**Parajapyx giecuevasae** n. sp., the first Parajapygidae (Diplura) from the Philippines

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**Abstract**

*Parajapyx giecuevasae*, n. sp., the first Philippine member of the Parajapygidae and the second reported Diplura from the Philippines, is described from Mt. Makiling, Laguna. It is distinct from other *Parajapyx* species by having the following combination of characters: mandible with five teeth and three denticles; prescutum of metasternum with 2+1 setae; tergite X with 12+1+12 macrosetae and 10+1+10 normal setae; and subcoxal organ with 4 accompanying setae, 9 glandular setae and 5 sensorial setae.

**Keywords:** Arthropoda, Entognatha, Hexapoda, *Parajapyx*, taxonomy

**Introduction**

The Class Diplura, also called two-pronged bristletails, is one of the three hexapod classes under the Superclass Entognatha. Unlike insects, their mouthparts are enclosed inside a buccal cavity. Other characteristics common to entognathous hexapods are reduced Malpighian tubules and degenerate or entirely lacking compound eyes. Diplurans are unpigmented narrow-bodied hexapods without eyes, with moniliform antennae, weakly-developed thorax, five-segmented legs, 10-segmented abdomen, and epimorphic larval development. They are usually found in damp soils underneath rocks or stones, decomposing matter and bark of trees (Conde & Pages 1991; Allen 2002).

At present, there are 800 described dipluran species in 10 families worldwide (Greenslade & Luan 2018). Despite that, they remain understudied in the Philippine entognathan fauna with only one recorded species, *Indjapyx bakeri* (Silvestri 1928) under the family Japygidae. Perhaps this is due to their infrequent occurrence in soil and leaf litter collection as compared to other members of the Entognatha, notably the Collembola. In this paper, a new species of *Parajapyx* is described from the Philippines, specifically from the lowland forest of Mt. Makiling, in Laguna province. This is only the first taxonomic account of Philippine Diplura after almost a century when Silvestri (1928) described the japygid mentioned earlier. This new species of *Parajapyx* is the second known dipluran and the first record of the family Parajapygidae in the Philippines.

**Materials and Methods**

The specimens used in this study were collected from Mt. Makiling, a dormant volcano located within a reserve on the border of the provinces of Laguna and Batangas on Luzon Island. The reserve has a total land area of 4,224 ha and is located at 14°8′ N and 121°12′ E spanning parts of Los Baños, Bay and Calamba in Laguna, and Sto. Tomas in Batangas and rises to an elevation of 1,090 m above sea level.

The holotype was collected from a batch of 120 soil and leaf litter samples collected along an elevational gradient (from 110 to 900 m asl) from Mount Makiling (Permit MCME-FWD-1517). Specifically, the holotype was collected from approximately 2.0 kg of leaf litter from lowland secondary evergreen rainforest at 110 m asl. Arthropods were extracted using a modified Berlese-Tullgren funnel. Specimens were sorted and preserved in 95% ethanol. The only dipluran specimen extracted from the sample was later mounted on a slide using modified Hoyer’s medium. Additionally, slide-mounted specimens of Diplura in the collections of the UPLB Museum of Natural History (UPLB MNH) were also examined but only one specimen of the new species was found among them. Photographs were taken using Zeiss Microscope Imaging. Illustrations were made using Inkscape. Measurements were done using ImageJ.

Chaetotaxy and abbreviations follow those used by García-Gomez (2009) and Montejo-Cruz et al. (2021); A(number)—accompanying setae in subcoxl organ, ad—admentum, BS—bacilliform setae, D(number)—teeth in inner cerci, fr—front, S(number)—glandular setae in subcoxl organ, la—lateral-anterior, le—external lobe, lp—lateral-posterior, M—macrosetae, m—microsetae, ma—medium-anterior, mp—medium-posterior, n—normal setae, po—plica orales, Sn(number)—sensorial setae in subcoxl organ, sm—submentum, SP—placoid sensilla, vt—vertex.

The patterns of macrochaeta on the thorax and abdomen are expressed in the description as pairs. For example, the premesternum of Abdomen I possesses 4+4 normal setae, meaning that there are four pairs of normal setae on the pusternum. The macrochaetae on the dorsal thorax and abdomen are further designated with additional notations (ma, mp, la, lp) with respect to their positions in the particular

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Cerci one-segmented, modified as pinchers
Antenna without trichobothria; thorax with 2 pairs of spiracles
Holotype: male; Philippines: Luzon Island: Laguna Province: Mt. Makiling, Los Baños. vi.1975, collected by R.C. Garcia (UPLBMNH DPL-002, mounted on slide).

