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**On the Lestremiinae (Diptera: Cecidomyiidae) of Japan.
General Introduction and Part 1:
Genus *Pseudoperomyia* Jaschhof & Hippa, 1999**

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Abstract. This is the first paper of a series on the taxonomy of Japanese gall midges belonging to the subfamily Lestremiinae (Diptera: Cecidomyiidae). These papers result essentially from a two year study of this group in forests of Japan between October, 1998, and September, 2000. The general introduction provides information on the group under study, on methods and material studied, and on the natural conditions within the Japanese archipelago in previous and recent times: palaeogeography, zoogeography, climate, and forest vegetation.

Part one treats the Japanese species of *Pseudoperomyia* of the Micromyini. Nine species are treated in depth, each with sections on adult morphology, their systematic position, and their distribution and biology within Japan. Six of these species are described as new to science: *Pseudoperomyia composita* sp. n., *P. fagiphila* sp. n., *P. furcillata* sp. n., *P. hondoensis* sp. n., *P. japonica* sp. n., and *P. velata* sp. n. The generic diagnosis supplemented here includes the description of *Pseudoperomyia* females for the first time. The systematics, zoogeography and biology of *Pseudoperomyia* are discussed taking into consideration the 28 species known to date. A key to *Pseudoperomyia* males is given.

Key words: systematics, Diptera, Cecidomyiidae, Lestremiinae, *Pseudoperomyia*, Japan, new species.

General Introduction

Foreword and acknowledgements

My intention at the beginning of my two year stay in Japan was to publish in a single volume all the results of my studies on lestremiine gall midges. This aim, however, was prevented by the subjects of research themselves. Being faced with an unexpected diversity of lestremiine species in forests of the Japanese archipelago, it now seems to me more economical to split up the work into manageable parts and proceed genus by genus under a central introduction.

Even if my research program was given a ecological background, the results presented here are essentially taxonomic. The reason for this is that a comparative study on species diversity in natural compared to cultivated forests, as the final goal of my project, can be based only on precisely identified and classified species. As Japanese Lestremiinae were poorly studied so far, research on their taxonomy was as exciting as seemingly infinite - and continues to be so. This study could not possibly result in a monograph and is

therefore not titled "The Lestremiinae of Japan". The inventory and description alone of all lestremiine species occurring within the Japanese archipelago, probably numbering between 500 and 1000, should require intensive activity for many additional years.

When a taxonomist leaves his central European home country for long-term research in Japan in both field and laboratory, he is faced with natural conditions which are often quite different and much more varied compared with those he is familiar with. Further, the foreign culture, in particular the persistent language problem, require, if the stay is supposed to be effective, the gracious and continuous assistance by local people in daily life as well as in doing the job. The support and friendship by the Japanese people that my wife and I experienced during our two years in the country have always been greater than expected. Consequently, the results presented here under a single name were gathered in team work rather than by the author alone. However, above all, I wish to thank my wife, Catrin, for her continuous interest in the project and her great technical assistance in the field as well as in coping with the never-ending amount of insect samples.

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Among the many Japanese colleagues I wish to thank, two stand out by their constant support and interest in the origin and progress of this project. Dr Junichi Yukawa, Professor of Entomology, Kyushu University, Fukuoka, was the initiator of this study and, as an authority in cecidology and Japanese Cecidomyiidae, was my preferred contact regarding group-specific problems. Dr Isamu Okochi, head of the Insect Management Laboratory, Forestry and Forest Products Research Institute (F. F. P. R. I.), Tsukuba City and who was my host researcher, has always done his best to provide excellent working conditions. He shared with me his immense knowledge of insects, Japanese nature and wildlife which have enriched both my visit and this paper.

The F. F. P. R. I., with its Forest Biology Division, served as a perfect host institution. I am thankful to its directory and staff, in particular to that of the Insect Management Laboratory, Mrs Keiko Takano, Dr Takenari Inoue, and Mr Katsuhiko Sayama, and that of the Insect Taxonomy and Ecology Laboratory headed by Dr Shunichi Makino.

Many institutions and researchers shared with me their facilities, experiences and time when supporting the fieldwork all over the country, or provided gall midge material for this study. The list that follows of those I am much indebted to is not a ranking but follows the geographical location of their institutions from north(east) towards south(west): Dr Masahiko Sato, Rishiri Town Museum; Mr Atsushi Okuda and Dr Joo Young Cha, Faculty of Agriculture of Hokkaido University, Nakagawa Experimental Forest; Mr Kazunobu Iguchi, Tokyo University, University Forest in Hokkaido, Furano; Dr Kenji Fukuyama and Dr Masahiro Isono, F. F. P. R. I. Hokkaido Branch, Sapporo; Dr Masanori Toda, Institute of Low Temperature Science of Hokkaido University, Sapporo; Dr Masahiro Ohara, Faculty of Agriculture of Hokkaido University, Sapporo; Dr Masashi Murakami, Faculty of Agriculture of Hokkaido University, Tomakomai Research Station; Dr Tadao Gotoh, F. F. P. R. I. Tohoku Branch, Morioka; Dr Masamichi Ito, F. F. P. R. I. Kiso Experimental Station, Kiso Fukushima; Dr Kazuyuki

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Lestremiine gall midges and their study in Japan

In current classifications, gall midges which are most primitive in both their biology and morphology are integrated into the Lestremiinae. Without doubt, this group, in its rank of a subfamily, is not monophyletic but paraphyletic. So far the subfamily status is accepted for convenience because their adults are easily separated morphologically from the remaining two subfamilies, the Porricondylinae and the Cecidomyiinae, by their first (most proximal) tarsomeres being longer than the distal ones and, as a rule, by the presence of ocelli. Present classification of the Lestremiinae is founded on the adult morphology mainly of their holarctic species (Jaschhof 1998). Generally, only males can be identified with certainty to species. Lestremiine larvae develop freely in many kinds of decaying organic matter, preferably that of broad-leaved trees, and feed on fungus mycelium. Their lifespan of lestremiine adults is short and their habits inconspicuous seen from a human perspective. Their body length reaches to only one to two millimetres in most species. Under suitable conditions of habitat and weather, lestremiine adults can be captured in large numbers representing numerous species by using effective methods, such as Malaise trapping, exhausting or sweepnetting. Broad-leaved forests in both the temperate and tropical zones accommodate the bulk of lestremiine taxa. Previously often considered a species-poor group, we are only beginning to understand the diversity of Lestremiinae.

The Japanese Cecidomyiidae were last revised by Yukawa in 1971. In that paper, 34 (plus four unnamed) species of Lestremiinae, which are now considered valid, were treated in detail and classified in 15 genera. Yukawa (1971) was used to make up the Lestremiinae section in the latest checklist of Japanese insects (Hirashima 1989). In a recent holarctic revision of the Lestremiinae (Jaschhof 1998), 38 Japanese species were considered. More recently, *Mycophila speyeri* was added to the Japanese list (Yukawa 1996). A brief historical outline on cecidomyiid studies in Japan up to 1971 is given in Yukawa (1971).

Material and Methods

Lestremiine material for this study originates essentially from three sources. A total of about 1000 male specimens in alcohol was provided by the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Fukuoka (as KUEC). This material was collected by Dr Junichi Yukawa and a few other dipterists mainly by sweepnetting at numerous sites throughout Japan between 1966-1978. Generally, these specimens stored in alcohol were in good condition for my purposes, but a part of the material had become too pale over the years and was consequently not used here. Additionally, slide-mounted lestremiine specimens of the above-mentioned collection were restudied. Second, the insect collection of F. F. P. R. I. contains numerous insect samples, fixed in alcohol and collected by Malaise trapping in Ogawa Research Forest, Ibaraki Prefecture, by Dr Kaoru Maeto during April-October, 1996. This material, extremely rich in Lestremiinae and studied here in parts, allowed a unique insight into the lestremiine fauna of various forest habitats, both natural and artificial, at a single geographical location throughout the seasons. Third, numerous specimens were collected by me by Malaise trapping, sweepnetting and exhausting in all main types of Japanese forest between October, 1998 and, as projected, September, 2000. Collecting sites cover the Japanese main islands as well as smaller, outlying island groups and stretch from northern Hokkaido to the subtropical Bonin Islands. Additionally, a small Japanese collection of Lestremiinae was gathered by me in 1995. In total, some 6000 specimens were identified and included in this study.

Techniques of collecting, preserving, slide-mounting, microscopy and drawing of lestremiine specimens for taxonomic purposes were explained in Jaschhof (1998). Terminology and classification follow usage in the same paper cited or are explained elsewhere in this paper.

All holotypes, some paratypes and a number of additional slide-mounted specimens are deposited in the KUEC. Other paratypes and the bulk of additional specimens are deposited in the Jaschhof collection in the Zoological Institute and Museum, University of Greifswald, Germany (ZIMG).

