Oribatid Mites from Several Mires in Northern Japan

II. Three Species of the Genus *Hydrozetes* (Acari: Oribatida) including Two New Species

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ABSTRACT

Two new species of *Hydrozetes* are described from several *Sphagnum* mires in Japan: *Hydrozetes japonicus* sp. n. and *H. harundinosus* sp. n. Local variability and certain ecological characters are surveyed in *H. japonicus*, a common species in the *Sphagnum* mires of North Japan. *H. lemnae* (Coggi, 1897) was collected for the first time from Japan. The Japanese species is redescribed in this paper.

Key words: Oribatida, new species, fertility, faecal pellet, *Hydrozetes*, *Sphagnum* mire

INTRODUCTION

The oribatid fauna in wet habitats is characterized by high density and low species composition (e.g. Kuriki, 2000; Peterson and Luxton, 1982). The present author has studied the oribatid fauna in wet habitats in northern and eastern parts of Japan and discovered many unknown and unrecorded species. A previous paper reported studies on the genus *Trhypochthoniellus* (Kuriki, 2005). The present paper describes three species belonging to the genus *Hydrozetes*.

Species in the genus *Hydrozetes* are representative oribatid mites in aquatic environments. Subias (2004) assigned 27 species of *Hydrozetes* distributed around the world. In Japan, two species of *Hydrozetes* have been reported up to this time (Fujikawa et al., 1993): *H. lacustris* (Michael, 1882) and *H. terrestris* Berlese, 1910. In North Japan, a further three species of *Hydrozetes* have been found in *Sphagnum* mires and a Japanese horseradish, *Wasabia japonica* field. Some ecological characters of the commonest species of the genus *Hydrozetes* in the *Sphagnum* mires are surveyed in this paper.

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STUDY SITE AND METHODS

Study sites

Two new species of the genus *Hydrozetes* are described from Yachidaira mire (37°44' N, 140°13' E, 1,510 m above sea level) in Fukushima prefecture and Kokeyachi mire (40°56' N, 140°20' E, 20 m above sea level) in Aomori prefecture. The variability of one species was surveyed among five localities as follows: Yachidaira, Numanohara (43°32' N, 142°57' E, 1,435 m above sea level) in Hokkaido, Midagahara (38°35' N, 140°01' E, 1,450 m) in Yamagata prefecture, Shibakusadaira (38°07' N, 140°27' E, 1,680 m) in Miyagi prefecture and Ozegahara (36°56' N, 139°15' E, 1,400 m) in Fukushima prefecture. The species from Yachidaira was also surveyed from an ecological aspect under laboratory culture. The third species, *H. lemnae* (Coggi, 1897), was collected for the first time from Japan. The locality is a Japanese horseradish field in the Botanical Research Gardens of the New Technology Development Foundation (35°10' N, 139°05' E, 300 m above sea level) in Shizuoka Prefecture, central Japan.

Methods

Some ecological characters of the common species of the genus *Hydrozetes* in *Sphagnum* mires in northern Japan were surveyed under laboratory cultures. The characters considered were reproductive method, ontogenetic development and faecal pellet deposition. Mites were collected from the edge of a pond containing decayed tissues of *Moliniopsis japonica* at Yachidaira during May–September in 2006. The mites in summer (July 22) and autumn (September 26) were reared under three constant temperature conditions (15, 20 and 25°C). On each occasion, 10 adults were reared individually in plastic vessels of 34 mm in diameter and 10 mm in height, with distilled water and decaying tissues of *M. japonica*. Observations of the mites were carried out every one to three days. After counting the number of faecal pellets and eggs, these were removed from the vessels. The adults collected on September 16 in 2008 were reared by the same methods in order to supplement the results.

TAXONOMY

Family Hydrozetidae Grandjean, 1954

Hydrozetes japonicus sp. nov.

[Japanese name: Yamato-mizunorodani]

(Figs. 1–3)

Adult

Measurements: Body length: holotype, 510 µm; paratypes (n=13), 470 (511) 515 µm. Body width: holotype, 340 µm; paratypes (n=13), 310 (334) 350 µm.

Color. Brown to dark brown.

Prodorsum: Rostrum round. Rostral setae (*ro*) smooth, 55 µm long, projecting strongly ventrad. Lamellae narrow, converging forward. Lamellar setae (*le*) with a few barbs, 45 µm long, at lamellar tips. Interlamellar setae (*in*) thin and short, 30 µm long, on base of lamellae.

