

# Thirty-fo bug-colle and beetle Entomology in m

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many popular video games. In fact, the modern market for insects and entomological accessories in Japan has annual sales of tens of millions of dollars (Kristof, 1999).

The purpose of this paper is to provide an overview of how insects are integrated into Japanese culture today. The paper is organized into four sections, each of which focuses on a key issue pertaining to insects in modern Japanese culture: 1) Japanese children and entomological education; 2) entomological supply stores and the unique equipment used by Japanese entomologists; 3) the plethora of insect collectors and personal insect collections in Japan; and 4) the recent popularity of breeding and selling live beetles. This paper is not about institutional research, but the large Japanese population of insect hobbyists, enthusiasts, and the culture that surrounds them.

## Japanese children and insects

Japanese children generally learn about insects from reading, taking science class, watching educational television, playing video games, or by directly observing live insects. Education focuses particularly on the life history of charismatic insects such as butterflies, cicadas, and large beetles. Young boys especially develop a liking for horned rhinoceros and stag beetles, and these beetles are often reared from grubs and kept as pets in their homes. Children in the suburbs can still find many large beetles in their natural habitat, and are frequently seen in the summer carrying insect nets in parks (Fig. 1). However, Japanese kids in urban areas must find an alternative for obtaining beetles, as many once-familiar insects have become increasingly rare.



*"Bug museums, bug zoos, bug exhibits in department stores, street-corner vendors selling crawling, flying and creeping creatures. Much of Japan may have been paved over, but the Japanese retain a special fondness in their hearts for the insects..." (Hiatt and Shapiro, 1988: A29).*

**Fig. 1.** Japanese children collecting insects in a city park in the summer.

As American entomologists, we are often unaware of how insects are integrated into other cultures. In Asia, insects first appeared on traditional Chinese and Japanese ornamental artwork dating before 600 A.D. (Crambrot, 1994). During the Meiji period (1868-1912), mushiya, or insect shops, sold collecting equipment and singing insects in cages (Laurent, 2001). Although there are no longer insect shops that specialize in singing insects, insects are still integrated into the bustling metropolises of modern Japan—charismatic insects regularly appear on candy wrappers and children's toys and are the central theme to



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In order to support the growing need for beetles, some Japanese companies have sold live beetles in vending machines (May, 1999). Live beetles are also accessible to children through beetle petting zoos (Fig. 2) and beetle conservation programs. In response to the declining population of stag beetles, a park in Yokohama developed a conservation-driven “Stag Beetle Foster Parent Program” in which a child could take a pair of lucanids to his home over the summer. At the end of the summer,

the child would bring back eggs produced by the pair, and the eggs would be returned to the park. The program was apparently so popular that the park had to hold a lottery to choose the children who would foster beetles (Hiatt and Shapiro, 1988). Not only does this program help restore the declining population of lucanids in Yokohama, but it also helps educate children about beetles and their conservation.

Live charismatic beetles can also be acquired from Japanese department stores. Part of the pet section in a Japanese department store is converted during the summer into an “insect corner” where different species of beetles are sold in cages, along with basic insect collecting and rearing equipment, general entomology books, and plastic cages (Fig. 3). These beetles are sold as pets, and they are displayed alongside cat toys, dog food, and goldfish. A male of the large, horned Japanese rhinoceros beetle, *Allomyrina di-*



**Fig. 3.** The “insect corner” of a department store, where basic collecting and rearing equipment are sold.



**Fig. 2.** A beetle “petting zoo” in Shizuoka, Japan. Children can pick up and play with live scarab beetles.



**Fig. 4.** Male “Kabuto-mushi,” the common Japanese rhinoceros beetle, *Allomyrina dichotoma* L.

*chotoma* L. (Fig. 4; commonly known as “Kabuto-mushi” in Japanese) typically costs ¥400 – ¥800 (approximately \$3.50 – \$7.50), while a female, without horns, is cheaper. Department stores also frequently sell live adults of *Meloidomorpha japonica* (de Haan), a cricket-like orthopteran called “Suzu-mushi,” males of which produce a beautiful musical call. Sold alongside Suzu-mushi are bags of sand and small wooden “cricket chewing blocks” developed for these singing pets. As a child growing up in Tokyo, I frequently went straight after school to the pet section of a nearby department store to watch live insects and read about them in children’s books.

Very few Japanese books that include insects portray them negatively—most are written to teach kids insect facts, and many entomological books focus on interesting features of insects. Many educational books for children are “zukan,” or “illustrated guides,” each on a particular subject, and typically part of a larger series (Fig. 5). Each zukan is like an encyclopedia on a different subject: one volume may be on insects, another on trains. Zukan are filled with photographs and illustrations, and children’s zukan frequently include cartoon characters to help illustrate particular concepts. Children’s entomological zukan are typically on domestic Japanese insects. One of the most popular children’s zukan series is the Shogakukan series, which has several volumes on entomology (e.g., *Insect Zukan* (Koike et al., 2002), *Scarab and Stag*



**Fig. 5.** Children’s zukan in a bookstore in Tokyo. Many zukan are on insects, and each volume is usually part of a larger series.

