reported *Bryobia* sp. from *Rosa* and *Tetranychus* sp. from *Mentha*. Takahashi (1938) recorded *Tetranychus telarius* L. (a number of plants), *Tetranychus* sp. (*Uragoga*), *Tetranychina* sp. (*Oxalis*), and *Stigmaeus floridanus* Banks (pineapple). Minamikawa (1951) identified a mite pest of tea with *Paratetranychus* sp. Pritchard and Baker(1955, 1958) recorded *Eotetranychus sexmaculatus* (Riley) and *Brevipalpus phoenicis* (Geijskes). Further, Baker and Pritchard (1960) reported *Eutetranychus orientalis* (Klein) from citrus. Tao and Cheng (1963) recorded *Panonychus citri* (McGregor) from citrus. Hu (1964) recognized *Oligonychus coffeae* (Nietner) and *Brevipalpus obovatus* Donnadieu as pests of tea. Recently Lo and Hsia (1968) recorded two species of Tenuipalpidae, and one species of Tetranychidae. Lo (1968a) reported *Tenuipalpus antipodus* Collyer and *Tuckerella pavoniformis* (Ewing). Furthermore, Lo (1968b) recorded nine species of tetranychids and three species of tenuipalpids. The last three contributions are comprehensive in enumerating many Taiwanese host plants for each species. Ehara (1969b) recorded *Oligonychus shinkajii* Ehara from sugar cane.

Some of these previously recorded mites were inaccurately identified. The materials upon which this paper is principally based were collected on various plants of Taiwan by the author and his co-operators in 1966. The following twenty-four species representing three families of Tetranychoidea, one of which is a new species, are treated in this paper:

Fam. Tenuipalpidae

1. *Pentamerimus oregonensis* McGregor
2. *Brevipalpus californicus* (Banks)
3. *Brevipalpus obovatus* Donnadieu
4. *Brevipalpus phoenicis* (Geijskes)

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5. *Dolichotetranychus floridanus* (Banks)

Fam. Tuckerellidae

6. *Tuckerella pavoniformis* (Ewing)

Fam. Tetranychidae

7. *Bryobia pritchardi* Rimando
8. *Petrobia harti* (Ewing)
9. *Eutetranychus orientalis* (Klein)
10. *Aponychus corpuzae* Rimando
11. *Panonychus citri* (McGregor)
12. *Eotetranychus asiaticus* Ehara
13. *Eotetranychus cendanai* Rimando
14. *Oligonychus coffeae* (Nietner)
15. *Oligonychus perditus* Pritchard et Baker
16. *Oligonychus orthius* Rimando
17. *Oligonychus shinkajii* Ehara
18. *Oligonychus biharensis* (Hirst)
19. *Tetranychus taiwanicus* n. sp.
20. *Tetranychus phaselus* Ehara
21. *Tetranychus kanzawai* Kishida
22. *Tetranychus neocaledonicus* André
23. *Tetranychus truncatus* Ehara
24. *Tetranychus piercei* McGregor

Superfamily TETRANYCHOIDEA
Key to Families

1. Palpus with a claw on penultimate segment..... 2
– Palpus without a claw..... Tenuipalpidae (p. 80)
2. Hysterosoma with 26 pairs of dorsal setae including caudal flagelliform and foliaceous setae..... Tuckerellidae (p. 83)
– Hysterosoma with 9 to 12 pairs of dorsal setae, no caudal flagelliform setae ..... Tetranychidae (p. 83)

Family TENUIPALPIDAE
Key to Genera

1. Palpus with three or four segments..... 2
– Palpus with five segments..... *Pentamerismus*
2. Palpus with three segments..... *Dolichotetranychus*
– Palpus with four segments..... *Brevipalpus*

Pentamerismus McGregor

Pentamerismus McGregor, 1949, p. 23.

(1) **Pentamerismus oregonensis** McGregor

Pentamerismus oregonensis McGregor, 1949, p. 27, Fig. 9, Pl. 9; Pritchard & Baker, 1952, p. 11, Fig. 10.

Previously this species was known from Japan, U. S. S. R. (Armenia, Georgia, Ukraine), Italy, Canada, U. S. A., and Brazil on *Cupressus*, *Juniperus*, *Libocedrus*, and *Thuja*.

Specimens examined. Eleven ♀♀, Fengshan, 1-IV-1966 (S. Ehara leg.), on *Juniperus chinensis* L.

Brevipalpus Donnadieu

Brevipalpus Donnadieu, 1875, Rech. serv. Hist. Tetranych. p. 116.

Key to Species

1. Hysterosoma with five pairs of dorsolateral setae..... 2
- Hysterosoma with six pairs of dorsolateral setae..... *californicus*
2. Tarsus II with one sensory rod..... *obovatus*
- Tarsus II with two sensory rods..... *phoenicis*

(2) **Brevipalpus californicus** (Banks)

Tenuipalpus californicus Banks, 1904, Jour. N. Y. Ent. Soc. 12: 55, Pl. 2, Fig. 2.
Brevipalpus californicus, McGregor, 1949, p. 11, Fig. 3, Pl. 1; Pritchard & Baker, 1952, p. 30, Fig. 30.

Brevipalpus californicus is known to occur commonly in warm regions of the world on numerous host plants. In Taiwan this species was recorded from tea, citrus, guava, *Diospyros*, *Ficus*, *Jasminum*, and *Pyrus* (Lo and Hsia, 1968, Lo, 1968b). So far as the present author's experience goes, it is very often found together with *B. phoenicis* in Taiwan.

Specimens examined. Five ♀♀, Fengshan, 7-IV-1966 (S. Ehara leg.), on shaddock; 6 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on lemon; 5 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on citrus; 2 ♀♀, Fengshan, 2-IV-1966 (S. Ehara leg.), on citrus; 1 ♀, Taitung, 13-IV-1966 (S. Ehara & C. S. Lo leg.), on citrus; 3 ♀♀, Fengshan, 1-IV-1966 (S. Ehara leg.), on *Hibiscus*; 13 ♀♀, Fengshan, 2-IV-1966 (S. Ehara leg.), on *Pithecolobium dulce* Benth.; 4 ♀♀, Fengshan, 6-IV-1966 (S. Ehara leg.), on *Acacia confusa* Merr.; 1 ♀, Fengshan, 15-IV-1966 (S. Ehara leg.), on *Thevetia peruviana* K. Schum.; 1 ♀, Fengshan, 22-III-1966 (S. Ehara leg.), on *Momordica cochinchinensis* Spr.

(3) **Brevipalpus obovatus** Donnadieu

Brevipalpus obovatus Donnadieu, 1875, Rech. serv. Hist. Tetranych. p. 116, Pl. 5, Figs. 43-48;

Pritchard & Baker, 1958, p. 231, Fig. 32.

Brevipalpus obovatus is a cosmopolitan species, having a great number of host plants. This species in Taiwan was first recorded by Hu (1964) on tea. Recently it was known to occur on various plants in Taiwan (Lo and Hsia, 1968).

Specimen examined. One ♀, Pinchen, 8-X-1964 (H. T. Chen leg.), on tea.

(4) **Brevipalpus phoenicis** (Geijskes)

Tenuipalpus phoenicis Geijskes, 1939, Meded. Landb. Hoogesch. Wageningen 42: 23, Fig. 7.

Brevipalpus phoenicis, Sayed, 1946, Bull. Soc. Fouad 1er Ent. 30: 99; Pritchard & Baker, 1952, p. 38, Figs. 38, 39.

Brevipalpus phoenicis is widely distributed in warm parts of the world. The host plants for this mite are numerous. In 1958 it was recorded from Taiwan by Pritchard and Baker, and it was recently reported to occur on citrus, guava, and *Pyrus* in this country (Lo and Hsia, 1968).

Specimens examined. One ♀, Fengshan, 7-IV-1966 (S. Ehara leg.), on shaddock; 3 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on lemon; 1 ♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on citrus; 1 ♀, Taitung, 13-IV-1966 (S. Ehara & C. S. Lo leg.), on citrus; 2 ♀♀, Taitung, 13-IV-1966 (S. Ehara & C. S. Lo leg.), on *Eugenia javania* Lamarck; 1 ♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on *Eugenia javania* Lamarck; 5 ♀♀, Fengshan, 26-III-1966 (S. Ehara leg.), on olive; 1 ♀, Fengshan, 26-III-1966 (S. Ehara leg.), on guava; 1 ♀, Fengshan, 1-IV-1966 (S. Ehara leg.), on *Hibiscus*; 4 ♀♀, Fengshan, 31-III-1966 (S. Ehara leg.), on West India cherry; 5 ♀♀, Fengshan, 31-III-1966 (S. Ehara leg.), on *Passiflora coerulea* L.; 1 ♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on unknown plant.