Data on distribution and biology of species include both new and previously published information if the reference material was seen by me. Under the biology section of particular species, Roman numerals are used for describing the period in which adults were collected. Distribution within Japan is presented by using a code with the abbreviations referring to political/geographical regions (listed geographically from northeast towards southwest) as follows:

Hokkaido: Hk

Soya Sub-Prefecture: So; Abashiri Sub-Prefecture: Ab; Rumoi Sub-Prefecture: Ru; Kamikawa Sub-Prefecture: Kk; Tokachi Sub-Prefecture: Ti; Kushiro Sub-Prefecture: Ks; Nemuro Sub-Prefecture: Ne; Ishikari Sub-Prefecture: Ir; Sorachi Sub-Prefecture: Sr; Hidaka Sub-Prefecture: Hd; Shiribeshi Sub-Prefecture: Sh; Iburi Sub-Prefecture: Iu; Oshima Sub-Prefecture: Oh; Hiyama Sub-Prefecture: Hm.

Honshu: Hn

Aomori Prefecture: Ao; Akita Prefecture: Ak; Iwate Prefecture: Iw; Yamagata Prefecture: Ya; Miyagi Prefecture: Mg; Fukushima Prefecture: Fs; Niigata Prefecture: Ni; Ibaraki Prefecture: Ib; Tochigi Prefecture: Tc; Gunma Prefecture: Gu; Saitama Prefecture: Si; Tokyo Prefecture: To; Chiba Prefecture: Ch; Kanagawa Prefecture: Kn; Nagano Prefecture: Nn; Yamanashi Prefecture: Yn; Toyama Prefecture: Ty; Ishikawa Prefecture:

Is; Fukui Prefecture: Fi; Shizuoka Prefecture: Sz; Aichi Prefecture: Ai; Gifu Prefecture: Gi; Shiga Prefecture: Sg; Mie Prefecture: Mi; Kyoto Prefecture: Ky; Nara Prefecture: Na; Osaka Prefecture: Os; Wakayama Prefecture: Wa; Hyogo Prefecture: Hy; Tottori Prefecture: Tt; Okayama Prefecture: Ok; Shimane Prefecture: Sm; Hiroshima Prefecture: Hi; Yamaguchi Prefecture: Yg.

Shikoku: Sh

Tokushima Prefecture: Tk; Kagawa Prefecture: Ka; Kochi Prefecture: Ko; Ehime Prefecture: Eh.

Kyushu: Ku

Fukuoka Prefecture: Fu; Saga Prefecture: Sa; Nagasaki Prefecture: Ns; Kumamoto Prefecture: Kt; Oita Prefecture: Oi; Miyazaki Prefecture: Mz; Kagoshima Prefecture: Km.

Ryukyu Islands: Ry

Northern Ryukyu's (to Kagoshima Pref.): Ry-Km; Southern Ryukyu's (to Okinawa Pref.): Ry-Ow.

Bonin Islands (to Tokyo): Bo-To

Brief outline on Palaeogeography, Zoogeography, Climate and Forest Vegetation

This section is based on the following sources: Brazil (1991), Kimura et al. (1991), Miyawaki (1979), Miyawaki & Nakamura (1988), Numata (1974), Ota (1998), Sedlag & Weinert (1987), WWF Japan (1984). It is addressed particularly to the non-Japanese reader who is less familiar with the natural conditions in this Far East country.

Paleogeography

The geohistory of the Japanese archipelago is most complex because the islands are not the result of a single orogenic cycle. Since the Silurian period, six main stages of earth movement have occurred, with each of them resulting in changes in the positions and directions of tectonic belts, belts of volcanic activity, metamorphism and folding. The youngest movements, in geological terms as recently as the Neogene, appear to have been the biggest. As a result, it is difficult to draw a concise picture of the all-Japanese paleogeography which goes beyond the mass of (local) details, and which is widely accepted. As for historic-zoogeographic considerations, it is important that the Japanese main islands have always kept their character as continental islands, close to or even (partly) connected with the Asian continent. During the Middle Jurassic, Japan reached its approximate present position by shifting northwards together with East Asia. The basin of the Japanese Sea, now separating Japan from the continent, started flooding in the Eocene, a process that was almost completed by the Early Miocene. More recent landbridges between the continent and Japan have existed to the Late Miocene / Early Pliocene (10 million years ago, extending from east China via Taiwan and Ryukyu Islands to main Japan), or since the Pliocene to the Late Pleistocene (7 m. y. a. until 20.000-15.000 y. a., between Korea and Japan). The Ryukyu island arc, or at least its southern islands, had a hypothesized land connection with East China via Taiwan as late as the Early or Middle Pleistocene (1,5-1 m. y. a.). The Ryukyus as a whole are considered separate from Kyushu (and thus from mainland Japan) for about 10 million years when the Tokara gap between the Tokara and Amami Islands was formed. The

essentially volcanic Bonin Islands, in contrast, are truly oceanic. Having arisen from the sea sometime between the Oligocene and the Pliocene, they have never had contact with any continental landmass.

Zoogeography

By far most of the Japanese territory is situated at the easternmost fringe of the Palearctic Region, forming its Manchurian Province together with China east of the great deserts and northwards to Manchuria, and together with Ussuria (to Russia) and Korea. In the north, Soya Strait, separating Hokkaido and Sakhalin, is considered the boundary between the Manchurian and Siberian Provinces and is called Hatta's Line. As for the southern limits of the Palearctic, Osumi Strait between Kyushu and Yaku Islands is usually considered the boundary for insect faunas between the Palearctic and Oriental Regions and is zoogeographically called Miyake's Line. Consequently, Japan's southwest, with the chain of the Ryukyu Islands, belongs to the Oriental Region (i. e., its Indo-Chinese Province). The oceanic Bonin Islands, situated in the Pacific about 1000 km slightly southeast of Tokyo, belong traditionally to the Oceanic Region, but this is subject to differing opinions depending on the group in study. Strictly speaking, Japan shares three zoogeographic regions in total.

As for the fauna's history, southwest Japan is known to be one of the refuges for the holarctic arboreal during the glacial periods in Pleistocene. This refuge is called the Japanese Center and may be considered a (secondary) center of dispersal for the times when the climate warmed again. Similar refuges existed in continental Asia facing Japan, called the Manchurian Center and the Sinopacific Center, respectively.

Climate

Corresponding to a 2400 km range from north to south, or from 46° to 20° N latitude, the Japanese archipelago shares four climatic zones, subarctic, cool temperate, warm temperate, and subtropical. Because of this wide range, seasons in Okinawa start almost two months earlier than in Hokkaido, for example. The distribution of the various zones within the country is explained in correspondence to the forest vegetation zones (see next section). Some 76 percent of the land area is mountainous or hilly, and consequently local climate much depends on elevation. Temperature is generally the dominating factor determining both climate and vegetation in Japan, because the archipelago enjoys a high precipitation throughout the year (annual mean of 1740 mm) and true arid regions do not exist. Average summer temperatures range from 20°C in Hokkaido to 27°C in Kyushu, those in winter from minus 10-0° C in Hokkaido to 5-9° C in Kyushu. Special features of Japan's climate are the occurrence of a rainy season (except in Hokkaido) which precedes summer, and the typhoon season with its peak in August and September. In Honshu, there are fundamental differences between the climates at the Japan Sea side (the side facing the Asian continent) and the Pacific side, caused by the highest mountain ranges which run roughly from northeast to southwest. The mountains form an effective barrier for the low altitude air masses brought by monsoon winds, prevailing from northwest in winter and southeast in summer. Whereas the inner zone (Japan Sea side) has high winter precipitation by heavy snowfall, the outer zone (Pacific side) has fairly dry winters but abundant rain in early summer. It is not surprising that in Japan, completely surrounded by sea, ocean currents have much effect on local climate, too. On the one hand, the warm

Japan Current, originating in Micronesia, furthers the subtropical and warm temperate conditions along the Pacific coasts of west Japan. Additionally, one of its branches, the Tsushima Current, causes more mild winter conditions in Honshu on the Japan Sea side. On the other hand, a cold current called Chishima (or Kurile) Current, originating in the Bering and Okhotsk Seas, cools off summers along the east Hokkaido and east Honshu coasts by building up thick fog. Another cold current, called the East Sakhalin Current, causes winter freezing of the coastal sea waters of north Hokkaido and the drop of temperatures even inland.

Forest vegetation

Natural vegetation in Japan is essentially forest, supported by a sufficiently warm and humid climate throughout the year. Japan's natural forest vegetation can be classified into four zones according to general physiognomy and climatic conditions.

1. Subarctic / subalpine evergreen coniferous forest. There is no true subarctic forest zone (taiga) in Japan and, consequently, this type of forest is restricted to subalpine elevations. These lie in southern Hokkaido between 400 and 1500 m a. s. l. (in northern Hokkaido stretching down to sea), in central Honshu between 1600 and 2500 m a. s. l., in Shikoku above 1800 m a. s. l., and are lacking in Kyushu and the more southern island groups. Characteristic trees of this zone are fir (*Abies*), spruce (*Picea*), and larch (*Larix*), often mixed with birch (*Betula*). Strictly speaking, the belt of small *Pinus pumila* above the timber forest zone belongs here too, but, no insect collections were made in those elevations within my study.

