Acta Biol. Univ. Daugavp. 16 (2) 2016
ISSN 1407 - 8953

A CONTRIBUTION TO THE KNOWLEDGE OF *SABACON IMAMURAI* SUZUKI, 1964 (ARACHNIDA: OPILIONES: SABACONIDAE)

Aleksey N. Tchemeris, Laimonas A. Trilikauskas

Tchemeris A.N., Trilikauskas L.A. 2016. A contribution to the knowledge of *Sabacon imamurai* Suzuki, 1964 (Arachnida: Opiliones: Sabaconidae). *Acta Biol. Univ. Daugavp., 16 (2): 247 – 255.*

The habitat preference, seasonal dynamics and phenology of *Sabacon imamurai* Suzuki, 1964 (Opiliones, Sabaconidae) have been studied in the Bureinskii State Nature Reserve (the Russian Far East), where this species was first found in 2002. In the region, *S. imamurai* is a common species inhabiting birch, poplar, fir and larch forests. Collecting plots were organized in each of the studied habitats. In the larch, fir and poplar forests the plots were areas of 50x50m; in the birch forest it were 50x30m. Pitfall traps were set up along the perimeter of each plot, spaced out by 10m apart each other. The traps were checked out every 5-7 days. Pitfall traps were exposed from July to September in 2002–2003, and from June to September in 2004. The seasonal dynamics is characterized via the dynamic density: viz., by a number of specimens (adults and juveniles) in one pitfall trap per a hundred trap-nights. This parameter is called the dynamic density and is an integrative indicator that reflects the number of individuals in the biotope and their movement activity. Dynamic density of *Sabacon imamurai* was highest in the poplar forest, and very low in the larch forest. Pitfall-trapping showed that immature specimens appear in the beginning/middle of July. The maximum activity was observed in the second half of August. In the Bureinskii Reserve, *S. imamurai* overwinters at the egg stage.

Key words: *Opiliones, , Sabacon, seasonal dynamics, habitat preference, the Bureinskii State Nature Reserve*.

Aleksey Tchemeris. Department of Invertebrate Zoology; Institute of Biology, Ecology, Soil, Agriculture and Forest Sciences; Tomsk State University, Lenin av. 36, Tomsk 634050 Russia, e-mail: opiliones@mail.ru
Laimonas Trilikauskas. Institute of Systematics and Ecology of Animals, Russian Academy of Sciences, Siberian Brach, Frunze str. 11, Novosibirsk 630091 Russia, e-mail: laimont@mail.ru

INTRODUCTION

The genus *Sabacon* (Sabaconidae, Ischyropsalidoidea, Palpatores) is a group of soil harvestmen restricted to the Holarctic Region (Tsurusaki & Song, 1993). Until recently, only one species of this group – *S. habei* Suzuki, 1966 – had been known from the fauna of the Russian Far East, but the record was based on juvenile specimens (Gritsenko, 1979) and therefore is to be treated as dubious one. In the important work on the genus *Sabacon* of the Palaearctic Region recently published by Martens (2015), a new cave species from the Russian Far East (southern Primorie) was described and *S. makinoi* Suzuki, 1949 was reported from Iturup Island as new to the Russian fauna. Yet, the latter author described 20 new *Sabacon* species and after the publication

of his paper the world fauna of the genus *Sabacon* yields some 60 species.

Two harvestman species – *S. crassipalpe* (C.L. Koch 1979) and *S. sergeidedicatum* Martens, 1989 – have been reported from several regions of Siberia and the Russian Far East (Martens 1983, Tchemeris & Logunov, 2000, Trilikauskas 2015). *S. imamurai* Suzuki, 1964 was first reported from the Russian Far East (Bureinskii State Nature Reserve) in 2002 (see Trilikauskas, 2009); hitherto it had been known only from Japan: Hokkaido, Honshu and Kyusyu Islands (Suzuki 1964, 1965, 1974, Suzuki & Tsurusaki 1983; Tsurusaki & Minato 2000). The finding of this species in the Russian Far East lies at the northernmost limit of its distribution. The phenology of *S. imamurai* was first studied by Tsurusaki (2003) for Hokkaido.

The available data on the ecology of *Sabacon* representatives from Asia are virtually limited to the only work by Tsurusaki (2003). Thus, the present study adds novel data on the distribution and ecology of the remarkable opilionid species – *S. imamurai*.