Dolichotetranychus Sayed

Dolichotetranychus Sayed, 1938, Bull. Mus. Hist. nat. Paris, 2e sér. 10: 606.

(5) **Dolichotetranychus floridanus** (Banks)

Stigmaeus floridanus Banks, 1900, U. S. Dept. Agr. Div. Ent. Tech. Ser. 8: 77, Fig. 16; Takahashi, 1938, p. 4.

Dolichotetranychus floridanus, Sayed, 1938, Bull. Mus. Hist. nat. Paris, 2e sér. 10: 606, Figs. 8-12; Baker & Pritchard, 1956, p. 374, Figs. 10, 11.

In 1938 this mite was recorded to infest pineapple in Taiwan under the name *Stigmaeus floridanus* by Takahashi. It is well known as a pest of pineapple in Taiwan, Okinawa Island, the Philippines, Java, Hawaii, North America, Central America, and Brazil.

Specimens examined. Three ♂♂ & 7 ♀♀, Fengshan, 24-III-1966 (S. Ehara & H. S. Chien leg.), on pineapple.

Family TUCKERELLIDAE

Tuckerella Womersley

Tuckerella Womersley, 1940, Trans. Roy. Soc. S. Austr. 64: 244.

(6) **Tuckerella pavoniformis** (Ewing)

Eupalopsis pavoniformis Ewing, 1922, Proc. Ent. Soc. Wash. 24: 106.
Tuckerella pavoniformis, McGregor, 1950, p. 368, Pl. 44; Baker & Pritchard, 1953, p. 253, Figs. 6 (a, c), 7.

Tuckerella pavoniformis is known from Taiwan, Japan proper (Honshu,* Kyushu), Okinawa Island, Georgian S. S. R., Mauritius, California, Florida, and Hawaii on various kinds of plants. This mite was recently discovered from Taiwan on tea (Lo, 1968a).

Specimen examined. One ♀, Fengshan, 9-IV-1966 (S. Ehara leg.), on *Casuarina stricte* Aiton.

Family TETRANYCHIDAE

Key to Subfamilies

1. Female with three pairs of anal setae; male with five pairs of genitoanal setae..... Bryobiinae (p. 83)
– Female with one or two pairs of anal setae; male with three or four pairs of genitoanal setae..... Tetranychinae (p. 85)

Subfamily Bryobiinae

Key to Genera

1. Dorsum of idiosoma with four pairs of propodosomal setae and twelve pairs of hysterosomal setae..... *Bryobia*
– Dorsum of idiosoma with three pairs of propodosomal setae and ten pairs of hysterosomal setae..... *Petrobia*

Bryobia Koch

Bryobia Koch, 1836, Deuts. Crust. Myr. Arachn. 1: 8, 9.

(7) **Bryobia pritchardi** Rimando

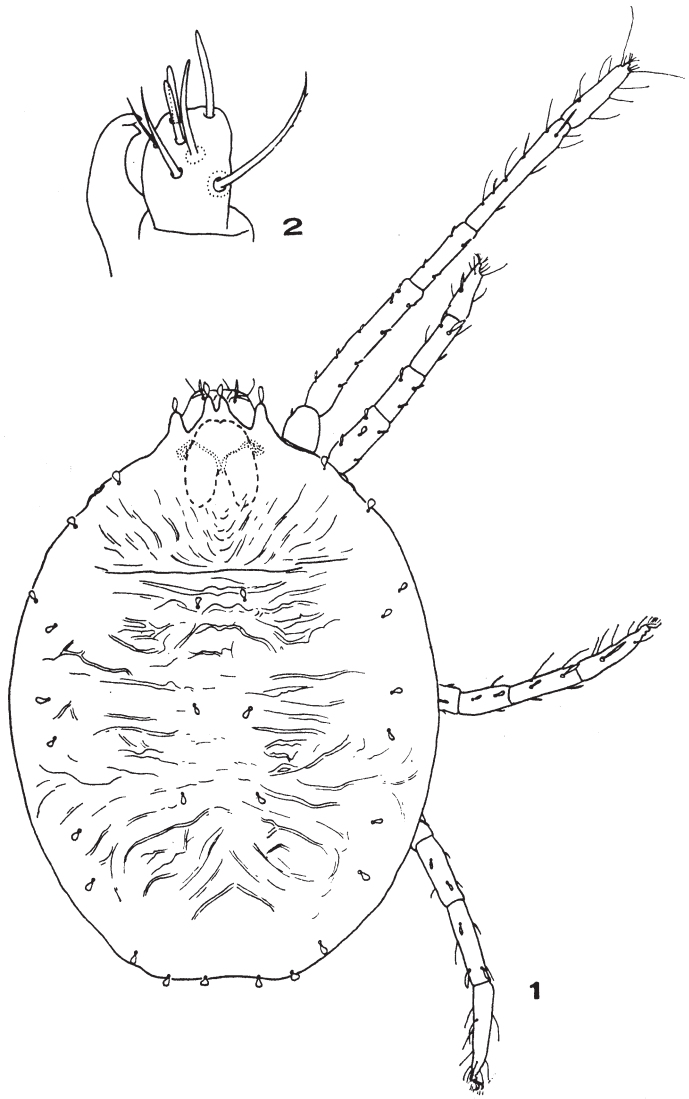
(Figs. 1-3)

Bryobia pritchardi Rimando, 1962b, p. 9, Figs. 3, 4.

Female. Body from above oval, with posterior end truncate; length of body

* New locality record: Hiratsuka, Kanagawa Pref. (N. Shinkaji), on deodar cedar.

including rostrum 710 μ, width of body 520 μ. Propodosoma granulate and wrinkled on dorsum; anterior margin of propodosoma with two pairs of granulate lobate projections; first and second pairs of dorsal propodosomal setae broadly spatulate, serrate, set on lobate projections; the second pair reaching base of the first pair; the third and fourth pairs smaller than the first and second pairs, broadly spatulate, serrate, arising from very weak tubercles. Hysterosoma with dorsal integument granulate and wrinkled; humeral and dorsal hysterosomal setae similar to third and fourth pairs of dorsal propodosomal setae; distances between



Figs. 1, 2. *Bryobia pritchardi*. 1, dorsum of female. 2, distal segment of palpus of female.

paired dorsocentral hysterosomal setae: DC_1 250 μ, DC_2 290 μ, DC_3 350 μ. Peritreme anastomosing distally. Venter of idiosoma finely granulate, weakly wrinkled. Rostrum very short, only reaching to distal end of trochanter I. Stylophore slightly longer than broad, cleft mediodistally. Distal segment of palpus with three tactile and four sensory setae as usual; palpal claw incised distally. Legs with spatulate, serrate setae dorsoproximally. Leg I, excluding coxa and claws, 610 μ long; tarsus I with ten or eleven sensory setae; tibia I with one sensory seta. Tarsus II with six sensory setae; tarsi III and IV each with one sensory seta. Claws of tarsus I padlike, those of tarsi II-IV uncinate; empodia I-IV each padlike, with two rows of ventral tenent hairs.

Male. Body, including rostrum, 440 μ long, 270 μ wide. Propodosomal lobate projections less prominent than those of female. Dorsal body setae tending to be slenderer than those of female; first pair of dorsal propodosomal setae much smaller than the second pair. Aedeagus abruptly narrowed to form a very slender caudal part. Leg I, excluding coxa and claws, 660 μ long; tarsus I with thirteen to fifteen sensory setae; tibia I with one sensory seta. Tarsus II with six sensory setae; tarsi III and IV each with one sensory seta.

Specimens examined. Three ♂♂ & 10 ♀♀, Tainan, 5-IV-1966 (S. Ehara leg.), on *Paederia scandens* (Lour.) Merr.

Remarks. *Bryobia pritchardi* was previously known only from the Philippines on *Paederia foetida* L. This species was originally figured as having six pairs instead of five pairs of dorsolateral hysterosomal setae. This is possibly erroneous.

Petrobia Murray

Petrobia Murray, 1877, Econ. Ent., Apt. p. 118.

(8) **Petrobia harti** (Ewing)

Neophyllobius harti Ewing, 1909, Trans. Amer. Ent. Soc. 35: 405, Pl. 14, Fig. 7.
Petrobia harti, Pritchard & Baker, 1955, p. 45. Figs. 28-30.
Tetranychina sp., Takahashi, 1938, p. 5.

