

Redescription of *Veigaia tibbetsi* Farrier, 1957 (Acari: Mesostigmata: Veigaiidae) based on the specimens found from the Korean Peninsula

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Mites in the family Veigaiidae, order Mesostigmata, subclass Acari are widely distributed in subsoil habitats. They are mostly free-living and predaceous on small arthropod eggs and larvae, and prefer habitats with rich organic matters including litter and humus layers of forest soil. The genus *Veigaia* Oudemans, 1905 of the family Veigaiidae (Acari: Mesostigmata) is one of the ubiquitous genera from the Holarctic Region. Until now, only two genera and five species of the family were recorded from Korea. Here we provide a report of the species *Veigaia tibbetsi* Farrier, 1957 with detailed redescription. Even though *V. tibbetsi* had appeared in some ecological literature, this is the first record of this species in Republic of Korea. This species was mostly found from pine forest (*Pinus densiflora*) of northeastern mountainous parts of the Korean Peninsula, in Gangwon and Gyeongbuk Provinces. We provided some ecological characteristics of the family Veigaiidae, which will help to further exploration of acarine biodiversity.

Keywords: acarine diversity, forest, redescription, soil, Veigaiidae

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DOI:10.12651/JSR.2019.8.2.233

INTRODUCTION

The family Veigaiidae comprises widely distributed free-living soil predatory mites in the order Mesostigmata (Acari). Preferred habitats include the upper layers of forest soils and in overlying organic humus and litter. Veigaiid mites are the dominant acarine predators in organic humus and litter habitats, especially those of temperate forests (Hurlbutt, 1965; Karg, 1965; Evans and Till, 1979), and occur throughout boreal to tropical regions of the Northern Hemisphere and some are specialized on rocky shorelines (Błaszak *et al.*, 2013). They prey on microarthropods such as mites, eggs of insects, springtails, and nematodes that share their habitat (Błaszak *et al.*, 2013).

Members of the veigaiid mites are usually pale to dark brown, and 250-1200 µm in length. Taxonomic studies of family Veigaiid species have been done by Evans (1959) and Till (1988) primarily for the British Isles, Athias-Henriot (1961) for the Circum-Mediterranean region, Karg (1993) for central Europe, Bregetova (1961, 1977) for Russia, Ishikawa (1978) for Japan, Tseng (1994) for Taiwan, Hurlbutt (1983) for east Africa, and Farrier (1957) and Hurlbutt (1965, 1984) for eastern regions of North

America.

Worldwide, there are four genera and 59 species of veigaiid mites: *Cyrthydroaelaps* (1), *Gamasolaelaps* (19), *Gorirossia* (1), *Veigaia* (38). However, in Korea, faunal information of Veigaiidae has been poorly studied. So far in Korea, five species in two genera (*Gamasolaelaps* Berlese, 1904 and *Veigaia* Oudemans, 1905) were record (NIBR, 2013; Table 1). There are scattered reports of *V. tibbetsi* from community ecology research papers; Kaczmarek (2000) and Jung *et al.* (2010), however no taxonomical details were confirmed. Thus, we provide a description and illustrations of this species.

MATERIALS AND METHODS

Specimens of veigaiid mites were collected in different forest regions in Korea over a period of nine years (2008-2017). Mite specimens were extracted using Berlese-Tullgren funnels (30W, 72h) from soil samples and preserved in 70% ethyl alcohol. Mites were cleared in Lactophenol solution and mounted in PVA mounting medium for identification (Downs, 1943). The examina-

Table 1. List of recorded veigaiid mites in Korea.

