Jpn. J. Ent., **60** (2): 401–408. June 25, 1992

Notes on *Eterusia watanabei* INOUE, stat. nov. (Zygaenidae, Chalcosiinae), Endemic to Tsushima, Western Japan[1)]

Mamoru OWADA

Department of Zoology, National Science Museum,
Hyakunin-cho 3–23–1, Shinjuku, Tokyo, 169 Japan

and

Kiyoshi HORIE

Sangenjaya 1–27–21, Setagaya, Tokyo, 154 Japan

Abstract The taxonomic status of *Eterusia taiwana watanabei* INOUE, 1982, is revised, and the moth is regarded as a good species endemic to Tsushima. Descriptions of both the sexes are given with notes on the behaviour and habitat, and a discussion is given on its relationship to the allied species, *E. tricolor* from Himalaya, China to Thailand and *E. taiwana* from Taiwan.

Key words: Lepidoptera; Zygaenidae; Chalcosiinae; *Eterusia watanabei*; new status; Tsushima; Japan; Taiwan; Himalaya.

On 8 July 1973, the late Mr. Toku WATANABE collected a beautiful large chalcosiine moth on Mt. Jirukubiyama of the southern island of Tsushima. The specimen was unfortunately a female, and he recorded it under the name of *Eterusia formosibia* STRAND, 1917, (junior synonym of *E. taiwana* WILEMAN, 1910), noting briefly that "this species is new to Japan, formerly known only in Taiwan," and that "moths of *Eterusia* are considered not to be migratory, so that it is very interesting from the biogeographical viewpoint that this moth can be aboriginal to Tsushima" (WATANABE, 1980, Aug.). EZIMA and SAKAI (1980, Nov.) also recorded this species under the name of *Eterusia taiwana* WILEMAN, stating that the moths visited flower tufts of chestnut trees, *Castanea crenata*, with a photograph of a male specimen collected on 14 June 1978 at Waita, Toyotama, the northern island of Tsushima.

In the book of "Moths of Japan", INOUE (1982) described this moth under the name *Eterusia taiwana watanabei* on the basis of the female collected by WATANABE and a female in the collection of the National Science Museum, Tokyo, and briefly noted the differences from the nominotypical form: "larger than *E. t. taiwana*, wings markedly darker, white markings of forewing more developed, in hindwing,

1) This study is supported by the Grants-in-aid No. 01041099 for Field Research of the Monbusho International Scientific Research Program, and No. 02640643 for Scientific Research from the Ministry of Education, Science and Culture, Japan.

outer black band extending to the base of CuA_2 and to the inside of the discoidal cell." According to Dr. INOUE (personal communication), he tried in vain to obtain male specimens, sending a request to Mr. Y. SAKAI without response.

At the first glance, the black female specimens from Tsushima look quite different from Taiwanese *E. taiwana* of which the forewing is bright green and the conformation of white markings is somewhat shifted. Then, we doubted its systematic status and found that it is much closer to *Eterusia tricolor* HOPE, 1840, in the wing maculation. By checking the female genitalia, we confirmed our view that *watanabei* is specifically different from *E. taiwana*, and keenly realized necessity of careful study of male *watanabei*.

In the middle of June, 1991, we made a short collecting trip to Tsushima, lying between Kyushu and Korea, with cooperation of Mr. Yoshihiro YANAGIDA and Mr. Yuichi OKUSHIMA, and were fortunate in taking some male specimens. By examining their genitalia, we have come to the conclusion that *E. watanabei* is a good species comparable to *E. tricolor* and *E. taiwana*.

In this paper, we will describe the male for the first time, redescribe the female, and note the habitat and flying activity with discussion on its relationship to allied species in the following lines.

Eterusia watanabei INOUE, 1982, stat. nov.

Eterusia formosibia: WATANABE, 1980, Moths Tsushima Island, p. 43. (Nec STRAND, 1917.)

Eterusia taiwana: EZIMA & SAKAI, 1980, Gekkan Mushi, (117): 51–52, fig. 4. (Nec WILEMAN, 1910.)