Description. *Parajapyx giecuevasae*, n. sp., differs from all other known *Parajapyx* species in the following combination of characters: mandibles with 5 teeth and 3 denticles; prescutum of metanotum with 2+1 setae; abdominal tergite X with 12+1 macrosetae and 10+1+10 normal setae; subcoxal organ with 4 accompanying setae, 9 glandular setae and 5 sensorial setae.


**Key to the Families of Diplura in the Philippines**

1. Cerci multi-segmented, filiform .............. *Campodeidae*
   – Cerci one-segmented, modified as pinchers ............ 2
2. Antenna with trichobothria; thorax with 4 pairs of spiracles .................................................. *Japygidae*
   – Antenna without trichobothria; thorax with 2 pairs of spiracles ............................................. *Parajapygidae*

*We have included Campodeidae in the key to families of Philippine Diplura due to the noted presence of undescribed species in the Philippines (Gapud et al. 2001).

**Family Parajapygidae** Womersley, 1939

Members of the Family Parajapygidae differ from other Diplura by the following combination of characters: a maximum of four placoid sensilla on the last antennal segment, absence of trichobothria on the antennae; thorax with two pairs of spiracles on sternites II and III; abdomen with a pair of styles and a pair of subcoxal organs on sternite I, and symmetrical cerci present at the tip of abdomen (Greenslade & Luan 2018).

This family is represented by four known genera (*Parajapyx* Silvestri 1903, *Ectasjapyx* Silvestri 1929, *Miojapyx* Erwing 1941, and *Lacandonajapyx* Garcia-Gomez 2009) and 62 species (Montejo-Cruz et al. 2021).

**Genus Parajapyx** Silvestri, 1903

**Diagnosis.** Antennae with 17 or 18 segments, two pairs of placoid sensilla on the last antennal segment; mandibles with five teeth and four denticles; abdominal sternites II and III with a pair of coxal vesicles; cerci with four to five internal teeth, and with a pair of lateral subcoxal organs on abdominal sternite I.

The genus *Parajapyx* comprised 55 species which are distributed worldwide (Montejo-Cruz et al. 2021).

**Parajapyx giecuevasae**, n. sp.


**Taxonomy**

**Class Diplura** Börner, 1904

Claretegalacta familiae: Diplura in the Philippines

1. Cerci multi-segmented, filiform .......... *Campodeidae*
   – Cerci one-segmented, modified as pinchers .......... 2
2. Antenna with trichobothria; thorax with 4 pairs of spiracles .................................................. *Japygidae*
   – Antenna without trichobothria; thorax with 2 pairs of spiracles ............................................. *Parajapygidae*

**Description.** Body length of holotype 2.16 mm (antenna and cerci not included). Tegument smooth and without ornamentation.

**Head.** Length 0.20 mm, width 0.16 mm. Head vertex (Fig. 1A) with 10 + 10 normal setae; front with 1 + 1 macrosetae and 4 + 4 normal setae; labrum with 2 + 2 normal setae and 6 + 6 microsetae. On head venter (Fig. 1B) admentum with 2 + 2 macrosetae and 8 + 8 normal setae; plica orales with 1 + 1 macrosetae and 3 + 3 normal setae, submentum with 1 + 1 macrosetae and 1 + 1 normal setae. Mandible (Fig. 1C) with 5 teeth and 3 denticles. Maxilla with first lamella slender and longer than half of the second, other lamellae pectinate and similar to each other; maxillary palp with 9 normal setae and one apical microsensillum.

Antennae (Fig. 1D) with 18 segments, length 0.4 mm. Number of bacilliform setae each on antennal segments: Ant segments I–IV: 0, V–VI: 2, VII: 3 or 4, VIII–XIII: 4, XIV: 6, XV–XVI: 8, XVII: 10, XVIII: more than 10 bacilliform setae and 4 placoid sensilla.

**Thorax.** Thoracic chaetotaxy is shown in Table 1 (Fig. 1A). With only a pair of mp macrosetae in the mesoscutum and metascutum.

