NOTES ON THE DISTRIBUTION OF LEPTOCARABUS (PENTACARABUS) HARMANDI (LAPOUGE) WITH REDESCRIPTION OF SUBSP. AKAISHIENSIS ISHIKAWA (COLEOPTERA, CARABIDAE)

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NOTES ON THE DISTRIBUTION OF *LEPTOCARABUS (PENTACARABUS) HARMANDI* (LAPOUGE) WITH REDESCRIPTION OF SUBSP. *AKAISHIENSIS* ISHIKAWA (COLEOPTERA, CARABIDAE)

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Abstract

Distribution of and relationship between two subspecies of ***Leptocarabus (Pentacarabus) harmandi*** (Lapouge), namely *quinquecatellatus* and mizunumai in the Hida Mountain Range are reported and discussed. ***L. (P.) h. akaishiensis*** is recharacterized on the basis of a longer series of specimens.

In my previous paper on ***Leptocarabus (Pentacarabus)*** *harmandi* (Lapouge) (Ishikawa, 1986), I revised and recognized ten subspecies in this species, and discussed their distribution. This species is distributed in mountain regions of central and northern Honshu where it inhabits forests of *Betula* and *Quercus mongolica* up to the subalpine region. The subspecies are allopatric in distribution, and most of them are distributed over separated mountains or mountain ranges sporadically within their ranges with one exception of the two subspecies, namely ***mizunumai*** Ishikawa and ***quinquecatellatus*** Ishikawa in the Hida Mountain Range situated on the borders between Nagano, Gifu, Toyama and Niigata prefectures. I reported their parapatric distribution in the eastern side of the mountain range, where they were hybridized on their borders, but nothing was known elsewhere on their distribution in this mountain range. In this paper are shown their ranges of these two subspecies in the areas in question, based on the data as a result of my survey up to 1987, and their meaning is discussed. In addition, subspecies ***akaishiensis*** Ishikawa, which was described on a few specimens in 1986 is revised on a longer series of specimens.

1. Ranges of ***L. (P.) h. quinquecatellatus*** Ishikawa and ***L. (P.) h. mizunumai*** Ishikawa in the Hida Mountain Range. (Fig. 1)

The northern half of the Hida Mountain Range is divided by a deep valley of the river Kurobegawa into eastern Ushirotateyama and western Tateyama ranges. I reported (loc. cit.) that these two subspecies, which differ from each other most noticeably among all the subspecies, are distributed parapatrically in the eastern side of the Ushirotateyama Range, but their distribution in the western part of this area remained unknown.

These two subspecies are distinguished from each other by the characters as follows :

Subsp. *quinquecatellatus* Ishikawa : Elytral sculpture quadruploid ; intervals between primaries regularly elevated, with secondary, tertiary and quarternary intervals almost evenly strongly elevated (Figs. 2a and b). Aedeagus robuster, with right lateral margin distinctly convex and basal