Petrobia harti is known from Taiwan, Japan proper (Honshu, Shikoku, Kyushu), Okinawa Island, the Middle East, Africa, North America, Brazil, Hawaii, and Australia on *Oxalis* and its neighboring plants. In 1938 this mite was recognized from Taiwan on *Oxalis* by Takahashi as *Tetranychina* sp. Recently it was also reported from this country on *Artocarpans integra* Merr. (Lo, 1968b).

Specimens examined. Eight ♀♀, Fengshan, 2-IV-1966 (S. Ehara leg.), on *Oxalis* sp.

Subfamily Tetranychinae

Key to Genera

1. Empodium rudimentary, tarsal appendages consisting practically of two pairs

of tenent hairs alone 2
– Empodium well developed 3
2. Female with two pairs of anal setae; male with four pairs of genitoanal setae. ..... *Eutetranychus*
– Female with one pair of anal setae; male with three pairs of genitoanal setae. ..... *Aponychus*
3. Opisthosoma with two pairs of para-anal setae 4
– Opisthosoma with a pair of para-anal setae 5
4. Empodium clawlike, with three pairs of proximoventral hairs ..... *Panonychus*
– Empodium (excluding legs I and II of male) consisting of three pairs of hairs. ..... *Eotetranychus*
5. Empodium clawlike, with proximoventral hairs ..... *Oligonychus*
– Empodium consisting of two or three pairs of hairs, with or without a dorsomedian spur ..... *Tetranychus*

Eutetranychus Banks

Neotetranychus (*Eutetranychus*) Banks, 1917, Ent. News 28: 197.
Eutetranychus, McGregor, 1950, p. 267.

(9) **Eutetranychus orientalis** (Klein)
(Figs. 4-11)

Anychus orientalis [Zacher] Klein, 1936, Bull. Agr. Res. Sta. Rehovoth 21: 3.
Eutetranychus orientalis, Baker & Pritchard, 1960, p. 464, Fig. 5.
Eutetranychus banksi (nec McGregor), Ehara, 1963a, p. 144, Figs. 1-10; Lo, 1965, J. Taiwan Agr. Res. 14: 47.

Female. Body from above oval; length of body including rostrum 410 μ, width of body 290 μ. Dorsal body setae borne on small tubercles, spatulate, more or less serrate, shorter than intervals to bases of setae next behind; dorsocentral hysterosomal and inner sacral setae shorter than remaining dorsal setae. Striae on dorsal surface of idiosoma as figured. Peritreme slightly dilated distally. Genital flap with transverse striae; area immediately anterior to flap with transverse striae. Palpus with terminal sensillum very long and slender; dorsal sensillum slender, much shorter than terminal sensillum. Leg I, excluding coxa and tenent hairs, 240 μ long. Tarsus I with twelve tactile and five sensory setae; tibia I with nine tactile and one sensory setae. Tarsus II with ten tactile and four sensory setae; tibia II with six tactile setae. Tarsi III and IV each with ten tactile and one sensory setae; tibia III with six tactile setae; tibia IV with seven tactile setae.

Male. Body, including rostrum, 360 μ long, 200 μ wide. Dorsal body setae slenderer than those of female. Aedeagus dorsally bent at an acute angle to shaft; the upturned part tapering to a truncate end. Terminal sensillum of palpus very slender, not easily discerned from remaining distal sensory setae; dorsal sensillum

distinct. Tarsus I with twelve tactile and seven sensory setae; tibia I with nine tactile and four sensory setae. Tarsus II with ten tactile and five sensory setae; tibia II with six tactile and two sensory setae. Tarsi III and IV each with ten tactile and one sensory setae; tibia III with six tactile setae; tibia IV with seven tactile setae.

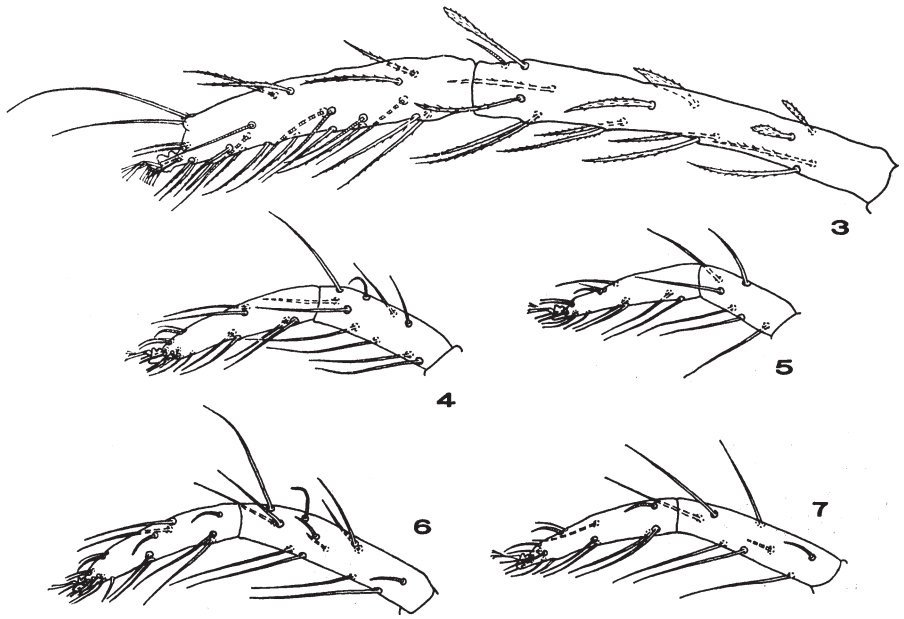


Fig. 3. *Bryobia pritchardi*, tarsus and tibia I of female. Figs. 4-7. *Eutetranychus orientalis*. 4, tarsus and tibia I of female. 5, tarsus and tibia II of female. 6, tarsus and tibia I of male. 7, tarsus and tibia II of male.

Specimens examined. Six ♂♂ & 19 ♀♀, Fengshan, 15-IV-1966 (S. Ehara leg.), on *Nerium indicum* Mirr.; 6 ♀♀, Fengshan, 15-IV-1966 (S. Ehara leg.), on *Thevetia peruviana* K. Schum.

Remarks. Eutetranychus orientalis is known from Taiwan, the Philippines, Thailand, India, Afghanistan, Iran, Israel, Cyprus, Egypt, Sudan, Senegal, and South Africa on various kinds of plants. From Taiwan this species was recorded in 1960 on citrus by Baker and Pritchard. Recently, thirteen genera of plants in Taiwan were recognized as hosts for the species (Lo & Hsia, 1968, Lo, 1968b). The specimens used in the present study were collected on the upper surfaces of the host leaves.

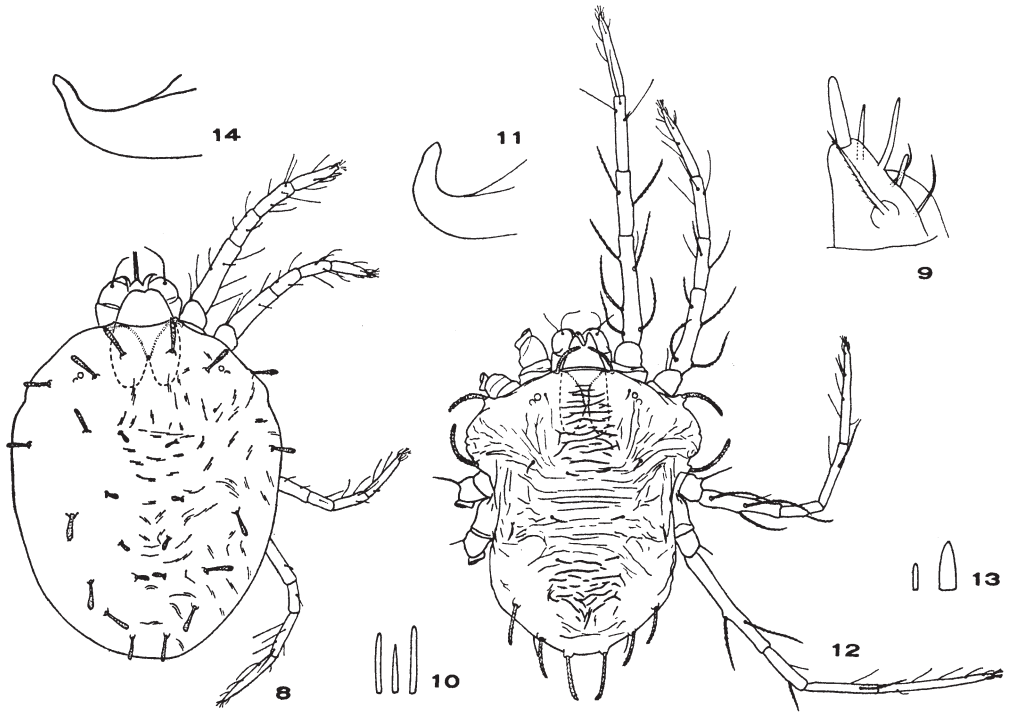
Aponychus Rimando

Aponychus Rimando, 1966, p. 107.