2. Cool temperate broad-leaved deciduous forest. This zone follows below the conifer belt in the mountains, and forms the lowland forest north of the 39th parallel what is in northern Honshu (Tohoku District). As a mountain forest, it occurs in central Honshu above 600-800 m a. s. l., in Shikoku above 900 m a. s. l., and on Yaku Island, south of Kyushu, above 1200 m a. s. l. In its typical expression it is a beech (*Fagus*) forest mixed with oaks (*Quercus*) and having a thick, tall undergrowth of dwarf bamboo (*Sasa*). Whereas this *Sasa* undergrowth is found virtually in all forest types, it is a most characteristic feature of Japan's deciduous forests. A fairly large number of deciduous tree species can be mixed among the dominant beech, these are species of maple (*Acer*), ash (*Fraxinus*), lime (*Tilia*), magnolia (*Magnolia*), and others. Among the trees accompanying beech are conifers as well. Beech forests are absent north of the Kuromatsunai line in southwest Hokkaido. Dominant trees in these northernmost deciduous broad-leaved forests of Japan are oak, elm (*Ulmus*), ash, and aralia (*Kalopanax*).

3. Warm temperate broad-leaved evergreen forest. This laurineous forest is the characteristic type of natural forest in western Japan, i. e. western Honshu, Shikoku, Kyushu and Ryukyu Islands. In eastern Honshu, it stretches as a narrow strip along the both sea sides as far north as Tohoku. Even in central Honshu, evergreen broad-leaved forest can reach up to 700 m a. s. l. in some places. This type of forest may have two or three layers of tall trees, with dominating evergreen oaks and oak chestnuts (*Castanopsis*). It is extremely rich in accompanying tree species of many genera, in particular, broad-leaved trees but also some conifers more inland.

4. Subtropical broad-leaved evergreen forest. This forest zone is the most sparsely represented in Japan and is restricted to the Ryukyu and Bonin Islands. It has been

widely destroyed and has extensively survived only on the small island of Iriomote, close to Taiwan. Differences between the Japanese subtropical and warm temperate evergreen broad-leaved forests are small, at least in the forests where my insect samples originate from. Consequently, I do not make a distinction here between the forest types under 3 and 4.

Almost 70 percent of the country is still forested, but one should keep in mind that the natural forest vegetation, as described above, has been strongly modified by man, and continues to be so. This is true especially for lowland evergreen broad-leaved forests which almost completely converted into rice paddies or other cultivated land for centuries. Hillsides in this zone are often occupied by secondary forests of deciduous trees and conifers that replace the former natural stands. Cool temperate and subalpine forests are generally better preserved, but these also have been widely replaced by plantations of conifers since World War II. Many of these forests were planted under unsuitable soil conditions and are now occupied by thickets of dwarf bamboo. The main conifer species in Japanese tree plantations are Japanese cedar, or sugi (*Cryptomeria japonica*), and false cypress, or hinoki (*Chamaecyparis obtusa*).

To characterize the present situation of Japanese forests in more detail, the following statistical survey may be of interest (source: World Agriculture and Forestry Census). In 1990, almost 42 percent of all Japanese forests were considered cultivated, with 41 percent referring to coniferous and less than 1 percent to broad-leaved forests. At the same time, 55 percent were considered natural forest, with just 10 percent referring to coniferous and 45 percent to broad-leaved forest. As for the ownership, almost 30 percent were referred to national forest, almost 5 percent each to prefectural and municipal forest, and 56 percent were owned privately.

Part 1: Genus *Pseudoperomyia* Jaschhof & Hippa, 1999

Introduction

Although *Pseudoperomyia* was not described until 1999 (Jaschhof & Hippa 1999a), it now already includes 22 species from the East Palearctic and Oriental Regions, plus six species described as new to science in this paper. The genus belongs to the Micromyini sensu Jaschhof (1998), with *Anodontoceras* or *Polyardis* as its evidently closest relatives (Jaschhof & Hippa 1999a, b). Among micromyine species, usually largely uniform in their morphology, many *Pseudoperomyia* species are exceptional by other than their often conspicuously modified antennae. Their male genitalic structures are of extraordinary diversity, and in many of its species those structures are strongly modified compared with ordinary micromyine taxa. *Pseudoperomyia* species, where they occur, are a regular component of the lestremiine fauna in broad-leaved forests, both deciduous and evergreen. However, almost all of the species seem to be rare even when occurring within a wide range. None of the Japanese species has ever been collected in greater numbers.

As for the Japanese fauna, *Pseudoperomyia* was recently reported to occur in Kyushu and Honshu (Jaschhof & Hippa 1999b). In this paper, current knowledge of nine Japanese species of *Pseudoperomyia* is summarized. In consideration of this new

information, the systematics, zoogeography and biology of this taxon is discussed and a key to species is given for the males.

Supplement to Information on the Genus

Description

Females of *Pseudoperomyia* are here described for the first time (see section for *P. composita* sp. n.). Another *Pseudoperomyia* female, fitting the description of *composita* but collected simultaneously with males of three similar species, has the antennae with 11 flagellomeres and the terminal flagellomeres each with a crown of three minute spines.

Systematics

Females of *Pseudoperomyia* correspond with those of the genus *Polyardis*. This is true for overall similarity as well as for the presence of a single, large and disc-shaped spermatheca, considered a synapomorphy for *Polyardis* + *Micromya* (cf. Jaschhof 1998). This may be another indication of a close relationship between *Pseudoperomyia* and *Polyardis* (cf. Jaschhof & Hippha 1999b).

Within *Pseudoperomyia*, there is a distinct group of species ("*longicornis*-group", corresponding to branch 42 in the cladogram in Jaschhof & Hippha 1999a: 164, Fig. 9) forming a well supported monophylum. In addition to *Pseudoperomyia longicornis*, *macrostyla* and *platistyla*, as well as three new species described here, *composita*, *hondoensis* and *japonica*, belong to this group. Other monophyletic groups, containing two or three species, can be justified by synapomorphies (cf. *Pseudoperomyia bryomyoides* and *gemina*, forming together the "*bryomyoides*-group"), but the bulk of the species cannot be classified into species groups. I hesitate to propose such a classification at the current stage of knowledge.

Pseudoperomyia is a diverse lestremiine taxon, much richer in number of species than currently indicated by its 28 representatives. I know of several additional species from both Malaysia and Japan. The 47 *Pseudoperomyia* specimens studied for this project belong to nine different species.

Zoogeography

Pseudoperomyia is presently distributed in the Palearctic Manchurian Province (six species), and in the Oriental Indo-Chinese (three species) and Indo-Malayan (22 species) Provinces. It seems to be absent from the lestremiine fauna of the West Palearctic which is fairly well known on the supraspecific level. But I expect *Pseudoperomyia* will be found in continental east Asia (China, Korea, or Ussuria) as indicated by its wide distribution within Japan. Certainly it is not by accident that the bulk of species is so far known from tropical southeastern Asia. Possibly South East Asia is the region to look for the center of origin of *Pseudoperomyia*. For example, 16 species were captured within a small area of one single evergreen broad-leaved forest in Peninsular Malaysia within a short time period (Jaschhof & Hippha 1999b). In Japan, *Pseudoperomyia* is now known from the Ryukyu Islands to as far north as Hokkaido. Records are lacking only from the isolated Bonin Islands. It is surprising that southern and western Japan with a predominantly evergreen broad-leaved vegetation does not have more species than central and northern Japan.

Despite the little data on the distribution of single species, three *Pseudoperomyia* species are now known from Peninsular Malaysia as well as from Japan. One of these species, *P. pyramidata*, extends its range to Hokkaido.

Biology

Larvae of *Pseudoperomyia* and their habitat remain unknown. There are indications that the adults of at least one species, *P. humilis*, emerged from humus soil (Jaschhof & Hippa 1999a). Adults were captured in both evergreen and deciduous broad-leaved forests, or those mixed with conifers. These evergreen broad-leaved forests include both tropical rainforests of the dipterocarp type (in Peninsular Malaysia and Borneo) and warm temperate / subtropical laurineous forest (in Japan). Various types of deciduous forest in Japan are inhabited by *Pseudoperomyia* as well, including the predominant beech forest and mixed deciduous forest north of beech-line. In respect to elevation, *Pseudoperomyia* species were captured from lowland up to mountain regions (in central Honshu, Japan, up to 1100 m a. s. l., in Peninsular Malaysia up to 1750 m a. s. l.). Collections inside forests proved to be much more productive in the number of species and specimens compared with collections along forest edges. Data on single species are too sparse to make conclusions about possible preferences in habitat selection or life cycle. For instance, *Pseudoperomyia pyramidata*, with its probable range from Peninsular Malaysia to Hokkaido, copes with tropical climate as well as with cool temperate, living as it does in rain forest as well as in deciduous forest. Further, there is no reason to consider *P. furcillata* an endemic of evergreen broad-leaved forests in Okinawa only because it is so far known only from this one island.

Key to Males of Known Species of *Pseudoperomyia*

Pseudoperomyia species known to occur in Japan are marked with an asterisk.