Fig. 1. *Hydrozetes japonicus* sp. nov.

A, dorsal view of adult. B, ventral view of adult. C, dorsal view of prodorsum near trichobothridium and notogastral shoulder. D, ventral view of subcapitulum. E, chelicera.

Fig. 2. *Hydrozetes japonicus* sp. nov.

A, left leg I. B, left leg II. C, left leg III. D, left leg IV.

Exobothridial seta (*ex*) thin and short, 20 μm long. Sensillus fusiform, 38 μm long, often broken. Distances between setae: *in-in* 110 μm > *le-le* 40 μm > *ro-ro* 20 μm . A pair of tutoria unciform, *tua* shorter than *tup*.

Notogaster: Anterior margin of notogaster arched, not clearly delimited medially. Notogaster with 14 pairs of pilose setae, 38–50 μm long; seta *c*₁ absent. Shoulder and a band around the notogastral margin, tuberculate; shoulders slightly swelling out with setae *c*₂ and *c*₃ on the pustulate band. Seta *la* never beyond the insertion of seta *lm*; *lm* remarkably close to seta *lp*, behind gland opening. Relative distances of setae: *dm-dm* > *da-da* $\cong$ *h*₁-*h*₁ > *dp-dp*.

Ventral side: Genital apparatus smaller than anal apparatus; distance between both apparatuses 2.0–2.1 $\times$ as long as genital apparatus. Genito-anal setae (*g*, *ag*, *an* and *ad*) glabrous, 22–25 μm long; genital setae 8 pairs. Lyrifissure *iad* 12 μm long, located at same level of seta *an*₂. Setal

Fig. 3. *Hydrozetes japonicus* sp. nov.

A, dorsal view of larva. B, dorsal view of protonymph. C, dorsal view of deutonymph. D, dorsal view of tritonymph. E, change of genital aspects (from left to right) of protonymph, deutonymph and tritonymph.

formula of epimerata: 3-1-2-3; every seta thin and glabrous. Seta *a* on infracapitulum thick, 25 μm long; setae *m* and *h* thin. Chelicera with two barbed setae; seta *cha* longer than seta *chb*, and situated further posteriorly; minute spines on lateral surface of seta *cha*; surface of the anterior half of chelicera with close-set, minute dots.

Legs: Tarsi I- IV monodactylous. Leg chaetotaxy (solenidion in parenthesis): I 1-5-3(1)-4(2)-20(2), II 1-5-3(1)-4(1)-15(2), III 2-3-1(1)-3(1)-15, and IV 1-2-2-3(1)-12. Tibia of all legs without distal spine on dorsal side.

Larva and Nymphs

The morphological features of each developmental stage are shown in Fig. 3 and Table 1.

Body length: larva 220-240 μm , protonymph 260-300 μm , deutonymph 330-380 μm , and tritonymph 400-460 μm .

Prodorsum: Setae *ro*, *le* and *in* with some barbs in larva, 25-42 μm long, longer than those in nymphal stages. Sensillus flagellate, extending from 60 μm long in larva to 105 μm long in tritonymph, arising from small pocket-like bothridium. Setae *ex* minute in each stage.

Notogaster: Integument clearly foveolate in larva, faintly and incompletely foveolate with several horizontal lines in nymphs. Notogastral setae 12 pairs in larva, five of these pairs on posterior margin thick with barbs. Fifteen pairs of notogastral setae in nymphal stages, classified into three types: Short thin setae (10-20 μm) on anterior, median and ventral area (*c*₁, *c*₂, *c*₃, *da*, *dm*, *dp*, *la*, *ps*₂ and *ps*₃), medium long thick setae (28-38 μm) with barbs on posterior margin (*h*₃ and *ps*₁), and very long (over 250-400 μm) black setae on posterior end (*h*₁, *h*₂, *lp* and *lm*). Long black setae absent on larval stage.

Ventral side: Genital plates with three pair of setae in protonymph, five pairs in deutonymph and seven pairs in tritonymph. Aggenital and adanal setae absent in protonymph, one pair and three pairs, respectively, in deutonymph. Two pairs of anal setae on tritonymph.