MATERIAL AND METHODS

The fieldwork was carried out near the confluence of Pravaya and Levaya Bureya Rivers (the Bureinskii State Nature Reserve, Khabarovsk Territory) and in Chegdomyn Village (Verkhnebureinskii District, Khabarovsk Territory) from June/July to September in 2002–2004. Bureinskii State Nature Reserve is located in the central part of the Khabarovsk Territori, covering an area of 358 444 ha. The reserve belongs to the light coniferous larch taiga natural zone. Dark coniferous (*Picea*) and birch forests occur along river valleys and on slopes, covering a relatively small area of the reserve. During fieldworks, extensive materials of some 3300 individuals of *S. imamurai* were collected by pitfall traps; viz., plastic cups of 7 cm in diameter and 10 cm high. Traps were set up in the four habitats that are typical of the region at hand: the birch (*Betula platyphilla*) (coordinates of collecting plot: 51˚40. 196″ N, 134˚17.113″ E), poplar (*Populus suaveolens*) (51˚39. 242″ N, 134˚16.331″ E), fir (*Picea ajanensis*) (51˚39. 511″ N, 134˚16.099″ E) and larch (*Larix cajanderi*) (51˚38.851″ N, 134˚15.754″ E) forests. Collecting plots were organized in each of the studied habitats. In the larch, fir and poplar forests the plots were areas of 50x50m; in the birch forest it were 50x30m. Pitfall traps were set up along the perimeter of each plot, spaced out by 10m apart each other. The traps were checked out every 5-7 days. In the larch, fir and poplar forests exposed 20 pitfall traps, in the birch forest – 16 traps. A total of more than 14000 trap-nights was undertaken. Pitfall traps were exposed from July to September in 2002–2003, and from June to September in 2004. Pitfall traps are used as a standard method for studying the seasonal/daily activity of ground-dwelling arthropods; see Gilyarov (1987) and Domingo-Quero, Alonso-Zarazaga (2010) for further details. In the present study, the seasonal dynamics is characterized via the dynamic density: viz., by a number of specimens (adults and juveniles) in one pitfall trap per a hundred trap-nights. This parameter is called the dynamic density and is an integrative indicator that reflects the number of individuals in the biotope and their movement activity. The phenology graphs for the birch forest in 2004 were not calculated because the birch forest and the corresponding line of pitfall traps were flooded by high water of the Pravaya Bureya River.

Of the collected and studied material of *S. imamurai*, 38 ♂ and 74 ♀ have been deposited in the Zoological Museum of the Institute of Systematics and Ecology of Animals, Novosibirsk, Russia (ISEA; curator: G.N. Azarkina) and 23 ♂ and 22 ♀ in The Manchester Museum, University of Manchester, UK (MMUE; curator: D.V. Logunov). The rest of the collected material (3140 individuals) is deposited in the personal collection of the second author. The abbreviations used in the text and description are as follows: Fm – femur, Mt – metatarsus, Pt – patella, Tb – tibia, Tr – trochanter, Ts – tarsus. ‘Clypeus’ is the space between the ocularium and the front margin of carapace. All measurements are in mm.

Digital photographs were taken by means of a Nikon Coolpix 4500 camera attached to a MBS-10 stereomicroscope and processed by using the Helicon Focus image-stacking software. The specimens to be photographed were placed in dishes containing 70% alcohol, with legs positioned using 9 insect pine. Micrographs of the penis were made on a Scanning Electron Microscope.

RESULTS

***Sabacon imamurai* Suzuki, 1964** (Fig. 1-13, Fig.14)

Material: RUSSIA: 38 ♂, 74 ♀ (ISEA), Khabarovsk Territory, Bureinskii State Nature Reserve, 6 August 2002, L.A. Trilikauskas; 23 ♂, 22 ♀ (MMUE), same territory, upper reaches of

