# Vertical and Horizontal Distributions of Oeneis norna asamana (Nymphalidae: Satyrinae) in the Hida Mountain Chain (the Northern Japan Alps) in Japan

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# VERTICAL AND HORIZONTAL DISTRIBUTIONS OF *OENEIS NORNA ASAMANA* (NYMPHALIDAE: SATYRINAE) IN THE HIDA MOUNTAIN CHAIN (THE NORTHERN JAPAN ALPS) IN JAPAN

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**ABSTRACT.** Vertical and horizontal distributions of *Oeneis norna* have been investigated at the Hida mountain chain (Northern Japan Alps) in Japan. It is shown that the lower limit of the vertical distribution tends to decrease from the south to north. Linearity is seen between the lower and upper limits of the vertical distribution. The range of vertical distribution tends to narrow with lowering the upper altitudinal limit of the habitat. It is inferred from the horizontal distribution pattern of *Oeneis norna* in this area that the tephra (Tt-D) derived from the volcano of Mt. Tateyama and accumulated about $10^5$ years ago, had an influence on the present distribution of this species in the Hida mountain chain.

**Additional key words:** high-altitude species, volcanic activity, arctic butterfly

The species of the genus *Oeneis* are found in the northern latitudes of the New and Old Worlds. All are dull colored, medium in size and found mainly in arctic or alpine habitats as well as in taiga forest. In Japan two *Oeneis* species, *O. norna* and *O. mellisa* are known to inhabit areas above the timberline. The former species is Eurasian but the latter inhabits both Eurasia and North America. *O. norna* has been reported as a holarctic species (Kawazoe & Wakabayashi 1967; Higgins & Riley 1970; Fukuda *et al.* 1984; Inomata 1990; Inomata & Matsumoto 1995; Shirozu 2006), but recent work indicated that it is confined to Eurasia (Lukhtanov & Eitschberger 2001). In Japan two subspecies of *Oeneis norna* have been described: *O. n. asamana* (Matsumura 1919) and *O. n. sugitanii* (Shirozu 1952). The former subspecies inhabits the Hida mountain chain with the highest peak of 3190 m (also called the Northern Japan Alps), while the latter inhabits Mt. Yatsugatake (the highest peak of 2899 m), both located almost in the middle of the island of Honshu, the main island of Japan (Fig. 1a).

It is important to document the local distribution of a subspecies from the viewpoint of ecology and conservation, and to record its general range. This paper deals with the vertical and horizontal distributions of *Oeneis norna asamana* in the Hida mountain chain. It is shown that the lower limit of the vertical distribution tends to be lowered from the south to the north. Distinct linearity is seen between the lower and upper limits of the vertical distribution. The range of vertical distribution is found to be narrowed as the upper limit of the distribution lowers. It is inferred from the horizontal distribution pattern that the tephra named Tt-D derived from the volcano of Mt. Tateyama about $10^5$ years ago had an influence on the present distribution of *Oeneis norna asamana* in the Hida mountain chain.

## METHODS

The habitats of *Oeneis norna asamana* were determined by identifying flying adults by walking around the mountain trail constructed mostly on the ridge of the mountain chain. Ten surveys were done on 25–26 July 1967, 26–28 July 1970, 3–4 Aug 1971, 27–31 July 1972, 3–6 Aug 1974, 30 July–1 Aug 1976, 26–29 July 1996, 23–24 July 1997, 20–22 July 2001 and 27 July–1 Aug 2007. Several of the surveys were carried out under the permission of the Ministry of the Environment of Japan, permission code, Kan-Chubu-Kyo 280 (2001).

## RESULTS

**Overall distribution** (Fig 1a, b). Figure 1a reflects the general location of the study area. Figure 1b shows the distribution of *Oeneis norna asamana* in the Hida mountain chain based on investigation by the author from 1966 to 2007. The northern limit of the habitat of *O. n. asamana* is located at near Mt. Yukikura-dake (2611 m; 36° 48" 10"N, 137° 45' 3"E) and the southern limit is located at near the peak called Nishoho-Dokuhyou (2701 m; 36° 16' 12"N, 137° 37' 24"E). The eastern limit of the distribution is located at Mt. Shirouma-Norikuradake (2456 m; 36° 46' 58"N, 137° 48' 12"E) and the western limit is located at Mt. Kitanomatadake (2661 m; 36° 25' 16"N, 137° 30' 43"E). As mentioned in previous papers (Itoh 1975, 1979), area in which *O. n. asamana* is absent occurs between Mt. Nunohiki-dake (2683 m; 36° 36' 38"N, 137° 44' 41"E) and Mt. Ninamisawadake (2630 m; 36° 29' 39"N, 137° 29' 11"E). The distribution record presented in Fig. 1b is different slightly from that reported previously (Fujioka 1975), and is significantly different from that described in reference books (Shirozu 2006; Fukuda *et al.* 1984). In the present survey, the habitat of *O. norna* could not be confirmed in the area from Mt.