Type series: Holotype and 13 paratypes from submerged edge of a pond in Yachidaira, Fukushima Pref., Japan, 22-IX-2007. G. Kuriki leg. The mire consists of *Sphagnum tenellum* and *Moliniopsis japonica*. All specimens in the present work are females. The holotype (NSMT-Ac 13612) and 13 paratypes (NSMT-Ac 13613) will be deposited in the collections of the National Science Museum, Tokyo.

Etymology: The specific name “*japonicus*” of Latin adjective refers to the country of origin of

Table 1. Changes in certain characters of *Hydrozetes japonicus* during ontogenetic development.

Character	Stage	Larva (n = 14)	Protonymph (n = 12)	Deutonymph (n = 13)	Tritonymph (n = 12)	Adults (n = 17)
Body length (μm)		220-240	260-300	330-380	400-460	470-515
Number of claws on tarsus		1	1	1	1	1
Number of notogastral setae (pairs)		12	14	14	14	14
Number of genital setae (pairs)		—	3	5	7	8
Number of aggenital setae (pairs)		0	0	1	1	1
Number of anal setae (pairs)		0	0	0	2	2
Number of adanal setae (pairs)		0	0	3	3	3

the species.

Remarks: Grandjean (1948) and Fernandez and Trave (1984) chose 16 characters in species classification of the genus *Hydrozetes*. According to these characters, the present species is distinguishable from all other established species by the combination of the following characters: 1) 14 pairs of notogastral setae, 2) seta *lm* close to *lp*, 3) eight pairs of genital setae, 4) monodactylous leg IV, 5) small spine at distal end of each tibia absent, and 6) four pairs of very long notogastral setae in nymphs.

Variation: This species has been recorded as “*Hydrozetes*” by Kuriki (2003) from several *Sphagnum* mires in the northern part of Japan: Numanohara, Midagahara, Shibakusadaira, Ozegahara and Yachidaira. They are not significantly different among the localities in body length (range 470-565 μm), in body width (range 320-370 μm), relative length of *ro*: *le*: *in*, relative distance of *ro-ro*: *le-le*: *in-in*, and leg chaetotaxy. Table 2 shows two morphological aspects of the species at five localities. Notogastral setae are generally 14 pairs except for specimens from Midagahara (15 pairs). Number of genital setae, on the other hand, are generally 8 pairs but varied with a range of 7-10 both within a single locality and among five localities. The present author regards this difference as intraspecific variation.

Table 2. Local variability in the numbers of notogastral and genital setae in adults of *Hydrozetes japonicus*. (Numerical values show percentage in each locality)

Characters	Locality	Yachidaira	Numanohara	Midagahara	Shibakusadaira	Ozegahara
Notogastral setae		(n=15)	(n=6)	(n=11)	(n=10)	(n=3)
on left and right sides						
	14-14	93	100		100	100
	14-15	7		9		
	15-15			91		
Genital setae		(n=21)	(n=9)	(n=12)	(n=11)	(n=10)
on left and right sides						
	7-7	5	11	17		10
	7-8	14	33	25	9	40
	8-8	76	44	58	82	50
	8-9	5				9
	8-10			11		

Hydrozetes harundinosus sp. nov.

[Japanese name: Sato-mizunorodani]

(Figs. 4-6)

Adult

Measurements: Body length: holotype, 485 μm ; paratypes (n=16), 470 (517) 570 μm . Body width: holotype, 320 μm ; paratypes (n=16), 320 (343) 380 μm .

Color: Brown to dark brown.

Prodorsum: Rostrum round. Rostral setae (*ro*) smooth, 60 μm long, projecting strongly

Fig. 4. *Hydrozetes harundinosus* sp. nov.

A, dorsal view of adult. B, ventral view of adult. C, dorsal view of portion of prodorsum near trichobothridium and notogastral shoulder. D, ventral view of subcapitulum. E, chelicera. F, sensilli.

Fig. 5. *Hydrozetes harundinosus* sp. nov.

A, right leg I. B, right leg II. C, right leg III. D, right leg IV.

ventrad. Lamellae narrow, converging forward. Lamellar setae (*le*) at lamellar tips. Seta *le* shorter than *ro*, with sparse minute barbs, 50 μm long. Interlamellar setae (*in*) thin and short with minute barbs, 32 μm long, on base of lamellae. Exobothridial seta (*ex*) thin and smooth, 30 μm long. Sensillus oval with short stem, often broken. Distances between setae; *in-in* 92 μm > *le-le* 32 μm > *ro-ro* 20 μm . A pair of tutoria unciform, *tua* shorter than *tup*. A weak transverse line present in front of tutorias.