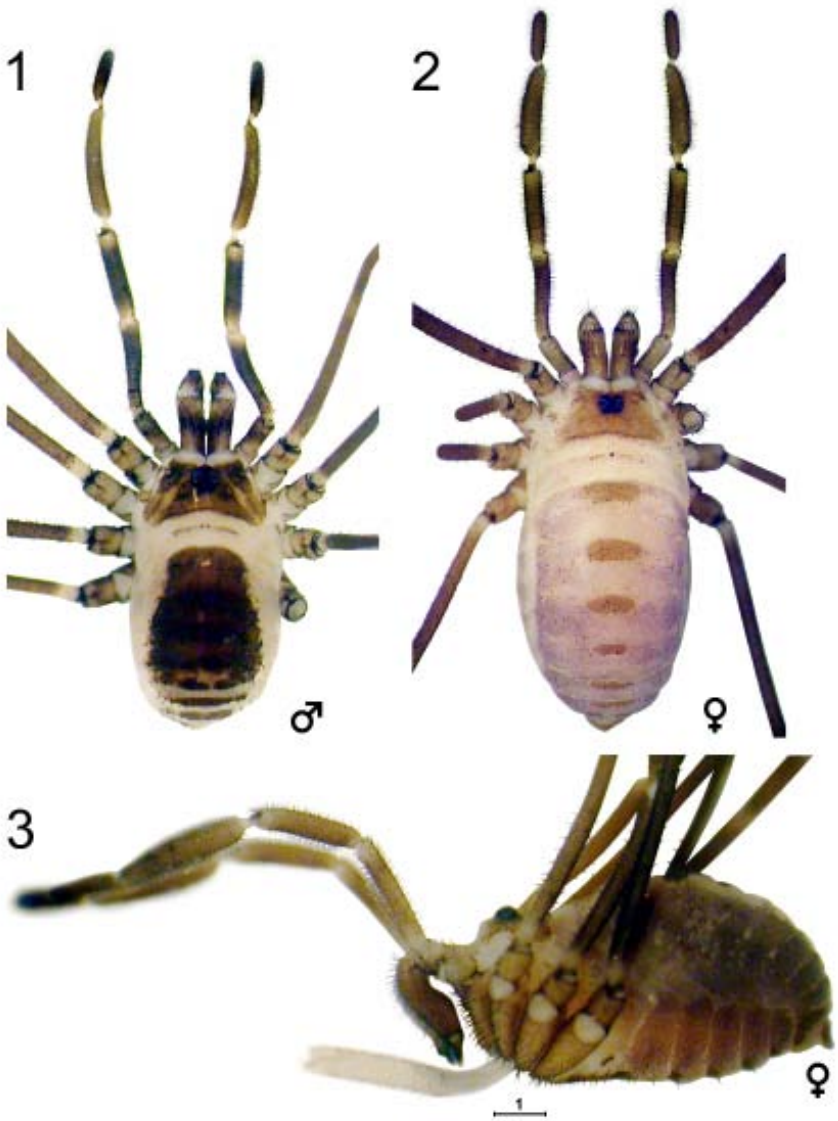

Fig. 1–3. View of body *Sabacon imamurai:* 1 – male, dorsally ; 2 – female, dorsally; 3 – female, laterally. Scale bar: 1 mm.

Bureya River, c. 1 km of the confluence of Levaya and Pravaya Bureya Rivers, 22–27.VIII.2002, L.A. Trilikauskas; 3140 individuals taken from the fist locality in 2002–2004 are deposited in the personal collection of L.A. Trilikauskas.

Distribution: Japan: Kyushu, Honshu, Hokkaido (Suzuki, 1964, 1965, 1974; Suzuki & Tsurusaki, 1983; Tsurusaki & Minato, 2000); Russia, the Russian Far East: the Bureinskii State Nature Reserve in Khabarovsk Territory (Trilikauskas, 2009; present data) (Fig.14.).

Description: *Male*: Measurements (n=38). Body: length 2.59–3.37; width 1.38–1.60. Carapace length: 0.78–0.85; width: 1.25–1.54. Ocularium width: 0.25–0.30. Chelicera: basal segment 0.65–0.73; distal segment 0.75–0.98; chela length 0.45–0.53. Penis: length 1.33–2.44.

Length of palp segments: Tr 0.45–0.46, Fm 1.09–1.38, Pt 0.89–1.05, Tb 1.01–1.40, Ts 0.65–0.68; total 4.09–4.97. Length of leg segments I: Fm 2.41–2.63, Pt 0.90–0.97, Tb 2.08–2.41, Mt 2.36–3.39, Ts 2.81–3.02; total 10.56–12.42. II: Fm 3.46–3.70, Pt 0.98–1.01, Tb 2.61–3.27, Mt 3.92–4.60, Ts 4.81–5.84; total 15.78–18.42. III: Fm 2.44–2.71, Pt 0.87–0.95, Tb 1.94–2.15, Mt 3.06–3.66, Ts 3.09–3.41; total 11.40–12.88. IV: Fm 3.27–3.81, Pt 0.96–1.12, Tb 2.47–2.75, Mt 4.05–5.12; Ts 5.57–6.36; total 16.32–19.16.