*Beetles* (Koike et al., 2006), *Butterflies of Japan* (Nakayama and Umino, 1985)). There are also zukan on the life history of a familiar insect such as a common butterfly (e.g., Cabbage Butterfly, *Pieris rapae*), or rare species such as *Sasakia charonda* (Hewitson), for the advanced reader. Nearly all entomological children’s zukan include a section which helps teach them how to collect insects and make an insect collection. In addition to zukan, insects also play a central role in many children’s storybooks, similar to the American classic, *The Very Hungry Caterpillar* (Carle, 1981). In a bookstore in Tokyo, I recently counted twelve different storybooks on insects for children. Boys are often found in the entomology section of a bookstore frantically reading about insects (Fig. 6).



**Fig. 6.** Young boys reading about insects in the entomology section of a bookstore.

There are also children’s books that are translated into Japanese directly from old Victorian entomological literature. The most popular of such books is the ten-volume series written by Jean-Henri Fabre (1823-1915), the autodidactic French entomologist who is famous for his observations on insect behavior. The series, *Souvenirs Entomologiques* (Fabre, [1879-1907]) has been translated by multiple Japanese publishers and is available for both children and adults. Fabre’s books have become so popular that in the summer of 2005, the 7-Eleven convenience store chain gave away plastic renditions of various insects that Fabre studied as a promotion to help boost sales (<http://www.sej.co.jp/campaign/fabre.html>). The eight replicas included a dung beetle, *Scarabaeus typhoon* (Fischer-Waldheim) rolling a large piece of dung; a carabid, *Carabus auratus* (L.) capturing a snail; and a sphecid wasp, *Podalonia hirsuta* (Scopoli) hunting a caterpillar (Fig. 7). These renditions were given to any customer who bought selected bottled drinks. Can you image the reaction of a 7-Eleven customer in the United States if given a ball of plastic dung with a beetle figurine as a gift for purchasing a bottle of Coke?

There are also festivals in Japan which promote insect education. One of the most popular festivals during the summer is “hotaru-matsuri,” the firefly festival. The hotaru-matsuri takes place during June





**Fig. 7.** Four of the eight entomological toys given away by 7-Eleven during the summer of 2005. Jean H. Fabre's classical entomological research was chosen as the theme in order to boost sales of bottled soft drinks.

and early July in many cities and towns throughout Japan, and usually draws a large crowd eager to see fireflies. Festivals are held at night, typically in a local city park where there is a stream. Many local vendors participate in these festivals and sell food, insect toys, and small cages containing live fireflies. There is usually a trail alongside a stream where fireflies fly freely, and visitors can read about life histories of different species on pamphlets and boards posted along the trail. In addition to firefly festivals, Japanese children can also observe live insects in the many beetle and butterfly houses or learn about insects on television.

The main Japanese television station, Nippon Hoso Kyoku (NHK), has a subsidiary called “Kyoiku Terebi” (or “Educational Television”), which broadcasts children’s educational programs during weekday mornings. Each of these shows is typically a fifteen-minute program hosted by an animated mascot and a young student. Japanese elementary school classrooms typically have a television for viewing these short programs. Topics for these shows range from biology to economics, and classes are usually scheduled to coincide with a particular subject’s broadcast. There are several programs on organismal biology in which a different topic is discussed each week. Episodes frequently cover the life history of a familiar Japanese insect, such as the Cabbage Butterfly (*Pieris rapae* L.), Oil Cicada (*Graptopsaltria nigrofasciata* [Motschulsky]), or White-spotted Asian Longhorned Beetle (*Anoplophora malasiaca* [Thomson]).

A typical grade school classroom has a cage containing amphibians, crustaceans, fish, or insects. Students work in groups and take turns caring for these animals. *Pieris rapae* caterpillars are fed cab-

bage leaves, while beetle grubs and dirt are sprayed with water on a daily basis. Since these larvae are usually collected outdoors, they are occasionally parasitized. Students learn about predation and parasitism through direct observation at a very young age.

In Japan, documentaries on insects are not only televised on cable channels equivalent to The Discovery Channel or Animal Planet, but regularly on standard channels. Popular television quiz shows frequently include questions pertaining to entomology, and manga cartoons and animation films often feature insect themes. Japanese animations containing insects have even reached the United States—Pokemon’s Caterpie, for example, was influenced by the life cycle of a butterfly. He first resembles a caterpillar and then becomes Metapod (a pupa-like character) before becoming Butterfree, a figure resembling a butterfly. Animation films such as Hayao Miyazaki’s *Nausicaä of the Valley of the Wind* (Miyazaki, 1984), and *Princess Mononoke* (Miyazaki, 1997) also include many insect conservation



**Fig. 9.** A talking stuffed beetle hat. The image in the upper right corner of the package shows how the hat should be worn.



**Fig. 8.** Beetle stickers sold in a toy store in Tokyo. “Kuwigata” and “Kabuto” refer to stag beetles and rhinoceros beetles, respectively.



**Fig. 10.** A scarab and lucanid party costume. The image on the package shows how the costume could be worn to fight others wearing beetle costumes.





**Fig. 11.** The “Mogi-Mogi-Kontyu-Saishu” candy. The candy wrapper shows a child collecting insects. Note the bagworm larva on the top.

themes, and have received global attention as top environmental animation films.