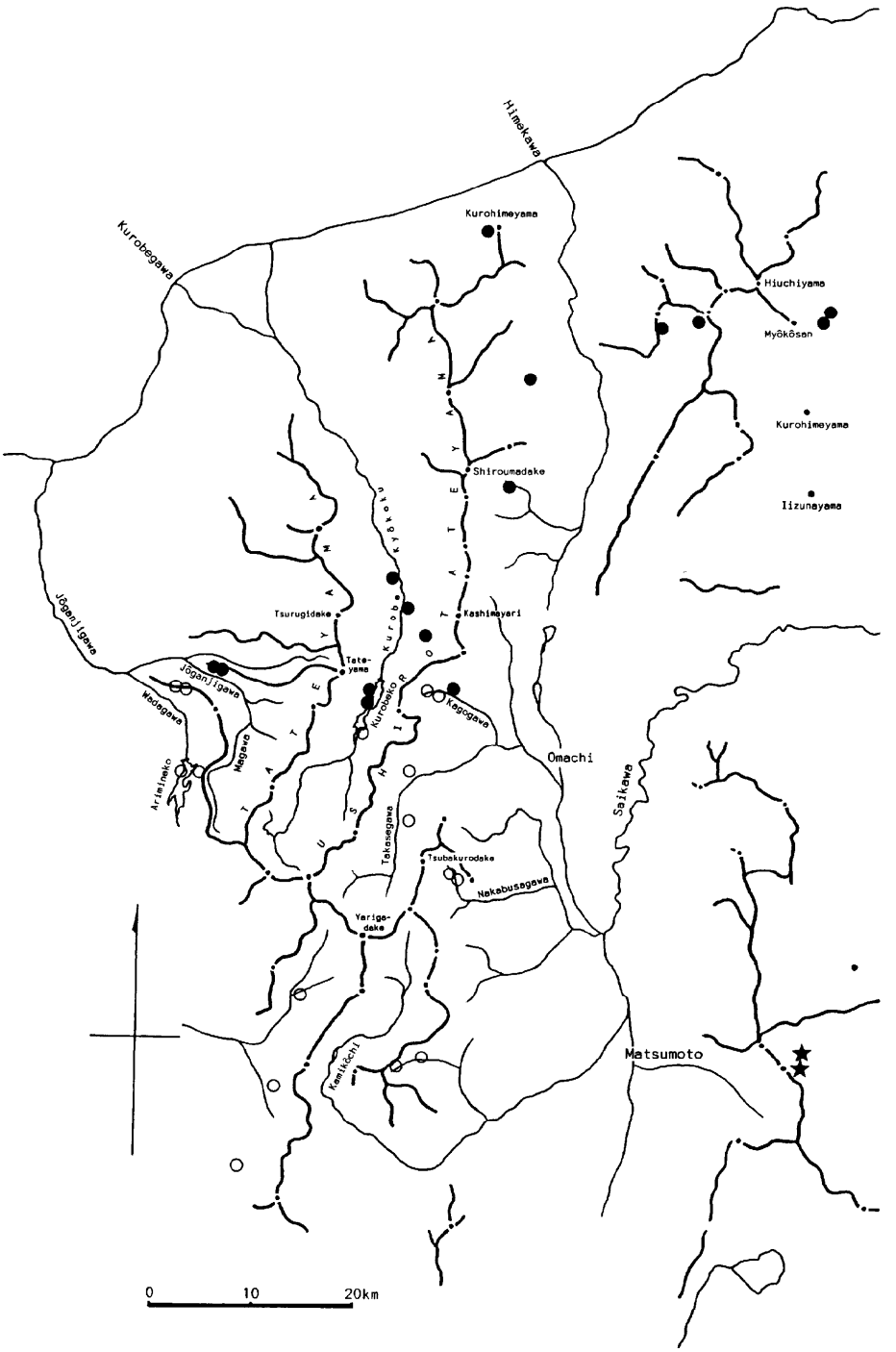


Fig. 1. Map showing the ranges of subsp. *quinquecatellatus*. and *mizunumai* of *Leptocarabus* (*Pentacarabus*) *harmandi* (Lapouge) in the Hida Mountain Range. Closed circles : *quinquecatellatus* Ishikawa ; open circles : *mizunumai* (Ishikawa) ; stars : *karasawai* (Ishikawa).