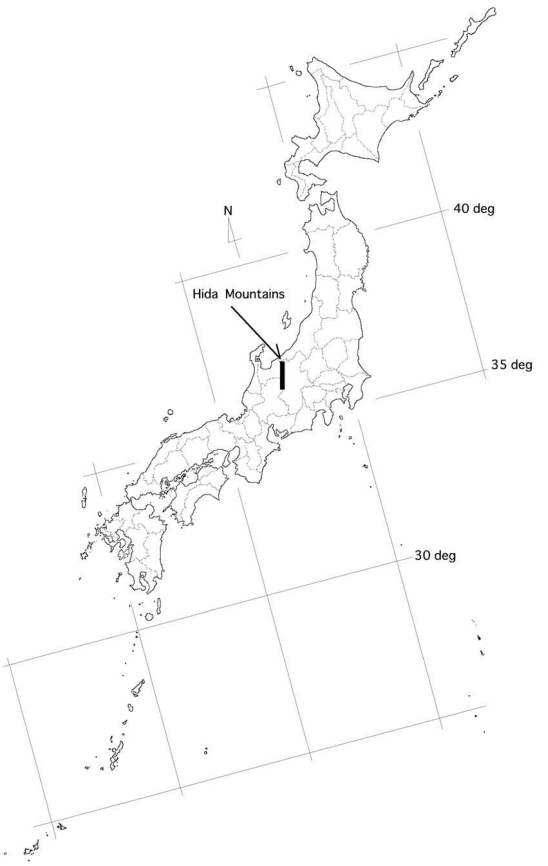


FIG. 1 **a**) Location of the Hida mountain chain (the Northern Japan Alps) on the island of Honshu, Japan, indicated by a vertical bar. The lines of longitude and latitude are indicated by 5 degree intervals.

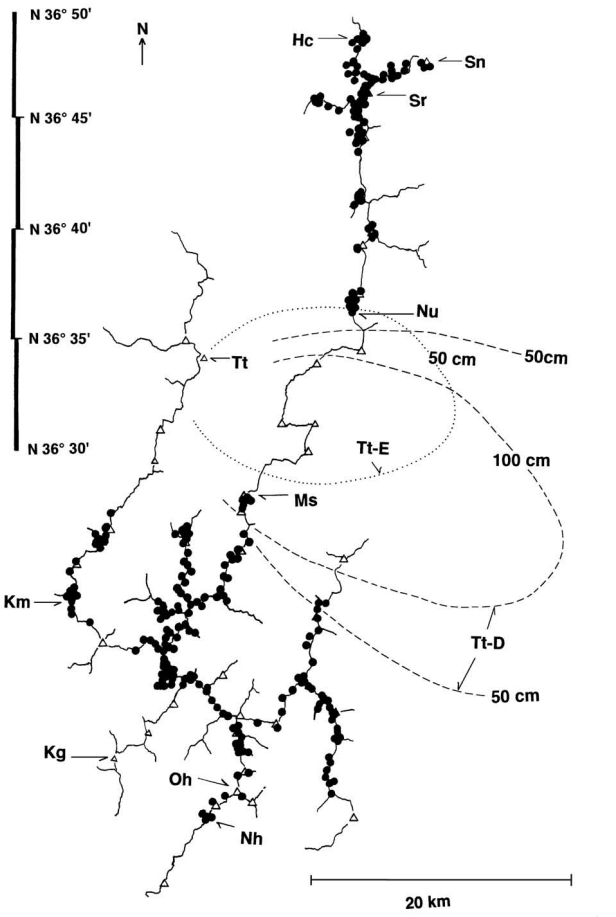


FIG. 1 **b**) Distribution of *Oeneis norna* in the Hida mountain chain along with that of the tephra, Tt-D and Tt-E (50 and 100 cm indicate the depth of tephra). North is up on the map. Abbreviations are: Yk, Mt. Yukikuradake (2611 m); Sn, Mt. Shirouma-Rengedake (2456 m); Sr, Mt. Shiroumadake (2932 m); Nu, Mt. Numohikiyama (2683 m); Tt, Mt. Tateyama (3015 m); Rg, Mt. Rengedake (2799 m); Ms, Mt. Minamisawadake (2625 m); Km, Mt. Kitanomatadake (2662 m); Nk, Mt. Nukedodake (2813 m); Kg, Mt. Kasagatake (2898 m); Oh, Mt. Okuhotakadake (3190 m); Nh, Mt. Nishihotakadake (2909 m).