- 1 Antennal flagellomeres with barrel-shaped nodes with crenulate whorls of setae, and with necks arising from the posterior margin of nodes (see Fig. 6A), or at least with 1 fully developed crenulate whorl on the barrel-shaped nodes 2
- Antennal flagellomeres with subglobular nodes lacking fully developed crenulate whorls of setae, and with necks arising from or close to the centre of nodes (see Fig. 1A) 9
- 2 Gonostyli very large (approximately as long as gonocoxites) and subglobular in ventral view, without apical tooth-like structure or spines 3
- Gonostyli shorter than gonocoxites and more or less elongated in ventral view, with spines and / or apical tooth or tooth-like structures (see Fig. 6B) 4
- 3 Gonostyli longer than wide; flagellomere 4 with 1 complete and 4 incomplete crenulate whorls..... *P. bryomyoides* Jaschhof & Hippa, 1999*
- Gonostyli as long as wide; flagellomere 4 with 1 complete crenulate whorl only *P. gemina* Jaschhof & Hippa, 1999
- 4 Gonostyli without apical tooth or tooth-like structure, but having 2 or 3 strong spines 5
- Gonostyli with apical tooth or tooth-like structure, and with 0 or 2 subapical spines (see Fig. 6B) 6

- 5 Ocelli absent; genital rod absent *P. trispinata* Jaschhof & Hippha, 1999
 - Ocelli 3; genital rod present *P. bispinata* Jaschhof & Hippha, 1999
- 6 Gonostyli concave inside and with ventral lobe along inner margin covering a weak, tooth-like structure; sternite 10 with distinct contours
 *P. obtecta* Jaschhof & Hippha, 1999
 - Gonostyli without ventral lobe; sternite 10 indistinct 7
- 7 Gonostyli curved inwards, with strong and truncated apical tooth, without subapical spines *P. obtusidentata* Jaschhof & Hippha, 1999
 - Gonostyli not curved, with small and pointed apical tooth and 2 subapical spines 8
- 8 Genital rod with funnel-shaped opening apically, with basal pedestal of various shape; R5 with macrotrichia proximally *P. variabilis* Jaschhof & Hippha, 1999
 - Genital rod without apical funnel and basal pedestal, with pubescent membranous mantle and longitudinal row of setae dorsally; R5 without macrotrichia
 *P. velata* sp. n.* (see Figs. 6A-C)
- 9 Antennal flagellomeres with regular single to triple whorl of setae basally (see Fig. 2A), or with additional regular whorl of sensory hairs below of the regular whorl of setae 10
 - Antennal flagellomeres with irregularly arranged and mixed setae and sensory hairs basally (see Fig. 5A) 22
- 10 Ocelli absent 11
 - Ocelli present 16
- 11 Genital rod not ending in membranous funnel apically 12
 - Genital rod ending in wide membranous funnel apically 13
- 12 Apical tooth of gonostyli fingernail-like truncated; tegmen tapered into narrow cap-like projection *P. acutistyla* Jaschhof & Hippha, 1999
 - Apical tooth of gonostyli pointed; tegmen with cut distal margin having a ventrally-directed peak-like projection *P. labellata* Jaschhof & Hippha, 1999
- 13 Gonostyli with one-pointed apical tooth 14
 - Gonostyli with two-pointed apical tooth *P. bidentata* Jaschhof & Hippha, 1999
- 14 Apical tooth of gonostyli very long and slender; tegmen parallel-sided and as long as wide *P. longidentata* Jaschhof & Hippha, 1999
 - Apical tooth of gonostyli short; tegmen tapered to tip and longer than wide 15
- 15 Eye bridge 8-9 facets long laterally; gonostyli without lobe at inner margin beneath the apical tooth *P. oculibunda* Jaschhof & Hippha, 1999
 - Eye bridge 6-7 facets long laterally; gonostyli with lobe at inner margin beneath the apical tooth *P. ventricosa* Jaschhof & Hippha, 1999
- 16 Postfrons with setae and scales; R5 with 1 sensory pore
 *P. polyardioides* Jaschhof & Hippha, 1999
 - Postfrons without vestiture; R5 without sensory pore 17
- 17 Flagellomere 4 with node wider than long, and with sensory hairs of same length regularly arranged to form a double to triple whorl 18
 - Flagellomere 4 with node as long as wide or longer, and with irregularly arranged sensory hairs of various length 19
- 18 Flagellomere 4 with sensory hairs reaching to the tip of neck; genital rod with sclerotized fork apically *P. furcillata* sp. n.* (see Figs. 3A-C)

- Flagellomere 4 with sensory hairs ending clearly below of the tip of neck; genital rod with membranous funnel apically *P. orophila* Jaschhof & Hippha, 1999
- 19 Flagellomere 4 with regular whorl of sensory hairs most basally, i. e. below the regular double to triple whorl of setae *P. pyramidata* Jaschhof & Hippha, 1999*
- Flagellomere 4 without regular whorl of sensory hairs most basally 20
- 20 Tergite 10 with distinct contours, elongated and with horn-like projections distally; gonostyli with subapical lobe ventrally *P. parvolobata* Jaschhof & Hippha, 1999
- Tergite 10 indistinct, ovoid and without modifications distally; gonostyli without lobe 21
- 21 Tegmen clearly longer than wide *P. fagiphila* sp. n.* (see Figs. 2A-C)
- Tegmen as long as wide or shorter *P. humilis* Jaschhof & Hippha, 1999*
- 22 Gonocoxites with ventral emargination extending to half the length of gonocoxites *P. intermedia* Jaschhof & Hippha, 1999
- Gonocoxites with ventral emargination extending to almost the full length of gonocoxites 23
- 23 Tegmen with strong waist-like medial constriction resulting in an almost rhomboid distal half; genital rod extremely short, i. e. 1/3 of tegmen length *P. platystyla* Jaschhof & Hippha, 1999
- Tegmen otherwise shaped; genital rod about as long as tegmen or so weakly membranous that it may appear to be lacking 24
- 24 Gonostyli very long and narrow in ventral view, without apical tooth or tooth-like structure (see Figs. 1B, 5B) 25
- Gonostyli not outstandingly long and narrow, with apical tooth or tooth-like structure (see Fig. 4B)..... 27
- 25 Genital rod weakly membranous (seems lacking sometimes); tegmen pointed distally; tergite 9 with horn-like processes directed inwards *P. composita* sp. n.* (see Figs. 1A-E)
- Genital rod strongly sclerotized; tegmen rounded distally; tergite 9 without horn-like processes directed inwards 26
- 26 Gonostyli dorsally with broadly rounded subbasal lobe with long spine-like setae; tergite 9 with four medial setae *P. japonica* sp. n.* (see Figs. 5A-D)
- Gonostyli dorsally with long, tapered subbasal lobe with short, spine-like apical setae; tergite 9 with two medial setae *P. macrostyla* Jaschhof & Hippha, 1999
- 27 Gonostyli with small, fingernail-like tooth apically; tergite 9 with very short horn-like processes directed inwards; tegmen with waist-like constriction in basal half *P. hondoensis* sp. n.* (see Figs. 4A-D)
- Gonostyli with large tooth-like plate inserting dorsally and extending to tip of gonostyli; tergite 9 with long horn-like processes; tegmen parallel-sided *P. longicornis* Jaschhof & Hippha, 1999

Species of *Pseudoperomyia* in Japan

Species are treated in alphabetical order. Character states not explicitly mentioned in the descriptions correspond to those given in the description of genus (cf. Jaschhof & Hippha 1999a, b).

Pseudoperomyia bryomyoides Jaschhof & Hippa, 1999

Distribution and biology. Oriental (Indo-Malayan), Palearctic (Manchurian). Japan: Ku (Kt, Km).

Japanese specimens of *bryomyoides* were collected in evergreen broad-leaved forest up to 600 m a. s. l. (in IV, VII, IX).

Material studied (2 males). Kyushu: Kagoshima Pref., Kagoshima City, Iso, 30 April 1968, leg. Yukawa, 1 male; Kumamoto Pref., Minamata City, Kugino, 6 July 1968, leg. Yukawa, 1 male [all in KUEC].

Pseudoperomyia composita sp. n.

(Figs. 1A-G)

Male. Body size: 1.1-1.3 mm.

Head: Postfrons nonsetose. Ocelli 3. Eye bridge 2-3 facets long laterally and 3-4 facets at vertex. With 2 rows of postocular bristles. Antennae with 12 flagellomeres; terminal flagellomere ovoid, with short neck and a crown of 3 minute spines. Neck of flagellomere 4 (Fig. 1A) shorter than node; node with numerous setae and short sensory hairs irregularly arranged in basal half, medially with irregular double to triple whorl of long setae, distally with numerous scattered sensory hairs, few sensory spines and 1 conical sensilla. Third palpal segment longer than second, second segment with few sensory hairs basally.

Thorax: Arrangement of lateral scutal setae of extended type. Wings: R1=2 1/2 rs.