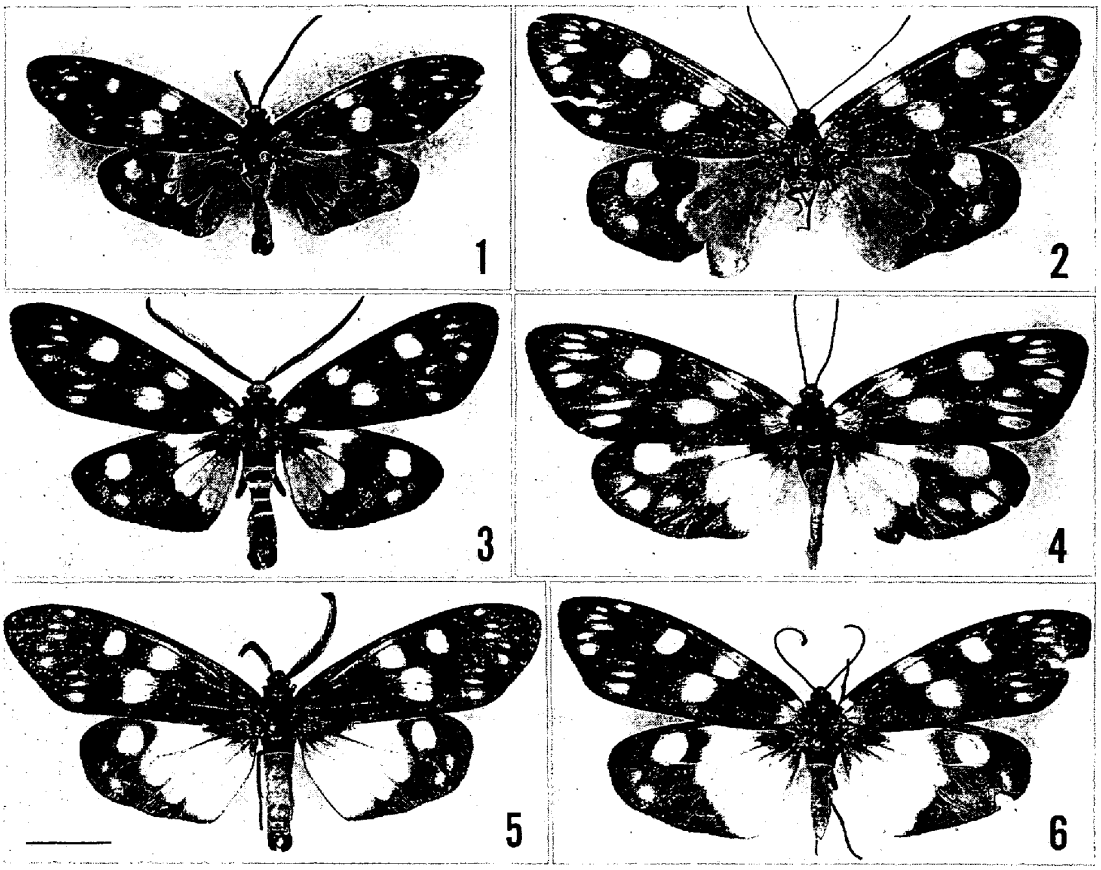
Eterusia taiwana watanabei INOUE, 1982, Moths Japan, **1**: 292, **2**: 217, pl. 33, fig. 12 (♀ holotype in colour).

Type series. Holotype of *Eterusia taiwana watanabei* INOUE, ♀, labeled "Tsushima, VII. 1969, Y. Doi / Holotype, Eterusia formosibia [sic] watanabei Inoue (1982) [handwriting by INOUE on red label] / ツシマキモンチラシ [Tsushima-kimonchirashi (Japanese common name)], Eterusia watanabei Inoue, det. M. Owada, 1991", preserved in the National Science Museum, Tokyo; paratype ♀, Tsushima, Jirukubiyama, 8. VII. 1973, T. WATANABE, in INOUE collection, Iruma.

Other material examined. Tsushima, Mine, Kisaka, 1 ♀, 29. VI. 1980, N. OHBAYASHI leg., genitalia slide no. NSMT 2117 ♀; Tsushima, Toyotama, Waita, 16 ♂, 16–18. VI. 1991, K. HORIE, M. OWADA & Y. YANAGIDA leg., genitalia slide no. NSMT 2186 ♂.

