Three New Species of the Genus *Nelima* from Japan
(Arachnida, Opiliones, Leiobunidae)

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**ABSTRACT**

In this paper are presented descriptions of three new species of *Nelima parva*, *N. similis* and *N. aokii* from Japan. All of these species are well characterized by the male genitalia.

Members of the genus *Nelima* are very common leiobunian harvestmen found throughout the northern temperate zone of the Old World and partly in Mexico, but they are rather difficult group because of poor development of the external morphology. In the classification of such a group emphasis must be placed on the genital morphology. Three new Japanese species, *Nelima parva*, *N. similis* and *N. aokii* described here are highly differentiated in the male genitalic structure. The first two species, *N. parva* and *N. similis* are clearly allopatric: the former is distributed in west Japan, while the latter is in the central and east Japan, and these both species seem to represent a closely related monophyletic species-pair. The third species, *N. aokii* is surely akin to *N. satoi* already known, and these two likewise appear to represent a closely related species-pair. They show the same distribution pattern (allopatry) as in the foregoing species-pair. Namely, *N. aokii* is confined to the central and eastern parts of Japan, while *N. satoi* has a wide distribution in west Japan.

All holotypes and paratypes are deposited in the Zoological Laboratory of Hiroshima University.

Suborder Eupnoi
Family Leiobunidae
Subfamily Leiobuninae
*Nelima parva* n. sp.
(Figs. 1, 2A–B)

**Diagnosis:** Distinguishable by the very small body, the presence of scutum intermedium in the female, and the structure of wings of penis shaft.

**Male.**
Very small animal; dorsal integument smooth, moderately hardened; transverse ridge posterior to eye tubercle and the last thoracic segment well delimited; first five tergites of abdomen fused to form a dorsal scutum; abdomen short, widely...
rounded and free tergites usually turned beneath. Sides of carapace lightly curved opposite insertions of coxae; eye tubercle separated by its diameter from the front margin of carapace, rounded, canalicate above, the carinae unarmed except for but few fine hairs; from laterally wider than high, from above nearly as long as wide. Supra-cheliceral lamellae very small, unarmed, smooth.

Venter. Coxae and genital operculum unarmed, smooth, with only scattered short brown hairs; sternites smooth, with short hairs usually disposed in transverse series.

Chelicera. As in Fig. 1F, normal, with sparse short hairs only.


Palpus. As in Fig. 1D–E; femur, from above widened distally, from laterally nearly straight; patella strongly curved below, thickened distally but no disto-
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Legs. Very slender, long; trochanters smooth, with a few fine hairs, rarely but few very small denticles on both lateral surfaces; femora armed with scattered very fine denticles and brown hairs; remainder of leg-segments only hairy.

Coloration. Carapace silvery-white, blotched with brown; anterior and posterior angles dark brown, sides margined with dark brown; two short brown streaks at mid-front area, four dark brown spots forming a diagonal series on each side of eye tubercle; eye tubercle dark brown, lighter in front, black around eye; a broad triangular dark brown to black blotch encloses the eye tubercle at its apex; a dark brown band across the ridge back of the eye tubercle and the last thoracic tergite. Abdomen above uniformly dark brown to black with metallic luster. Chelicera light yellow, fingers black-tipped; femur and patella of palpus dark brown, tibia and tarsus lighter. Venter lighter than dorsum; coxae light yellowish brown, darker distally; genital operculum same as coxae; sternites lighter, usually with a dark brown band, in addition, first three sternites with a large white patch on either side. Trochanters of legs rusty to yellowish brown; femora dark brown to black, bases of femora, except for caput, lighter; rest of leg-segments brown to dark brown.

Penis. Mt. Hikosan ex.: Shaft 1.62 mm long, 0.25 mm wide at base, 0.08 mm wide at the middle of the length; glans 0.21 mm long, 0.06 mm wide; stylus 0.06 mm long. Penis shaft flattened dorso-ventrally, widest at base, decreasing in width distally; alate; wings well developed, elongated, extending along the proximal two thirds of penis shaft; as in Fig. 1G–I.