(10) **Aponychus corpuzae** Rimando
(Figs. 12-18)

Aponychus corpuzae Rimando, 1966, p. 107, Figs. 1-4.

Female. Body dorsoventrally depressed, with lateral surfaces concave; length of body including rostrum 370 μ, width of body 260 μ. Idiosoma with dorsal integument wrinkled as figured. Dorsal body setae more or less serrate. First dorsal propodosomal setae long, subspatulate; third dorsal propodosomals similar to first dorsal propodosomals but longer; humeral setae similar to third dorsal propodosomals but longer. Second dorsal propodosomals, first dorsolaterals, and first to third dorsocentrals small, subequal in size; second dorsolaterals similar to

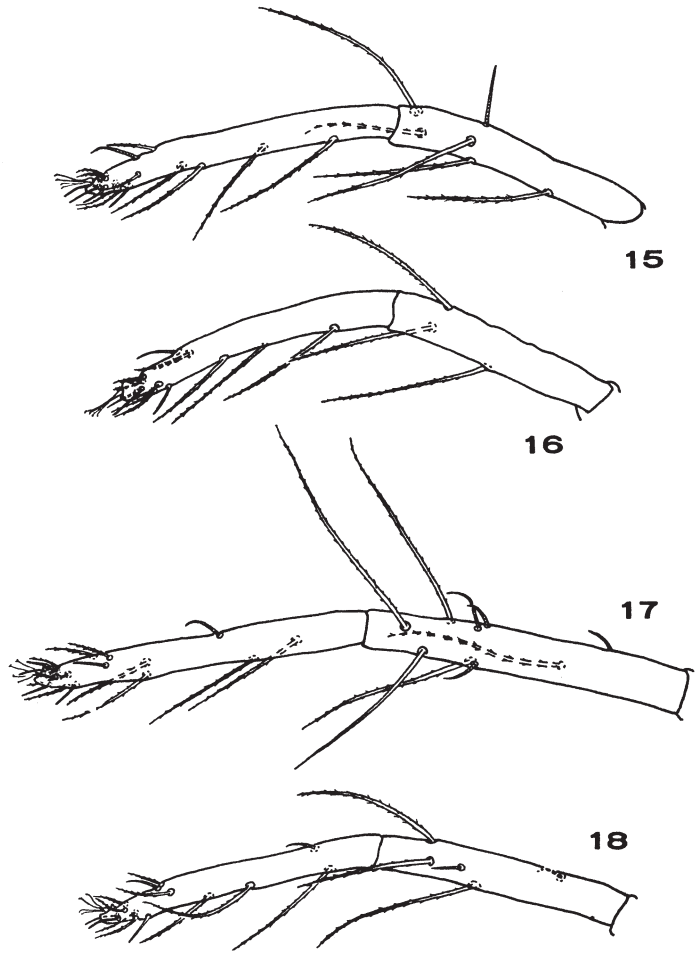


Figs. 8-11. *Eutetranychus orientalis.* 8, dorsum of female. 9, distal segment of palpus of female. 10, distal sensory setae on distal segment of male palpus (center, terminal sensillum). 11, aedeagus. Figs. 12-14. *Aponychus corpuzae.* 12, dorsum of female. 13, dorsal and terminal sensilla on distal segment of female palpus. 14, aedeagus.

these setae but slightly longer. Third dorsolaterals long, subspatulate, similar to inner sacrals; clunals similar to third dorsolaterals but longer; outer sacrals very slender, much smaller than inner sacrals. Peritreme slender, not obviously dilated distally. Genital flap with transverse striae; area just anterior to flap with transverse striae. Stylophore deeply cleft mediodistally. Palpus with terminal sensillum slender, subconical; dorsal sensillum very slender, much shorter than terminal sensillum. Legs with stout tactile setae proximally. Legs I and IV, excluding coxa and tenent hairs, 440 μ and 460 μ long, respectively. Tarsus I with ten tactile and five sensory setae; tibia I with five tactile and one sensory setae. Tarsus II with eight tactile and four sensory setae; tibia II with three tactile

setae. Tarsi III and IV each with eight tactile and one sensory setae; tibiae III and IV each with two tactile setae.

Male. Body, including rostrum, 270 μ long, 170 μ wide. Dorsal body setae similar to those of female. Aedeagus abruptly bent dorsad near distal end; the upturned part sigmoid, tapering to a blunt tip. Terminal sensillum of palpus similar to that of female, but more subconical; dorsal sensillum similar to that of female. Legs I and IV, excluding coxa and tenent hairs, 450 μ and 440 μ long, respectively. Tarsus I with ten tactile and six sensory setae; tibia I with five tactile and four sensory setae. Tarsus II with nine tactile and five sensory setae; tibia II with three tactile and two sensory setae. Tarsi III and IV each with eight tactile and one sensory setae; tibiae III and IV each with two tactile setae.



Figs. 15–18. *Aponychus corpuzae.* 15, tarsus and tibia I of female. 16, tarsus and tibia II of female. 17, tarsus and tibia I of male. 18, tarsus and tibia II of male.

Specimens examined. Two ♂♂ & 13 ♀♀, Taipei, 20-IV-1966 (S. Ehara leg.), on bamboo; 4 ♀♀, Fengshan, 24-III-1966 (S. Ehara leg.), on bamboo.

Remarks. *Aponychus corpuzae* was previously known only from the Philippines on *Schizostachyum lima* (Graminae). Japanese specimens (Hokkaido and Honshu, on bamboo) are also available for this study. *A. corpuzae* is first recorded from Taiwan and Japan. This mite feeds on the under surfaces of the host leaves.

Rimando (1966) erected the subfamily Aponychinae for *Aponychus* Rimando. But, Tuttle and Baker (1968) do not accept this subfamily. The present author agrees with Tuttle and Baker's opinion.

Panonychus Yokoyama

Panonychus Yokoyama, 1929, Saishin Nippon Sangyô Gaichû Zensho, p. 531.

(11) **Panonychus citri** (McGregor)

Tetranychus citri McGregor, 1916, Ann. Ent. Soc. Amer. 9: 286, Pl. 14, Figs. 1-9.
Metatetranychus citri, Reck, 1941, Soobsh. Akad. Nauk Gruz. S. S. R. 2: 832; Pritchard & Baker, 1955, p. 133, Figs. 96-99.
Panonychus citri, Ehara, 1956, p. 500.

Panonychus citri, a serious pest of citrus, is known to occur not only in most citrus-growing areas of the world, but also in some colder regions, such as Hokkaido and northern Honshu. In Asia *P. citri* has been recorded from Japan (Hokkaido, Honshu, Shikoku, Kyushu), China, the Philippines, India, Ceylon, the Middle East, and Taiwan on citrus and other various plants. This species in Taiwan was recently found on many plants belonging to fourteen genera (Tao and Cheng, 1963, Lo and Hsia, 1968).

Specimens examined. Two ♂♂ & 5 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on citrus; 3 ♀♀, Taitung, 13-IV-1966 (S. Ehara & C. S. Lo leg.), on citrus; 1 ♂, Fengshan, 7-IV-1966 (S. Ehara leg.), on avocado; 2 ♂♂ & 8 ♀♀, Fengshan, 24-III-1966 (H. S. Chien leg.), on papaya; 7 ♀♀, Fengshan, 9-IV-1966 (S. Ehara leg.), on papaya; 1 ♂, Fengshan, 2-IV-1966 (S. Ehara leg.), on *Pithecolobium dulce* Benth.

Eotetranychus Oudemans

Eotetranychus Oudemans, 1931, Ent. Ber. 8: 224.

Key to Species

1. Tibia II with five tactile setae..... *cendanai*
– Tibia II with eight tactile setae..... *asiaticus*

(12) **Eotetranychus asiaticus** Ehara
(Figs. 27-28)

Eotetranychus asiaticus Ehara, 1966, p. 8, Figs. 5-13; Ehara, 1969a, p. 18, Figs. 18-29.

