Case Studies on Sting Dermatitis by Bethylid Wasp, *Cephalonomia gallicola* (Ashmead, 1887) (Hymenoptera: Bethylidae) Found in Okayama, Japan

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ABSTRACT. Four human cases of sting dermatitis (28-year-old woman, 27-year-old woman, 43-year-old woman and 15-year-old boy) by bethylid wasps from Tatami-mats in Okayama Prefecture are reported. An appreciable number of itching edematous erythema appeared on skin surface of the extremity and trunk of the patients during June to July from 1982 to 1990. Itching erythema of the patients seemed somewhat like punctured wounds by small arthropod, and two kinds of small insects were found. On insectological observation both adult female and winged adult male bethylid wasps, *Cephalonomia gallicola* (Ashmead, 1887) for agential pest, and the other adult of Death-Watch beetle, *Lasioderma serricorne* (Fabricius) for parasitic host for the *C. gallicola* larvae were identified. After spraying 0.2% pyrethrin oil solution on the Tatami-mats, the agential insects almost disappeared within a few days. The patients were treated with single or double application of Celestamine, Topsym cream and Eurax ointment, and the skin lesions completely healed two weeks after the treatment.

Key words: sting dermatitis — bethylid wasp — *Cephalonomia gallicola* — Hymenoptera — Bethylidae

Bethylid wasp (Bethylidae) belonging to the order Hymenoptera is one of parasitic beetles which somewhat resembles to ant, and is parasitic to the body surface of lepidopterous, coleropterous and hymenopterous larvae. Thus, the bethylid wasp has both noxious and benefical natures to the human society. Recently, some species of Death-Watch beetle (Coleroptera: Anobiidae) [Jap. name: Shibanmushi] have gradually been increased in number in households in Japan, and a significant increase of bethylid wasps was especially noticed. The bethylid wasp, *Cephalonomia gallicola* (Ashmead, 1887) [Jap. name: Shibanmushi-Arigatabachi] in the present report is most common parasite on the larval body surface of cigarette beetle, *Lasioderma serricorne* (Fabricius) which is principally habiting in tobacco storages. However in recent days, *L. serricorne* beetles are rather developing in the Tatami-mats of numerous households of Japan. It is supposed that the poorly-ventilated structure of modern Japanese houses having relatively high temperature and humidity is primarily responsible for high incidence of these indoor vermins.

Adult female of *C. gallicola* has a strong sting apparatus on the terminal

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segment of abdomen, and it is known to frequently attack human beings and inject their body fluids into the skin. The authors report here four human cases of sting dermatitis found in Okayama Prefecture, Japan, by bethylid wasps which were derived from Tatami-mats.

