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Fauna and Key to the Chigger Mites of Korea (Acarina: Trombiculidae and Leeuwenhoekiidae)

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한국의 털진드기상 및 검색표 (진드기 목 : 털진드기 과 와 Leeuwenhoekiidae)

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적 요

한국산 털진드기 종을 다룬 모든 문헌을 조사 정리한 결과 총 43종이 보고되었는데, 그중 *Walchia brennani ventralis*는 오동정한 것으로 *W. comataxilla*이었고 *Shunsennia gracilis*는 *S. hertigi*의 동종이명일 가능성이 있으나 문헌상으로는 확인할 수가 없었다. *Leptotrombidium intermedium*의 경우 문헌상의 근거가 전혀 없어 국내 서식종으로 인정할 수 없었다. 필자가 직접 표본을 조사하여 확인할 수 있었던 종은 모두 17종이었는데 그 가운데 *Leptotrombidium akamushi*는 *L. zetum*의, *L. miyajimai*는 *L. orientale*의 오동정 이었다. 결국 한국산 털진드기류는 모두 2과, 12속, 39종이 된다. 이 중 2종은 조류에, 7종은 박쥐에, 그리고 29종은 설치류에 각각 기생하는 종이고 1종은 조류와 포유류에 공동 기생하는 종이다.

현재 한국산 털진드기를 동정하는데 이용할수 있는 검색표로는 29종을 다룬 Southwick (1968)의 것이 있을 뿐이고, 우리 나라와 동물상이 유사한 일본 종에 대한 검색표도 우리나라 토착종 21종이 들어 있지 않아 도움이 되지 않는다. 뿐만 아니라 기존 검색표는 다리의 강모식(leg setal formula)이나 촉수의 강모식(palpal setal formula)등 관찰하기 어려운 형질을 많이 사용하고 있어서 동정에 어려움이 많았다. 이에 필자는 현재까지 한국 종으로 정리된 총 39종에 되한 검색표를 만들었는데, 관찰이 용이하면서도 변이가 적은 형질을 최대한 사용하였고 특히 종 특징을 잘 나타내는 배판(scutum)의 형질을 주로 사용하였다. 실용성이 보다 큰 도식형 검색표(pictorial key)도 함께 만들었는데 원 저

자들의 도표에서 배판(scutum)을 그대로 전사하여 종 간 비교를 용이하게 하였다.

Key words: fauna, key, chigger mites, Korea.

INTRODUCTION

Since 1985, several hundred cases of tsutsugamush disease (scrub typhus) have been reported every year throughout Korea, so that the disease raises the serious health problem. Neverthless, almost no information on the epidemiological features of the disease including the vector species and its/their ecological aspects is available.

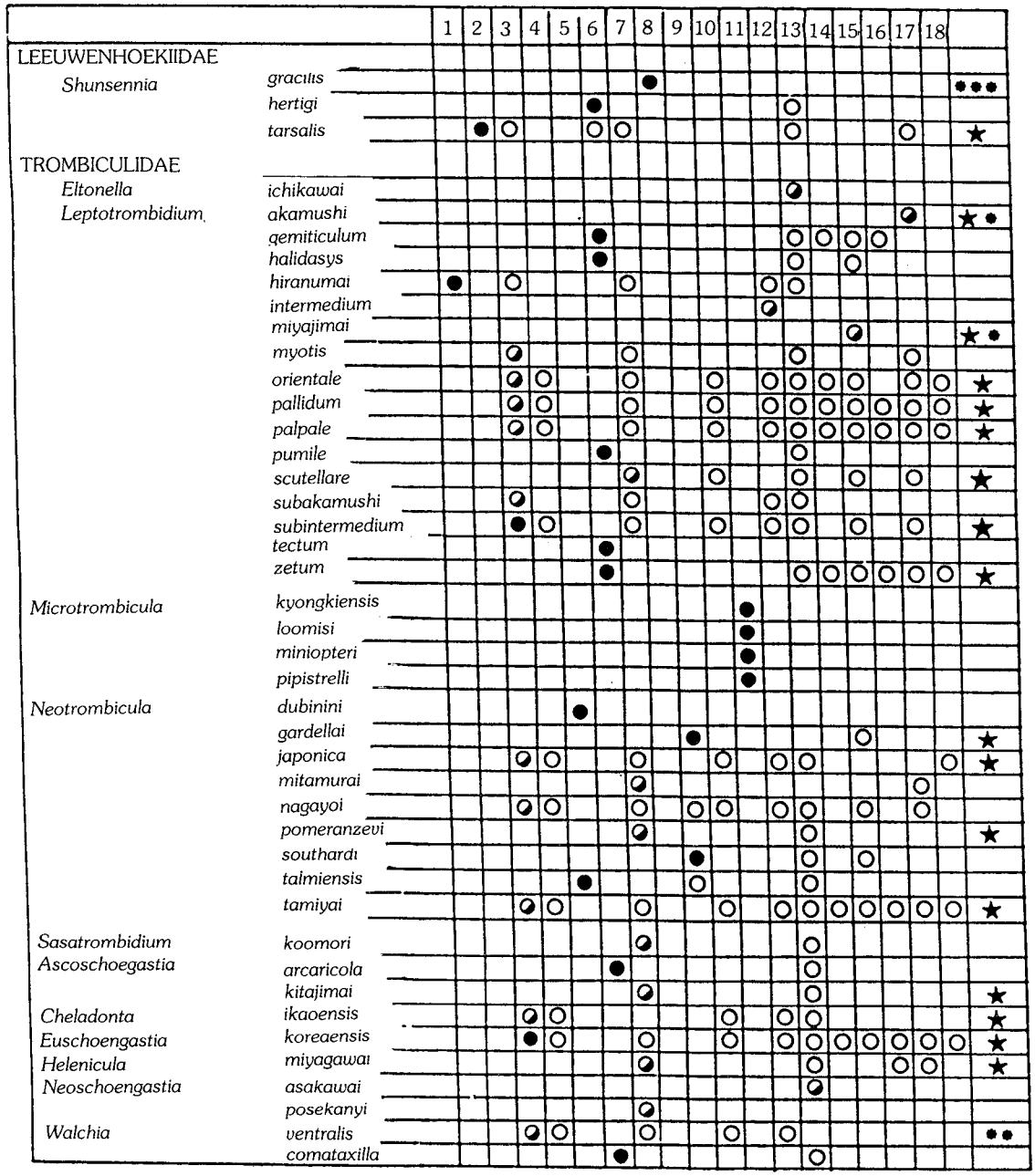
As the first phase of the vector studies, this taxonomical investigation was initiated. All the references on Korean chigger mites (the larval stage of Trombiculidae and Leeuwenhoekiidae) are reviewed, and as it is found that the keys to Korean species which were prepared by the previous workers are not useful, a new key is prepared. The terminology including abbreviations and taxonomical arrangement in the present paper is based on that of Vercammen-Grandjean (1968).