Species	Korean name	References
<i>Gamasolaelaps ctenisetiger</i> Ishikawa, 1978	등파인잘록응애	Jung <i>et al.</i> , 2010
<i>Veigaia arvensis</i> Ishikawa, 1969	비늘잘록응애	Lee, 2009
<i>Veigaia ashizuriensis</i> Ishikawa, 1969	긴다리잘록응애	Kaczmarek, 2000
<i>Veigaia uenoi</i> Ishikawa, 1972	큰잘록응애	Choi, 1994; Lee, 2009, Jung <i>et al.</i> , 2010; Keum <i>et al.</i> , 2010, Keum <i>et al.</i> , 2011; Keum and Jung, 2012
<i>Veigaia wonsanensis</i> Seo & Che	베이가이원산좁응애	KSSZ, 1997

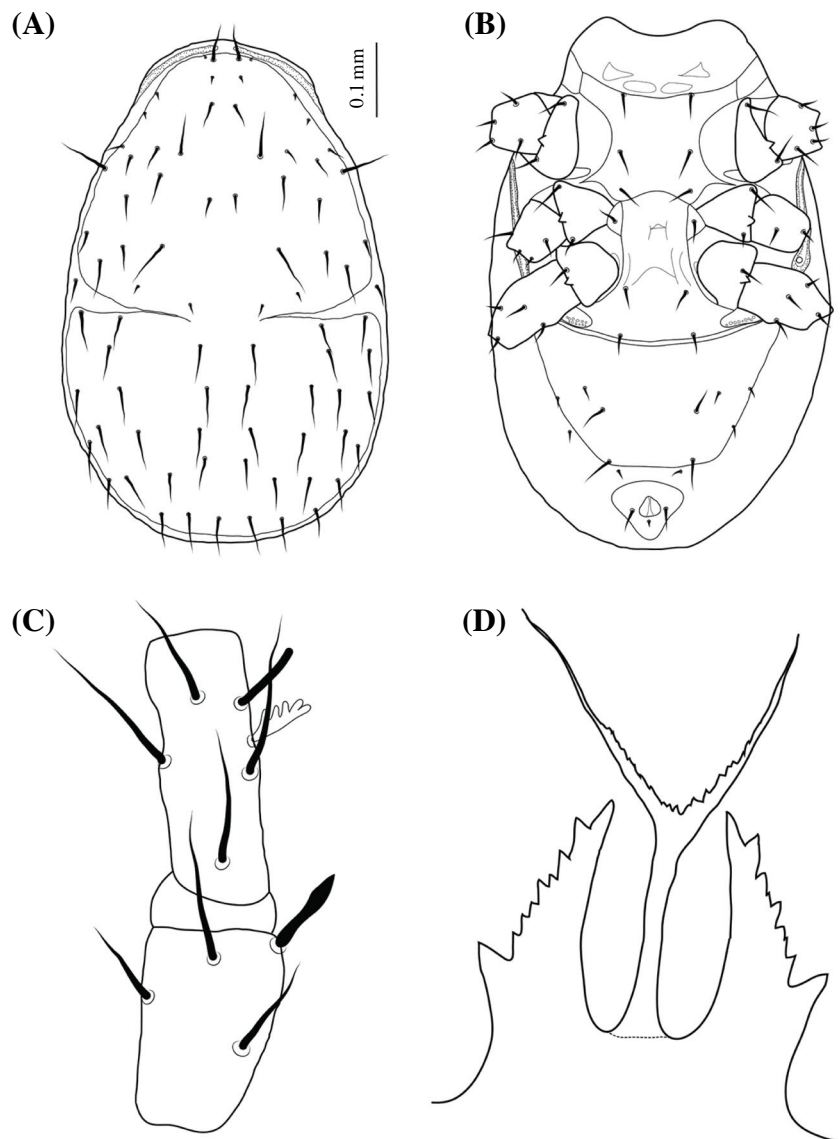


Fig. 1. Original description of *Veigaia tibetsi* Farrier, 1957, Female. (A) dorsal idiosoma; (B) ventral idiosoma; (C) palp; (D) tectum (from Farrier, 1957).

tion of the specimens was performed with an Olympus BX51 phase contrast microscope. Measurements of structures are expressed in micrometers. The length was

measured from the anterior to posterior margins along the midline, and the width at its broadest point. Specimens were deposited in the Insect Ecology Lab, Depart-