Compared to other *Sabacon* species, the body of *S. imamurai* is rather large and weakly chitinized (Fig. 1–4). Carapace and scutum are divided by a visible furrow, both almost smooth, with hardly

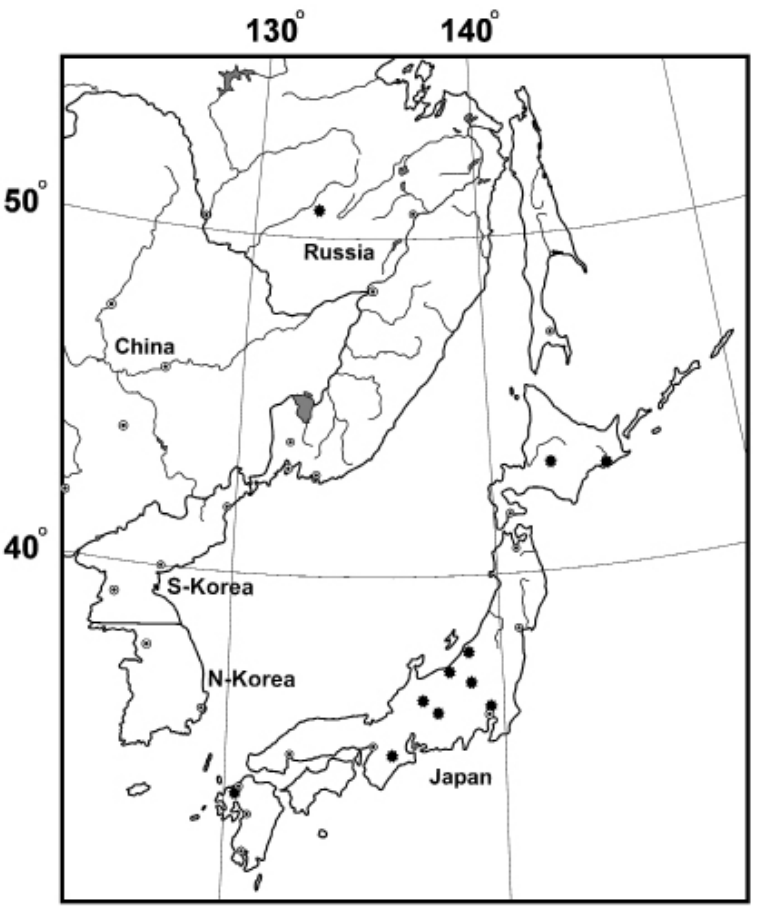

Fig.14. Distribution of *Sabacon imamurai*.

noticeable (not risen) microsculpture. Abdominal scutum: scutum parvum towards laminatum.

Cephalotorax and abdominal tergites without sharp borders. Abdominal sternites distinct, each with a longitudinal row of hairs in its middle part. Supracheliceral lamellae smooth. Ocularium simple, with rare setae (Figs 1–4).

Chelicerae (Figs 5–6): their basal segments without a dorsal apophysis (in some species dorsal apophyses are well developed). Distal segment slightly ridged proximally, with 1–3 black frontal tubercles, rarely with few accessory tubercles. Chela digits with numerous flat microsetae.

Palps elongated, normally proportioned, not swollen (Figs 1, 4). Patellae armed with a ventro-medial row of numerous black tubercles (Figs 7–8). Tarsal claws absent.

Legs as in all *Sabacon* are long and thin with rows or sparse hairs and setae. Claws of all legs are simple.

Penis: corpus slender and elongated, flattened dorso-ventrally, with a widened base, moderately swollen apically (Figs 9–11). Glans swollen with one prominent dorsal process at the distal margin, armed with numerous long spines on its ventral surface and a few fine long spines on its dorsal surface (Fig. 11–13).