FAUNA AND HISTORICAL BACKGROUND ON STUDIES OF KOREAN CHIGGER MITES

Total 18 references, in which Korean species of Trombiculidae and Leeuwenhoekiidae were dealt were available so far. 43 known species and the related references are given in Table 1. Kanda in 1942 reported *Trombicula hiranumai* for the first time (Cited from Jameson and Toshioka, 1954), and Jameson and Toshioka (1953) described *Shunsennia tarsalis*, each as new species from Korea. Jameson and Toshioka (1954) added 10 unrecorded species and two new species to Korean fauna of trombiculid mites: *Shunsennia tarsalis, Gahrliepia (Walchia) brennani* var. *ventralis, Eushoengastia ikaoensis, E. koreaensis, Trombicula (Leptotrombidium) palpalis. T. (L.) orientalis, T. (L.) pallida, T. (L.) hiranumai, T. (L.) myotis, T. (L.) subakmushi, T. (L.) taniyai, T. (Neotrombicula) japonica, T. (N.) nagayoi, Eushoengastia koreaensis* n. sp. and *T. (L.) subintermedia* n. sp. In 1955 two new species, *Trombicula dubinini* and *T. talmiensis* were collected in North Korea and described by Schluger (1955); the latter species was collected in South Korea and redescribed by Kardos (1961) but the former has not found in South Korea. Traub *et al.* (1958) described and illustrated eight new species from Korea: *Trombicula (Leptotrombicula) gemiticula, T. (L.) zeta, T. (L.) tecta, T. (L.) pumilis, T. (L.) halidaxys, Eushoengastia (Laurentella) arcaricola, Gahrliepia (Walchia) comataxilla* and *Shunsennia hertigi*.

Chung (1959) who was the first Korean worker of trombiculid mites briefly redescribed 22 species without illustration, including five unrecorded species from Korea: *Neoshoengastia posekanyi, Eushoengastia kitajimai, E. miyagawai, Trombicula pomeranzevi* and *T. scutellaris*. One new species that he found is not valid, because it was not named (simply *Trombicula* sp.) and too briefly described without illustration. Ah (1960) described a new species, *Shunsennia gracilis* collected from *Apodemus* mice at central Korea. However, this new species was not compared with *Shunsennia hertigi* Traub, Morrow and Lipovsky, 1958, all the characters of which were identical to those of *S. gracilis*, except the number of fine teeth of the chelicera and the number of the setae on the palpal tarsus. Ah (1960) described that *S. gracilis* had "chelicera with

KOREAN SPECIES OF LEEUWENHOEKIIDAE AND TROMBICULIDAE



● new species: ◒ new record; ★ Confirmed by the author; • misidentified; •• not *ventralis*, bur *W. comataxilla*; ••• probably synonym of *hertigi* (?).

1. Kanda, 1942
2. Jameson & Toshioka, 1953
3. Jameson & Toshioka, 1954
4. Traub *et al.*, 1954
5. Schluger, 1955
6. Traub *et al.*, 1958
7. Chung, 1950
8. Ah, 1960
9. Kardos, 1961
10. Huh *et al.*, 1962
11. Ah, 1964
12. Woo & Kim, 1967
13. Southwick, 1968
14. Kwon & Lim, 1973
15. Lee *et al.*, 1983
16. Kim *et al.*, 1987
17. Lee *et al.*, 1988
18. Ree *et al.*, 1989

numerous minute teeth (more than 12) on ventral surface of cheliceral blade and a subapical dorsal teeth". Traub *et al.* (1958) wrote in the description of *S. hertigi* "chelicereae about 3/8 as long as broad at base; with subapical row of very small teeth immediately proximal to the cheliceral cap", in which the number of the teeth was not mentioned, however there were only 5-6 teeth on their origical illustration. Ah's illustration was not coincide with his description, i.e. "a subapical dorsal tooth" was not shown in the illustration. The original illustrations of *S. hertigi* (drawn by Traub et al., 1958) and *S. gracilis* (drawn by Ah, 1960) are given on Fig. 1. The descriptions and illustrations of the above two papers do not make it clear whether the chelicerae of two species are morphologically identical or different. Another difference between *S. gracilis* and *S. hertigi* is the number of the branched setae on the plapal tarsus, i. e. the former has seven, whereas six in the latter species. Traub and Nadchtram (1966) treated *S. gracilis* as a synonym of *S. hertigi*, without mentioning any remarks, nor giving the comparison of characters between two species. They simply remarked that "*gracilis* is deemed a synonym of *hertigi*". On the other hand, Vergammen-Grandjean (1968) treated *S. gracilis* Ah, 1960 as a distinct species on the list of the chigger mite of the Far East. Judging from all the references mentioned above, the writer proposes that *Shunsennia gracilis* Ah, 1960 be retained as valid name, until new findings on *gracilis* and/or *hertigi* are obtained.