Male (Fig. 3). Length of forewing: 28–30 mm.

Antenna black, bipectinate. Head, patagia and mesoscutellum black with bluish bright, thorax and tegula black; abdominal segments black, with an orange yellow band from 2nd to 6th segment, ventral surface cream yellow. Forewing black, tinged slightly with dark moss-green luster; large yellowish spots at the base, at the middle of discoidal cell and CuP and at the end of the cell, respectively; several small yellowish dots irregularly surrounding the discocellular spot; underside



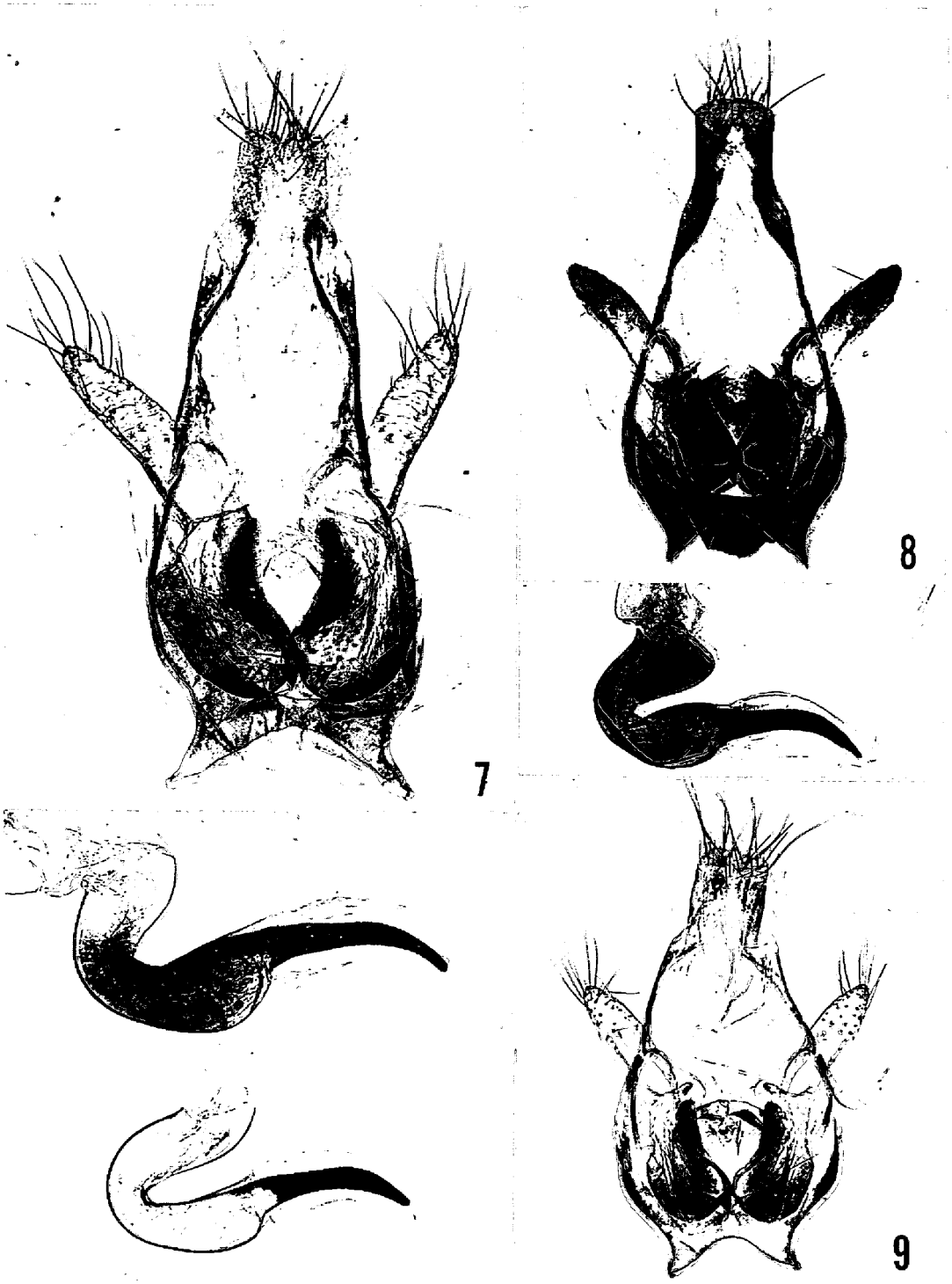
Figs. 1–6. *Eterusia tricolor*-complex. —— 1, *E. tricolor* HOPE, ♂, Thailand; 2, ditto, ♀, Nepal; 3, *E. watanabei* INOUE, ♂; 4, ditto, ♀ holotype; 5, *E. taiwana* WILEMAN, ♂; 6, ditto, ♀. Scale about 10 mm.