Insects also frequently appear on Japanese children’s toys, costumes, and children’s snacks. Toy stores often have a section on beetle paraphernalia such as beetle puzzles, and stickers (Fig. 8), and sometimes even sell talking stuffed beetle hats for kids (Fig. 9), and inflatable scarab and lucanid party costumes (Fig. 10). Some children’s candies come with a free plastic beetle, and there is even a Japanese candy called “Mogi-Mogi-Kontyu-Saishu,” which translates as “Mogi-Mogi-Insect-Collecting.” The wrapper of this candy shows a child collecting insects (Fig. 11). There is a psychid (bagworm) moth larva at the top of the candy wrapper! Can you imagine a bagworm larva pictured on a wrapper of Skittles or M&M’s?

While war and combat video games are popular in the United States, there has been a recent surge in video games involving insects in Japan. Surprisingly, these games are not about exterminating giant bug-like alien monsters, but instead, most are about battles between real beetle species, breeding them, or making an insect collection. One of the current popular Japanese children’s video games is “Kontyu Ouja Mushi Kingu” (translated as “King of Coleoptera: Bug King”), first distributed by Sega in 2003 (<http://mushiking.com>).

Mushi-King is similar to Street Fighter® or Mortal Combat® in that it involves two characters that fight. However, the game differs in that all characters are beetles. Each beetle resembles a real beetle species, and is capable of particular battle moves.

For instance, Grant’s Rhinoceros Beetle, *Dynastes granti* Horn, found in the Southwestern United States, is olive-brown with black spots and can have special moves such as “dragon attack,” “tornado throw,” and “bull lock.” The player fights a different beetle enemy during each level until his beetle loses a battle.

Due to its popularity among children, the game can be purchased for Gameboy Advance®, has been made into an animation film, and Mushi-King tournaments are held at arcades throughout Japan. Mushi-King popularity is growing so rapidly in Asia that Sega has made Philippine, Singaporean, and Taiwanese arcade versions of the software (<http://web-japan.org/kidsweb/cool>).

html). In the arcade version (Fig. 12), a card depicting a particular lucanid or rhinoceros beetle (Fig. 13) comes out of a slot once a ¥100 coin is inserted into the machine. A game mode is chosen, and the game begins when the player swipes his bar-coded card in the card-reader. In addition to beetle cards, there are also skill cards, which when used in combination with a beetle card will allow the beetle to perform advanced moves. In total, there are 856 different beetle and skill cards. Each beetle card includes the species’ scientific name and an explanation of its approximate size, habitat, and distribution.

In two years since becoming available, 256 million colorful Mushi-King beetle trading cards were sold (Wallace, 2005). According to the videogame magazine *Famitsu* (<http://www.famitsu.com/>), Mushi-King was the best selling videogame for GameBoy Advance in June 2005, selling 220,000 copies in one month. Mushi-King paraphernalia such as stuffed animal beetles and key chains are regularly sold in Japanese arcades. The videogame



**Fig. 12.** Mushi-King arcade videogame machines. Photograph taken in a department store in Yokohama.



**Fig. 13.** Mushi-king playing cards. The full set includes over 800 species and skill cards.

was so popular that it inspired the international commuter airline, Japan Airlines, to decorate one of its planes with illustrations of some of Mushi-King's main characters.

There are also video games such as "Kontyu Monster Battle Master," and "Kontyu Monster Battle Stadium," both for GameBoy Advance. These are simulation games that involve rearing powerful beetles and battling them. According to the Nintendo Japan website (<http://www.nintendo.co.jp/>), Kontyu Monster Battle Stadium includes a "DNA evolution system" that allows the player to extract DNA from a beetle that has been bred to create more powerful offspring.

Another children's entomological videogame is "Za Kontyu Saishu" (or "Bug Collecting") designed for Sony Playstation 2® (Fig. 14). This game differs from the games previously described in that the goal of this game is to collect insects. The main character in the game is a ten-year-old boy named Shota, whom the player controls. When the game begins, Shota is left on an isolated island somewhere in the middle of the Pacific Ocean. The island has an entomological laboratory owned by a 70-year-old entomologist, Dr. Takagi. The professor of entomology informs Shota that all of his laboratory insects have escaped, and that Shota must retrieve the 300 insect species from the island. Insects that appear in the game are mainly Japanese species, but some charismatic exotic taxa are also included. With a ten-year-old female companion named Misaki, Shota uses a variety of entomological equipment, such as aerial and aquatic nets, jars, and insect sprays. The game even includes a lantern for attracting nocturnal insects.

Za Kontyu-Saishu is very similar to first-person shooter video games like Doom®, but instead of walking around with a gun, the player carries different kinds of nets and interchangeable collecting equipment. Insect specimens vary in size, sex, and abundance. The behavior and activity time for each insect reflects the true natural history of the species. Specimens brought back to the laboratory are databased into Dr. Takagi's card catalog. Once databased, the player can look up the species in the catalog and learn interesting facts about the insect, such as its natural history and distribution. For example, if the player collects *Bombus ardens* Smith (Apidae), the information box reads, "This species is rather similar to *Xylocopa appendiculata*, but differs in that its body is more hairy, and has an orange patch on the posterior tip of its abdomen. The bee is active during the spring and early summer, and can be found even in urban areas." The player can also zoom in on the insect and look at it up close. If the player collects a male cicada or a male orthopteran, the information box will often provide an aural sample of its mating call. Not only is this game educational because it teaches children interesting facts about insects, but the player must know a little about the insect's life history and behavior to collect it. For instance, if the player tries to collect a stinkbug with an aquatic net, the hemipteran will likely escape through large seams

in the netting and fly away. The game also includes Payan, a thirteen-year-old assistant of Dr. Takagi. The unfriendly Payan is Shota's rival, and reveals collecting tips if Shota's insects can beat Payan's bugs in one-on-one competitions such as "dragonfly races," "beetle battles," and "grasshopper jumping competitions."