Trombicula (Neotrombicula) gardellai and *T. (N.) southardi* were added by kardos (1961), both as new species to the fauna of Korean trombiculid mites in 1961. Ah (1964) described four new species of genus *Microtrombicula*: *M. kyongkiensis, M. loomisi, M. miniopteri* and *M. pipelli*, all of which were internasal species of the bat. Woo and Kim (1967) listed 12 species of tombiculid mites in their ecological study reports, and *Leptotromidium intermedia,* an unrecorded species until that time in Korea, was included in the list. However, because this paper was ecological one rather than taxonomical and there was neither taxonomical remarks nor discussions, this species would better not inlcluded in the list of Korean Trombiculidae. Moreover, *Neotrombidium coreana* was also included in the list, but there is no such named species in Trombiculidae. In the progress report "Ectoparasite Survey of South Korea" of the 5th Preventive Unit, 65th Medical Group, FASCOM, Southwick (1968) listed 29 species of Korean trombiculid mites without redescription and illustration, in which two unrecorded species from Korea were included. They were *Neoschoengastia asakawai* and *Neotrobicula ichikawai. Neoschoengastia posekanyi* was included only in the key, but not in his collection records. In 1980s, *Leptotrombidium miyajimai* and *L. akamushi* were reported for the first time in Korea, the former species by Lee *et al.* (1983) and the latter by Kim *et al.* (1987). Both papers were the ecologicial ones and no taxonomicai remarks were given. With the kindness of the head authors of both papers, the writer could check the specimens and confirmed that both species were mis-identified. Therefore these two species are deleted from the list. *Walchia brennani ventralis* was reported for the first time in Korea by Jameson and Toshioka (1954), and followed by Traub *et al.* (1954), Chung (1959), Huh *et al.* (1962) and Woe and Kim (1967). However, Traub *et al.* (1958) reported that the Korean species reported by Jameson and Toshioka (1954) was not *W. brennani ventralis*, being separable from *W. b. ventralis* by shorter postlateral

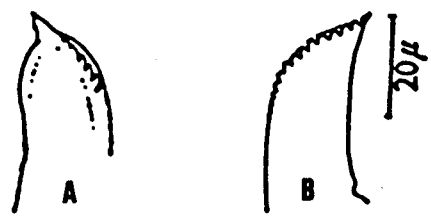


Fig. 1. Chelicera of *shunsenuia hertigi* (A: illustrated by Traub *et al*., 1958) and *S. gracilis* (B: illustrated by Ah, 1960).

setae (PL), smaller coxa II (PW/coxa II = 0.91, whereas 0.74 in *W. b. ventralis*) and larger AW and PW (44 and 50 μ respectively, whereas 34 and 45 μ in *W. b. ventralis*). Taking into account such characters, they designated the Korean specimens as a new species nawed *W. comataxilla*. The writer found that the key characters of *W. b. ventralis* redescribed by Jameson and Toshicka (1954) was well coinsided with *W. comataxila's*. Also as *W. b. ventralis* belongs zoogeographically Indo-Malayan subregion of Oriental region, this species should be deleted from the list.

In summary, total 39 species, 12 genera of Trombiculidae and Leeuwenhoekiidae were recorded in Korea, as shown in Table 2. Among 39 species, two are parasitic on birds, 36 on mammals (7 spp. on bats and 29 spp. on redents) and one on both birds and mammals.

Table. 2. List of Trombiculidae and leeuwenhoekiidae in Korea

TROMBICULIDAE Ewing, 1944
TROMBICULINAE Ewing, 1929
TROMBICULINI Vercammen-Grandjean, 1960
Eltonella Audy, 1956
1. *E.* (*E*) *ichikawai* (Sasa, 1952)
Leptotrombdium Nagayo, Miyagawa, Mitanura & Imamura, 1916
2. *L.* (*Ericotrombidium*) *gemiticulum* (Traub, Morrow & Lipovsky, 1958)
3. *L.* (*L.*) *halidasys* (Traub, Morrow & Lipovsky, 1958)
4. *L.* (*L.*) *hiranumai* (Kanda, 1942)
5. *L.* (*L.*) *myoti* (Ewing, 1929)
6. *L.* (*L.*) *orientale* (Schluger, 1948)
7. *L.* (*L.*) *pallidum* (Nagayo, Mitamura & Tamiya, 1919)
8. *L.* (*L.*) *plapale* (Nagayo, Mitamura & Tamiya, 1919)
9. *L.* (*L.*) *pumile* (Traub, Morrow & Lipovsky, 1958)
10. *L.* (*L.*) *scutellare* (Nagayo, Mitamura, Tamiya & Tenjin, 1921)
11. *L.* (*L.*) *subakamushi* (Schluger, 1948)
12. *L.* (*L.*) *subintermedium* (Jameson & Toshioka, 1945)
13. *L.* (*L.*) *tectum* (Traub, Morrow & Lipovsky, 1958)
14. *L.* (*L.*) *zetum* (Traub, Morrow & Lipovsky, 1958)
Microtrombicula Ewing, 1950
15. *M. kyongkiensis* Ah, 1964
16. *M. loomisi* Ah, 1964
17. *M. miniopteri* Ah, 1964
18. *M. pipistrelli* Ah, 1964
Neotrombicula Hirst, 1915
19. *N.* dubinini (Schluger, 1955)
20. *N.* (*N.*) *gardellai* (Kardos, 1961)
21. *N.* (*N.*) *japonica* (Tanaka, Kaiwa, Teramura & Kogaya, 1930)
22. *N.* (*N.*) *mitamurai* (Sasa, Hayashi, Kumada & Teramura, 1950)
23. *N.* (*N.*) *nagayoi* (Sasa, Hayashi, Sato, Miura & Asahina, 1950)
24. *N.* (*N.*) *pomeranzevi* (Schluger, 1948)