Female. – The female is larger in size than the male and the abdomen is pointed behind; the median sclerotized patches of the first three segments of abdomen are fused to form a single scutal plate, those of the remaining segments being free, thus showing the type of "scutum intermedium"; the tarsus of the palpus lacking the definite row of ventral tubercles and is slenderer than in the male. General coloration above same as in the male, although abdomen dorsal lighter except for median patches, there is a large silvery-white blotch on both sides of the abdomen above.

Ovipositor. Consisting of three forceps segments and about twenty normal segments, of which first nine to eleven armed with a whirl of eight spines; seminal receptacles located within the second or between the second and third segments; as in Fig. 1J–K.

Measurements (in mm): Range and median are given for Ishizuchi-specimens.
Type-series: Holotype: male, Mt. Hikosan, Fukuoka pref. (on the trunk of beech, at 1,150 m in height), 21–IX–1958 (Yoshio Inoue and Michio Makihara); paratypes: 2♂, Mt. Ishizuchi-yama, Ehime pref., 2–X–1939 (Ikio Sato and S. Suzuki); 1♀, same locality, 23–VIII–1940 (S. Suzuki); 1♂, 4♀, Mt. Kuroiwa-yama (at 1,200 m), Ehime pref., 7–VIII–1956 (Toshiaki Kunita); 7♀, 4♀, Mt. Ishizuchi-yama (from 1,600 m to 1,900 m in altitude), 29–VIII–1956 (T. Kunita); 13♀, 3♂, same locality (from 1,200 m to 1,900 m), 24/25–IX–1956 (T. Kunita); 4♀, 5♂, 21 pull., same locality (from 1,000 m to 1,900 m), 8–VIII–1957 (S. Suzuki); 3♀, 1♂, Mt. Hikosan, Fukuoka pref., 21–IX–1958 (Y. Inoue and M. Makihara); 1♂, 2♀ Mt. Ishizuchi-yama (from 1,200 m to 1,700 m), 3–IX–1959 (S. Suzuki and Masaru Kuramoto); 5♀, 4♂, same locality, 26/28–VIII–1961 (S. Suzuki); 1♀, same locality, 28/30–VIII–1962 (S. Suzuki).

Distribution and habitats: Kyushu and Shikoku. Found in herbs and bamboo-grasses, rarely on the trunks of trees.

Remarks: This species somewhat resembles Nelima satoi Suzuki in the general appearance, but differs in being of much smaller size and in lacking the armaments at the disto-medial portion of the male palpal tibia. Moreover, the structure of the penis is distinct enough to separate the both species. (Compare Fig. 1G–I with Fig. 4J–K.)

Nelima similis n. sp.
(Figs. 2C–D, 3)

Diagnosis: Distinguishable by the very small body, well-developed central figure on the abdomen and fairly elongated wings of the penis shaft.

Male.

Very small animal, lateral margins of cephalothorax lightly curved opposite insertions of coxae; abdomen short, widest between the fourth and fifth tergites, bluntly pointed behind and free tergites usually turned under. Dorsal integument above smooth, relatively soft, with scattered obsolete hairs, hairs disposed more or less in transverse series on the ridge back of eye tubercle and on the segments of abdomen. Eye tubercle rounded, slightly constricted at base, from the side wider than high, canaliculate above, unarmed, with but few short hairs on the frontal surface. Supra-cheliceral lamellae very small, unarmed.
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Leg L

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<td>46.4</td>
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<td>3</td>
<td>37.2-45.6</td>
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...the trunk of (S. Makihara); to Sato and (Mt. Kuroiwa-
...VIII–1956
...to 1,900 m),
...same locality, (S. Suzuki),

...the general

...and bamboo-

...central

...opposite

...fifth tergites,

...dorsal integu-

...ears disposed

...base, from

...short hairs

Fig. 2 A-B. *Nelina parva* n. sp. Dorsal views of body: A, male and B, female. (A × 9, B × 5)

Fig. 2 C-D. *Nelina similis* n. sp. Dorsal views of body: C, male and D, female. (×6)

Fig. 2 E-G. *Nelina askit* n. sp. E, lateral view of body, male, F, dorsal view of male and G, same view of female. (×5)
Venter. Coxae of all legs and genital operculum unarmed, smooth, with sparse short brown hairs, hairs more numerous on the first coxa; sternites smooth, with only very few short hairs.