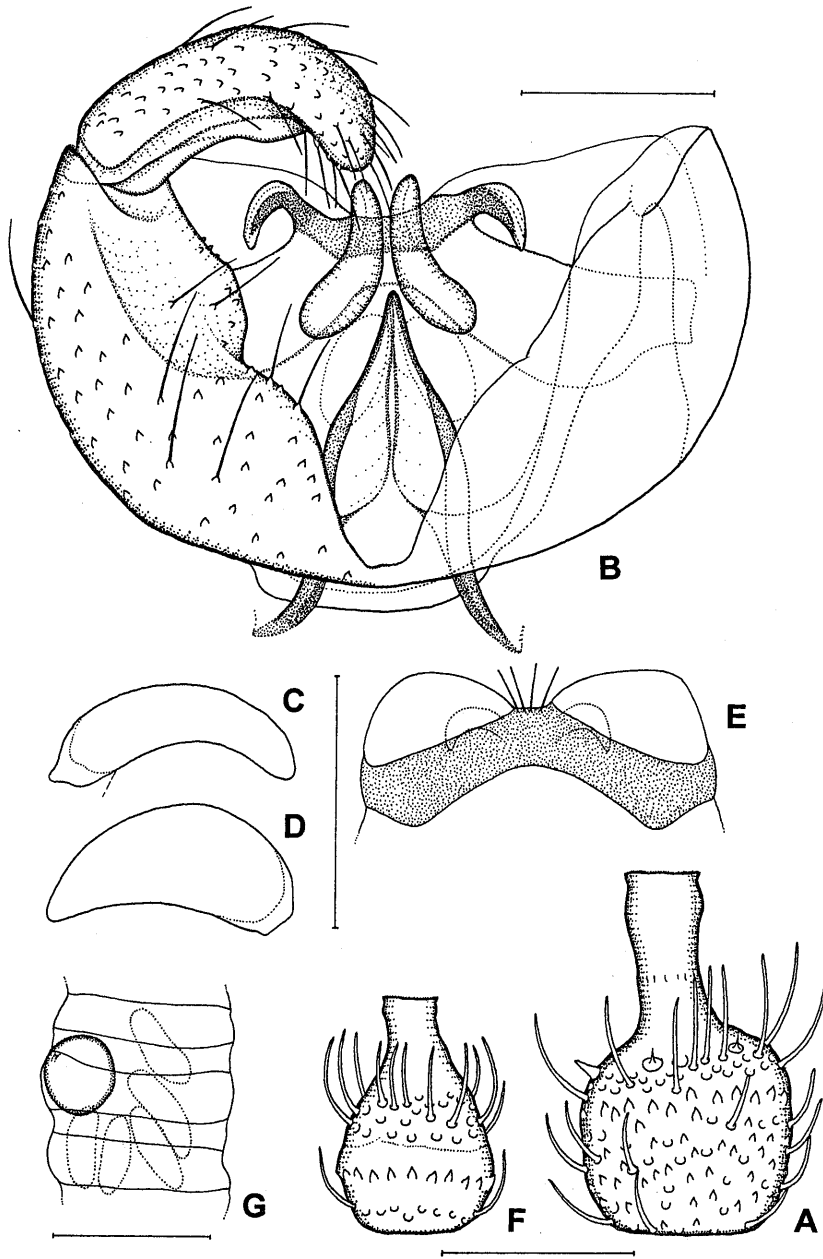
Abdomen: Pattern of tergal plaques: 0 / 2 / 2 / 2 / 2 / 1 / 0 / 0.

Terminalia: Wide and much extended in third dimension. Gonocoxites (Fig. 1B) with very deep, roughly V-shaped emargination ventrally (consequently, almost completely divided basoventrally), covered with setae and scales ventrally. Gonostyli (Figs. 1B-D) huge, elongated; curved and slender when seen from lateral, crescent-shaped and flattened with wider basal half when seen from above; outside with fairly short setae most dense in distal fourth, and with few scales basally, inside nonsetose except dorsal margin with long setae. Tegmen (Fig. 1B) longer than wide, tapered to tip and pointed, parameral apodemes extending beyond basal gonocoxal margin. Genital rod long but membranous and consequently not always visible (so, for example, in holotype). Tergite 9 (Fig. 1E) with short, sclerotized, band-like central portion and 2 big distolateral membranous lobes, additionally with 2 long, hooked processes directed inwards, setation widely reduced with 4 medial setae along distal margin. Tergite 10 (Fig. 1B) with sharp contours, bilobed, elongated and bean-shaped, densely pubescent and with few short setae distally. Sternite 10 bilobed, indistinct, pubescent.

Female. Body size: 1.3-1.5 mm.

Head: Antennae broken in specimens available with maximally 9 flagellomeres remained. Flagellomere 4 (Fig. 1F) pear-shaped, with short neck, with 1 whorl of short sensory hairs basally and, beyond latter, with 1 whorl of long setae, medially and distally with numerous scattered short sensory hairs, few sensory spines and 1 conical sensilla.

Abdomen: With 1 big, disc-shaped, sclerotized spermatheca (Fig. 1G) lacking pores. Genitalia of usual micromyine type; sternite 8 with strong, spine-like setae distally and fine setae scattered elsewhere.



Figs. 1A-G: *Pseudoperomyia composita* sp. n.; A: flagellomere 4 of male, ventrolateral view (0.05 mm); B: male genitalia, ventral view (0.05 mm); C: gonostylus, lateral view (0.1 mm); D: gonostylus, seen from above (0.1 mm); E: tergite 9 of male, dorsal view (0.1 mm); F: flagellomere 4 of female, lateral view (0.05 mm); G: abdominal segments 3-5 of female with spermatheca and eggs, dorsal view (0.25 mm). A: holotype; B-G: paratypes. (In parenthesis: length of scale bar.)

Types. Holotype: male, no. A0791, Japan, Honshu, Ibaraki Pref., Kitaibaraki City, Sadanami, Ogawa Research Forest, in secondary deciduous forest, 650 m, 6-20 August 1996, by Malaise trap, leg. Maeto [in KUEC]. Paratypes: 7 males and 5 females, no. A0792-A0803, same data as holotype [no. A0800 in KUEC, others in ZIMG].

Discussion. Male genitalia in *Pseudoperomyia composita* are most similar to those in *P. macrostyla* and *P. japonica* (see below in this paper). Among these three species, *composita* is the only one with the gonostyli lacking a distinct subbasal lobe, and with tergite 9 having two hooked processes inside. Additional differences concern gonocoxites, tegmen and genital rod.

Distribution and biology. Palearctic (Manchurian). Japan: Hn (Ao, Ib, Nn).

This species is known from central and eastern Honshu (in VII-IX) where specimens were collected in both young and mature deciduous forests dominated by beech (*Fagus crenata*). The collecting sites lie between 500 and 1100 m a. s. l. *P. composita* was once Malaise trapped together with the closely related *P. hondoensis* and *japonica* (for both, see below).

Etymology. The name (in Latin *compositus* = compound) refers to male genitalia in this species which look like an arrangement of characters "borrowed" from several other *Pseudoperomyia* species described previously.

Other material studied (2 males). Honshu: Aomori Pref., Towadako Town, near Tsuta Onsen, 28 July 1999, 1 male, no. A0804, leg. Jaschhof; Nagano Pref., Kiso Vill., Mizukisawa Forest, 16 August-6 September 1999, 1 male, no. A0817, leg. Jaschhof [all in ZIMG].

Pseudoperomyia fagiphila sp. n.

(Figs. 2A-C)

Male. Body size: 1.0 mm.

Head: Postfrons nonsetose. Ocelli 3. Eye bridge 2-3 facets long. With 1 row of postocular bristles. Antennae broken in specimens available with maximally 10 flagellomeres remained. Neck of flagellomere 4 (Fig. 2A) as long as node or little longer; node rather slender, with double to triple whorl of long setae basally and with numerous, irregularly arranged sensory hairs of various length, distally with 1 small, bottle-shaped sensilla and few sensory spines among the setae. Third palpal segment longer than second, second segment with few sensory hairs basally.

Thorax: Arrangement of lateral scutal setae of reduced type. Wings: R1=2 -3 rs.

Abdomen: Pattern of tergal plaques uncertain.

Terminalia: Gonocoxites (Fig. 2B) ventrally with U-shaped emargination extending to less than half the length of gonocoxites, covered with setae and few scales ventrally. Gonostyli (Fig. 2B) stout, broadest in proximal half and tapered to tip in distal half, with straight, fingernail-like apical tooth and 2 subapical spines shorter than the tooth, gonostyli evenly covered with fairly long setae. Tegmen (Fig. 2C) longer than wide, slightly tapered to tip, with rounded, weakly membranous distal margin, with parameral apodemes not extending beyond basal gonocoxal margin. Genital rod (Fig. 2C) slightly longer than tegmen, slender, sclerotized, with membranous funnel apically running into margins of tegmen. Tergite 9 short, with halfmoon-shaped sclerotization, with row of

setae along distal margin. Tergite 10 bilobed, rounded, densely pubescent and with few fine setae. Sternite 10 very weakly membranous, bilobed, pubescent.