Table 2 (Continue)

25. *N.* (*N.*) *southardi* (Kardos, 1961)
26. *N.* (*N.*) *talmiensis* (Schluger, 1955)
27. *N.* (*N.*) *tamiyai* (Philip & Fuller, 1950)

Sasatrombidium Vercammen-Grandjean, 1960

28. *S.* (*S.*) *koomori* (Sasa & Jameson, 1954)

SCHOENGASTIINI Vercammen-Grandjean, 1960

Ascoschoengastia Ewing, 1948

29. *A.* (*A.*) *arcaricola* (Traub, Morrow & Lipovsky, 1958)
30. *A.* (*A.*) *kitajimai* (Fukuzumi & Obata, 1953)

Cheladonta Lipovsky, Crossley & Loomis, 1955

31. *C. ikaoensis* (Sasa, Sawada, Kano, Hayashi & Kumada, 1951)

Euschoengastia Ewing, 1938

32. *E.* (*E.*) *koreaensis* Jameson & Toshioka, 1954

Helenicula Audy, 1954

33. *H.* (*H.*) *miyagawai* (Sasa, Kumada & Miura, 1951)

Neoschoengastia Ewing, 1929

34. *N.* (*N.*) *asakawai* Fukuzumi & Obata, 1953
35. *N.* (*N.*) *posekanyi* Wharton & Hardcastle, 1946

GAHRLIEPIINAE Womersley, 1952

Walchia Ewing, 1931

36. *W.* (*W.*) *comataxilla* (Traub, Morrow & Lipovsky, 1958)

LEEUWENHOEKIIDAE Womersley, 1945

Shunsennia Jameson & Toshioka, 1953

37. *S. gracilis* Ah, 1960
38. *S. hertigi* Traub, Morrow & Lipovsky, 1958
39. *S. tarsalis* Jameson & Toshioka, 1953

KEY TO THE CHIGGER MITES OF KOREA

Jameson and Toshioka (1954) presented the key to 14 species of the chiggers of South Korea, and Chung (1959) added seven species to the key. However, Chung's revised key was not reliable in several aspects. Southwick (1968) prepared another key to 29 Korean species of the chiggers. The key characters that the previous workers had employed were mainly the leg setal formulae, palpal setal formula and some others, some of which are very difficult to observe, particularly in case that the specimens are not perfectly prepared.

The writer prepared the larval key to 39 species of Trombiculidae and Leeuwenhoekiidae of Korea, employing mostly the characters of the scutum, the dorsal setal formula and coxal setal III, which are not only comparatively easy to observe but highly stable. In case that it is not possible to identify the species by comparing one or two key character(s), the pictorial key (Annex I) is made by using several characters at the same time, which resulted inevitably in a little complicated one. In the pictorial key, the original illustration of the scutum of each species are given in stead of diagramatic drawings of the relevant characters, as the scutum has several important characters.

KEY TO THE CHIGGER MITES OF KOREA

1. -Scutum without, or with only one anteromedian seta (AM) ..... TROMBICULIDAE 2
   -Scutum with two anteromedian setae (AM) ..... LEEUWENHOEKIIDAE 37
2. -Scutum without anteromedian seta (AM). Leg II and III with 6 segments ..... GAHRLIEPIINAE
   ..... With 4 scutal setae. Humeral setae 2 pairs. PW 15 μ ..... *Walchia comataxilla*
   -Scutum with one anteromedian seta (AM). Leg II and III with 7 segments .....
   ..... TROMBICULINAE 3
3. -Sensillae expanded (lanceolate to globose) ..... SCHOENGASTIINI 4
   -Sensillae filamentous ..... TROMBICULINI 10
4. -Sensillary bases (SB) close together. Coxa III with 2 setae. Anterolateral setae (AL) longer than anteromedian seta (AM) ..... *Helenicula miyagawai*
   -Sensillary bases (SB) wide apart 5
5. -A portion of scutum (usually posterior half) overlapped by cuticular striations .....
   Neoshoengastia 6
   -Scutum not overlapped by cuticular striations 7
6. -Humeral setae 1 pair. 1st row of post-humeral dorsal setae (1st PHS) 8. Galeal seta nude (on birds)
   ..... *N. posekanyi*
   -Humeral setae 2 pairs. 1st row of post-humeral dorsasl setae (1st PHS) 12-14. Galeal seta branched (on birds) ..... *N. asakawai*
7. -Scutum with anterolateral (AL) shoulders; anteromedian seta (AM) in advance of a line of anterolateral setae (AL line) ..... *Ascoshoengastia* 8
   -Scutum without AL shoulder; AM behind of AL Tine 9
8. -Posterior margin of scutum evenly rounded (convex). lst row of posthumaral setae (1st PHS) 10 or more ..... *A. kitajimai*
   -Posterior margin of scutum slightly sinuate (biconvex). 1st row of posthumeral setae (1st PHS) 8
   ..... *A. arcaricola*
9. -Humeral setae (HS) 2 pairs. Dorsolateral tibial seta of palpus branched ..... *Cheladonta*
   ..... SB in advance of PL line. Coxa III oval ..... *C. ikaoensi*-
   -Humeral setae (HS) 1 pair. Dorsolateral tibial seta of plapus nude ..... *Eushoengastia*
   ..... SB behind of PL line. Coxa III elongate ..... *E. koreaensis*
10. -Scutum rectangular; posterior margin never angulate ..... *Leptotrombidium* 11
    -Scutum pentagonal or subpentagonal; posterior margin broadly U or V shaped 23
11. -Coxal seta III on or close to anterior margin of the coxa 12
    -Coxal seta III separated from anterior margin of the coxa, by more than twice the setal diameter 14
12. -1st row of posthumeral setae (1st PHS) 8. Postlateral setae (PL) submarginal, with shoulders. Base of sensilla (SB) behind of PL line. Sensilla basally barbed. fpp=N/N/BNB ..... *L. orientale*
    -1st row of posthumeral setae (1st PHS) 10 or more. SB more or less on PL line 13
13. -Scutum larger (PW 80xSD 45 μ). PL shoulders absent. Base of sensillae with very minute barbs. fD = 2, 12, 8, 10, 8, 4, 2=46 ..... *L. gemiticulum*
    -Scutum smaller (PW 71 x SD 38μ). PL shoulders prosent. Base of Sensillae nude. fD= 2, 10, 10, 10, 8, 6, 2=50 ..... *L. palpale*