Chelicera. As in Fig. 3D, unarmed, with sparse short hairs only.

Palpus. Slender; every segment unarmed, only hairy, as in Fig. 3B; patella and tibia without a disto-medial apophysis; tarsus lacking a definite row of small tubercles (Fig. 3C); claw with slender teeth below at base.

Legs. Slender, elongated; trochanters with very short hairs only; femora of all legs with scattered fine hairs.

Coloration. Ground color of dorsum rusty yellow to greyish white blotched with brown on the carapace; two pale short median lines in front of eye tubercle. Eye tubercle dark brown, eyes encircled black, the canal lighter. Central figure dark brown to black well developed and extending anteriorly from ridge back of eye tubercle and posteriorly to the end of the abdomen, limited laterally with rounded silvery-white spots and bordered segmentally with a pale transverse line; the ridge back of eye tubercle and segments of abdomen, within the central figure, with a small silvery-white spot; sides of abdomen slightly darkened. Venter lighter than dorsum, pale rusty yellow; sternites with a silvery-white blotch on each side. Chelicera and palpus pale rusty yellow; femur distally and patella entirely brownish. Legs: Trochanters I–IV rusty yellow, slightly darker distally; femora brown, femora II and IV with a white band at tips; patellae dark brown; tibiae, metatarsi and tarsi yellowish brown, metatarsi and tarsi darker distally.

Penis. Ohminé-yama, Gunma pref. ex.: Shaft 1.30 mm long, 0.14 mm wide at base; glans 0.19 mm long; stylus 0.02 mm long. Penis shaft flattened dorso-ventrally, widest at base, gradually reducing in width toward tip; alate, wings extremely long, extending from base to the top of the penis shaft; as in Fig. 4E–G.

Female. Similar to male but larger in size; the abdomen longer and more pointed behind; central figure usually better developed. In some specimens the carapace with white spots forming a diagonal row on either side and the central figure involving the eye tubercle.

Ovipositor. Three forceps segments and about seventeen normal rings, of which first eight with a whirl of eight spines; seminal receptacles within the third segment; as in Fig. 3H.

Measurements: Futago-jaya, Hakone exs.: (♀, ♂ in parentheses): Cephalothorax 1.5 (2.0) mm wide, 0.6 (0.8) mm long; abdomen 1.3 (2.5) mm wide, 1.5 (3.1) mm long; total body length 2.1 (3.9) mm.

Femora: I 3.8 (4.1), II 6.8 (7.5), III 3.8 (4.1), IV 5.7 (6.4) mm. Legs: I 18.3 (20.0), II 32.3 (38.4), III 18.6 (20.1), IV 27.6 (29.0) mm.

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1969 (Hiyoshi Akama); 1♀, Atsugi Farm of Tokyo University of Agriculture, Funako, Atsugi city, Kanagawa pref., 15–IX–1970 (K. Sasaki); 1♂, Mt. Banjirodake, Amagi, Izu Pen. (at about 1,100 m), 28–IX–1972 (Masahisa Ohriui); 1♀, Ananohara Cave (at the bottom of lava cave), Ito city, Izu Pen., 2–XI–1972 (M. Ohriui); 1♂, Mt. Ohmuro-yama, same city, 17–XI–1972 (M. Ohriui); 1♀, Kazamatsuri, Odawara city, Kanagawa pref., 16–VII–1973 (Michiya Tashiro); 1♀, near Shojingaike L., Hakone (at about 850 m), 15–VIII–1973 (M. Tashiro); 4♂, 18♀, same collection data as holotype; 1♂, 3♀, Mt. Shimofutago-yama, Hakone (at about 1,010 m), 2–IX–1973 (S. Suzuki); 1♂, 1♀, Amagi-toge, Izu Pen., 12–X–1973 (M. Ohriui).

