

—Review—

## Yoso-Tama-No-Kakehashi; The First Japanese Guidebook on Raising Rats

Takashi KURAMOTO

*Institute of Laboratory Animals, Graduate School of Medicine, Kyoto University,  
Yoshidakonoe-cho, Sakyo-ku, Kyoto 606-8501, Japan*

**Abstract:** During the 18th century, raising the “nezumi” rodent became so prevalent in Japan that two guidebooks were published on the topic. The first guidebook was entitled *Yoso-tama-no-kakehashi* (1775) and the second was entitled *Chinganso-date-gusa* (1787). It remains unclear in these texts whether the term nezumi was used to refer to the rat (*Rattus norvegicus*) or the mouse (*Mus musculus*). In this review, I explore *Yoso-tama-no-kakehashi* (English translation: A bridge to obtaining novel jewel-like nezumi). It was written by the owner of “Shunpo-do” and comprises two volumes; the first is 34 pages in length and the second is 14 pages. It introduces the nezumi and then provides details on novel varieties and the methods that were used to raise them. The nezumi dwells in peoples’ homes. It is noteworthy that the “norako” species is classified in the same group as the nezumi. The norako is smaller than the nezumi. Its alias is “hatsuka-nezumi”, a term which is still used in Japan today when referring to the mouse. This indicates that when the guidebook was written people distinguished the rat from the mouse by identifying the rat using the word nezumi and the mouse using the word norako. Moreover, I recently confirmed that the rat varieties which are introduced in *Yoso-tama-no-kakehashi*, such as “white”, “spotted”, “black bear-like”, “deer-spotted”, and “cracked-mark”, can be found in modern laboratory rats. Taken together, it is very likely that the term nezumi is used to refer to the rat in *Yoso-tama-no-kakehashi* and that this was indeed a guidebook on the rat.

**Key words:** domestication, mouse, mutant, nezumi, rat

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### Introduction

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During the Meiwa period (1764–1771) of the Edo era in Japan, the hobby of raising nezumi as pets became prevalent in Osaka. By that time, nezumi had been domesticated. People were anxious to breed nezumi that had unusual coat colors and patterns that nobody had seen before. Unusual coat colors included “white”, “egg color”, “pale purple”, and “lilac”, and examples of un-

usual patterns included “spots”, “bear spots”, and “deer spots”.

In those days, two books were published which were used to introduce different varieties of nezumi to people and to encourage them to raise this type of rodent. The first was entitled *Yoso-tama-no-kakehashi* (1775) and the second was entitled *Chinganso-date-gusa* (1787). Because the original copy of *Chinganso-date-gusa* had survived, it was introduced to the scientific community

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Address corresponding: T. Kuramoto, Institute of Laboratory Animals, Graduate School of Medicine, Kyoto University, Yoshidakonoe-cho, Sakyo-ku, Kyoto 606-8501, Japan

as an eighteenth century Japanese guidebook on mouse-breeding by Dr. Tokuda in 1935 [9]. He pointed out that in this document, the term nezumi refers to the mouse (*Mus musculus*). When explaining the “mame-nezumi” variety, he noted that he was not sure himself whether or not the term mame-nezumi refers to the mouse, or the term nezumi refers to the rat. However, given the word for the mouse that is used in classical Japanese, the size of the nezumi that are illustrated in *Chinganso-date-gusa*, and the asymmetrical “piebald” pattern that can be found in the modern mouse mutant, he concluded that the term nezumi means the mouse. His conclusion formed the basis of the description of the origins of the modern laboratory mouse [12].

*Yoso-tama-no-kakehashi* is composed of two volumes. The first volume has survived but the text has not yet been translated into modern Japanese. The second volume was previously thought to be lost. Given the appearances of the nezumi in the illustrations, Serikawa recently concluded that the term nezumi as used in the first volume refers to the rat [7, 8]. It seems that *Yoso-tama-no-kakehashi* was referenced in *Chinganso-date-gusa*, because some of the content of both is similar. For example, the illustration that depicts the bear-type coat color seems to be identical. Thus, if one were to specify the species that the term nezumi denotes in *Yoso-tama-no-kakehashi*, it would be helpful for identifying the species that are referred to in *Chinganso-date-gusa*.