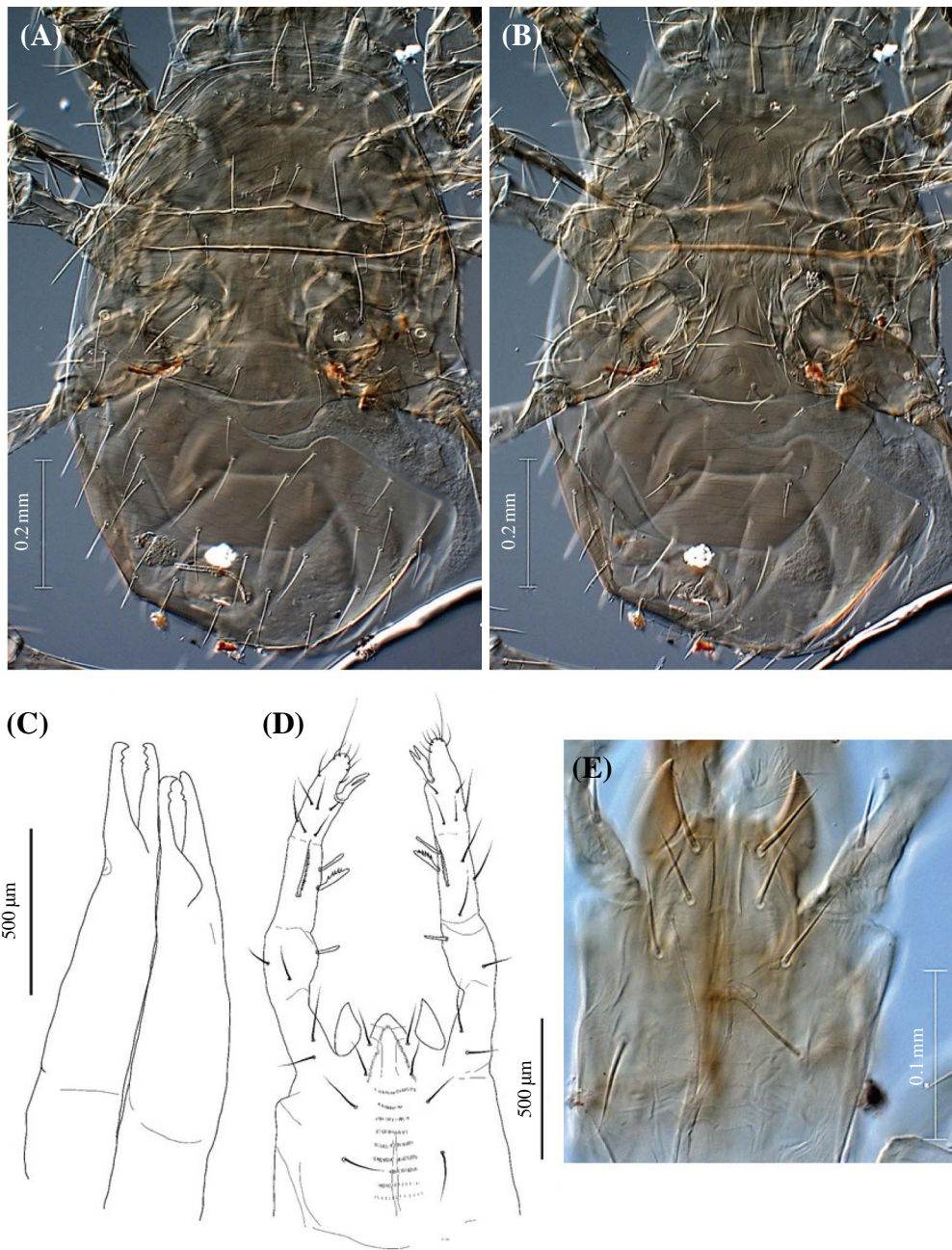


Fig. 2. Specimen recorded in this paper as *Veigaia tibetsi* Farrier, 1957, Female (A, B, E) and Deutonymph (C, D). (A) dorsal idiosoma; (B) ventral idiosoma; (C) chelicera; (D, E) gnathosoma and palp (drawing and photo).

ment of Plant Medicine, Andong National University (ANU), Andong, Korea, and also in NIBR with deposit number, VQUMIV000009719.

RESULTS AND DISCUSSION

Family Veigaiidae Oudemans, 1939

Diagnosis. Dorsal shield entire, with lateral incisions

transversely. The dorsal shield is divided into two sub-dorsal shields in some of the species. The metaseternal shields are rectangular, elongated, and are closer to the posterior margin of sternal shield. The genital shield is usually separated to a ventral shield by an incomplete suture. Palptarsal claw of palp with three tines and with a transparent membranous lobe arising at the potelic base. Dorsal shield entire, with lateral incisions transversely (Farrier, 1957).

