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A Preliminary Report of the Land Snail Fauna in Tomi Area, Niigata Prefecture, Central Japan

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新潟県糸魚川市の田海地域の陸産貝類相(予察報告)

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1. Introduction

To characterize local land snail fauna from the viewpoint of a natural foundational investigation, data must be as detailed as possible. Land snail fauna in Hokuriku region has been surveyed in many areas by many malacologists. In this study, the author surveyed land snail fauna in three areas in the Hokuriku region in central Japan: Hakusan area in Ishikawa Prefecture (Kashiwagi *et al.*, 2019), Kurobe Gorge in eastern Toyama Prefecture (Minato *et al.*, 2020), and Tomi area in western Niigata Prefecture (Fig. 1). These three areas have common geographic features, namely steep mountainous ranges underlain by carbonate rocks, limestone caves, and heavy snowfall during winter. In the present paper, the author present a preliminarily report outlining the land snail fauna in Tomi area. Detailed morphological descriptions and assemblage analysis will be presented in a future report.

2. Study area, materials and method

The Tomi area, the target area for the present study, occupies the Tomi River drainage basin in Itoigawa City, western Niigata Prefecture. The Tomi River flows northward through geological systems of different rock types and ages to the Sea of Japan (Fig. 2). Field work was conducted in two locations in Tomi area; each location is underlain by Permian

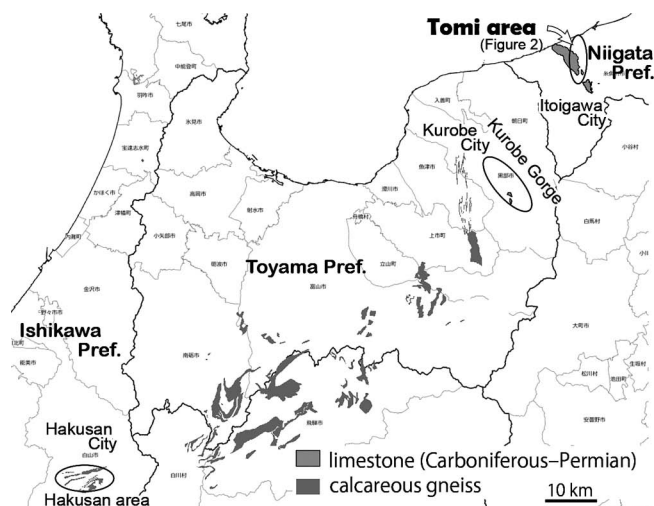


Fig. 1 Study areas for land snail fauna in Hokuriku region; Hakusan area in Ishikawa Prefecture, Kurobe Gorge in eastern Toyama Prefecture, and Tomi area in western Niigata Prefecture. The study area in this paper is Tomi area. The distribution of limestone and calcareous gneiss was referred from the Seamless Digital Geological Map of Japan (1:200,000) originally edited by the Geological Survey of Japan, AIST.

non-calcareous sedimentary rocks (Nagamori *et al.*, 2010, 2018). The precise locations have not been outlined in the manuscript due to conservation and protection of rare species and habitats.

Location 1 was situated in a broad-leaved deciduous forest, and Location 2 was in a coniferous cedar forest. Field surveys were conducted twice: in Loc. 1 on November 3, 2020 by the author and three students, and in Loc. 1 and 2 on November 16, 2020 by the author. At each field location, an intensive search was conducted for medium- to large-sized land snails and slugs on the leaves of shrubs and weeds, which were then collected directly by hand. We also searched for small-sized shells on the dead leaves in the litter leaf layer, which were picked up with tweezers.

On November 16, wet fallen leaves were raked from the leaf litter layer (~ 10 cm thick) covering a single square meter in Loc. 1; the samples were stored in a plastic garbage bag and were not sieved in the field. On December 3, 2020, substantial small dead and/or living shells, with a few medium- to large-sized dead shells, were collected with tweezers by visual confirmation from a pile of wet fallen leaves over a 2-hour collection period; collection was conducted by 31 undergraduate students as part of a class's scientific experiment. Small-sized shells were classified