CASE NOTES

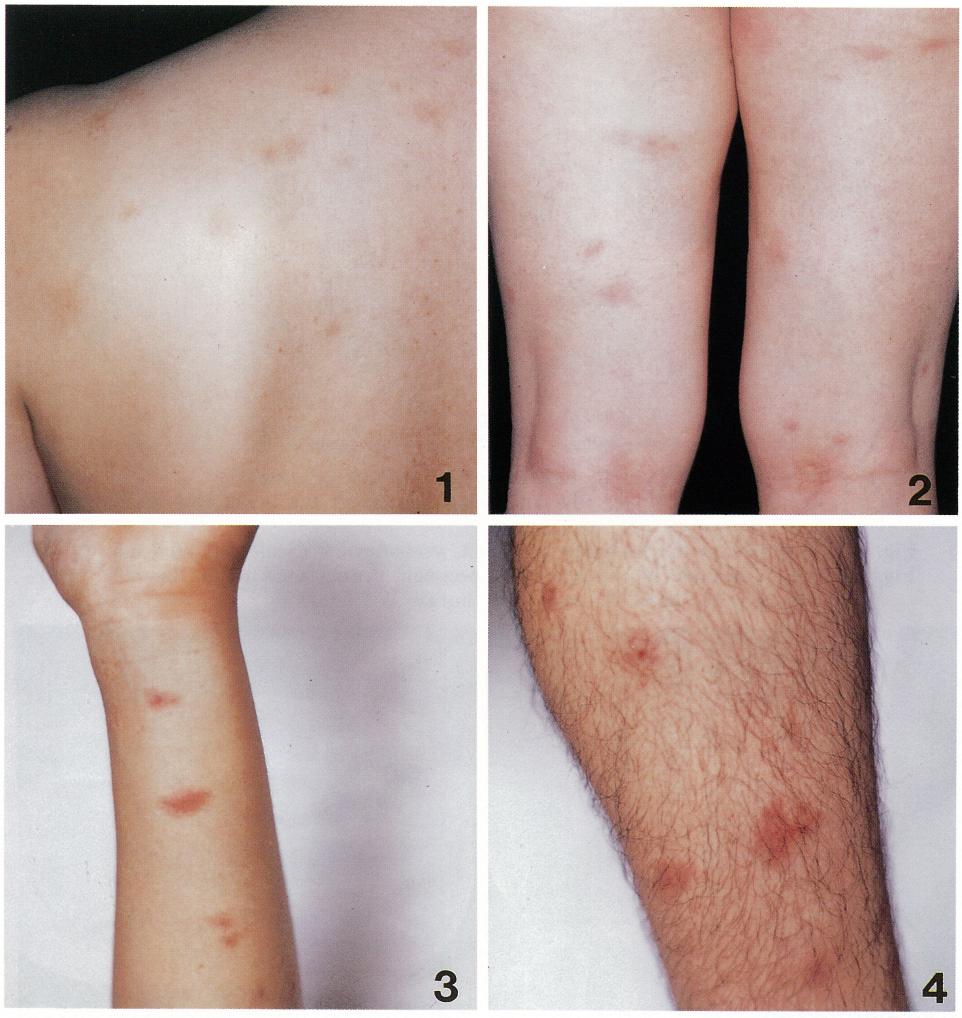
Case 1: The patient (M. D.) was a 28-year-old woman living in Akasaka-Cho, Akaiwa-Gun, Okayama prefecture, Japan. The patient served at draper shop in Okayama City for several years, of constantly labor in sitting position on Tatami-mats. In the middle of June 1982, the patient first noticed the presence of itching erythemata on skin surface of her face, trunk and upper extremity, thus she visited our hospital on July 2nd, 1982.

On cutaneous findings, a few number of wounds were found on upper and lower extremities and trunk showing edematous erythema with mild itching, size of a thumb. No vesicle was seen in the lesions. The skin lesions appeared to be the bite wounds by certain arthropod. A few days after, the patient brought several small insects, resembling the ant which caught from the Tatami-mat where she worked. From the results of insectological examination these insects are identified as adult females of *Cephalonomia gallicola* (Ashmead, 1887) based on the morphological characteristics of head, thorax and abdomen. Details of therapy and patient's course are not available.

Case 2: The patient (M. N.) was a 27-year-old woman living in Kurashiki City, Okayama Prefecture, Japan. She served in the draper shop same as the patient of Case 1. For several weeks, the patient noticed frequent itching erythematous papules on the skin surface of almost all over the body, and she visited us on July 3rd, 1982. On gross inspection, clinical characteristics of the skin lesions showed practically identical symptoms as those of the patient of Case 1. Since the itching dermatitis could be caused by adult females of *Cephalonomia gallicola*, insectiside spray in and around the Tatami-mats was recommended for exterminating the agential wasps.

Case 3: The patient (K. K.) was a 43-year-old housewife living in Sanyo-Cho, Akaiwa-Gun, Okayama Prefecture, Japan. The patient first noticed the presence of itching erythemata on the skin surface of her shoulder region in the middle of May, 1984. She visited our hospital on June 8th, 1984 because the erythema spreaded gradually to the extremities. Skin examination revealed a significant number of edematous erythema with severe itching of an index finger-size on the skin surface of almost all over the body. The wounds were most prominent in shoulder (Fig. 1) and upper femur (Fig. 2) region, and these lesions looked to be the punctured wounds caused by indoor vermin. When dermatological re-consultation was done, she brought a number of insects resembling ant collected on the Tatami-mat surface of her house. Among those collected, several adult females of *Cephalonomia gallicola* were recognized. The patient was treated with double application of Celestamine and Topsym cream, yet further course of the patient was not followed.