Genus *Veigaia* Berlese

***Veigaia tibetsi* Farrier, 1957**

입뿔개잘록응애 (신칭) (Figs. 1, 2)

Specimens examined. four females, Samcheok, Gangwon Province, 37°19'N, 128°12'E, 6 May 2012, C. Jung and E. Keum coll., from soil and humus (*Pinus densiflora*); 29 females and 10 deutonymph, Daegwallyeong Natural Recreation Forest, Gangneung, Gangwon Province, South Korea 37°42'N, 128°47'E, 07 Jun 2012, C. Jung and E. Keum coll., from soil and humus (*Pinus densiflora* for. Erecta.); 36 females, Cheongtae Natural Recreation Forest, Hoengseong, Gangwon Province, South Korea 37°31'N, 128°17'E, 12 Jun 2013, C. Jung and E. Keum coll., from soil and humus (*P. densiflora* and *P. koraiensis*); 12 females, Chilbosan Natural Recreation Forest, Yongdeok, Gyeongbuk Province, South Korea 36°37'N, 129°21'E, 7 Sep 2013, C. Jung and E. Keum coll., from soil (*P. densiflora*); 18 females and 12 deutonymphs, Cheongoksan Natural Recreation Forest, Bonghwa, Gyeongbuk Province, South Korea 37°02' N, 128°59' E, 08 July 2014, 6 Oct 2014, C. Jung and E. Keum coll., from soil (*P. densiflora* and *P. koraiensis*).

Diagnosis. Female. Dorsal shield length 920.7 µm, width 613.8 µm; arterial shield 544.5 µm, posterior shield 376.2 µm. Dorsal shield joined medially, incisions wider laterally from the center, point curved slightly posteriorly. Dorsal setae not pilose; anterior part with cervical, humerals and third, fourth and sixth medial pairs enlarged two or more times the other dorsal setae in diameter but not in length; posterior shield with setae longer than those on anterior shield. Tectum Y-shaped and median projection, anterior margin indistinctly serrate in the middle; lateral projections with medial margins converging slightly apically and terminating at fork of medial projection; with two larger teeth, anterior margin irregularly serrate apically; lateral margin short and emarginated. Palps with anteromedial setae on genu slightly spatulated apically; on apical two-thirds of shaft posteromedial seta with 6-8 toothed comb. Corniculi small projecting half the length of their medial surface. Presternal shield two pairs; anterior and posterior margins of sternal shield emarginated. Triangular metasternal shield, anteriorly rounded; triangular mark on genital area; on medial margin of punctiform organ lateral epigynial setae located; punctiform organ having 16-19 pits located in two rows on posterior margin; epigynium joined to ventral shield by punctiform organ. Trapezoidal ventral plate not joined to peritremal shield; with five pairs of setae, most posterior and medial two pairs twice longer than others on plate. Anal plate having three perianal setae. Legs without noticeable specific characters (Farrier, 1957).

Remarks. This species can be distinguished from congener species by following characteristics; Dorsal shields joined medially and with first, second, third and sixth anterior medial seta significantly longer, disjoined peritremal and ventral shields, and Y-shaped tectum. From this character, we named “입뿔개잘록응애”. Farrier (1957) originally described and reported as a new species with the specimens collected from Korean National Forest collected by Ted Tibbets. Holotype of one female in leaf mold, Korea, 2 October, 1953 collected by Ted Tibbets was deposited in USNM. No further information could be found after Farrier (1957), but as Kaczmarek (2000) and Jung *et al.* (2010) reported, this species is abundant in pine forest area in Korea.

ACKNOWLEDGEMENTS

This study was partly supported from the program “The Survey of Korean Indigenous Species” from the National Institute of Biological Resources (NIBR) of the Ministry of Environment (MOE) in Korea (NIBR201801202) and by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2018R1A6A1A03024862).

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Submitted: September 28, 2018

Revised: November 2, 2018

Accepted: November 7, 2018