While looking for the original copy of the second volume of *Yoso-tama-no-kakehashi*, I came across full page images of it that are stored in the Internet archive of the National Diet Library (<http://www.ndl.go.jp/nature/thum/004.html>). Subsequently, I obtained the full text of both volumes that were translated by an expert on classical Japanese language. After reading the text, I believe that the term nezumi as it appears in *Yoso-tama-no-kakehashi* refers to the rat. Moreover, I recently showed that modern laboratory rats or those that are derived from current fancy rats exhibit coat colors or coat patterns which are similar to those that are mentioned in *Yoso-tama-no-kakehashi*. Here, I introduce the contents of *Yoso-tama-no-kakehashi* and clarify the meanings of some parts of that text. I also advocate that the term nezumi refers to the rat.

**Table 1.** Contents of *Yoso-tama-no-kakehashi*

Volume	Contents	Pages	
Volume 1	Preface	1–8	
	Introduction	9–22	
	Taxonomy	23–34	
Volume 2	How to raise rats	Rat varieties (1)	2–3
		Disease treatment	3
		Raising pups	3–4
		Food	5
		Rat varieties (2)	5–9
		Mating	9–10
		Housing	10–11
		Taming	12
		Trading	13
		Credits	14

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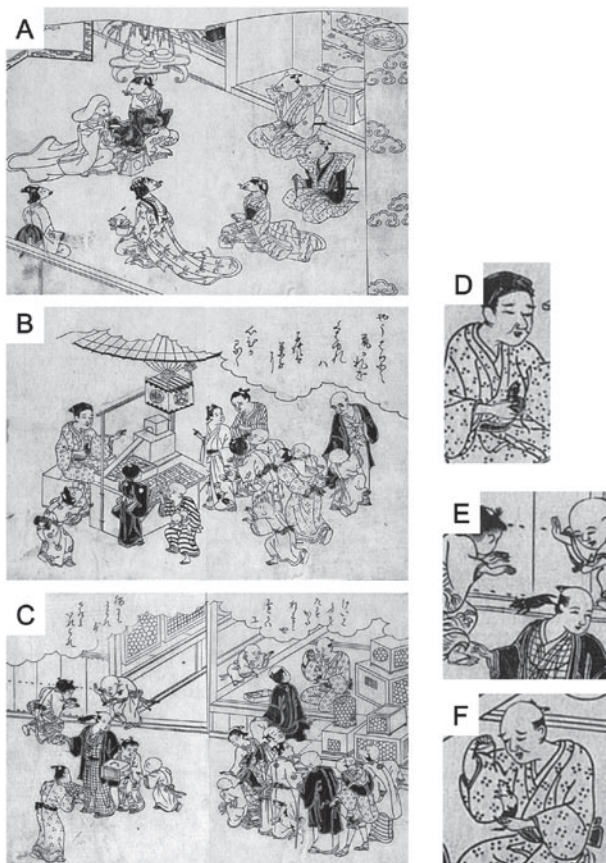
***Yoso-Tama-No-Kakehashi:***  
**An Eighteenth Century Japanese**  
**Guidebook on Raising Nezumi**

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*Yoso-tama-no-kakehashi* (English translation: A bridge to obtaining novel jewel-like nezumi) was published in Osaka in the fourth year of the An’ei era (1775). It was written by the owner of “Shunpo-do”, whose real name is unknown. It comprises two volumes; the first is 34 pages in length and the second is 14 pages. To make it easy for even children to understand its contents, comic-style illustrations are used. In total, 14 illustrations are used, some of which are accompanied by “Kyo-ka”, a popular type of tanka poetry (Fig. 1).

The author fancied nezumi and raised many novel types. His colleagues shared the same hobby and created a group to exchange information on the subject, and he published a book through which he could share his know-how with them. Through this guide, he advised his readers on how to improve the methods that were used to raise nezumi and he encouraged them to obtain their own rare specimens, which he called “jewels”.

After the preface which was provided by Kan-ga-sho, the author introduces old Japanese and Chinese tales about nezumi, the different classes of nezumi, and those varieties which were prized at that time. He also provides his know-how on how to raise them (Table 1).