14. -1st PHS 12-14. Sensilia basally barbed. PL submargical. with shoulders. fD=2, 12-14,11-12, 12, 10, 8, 6, 4 ..... *L. pallidum*
    -1st PHS 8-10 15
15. -1st PHS usuablly 10 16
    -1st PHS usually 8 18
16. -PL submarginal, with shoulders. Galeal seta branched. PW 77 μ. fD=2, 10, 8-10, 8 ..... =40-46 ..... *L. tectum*
    -PL at corners, without shoulders 17
17. -Scutum less than twice as wide as long; posterior margin slightly convex; SB more or less on PL line. fD=2, 10-12, 10-12, 2, 9-12, 8-10, 4, 2=47-62 ..... *L. scutellare*
    -Scutum more than twice as wide as long; posterior margin more or less straight; SB in advance of PL line. fD=2, 10, 8, 8, 7-8, 4, 2=41-42. (on rabbits) ..... *L. hiranumai*
18. -Sensillary bases (SB) in advance of PL line. a pair of crescental shaped lines near anterior margin of scutum present 19
    -Sensillary bases (SB) behind of PL line 20
19. -Anterolateral corners of scutum round. Posterior margin of scutum straight. fpp=N/N/NNN. Parasitic on bats ..... *L. subakamushi*
    -Anterolateral corners of scutum angulate. Posterior margin of scutum biconvex. fpp=N/N/BNN. Parasitic on bats ..... *L. myotis*
20. -PL submarginal, with shoulders 21
    -PL at corners, without shoulders 22
21. -Scutum smaller (PW 77xSD 47 μ). Sensillae basally nude. AM 50 μ. fD=2, 8, 6, 6, 6, 4, 4 .... *L. subintermedium*
    -Scutum larger (PW 90x SD 51 μ). Sensillae basally barbed. AM 71μ. fD=2, 8, 6, 6, 6, 4, 2 .... *L. zetum*
22. -Scutum very wide (PW 108μ), more than twice as wide as long; anterior margin concave at AL corners; lateral margin straight; posterior margin not sinuate. Sensillae thin, fragile and very sparsely branched at distal 2/3. fD=2, 8, 12, 10 .... =85-105 ..... *L. halidasys*
    -Scutum not so wide (PW 69 μ), less than twice as wide as long; anterior margin straight; lateral margin slightly concave; posterior margin biconvex. Distal 2/3 of sensillae plumose. fD=2, 8, 6, 6, 6, 2=30 ..... *L. pumile*
23. -Scutum wider than long 24
    -Scutum longer than wide .....*Microtrombicula* (Parasitic on bats) 34
24. -Scutum with AL shoulders .... *Eltonella* ....fpp=B/B/NNB. fD=2.6,6,6,4,4,2=30 .... *E. ichikawai*
    -Scutum without AL shoulders 25
25. -Lateral margin of scutum concave ..... *Sasatrombicula* ..... Galeal seta nude. fpp=B/B/NBB. fD=2,14,10,8,8,6,4. Parasitic on bats. ..... *S. koomori*
    -Lateral margin of scutum straight ..... *Neotrombicula* 26
26. -Humeral setae (HS) 2 pairs 27
    -Humeral setae (HS) 1 pair 28
27. -Galeal seta nude. SB on PL line. fD=4, 6, 6, 6, 6, 4, 2, 2 ..... *N. japonica*
    -Galeal seta branched ..... *N. dubinini*
28. -Distal 2/3 of sensillae branched. Posterior margin of scutum U shape(except *talmiensis*) 29

-Sensillae nude, with very minute barbs on basal 1/3. Posterior margin of scutum V shape. SB slightly behind of PL line ..... *N. pomeranzevi*

29. -1st row of posthumeral setae (1st PHS) 10-12 30
-1st row of posthumeral setae (1st PHS) 6-8 32

30. -Sensillary bases (SB) on PL line. Leg III with 1 mastitarsala, and without tibiala. fD = 2,10, 10 = 65-74. PL 66 μ ..... *N. southardi*
-Sensillary bases (SB) well behind of PL line. Leg III with 3 mastitarsalae, and 1-2 tibiala(e) 31

31. -Sensillae branched on distal 2/3. Coxa III elongate. fD = 2, 10, 8, 2, 9, 2, 6, 4, 2 = 45 ..... *N. tamiyai*
-Sensillae with 4-6 branches on middle part only (distal 1/3 nude), Coxa III oval. fD = 2, 12, 2, 10, 2, 10, 8, 4 = 45 ..... *N. mitamurai*

32. -SB slightly behind of PL line. Galeal seta forked. PL 65 μ (58-74μ). fpp = B/B/BBB. fD = 2, 8, 6, 6, 2, 4, 4, 2 ..... *N. talmiensis*
-SB in advance of PL line. Galeal seta nude. fpp = B/B/NBB 33