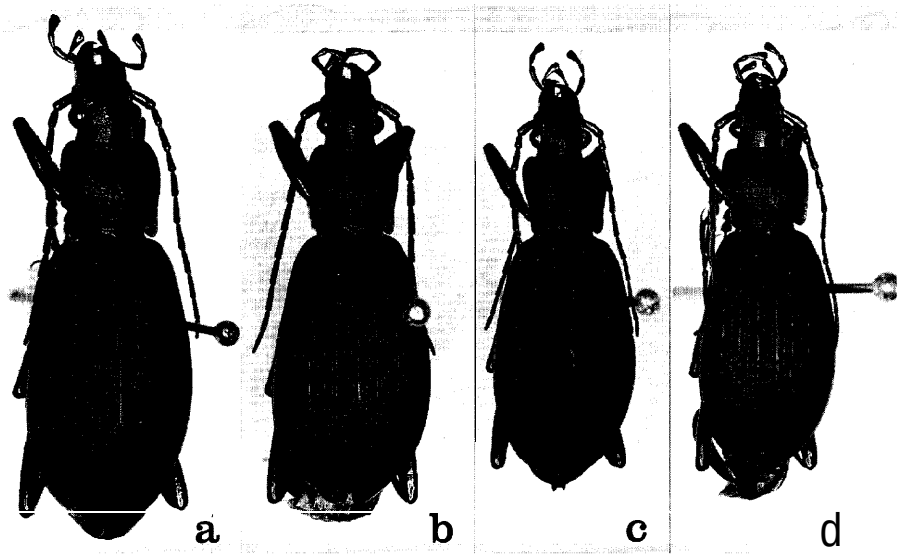


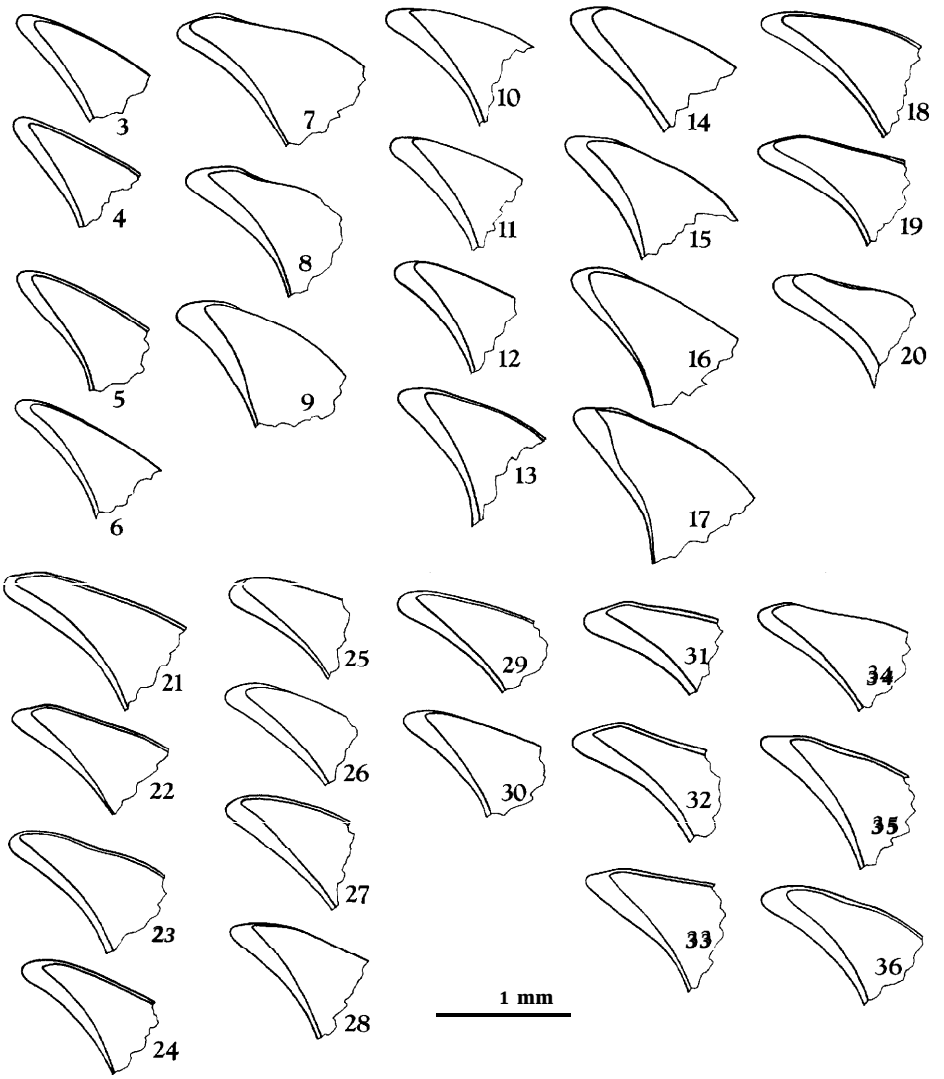
Fig. 2. **a** and **b,** *L. (P) harmandi* ***quinquecatelhtus*** (Ishikawa) from Tsubame, 1000 m., Mt. Myô-kôsan, Niigata Pref. ; **c** and d, *L. (P) harmandi* ***mizunumui*** (Ishikawa) from Higashizawa, 1250-1280 m., Takasedani, Nagano Pref. Females (left) and males (right).

ventral tubercle strongly angulated ; apical part broader, but narrowed abruptly to tip so that the left (outer) margin distinctly convex (Figs. 7-9).