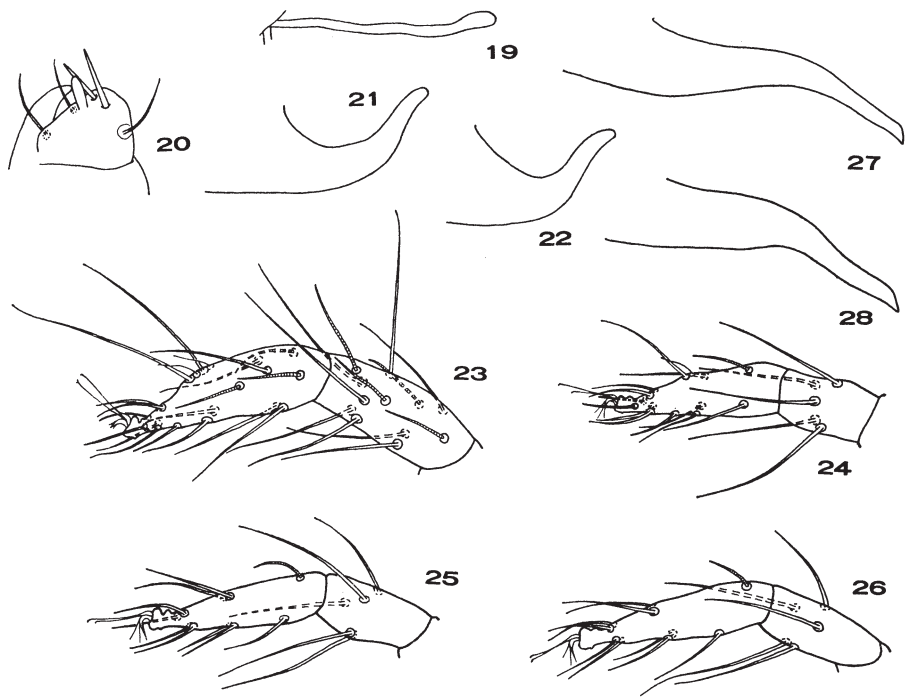
This species has been recorded from Japan proper (Honshu, Kyushu) on citrus and persimmon, Okinawa Island on *Ficus*, and Taiwan on citrus, *Ficus*, grape and guava (Lo, 1968b).

Specimens examined. Three ♂♂ & 11 ♀♀, Fengshan, 26-III-1966 (S. Ehara leg.), on guava; 3 ♂♂ & 20 ♀♀, Fengshan, 7-IV-1966 (S. Ehara leg.), on shaddock.

(13) **Eotetranychus cendanai** Rimando
(Figs. 19-26)

Eotetranychus cendanai Rimando, 1962a, p. 537, Fig. 2.

Female. Body, including rostrum, 390 μ long, 240 μ wide. Dorsum of idiosoma with longitudinal striae between third pair of dorsocentral hysterosomal setae. Dorsal setae slender, tapering, pubescent; dorsocentral hysterosomal setae about as long as, or longer than longitudinal intervals between them. Peritreme with



Figs. 19-26. *Eotetranychus cendanai.* 19, peritreme of female. 20, distal segment of palpus of male. 21, 22, aedeagus. 23, tarsus and tibia I of male. 24, tarsus and tibia II of male. 25, tarsus and tibia III of male. 26, tarsus and tibia IV of male. Figs. 27, 28. *Eotetranychus asiaticus*, aedeagus.

distal end dilated, not hooked. Medioventral opisthosomal setae normal in thickness. Genital flap transversely striate; area immediately anterior to flap transversely striate. Palpus with terminal sensillum approximately twice as long as broad; dorsal sensillum slender. Tarsus I with four tactile and one sensory setae proximal to proximal set of duplex setae; tibia I with eight tactile and one sensory setae. Tarsus II with two tactile and one sensory setae proximad of duplex setae; tibia II with five tactile setae. Tarsi III and IV each with one tactile and one sensory setae on proximal half; tibiae III and IV each with five tactile setae.

Male. Body, including rostrum, 270 μ long, 150 μ wide. Aedeagus dorsally bent; the upturned part very shallowly sigmoid, gradually tapering to a blunt tip. Palpus without terminal sensillum; dorsal sensillum fusiform. Tarsus I with four tactile and three sensory setae proximad of proximal set of duplex setae; tibia I with eight tactile and four sensory setae. Tarsus II with one tactile and one sensory setae proximal to duplex setae; tibia II with five tactile setae. Tarsi III and IV each with one tactile and one sensory setae on proximal half; tibiae III and IV each with five tactile setae.

Specimens examined. Four ♂♂ & 3 ♀♀, Fengshan, 7-IV-1966 (S. Ehara leg.), on shaddock.

Remarks. *Eotetranychus cendanai* was originally described from the Philippines on citrus, and it is new to Taiwan. It is strikingly distinct from all other known members of this genus, in having eight tactile setae on tibia I and five tactile setae on tibia II. The present materials differ from Rimando's specimens in that the upturned part of the aedeagus is somewhat stouter. However, the author considers this is possibly a variation.

Oligonychus Berlese

Oligonychus Berlese, 1886, Acari Dann. Piante Coltiv. p. 24.

Key to Species

1. Tibia II with five tactile setae; aedeagus bent ventrad..... 2
- Tibia II with seven tactile setae; aedeagus bent dorsad..... 3
2. Tarsi I and II each with one tactile seta ventrad of duplex setae..... *coffeae*
- Tarsi I and II each with two tactile setae ventrad of duplex setae..... *perditus*
3. Peritreme ending in a simple bulb..... 4
- Peritreme retrorse distally; knob of aedeagus very long, sickle-shaped..... ..... *biharensis*
4. Aedeagus with a terminal knob..... *shinkajii*
- Aedeagus without a terminal knob..... *orthius*

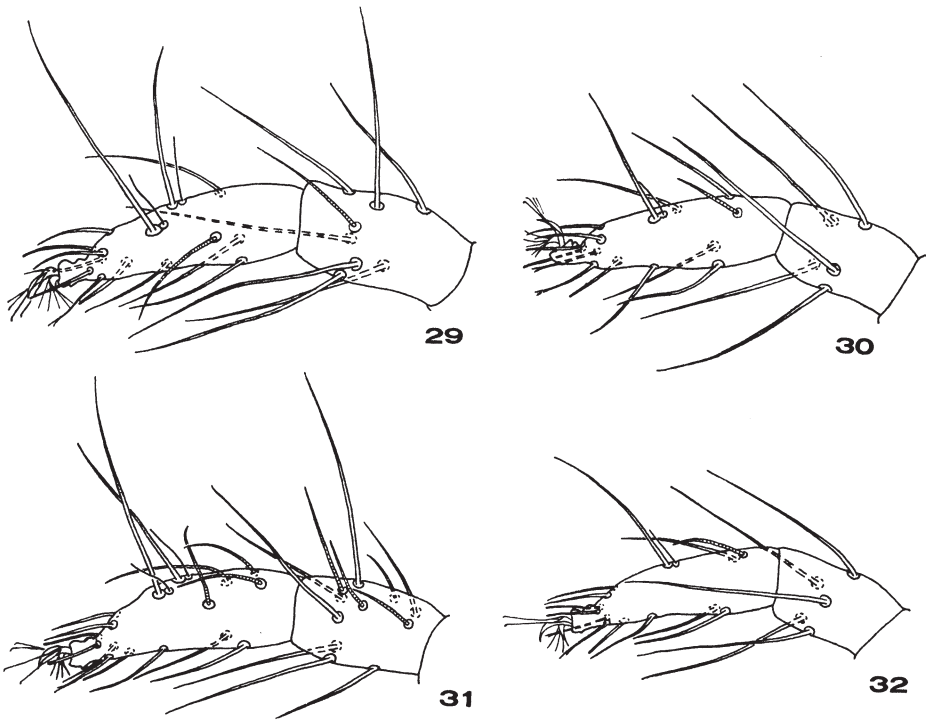
(14) **Oligonychus coffeae** (Nietner)

(Figs. 29-37)

Acarus coffeae Nietner, 1861, Observ. Enem. Coffee Tree Ceylon, pp. 1-31.

Oligonychus coffeae, Pritchard & Baker, 1955, p. 315, Figs. 268, 269.
Paratetranychus sp. Minamikawa, 1951, p. 53.

Oligonychus coffeae is known from Taiwan, the Philippines, Ceylon, India, Mauritius, Reunion, Africa, Florida, Hawaii, and Australia on a wide variety of plants including coffee and tea. This species in Taiwan was first referred to



Figs. 29-32. *Oligonychus coffeae*. 29, tarsus and tibia I of female. 30, tarsus and tibia II of female. 31, tarsus and tibia I of male. 32, tarsus and tibia II of male.

Paratetranychus sp. (Minamikawa, 1951, tea). Later the biology of the species on tea in Taiwan was studied by Hu (1964), and Hu and Wang (1965); these authors correctly referred it to *O. coffeae*. Recently it was reported to occur on a number of plants in Taiwan (Lo, 1968a, b).