Female: Measurements (n=74). Body: length

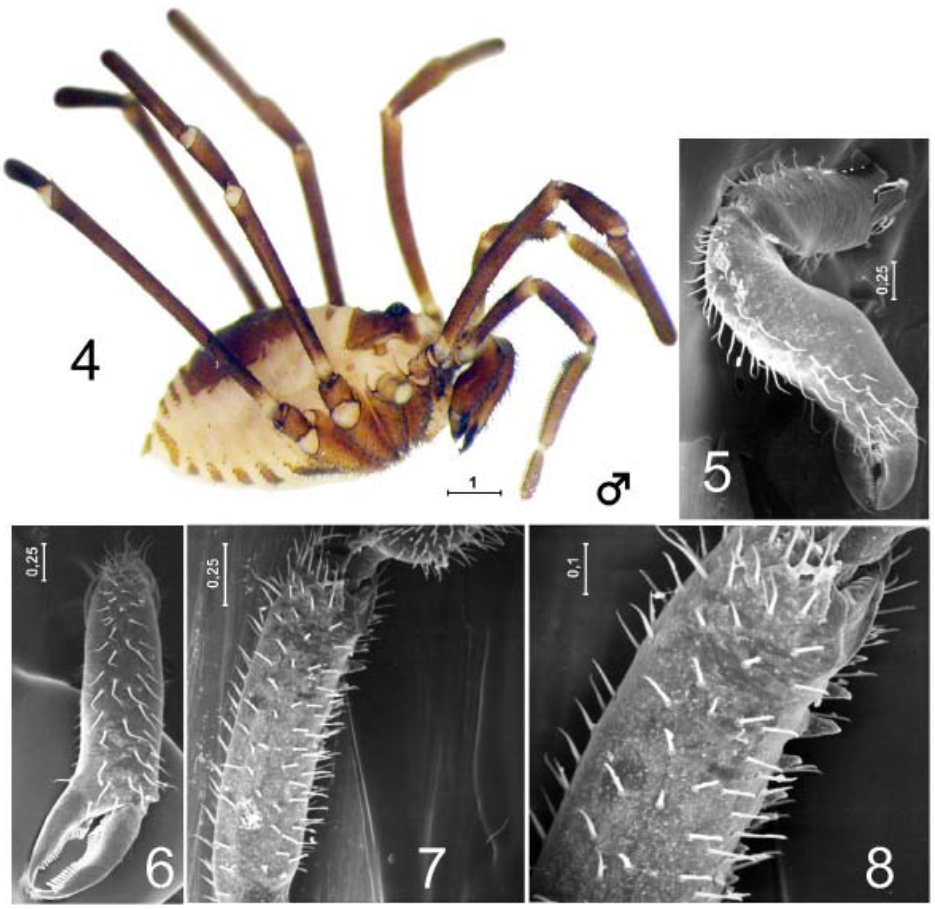

Fig. 4-8. Male of *Sabacon imamurai*: 4 – body, laterally; 5 – chelicerae, frontal-laterally; 6 – distal segment of chelicerae, frontally; 7 – patella of palp, laterally; 8 – dentate area of patella palp, laterally. Fig. 5-8 electron-scanning microscope.

4.22–4.56; width 2.22–2.41. Carapace length: 0.59–0.85; width: 1.75–1.79. Ocularium width: 0.33–0.34; Chelicera: basal segment 0.85; distal segment 1.00–1.10; chela length 0.45. Length of palp segments: Tr 0.37–0.55, Fm 1.46–1.50, Pt 1.18–2.21, Tb 1.65–2.05, Ts 0.72–0.74; total 5.38–7.05. Length of leg segments: I: Fm 2.57–2.63, Pt 0.96–0.98, Tb 2.38–2.62, Mt 2.94–3.12, Ts 2.83–2.91; total 11.68–12.26. II: Fm 3.64–3.57, Pt 0.95–1.15, Tb 3.05–3.29, Mt 4.36–5.08, Ts 4.85–5.32; total 17.42–18.41. III: Fm 2.55–2.62, Pt 0.90–0.98, Tb 2.14–2.28, Mt 3.29–3.41, Ts 3.32–3.55; total 12.20–12.84. IV: Fm 3.44–3.70, Pt 1.06–1.11, Tb 2.56–2.92, Mt 4.14–5.00, Ts 4.67–4.96; total 15.87–17.69.

Female general appearance is similar to that of the male (Fig. 2–3), but differs in the following characters: body usually larger, abdomen swollen and bluntly pointed posteriorly, scutum laminatum or scutum laminatum towards dissectum, all abdominal tergites free, each provide a small chitinized patch in the middle tergit.

Coloration. Male: Sclerotized parts of dorsum cephalothorax and abdomen ochre-brown to black-brown, except for white-ochre, softer, membranous structures. Ocularium black. Sternites and genital operculum lighter than tergites, ochre or ochre-grey. Limbs ochre-brown to dark brown. Penis brown to black. *Female*: usually lighter than the males, light ochre-grey to ochre brownish.

Variations: There is a considerable intraspecific variation in the body size and leg length (see above for the measurement ranges).