black, veins broadly stained with bluish gloss in middle portion, yellowish marks as on the upperside, the central two marks fused, forming a yellow band. Hindwing black, without moss-green luster, medial band orange yellow, whitish yellow in costal portion, a large yellow spot present at the end of discoidal cell, a small yellow spot below discocellular mark, edged externally with bluish gloss; underside black, veins stained with bluish gloss in outer portion, yellow band and spots broader and larger than those on the upperside.

Female (Fig. 4). Length of forewing, 30–33 mm.

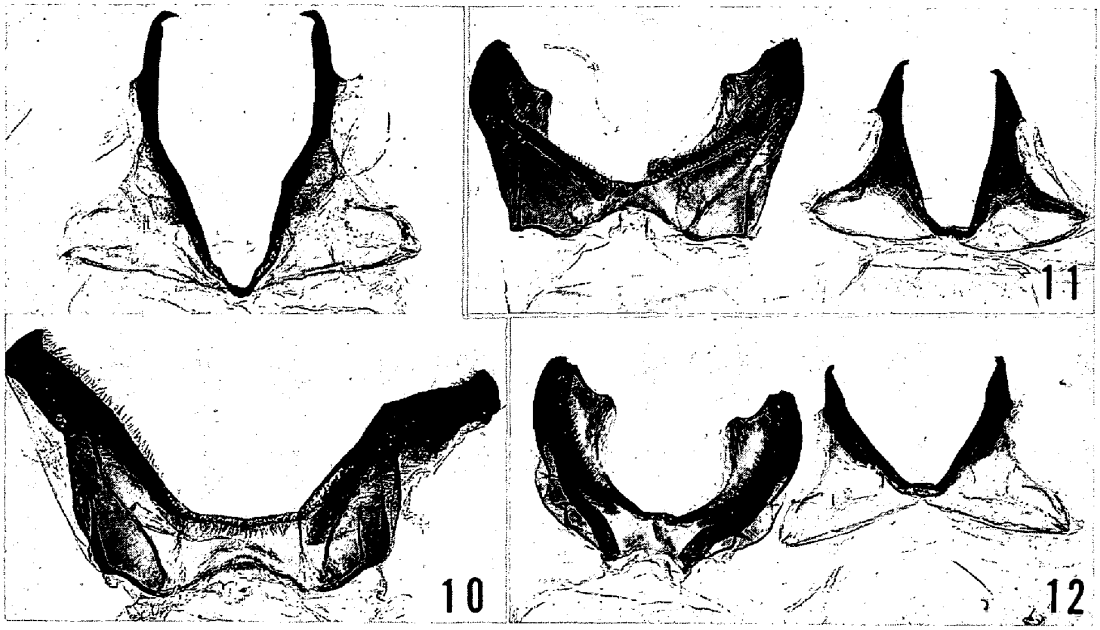
Antenna very short bipectinate, almost simple at a glance, slightly broadened at apex. Coloration almost as in male. Abdomen yellow except for the basal black portion, black spiracles and a ventral black band on each segment. Yellow spots and band on wings larger and broader; discocellular spot of hindwing linked with middle band by a yellow slender line on vein M.