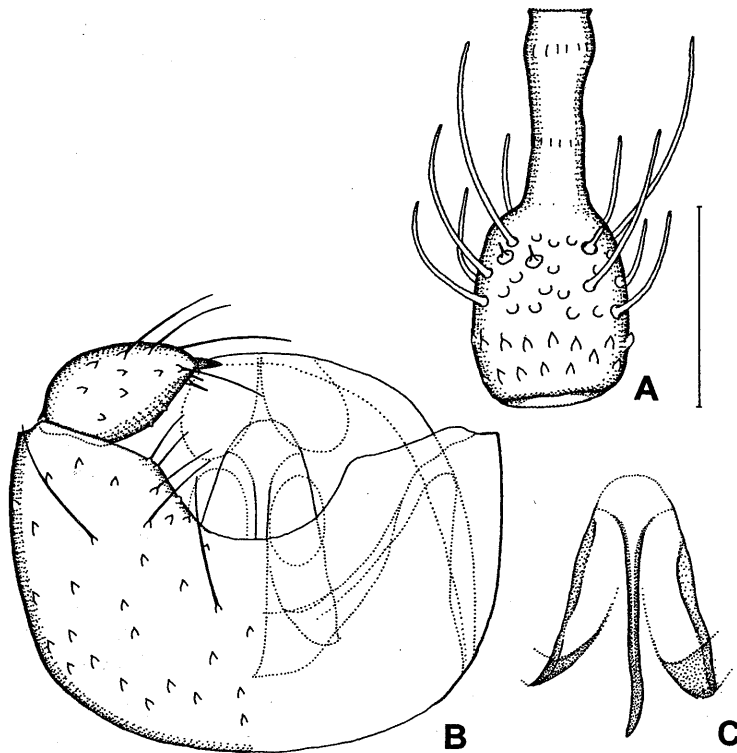
Female. Unknown.

Types. Holotype: male, no. A0818, Japan, Honshu, Ibaraki Pref., Kitaibaraki City, Sadanami, Ogawa Research Forest, in secondary deciduous forest, 650 m, 9-25 July 1996, by Malaise trap, leg. Maeto [in KUEC]. Paratypes: 3 males, no. A0819-A0821, Honshu, Akita Pref., Minehama Vill., Shirakami Mts., Mizusawa River Valley, in primary mixed deciduous forest, 500-700 m, 22 June 1999, by sweepnet, leg. Jaschhof [in ZIMG].

Discussion. *Pseudoperomyia fagiphila* is most similar to *P. humilis*. It differs from the latter (characters in parenthesis) as follows: eye bridge 2-3 facets long (4-5 facets), gonostyli thicker and with a straight, slightly fingernail-like tooth (with a slightly curved, pointed tooth), tegmen clearly longer than wide (tegmen as long as wide, or even wider than long).

Distribution and biology. Palearctic (Manchurian). Japan: Hn (Ak, Ib).

The few specimens known were collected in central and eastern Honshu (in VI-VII) in mature deciduous forest dominated by beech (*Fagus crenata*) in 500-700 m a. s. l.



Figs. 2A-C: *Pseudoperomyia fagiphila* sp. n., male; A: flagellomere 4, lateral view; B: male genitalia, ventral view; C: tegmen and genital rod, ventral view. A-C: holotype. (Length of scale bar: 0.05 mm.)

Etymology. The name *fagiphila* (in Greek *fagiphilus* = beech loving) refers to the forest type where the specimens were captured.

Pseudoperomyia furcillata sp. n.
(Figs. 3A-C)

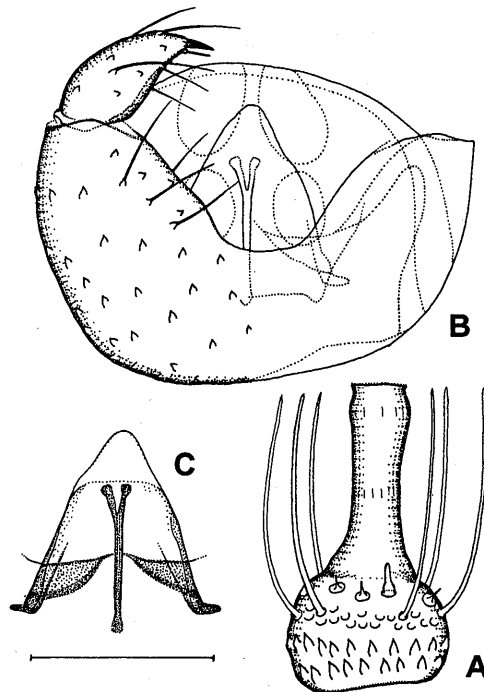
Male. Body size: 1.0 mm.

Head: Postfrons nonsetose. Ocelli 3. Eye bridge 3 facets long laterally and 3-4 facets at vertex. With 1 row of postocular bristles. Antennae broken in specimens available with maximally 8 flagellomeres remained. Neck of flagellomere 4 (Fig. 3A) longer than node; node wider than long, with double to triple whorl of long setae basally, medially with double whorl of sensory hairs of about same length, i. e. as long as neck, distally with 1 bottle-shaped sensilla and few sensory spines. Third palpal segment longer than second.

Thorax: Arrangement of lateral scutal setae of reduced type. Wings: R1=1 1/2 rs.

Abdomen: Pattern of tergal plaques: 0/2/2/2/2/1/0/0.

Terminalia: Gonocoxites (Fig. 3B) with U-shaped emargination ventrally extending to less than half the length of gonocoxites, covered with setae ventrally. Gonostyli (Fig. 3B) slender, slightly curved inwards, broadest in proximal third and tapered to tip distally, with straight apical tooth and 2 subapical spines just as long as and very close to the tooth, gonostyli evenly covered with setae. Tegmen (Fig. 3C) longer than wide, ta-



Figs. 3A-C: *Pseudoperomyia furcillata* sp. n., male; A: flagellomere 4, lateral view; B: male genitalia, ventral view; C: tegmen and genital rod, ventral view. A-C: holotype. (Length of scale bar: 0.05 mm.)

pered to tip, with distal third weakly membranous, with parameral apodemes not extending beyond basal gonocoxal margin. Genital rod (Fig. 3C) shorter than tegmen, slender, sclerotized, with sclerotized fork apically. Tergite 9 short, with halfmoon-shaped sclerotization, with row of setae along distal margin. Tergite 10 bilobed, rounded, densely pubescent and with fine setae. Sternite 10 weakly membranous, bilobed, pubescent.

Female. Unknown.

Types. Holotype: male, no. A0836, Japan, the Ryukyu Islands, Okinawa Pref., Okinawa, Yambaru Peninsula, Yona Vill., in evergreen broad-leaved forest, 18-22 March 1999, by Malaise trap, leg. Jaschhof [in KUEC]. Paratypes: 2 males, no. A0837-A0838, Okinawa, Yambaru Peninsula, Kunigami Vill., Okuma, in primary evergreen broad-leaved forest, 19 March 1999, by exhaustor, leg. Jaschhof [in ZIMG].

Discussion. *Pseudoperomyia furcillata* is similar to *P. orophila* in sharing the wide nodes of antennal flagellomeres with regularly arranged sensory hairs of same length. Both species may easily be distinguished by characters of their genitalia. In *furcillata*, the genital rod is forked at tip whereas it runs into a membranous funnel in *orophila*. Gonostyli in *furcillata* are more slender and have a simple apical tooth, those in *orophila* are stout and have a multiple pointed apical tooth.

Distribution and biology. Oriental (Indo-Chinese). Japan: Ry-Ow.

The few known specimens were captured at two closely adjacent sites on Okinawa (in III), both in lowland evergreen broad-leaved forest.

Etymology. The name *furcillata* (in Latin *furcillatus* = forked) refers to the genital rod which has a forked tip.

Pseudoperomyia hondoensis sp. n.

(Figs. 4A-D)

Male. Body size: 1.0 mm.

Head, thorax and abdomen: Corresponding with *P. composita* (see there), but antennae broken in specimens available with maximally 5 flagellomeres remained, and pattern of tergal plaques uncertain.

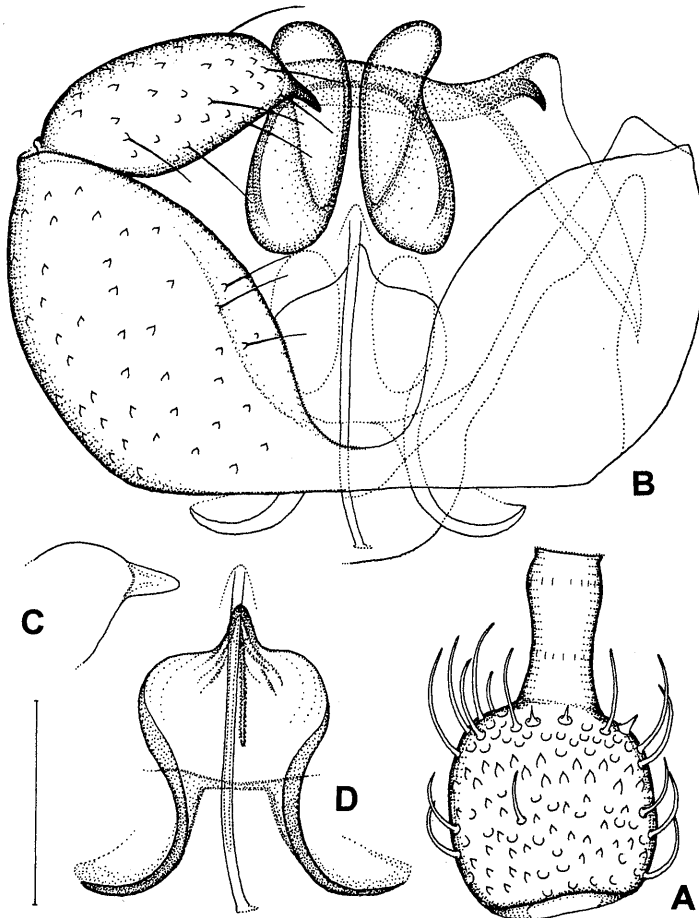
Terminalia: Gonocoxites (Fig. 4B) wide, with very deep U-shaped emargination ventrally (consequently, almost completely divided basoventrally), covered with setae ventrally. Gonostyli (Figs. 4B and C) big compared with gonocoxites, somewhat flattened when seen from above, slightly tapered to tip when seen from lateral, with fingernail-like apical tooth, evenly covered with fairly long setae. Tegmen (Fig. 4D) longer than wide, with parameral apodemes extending beyond basal gonocoxal margin and widely spread-out, with waist-like constriction in basal half, distal margin pointed with seemingly sclerotized knob medially, latter very probably originating from nose-like projection directed dorsad. Genital rod (Fig. 4D) slightly longer than tegmen, slender, poorly sclerotized, with membranous cap apically. Tergite 9 (Fig. 4B) with distal margin narrowed and 2 rather inconspicuous distolateral membranous lobes, with 2 short, hooked distolateral processes directed ventrad, with row of setae along distal margin. Tergite 10 (Fig. 4B) big, with sharp contours, bilobed, elongated and bean-shaped,