Specimens examined. Three ♂♂ & 6 ♀♀, Pinchen, 8-X-1964 (H. T. Chen leg.), on tea; 4 ♂♂, Fengshan, 1-IV-1966 (S. Ehara leg.), on mango; 4 ♂♂ & 9 ♀♀, Fengshan, 15-IV-1966 (S. Ehara leg.), on mango; 1 ♂, Fengshan, 7-IV-1966 (S. Ehara leg.), on avocado; 1 ♂, Fengshan, 9-IV-1966 (S. Ehara leg.), on citrus.

(15) **Oligonychus perditus** Pritchard et Baker
(Fig. 38)

Oligonychus perditus Pritchard & Baker, 1955, p. 316, Figs. 270-273; Ehara, 1962, p. 165, Figs.

22-29; Ehara, 1963b, p. 230, Fig. 11.

Previously *Oligonychus perditus* was known only from Japan (Hokkaido, Honshu) on *Juniperus*.

Specimens examined. Two ♂♂ & 16 ♀♀, Fengshan, 15-IV-1966 (S. Ehara leg.), on *Juniperus chinensis* L.

(16) **Oligonychus orthius** Rimando
(Fig. 39)

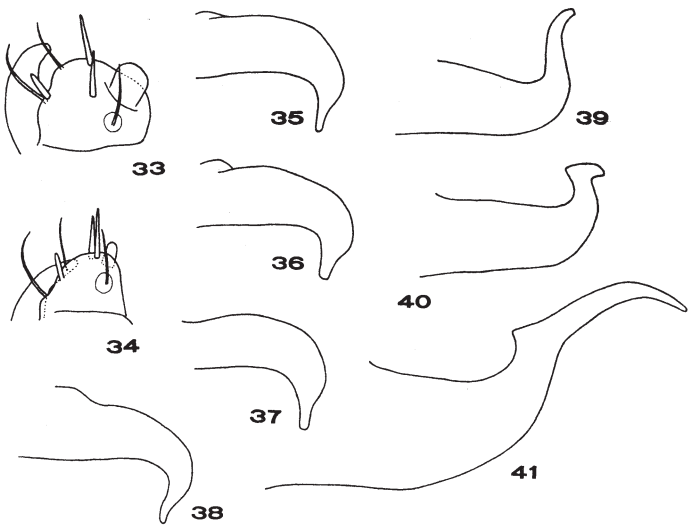
Oligonychus orthius Rimando, 1962b, p. 22, Fig. 11 (in part).
Tetranychus exsiccator (partim) (nec Zehntner), Takano, 1934, p. 57.

In 1934, spider mites infesting sugar cane in Taiwan were erroneously referred to *Tetranychus exsiccator* Zehntner by Takano. Recently *Oligonychus orthius* was recorded from Taiwan on sugar cane and banana (Lo, 1968b). Further, it was reported by Ehara (1969b) that two species of *Oligonychus*, *orthius* and *shinkajii*, occur on sugar cane in Taiwan. In addition, *O. orthius* has been recorded from the Philippines, Okinawa Island, and Taiwan.

Specimen examined. One ♂, Tainan, 7-IX-1966 (Y.-S. Pan leg.), on sugar cane.

(17) **Oligonychus shinkajii** Ehara
(Fig. 40)

Oligonychus shinkajii Ehara, 1963b, p. 228, Figs. 1-10.
Tetranychus exsiccator (partim) (nec Zehntner), Takano, 1934, p. 57.



Figs. 33-37. *Oligonychus coffeae.* 33, distal segment of palpus of female. 34, distal segment of palpus of male. 35-37, aedeagi. Figs. 38-41. Aedeagi. 38, *Oligonychus perditus.* 39, *O. orthius.* 40, *O. shinkajii.* 41, *O. biharensis.*

This species has been recorded from Honshu (greenhouse) on corn and rice, and from Kyushu (greenhouse), Tanegashima Id., Amami-ôshima Id. and Taiwan on sugar cane (see Ehara, 1969b).

Specimens examined. Thirteen ♂♂ & 21 ♀♀, Tainan, 7-IX-1966 (Y.-S. Pan leg.), on sugar cane.

(18) **Oligonychus biharensis** (Hirst)

(Fig. 41)

Paratetranychus biharensis Hirst, 1924, Proc. Zool. Soc. Lond. 1924: 69, Fig. 15.
Oligonychus biharensis, Pritchard & Baker, 1955, p. 364, Figs. 316-318.

Oligonychus biharensis is known from Taiwan, Okinawa Island, the Philippines, Thailand, India, Mauritius, Hawaii, and Antigua on diverse plants. This species in Taiwan was recently found on *Artocarpans, Eriobotrya, Eugenia, Euphoria, Litchi, Persea, Psidium, Pyrus* and *Vitis* (Lo, 1968b).

Specimens examined. Six ♀♀, Fengshan, 7-IV-1966 (S. Ehara leg.), on avocado; 5 ♀♀, Fengshan, 14-IV-1966 (S. Ehara leg.), on avocado; 8 ♂♂ & 17 ♀♀, Taitung, 13-IV-1966 (S. Ehara & C. S. Lo leg.), on loquat; 1 ♂ & 5 ♀♀, Fengshan, 14-IV-1966 (S. Ehara leg.), on *Acacia confusa* Merr.

Tetranychus Dufour

Tetranychus Dufour, 1832, Ann. Sci. Nat. Paris 25: 276.

Key to Species

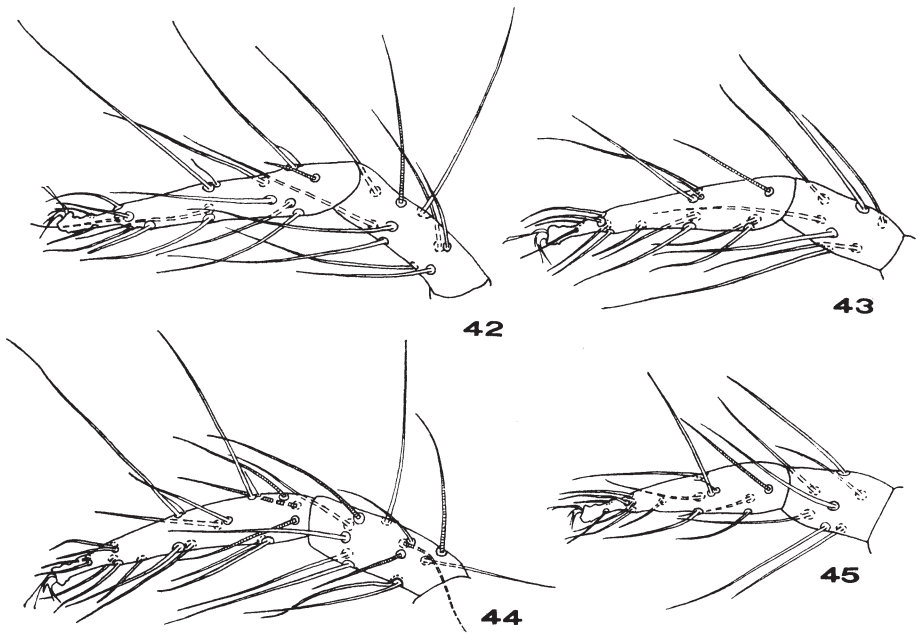
1. Empodium with three pairs of proximoventral hairs; aedeagus with a terminal knob 2
- Empodium with two pairs of proximoventral hairs; aedeagus without a terminal knob ..... *taiwanicus*
2. Knob of aedeagus not elongate 3
- Knob of aedeagus elongate, very slender ..... *phaselus*
3. Knob of aedeagus distinct 4
- Knob of aedeagus tiny, barely discernible ..... *piercei*
4. Knob of aedeagus with an angulation 5
- Knob of aedeagus berry-shaped ..... *neocaledonicus*
5. Knob of aedeagus very large, about one half to two-fifth as long as dorsal margin of shaft ..... *kanzawai*
- Knob of aedeagus small, about one-fifth as long as dorsal margin of shaft .... *truncatus*

(19) **Tetranychus taiwanicus** n. sp.

(Figs. 42-47, 60-62)

Female. Body, including rostrum, 450 μ long, 290 μ wide; reddish in color.