Notogaster: Anterior margin of notogaster arched forwards, not clearly delimited medially. Notogaster with 15 pairs of pilose setae, 45–70 μm long; seta *c*₁ present. Shoulder and a band around the notogastral margin, tuberculate; shoulders slightly swelling out with setae *c*₁, *c*₂ and *c*₃ on the tuberculate band. Seta *c*₁ beyond the insertion of seta *c*₂. Seta *la* never beyond the insertion of seta *lm*; *lm* ahead of gland opening. Relative distances of setae: $dm-dm \approx da-da > h_1-h_1 \approx dp-dp$. Lyrifissure *im* visible in dorsal view.

Ventral side: Genital apparatus smaller than anal apparatus; distance between both

Fig. 6. *Hydrozetes harundinosus* sp. nov.

A, dorsal view of protonymph. B, dorsal view of tritonymph. C, change of genital aspects of protonymph, deutonymph and tritonymph (left to right).

apparatuses 2.1-2.4× as long as genital apparatus. Genito-anal setae (*g*, *ag*, *an* and *ad*) glabrous, almost same in length, 22-25 µm long; genital setae 7 pairs. Lyrifissure *iad* 12 µm long, located at the same level as seta *an*₂. Setal formula of epimerata: 3-1-2-3; all setae thin and glabrous. Seta *a* on infracapitulum thick, 25 µm long; setae *m* and *h* thin. Chelicera with two barbed setae; seta

cha longer than seta *chb*, a little posterior of seta *chb*; a minute spine anterior to seta *cha*; surface of anterior of chelicera with minute dots.

Legs: Tarsi I- IV monodactylous. Leg chaetotaxy (solenidion in parenthesis): I 1-5-3(1)-4(2)-20(2), II 1-5-3(1)-4(1)-15(2), III 2-3-1(1)-3(1)-15, and IV 1-2-2-3(1)-12. Distal spine absent from dorsal side of each tibia.

Nymphs

The morphological features of protonymph and tritonymph are shown in Fig. 6A and 6B, respectively.

Body length: protonymph 300 μm ($n=1$), deutonymph 360-405 μm ($n=4$), and tritonymph 460-550 μm ($n=7$).

Prodorsum: Setae *le*, *in* and *ex* smooth, seta *ro* with minute barbs. Sensillus flagellate, extending from 80 μm long in protonymph to 100 μm long in tritonymph, arising from small pocket-like bothridium.

Notogaster: Integument faintly and incompletely foveolate with several horizontal lines. Fifteen pairs of notogastral setae classified into three types: Short thin setae (20-50 μm) without barbs, medium long thick setae (45-75 μm), and very long black setae (over 100-520 μm). The number of setae of each type variable. The long black setae generally six pairs of c_2 , *la*, *lm*, *lp*, h_2 and h_1 , sometimes joined by c_1 , *da*, *dm*, h_3 and ps_3 .

Ventral side: Genital plates with two pair of setae in protonymph, four pairs in deutonymph and six pairs in tritonymph. Aggenital and adanal setae absent in protonymph, one pair and three pairs appear in deutonymph, respectively. Two pairs of anal setae present in tritonymph.

Type series: Holotype and 16 paratypes from edge of a pond in Kokeyachi mire, Aomori Pref., Japan, 14-VII-1998. The mire consists of *Sphagnum palustre* and *Phragmites australis*. G. Kuriki leg. All specimens observed are females. The holotype (NSMA-Ac 13614) and all paratypes (NSMA-Ac 13615) will be deposited in the collections of the National Science Museum, Tokyo.

Etymology: The specific name “*harundinosus*” of Latin adjective refers to the environment of the location where the specimens were collected.

Remarks: According to 16 characters for the classification of the *Hydrozetes* species (Grandjean, 1948; Fernandez and Trave, 1984), this species is distinguishable from the established species by a combination of following characters: 1) 15 pairs of barbed notogastral setae, 2) seta *lm* ahead of gland opening, 3) 7 pairs of genital setae, 4) monodactylous leg IV, 5) small spine absent from distal end of each tibia, and 6) 6 pairs of very long notogastral setae on every nymph. A few morphological aspects, however, varied in number and size: number of notogastral setae decrease (c_1 often absent); range of body size (470-570 μm); number of long black setae on nymphs increase (13 pairs maximum).