densely pubescent and with few fine setae distally. Sternite 10 bilobed, weakly membranous, pubescent.

Female. Unknown.

Types. Holotype: male, no. A0809, Japan, Honshu, Ibaraki Pref., Kitaibaraki City, Sadanami, Ogawa Research Forest, in secondary deciduous forest, 650 m, 6-20 August 1996, by Malaise trap, leg. Maeto [in KUEC]. Paratype: 1 male, no. A0810, same data as holotype [in ZIMG].

Discussion. *Pseudoperomyia hondoensis* is similar to *P. longicornis*. It differs from the latter in the male genitalia as follows: gonostyli thicker and with much smaller fingernail-like tooth, tegmen shorter and wider, genital rod more slender, and tergite 9 with much shorter hooked processes.



Figs. 4A-D: *Pseudoperomyia hondoensis* sp. n., male; A: flagellomere 4, ventrolateral view; B: male genitalia, ventral view; C: tip of gonostylus, seen from above; D: tegmen and genital rod, ventral view. A, B and D: holotype; C: paratype. (Length of scale bar: 0.05 mm.)

Distribution and biology. Palearctic (Manchurian). Japan: Hn (Ib).

Specimens were trapped in central Honshu (in VIII) in a young deciduous forest dominated by beech (*Fagus crenata*) at 650 m a. s. l.

Etymology. The name is derived from Hondo, a historical name for Honshu, where the type-material originates from.

Pseudoperomyia humilis Jaschhof & Hippa, 1999

Discussion. The eye bridge in the Japanese specimen is six facets long and thus little longer than in specimens from Malaysia in which it is four to five facets long.

Distribution and biology. Oriental (Indo-Chinese, Indo-Malayan). Japan: Ry-Ow. New for Japan.

The single Japanese specimen was trapped on Iriomote Island (in III) in a lowland primary evergreen broad-leaved forest.

Material studied (1 male). Ryukyu Islands: Okinawa Pref., Iriomote, Funaura, Mare River Valley, 5-15 March 1999, leg. Jaschhof, 1 male, no. A0816 [in ZIMG].

Pseudoperomyia japonica sp. n.

(Figs. 5A-D)

Male. Body size: 1.0-1.1 mm.

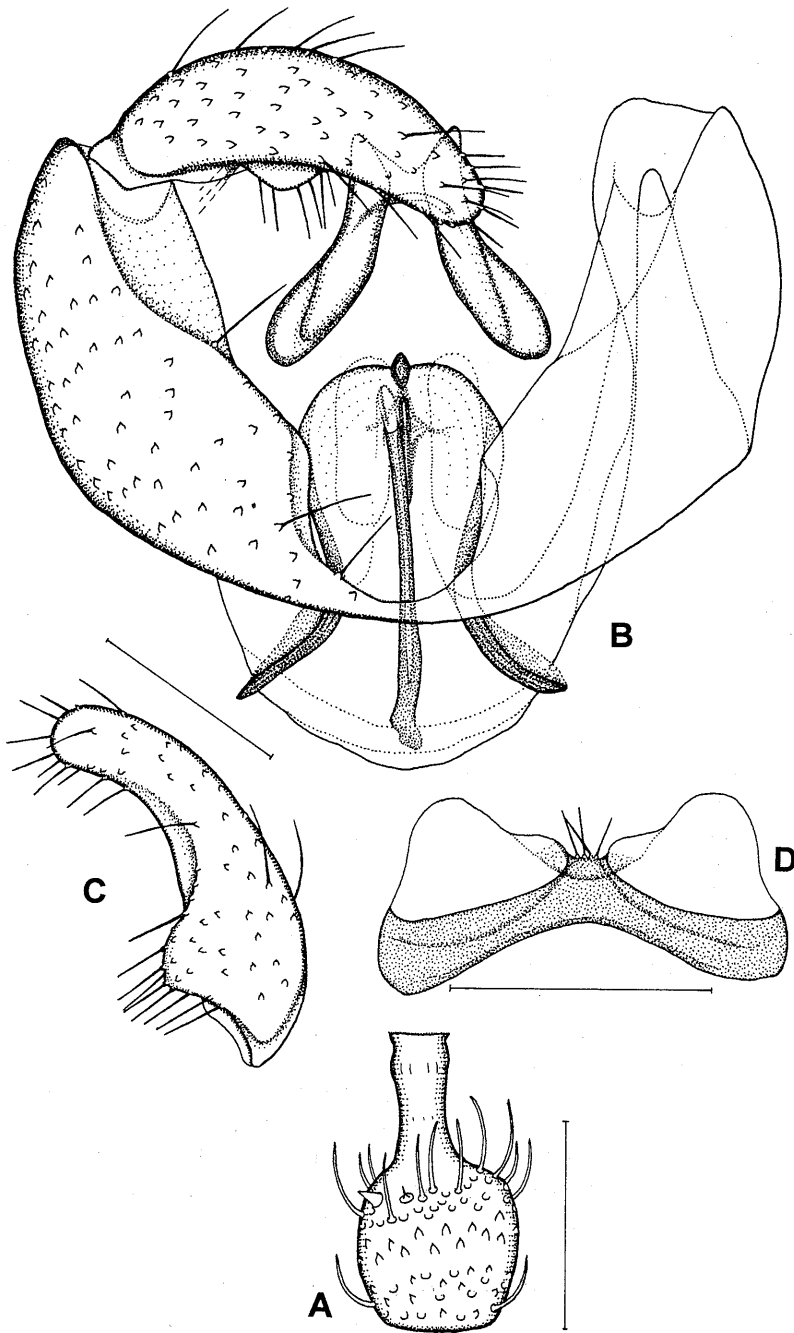
Head, thorax and abdomen: corresponding with *P. composita* (see there).

Terminalia: Wide and much extended in third dimension. Gonocoxites (Fig. 5B) with very deep, V- to U-shaped emargination ventrally (consequently, almost completely divided basoventrally), covered with setae ventrally. Gonostyli (Figs. 5B and C) huge, elongated, curved and slender when seen from lateral, flattened when seen from above, dorsally with subbasal rounded lobe having fairly long spine-like setae; outside with fairly short setae most dense in distal fourth, inside nonsetose. Tegmen (Fig. 5B) longer than wide, with parameral apodemes clearly extending beyond basal gonocoxal margin and widely spread-out, distal margin broadly rounded with sclerotized knob medially, latter very probably originating from nose-like projection directed dorsad, another probable nose-like projection more centrally. Genital rod (Fig. 5B) as long as tegmen, slender and sclerotized except at tip. Tergite 9 (Fig. 5D) with short, sclerotized, band-like central portion and 2 big distolateral membranous lobes, setation widely reduced with 4 medial setae along distal margin. Tergite 10 (Fig. 5B) with sharp contours, bilobed, elongated and bean-shaped, with pinecone-like structure distally and densely pubescent elsewhere. Sternite 10 bilobed, distinct by its strong pubescence.

Female. Unknown.

Types. Holotype: male, no. A0805, Japan, Honshu, Ibaraki Pref., Kitaibaraki City, Sadanami, Ogawa Research Forest, in secondary deciduous forest, 650 m, 9-25 July 1996, by Malaise trap, leg. Maeto [in KUEC]. Paratypes: 3 males, no. A0806-A0808, same locality as holotype, but 6-20 August 1996 [in ZIMG].