Case 4: The patient (H. H.) was a 15-year-old boy of Kurashiki City, Okayama Prefecture, Japan. Early in July, 1990, the patient complained itching whenever he moved in his room. The patient used a room on upstair open to the south which was recently expanded to a Japanese style wooden house. In

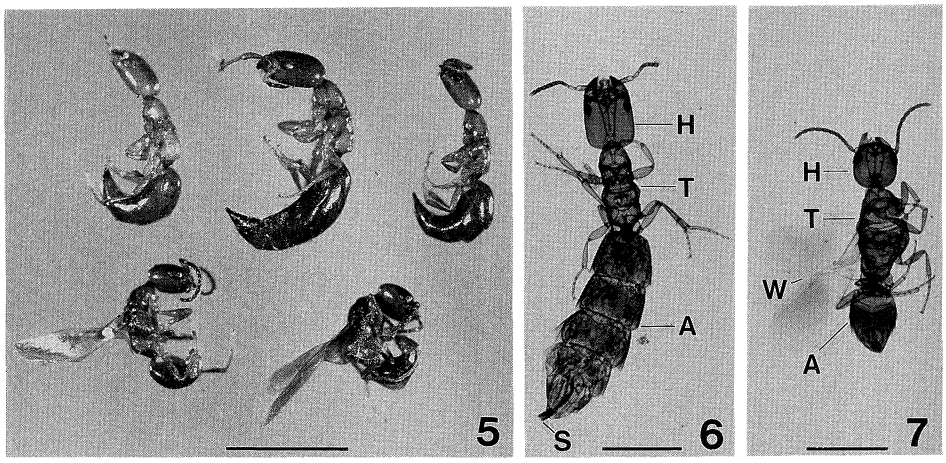


Figs. 1–4. Clinical pictures of edematous erythema produced by *Cephalonomia gallicola*. Left shoulder region of case 3 (1), posterior femur of case 3 (2), left forearm of case 4 (3) and right lateral crus of case 4 (4)

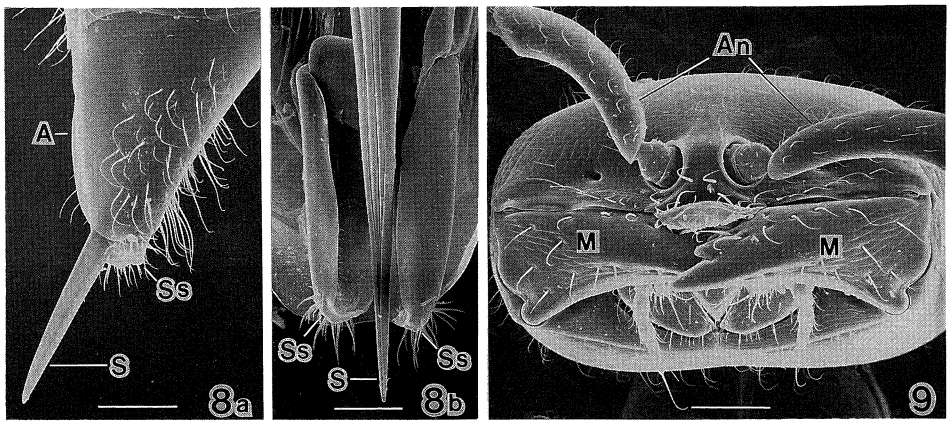
the patient's house cheyletid mites were found from Tatami-mats from a newly built room of downstairs.