Dorsal setae of idiosoma slender, pubescent, longer than intervals between longitudinal bases. Striae forming a diamod-shaped pattern between the third and fourth pairs of dorsocentral hysterosomal setae; lobes of striae showing an intermediate type between the *urticae*- and *cinnabarinus*-types. Peritreme U-shaped distally. Medioventral opisthosomal setae normal in thickness. Genital flap with transverse striae; area immediately anterior to flap with longitudinal striae. Terminal sensillum of palpus slightly longer than wide, with a pit at tip; dorsal sensillum slightly shorter than terminal sensillum. Each empodium with a strong



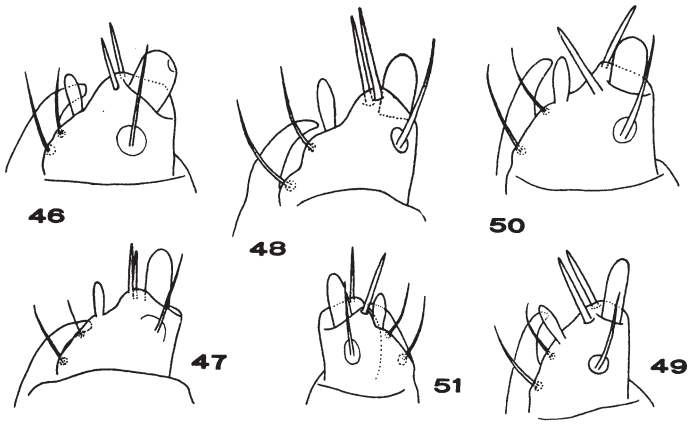
Figs. 42-45. *Tetranychus taiwanicus* n. sp. 42, tarsus and tibia I of female. 43, tarsus and tibia II of female. 44, tarsus and tibia I of male. 45, tarsus and tibia II of male.

mediodorsal spur and two pairs of longer proximoventral hairs. Tarsus I with separated sets of duplex setae; with four tactile and one sensory setae, and proximal set of duplex setae proximal to distal set of duplex setae; tibia I with nine tactile and one sensory setae. Tarsus II with two tactile and one sensory setae proximal to duplex setae; tibia II with seven tactile setae. Tibia III with six tactile setae; tibia IV with seven tactile setae.

Male. Body, including rostrum, 320 μ long, 150 μ wide. Aedeagus broadly bent dorsad to form a distal narrow part of subequal width; the caudal end truncate. Terminal sensillum of palpus about twice as long as wide, much longer than dorsal sensillum. Each empodium with two pairs of proximoventral hairs and a strong mediodorsal spur. Tarsus I with four tactile and three sensory setae, and proximal set of duplex setae proximal to distal duplex set; tibia I with nine tactile and four sensory setae. Tarsus II with two tactile and one sensory setae proximad

of duplex setae; tibia II with seven tactile setae. Tibia III with six tactile setae; tibia IV with seven tactile setae.

Type-series. Holotype (♂) and allotype (♀): Fengshan, 24-III-1966 (S. Ehara leg.), on *Pandanus odoratissimus* L. Paratypes: 3 ♂♂ & 4 ♀♀, data same as for holotype. The types are retained in the Biological Institute, Faculty of Education, Tottori University, Tottori.



Figs. 46-51. Distal segments of palpi. 46, *Tetranychus taiwanicus* n. sp., female. 47, *T. taiwanicus* n. sp., male. 48, *T. phaselus*, female. 49, *T. phaselus*, male. 50, *T. neocaledonicus*, female. 51, *T. neocaledonicus*, male.

Remarks. *Tetranychus taiwanicus* n. sp. is closely related to *T. fijiensis* Hirst, 1924 (Fiji, Nakuoro Id., Likiep Id., the Philippines, India, Thailand), in that the empodium is provided with two pairs of proximoventral hairs and a strong mediodorsal spur. However, the aedeagus of *taiwanicus* is broadly curved dorsad to form a distal narrow part of subequal width, while in *fijiensis* the aedeagus is sharply bent dorsad to form a very slender stylet.

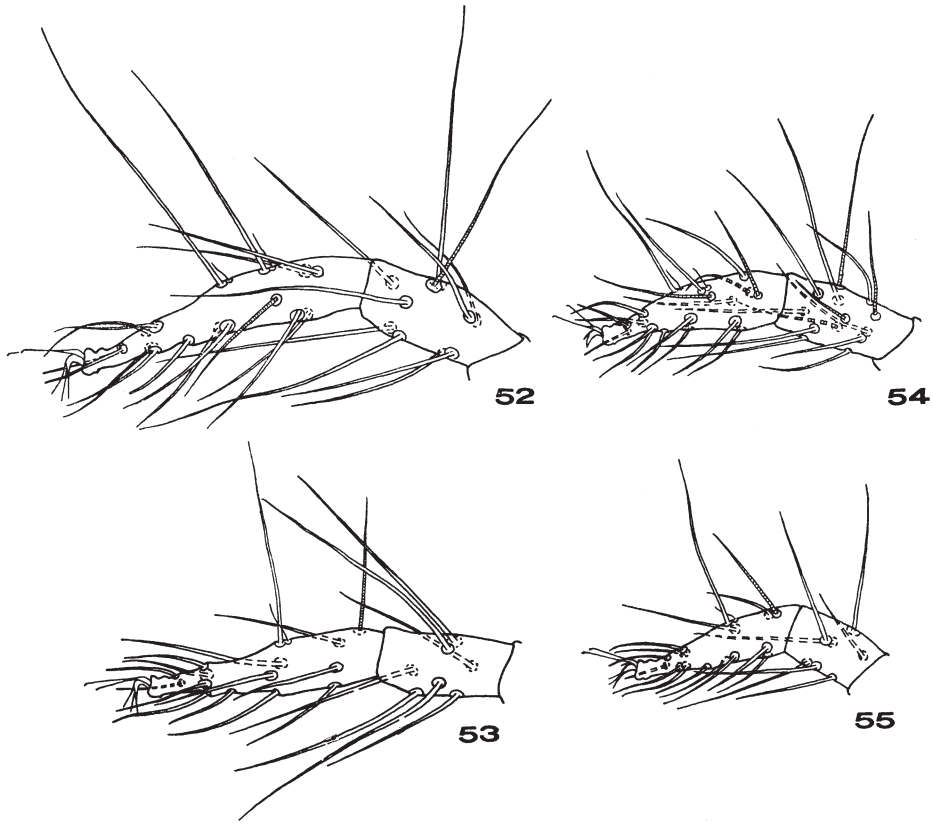
(20) **Tetranychus phaselus** Ehara

(Figs. 48, 49, 52-55, 63, 64)

Tetranychus phaselus Ehara, 1960, p. 238, Figs. 28-39.

The knob of the aedeagus is about as long as the dorsal margin of the shaft. The anterior projection of the knob is small but distinct, and the posterior projection is extremely long, very slender and attenuate. The axis of the knob forms a strong angle with the axis of the shaft. The male has a distinct mediodorsal spur on empodia I-IV each. The empodium of the female is very tiny or absent. The lobes of the female dorsal striae show an intermediate type between the *urticae-* and *cinnabarinus*-types.

Previously *T. phaselus* was known only from Kanagawa Prefecture, Honshu, Japan, on *Phaseolus vulgaris* L.



Figs. 52-55. *Tetranychus phaselus*. 52, tarsus and tibia I of female. 53, tarsus and tibia II of female. 54, tarsus and tibia I of male. 55, tarsus and tibia II of male.

Specimens examined. Three ♂♂ & 13 ♀♀, Hwalien (in greenhouse), 12-IV-1966 (S. Ehara leg.), on soy bean.

(21) **Tetranychus kanzawai** Kishida
(Figs. 65-67)

Tetranychus kanzawai Kishida, 1927, Zool. Mag. 39: 105; Ehara, 1956, p. 504, Figs. 15-25; Ehara, 1960, p. 240; Ehara, 1963b, p. 230, Figs. 12-15.

Tetranychus kanzawai is known from Japan proper (Hokkaido, Honshu, Shikoku, Kyushu) and Okinawa Island on a wide variety of plants, and it is particularly a serious pest of tea. Recently *T. kanzawai* was also recorded from the Philippines (Rimando, 1962b), but the present author has not examined Philippin specimens of this species. It is first recorded from Taiwan.

Specimens examined. Four ♂♂ & 19 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on cassava; 1 ♂, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on teak.