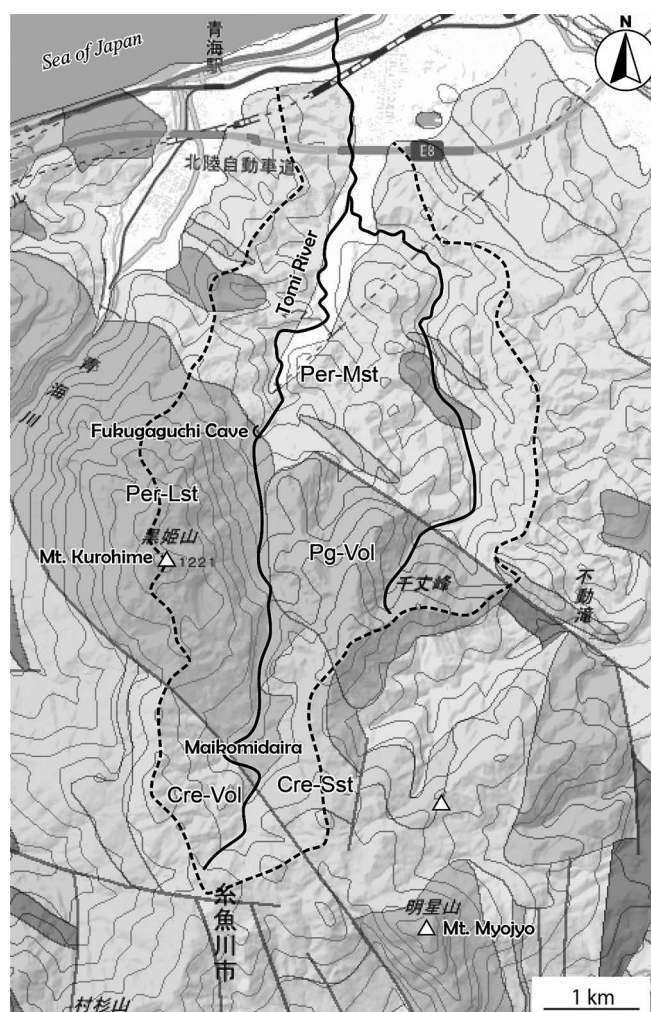


Fig. 2 Shaded geological map of the Tomi River drainage basin and its surrounding area, Itoigawa, Niigata Prefecture. The Tomi River drainage basin area is outlined by the dashed line. The geological map was referred from the Seamless Digital Geological Map of Japan (1:200,000) originally edited by the Geological Survey of Japan, AIST. Legends; Cre-Vol; Late Cretaceous volcanic rocks, Pg-Vol; Paleogene volcanic rocks, Cre-Sst; Cretaceous sandstone and conglomerate, Per-Lst; Carboniferous-Permian limestone, Per-Mst; Permian mudstone with sandstone.

roughly at the species or genus levels by the students, according to the naked eye and/or under stereomicroscopes, with the help of the first author. Upon completion of the class, all shells were cleaned using an ultrasonic cleaning device, and then identified precisely under a stereomicroscope by the author. Some representative specimens were taken with a digital microscope at the University of Toyama. All specimens have been deposited into my private collection and into the Toyama Science Museum.

3. Results and brief comments

Species lists of the land snail fauna found at the two locations in Tomi area are shown below. Species names are listed in descending order in terms of occurrence numbers, and the population of each species is shown in parentheses. The plus symbol in parentheses shows the presence of other broken materials. More than 600 individuals encompassing at least 17 snail species were found within the narrow area of about 1 m² at Loc. 1. In Loc. 2, three living species were collected, two of which were also found at Loc. 1. Additionally, small numbers of centipedes, millipedes, insects (*Eysarcoris aeneus* (Scopoli, 1763), Lioididae gen. et sp. indet., Phalacridae gen. et sp. indet.), and sow bugs (*Haplophthalmus danicus* Budde-Lund, 1880) were simultaneously collected during this process.