Hydrozetes lemnae (Coggi, 1897)

[Japanese name: Futatsume-mizunorodani]

(Figs. 7-9)

Notapsis lemnae Coggi, 1897

Hydrozetes lemnae: Grandjean 1948, p.328, Figs. 2B and 2G, Figs. 3B and 3D; Hammer 1966, p.57, pl 25, Fig.79.

Fig. 7. *Hydrozetes lemnae* (Coggi, 1897).

A, dorsal view of adult. B, ventral view of adult. C, ventral view of subcapitulum. D, chelicera.

Fig. 8. *Hydrozetes lemnae* (Coggi, 1897).

A, left leg I. B, left leg II. C, left leg III. D, left leg IV.

Hydrozetes mollicoma Hammer, 1958, p.63, Figs. 73, 73a, 73b.

Morphological features of Japanese specimens are as follows.

Adult

Measurements: Body length 460-500 μm ($n=5$), body width 300-320 μm ($n=5$).

Color: Brown to dark brown.

Prodorsum: Rostrum rounded. Rostral setae smooth, 45 μm long. Lamellae narrow, converging forward. Lamellar setae smooth, 32 μm , at lamellar tips. Interlamellar setae short, 16 μm , on base of lamellae. Setae *ex* minute, 12 μm . Sensillus clavate, slightly curved inward, pedicel of sensillus relatively long. Distance between setae: *in-in* 85 μm $>$ *ro-ro* $\approx$ *le-le* 32 μm . A pair of tutoria unciform, *tua* shorter than *tup*. A weak transverse line present in front of tutorias.

Notogaster: Anterior margin of notogaster arched, not clearly delimited medially. Shoulder and a band around notogastral margin tuberculate. Notogaster with 13 pairs of long glabrous setae, 50-92 μm long; setae of *l*-series (*la*, *lm*, *lp*) exceeding obviously beyond the insertion of the succeeding setae; seta *lm* considerably ahead of the grand opening; setae *ps*₂ and *ps*₃ shorter than the others; shoulder with only one seta *c*₂. Relative distances between seta: *dm-dm* $>$ *da-da*

Fig. 9. *Hydrozetes lemnae* (Coggi, 1897).
Dorsal view of tritonymph.

$> dp-dp \doteq h_1-h_1$.

Ventral side: Genital apparatus smaller than anal apparatus; distance between both apparatuses about $2 \times$ length of genital apparatus. Genito-anal setae (*g*, *ag*, *an* and *ad*) glabrous, almost same in length, 22-25 μm long; genital setae 6 pairs. Lyrifissure *iad* 12 μm long, located at a little behind the level of seta *an*₂. Setal formula of epimerata: 3-1-2-3; every seta thin and glabrous. Seta *a* on infracapitulum thick, 18 μm long; seta *m* thin. Chelicera with two barbed setae; seta *cha*

longer than seta *chb*, a little behind at the level of seta *chb*; surface of middle part of chelicera dotted minutely in antiaxial side.

Legs: Tarsi I-III monodactylous; tarsus IV bidactylous, one strong claw, similar to that of tarsi I-III, and the other slender claw, about $1.5\times$ as long as the strong claw. Leg chaetotaxy (solenidion in parenthesis): I 1-5-3(1)-4(2)-18(2), II 1-5-3(1)-4(1)-15(2), III 2-3-1(1)-3(1)-15, and IV 1-2-2-3(1)-12. Each tibia provided with a distal spine on dorsal side, largest on tibia II.

Nymphs

Body length: Protonymph 300 μm ($n=1$), deutonymph 385 and 400 μm ($n=2$), and tritonymph 480 and 490 μm ($n=2$).

Prodorsum: Setae *le* and *in* thick with some barbs, 45 μm long in deutonymph, 50 μm long in tritonymph. Sensillus flagellate, 70 μm long in deutonymph, 80 μm long in tritonymph, arising from small pocket-like bothridium. Setae *ro* thin and short, 25 μm long. Setae *ex* minute.

Notogaster: Integument faint, incomplete foveolate. Notogastral setae in dorsal view classified into three types: short thin setae (12-20 μm) on median area (*c*₁, *c*₂, *da*, *dm* and *dp*), medium long thick setae (40-75 μm) with barbs in lateral row and on posterior margin (*c*₃, *la*, *lm*, *h*₃ and *ps*₁), and very long (over 300 μm) black setae on posterior end (*h*₁, *h*₂ and *lp*).