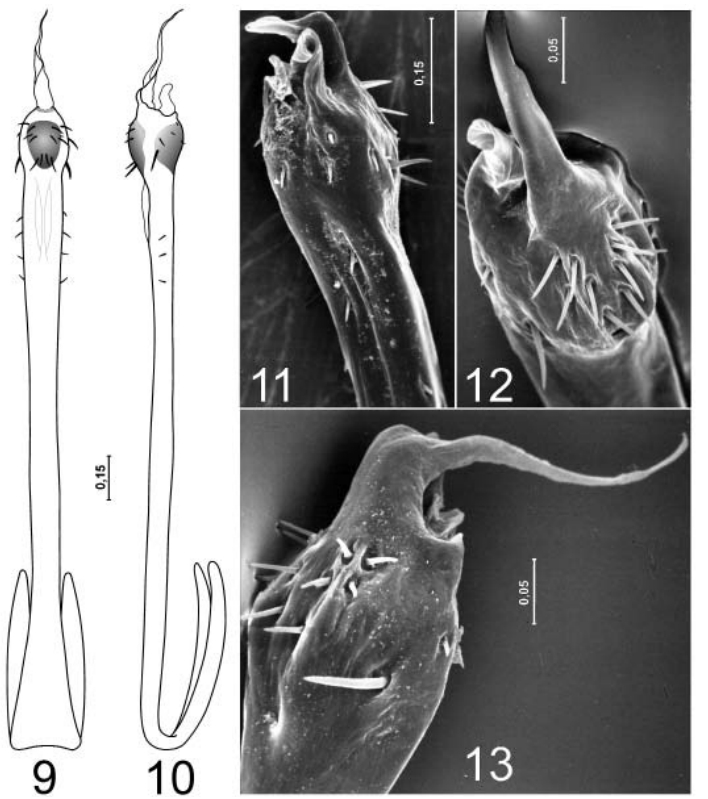

Fig. 9–13. Penis of *Sabacon imamurai*: 9 – Corpus, ventrally; 10 – Corpus, laterally; 11 – apical part of corpus, laterally; 12 – apical part of corpus, disto-ventrally; 13 - apical part of corpus, laterally. Fig. 9-13 electron-scanning microscope.

Habitat: In Japan, the specimens of *S. imamurai* were found outside and inside caves (up to 50 m deep of the entrance), from lowlands up to approximately 1,800 m a.s.l. (Suzuki, 1964b, 1974a). In the Russian Far East, this species was found in the plain taiga and inundated forests.

Seasonal dynamics

Birch (*Betula platyphilla*) forest. As shown in Fig. 15, in 2002, *S. imamurai* began to be captured by pitfall traps from mid-July. Since August 7th, the highest activity of this species was registered, with its peak being recorded in the third decade of August. The highest dynamic density was recorded on August 27th, making up to 99 specimens per 100 trap-nights. In 2003, the species was observed in traps from the first decade of July, and its dynamic density was kept at the level

of not lower than10 specimens per 100 trap-nights until the end of observations. The highest dynamic density was observed on August 16th, making up to 78 specimens per 100 trap-nights. Overall, in 2003, the dynamic density of *S. imamurai* was less stable, with its maximum being lower than that in 2002.

In 2004, the natural course of seasonal activity and dynamics of *S. imamurai* was broken by the flood of the Pravaya Bureya River. The birch forest was flooded and a considerable part of the harvestman's population perished. Only in 5 weeks after the flood first specimens of *S. imamurai* were caught again by pitfall-traps, probably as a result of the migration from adjacent habitats.

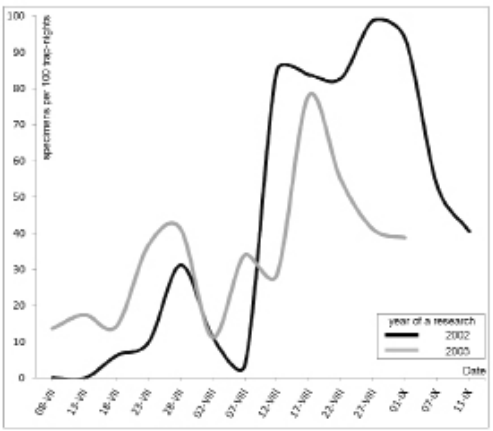

Fig 15. Seasonal dynamics in birch (*Betula platyphilla*) forest (adults and juveniles in sum).

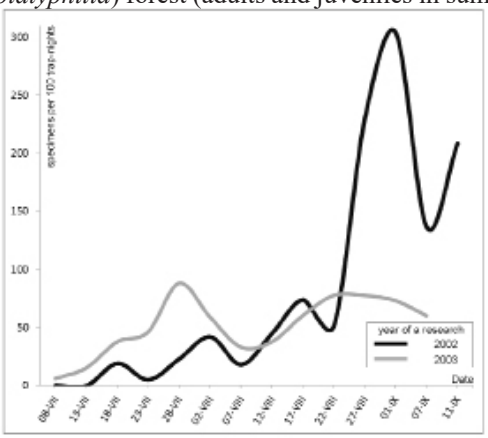

Fig 16. Seasonal dynamics in poplar (*Populus suaveolens*) forest (adults and juveniles in sum).