Distribution and habitats: Kanagawa, Shizuoka, Gunma prefectures. Found in herbs, particularly abundant in bamboo grasses.

Remarks: The present species is most close to Nelima parva described just above. Indeed, they exhibit considerable similarities in the size, general morphology and habitat, and seem to represent a closely related monophyletic species-pair. However, both species are readily separated by the characters shown in Table 1.
TABLE 1

Diagnostic characters of the two species of the parva-group

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<tr>
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<th><em>N. parva</em></th>
<th><em>N. similis</em></th>
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<tr>
<td>Type of scutum</td>
<td>♂-scutum parvum</td>
<td>♂-scutum parvum</td>
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<td></td>
<td>♀-scutum intermedium</td>
<td>♀-scutum parvum</td>
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<tr>
<td>Central figure of abdomen (♂)</td>
<td>indistinct, scutum entirely black</td>
<td>well developed</td>
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<tr>
<td>Palpal tarsus (♂)</td>
<td>armed with a definite row of tubercles</td>
<td>unarmed</td>
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<tr>
<td>Wings of penis</td>
<td>extending along proximal two-thirds of penis shaft</td>
<td>extending along entire length of penis shaft</td>
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<td>Geographical distribution</td>
<td>west Japan</td>
<td>central and east Japan</td>
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*Nelima aokii* n. sp.

(Figs. 2E–G, 4)

*Diagnosis:* Distinguishable by the enlarged body, strongly armed palpal segments and the penis bearing rather simple wings.

*Male.*

Dorsum. Enlarged animal, nearly oval in outline, cephalothorax wider than abdomen; lateral margins of cephalothorax indented opposite insertions of legs; dorsal integument hardened, finely granular; sparse small dark brown denticles on the anterior margin and on either side of carapace (Fig. 4F). Abdomen widest at the middle of the length, bluntly pointed behind, in some specimens broadly rounded behind and free tergites turned under; first and second areas of dorsal scutum with a few small dark brown denticles on the central area. Eye tubercle rounded, slightly constricted at base, canaliculate, the carinae nearly smooth except for but few very small denticles. Supra-cheliceral lamellae bluntly pointed medially, armed with small denticles.

Venter. Surface of 1–4 coxae and genital operculum armed with numerous evenly spaced dark brown granules (Fig. 2E); free sternites likewise with granules, mostly confined to the central area.

Chelicera. Normally structured, unarmed, with sparse short hairs only.

Palpus. Moderately developed, all segments armed with short brown hairs and numerous dark brown sharp-pointed denticles (Fig. 4A–B). Trochanter armed below with a few distal denticles. Femur, from above wider distally, armed with a few denticles at distal margin; from the side a little curved below, armed ventrally and disto-laterally with a large number of denticles. Patella thickened distally, acutely curved below, no disto-medial process, armed throughout with denticles; tibia slender, three times as long as wide, not produced disto-medially, armed ventrally with numerous denticles, laterally, medially and dorsally with similar but fewer denticles; tarsus elongated, as long as tibia plus patella, from laterally lightly curved below, armed ventrally with two series of numerous small black denticles, denticles disposed closely, extending from base to tip; claw with
Legs. Trochanters armed with small sharp-pointed denticles on both fore and rear margins; legs extremely long, slender; femora armed throughout with very small denticles, Similar denticles also on patellae, tibiae and distal portion of metatarsi, tarsi only hairy.