Male genitalia (Fig. 7). Uncus membranous, nearly square, indented at middle on distal margin, with many long bristles on apical portion. Tegumen slender, rather membranous, with sclerotized ridges. Vinculum sclerotized, with a pair of



Figs. 7–9. Male genitalia. —— 7, *Eterusia watanabei*; 8, *E. taiwana*; 9, *E. tricolor*.

triangular processes anteriorly. Valva simple, basal half sclerotized, distal half represented by a membranous lobe clothed with long bristles. Aedeagus markedly



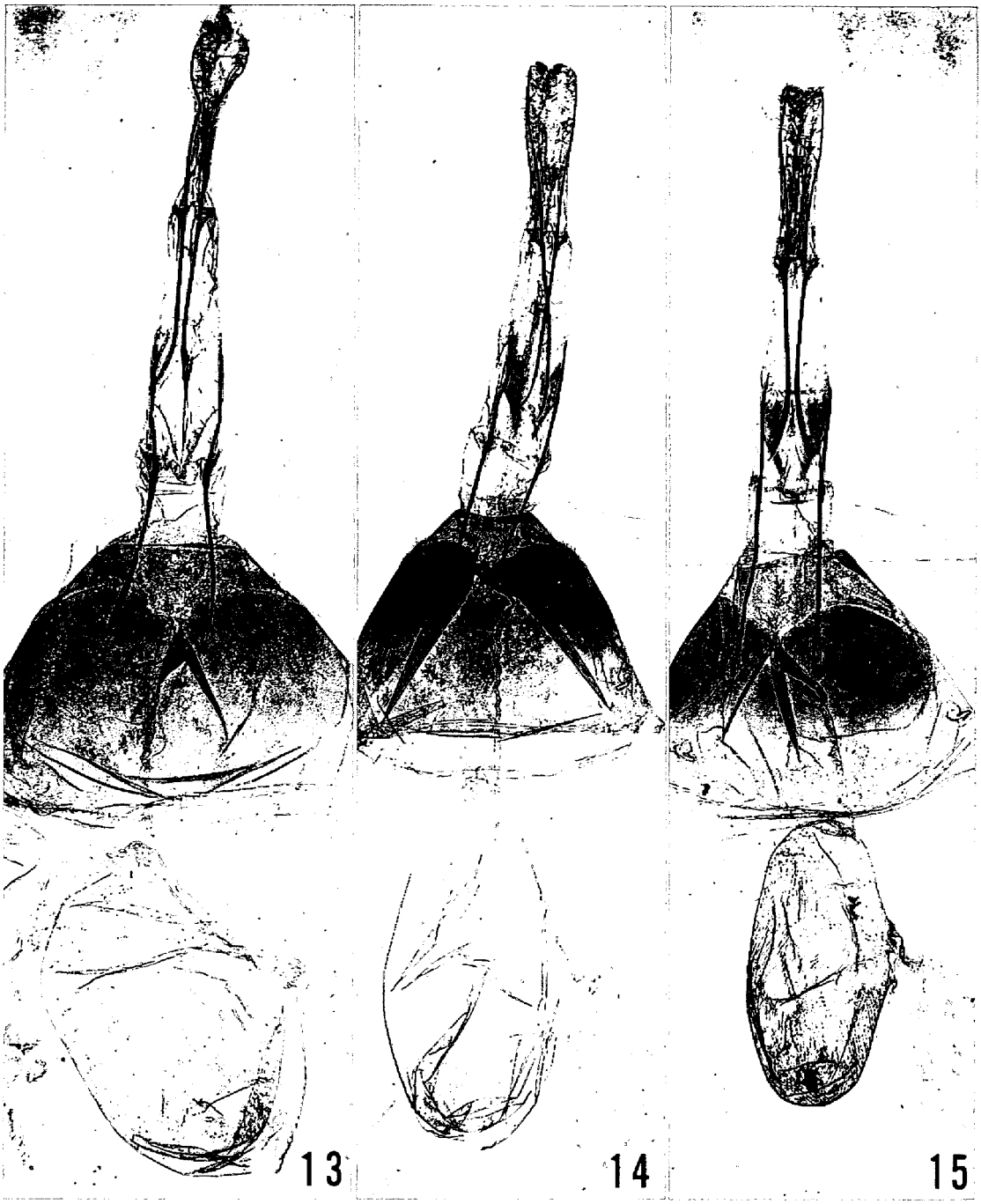
Figs. 10–12. Eighth abdominal segment of male. —— 10, *Eterusia watanbei*; 11, *E. taiwana*; 12, *E. tricolor*.

curved, basal half broad, distal half strongly sclerotized, apex pointed.