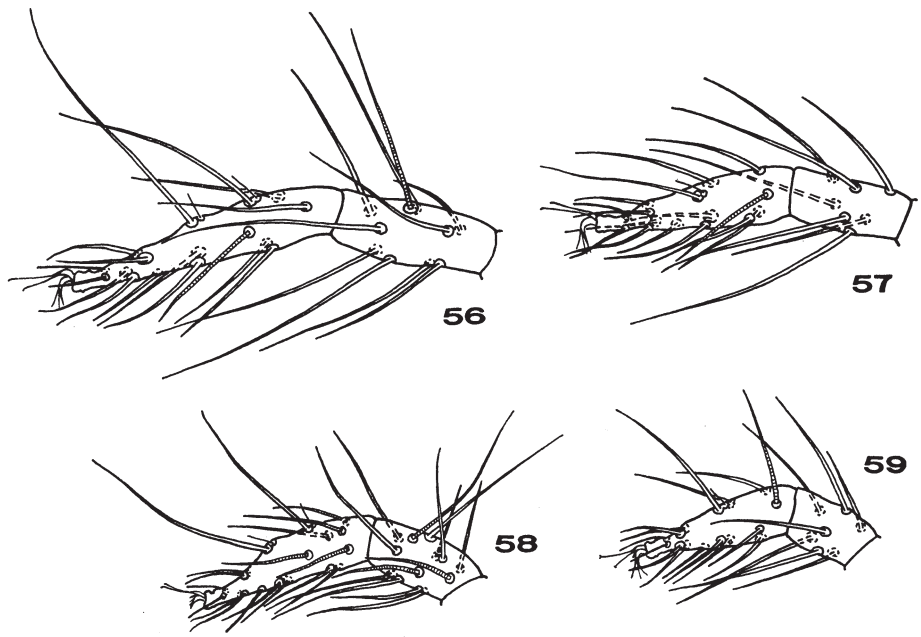
(22) **Tetranychus neocaledonicus** André

(Figs. 50, 51, 56-59, 68, 69)

Tetranychus neocaledonicus André, 1933, p. 302, Figs. 1, 2; André, 1959, p. 53, Figs. 1, 2, 4, 5; Baker & Pritchard, 1960, p. 546, Figs. 86-88.

Tetranychus cucurbitae Rahman & Sapra, 1940, p. 179, Figs. 1, 1a, 1b, 1c, 1d; Pritchard & Baker, 1955, p. 419, Figs. 375-377.

Tetranychus neocaledonicus is distinct in that the aedeagal barb is berry-shaped and has a slight dorsal notch. This species is known to occur in Taiwan, the



Figs. 56-59. *Tetranychus neocaledonicus*. 56, tarsus and tibia I of female. 57, tarsus and tibia II of female. 58, tarsus and tibia I of male. 59, tarsus and tibia II of male.

Philippines, India, Mauritius, Madagascar, Africa, the southeastern United States, Puerto Rico, the Bahamas, Venezuela, Brazil, Fiji, Hawaii, Australia, and New Zealand (imported). From Taiwan it was recorded as *T. cucurbitae* by Lo (1968b) on many kinds of plants including fruit trees.

Specimens examined. Four ♂♂ & 5 ♀♀, Fengshan, 22-III-1966 (S. Ehara leg.), on *Momordica cochinchinensis* Spr.; 3 ♂♂ & 9 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on teak; 2 ♂♂ & 10 ♀♀, Kenting, 4-IV-1966 (S. Ehara leg.), on *Erythrina crista-galli* L.; 3 ♂♂ & 4 ♀♀, Niausong, 30-III-1966 (S. Ehara & H. S. Chien leg.), on unknown plant.

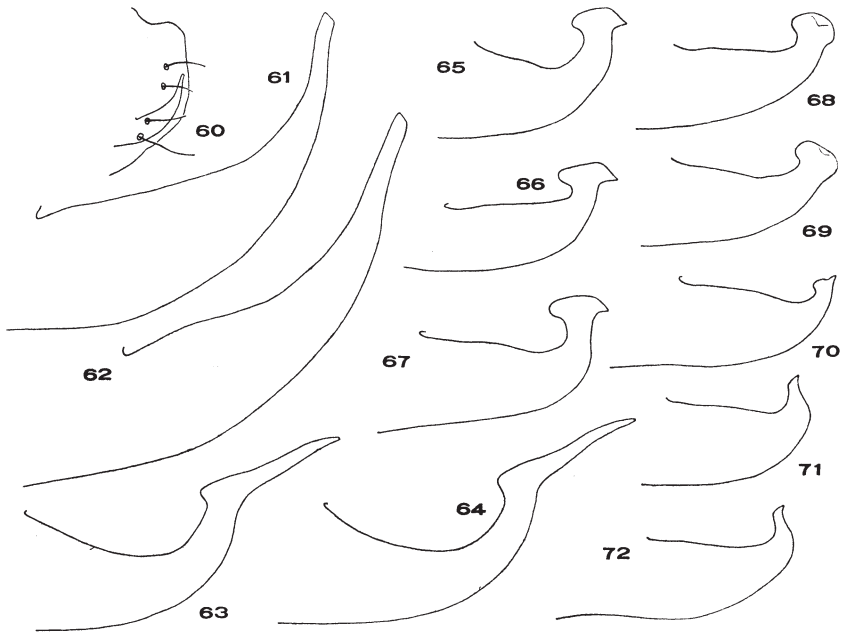
(23) **Tetranychus truncatus** Ehara

(Fig. 70)

Tetranychus truncatus Ehara, 1956, p. 507, Figs. 28-31; Ehara, 1963b, p. 231, Figs. 16-19.

Tetranychus truncatus is known from Japan (Honshu, Kyushu) on mulberry, beet, melon, and egg plant. This species was also reported from the Philippines on diverse plants (Rimando, 1962b). (Specimens from the Philippines have not been examined by the present author.) It is recorded from Taiwan for the first time.

Specimens examined. One ♂ & 3 ♀♀, Pingtung, 4-IV-1966 (S. Ehara & H. S. Chien leg.), on *Momordica cochinchinensis* Spr.



Figs. 60-72. Aedeagi. 60-62, *Tetranychus taiwanicus* n. sp. 63, 64, *T. phaselus*. 65-67, *T. kanzawai*. 68, 69, *T. neocaledonicus*. 70, *T. truncatus*. 71, 72, *T. piercei*.

(24) **Tetranychus piercei** McGregor

(Figs. 71, 72)

Tetranychus piercei McGregor, 1950, p. 299, Fig. 7, Pl. 6 (Fig. 13); Pritchard & Baker, 1955, p. 431, Fig. 385.

This species has been recorded from the Philippines (*Clitoria, Musa*), Okinawa Island (sweet potato, a palm), and Taiwan (peach, banana; Lo, 1968b).

Specimens examined. Six ♂♂ & 12 ♀♀, Fengshan, 24-III-1966 (H. S. Chien leg.), on papaya; 1 ♂ & 6 ♀♀, Fengshan, 24-III-1966 (H. S. Chien leg.), on banana; 5 ♂♂ & 12 ♀♀, Linpen, 8-IV-1966 (S. Ehara leg.), on banana.

Species Previously Recorded and Not Treated in This Study

Tenuipalpidae

1. *Brevipalpus lewisi* McGregor (Lo & Hsia, 1968)
2. *Brevipalpus melichrus* Pritchard et Baker (Lo, 1968b)
3. *Tenuipalpus anoplus* Baker & Pritchard (ibid.)
4. *Tenuipalpus antipodus* Collyer (Lo, 1968a)

Tetranychidae

5. *Eotetranychus sexmaculatus* (Riley) (Pritchard & Baker, 1955)
6. *Schizotetranychus baltazarae* Rimando (Lo & Hsia, 1968)
7. *Oligonychus bicolor* (Banks) (Lo, 1968b)
8. *Tetranychus tumidellus* Pritchard et Baker (ibid.)
9. *Tetranychus hydrangeae* Pritchard et Baker (ibid.)
10. *Tetranychus telarius* (Linnaeus) (Takahashi, 1938)

The mites identified with *Tetranychus hydrangeae* (9) by Lo (1968b) appear to represent *T. kanzawai* Kishida. In addition, *T. kanzawai* is probably a prior name for *T. hydrangeae*. Takahashi's mites referred to *T. telarius* (10) possibly included a few species of spider mites. Lo's description (1968b) of *T. telarius* indicates that his "*telarius*" represents *T. urticae* Koch plus *T. cinnabarinus* (Boisduval).

Summary

Twenty-four species of phytophagous mites of the superfamily Tetranychoidea from Taiwan are treated in this paper. Of these, the following eight previously named species are first recorded from Taiwan: *Pentamerismus oregonensis* McGregor, *Bryobia pritchardi* Rimando, *Aponychus corpuzae* Rimando, *Eotetranychus cendanai* Rimando, *Oligonychus perditus* Pritchard et Baker, *Tetranychus phaselus* Ehara, *Tetranychus kanzawai* Kishida, and *Tetranychus truncatus* Ehara. A new species *Tetranychus taiwanicus* is described. Information about the plant hosts and distribution are given for all species.

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