By gross examination of the skin, itching eruptions were recognised on upper and lower extremities and trunk with scattered edematous erythemata with reddish color of 10 to 20 mm in diameter (Figs. 3,4). The erythema looked somewhat like the punctured wounds by small insects or mites because petechia was always found in the central portion of each eruption, and several erythemata showed a slight tendency to be arranged in an almost straight line. On questioning the patient, it became evident that itching eruptions occurred during his sleep. Then careful examination on the Tatami-mat surface was done, and two kinds of crawling small and medium size insects were found.

On morphological observation of these insects, the small size ones were identified as adults of wing-less female and winged-male of *C. gallicola*

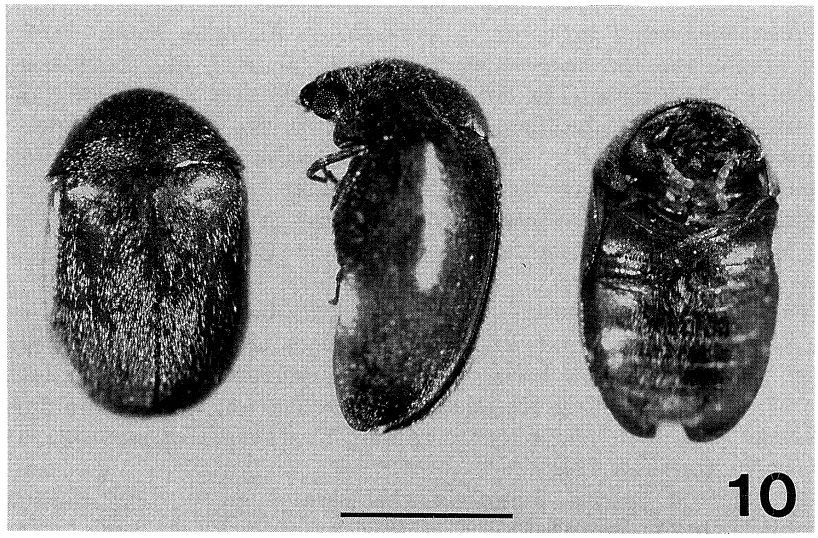


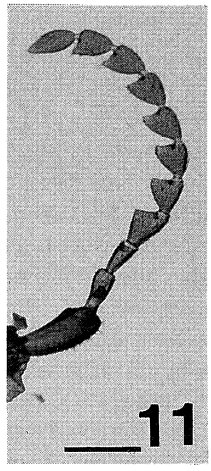
Figs. 5-7. Adults of bethylid wasp, *Cephalonomia gallicola* of case 4
Fig. 5. Females in the upper row and winged-males in the lower row (Scale bar=1.0 mm)
Fig. 6. A female in the mounted specimen, ventral view (Scale bar=0.5 mm)
Fig. 7. A winged-male in the mounted specimen, dornal view (Scale bar=0.5 mm)
A: abdomen, H: head, S: sting, T: thorax, W: wings



Figs. 8-9. SEM pictures of a female adult of *Cephalonomia gallicola*
Fig. 8a. Terminal segment of abdomen, lateral view (Scale bar=0.05 mm)
Fig. 8b. Dissected terminal segment of abdomen, showing a sting lies in the abdominal cavity (Scale bar=0.03 mm)
Fig. 9. A head, showing stout mandibles situated in front of the mouth part, frontal view (Scale bar=0.06 mm)
A: abdomen, An: antenna, M: mandible, S: sting, Ss: sting-seath

(Ashmead, 1887) (Figs. 5-7), and the other medium size individuals were adults of *Lasioderma serricorne* (Fabricius) from their external characteristics (Fig. 10). Furthermore, small rounded apertures of about 1.0 mm in diameter from the *L. serricorne* adults were recognized in various spots on the Tatami-mat surface (Fig. 12). A large number of carcasses and fecal pellets resulting from the *L. serricorne* adults were found in accumlated dusts under the Tatami-mats. Then an insecticide, 0.2% pyrethrin oil solution to effectively kill the indoor vermin was repeatedly sprayed in and the back side of the Tatami-mats.