Subsp. ***mizunumai*** Ishikawa : Elytral sculpture triploid ; intervals between primaries not regularly elevated, with quarternary intervals if any much weaker than secondary and tertiary intervals, usually inconspicuous (Figs. 2c and d). Aedeagus slender, with right lateral margin feebly convex and basal ventral tubercle not or weakly convex ; apical part slender, facing outwards, apex beyond the membraneous area very short (Figs. 3-6).

A. Distribution in the eastern side of the Ushirotateyama Range.

In the eastern side, the ranges of the northern subspecies *quinquecatellatus* and the southern ***mizunumui*** are defined by the valley of the river Kagogawa, in the west of the city of Omachi, in Nagano Prefecture. A series of specimens (11 females and 12 males) collected at its left (northern) bank, 1280 m. alt. include besides seemingly typical *quinquecatellatus* (Figs. 14-17, 37a), individuals which are not exactly this subspecies in elytral sculpture (Figs. 37b, c and d) as well as in aedeagal features (Figs. 10-13). Specimens (4 females and 3 males) from the opposite (right) bank ca 1380 m. alt. near Ohgizawa are mostly nearer but not exactly *mizunumai*, though the intervals between the primaries are not equally developed, nor without distinct quartemaries as are in *quinquecatellatus* (Figs. 37e, f and g), with aedeagal features intermediate between them (Figs. 18-20). Two females from Nanakura, 1100-1250 m. alt. in the left bank of the valley of the river Takasegawa are typical ***mizunumui*** in elytral sculpture, though I was unable to examine a male specimen. Specimens (14 females and 18 males) from Higashizawa, ca 1250 m. alt. at the right bank of the same river are typical ***mizunumai*** (Figs. 2c, 2d, 5 and 6), identical with those from the high valley of the Nakabusagawa (Figs. 3 and 4). These facts show that the two subspecies are hybridizing by the Kagogawa, and this river seems to work as a barrier but not completely to prevent their dispersal.



Figs. 3-36. Apices of aedeagus of *Leptocarabus* (*Pentacarabus*) ***hawnandi*** (Lapouge) ; 3-6, typical ***mizunumai*** (3 and 4, Nakabusagawa, 1325—1420 m. ; 5 & 6, Higashizawa, 1250—1280 m.) ; 7-9, typical *quinquecatellatus*, Tsubame, 1000 m., Mt. Myôkôsan, Niigata Pref. ; 10-17, *quinquecatellatus*, hybridized with ***mizunumai,*** from the left bank of the river Kagogawa, 1280 m. ; 18-20, ***mizunumai,*** hybridized with ***quinquecatelkztus,*** from the right bank of the river Kagogawa, 1380m.; 21-24, ***mizunumui*** from Lake Arimineko, 1100 m. ; 25-28, ***mizunumui,*** not typical, from Mt. Setokurayama, 1200-1310 m. ; 29-30, ***mizunumai,*** not typical, from Harinokidani, 1450 m. by Lake Kurobeko ; 31-32 and 34-36, *quinquecatellatus* from the Kurobe Kyôkoku (31 and 32, Oyamadani, 1470 m., by Lake Kurobeko ; 34, Azohara, 850-960 m. ; 35, Sakurôdani, 1350 m. ; 36, Bôgoyazawa, 1350 m.) ; 33, *quinquecatellatus* from Bunazaka, 1000-1180 m.

B. Distribution in the western side of the Tateyama Range.

The parapatric distribution of these two subspecies became clear also in the western side of the Tateyama Range in Toyama Prefecture, where their ranges are defined by a deep valley of the river Jôganjigawa. The specimens (4 females and 1 male) collected at Bunazaka, 1000-1180 m. alt. on the western slope extended from Mt. Tateyama, north of the valley of the Jôganjigawa, are *quinquecatellatus* in elytral sculpture (Fig. 38 a and b) as well as in the aedeagal features (Fig. 33) ; whereas specimens (19 females and 16 males) from Mt. Setokurayama, 1190-1310 m. alt., just south and the opposite side of the same valley are ***mizunumai*** in elytral sculpture (Figs. 38c and d) and in general features of aedeagus, though the basal ventral tubercle is strongly convex and the apices are slightly variable (Figs. 25-28) as in those from Arimineko (Figs. 21-24 and 38e).