**Fig. 1.** Rats as illustrated in *Yoso-tama-no-kakehashi*. A) Spouse for a rat. There is a bride with whiskers. She is a rat, which is auspicious as well. There is a Japanese folk tale about a rat's wedding, the bride looks very happy even though she is a rat with whiskers. B) The candy stall and its owner who kept his rat at hand (close-up shown in D). A rat draws a lottery ticket gently and that attracts children whom want some sweets. There was a store where children could get sweets according to the number on a lottery ticket that is carried by a rat. C) In front of a rat trade shop. Children are running after a rat (colored black) that has escaped from the store (close-up shown in E). The owner has a spotted rat in his hand and is playing with it using a string (close-up shown in F). People have crowded around to watch. A rat doing a captivating trick is kept in the cage and will never be caught by a cat. If a rat can do a trick, he could get a cage and even a cat could not catch him.

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### The “Nezumi” Is the Rat, While the “Norako” Is the Mouse

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In *Yoso-tama-no-kakehashi*, the nezumi and twenty-two other species are classified in the same group. The group includes not only the rat and the mouse, but also

the mole, marten, mink, hedgehog, musk shrew, and flying squirrel. Detailed explanations for these species seem to have been reproduced from *Wakan-sansai-zue*, which is a Japanese encyclopedia that was published around 1712.

The nezumi is described as “being small, having a rabbit-like body shape with a hairless tail. Its coat color is dark grey, its whiskers are long, and its eyes pop out”. Meanwhile, it is noteworthy that the norako species is introduced as a specific type of nezumi. The term norako is also found in *Wakan-sansai-zue* but not in *Chingan-so-date-gusa*. The alias of the norako is “hatsuka-nezumi”. In modern Japanese, hatsuka-nezumi denotes the mouse. The detailed explanation of the norako is that “it is smaller than the nezumi and no more than ~6 cm in size. It is not a weaned nezumi that can be seen exiting the nest. Its alias, ‘hatsuka’, means small thing”.

Thus, it is reasonable to think that Japanese people at that time distinguished the rat from the mouse and referred to the rat using the term nezumi and to the mouse using the term norako. Therefore, *Yoso-tama-no-kakehashi* was written for the purpose of raising the rat, not the mouse.

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### White Rats and Spotted Rats Are the Major Varieties

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Several varieties of rats are introduced in *Yoso-tama-no-kakehashi*; the most important one is the white rat. Two kinds of white rat are mentioned; one is the “red-eyed white” and the other is the “black-eyed white”. Of the two, the black-eyed white was highly prized, because it was believed to portend prosperity. The other important variety was the spotted rat which had a black and white piebald pattern. The author advised that white rats should be mated with white rats and spotted rats should be mated with spotted rats. Mating one type with the other would result in a loss of their special characteristics and this should be avoided.

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### Other Varieties

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Although mating rats with different coats was often avoided, some people mated them to obtain other varieties. These varieties included the “bear rat”, “dwarf rat”,

“cracked rat”, “deer-spotted rat”, and “fox rat”. The bear rat possessed a black coat and a moon ring spot on its breast. The dwarf rat was much smaller in size than the common rat; its body size was no more than ~3 cm. However, it was not a mouse. Illustrations of the cracked rat show unilateral pigmentation on its head or hair that is divided to the left and right along the midline of the head with a white spot that traverses the bridge of the nose. The deer-spotted rat had a mottled pattern that is similar to the coat of a deer. The fox rat had a coat color that is similar to that of a fox and it also had a white belly. Additionally, “yellowish”, “bright red”, “lilac”, and “clay-pot” colored varieties of rat may have existed.

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### **Raising the Rat as Described in *Yoso-Tama-No-Kakehashi***

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The raising and breeding rats, including housing, food and water, and how to treat their diseases are described in *Yoso-tama-no-kakehashi*. Written below in italics are translated excerpts from its text.