Kasagadake (2898 m) to Mt. Nukedodake (2813 m), although it was described that *norna* inhabits Mt. Kasagadake (Fukuda *et al.* 1984) and the area from Mt. Kasagadake to Mt. Nukedodake (Shirozu 2006).

**Vertical distribution** (Figs. 2-4). Figure 2 shows the upper and lower altitude limits for each habitat of *Oeneis norna* in the Hida mountain chain. The upper altitude limit of the each habitat corresponds almost to the altitude of the highest peak in the habitat. In most of the habitats, the upper limit is lower by only 5 to 10 m than the altitude of the highest peak in the habitat. Thus, in most places the upper limit depends on the altitude of the highest peak in the habitat. In the habitats near Mt. Okuhotaka-take (3190 m), the lower limit could not be determined, because of the steep slope of the mountain. The lowest altitudes of the habitat are found at 2380 m near the Nagaike pond (36° 40' 20"N, 137° 44' 56"E) near Mt. Hachigatake (2563 m), at 2440 m near Mt. Shirouma-Norikuradake (2456 m; 36° 46' 58"N, 137° 48' 12"E) and at 2360 m near Mt. Yukikuradake (2611 m; 36° 48' 10"N, 137° 45' 3"E). Fig. 2 shows that the lower limit of distribution tends to decrease from the south to the north in the Hida mountain chain. There is distinct linearity between the upper and lower limits of the distribution with a correlation factor of 0.968 (N = 74) (Fig. 3). Figure 4 shows the range of vertical distribution plotted as a function of the upper limit of the distribution for each habitat in the Hida mountain chain. The range of vertical distribution tends to narrow as the upper limit of the distribution lowers.

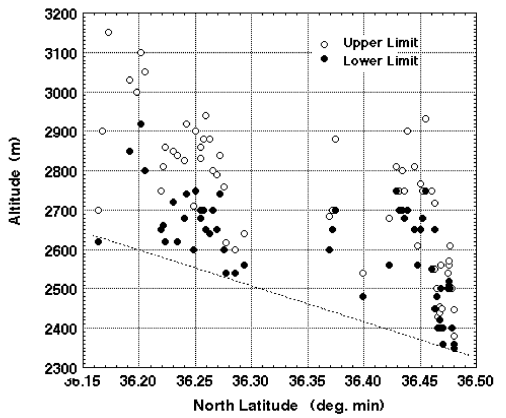


FIG. 2. Lower (closed circles) and upper limits (open circles) ofS of the distribution of *Oeneis norna* plotted against the latitude of the distribution in the Hida mountain chain.

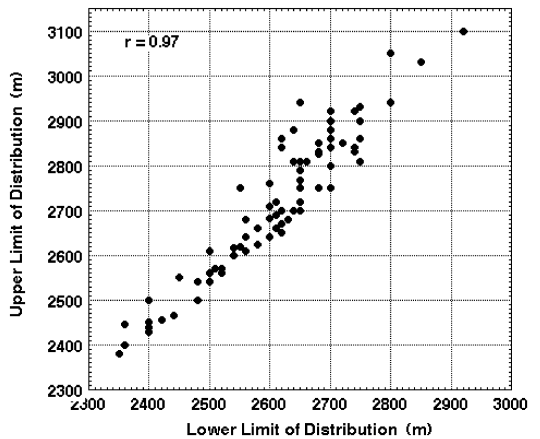


FIG. 3. Relationship between the lower and upper limits of the distribution for each habitat of *Oeneis norna asamana* in the Hida mountain chain.

## DISCUSSION

*Oeneis norna asamana* in the Hida mountain chain is divided into northern and southern groups depending on variation of the wing color (Itoh 1975, 1979). The wing color of the specimens in the northern group is slightly darker than that in the southern group. Further, it was shown that the southern limit of the northern group is located near Mt. Nunohiki-dake (2683 m; 36° 36' 38"N, 137° 44' 41"E) and that the northern limit of the southern group is located at Mt. Ninamisawadake (2630 m; 36° 29' 39"N, 137° 29' 11"E). *Oeneis norna asamana* was not found in the area between Mt. Nunohikiyama and Mt. Ninamisawadake, although there are several peaks over 2600 m between these two mountains with suitable habitat. It is inferred from the distribution pattern in Fig. 1b that the existence of this disjunct area ranging from Mt. Minamisawadake (2625 m) to Mt. Nunohiki-yama (2683 m) is due to past geologic activity and possibly to its effect on food plants. Volcanic activity that occurred about $10^5$ years ago on Mt. Tateyama (3015m), which is located very close to where *Oeneis norna asamana* has not been recorded, is one possibility. In fact, the area of tephra (Tt-D) derived from the volcano of Mt. Tateyama and accumulated about $10^5$ years ago (Machida & Arai 1992), agrees well with the area where *Oeneis norna asamana* is absent (Fig. 1a). Actually, two kinds of tephra, Tt-E (accumulated $6.0 \sim 7.6 \times 10^4$ years ago) and Tt-D (accumulated $9.5 \sim 13.0 \times 10^4$ years ago) have been reported for those derived from the volcano of Mt. Tateyama, but the range of the latter is much larger than the former. Therefore, *Oeneis norna asamana* has probably been present on the Hida mountain chain since at least $10^5$ years before present.