Coloration. Ground color above dark brown to black with yellowish to greyish white blotches or spots. Anterior portion of carapace whitish yellow with short brown median lines in front of eye tubercle. Eye tubercle dark brown, lighter in front, black around eyes. Transverse ridge back of eye tubercle and last thoracic tergite with irregular whitish blotches on each side; central figure dark brown to black moderately developed, usually limited laterally by distinct white spots, bordered segmentally with white line and the segments, within the central

Magnifications. A-B ×15; C ×18; D-H, J-K ×20; I ×350.
figure, there is a pale transverse band or blotch. Venter lighter than dorsum; 1–4 coxae whitish yellow, widely darker distally; genital operculum and sternites same color as coxae, sternites with a large silvery-white blotch on either side. Chelicera pale whitish yellow; palpus yellowish to brown, femur marked distally with dark brown, patella entirely dark brown, tibia darkened proximally. Legs: Trochanters of all legs dark brown, darker laterally and below, two small yellowish spots distally above; remaining leg segments, femora, patellae, and metatarsi brown to blackish, tarsi yellowish to brown; femora paler proximally except for a caput of black and with a yellowish-white tip; patellae somewhat paler distally; a broad white band at distal ends of tibiae and at proximal ends of tarsi I–IV and metatarsi II, these white bands contrasting to dark brown leg-segments.

Penis. Penis shaft 0.47 mm wide at base, 0.20 mm wide at narrowest portion, 2.73 mm long; glans 0.11 mm wide at widest portion, 0.40 mm long; stylus 0.09 mm long. Of the shape as illustrated in Fig. 4G–H; alate, wings short, rounded, rather simple, located at distalmost portion of the penis shaft.

Female. – The female is larger than the male and the abdomen is longer and more pointed posteriorly. The segments of palpus are armed with fewer denticles than in the male and the tarsus lacking the definite rows of denticles on the ventral surface.

Ovipositor. Three forceps segments and 29 normal segments, of which first 15 with a whirl of eight spines; seminal receptacles within the second segment, as in Fig. 4I.

Measurements: ♀: Body 6.2–6.9 mm long, 4.4–4.6 mm wide at widest portion of cephalothorax.

Femora: I 15.2–17.0, II 27.6–29.9, III 14.4–16.2, IV 18.2–21.1 mm. Legs: I 74.5–79.2, II 149.2–161.2, III 75.3–80.5, IV 97.1–105.3 mm.

♂: Body 9.1–10.2 mm long, 5.8–6.0 mm wide at widest portion of abdomen.

Femora: I 15.2, II 27.0, III 14.7, IV 19.8 mm. Legs: I 67.8, II 140.0, III 70.0, IV 92.7 mm.

Type-series: Holotype: male, Nippara, Tokyo pref. (on the Bentô-iwa rock), 1–VIII–1965 (Jun-ichi Aoki); paratypes: 1♀, Kurasawa-dô Cave, Tokyo pref., 15–VIII–1951 (S.-I. Uéno); 1♂, 2♀, 1 pull., Nippara, Tokyo pref., 15–VIII–1963 (J. Aoki); 4♀, same collection data as holotype; 1♀, near Ōmonzawa-goya Hut, Nakakoma-gun, Yamanashi pref. (about 2,000 m in altitude), 22–VIII–1973 (Naoki Hiasa); 1♂, 1♀, Mt. Tôgasaya-yama, Izu Pen. (about 1,100 m in altitude), 31–VIII–1973 (S. Suzuki); 1♂, 1♀, Nakagawa hot spring, Yunosawa, Yamakita-chô Kanagawa prefect., 10–X–1973 (Katsunobu Sato).

Variation: The male from Tôgasaya-yama, Izu Pen. has the palpus with fewer denticles than that from the type-locality (Fig. 4C).

Distribution: So far collected from Tokyo, Kanagawa, Yamanashi, Shizuoka prefectures.

Remarks: This species is most closely related to N. satoi Suzuki, 1944 known from west Japan but is clearly distinguished from it by the larger size and by having strongly armed palpal segments. Also, the structure of the penis, particularly...
that of the wings is quite unique. (Compare Fig. 4G–H with J–K). The species is named after Dr. J. Aoki.

ACKNOWLEDGMENTS

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LITERATURE