#### *Housing*

*It is beneficial to use a large cage for raising rats. The width should be 36–40 cm, the height 42–45 cm and the depth 24–27 cm. It should be enclosed on three sides with plates. The front and bottom should be made from steel netting and drain board. Below the drain board, make a drawer that can be used for cleaning. Place a small hanging tray made of straw or a wooden box within the cage. It is also okay to enclose one of its corners. In all cases, put straw or cotton inside it. Place food into a sliced section of bamboo and water into a small cup. For the netting, if iron is not used then it will be chewed apart. For food, give white rice, rice grains or sticky rice cake. In the case of using rice grains, water must also be provided. There also is no problem with providing fresh fish or fresh vegetables. If they consume too many varieties of fish, their coat will lose its luster. If they are fed soya beans, their coat color will improve.*

#### *Breeding*

*To obtain offspring, it is best if the male is young and the female has reached maturity. Pups are usu-*

*ally born about twenty days after mating. After mating, the male and female should be placed in separate cages. At most, eight to nine pups can be produced, but there are cases where one or two are produced. About seventeen days after birth, their eyes will open and their coat will appear. Until their eyes open, they should be raised on mother’s milk. After their eyes open they will consume food other than milk. Therefore, until their eyes open, allow them their mother’s milk. It is also okay to give them sticky rice cake. In the case that the mother is absent and they have to be taken from the nest, warm them often, and give them hard candy that has been dissolved in water. It is also okay to give them human breast milk. In these cases, feed them until they have opened their eyes.*

Rats open their eyes within 14 to 17 days of age [5]. Although they are typically weaned at 20–21 days of age, they may be weaned successfully as early as 17 days [2]. Thus, it is reasonable to say that open eyes is a good indicator of having been weaned.

#### *Disease Treatment*

*In the case of illness, feed with broiled crayfish. It is also permissible to heat some camphor and fan the odor.*

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### **Rat Trade Shops in Osaka**

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At the end of *Yoso-tama-no-kakehashi* there is an introduction to five shops which bought and sold rats. Among them, four were located on Shinsai-bashi Street and one was located on Sanoya-bashi Street; they are located in present day Minami-senba, Chuo-ku, Osaka. What is interesting is not only the types of rats that were available for purchase but that it is recommended that they be taken home to be raised and bred to produce novelty rats. These rats could then be brought back to the store and sold. The owner of the rats and the store clerk probably negotiated the price of the rats (Fig. 1C).

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### **Fancy Rats of Today**

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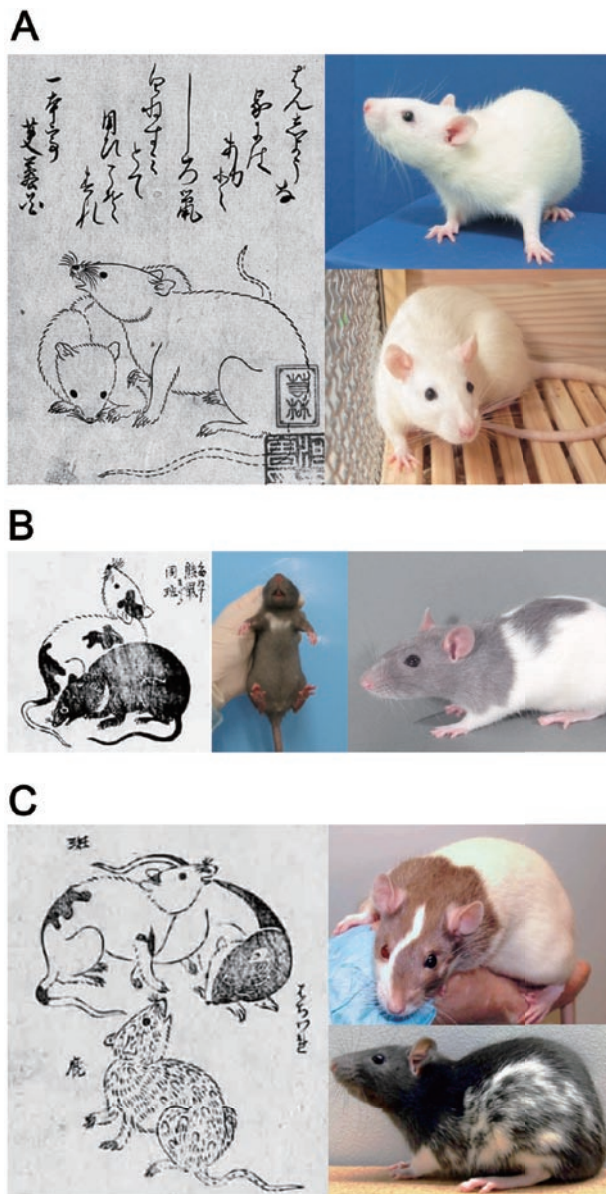
Even now, there are people who raise rats as pets. I visited a rat fancier in Kansas City, Missouri, USA in