Eighth adominal segment specialized as in Fig. 10; tergite deeply indented at middle, forming a pair of sclerotized hooked processes; sternite sclerotized, wide U-shaped, distal margin clothed with short black hair-like scales.

Female genitalia (Fig. 13). Papillae anales markedly long, slender, with slender apophyses; 8th tergite long, anterior margin acutely protruding, apophyses anteriores slightly shorter than apophyses posteriores. Seventh sternite fused with pleural region, forming a sclerotized broad ventral plate. Ostium bursae at the centre of distal margin of 7th sternite; bursae copulatrix membranous, ductus bursae long, slender, irregularly furrowed, corpus bursae ovate, large, with an appendix bursae.

Notes. In the morning on June 16th, 1991, we landed on Tsushima, and were soon bound for Waita where many moths had been observed on flower tufts of chestnut trees, *Castanea crenata*, Fagaceae (EZIMA & SAKAI, 1980). It was cloudy and sometimes gleamy. At Waita, the first moth was soon secured by HORIE on flower tufts of a chestnut tree, and then we collected some more males in the same place. Chestnut trees are quite common in Tsushima. On the next day, we tried in vain to seek the moths through not only the northern island but also the southern island. Then, we concentrated our research field at Waita where there are secondary forests of deciduous broadleaf trees, e. g. *Quercus serrata*, Fagaceae, *Platycarya strobilacea*, Juglandaceae, etc. The collecting site was an open place in the forest, and several chestnut trees were in full bloom. Early in the morning on June 18th, YANAGIDA observed many moths flying over tree crowns, and the same was also observed by us in the late afternoon just before twilight of the same day. It was fine whole



Figs. 13–15. Female genitalia. —— 13, *Eterusia watanabei*; 14, *E. taiwana*; 15, *E. tricolor*.

day long on June 18th. We were able to collect fresh males only, so that the middle of June must be the incipient time of occurrence of *E. watanabei*, and the flying activity in the early morning and before twilight may be the courtship behaviour of males. Similar mass-flyings in the twilight time were observed in *Erasmia*

pulchella HOPE, 1840, at Ômura, Nagasaki, northwestern Kyushu (OHKUBO, 1991), and at Matsuzaka, central Honshu (MANO, personal communication).

Diagnosis. *Eterusia watanabei* is easily distinguished by external characters from *tricolor* and *taiwana*. These three species are similar to *Eterusia aedea* (CLERCK, 1759), somewhat variable species (OWADA, 1989), but distinguished by the two spots in the discoidal cell and the cell CuA of forewing instead of a continuous band in *aedea*.

Eterusia tricolor (Figs. 1–2) is sexually dimorphic, the male being smaller than the female and the male forewing is slenderer than those of the female and of *watanabei*. The coloration is very similar to that of *E. watanabei*, but the yellow band of hindwing is markedly broader, extending to the cell CuA_2, and is more deeply tinged with orange.

Eterusia taiwana (Figs. 5–6) is characterized by the bright green forewing in which the two spots in the discoidal cell and the cell CuA are shifted to the discocellular spot. In the male, the basal spot of forewing is absent and the dorsal surface of abdomen is unicoloured in yellow except for the basal and distal parts. The spots and bands are much paler than those of *tricolor* and *watanabei*.

The genitalia of the three species are very similar. The male genitalia of *watanabei* (Fig. 7) are much larger than those of *tricolor* (Fig. 9) and *taiwana* (Fig. 8); in proportion the ring of 9th segment is rather long, the pair of triangular processes of vinculum are long, the basal part of aedeagus is short, and the pair of processes of 8th tergite are long and more strongly hooked. In the female genitalia, the pleural areas of the 7th segment of *taiwana* (Fig. 14) are strongly sclerotized, and the 8th segment of *watanabei* (Fig. 13) is longer than those of *tricolor* (Fig. 15) and *taiwana*.