Nintendo has its own versions of insect collecting games such as "Kontyu Hakase" ("Doctor Entomologist") for GameBoy Advance, and the recently released "Za Mushi-Tori Okoku" ("The Bug Collecting Kingdom") for the portable Nintendo DS® entertainment system. Kontyu Hakase requires the player to collect 250 insects and construct a zukan. The player begins as a novice entomologist but gradually improves his collecting skills and broadens his insect knowledge by developing entomological contacts and upgrading his collecting equipment.

Za Mushi-Tori Okoku is similar, but differs in that the player carries a simulated zukan, which he uses to identify insects and record collecting data. The player must also know the food source of each insect because he will have to feed it so that it can survive. Za Mushi-Tori Okoku includes 400 insect species and contains unique features such as allowing the player to discover new species and hybridize existing species to create new subspecies.

The increasing number of entomological video games available for Japanese children was developed not only to capture the children's interest in insects, but also to target parents. According to the developers of Mushi-King, the incredible success of this videogame can not only be attributed to children's interest in insects, but because "the parents ... can relate to [beetles] as well. Fathers remember catching and keeping beetles when *they* were kids" (Wallace, 2005: A9). If Japanese parents had not learned about entomology during their formative years, they probably would not purchase these educational games for their children.

It is therefore a combination of the parents' entomological experiences during childhood and the plethora of available entomological resources that helps educate children about entomology in Japan. When these children become parents themselves, they too are likely to participate in their child's entomological education. This education process can continue over generations, and helps strengthen the society's overall appreciation for entomology and natural history. Although video games on insects were not developed until recently, other resources have been available for many years in Japan. One such resource is entomological supplies.



Fig. 14. "Za Kontyu Saishu" insect collecting videogame.





**Fig. 15.** The Shiga-Kontyu entomological supply store, located in Shibuya, Tokyo.

### Entomological Supplies

If it were not for my father's childhood experiences and the availability of Japanese entomological supplies, I am fairly certain that I would not be writing this article today. The day that helped direct my career path as an entomologist came when my father walked into a Japanese department store and accidentally came upon insect collecting equipment. He bought a net for me that day, as the equipment in the store brought back memories of his childhood experience rearing the papilionid butterfly, *Luehdorfia japonica* Leech. I was immediately captivated by the net, became fascinated with collecting, and collected anything that moved. Other entomological supplies and zukan quickly followed. During elementary school, I learned that a Japanese supply company was distributing its products to department stores, making it easier for the general public to purchase entomological products.

That company is Shiga Kontyu, one of the oldest Japanese entomological supply companies, open since 1931 (Fig. 15). Shiga Kontyu is located in central Tokyo, and sells entomological supplies such as vials, forceps, drawers, nets, spreading boards, and envelopes, in addition to entomological literature and dried specimens. The owner of the store is the 103-year-old Mr. Utsuke Shiga, who has perfected his equipment over the years to meet the needs of many Japanese entomologists. Although Mr. Utsuke Shiga does not manage the store anymore, he still occasionally visits. His career as an entomological supplier is discussed in his autobiography (Shiga, 2004).

Japanese collecting equipment is fairly standardized, and most Japanese entomologists use similar equipment. Japanese lepidopterists and odonatists typically do not use rectangular envelopes, but instead use triangular ones, mainly because triangular carrying cases are available (Fig. 16). These triangular cases, made of metal or hard leather, protect papered specimens in the field. The case can hold over one hundred envelopes, and can be tied to a string and carried around the neck or attached to a waist belt. Triangular boxes allow collectors to paper specimens quickly in the field, and some triangular boxes have additional straps to hold killing jars.

There are three general types of Japanese telescopic net shafts: aluminum, bamboo, or graphite (Fig. 17). Nets come in various lengths, ring diameters, cloth materials, and colors. Most net parts are interchangeable, and different net colors are supposedly better suited for collecting different insects. According to a saleswoman at Shiga Kontyu, dragonfly collectors prefer black, green, and red nets, while blue nets are preferred by collectors after morphos and particular papilionid butterflies. The standard Japanese aluminum telescopic net (approximately ¥6000, \$50) is light, flexible, and can easily fold and fit into one's backpack. Nearly all insect enthusiasts in Japan have one of these nets, regardless of the kind of insects they study. Unfortunately, these nets are not available from BioQuip® or other suppliers in the United States.

**Fig. 16.** Triangle envelope carrying case. This case has straps along the side to allow the collector to carry tubes and killing jars.



**Fig. 17.** Three main types of entomological net shafts. From top to bottom: aluminum, graphite, bamboo.



There are also very long telescopic extension nets that reach nearly 30 feet, which are great for collecting canopy insects (Fig. 18).

Japanese entomologists generally use Shiga's stainless steel insect pins for specimens in their collection. These pins differ from typical Western pins in that they are slightly longer and do not have a large beaded head. Pins range from size 000 to 6, and are small-headed or non-headed. Non-headed pins are often used for photographing so that the body of the insect is not obscured by the pinhead. Pins come in sets of 100, and each pack is approximately ¥250 – ¥400 (\$2.10 – \$3.30). Minutens are also available through Shiga, but Shiga only sells one size, and they are longer than those sold in Europe or North America.