2002. Her colony is named “Spoiled Ratten Rattery” (for details see <http://www.spoiledratten.com/index.html>). The rats live in several cages that are 60 cm wide, 40 cm deep and 80 cm high. A plastic chest with wheels is used as a breeding cage. If a female rat becomes pregnant, she is transferred to the breeding cage where she delivers her pups. She then feeds her pups for several weeks until they have been weaned. I was surprised at how accustomed the rats were to people and their variety. When I entered the room, they looked up as if to ask “who is this person? can you play with us?” When their owner opened

a cage, the rats licked my extended finger. When the owner spoke a name, a rat immediately came forward. This is also mentioned in *Yoso-tama-no-kakehashi* where “one can call out and rats will come to hand”.

### Rat Varieties in *Yoso-Tama-No-Kakehashi* Are Reproduced in Modern Laboratory Rats

Coat colors and coat patterns of the rat varieties that are introduced in *Yoso-tama-no-kakehashi* are found in modern laboratory rats. The red-eyed white is seen in albino rats. The black-eyed white is seen in the WS rat that is homozygous for the *Kit* mutation [10] and the KFRS6/Kyo rat that is homozygous for the Black eye (*Be*) mutation [3] (Fig. 2A). The spotted pattern is commonly seen in the hooded rat. The crescent-shaped white



**Fig. 2.** Novelty rats that are introduced in *Yoso-tama-no-kakehashi*. A) Left: Illustration of a black-eyed white with Kyo-ka. It is said that a prosperous family always has a white rat in their house, as a symbol of good luck. Upper right: the black-eyed white coat color can be observed in rats that are homozygous for the *Kit* mutation. The 12-bp deletion in the tyrosine kinase domain of the rat *Kit* gene results in defects in melanocyte progenitor differentiation and migration. As a result, melanocytes are not distributed in hair follicles [10]. Melanocytes in the eye can develop without expressing *Kit* and the irises of rats that are homozygous for the *Kit* mutation are pigmented. Lower right: the black-eyed white KFRS6/Kyo rat in a wooden cage that was remade based on information contained in *Yoso-tama-no-kakehashi*. The KFRS6/Kyo rat carries the autosomal dominant Black eye (*Be*) mutation. The *Be* mutation is dominant only in the presence of the homozygous state albino mutation [3]. B) Left: illustration of a spotted rat (rear) and a black bear rat (front). Center: the crescent-shaped white spot, which is like the black bear rat, can be obtained as F<sub>2</sub> progeny of Wistar/ST and BN/NSIc rats. This type of pattern is thought to occur when the multiple genes involved in producing white spots are combined. Therefore, it is difficult to fix the phenotype. Right: KFRS3B/Kyo rat that is carrying the hooded mutation. The hooded pattern can be modified by selecting in both directions toward more black and to toward more white [1]. Note that the KFRS3B rat carries the grey mutation and therefore the coat color pigmentation is diluted [3]. C) Left: illustrations of a spotted rat (left), cracked rat (right), and deer rat (front). Upper right: a cracked rat where the white spot traverses the bridge of the nose. This type of rat is found in the fancy rat-derived KFRS4/Kyo strain [3]. Note the different colors of the eyes. This strain may possibly be used as a model of iris heterochromia. Lower right: the spot coat color pattern is present in descendants of a modern fancy rat that carries the downunder mutation [6].

spot, which is like the “black bear rat”, can be obtained from F<sub>2</sub> progeny of Wistar/ST and BN/NSlc rats (Fig. 2B). The asymmetrical cracked pattern is seen in the KFRS4/Kyo strain [3]. The deer-spotted pattern is found in descendants of a modern fancy rat that carries the “downunder” mutation [6] (Fig. 2C).