Length of leg III (Figure 1E showing only dorsal setae) 0.16 mm, with smooth setae; coxa with 3 normal setae and 4 microsetae; trochanter with 3 normal setae and 2 microsetae; femur with 10 normal setae and 3 microsetae; tibia with 8 normal setae; tarsus with 10 normal setae; claws symmetrical.

**Abdomen.** Abdominal chaetotaxy is shown in Table 2 (Fig. 2). Without lp on abdominal tergites I–VII.

On sternite I (Fig. 2B), pre sternum with 4+4 normal setae; sternum with 15+2+15 normal setae and 4+4 microsetae. Subcoxal organ (Fig. 3A) with 4 accompanying setae, 9 glandular setae and 5 sensorial setae. On sternite II (Fig. 2B), pre sternum with 4+1+4 normal setae; sternum with 13+13 normal setae and 3+3 microsetae. Eversible vesicles present on Stermites I and II. Male genitalia (Fig. 3B) with 6+6 normal setae and 1+1 microsetae.

Tergite IX (length=0.05 mm) (Figs. 2C, 2D) slightly shorter than Tergite VIII (length=0.07 mm).

Each cercus (Figs. 3C, 3D) with 5 internal teeth; DI and D2 small, D3 and D4 slightly larger and conspicuous; D5 largest. Dorsally, two extra setae, M1' and M2' present beside M1 and M2, respectively. Each cercus with three pores dorsally. Ventrally, M5, M7, and M9 absent, but with one macroseta (M2') present beside M2.

**Remarks.** The paratype slightly differs from the holotype by having 1 extra normal setae each on the scutum of metanotum and on the pre sternum of Abd I.

**Etymology.** This species is named after Dr. Virginia C.
Figure 1. Parajapyx giecuevasae, n. sp.; (A) Dorsal view of head and thoracic segments. (B) Ventral view of head. (C) Maxilla, mandible and labrum. (D) Antennal segment XVIII (only the dorsal bacilliform setae and placoid sensilla are shown). (E) Dorsal view of Leg III.
Figure 2. *Parajapyx giecuevasae*, n. sp. (A) Abdominal tergites I and II. (B) Abdominal sternites I and II. (C) Tergites VIII-X, dorsal view. (D) Tergites VIII-X, ventral view.
Table 1. Distribution of thoracic setae of *Parajapyx giecuevasae* n. sp.

<table>
<thead>
<tr>
<th>Region</th>
<th>Microsetae (m)</th>
<th>Macrosetae (M)*</th>
<th>Normal setae (n)</th>
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<tr>
<td></td>
<td></td>
<td>ma</td>
<td>mp</td>
</tr>
<tr>
<td>Pronotum</td>
<td>6+6</td>
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<td>2+2</td>
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</tr>
<tr>
<td></td>
<td>Metascutum</td>
<td>3+3</td>
<td>2+2</td>
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</tbody>
</table>

*abbreviations: ma- medium-anterior, mp- medium-posterior, la- latero-anterior, lp- latero-posterior. Numbers in parenthesis are based on the paratype.

Table 2. Distribution of abdominal setae of *Parajapyx giecuevasae* n. sp.

<table>
<thead>
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<th>Region</th>
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<th>Macrosetae (M)*</th>
<th>Normal setae (n)</th>
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</thead>
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<tr>
<td></td>
<td></td>
<td>ma</td>
<td>mp</td>
</tr>
<tr>
<td>I</td>
<td>Prescutum</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>Scutum</td>
<td>5+5</td>
<td>2+2</td>
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<tr>
<td>II-VII</td>
<td>Prescutum</td>
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<td></td>
<td>Scutum</td>
<td>4+4</td>
<td>2+2</td>
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<td>VIII</td>
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<tr>
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<td></td>
<td>6+6</td>
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*abbreviations: ma- medium-anterior, mp- medium-posterior, la- latero-anterior, lp- latero-posterior. Numbers in parenthesis are based on the paratype.

Figure 3. *Parajapyx giecuevasae*, n. sp. (A) Subcoxal organ. (B) Male genitalia. (C) Cerci dorsal view. (D) Cerci ventral view.
Cuevas, Professor Emeritus of the Institute of Biological Sciences, College of Arts and Sciences, University of the Philippines Los Baños and Academician, National Academy of Science and Technology, Philippines, in recognition of her contributions to ecology and environmental science, especially in soil microbial ecology.

**Known Distribution.** Philippines: Luzon (Mt. Makiling).

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**Literature Cited**