Poplar (*Populus suaveolens*) forest. In 2002, first specimens of *S. imamurai* were caught by traps in the first decade of July (Fig. 16). The dynamic density was increasing from the first decade of August, with its maximum reaching more than 300 specimens per 100 trap-nights in the season. The latter value was registered from August 28th to September 1st.

In 2003, the observed dynamic density of *S. imamurai* was comparatively low. Its maximum was recorded below 90 specimens per 100 trap-nights. Harvestmen were caught by pitfall traps during the entire period of observations, from July to September. The peak of seasonal activity was not marked in 2003. After July 17th, the dynamic density never was below 30 individuals per 100 trap-nights, demonstrating some fluctuations only.

In 2004, the fieldwork was conducted from the early June to the late August. In July, the poplar forest was not flooded during the aforementioned flood of the birch forest, but in July and August a considerable part of pitfall traps was damaged by wild animals probably migrating from adjacent flooded territories. Because of a small number of working pitfall traps was left, we did not get comparative data about the dynamic density of *S. imamurai* in 2004.

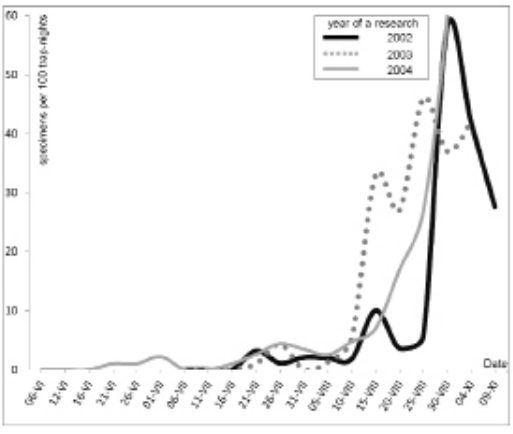

Fig 17. Seasonal dynamics in fir (*Picea ajanensis)* forest (adults and juveniles in sum).

Fir (*Picea ajanensis*) forest. As seen in Fig. 17, in 2002, *S. imamurai* began to be captured by pitfall traps from the second decade of July. The peak of its seasonal activity was registered after August 25th. The maximum of its dynamic density was observed between August 25-30th, making up to 58 individuals per 100 trap-nights. In 2003, the peak of seasonal activity was registered after August 10th. First individuals were caught by pitfall traps after July16th. The highest dynamic density was recorded between August 20th and 25th. In 2003, this parameter never exceeded 46 specimens per 100 trap-nights. In 2004, first individuals were also collected by pitfall traps after July 16th (as compared to 2013). The peak of seasonal activity was registered after August 15th, making up more than 112 specimens per 100 trap-nights until September 4th.

Larch (*Larix cajanderi)* forest. In this habitat, *S. imamurai* is a very rare species. Four individuals were collected during the three seasons only.

The fieldworks undertaken in the Bureinskii State Nature Reserve have revealed that *S. imamurai* can occur in the litter of various forest types. Yet, the species is very rare in the larch forests, apparently due to the cold moss and sphagnum litter thereof underlined by permafrost seems to be least suitable for it. The highest dynamic density of *S. imamurai* was recorded in unundated forests, in the areas of a wide river valley and with the thick leaf litter, for instance, in the poplar forest. The birch forest occupies a small area of the narrow part of Pravaya Bureya River; the dynamic density of *S. imamurai* here was significantly lower than that in the poplar forest (but higher than in the fir forest). In unundated forests the activity peak may be extended, and sometimes two peaks can be observed. In the fir forest, the maximum of dynamic density was observed in late August or early September.

Phenology

The present study has revealed that in the area at hand *S. imamurai* overwinters at the egg stage. Nymphs of early stages appeared in pitfall traps in the inundated forests not earlier than the third decade of June, and in the dark coniferous forests after June 15th. At the beginning of August, the population of *S. imamurai* was predominantly represented by juveniles of late stages (at least 60-70% individuals of 3-4 age) and first adult females. Since the middle of August mainly adults started to appear in pitfall traps and at the end of August these were mostly the males. However, juveniles of late stages were collected until September.