33. -1st PHS 8. Scutum larger (PW 86-98 × SD 55-61μ). PL longer (55μ). fD = 2, 8, 8, 2, 10, 4, 6, 2 ..... *N. nagayoi*
-1st PHS 6, Scutum smaller (PW 79-88 × SD 46-57μ). PL shorter (50 μ). fD = 2, 6, 6, 2, 6, 4, 4, 2 ..... *N. gardellai*

34. -1st PHS 6. Scutum wider (PW 59-64μ). Sensillae long (75μ). fpp = B/B/BBB., ... *M. loomisi*
-1st PHS 8. Scutum narrower (PW less than 40 μ). Sensillae short (55 μ or less) 35

35. -Palpal genual seta nude. Coxal seta III well separated from anterior margin of the coxa. fpp = B/N/NNN ..... *M. miniopteri*
-Palpal genual seta branched. Coxal seta III close to anterior margin of the coxa 36

36. -Coxal seta III on just rear anterior margin of the coxa. Scutum narrower (PW 30-34μ). Sensilla shorter (36μ). fpp = B/B/NNB ..... *M. pipistrelli*
-Coxal seta III on anterior margin of the coxa. Scutum wider (PW 39 μ). Sensilla longer (55 μ). fpp = B/B/BNB ..... *M. kyongkiensis*

37. -Posterior margin of scutum convex. Eyes single. fpp = B/B/BBB ..... *Shunsennia tarsalis*
-Posterior margin of scutum biconvex. Eyes double. fpp = B/B/BNN 38

38. -Chelicera with 5-6 fine teeth subapically. Palpal tarsus with 6 branched setae ..... *Shunsennia hertigi*
-Chelicera with more than 12 teeth subapically. Palpal tarsus with 7 branched setae. ..... *Shunsennia gracilis*

ABSTRACT

All the available taxonomical informations on Korean chigger mites were reviewed. Total 43 species, including 21 new species were reported from Korea, of which 4 species were misidentified or synonym. The larval key to 39 Korean species of Trombiculidae and Leeuwenhoekiidae is made, by using mostly the characters of the scutum.

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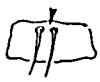
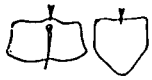
LARVAL KEY TO GENERA AND SPECIES OF TROMBICULIDAE AND LEEUWENHOEKIIDAE IN KOREA

SHEET I
TROMBICULIDAE



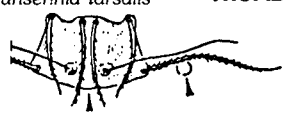
Sctum with 2 AM.
LEEUWENHOEKIIDAE

Scutum with 1 AM, or absent.
TROMBICULIDAE



Posterior margin of scutum slightly biconvex. Eyes double. B/B/BNN.

Posterior margin of scutum convex. Eyes single. B/B/BBB.
Shunsennia tarsalis

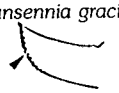


Scutum with 1 AM. Leg II and III with 7 segments.
TROMBICULINAE

AM absent. Leg II and III with 6 segments.
GAHRLIEPIINAE

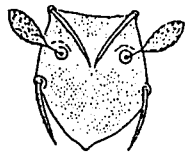
Chelicera with 5-6 teeth. 6 setae on palpal tarsus.
Shunsennia hertigi

Chelicera with 12 teeth or more. 7 setae on palpal tarsus.
Shunsennia gracilis



4 scutal setae.
(Walchia)

HS 2 pairs. Scutum 50x75 μ.
W. comataxilla



Sensillae expanded.
SCHOENGASTIINI

Sensillae filamentous.
TROMBICULINI

SHEET II
TROMBICULINI

SB close together. Coxa III with 2 setae. AL longer than AM.
Helenicula miyagawai

SB wide apart.

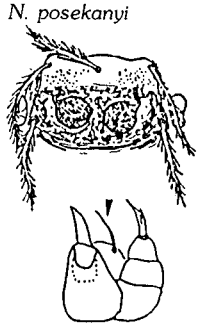
A portion of scutum (usually 1/2 of posterior margin) overlapped by cuticular striations.
(Neoschoengastia)

Scutum not overlapped by cuticular striations.

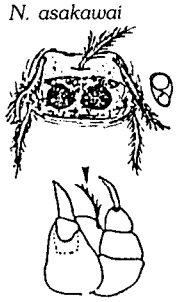
Scutum without AL shoulders. AM behind AL line.

Scutum with AL shoulders. AM in advance of AL line.
(Ascoshoengastia)

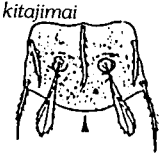
HS 1 pair. lst PHS 8. Galeal seta nude.
N. posekanyi



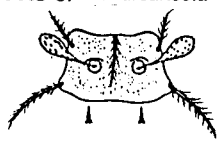
HS 2 pairs. 1st PHS 12-17. Galeal seta branched.
N. asakawai



Posterior margin of scutum evenly rounded (convex). 1st PHS 10 or more.
A. kitajimai