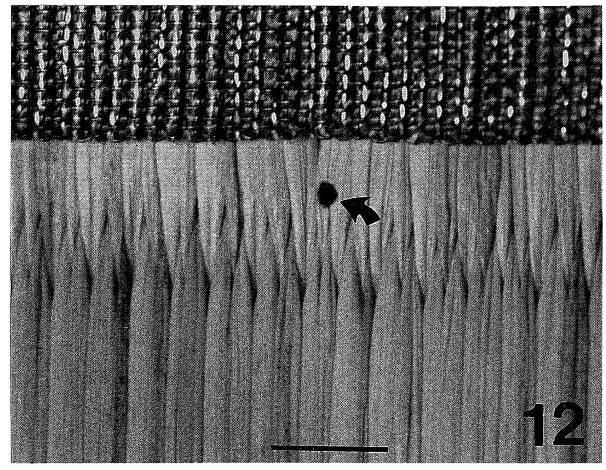


Fig. 10. Adults of *Lasioderma serricorne* of case 4. Dorsal view (left), lateral view (middle) and ventral view (right) (Scale bar=1.0 mm)
Fig. 11. Right antenna of adult *L. serricorne*, showing an arrangement of 11 segments (Scale bar=0.2 mm)
Fig. 12. A small rounded aperture (arrow) serving for the extrication of adult *L. serricorne* (Scale bar=5.0 mm)

Several days after no agential insect was recognized on the mat surface. With Eurax ointment, the skin lesions were recovered within 10 days.

Morphological aspects of agential insects: The external appearance of the *C. gallicola* adults was very similar to ant but lacks petiolus (Fig. 5). The adult females of *C. gallicola* are always wing-less, 2.0 to 3.0 mm in length, yellowish-brown in color, with 3 minute ocelli on posterior edge of the head (Fig. 6). The head segment is slightly large and oblong in shape, and stout mandibles situate in front of the mouth parts (Fig. 9). The antennae consist of 12 segments in each side, as same length as the head segment. In the pointed abdominal end, a strong sting apparatus often protruded toward outside (Figs. 6, 8a, 8b).

The winged adult males of *C. gallicola*, on the other hand, are 1.3 to 2.0 mm in length and the head segment is round or oval and somewhat smaller than that of the female (Fig. 7). The compound eyes and ocelli are slightly larger than those of the female, and there is no sting apparatus on the abdominal end (Figs. 5,7). All of the adult males in the present studies had two pairs of wings, and the hind-wings were smaller than those of the fore-ones. The wings were transparent, pale-gray in color, and several fuzzes of about 5.5 μm were located in single row on the posterior edges of each hind-wing.

The adults of *L. serricorne* are cylindrical in form, about 2.5 mm in length, bright dark-brown in color, and body surfaces are covered with numerous number of delicated short hairs. The head segment is partly concealed by a prothoracic plate. The legs are relatively short and not visible from dorsal side of the body (Fig. 10). The antennae contain 11 segments in each side, and they are in same size (Fig. 11).

The agential insects found in the present cases were essentially in agreement with the morphological aspects of *C. gallicola* and *L. serricorne* adults.

DISCUSSION

Several species of bethylid wasps belonging to the genus *Cephalonomia* have so far been reported, and those species can easily be distinguished exclusively by their body size, form and color of head, thorax, abdomen, wings as well as legs (Ashmead, 1893).[1] The bethylid wasp, *Cephalonomia gallicola* is widely distributed in Europe, North America and Asia, and well known as a natural enemy of anobiid beetles. In Japan, however, it has long been believed that human dermatitis caused by bethylid wasps were induced only by *Sclerodermus nipponicus* Yuasa, 1930. The human cases by *S. nipponicus* have reported from 3 districts of Tokyo (Asahina, 1953),[2] Ibaragi (Kawashima, 1959)[3] and Nagasaki (Ito *et* Shimogama, 1962[4]; Oda *et al.*, 1981[5]) Prefectures. Since the existence of *C. gallicola* in Japan was first confirmed by Tachikawa (1976)[6] of Matsuyama and Nagoya Cities, several cases of human dermatitis caused by *C. gallicola* have hitherto been reported such as; from Nagoya City by Shimada *et al.* (1976)[7] and Matsuura (1981),[8] from Matsuyama City by Sasaki *et* Nishida (1978),[9] from Kasuga and Fukuoka Cities by Yamamoto *et al.* (1979)[10] and from Sendai City by Matsutani (1989).[11]