C. Distribution in the Kurobe Kyôkoku (the valley of the river Kurobegawa).

I have examined specimens of this species collected at approximately five localities (two of all the six localities are contiguous) in this valley, in Toyama Prefecture. The specimens (6 females and 3 males) from the uppermost locality, Harinokidani, 1450 m. alt. one of the major valleys in the right (eastern) side of the river Kurobegawa (exactly by the lake Kurobeko), are ***mizunumai*** in elytral sculpture (Figs. 38g and h), though apices of the aedeagus (Figs. 29 and 30) are not typical of that subspecies. The specimens from four other localities are all ***quinquecatellatus*** in elytral sculpture (Fig. 38f) and in aedeagal features (Figs. 31-32, 34-36).

Because the Kurobe Kyôkoku is outlined by alpine ridges of the Tateyama and Ushirotateyama ranges which are averagingly over 2500 m. in altitude, much above the upper limit of approximate ranges of this species, the populations of *quinquecatellatus* in this valley are presumed to be immigrants from the downstream. But, the population of ***mizunumai*** at Harinokidani is not likely an immigrant from the same way. I presume the possibility that this subspecies immigrated there from the eastern slope beyond the ridge at the back of the valley of Harinokidani, since this part is the lowest area of the Ushirotateyama Range and there are saddles less than 2300 m. in altitude.

D. Discussion.

The two subspecies, *quinquecatellatus* and ***mizunumai,*** distributed parapatrically in the Hida Mountain Range, are most contrastable forms morphologically among all the ten subspecies of ***L. harmandi***. They differ noticeably in elytral characteres : in ***quinquecatellatus,*** quadriploid is developed to the level of homodynamic condition, while in ***mizunumai,*** triploid heterodynamic condition is reserved. In genitalic characters, the difference is not so great as in the elytral characters, but *mizunumai* has seemingly least specialized aedeagus, if its slender shape and very short apex is not owing to degeneration from more varied form in that of ***quinquecatelkztus,*** not to say those of the subspecies of the ***fujisan*** subspecies group. Such morphological differences between them, and mosaic combination of characteristic features in the individuals which are regarded as hybrids collected from the borders suggest that there are considerable genetical differences between these subspecies.

This species is distributed in the mountain regions of central and northern Honshu, inhabiting altitudes where *Fagus* and *Quercus mongolica* grows up to the subalpine region. The range of a subspecies may be restricted in an isolated mountain or a group of mountains, as in subsp. ***fujisan*** of Mt. Fujisan and subsp. ***tanzawaensis*** of Mts. Tanzawasan, but most other subspecies are distributed sporadically at isolated habitats within the ranges that cover mountains and/or mountain ranges. This pattern of distribution manifests that the subspeciation had occurred before they established the present ranges, and if it was during the Last Glacial time, there is no evidence that they could have extended their ranges since that time.

The parapatric distribution of ***quinquecatellatus*** and ***mizunumai*** in the Hida Mountain Range