Material examined: Five adults and five nymphs from submerged edge of Japanese horseradish field in the Botanical Research Gardens of the New Technology Development Foundation in Shizuoka Prefecture. Japan, 11-V-2005. G. Kuriki leg.

Remarks: According to 16 characters for the classification of *Hydrozetes* species (Grandjean, 1948; Fernandez and Trave, 1984), this Japanese species of the genus *Hydrozetes* is identified as *H. lemnae* (Coggi, 1987). The several characters of this species are 1) thirteen pairs of notogastral setae, 2) six pairs of genital setae, 3) bidactylous leg IV, 4) a small spine at distal end of each tibia, and 5) three pairs of very long notogastral setae on nymphs.

BIOLOGY

Seasonal change of gravid rate of Hydrozetes japonicus sp. nov.

Fig.10 shows a few aspects on eggs carried by *H. japonicus* at Yachidaira during a period except snow season. In May 15, sixteen adults carried a mean of 2.6 eggs with a range of 0-5. The number of eggs gradually decreased, reaching zero on September 10. The eggs inside the body varied in embryonic stage during the season, but each egg in a given body was observed to be at almost the same stage.

Table 3 lists some ecological characters of adults collected in summer and autumn and maintained in laboratory culture. The life span of adults in summer was shorter than that in autumn adults, but no significant differences were observed among the three temperature conditions. Fertility was low at each temperature in both seasons: a mean of only 1.1 eggs, with a maximum of four eggs at 25°C in the summer season. This result suggests that the main reproductive period is some time before this season (July 22). The maximum number of faecal pellets per day, however, increased with temperature from 5 or 6 at 15°C to 10 or 11 at 25°C.

Reproductive process of Hydrozetes japonicus in laboratory

Fig. 10. Seasonal change in number of eggs carried by adults.

Mean number of eggs per adult (upper figure) and number distribution for eggs carried by adults (histograms below).

Table 3. Some ecological characteristics of adults (*Hydrozetes japonicus*) collected in summer (July 22) and autumn (September 26) seasons and cultured in the laboratory.

	Summer season	Autumn season
Mean life span ¹⁾ (days±SE)		
15°C	46.1±12.8	94.0±18.0
20°C	68.9± 9.7	93.2±17.8
25°C	50.5±12.5	38.6± 5.8
Fertility ²⁾ (minimum-mean-maximum)		
15°C	0	0
20°C	0.0-1.0-3.0	0
25°C	0.0-1.1-4.0	0.0-0.2-2.0
Maximum number of faecal pellets/ day ³⁾ (mean±SE)		
15°C	5.2± 0.5	6.4± 1.0
20°C	11.7± 0.9	9.6± 0.8
25°C	11.3± 1.0	10.3± 1.6

1): Survival days of adults in the laboratory.

2): Total egg production in the laboratory.

3): This paper deals with the maximum number of faecal pellets per day for ten adults because the faecal pellets were not observed when the mite was floating on the water or otherwise separated from the foods.

Fig. 11. Two examples of adult culture of *Hydrozetes japonicus* obtained on July 22, 2006 at 25°C. Circles show appearance of eggs. Thick bars show number of faecal pellets released per day.

Fig. 11 shows two examples of egg deposition times at 25°C, along with the number of faecal pellets released each day. These mites were at the first and second ranks of fertility under this condition. On the upper example (animal No.1), the first three eggs were observed 19 days after the start of the culture. After deposition of the fourth egg on next day, the mite died 40 days after the start of the culture. The second example (No.9) laid four eggs 29 days after the start of the culture and died after 51 days. The number of faecal pellets released per day changed over a range of 0-15. The total number of pellets released over this time was 116 and 111, respectively. On a supplementary culture at 20°C in 2009, each period of developmental stages were measured as follows: 11 days for the egg stage, 20 days for the larval stage, 17 days for the protonymphal stage and 34 days for the deutonymphal stage.

This result suggests that the reproductive season is restricted to the period between late spring and early autumn, and is probably applicable to most oribatid species in the mire because the soil temperature drops markedly outside this period.