No *C. gallicola* was found in the places where the larvae of Lepidoptera, Coleroptera and Hymenoptera do not exist. Among these insects, particularly important one is the coleropterous larvae which are now often found in the Tatami-mats of poorly-ventilated households in Japan. In the present studies the anobiid beetle, *L. serricorne* belongs to Coleroptra, and it is widely known as the parasitic host for *C. gallicola*.

The adult females of *C. gallicola* lay eggs on the body surface of either mature larvae, pre-pupae, or pupae of the beetle. Although the length of incubation period varies with temperature and humidity, the eggs are commonly hatched within 2 or 4 days after being laid. The bethylid wasp develops into adult by complete metamorphosis passing through 3 developmental stages; egg, larva and pupa. The developmental duration of bethylid wasp from larvae

to adults may be enumerated as follows: 13 to 27 days under the reared conditions (Kearns, 1934),[12] about 60 days in the spring but 20 to 30 days in the summer (Ito, 1980).[13] These investigations suggested that the spontaneous generation of bethylid wasp originated very often from Tatami-mats in limited period of time in the summer. The completely developed adult wasps in Tatami-mats appear on the mat surface moving through the straws. There are 3 distinct adult forms in this species, males being dimorphic of winged and wing-less. Adults of male and female wasp have stout mandibles in front of the mouth parts (Fig. 9). The mandibles are not needed for adult stage but the larva of prosperous feeding period are the only things required. Hence it appears that the causative tool for human dermatitis is only females with stings.

In the past sting victims by the *C. gallicola* adults frequently occurred in the summer season, namely June to Sept. in Nagasaki City (Shimada, 1976)[7], June and Sept. in Matsuyama City (Sakai *et* Nishida, 1978),[9] May to Oct. in Nagasaki City (Matsuura, 1981),[8] and June in Kasuga and Fukuoka Cities (Yamamoto, *et al.*, 1979).[10] Those data agree with the present report. Thus, there is definite seasonal occurrence of sting dermatitis by bethylid wasps exclusively during the warm months. In addition the occurrence prove the experimental data which was that the *C. gallicola* adults increased rapidly during early June to Sept. (Ito, 1980).[13]

The sting wounds caused by bethylid wasp are different from other common eruptions and urticarias by the existence of a petechia in the center of each lesion. The sting wounds are more severe as compared with those of bite wounds of the house-dust mite, *Cheyletus fortis* (Hatsushika *et al.*, 1989)[14] and the cat and dog flea infestation (Miyoshi *et* Hatsushika, 1984).[15] In cases 3 and 4 in our studies, there were numerous edematous erythemata, 10 to 20 mm in diameter with slightly reddish color on the upper and lower extremities and trunk, and a petechia of pinpoint to pinhead-size in the center of each erythema (Figs. 1-4). The erythema quickly appeared right after stung. It is quite conceivable that the toxicity of body fluid of bethylid wasp is functional for human body as immediate type of allergic reaction.

On cutaneous findings of the sting wounds by bethylid wasp, there was no essential difference between the women and men, and all the patients recovered within 10 days after the external application of common dermatological treatments without the squelae of pigmentation. The adults of bethylid wasp weakly resist to several types of insecticides, and the wasps can be cotrolled by commercial insecticides. However, to control indoor vermins, it is suggested to keep Tatami-mats dried for preventing invasion of the insects as the authors stated previously (Hatsushika *et al.*, 1989).[14] The authors suggest to dry Tatami-mats at least once a year during the hottest period of summer.

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