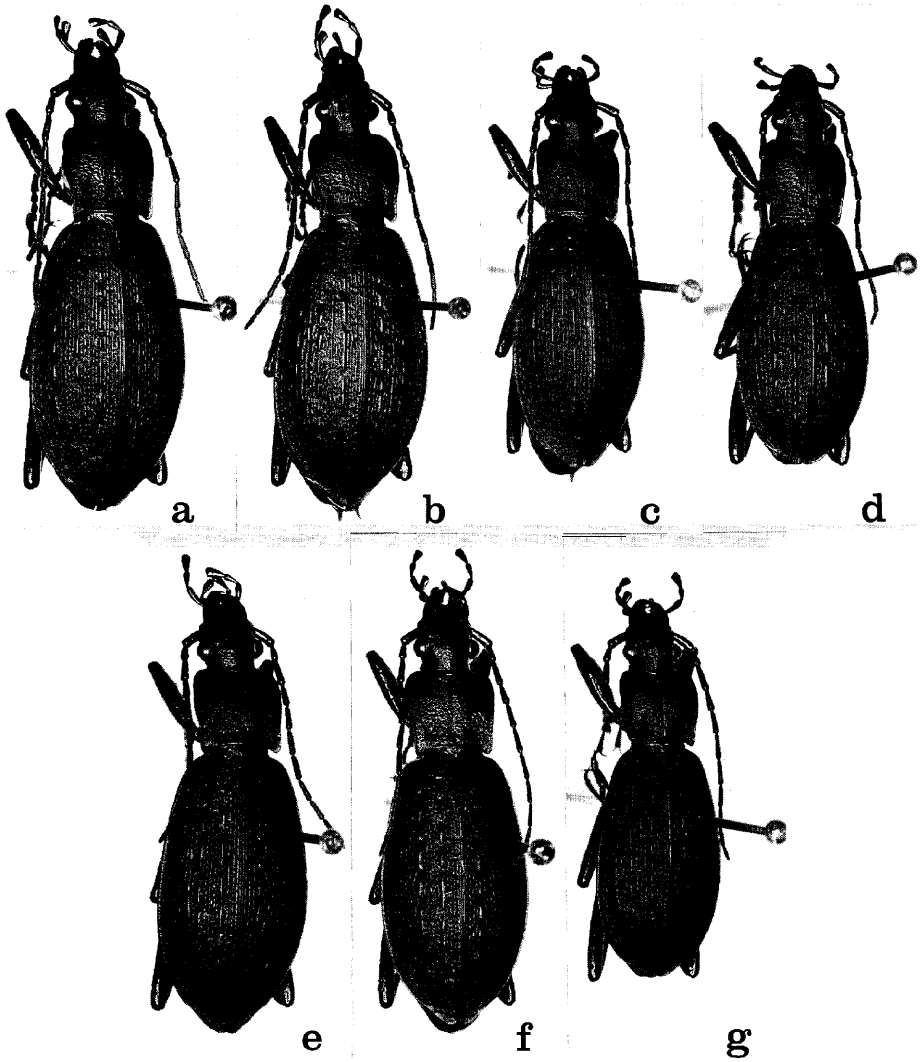


Fig.* 37. *a-d, L. (P.) *harmandi quinquecatellatus* hybridized with *mizunumai*, from the left bank of the river Kagogawa, 1280 m. ; ***e-g,*** *L.(P.) harmandi* ***mizunumai*** hybridized with *quinquecatellatus*, from the right bank of the river Kagogawa, 1380 m. **(a-c, e** and **f** : females ; **d** ***and g*** : males).

seems to have been established recently by the expansion of the range of either of these subspecies, because, they are producing hybrids but only in and near the valleys that define their ranges, although they do not appear to be so complete barriers over a long period of time on both eastern and western sides of that mountain range.

Subsp. ***quinquecatelhtus*** is apparently more related to subsp. ***adatarasanus*** Ishikawa and ***harmandi s.*** str. than to any other subspecies, but some populations of ***adatarasanus*** from the western localities in its range include individuals which are so closely similar to *quinquecatellatus*. This fact suggests that *quinquecatellatus* might have evolved from isolated populations in the Myôkô Mountains, situated at the east of the Hida Mountain Range, of ***adatarasanus*** derived from the northern