ACKNOWLEDGEMENTS

The authors are extremely grateful to Dr N. Tsurusaki (Tottori, Tottori University Japan) for the help in the identification of collected specimens and Dr D.V. Logunov (Manchester, UK) for critical comments on the manuscript and editing the English of the first draft.

REFERENCES

Domingo-Quero T., Alonso-Zarazaga M.A. 2010. Soil and litter sampling, including MSS. Manual on field recording techniques and protocols for All Taxa Biodiversity inventories and Monitoring. Abc Taxa, 8(1): 173-212.

Gilyarov M.S. 1987. Quantifying macro-invertebrates (mesofauna). Methods of quantifying in soli zoology, Moscow: Nauka, 9-26. (in Russian)

Gritsenko N.I. 1979. The harvestmen (Opiliones) of the Asian part of USSR (Ed. Yu. S. Balashov): Fauna i ekologiya paukoobraznykh. *Trudy Zool. Inst. AN SSSR. Leningrad*, 85: 28–38. (in Russian)

Martens J. 1983. Europaische Arten der Gattung *Sabacon* Simon 1879 (Arachnida: Opiliones: Sabaconidae). *Senckenbergiana biologica*, 63(3/4): 265–296.

Martens J. 2015. *Sabacon* Simon, 1879 in the Palaearctic: A survey a new and known

species from France, Nepal, India, China, Russia and Japan (Arachnida, Opiliones, Sabaconidae). Hartmann M. & J. Weipert: *Biodiversität & Naturausstattung im Himalaya*. 5: 167–210.

Suzuki S. 1941. Opiliones from Manchoukou and North China, with a description of a new species of the interesting genus Sabacon (Ischyropsalididae). *Bulletin of the Biogeografical Society of Japan*, 11(4): 15–22.

Suzuki S. 1964. A new member of the genus *Sabacon* (Phalangida) from Japan. *Annotationes Zoologicae Japonenses*, 37(1): 58–62.

Suzuki S. 1965. General statement of the class Arachnida; order Opiliones. In: Okada, Yo. K. et al. (Eds.), New illustrated encyclopedia of the fauna of Japan. Hokuryu-kan, Tokyo, 2: 347–355.

Suzuki S. 1974. The Japanese species of the genus *Sabacon* (Arachnida, Opiliones, Ischyropsalididae). *Journal of Science of the Hiroshima University*, Series B, Division 1 (Zoology), 25(1): 83–108.

Suzuki S. & Tsurusaki N. 1983. Opilionid fauna of Hokkaido and its adjacent areas. *Journal of the Faculty of Science Hokkaido University*, Series VI Zoology, 23(2), 195–243.

Tchemeris A.N., Logunov D.V. 2000. Notes two species of *Sabacon* Simon, 1879 from mountains of South Siberia (Arachnida, Opiliones, Sabaconidae). *Arthropoda Selecta*, 9(3): 207–213.

Trilikauskas, L.A. 2009. [To the fauna of harvestmen (Arachnida: Opiliones) and pseudoscorpiones (Arachnida: Pseudoscorpiones) of the Bureinskii Reserve and adjacent territories]. Regions in the condition of unsustainable development: Materials of the internetional scientific-practical conference " Issues of further development of Russian regions in the global financial crisis". Sharya, 23-25 April 2009. / Comp. A.M. Bazankov, I.G. Krinitsyn, A.P. Lipayev. Sharinskaya branch of Kostroma State University, 2: 215–216. (in Russian)

Trilikauskas L.A. 2015. [On the harvestman genus *Sabacon* (Opiliones: Sabaconidae) in the specially protected nature territories of Siberia and the Russian Far East] // Mountains ecosystems of South Siberia: study, conservation and rational nature use. *Proceeding of the Tigirek State Natural Reserve. Barnaul*, 7: 236–238. (in Russian)

Tsurusaki N. 2003. Phenology and biology of harvestmen in and near Sapporo, Hokkaido, Japan, with some taxonomica notes on *Nelima suzukii* n.sp. and allies (Arachnida: Opiliones) // *Acta Arachnologica*, 52(1): 5-24.

Tsurusaki N. & Minato H. 2000. Opiliones of Wakayama Prefecture, Honshu, Japan. Nankiseibutu: *The Nanki Biological Society*, 42(1), 3–8.

Tsurusaki N. & Song D. 1993. Two new species of *Sabacon* from Sichuan Province, China (Arachnida: Opiliones: Sabaconidae*). Zoological Science*, 10: 155–159.

Received: 09.11.2016.
Accepted: 28.11.2016.