Numerous Japanese entomological supply companies sell spreading boards, but in my opinion, the best boards are made by the Art Inabaya Company, located in Tottori Prefecture. As with other Japanese spreading boards, Inabaya boards come in different widths, and some are slightly angled to prevent wing sagging. Inabaya boards are a bit pricey (ranging from \$14 to \$30 per board), but they are carefully crafted and reliable. Nearly all Japanese spreading boards are made from the soft wood of the Princess Tree, *Paulownia tomentosa* (Thunb.) Steud. Each is built to fit securely into a spreading board carrying case that allows drying specimens to be transported on boards without damage (Fig. 19). Also available are cork boards for spreading legs of Coleoptera and Hemiptera, and adjustable spreading boards in which the gap between the boards can be set to match the width of the insect's body.

Dried insect specimens are typically stored in a large black display case with a foam bottom, or smaller boxes made of cardboard or wood with a cork bottom. Some collectors have begun using unit trays for their collection, but unit trays are relatively new in Japan, and many collectors still pin specimens directly into the foam bottom of display cases. Standard Japanese black display cases are slightly larger than the Cornell drawer, and the lid of the drawer is much tighter than those sold in the United States. Lids are hand-crafted to fit very tightly to prevent dermestids and moisture from entering. Humidity in central Japan is very high during the summer, rarely dropping below 80% even on a sunny day. Some Japanese lepidopterists will refuse to open their drawers containing dry specimens on a rainy day in fear that the wings will permanently droop. Others even store their drawers containing Lepidoptera upside-down to prevent wing sagging.

Many tools are available for spreading and preparing specimens because specimen presentation is considered very important in Japan. Regardless of the taxonomic group, specimens in personal collections are usually spread with tremendous amount of care. For instance, most Japanese coleopterists will spread antennae and every leg so that the specimen is perfectly symmetrical. In fact, while I was growing up in Japan, I had never heard of field



Fig. 18. The 30-foot long extension net used to collect canopy insects.

pinning. It wasn't until I took a general entomology course as an undergraduate in the United States that I learned about this technique. The beauty of the insect, and the art of insect presentation, is particularly important in Japanese personal insect collections.

#### Personal Insect Collections, Publications, and Conservation

The availability of insect collecting equipment and supplies allows many Japanese insect hobbyists to make personal collections. There are thousands of personal insect collections throughout Japan, each kept in the private collector's small home. Most insect collectors are interested in Macrolepidoptera or charismatic beetles (typically Carabidae, Cerambycidae, Lucanidae, or Scarabaeidae). There are a few who collect other groups of insects, such as Diptera and Hemiptera, but these collectors are of the considerable minority.



Fig. 19. The spreading board case available through Shiga Kontyu. Spreading boards slide into the case and are firmly secured to prevent damage of spread material.



Regardless of the taxonomic group, most insect collectors take entomology very seriously, and self-train themselves in systematics and taxonomy. Many famous Japanese insect taxonomists are not affiliated with a university, but work from their home. They publish their findings regularly in Japanese journals and also publish many books on natural history, many of which include spectacular color photos.

Almost all collectors treat entomology as a hobby because insects do not provide a means for financial support (for exceptions, see section entitled "Beetlemania"). Financial support for most non-institutional Japanese entomologists comes from a full-time job that is unrelated to entomology. For example, a colleague of mine has compactors in his tiny attic in Tokyo, storing over 10,000 specimens of butterflies, but works as a salesperson and sells electronic household appliances as his profession. Many entomologists are eager to retire, as vacation days are limited for many full-time jobs in Japan. As soon as Japanese entomologists retire from their non-entomological occupation, they will often devote their time to documenting insect life histories or to collecting taxa that are not represented in their collections.

Charismatic Japanese insects are well studied, mainly because of the deep public interest in entomology. For example, there are approximately 230 species of native Japanese butterflies (Kawazoe and Wakabayashi, 1976), and there are more than fifty books on Japanese butterflies. While most are illustrated zukan for both children and adults, some books are guidebooks to collecting particular insects, such as butterflies. One such book is *Tyo no Saishu Mappu* (Nishiyama, 1984) which can be translated as "A collecting map for butterflies."

When I was a child attending elementary school in Tokyo, my father bought this book. During the summer, we took a three- to four-hour train ride at 4:00 a.m. every Sunday to look for particular species included in this butterfly treasure map. On one occasion, we went to look for *Favonius yuasai* Shirôzu, a relatively rare thecline lycaenid which flies in the canopy. When we arrived at the locality, I was shocked to discover over ten lepidopterists with their 30-foot extension poles lined up against a forest just after dawn. The scene reminded me of a line of trout fishermen along a stream in upstate New York. The lepidopterists were staring into the canopy waiting for the morning flight of the drab brown lycaenid. I was the luckiest eight-year old that day, because while the collectors were diligently looking into the canopy, a female *F. yuasai* landed on a low branch a few steps in front of me. It started raining heavily a few minutes later, and I may have been the only one that day to have collected the butterfly.