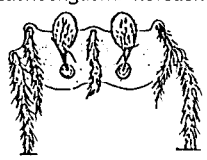


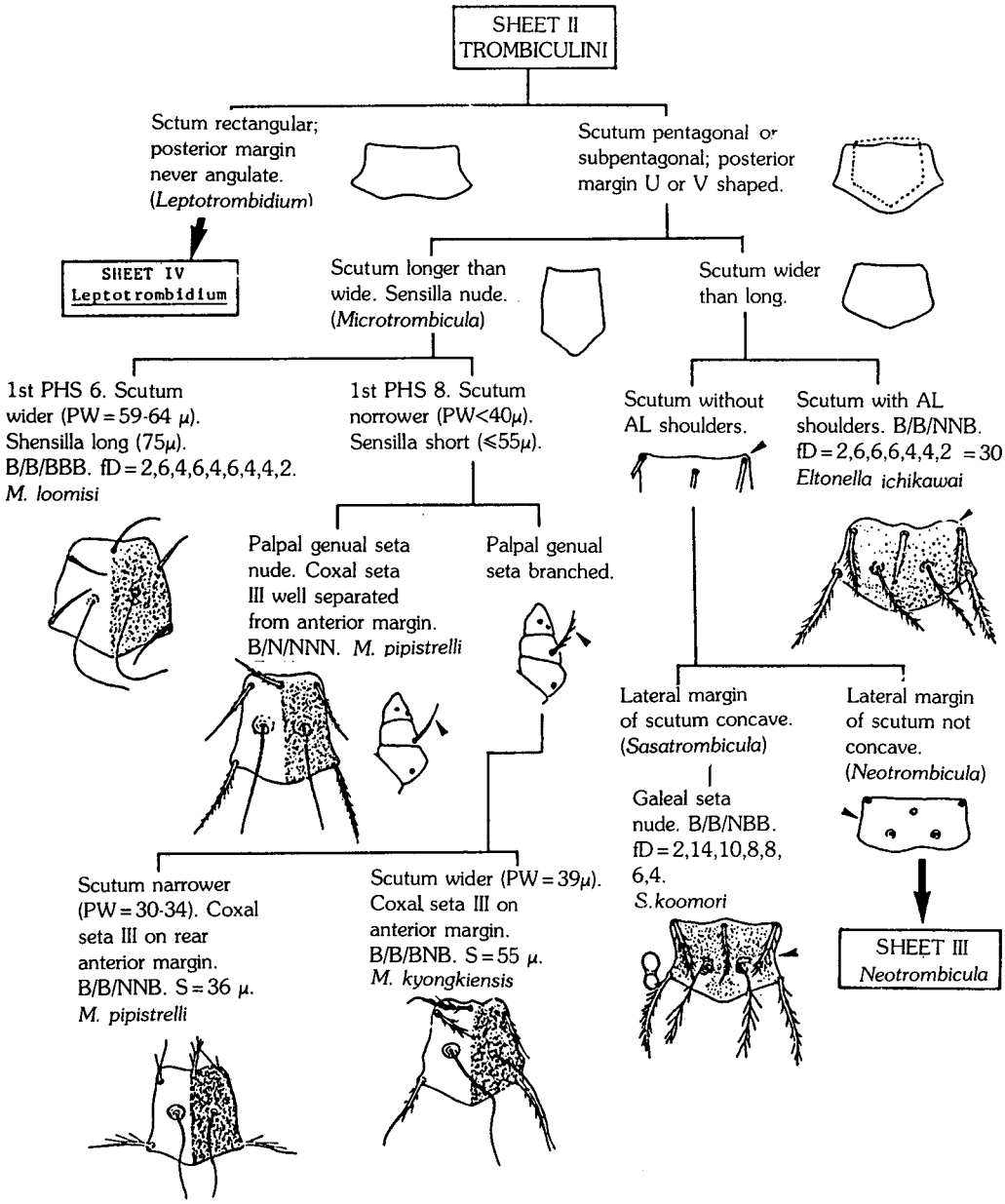
Posterior margin of scutum slightly biconvex. 1st PHS 8. *A. arcaricola*



HS 2 pairs. SB slightly in advance of PL line. Coxa III oval form. SB with crescental shaped marking anteriorly.
Cheladonta ikaoensis

HS 1 pair. SB behind of PL line. Coxa III elongate.
Eushoengastia koreaensis

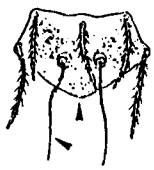



SHEET II
TROMBICULINI
Sctum rectangular; posterior margin never angulate. (Leptotrombidium)
Scutum pentagonal or subpentagonal; posterior margin U or V shaped.
SHEET IV
Leptotrombidium
Scutum longer than wide. Sensilla nude. (Microtrombicula)
Scutum wider than long.
1st PHS 6. Scutum wider (PW=59-64 μ). Shensilla long (75μ). B/B/BBB. fD=2,6,4,6,4,6,4,4,2. M. loomisi
1st PHS 8. Scutum norrower (PW<40μ). Sensilla short (≤55μ).
Scutum without AL shoulders.
Scutum with AL shoulders. B/B/NNB. fD=2,6,6,6,4,4,2 =30 Eltonella ichikawai
Palpal genual seta nude. Coxal seta III well separated from anterior margin. B/N/NNN. M. pipistrelli
Palpal genual seta branched.
Lateral margin of scutum concave. (Sasatrombicula)
Lateral margin of scutum not concave. (Neotrombicula)
Galeal seta nude. B/B/NBB. fD=2,14,10,8,8, 6,4. S.koomori
SHEET III
Neotrombicula
Scutum narrower (PW=30-34). Coxal seta III on rear anterior margin. B/B/NNB. S=36 μ. M. pipistrelli
Scutum wider (PW=39μ). Coxal seta III on anterior margin. B/B/BNB. S=55 μ. M. kyongkiensis

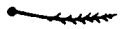
SHEET III
Neotrombicula

HS 1 pair.

Sensilla nude, with very minute barbs on basal 1/3. Posterior margin of scutum V shaped. fD = 2,10,2,8-10,8, 6,4,2,.
pomeranzevi

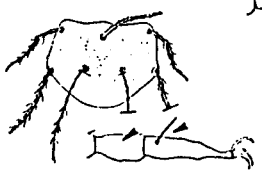


Sensillae branched. Posterior margin of scutum U shaped (except *talmiensis*).



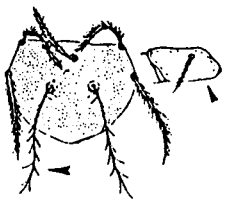
1st PHS 10-12.