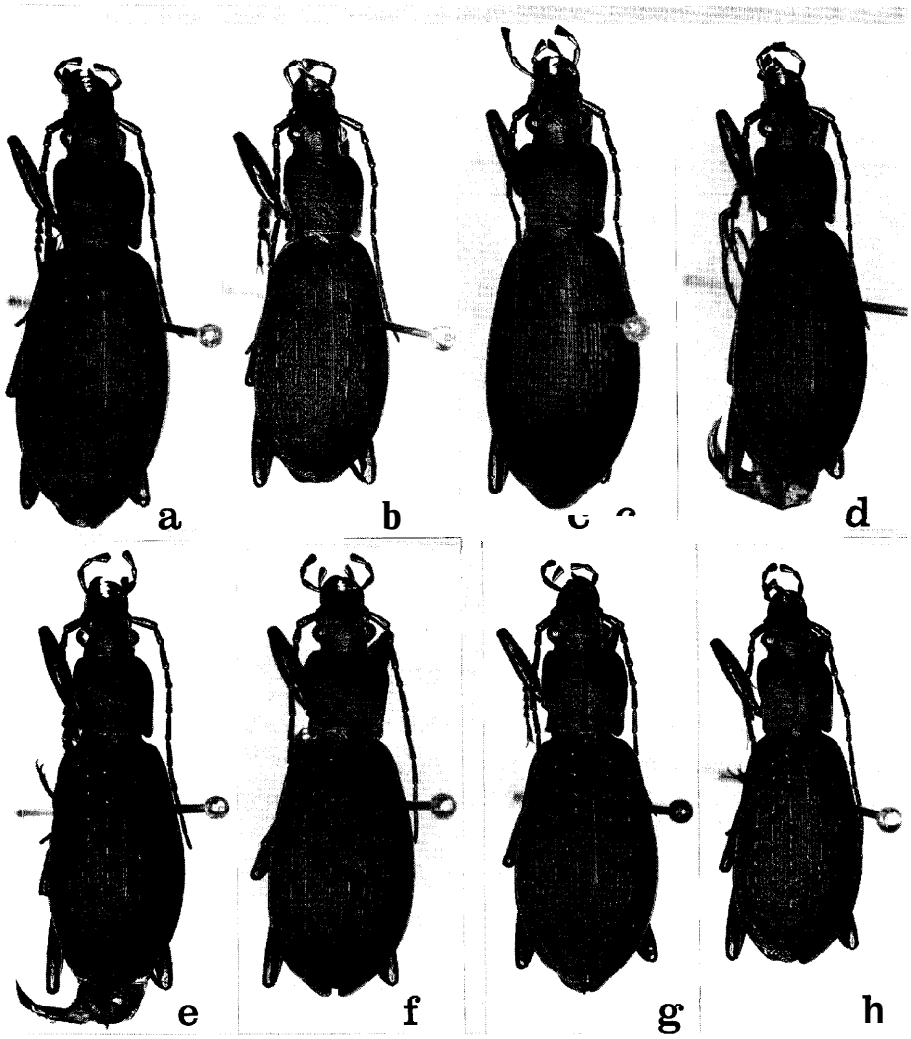


Fig. 38. a and **b,** *L. (P.) harmandi quinquecatellatus* from Bunazaka, 1000-1180 m. ; **c** and **d,** *L. (P.) harmandi mizunumai* with typical elytral sculpture from Mt. Setokurayama, 1200-1310 m. ; e, *L. (P.) harmandi mizunumai* from Lake Arimineko, 1100 m. ; **f,** *L. (P.) harmandi quinquecatellatus* from Sakurôdani, 1350 m., in the Kurobe Kyôkoku ; g and **h,** *L. (P.) harmandi mizunumai* from Harinokidani, 1450 m. (a, c, f and g : females ; **b, d, e** and **h** : males).

ranges. If this assumption is verified, *quinquecatellatus* in the Hida Mountain Range is most possibly recent immigrants from the Myôkô Mountains. Since the final opportunity that a population of *quinquecatellatus* could immigrate to the Hida Mountain Range over the valley of the river Himekawa which separates these mountains could not be later than the Last Glacier time, subspeciation in *L. harmandi* must have been completed before that time, because the lower limit in altitude of the range of this species at that region is approximately 1000 m. above sea level at present.

2. ***L. (P.) harmandi akuishiensis*** Ishikawa

This subspecies was described on three specimens (1 female and 2 males) from Nikengoya and Hirogawara in the Akaishi Mountain Range (loc. cit., p. 235). The following notes are based on additional series of specimens.

Length of body : Female 19-21 mm. ; Male 17-20 mm.

Similar to subsp. *fujisan* (Ishikawa), but differs from it as follows : Rugae on frons sparser or coarser at median portion than at sides. Pronotum more plainly narrowed posteriorly, with lateral margins less sinuous ; posterolateral corners shorter and not directed posterolaterally ; punctures on disk finer. Elytra with primary foveae shallower; areas between primaries not so uneven with granulated intervals not so irregularly contiguous ; granules of umbilicate series more numerous ; preapical margins shallowly but distinctly concave. Aedeagus with right lateral margin more gently convex, but left lateral margin back of the membraneous area more swollen ; apical part narrower and longer.

Additional specimens examined : 50 females and 70 males, Hirogawara, 1500-1600 m., Ashiyasu-mura, Yamanashi Pref., vi. 1986, vi. 1987, and vi. 1988, K. Nemoto and T. Shimomura leg. ; 1 female and 1 male, Abe-tôge, 1400 m., Shizuoka-shi, Shizuoka Pref. vii. 2-3. 1988, K. Nemoto leg.

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