Butterflies are not the only insects popular with fanatic Japanese collectors. Ikeda (1999) discussed the craze surrounding particular Japanese cerambycids. He reports that during the few weeks when tiny, short-winged cerambycids in

the genus *Necydalis* are active, collectors will surround particular flowering trees. Collectors travel hundreds of miles very early in the morning to stake out flowering trees that are known within the cerambycid community to be "longhorn magnets." Ikeda mentions that some collectors will sit in a tree for more than three hours during the morning in an attempt to collect one specimen of a rare *Necydalis*. Speaking from experience, he states that one of the biggest problems is having to use the restroom while sitting in the tree. If he climbs down, he risks losing his spot to the many collectors waiting below.

Many Japanese entomologists have shifted their interest from native Japanese insects to those that are foreign. A switch often takes place once the collector has acquired most of the focal Japanese taxa of interest, and seeks foreign species because most Japanese charismatic insects are well studied and there are relatively few new discoveries to be made. Popular foreign countries among Japanese collectors are those that are geographically close to Japan, such as China, Russia, and Taiwan. As they have done for Japan, Japanese insect collectors have contributed significantly to furthering the understanding of insects from these neighboring countries, as new entomological findings are regularly published in Japanese and foreign entomological publications.

There are, however, particular problems with the abundance of Japanese private collections. One problem is that entomologists with private collections are sometimes unwilling to deposit scientifically valuable specimens in museums because specimens are treated as treasures of the collector. For example, type specimens are occasionally sold or traded. I have seen an instance in which a Japanese collector created a paratype series of over fifty specimens so that he could make a personal profit.

Another problem is over-collecting. Many private insect collectors do not have official collecting permits for neighboring countries, primarily because it is very difficult for private collectors to obtain them. Several Asian countries have recently enforced strict regulations against Japanese insect collectors, in fear of populations becoming extirpated. Although many discoveries are published and properly reported, insect specimens are almost always put into a private Japanese collection, and only occasionally is a voucher specimen deposited in the country from which it was collected.

In Japan, insects can be readily collected without a permit in most places outside of national parks and restricted areas. In order to prevent over-collecting of rare species, Japanese national and local governments have enforced regulations against collecting particular insects. Governments have recognized some species and localized populations as "Tennen Kinenbutu," or "national monumental things" (Sibatani, 1990). It is illegal to collect species that have been labeled as Tennen Kinenbutu anywhere in Japan.

According to the Japan Integrated Biodiversity

Information System (<http://www.biodic.go.jp/J-IBIS.html>), 66 of the 30,000 or so described Japanese insects are currently listed as endangered; most of these are butterflies, beetles and dragonflies. Two insects are listed as extinct, both carabid beetles: *Rakantrechus elegans* (Uéno), and *Ishikawatrechus intermedius* (Uéno). Unfortunately, proper management plans have not been implemented for many of these species or populations in most or all of their distribution, and many species have declined even in the absence of collecting pressure (Sibatani, 1990).

Development and destruction of natural habitat is the primary cause of decline in the number of particular Japanese insect species (Sei, 1988; Hama *et al.*, 1989; Sibatani, 1990). There have been many local efforts to conserve and protect such species, and these efforts are often organized by the insect collectors themselves. For instance, the Lepidopterological Society of Japan (LSJ), an organization of lepidopterists who are mainly collectors, held special symposia and published a multi-volume series documenting the decline and conservation needs for particular endangered Japanese butterfly species (Hama *et al.*, 1989; Yata and Ueda, 1993; Ae *et al.*, 1996; Tanaka and Arita, 1996). Successful conservation efforts for butterflies can be attributed to maintenance of natural habitat rather than formal prohibition of collecting, and LSJ has urged governments to restore natural habitats (Hama *et al.*, 1989; Yata and Ueda, 1993; Ae *et al.*, 1996; Tanaka and Arita, 1996).

Restoration efforts for insects often involve local Japanese residents. In Shizuoka, for example, Japan's national butterfly, *Sasakia charonda*, has become increasingly rare in recent years, and some local towns are planting its larval food plant in and around the city. Local elementary schools help plant these trees, and annually release captive-bred adults of this butterfly. As a result, populations of *S. charonda* in Shizuoka have been thriving (Kunihiko Kobayashi, pers. comm., 2000). There have been similar efforts to restore habitat for declining populations of dragonflies. A dragonfly pond restoration program was recently created, and there are now between 500 and 1000 artificial ponds for dragonflies in Japan (Primack *et al.*, 2000). There are also regional beetle conservation programs which focus on stag beetles and involve aid from local children (e.g., Hiatt and Shapiro, 1988).

Japanese collectors, breeders, and conservationists can readily publish their findings in any of the fifty or so Japanese journals on entomology that circulate in a country roughly the size of Montana. As in the United States, there are many regional and international entomological journals, and each journal publishes papers for a different entomological audience. While many peer-reviewed Japanese journals publish scientific research papers only, others are written for the broader community of insect enthusiasts. There are also journals that bridge the gap between hobbyists and professionals, including articles written by both. One such journal is *Gekkan Mushi*, published by Mushi-Sha,

which has its main office and entomological supply store in Nakano, Tokyo (<http://homepage2.nifty.com/mushi-sha/>). The journal publishes articles on all aspects of entomology in color, and like many other Japanese entomological journals, there are no page charges. In order to finance page costs, Japanese journals typically charge a higher price for membership than in the United States (approximately \$100 annually for *Gekkan Mushi*). To displace the high membership fee, some journals have special deals in which the fee can be reduced if that subscriber has multiple accepted papers to the journal in a given year.