Although the rat varieties present in *Yoso-tama-no-kakehashi* have been reproduced during 21st century, it remains unclear if any descendants of these varieties contributed to the establishment of modern laboratory rats. Literature or historical records about the establishment of modern laboratory rats are only available from 1906, when the albino rat stock were established at the Wistar Institute. The “Wistar rats” were disseminated from this commercial colony all over the world and genetically contributed to a major proportion of the established strains of rats [4]. Thus, as shown in mice [11], further study is required to generate highly dense phylogenetic trees of the rats, which may imply the origin of the laboratory rat.

In summary, *Yoso-tama-no-kakehashi* is a guide that was used for raising the nezumi. During the 1700’s, Japanese people distinguished the rat from the mouse by calling the rat, nezumi, and the mouse, norako. Coat phenotypes of the novel varieties of rat that appear in *Yoso-tama-no-kakehashi* are mostly seen in modern laboratory rats. Therefore, the animal that *Yoso-tama-no-kakehashi* focuses on is the rat.

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### References

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1. Castle, W.E. and Phillips, J.C. 1914. Piebald Rats and Selection; An Experimental Test of the Effectiveness of Selection and of the Theory of Gametic Purity in Mendelian Crosses, Carnegie Institution of Washington, Washington, D.C.
2. Kohn, D.F. and Clifford, C.B. 2002. Biology and diseases of rats. pp. 121–165. *In: Laboratory Animal Medicine* (Fox, J.G., Anderson, L.C., Loew, F.M., and Quimby, F.W. eds.), Academic Press, London.
3. Kuramoto, T., Yokoe, M., Yagasaki, K., Kawaguchi, T., Kumafuji, K., and Serikawa, T. 2010. Genetic analyses of fancy rat-derived mutations. *Exp. Anim.* 59: 147–155.
4. Lindsey, J.R. and Baker, H.J. 2006. Historical foundations. pp. 1–52. *In: The Laboratory Rat* (Suckow, M.A., Weisbroth, S.H., and Franklin, C.L. eds.), Elsevier Academic Press, Burlington, MA.
5. Lohmiller, J.J. and Swing, S.P. 2006. Reproduction and breeding. pp. 147–164. *In: The Laboratory Rat* (Suckow, M.A., Weisbroth, S.H., and Franklin, C.L. eds.), Elsevier Academic Press, Burlington, MA.
6. Perez, C. 2004. Unique dominant rat spotting gene known as australian downunder may represent a new major spotting gene of *rattus norvegicus*. *Pigment Cell Res.* 17: 451.
7. Serikawa, T. 2004. Colourful history of Japan’s rat resources. *Nature* 429: 15.
8. Serikawa, T., Mashimo, T., Takizawa, A., Okajima, R., Maedomari, N., Kumafuji, K., Takami, F., Neoda, Y., Otsuki, M., Nakanishi, S., Yamasaki, K., Voigt, B., and Kuramoto, T. 2009. National BioResource Project-Rat and related activities. *Exp. Anim.* 58: 333–341.
9. Tokuda, M. 1935. An eighteenth century Japanese guide-book on mouse-breeding. *J. Hered.* 26: 481–484.
10. Tsujimura, T., Hirota, S., Nomura, S., Niwa, Y., Yamazaki, M., Tono, T., Morii, E., Kim, H.M., Kondo, K., and Nishimune, Y. 1991. Characterization of Ws mutant allele of rats: a 12-base deletion in tyrosine kinase domain of c-kit gene. *Blood* 78: 1942–1946.
11. Yang, H., Bell, T.A., Churchill, G.A., and Pardo-Manuel de Villena, F. 2007. On the subspecific origin of the laboratory mouse. *Nat. Genet.* 39: 1100–1107.
12. Yonekawa, H. and Moriwaki, K. 1986. [Origins and development of laboratory mice: application of wild mice to breeding of new laboratory strains]. *Tanpakushitsu Kakusan Koso* 31: 1151–1170 (in Japanese).