Relationship. It is doubtless that *Eterusia tricolor*, *E. taiwana* and *E. watanabei* are closely related to one another, and that the sister species of this complex is *E. aedea*. *Eterusia tricolor* is known as a moth widely distributed from the Himalayas and western China, through Myanmar (=Burma) (BRYK, 1936), to Thailand (new record). On the other hand, *E. taiwana* is restricted to Taiwan and *E. watanabei* to Tsushima. The male genitalia of *tricolor* and *taiwana* are very similar, but the female genitalia of *taiwana* are unique in the pleural parts of 7th segment distinctly sclerotized. The sexual dimorphism of *tricolor*, the size and wing shape, is considered to be a highly specialized feature, and *taiwana* and *watanabei* may be insular relicts.

It is worth noting that the distributional ranges of the *tricolor*-complex and *aedea* are almost the same and the geographical variations also correspond to each other, i. e. the blackish forewing and the orange yellow band of hindwing (this band is rather variable from yellow to disappearing) in *E. aedea edocla* DOUBLEDAY, 1847, from the Himalayas and southwestern China to Thailand are very similar to those in *E. tricolor*, and the green forewing and the whitish band of hindwing in Taiwanese *E. aedea formosana* JORDAN, 1908, are to those in *E. taiwana* (see

OWADA, 1989). Besides, the blackish forewing and the yellow band of hindwing in *E. watanabei* are markedly different from those in *E. aedea sugitanii* MATSUMURA, 1927, from Tsushima, Kyushu, Shikoku and western and southern central Honshu, i.e. the forewing is dark green and the band of hindwing is whitish. *Eterusia watanabei* flies in June to July and *E. aedea sugitanii* flies in September. In the Tsushima Islands, therefore, the two *Eterusia* species never fly at the same time, and this may be the reason why they have not the same wing coloration in parallelism.

Acknowledgement

We wish to express our cordial thanks to Dr. Hiroshi INOUE, Otsuma Women's University, Iruma, for his invaluable advice and encouragement. Our thanks are also due to Mr. Yoshihiro YANAGIDA, Yokohama, and Mr. Yuichi OKUSHIMA, Kurashiki Museum of Natural History, Kurashiki, for their kind aid in the field survey in Tsushima, and to Dr. Shun-Ichi UÉNO, National Science Museum, Tokyo, for reading the manuscript. We extend our sincere appreciation to Messrs. Yasunori KISHIDA, Toshitsugu ENDO and Shigero SUGI, Tokyo, Takahiro MANO, Miwa, Aichi, and Dr. Nobuo OHBAYASHI, Yokosuka, for the material and information used in this study.

References

BRYK, F., 1936. Zygaenidae II. *In* STRAND, E. (ed.), *Lepid. Cat.*, (71): 1–332.

EZIMA, M., & Y. SAKAI, 1980. [Records of *Catocala* species and *Eterusia taiwana* from Tsushima.] *Gekkan Mushi*, (117): 51–52, 4 figs. (In Japanese.)

INOUE, H., 1982. Zygaenidae. *In* INOUE, H., *et al.*, *Moths of Japan*, **1**: 291–296, **2**: 217–219, pls. 32–34. Kodansha, Tokyo. (In Japanese.)

OHKUBO, N., 1991. Life history and rearing of a Zygaenid moth, *Erasmia pulchella*. *Insectarium*, **28**: 306–311, 15 figs. (In Japanese.)

OWADA, M., 1989. Notes on geographical forms of the chalcosiine moth *Eterusia aedea* (Lepidoptera, Zygaenidae). *Mem. natn. Sci. Mus., Tokyo*, (22): 197–214, 41 figs.

STRAND, E., 1917. H. SAUTER's Formosa-Ausbeute: Lithosiinae, Nolinae, Noctuidae (p. p.), Ratardidae, Chalcosiinae, sowie Nachtäge zu den Familien Drepanidae, Limacodidae, Gelechiidae, Oechophoridae und Heliodinidae. *Stettin. ent. Ztg.*, **82A**(3): 111–152.

WATANABE, T., 1980. Moths of Tsushima Island, from a Collection Made during the Surveys in 1973–1974. 201 pp., 14 pls. Japan Heterocerists' Society, Tokyo. (In Japanese.)

WILEMAN, A. E., 1910. Some new Lepidoptera-Heterocera from Formosa. *Entomologist*, **43**: 176–179.

(Received January 30, 1992; Accepted March 3, 1992)