Discussion. *Pseudoperomyia japonica* is similar to *P. macrostyla*. It differs from the latter (characters in parentheses) in male genitalia as follows: gonocoxites with unmodified inner bridge (inner bridge extended inwards forming a pointed, setose lobe),



Figs. 5A-D: *Pseudoperomyia japonica* sp. n., male; A: flagellomere 4, lateral view (0.05 mm); B: male genitalia, tergite 9 omitted, ventral view (0.05 mm); C: gonostylus, dorsal view (0.05 mm); D: tergite 9, dorsal view (0.1 mm). A-D: paratypes. (In parenthesis: length of scale bar.)

gonostyli dorsally with broadly rounded subbasal lobe with long spine-like setae (gonostyli dorsally with long, tapered subbasal lobe with short, spine-like apical setae), tegmen shorter and wider in *japonica*, genital rod more slender in *japonica*, tergite 9 with four medial setae (tergite 9 with two medial setae).

Distribution and biology. Palearctic (Manchurian). Japan: Hn (Ib).

The specimens, known from a single locality in central Honshu, were collected in young and mature deciduous forest dominated by beech (*Fagus crenata*) at 650 m a. s. l. They occurred in summer (VII-VIII).

Etymology. The name refers to the Japanese origin of the type-material.

Pseudoperomyia pyramidata Jaschhof & Hipka, 1999

Male (Supplement to description).

Head: Postocular bristles arranged in 2 rows with second row consisting of 2-6 bristles. Antennae broken in specimens available, but with at least 10 flagellomeres. Flagellomere 4 as described previously, but additionally with basal row of sensory hairs ventrally.

Thorax: Wing vein R₁=up to 2rs.

Genitalia: Gonocoxites with distal margin emarginated ventrally as described previously, but emargination extending from 1/4 to 1/3 of the length of gonocoxites. Gonostyli with multipointed apical tooth, probably 3- or more-pointed what is not or hardly visible in some preparations but clear in others. Tegmen with its distal third weak in contours and with tip triangular or slightly rounded.

Discussion. The original description of *pyramidata* is here completed on the basis of additional specimens from Japan. Japanese specimens and Malaysian type-material correspond completely except in the length of the second row of postocular bristles which seems generally little longer in Malaysian material. *P. pyramidata* is unique by having the flagellomeres with a ventral row of sensory hairs most basally. Further, it is characterized by its short, fairly small gonostyli with a long, multipointed apical tooth.

Distribution and biology. Oriental (Indo-Malayan), Palearctic (Manchurian). Japan: Hk (Ir), Sh (Ko). New to Japan.

Japanese specimens were collected in the southwest (in XI) and in the north (in VII) of the country. Collecting sites were situated in lowland in a secondary mixed coniferous / evergreen broad-leaved forest and in a secondary mixed deciduous forest.

Material studied (5 males). Hokkaido: Sapporo, Toyohira, 29 June-26 July 1999, leg. Fukuyama & Jaschhof, 4 males, no. A0812-A0815; Shikoku: Kochi, Asakura, 4 November 1998, leg. Jaschhof, 1 male, no. A0811 [all in ZIMG].

Pseudoperomyia velata sp. n.

(Figs. 6A-C)

Male. Body size: 0.9-1.0 mm.

Head: Postfrons nonsetose. Ocelli 3. Eye bridge 4-5 facets long. With 1 row of postocular bristles. Antennae broken in specimens available with maximally 10 flagellomeres remained. Neck of flagellomere 4 (Fig. 6A) little shorter or as long as node;

node with 1 whorl of setae basally, with 1 complete and 3-4 incomplete crenulate whorls of setae, distally with numerous sensory hairs of various length, 1 bottle-shaped sensilla and few sensory spines. Third palpal segment longer than second, second segment sometimes with few sensory hairs basally.

Thorax: Arrangement of lateral scutal setae of reduced type. Wings: R1=1 1/2 -2 1/2 rs; R5 without macrotrichia.

Abdomen: Pattern of tergal plaques uncertain.

Terminalia: Gonocoxites (Fig. 6B) with U-shaped emargination ventrally extending to less than half the length of gonocoxites, covered with setae and few scales ventrally. Gonostyli (Fig. 6B) stout, broadest in proximal half and tapered to tip in distal half, with straight, comparatively long apical tooth and 2 subapical spines shorter than and very close to the tooth, gonostyli evenly covered with fairly long setae. Tegmen (Fig. 6C) little longer than wide, slightly tapered to tip, with rounded distal margin, with parameral apodemes not extending beyond basal gonocoxal margin. Genital rod (Fig. 6C) about as long as tegmen, slender, poorly sclerotized and often with indistinct contours, covered by weakly pubescent, membranous mantle ventrally, dorsally with indistinct longitudinal row of setae. Tergite 9 short, with halfmoon-shaped sclerotization, with row of setae along distal margin. Tergite 10 bilobed, rounded, densely pubescent and with fine setae. Sternite 10 weakly membranous, bilobed, pubescent.

Female. Unknown.

Types. Holotype: male, no. A0822, Japan, Ryukyu Islands, Okinawa Pref., Okinawa, Yambaru Peninsula, Kunigami Vill., in primary evergreen broad-leaved forest, 19 March 1999, by exhaustor, leg. Jaschhof [in KUEC]. Paratypes: 3 males, no. A0823-A0825, same data as holotype; 1 male, no. A0826, Okinawa, Yambaru Peninsula, Yona Vill., in primary evergreen broad-leaved forest, 18 March 1999, by sweepnet, leg. Jaschhof [in ZIMG].

Discussion. *Pseudoperomyia velata* is most similar to *P. variabilis*. Structure of the tegmen / genital rod-complex differs in the both species. In *velata*, the genital rod lacks a funnel-like opening at tip as well as a basal pedestal, both found in *variabilis*. The genital rod in *velata* is covered by a membranous mantle with a weak pubescence, and dorsad of the genital rod is a longitudinal row of setae which is hardly visible in many of the slide mounts. Additionally, wing vein R5 in *velata* lacks macrotrichia whereas the proximal section of R5 in *variabilis* has a few macrotrichia.

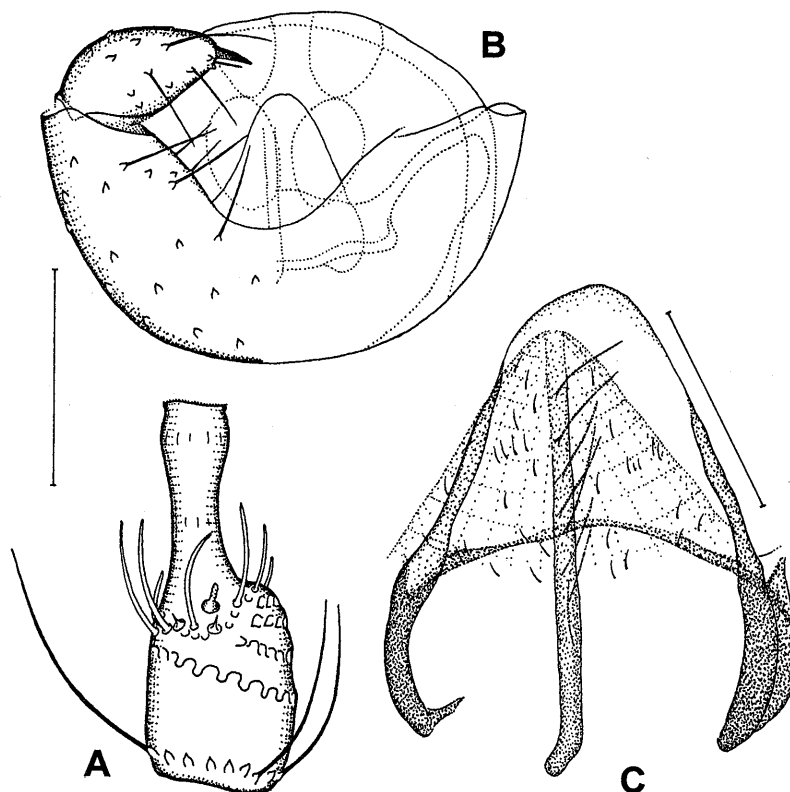
The eye bridge in *velata* is usually shorter (four to five facets long) than that in *variabilis* (six to seven facets). But, there are four specimens from Hokkaido and Honshu (no. A0832-A0835) that widely fit *velata* except their eye bridge which is as long as in *variabilis*. For the moment, I leave these specimens unidentified to species.

Distribution and biology. Oriental (Indo-Chinese). Japan: Ry-Km, Ry-Ow.

Specimens of *velata* were collected in various lowland evergreen-broad-leaved forests, primary or at least mature, in the Ryukyu Islands (in III).

Etymology. The name *velata* (in Latin *velatus* = covered) refers to the genital rod covered by a pubescent membrane.

Other material studied (5 males). Ryukyu Islands: Kagoshima Pref., Amami Oshima, Uken Vill., 28 March 1999, leg. Jaschhof, 2 males, no. A0827-A0828; Amami Oshima, Kawauchi Vill., Kamiya Forest, 26 March 1999, leg. Jaschhof, 1 male, no. A0829;



Figs. 6A-C: *Pseudoperomyia velata* sp. n., male; A: flagellomere 4, lateral view (0.05 mm); B: male genitalia, ventral view (0.05 mm); C: tegmen and genital rod, ventral view (0.02 mm). A-C: holotype. (In parenthesis: length of scale bar.)

same locality, but 30 March 1999, 2 males, no. A0830-A0831 [no. A0829 in KUEC, others in ZIMG].

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