The following species were collected from Loc. 1: *Diplommatina uzenensis cassa* (Pilsbry, 1901) (230+ca. 50), *Nakadaella micron* (Pilsbry, 1900) (150), *Dicharax pilsbryi* (Kobelt, 1902) (79), *Diplommatina (Sinica) pusilla* (Martens, 1877) (57), *Gastrodontella stenogyra* (A. Adams, 1868) (32+5), *Carychium noduliferum* Reinhardt, 1877 (31), *Coneuplecta praealta* (Pilsbry, 1902) (21), Helicarionidae gen. et sp. indet A (19), *Trochochlamys crenulate* (Gude, 1900) (11), Helicarionidae gen. et sp. indet B (5), *Trochochlamys fraterna* (Pilsbry, 1900) (4), *Carychium nipponense* Pilsbry and Hirase, 1904 (4), *Trishoplita mesogonia* Pilsbry, 1900 (4), *Stereophaedusa japonica japonica* (Crosse, 1871) (3), *Euhadra brandtii roseoapicalis* Kuroda, in Kira, 1959 (2), *Aegista vulgivaga* (Schmacker and Boettger, 1890) (1), *Parasitala* sp. (1). Among these species, the following species were found alive: *D. uzenensis cassa*, *D. pilsbryi*, *D. (Sinica) pusilla*, *G. stenogyra*, *C. noduliferum*, *C. praealta*, *C. nipponense*, *T. mesogonia*, *E. brandtii roseoapicalis*, *S. japonica japonica*. *D. uzenensis cassa* of the most abundant species included substantial fresh adult shells of a light brown color with white-colored juvenile shells outlined by an equilateral triangle. *D. pilsbryi* specimens included abundant fresh individuals with operculum. Three living *T. mesogonia* were collected from the surface of the leaves of broadleaf evergreen trees and from the leaf litter layer. One living *S. japonica japonica* individual and one living *E. brandtii roseoapicalis* individual were recovered from



Fig. 3 *Fukuia integra* collected at Loc. 2.

the leaf litter layer. Empty *N. micron* shells were milky white in color due to weathering and more or less broken around the aperture.

In Loc. 2, the following three species were collected as living individuals: *D. uzenensis cassa* (8), *C. praealta* (2), and *Fukuia integra* (1).

Among the snail species identified here, three species; *F. integra*, *C. praealta*, and *T. fraternal*, have been designated as VU (Vulnerable), NT (Near Threatened), and DD (Data Deficient) respectively in red list on molluscs by Ministry of the Environment of Japan Government (<https://ikilog.biodic.go.jp/rdb/booklist>; Accessed 10 Feb 2020). *F. integra* (Fig. 3) is known to be present in isolation across more than 10 localities in Niigata Prefecture (from southwest to northeast): Shirahige Shrine, Tenken, Tonami, Haguro Shrine, Mt. Shimizu and Nouhakusan Shrine in Itoigawa City, Kasajima and Yonahime Shrine in Kashiwazaki City, Kamasawa and Sawa in Nagaoka City, and Kasabori in Sanjyo City (Emura, 1970; Murayama, 1972, 1984, 1993; Tamura, 1975; Kiyozuka, 1975; Yoshida, 1991; Koike, 1992; Takizawa, 1992; Division of Environment in Niigata Prefecture, 2001; Nomura, 2015; Kaneyasu, 2019). Tomi area, which was surveyed during this study, is the seventh occurrence site of *F. integra* in Itoigawa City, western Niigata Prefecture. The number of occurrence sites in Itoigawa City accounts for almost half of all *F. integra* habitats in Niigata Prefecture. In addition, the species has been designated as CR+EN (Critically Endangered + Endangered), VU or NT by 10 prefectural governments (Yamagata, Niigata, Toyama,

Fukui, Gifu, Shiga, Mie, Tottori, Shimane, Shizuoka) in Japan (Research System of Japanese Red Data; <http://jpnrd.com/index.html>; Accessed 10 Feb 2020). In terms of species and habitat conservation in Niigata Prefecture, Itoigawa City must be an area of focus.

In the area underlain by upper Paleozoic carbonate rocks, the author preliminarily proceeded with a land snail fauna survey to collect several empty shells of the large-sized snails; *Waldemaria japonica* (A. Adams, 1861), *Mirus reinianus* (Kobelt, 1875), and *Euhadra Quaesita* (Deshayes, 1850). Kaneyasu *et al.* (2011) and Sato (2012) identified the presence of 37 land snail species in Maikomidaira at the upper Tomi River, based on a three-day field survey conducted by the Niigata Shell Club (Fig. 2). Maikomidaira shows typical karst topography with alpine plants conserved as part of the Maikomidaira Nature Conservation Area and one of the geosites in Itoigawa UNESCO Global Geopark (Takenouchi, 2011). Access to the area is strictly restricted to academic research with pre-authorized permission or specially-planned guided tours (<http://geo-itoigawa.com/eng/about/geosite/geosite7/>; accessed 10 Feb 2021). There were 12 snail species in common between the present study's locations and the Maikomidaira: *N. micron*, *D. pilsbryi*, *D. (Sinica) pusilla*, *D. uzenensis cassa*, *C. nipponense*, *C. noduliferum*, *S. japonica japonica*, *G. stenogyra*, *T. fraternal*, *T. crenulate*, *C. praealta*, and *T. mesogonia*. In total across these studies, more than 40 land snail species have been identified in the Tomi River drainage basin.

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