Japan also has some extremely specialized journals which do not have counterparts in the United States. For instance, *Tinea* is a journal published by the Japan Heterocerists' Society, which specializes in moths, and *Rostria* is a journal on Hemiptera, published by the Hemipterological Society of Japan. In the early 1990's, there was even a journal called *Donaciist* which published articles solely on aquatic chrysomelid beetles.

Older journal issues can be purchased directly from publishers or through used bookstores that specialize in natural history. Two examples of used natural history bookstores are *Naturebook.net*, formerly known as *Baur and Sato Japan* (<http://www.insectbook.com/>), and *Nan-Yodo* (<http://www.nanyodo.net/>). The Hokkaido-based Nan-Yodo carries new and old Japanese entomological literature, much of which is quite rare. In addition to old entomological books, these used bookstores sell recent popular publications such as books on breeding pet beetles.

## Beetlemania

Within the past ten to fifteen years, beetle breeding and rearing has become extremely popular in Japan, and there are at least 300,000 beetle breeding fans in the country (Ida, 1999, Fig. 20). I have a Japanese friend who rears dung beetles as a hobby, and he stockpiles dung from various animals in Ziploc bags in his freezer at home. During the summer, he collects fresh dung at local farms to feed his pet beetles, and he keeps frozen dung for them until the winter. Each time he feeds his beetles, he thaws out the dung. His wife was very supportive of his hobby until one day, she took out one of the Ziploc bags, opened it, and pulled out what she thought was ground beef. He was lucky she didn't ask for a divorce – he was forced to buy a separate freezer for his dung collection.

Live lucanid stag beetles are also highly prized, especially foreign species and those in the genus *Dorcus*. Foreign species have become so popular that Japanese collectors are occasionally caught in



**Fig. 20.** Beetle breeding fans push and shove for a chance to buy their favorite live beetle at an insect fair.



**Fig. 21.** “Dorcus Jelly,” one of the many beetle jellies manufactured for rearing beetles.



other countries for illegally collecting and smuggling beetles (Stanton, 2001; Hall, 2003). After import restrictions for beetles were eased in 1999 when the Plant Protection Law was revised, hundreds of thousands of beetles have been brought into Japan annually (Mamemachi, 2005). In 2002, 96 beetle species from 25 countries, totaling 682,800 beetles, were imported (Hall, 2003), and Japan allowed the import of 505 beetle species in 2004 (Mamemachi, 2005). The Japanese government allowed beetles to be legally imported because it was assumed that tropical species have little chance of surviving in temperate Japan (Wayne Hsu, pers. comm.).

A species that has continued to fascinate beetle enthusiasts is the domestic lucanid, *Dorcus curvidens* (Hope), which has become increasingly rare in Japan. Due to its large mandibles and body size, live captive-bred males of *D. curvidens* are usually valued at \$30 – \$200 depending on their size. Although details remain somewhat unclear, on one occasion, a live male *D. curvidens* specimen over 80 mm long was believed to have sold for 10 million yen (~\$90,000 US dollars) (Anonymous, 1999; Ida, 1999). The pet beetle was apparently bred by an amateur breeder in Fukui Prefecture, brought to an insect specialty shop in Tokyo, and sold to an unidentified 36-year-old president of a Japanese communications company. To avoid media attention, the parties supposedly secretly met in a karaoke cubicle to make the transaction (Ida, 1999). At one point, these “black diamonds” were worth so much that collectors took out bank loans to have broken into insect stores in Tokyo and stolen \$67,000 worth of beetles (Anonymous, 1999).

In response to such demand, many coleopterists developed specialized techniques to grow large beetles in captivity. For example, there are lucanid-grub rearing jars containing fungi called “Kinshi-bin,” which are available in department stores, along with large bags of beetle dirt. These bags of dirt typically contain oak chips, dung, and fungi. The price of a 1 kg bag ranges anywhere

from \$4 to \$25, depending on the quality of the dung and dirt. A substance similar to oak sap is sold in small bottles or as individually-sealed jellies for adult beetles. Beetle jellies such as “Dorcus Jelly” (Fig. 21) are manufactured to help beetles live longer. Such jellies cost approximately \$12 for a large bag. Other beetle jellies include “Hyper Jelly,” “Power-up Jelly,” and “Wellness Jelly,” which are presumably for lethargic beetles. Some varieties contain high amounts of protein and are produced solely for female beetles, so that they will lay many large eggs. Spray bottles containing pheromones can be purchased and sprayed on the elytra of female beetles, which stimulates males to copulate (Fig. 22). Other tools for beetles include tongs designed to pick up grubs, scent removal powder and sheets, and a toothbrush designed to remove mites from beetle sterna (Fig. 23). There is a plethora of literature on breeding lucanids and scarabs that focuses strictly on techniques for care, rearing, and measurement. Many of the standard beetle rearing supplies are available from insect specialty shops, but can also be purchased from the pet section of Japanese department stores.

The price of beetles has declined over the last several years, mainly due to the number of beetle suppliers and improved techniques and resources for rearing large beetles, but some rare breeds are still quite expensive. I have a friend in Japan who bought a Ferrari several years ago with money he saved from selling beetles in his beetle store. Maybe someday caterpillars and maggots will be worth as much as Japanese lucanid grubs!