DISCUSSION

Variation among Hydrozetes species

Sexual dimorphism is exhibited in many *Hydrozetes* species, especially the setae of legs (Willmann 1931; Grandjean 1948; Fernandez et Trave 1984), distance between genital and anal openings, size of chitinous ring surrounding the genital opening, and shortness of penis size compared to ovipositor size (Newll, 1945). In the present study, however, sexual dimorphism was not confirmed, because no males of *H. lemnae* were obtained. On the other hand, Fernandez et Trave (1984) showed large morphological variations in 27 *Hydrozetes* species, such as the number of notogastral setae (11-17 pairs), genital setae (5-7 pairs), leg claws (1-3), number of

long notogastral setae of immatures (4-28), form of bothridium aperture and tutoria. In this study, *H. japonicus* showed wide variability on the number of genital and notogastral setae within a single locality and among localities.

Reproductive process of Hydrozetes japonicus sp. nov.

Some data concerning the reproduction of this species have been obtained from laboratory cultures. First, it is obvious that *H. japonicus*, the common *Hydrozetes* species in Japanese *Sphagnum* mires, is oviparous, because eggs were found free on the bottom of the vessel in laboratory culture.

Second, this species is probably semelparous, for most females deposited a small number of eggs at once and died soon after in the culture. Therefore, the fertility of this species is equivalent to fecundity (maximum of 5). Whereas, a few (10% of) adults collected in September laid two eggs at 25°C, 16 days after the start of the culture. This suggests that females in the autumn are unable to lay eggs even if the water temperature rises a little temporarily in the highland field 1,510 m above sea level.

Faecal pellet deposition of H. japonicus sp. nov.

The adults deposited a small number of faecal pellets during the period of culture: a maximum of 15 faecal pellets per day. This amount is smaller than for *Trhypochthoniellus brevisetus* and *Limnozetes ciliatus* (Kuriki, 1996; 2008), two dominant species in the mire. Faecal pellets were not observed (as also in the former two species) when the mite was floating on the water or otherwise separated from the decayed tissues used for food in the vessel. The maximum number of faecal pellets per day appears to have a weak correlation with temperature. This result is similar to *L. ciliatus* (Kuriki, 2008) as compared with *T. brevisetus*, where there was a high correlation (Kuriki, 1996). The factors directly influencing these difference have yet to be elucidated.

Faecal pellets are globular or cylindrical in shape, with a mean volume of $32 \times 10^4 \mu\text{m}^3$. An example of deposition at 25°C (mite No. 1), which deposited 116 faecal pellets within 38 days: the total volume of faecal matter released in this period was calculated to be 0.037 mm^3 for this animal. Total amount of faecal pellets during a generation are able to be measured during a laboratory culture. In this connection, the total amount of faecal matter deposited by *T. brevisetus* was calculated to be 1.15 mm^3 per individual (Kuriki, 1996).

As suggested in the previous paper (Kuriki, 2008), the methods of culturing require further improvement to enable full elucidation of the life cycle of the mite, in particular because juveniles could not be reared well with the present methods.

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摘要

北日本の湿原に生息するササラダニ類Ⅱ. ミズノロダニ属の3種

栗城 源一 (奥羽大学口腔機能分子生物学講座)

東北および北海道のミズゴケ湿原内の池塘岸縁から得られたミズノロダニ属の2種をヤマトミズノロダニ *Hydrozetes japonicus* sp. nov. サトミズノロダニ *H. harundinosus* sp. nov. として新種記載した。前種はわが国の高層湿原に生息するミズノロダニ属の普通種で、背毛14対、生殖板毛8対、若虫に極めて長い黒毛が4対存在することなどから既知種と区別される。しかしこれらの形質は地方および個体群内での変異が大きいことが明らかになった。また飼育実験から、本種は産卵した最大5個の卵をまとめて産下したのち死亡する1回繁殖のササラ

ダニと考えられた。成虫の排糞数は1日当たり最大でも15個と少ないものであった。後種は低地の湿原に生息する種で、背毛15対、生殖板毛7対、若虫の黒色長背毛6対等で既知種と区別できる。加えて、静岡県内のワサビ田から得られたミズノロダニ属の種は、胴感毛先端が強く膨らみ、生殖板毛6対、長い背毛13対、第Ⅳ脚に2本の爪、若虫に黒色長背毛が3対あることから *Hydrozetes lemnae* (Coggi, 1897) と判断し、フタツメミズノロダニの和名を与えた。