SB on PL line. Leg III with 1 mastitarsala, without tibiala. fD = 2,10, 10 ··· = 65-74. PL = 66 μ.
southardi

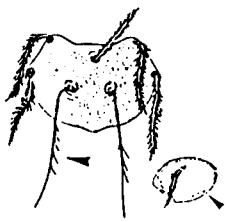


SB behind of PL line. Leg III with 3 mastitarsala and 1-2 tibiala.

Coxa III elongate. Sensilla branched on distal 2/3. fD = 2,10,8,2,9,2,6, 4,2 = 45
tamiyai



Coxa III oval shaped. Sensilla with 4-6 branches on middle part only. fD = 2,12, 2,10,2,10,8,4 = 50.
mitamurai

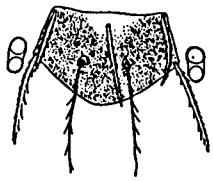


1st PHS 6-8.

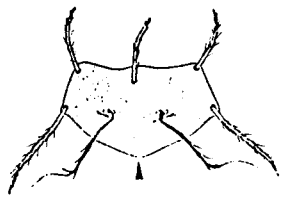
HS 2 pairs.

Galeal seta branched.
dubinini

Galeal seta nude. fD = 4,6,6,6,6,4,2, 2 = 36.
japonica

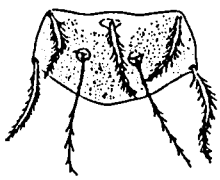


SB slightly behind of PL line. Galeal seta forked. PL 65(58-74)μ, B/B/BBB. fD = 2,8,6,6,2, 4,4,2.
talmiensis

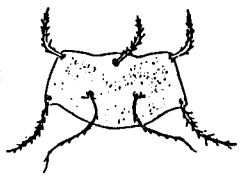


SB in advance of PL line. Galeal seta nude. Posterior margin of scutum U shaped. B/B/NBB.

1st PHS 8. Scutum larger (PW 86-98 x SD 55-61μ). PL = 55μ. fD = 2,8,8,2,10,4,6,2.
nagayoi



1st PHS 6. Scutum smaller (PW 79-88 x SD 46-57μ). PL = 50μ. fD = 2,6,6,2, 6,4,4,2.
gardellai

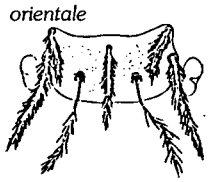


SHEET IV
Leptotrombidium

Coxal seta III on or close to anterior margin of the coxa.

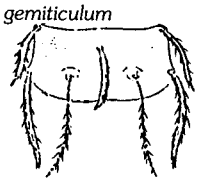
Coxal seta III separated from anterior margin of the coxa, by more than twice the setal diameter.

1st PHS 8. SB well behind of PL line. sensillae basally barbed. PW 67 μ. fD = 2,8,8(6) .... = 32.
orientale

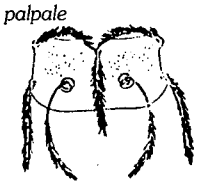


1st PHS 10 or more. SB on, or very slightly behind PL line.

Scutum larger (PW 80 × 45μ). PL 52μ. Base of Sensillae with very minute barbs.
gemiticulum

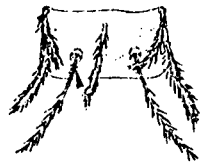


Scutum smaller (PW 65 -71 × SD 38μ). Base of sensillae nude. PL shorter (47μ).
palpale



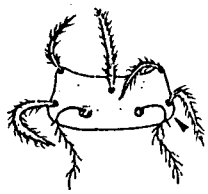
1st PHS 8-10.

1st PHS 12(-14). Sensillae basally barbed. PW 73μ. fD = 2, 12,12,11 ..... = 70.
pallidum



1st PHS 10.

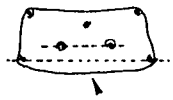
PL with shoulders. PW 77 μ. fD = 2,10, 8(10), 8 ..... = 40-46. Galeal seta branched.
tectum



PL without shoulders.

Scutum less than twice as wide as long; posterior margin convex. SB on PL line. fD = 2, 10-12, 10-12. ..... = 47-62.
scutellare

Scutum more than twice as wide as long; posterior margin more or less straight. SB in advance of PL line. fD = 2,10, 8,8 ..... = 41-42.
hiranumai

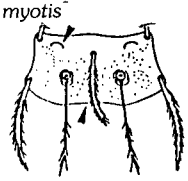


1st PHS 8.

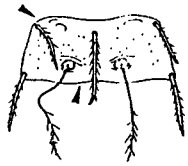
SB on or behind PL line.

SB in advance of PL line. 2 crescental shaped lines near anterior margin of scutum.

AL corners sharply angulated. Posterior margin of scutum biconvex. N/N/BNN (on bats).
myotis

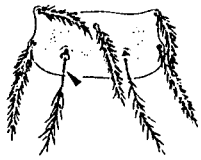


AL corners round. Posterior margin of scutum straight. N/N/NNN. (on bats).
subakamushi

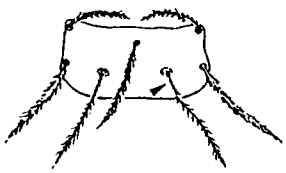


PL with shoulders.

Scutum smaller (PW 77 × SD 47 μ). Sensillae basally nude. AM 50 μ.
subintermedium

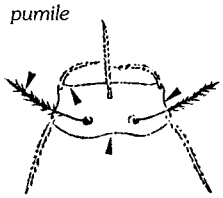


Scutum larger (PW 90 × SD 56 μ). Sensillae basally barbed. AM 71 μ.
zetum



PL without shoulders.

Scutum: anterior margin straight; lateral margin slightly concave; distal 2/3 of sensillae plumose; PW 69μ. DS = 27-32.
pumile



Posterior margin of scutum slightly convex; anterior margin concave at AL; lateral margin straight. Sensilla thin, fragile and very sparsely branched. PW 108μ. Total DS = 85-105.
halidasys