## Conclusions

The insect theme can be found all over Japan today, on children’s video games, books, candies sold in convenience stores, and pet beetles in department stores. Japanese children are educated



**Fig. 22.** Spray bottles containing lucanid pheromones that stimulate copulation.



**Fig. 23.** Japanese rearing equipment for beetles and other pet insects sold in a department store.

From left to right:

1. tongs for picking up beetles;
2. a toothbrush for removing mites from beetle sterna;
3. powder for mite removal;
- 4, 5, 8. small and large fruit fly contraption cases;
6. powdered insect scent remover;
7. scent removal and substrate hydration sheet;
- 9, 10. fruit fly prevention sheets.

about insects through reading, watching television programs, playing with insect-related toys and video games, and from collecting insects. When these children become adults, they help teach their children about entomology, and an interest in entomology continues for generations. Unfortunately, insects do not have their own place in American department stores, there are relatively few toys or video games that promote entomological education in the United States, and it is unusual to see American children frantically reading books on entomology in a bookstore. Having lived in both countries during my childhood, I believe our society often portrays insects as being scary, gross, and creepy, which in many cases is misleading and scientifically inaccurate. Reality television shows with disgusted participants who are forced to eat bugs do not help teach the general public about natural history. Nor do Hollywood films depicting monstrous insects and arachnids help educate children or their parents.

As American entomologists and educators, we must change the general misleading perception that frequently surrounds insects in our country. Negative perceptions associated with insects often develop from a lack of understanding about insects. Many of our children are brainwashed during their formative years to believe that they should stay away from insects. The American entomologist Harold Ensign Evans once wrote:

*"Biased we are, for most of us are brainwashed in childhood against anything devoid of hair or feathers ... Even a mature and thoughtful man, imbued with reverence for living things, has not quite the same feeling for a beetle that he has for a squirrel"* (Evans, 1968: 82).

There are certainly American children who are eager to learn about insects, and American books and movies that help educate children about entomology. However, it is hard to compare our children to Japanese kids, who will fight to grab a

beetle as soon as they see one.

Children have an innate curiosity to learn about natural history. It is imperative that we aid their curiosity and teach them about this subject, as it introduces a child to biodiversity, scientific experimentation, and the basics of life. In a recent article on insect culture in Japan, Erik Laurent wrote:

*"[Japanese children] learn very early, for instance, that fireflies, rhinoceros beetles, and other creatures appear and then die during a limited period of the year. [Insects] give children concrete material for their experimental dialogue with nature and introduce them to biological diversity. An insect's relatively short life span also teaches them about ontogenetic development and the cycles of life."* (Laurent, 2001: 71).

Educating children about biodiversity is especially critical, as we are facing a biodiversity crisis and more organisms are becoming extinct than ever before (Wilson, 1985, 1988). Insects are one of the most diverse groups on the planet, but we will never know what existed when it disappears. Furthering our understanding of insect diversity requires countless taxonomic specialists and students training in taxonomy (Wilson, 1985; Wheeler, 1990, 1995; Wheeler *et al.*, 2004). Unfortunately, doctoral degrees in all fields of systematics have declined in the United States (Nash, 1989), and few undergraduate programs teach taxonomy (Schrock, 1989). It is much easier for a child to become an insect taxonomist when insects are accepted and integrated as part of culture.

Over-collecting in Japan has certainly led to numerous problems, but collecting is one of the main reasons why Japan has excelled in entomology – especially taxonomy. With a reasonable conservation agenda in mind, we must continue providing nets to our children, as direct observation and exposure are the best ways to educate kids about insects and natural history. We rely on our children, as it is they who will continue teaching entomology to future



generations, and further the science of entomology in the United States and abroad.

## Acknowledgements

Aspects of this paper originated from a presentation given at the Lepidopterists' Society annual meeting in 2003 in Olds, Canada, organized by Felix A. H. Sperling. Contents were edited and improved after presentations at the University of Maryland, organized by Amy E. Brown; The 1103<sup>rd</sup> Entomological Society of Washington Meeting, organized by John Brown, David G. Furth and Steven W. Lingafelter; and at a guest lecture at the University of Florida, organized by Thomas C. Emmel. I thank organizers and participants in each case for stimulating discussions which improved the manuscript. Robert Dirig, Robert M. Pyle, and Lisa A. Taylor kindly reviewed an earlier draft. I also thank Wayne W. Hsu, Sahe Kawahara, the Hiraoka family, Jessica Oreck, Myriapod Productions and the many Japanese and American entomologists who provided the information necessary to write this paper. I am especially indebted to my parents for providing the opportunity to split my formative years between Japan and the United States. Without their dedication, I would not have experienced and absorbed the culture surrounding entomology in Japan.

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This is a photo of chewing lice, *Plagiella pervalis* (Leidy) (Phthiraptera: Menoponidae), inside the pouch of a preflighted American white pelican. Pouch lice are very common in white pelicans and are readily transferred among preflighted. They are a large, robust louse (5-7 mm in length). The calliphoridae in the lower right corner (an opportunistic visitor while examining this pelican) offers a size comparison. The lice feed inside the pouch on epidermal cells and blood, causing ulcerations which reportedly weaken preflighted. Feeding produces a reddish-brown exudate. The photograph was taken at Medicine Lake National Wildlife Refuge in the northeast corner of Montana.

“What is it?”  
answer.