As is seen in Fig. 2, the lower limit of the distribution tends to decrease from the south to the north in the Hida mountain chain, with a slope of approximately 500 m/degree (~ 2.5 m/km). This tendency is presumably caused by the difference in the amount of snow accumulated during the winter season between the northern and southern parts of the mountain chain. In Japan, the areas facing the Japan Sea receive more snow in winter as compared with the Pacific coast or the inland of the island of Honshu. This likely also causes the difference in the vegetation as well as the altitude of the timberline. Since the habitat of *O. norna* in the Hida mountain chain ranges only 100 km (62 mi) from the south to the north, the difference in habitat latitude may not significantly influence the lower limit of the distribution (Fig. 1b). Of course, the habitat altitude is also influenced by the temperature of the habitat, which may correlate with the amount of residual snow in early summer.

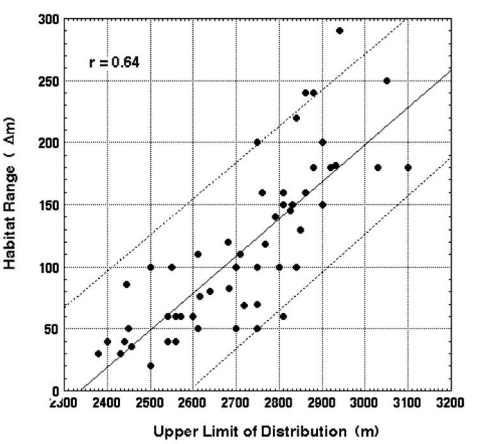


FIG. 4. Vertical distribution range plotted against the upper limit of the distribution for *Oeneis norna asamana* in the Hida mountain chain.

There is distinct linearity between the upper and lower limits of the vertical distribution with a correlation factor of 0.968 (N = 74) (Fig. 3). This observation indicates that the lower limit of the distribution is determined mainly by the nearest peak height in the habitat, because the upper limit of the distribution correlates with the altitude of the highest peaks in the habitat. Further, the vertical distribution range tends to narrow as the upper limit of the distribution decreases (Fig. 4). This also indicates that the range of vertical distribution is influenced mainly by the height of the mountain that *O. norna* inhabits.

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## LITERATURE CITED

FUJIOKA, T. 1975. Butterfies of Japan. Kodansha, Tokyo. (in Japanese)

FUKUDA, H., E. HAMA, T. KUZUYA, A. TAKAHASHI, M. TAKAHASHI, B. TANAKA, H. TANAKA, M. WAKAHAYASHI, W. WATANABE. 1984. The life histories of butterflies in Japan, IV. Hoikusha, Osaka. (in Japanese with English summary)

HIGGINS, L. G. & N. D. RILEY. 1970. A field guide to the butterflies of Britain and Europe. Collins, London.

INOMATA, T. 1990. Keys to the Japanese butterflies in natural color. Hokuryukan, Tokyo (in Japanese.)

INOMATA, T. & K. MATSUMOTO. 1995. Yamakei field-books, 11 Butterflies. Yamakei, Tokyo. (in Japanese.)

ITOH, T. 1975. Variation of *Oeneis norna* at the Hida mountains in Japan (2nd report). Nature and Insects (Konchu to Sizen) 10(11): 6–10. (in Japanese)

———. 1979. Variation of *Oeneis norna* at the Hida mountains in Japan (3rd report). Nature and Insects (Konchu to Sizen) 14(9): 20–22. (in Japanese)

KAWAZOE, A. & M. WAKABAYASHI. 1976. Colored illustrations of the butterflies of Japan. Hoikusha, Osaka. (in Japanese.)

LUKHTANOV.V, & U. EITSCHBERGER. 2001. Catalogue of the genera *Oeneis* and Davidina. In Butterflies of the world, Supplement 4.

MACHIDA H. & ARAI F. 1992. Atlas of tephra in and around Japan. University of Tokyo Press, Tokyo. (in Japanese)

MATSUMURA, S. 1919. Thousand insects of Japan. Additamenta 3: 700.

SHIROZU, T. 2006. The standard of butterflies in Japan. Gakken, Tokyo (in Japanese.)

———. 1952. New or little known butterflies from the north east Asia with some synonymic notes I. Sieboldia 1: 11-37.

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