

A FIELD GUIDE TO BENTHIC MACROINVERTEBRATES OF THE AWU STREAM (CENTRAL JAVA, INDONESIA)

PART 1: DIPTERA

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INTRODUCTION

There is little information on the limnology of Javanese rivers except from reports on pollution aspects and water quality. Neame (1988) has documented the hydrochemistry of the Solo River and Sabar (1990) presented information on the hydrobiology of some rivers in the vicinity of Bogor, Western Java. Recent studies include the temporal distribution of organic matter in the bed sediments of the Javanese mountain stream Awu (Leichtfried & Kristijanto 1994).

Until recently only a limited number of studies are found in the literature, and rather few groups of lotic freshwater organisms have been systematically investigated. One of the few existing data available are the results of the „Deutsche Limnologische Sunda Expedition“ in 1928–1929. Most of the papers published were taxonomically orientated and consisted of over 1100 new species records. The deficiency in knowledge of the general species composition is the major obstacle in stream studies in Indonesia, and an investigation of this scope has just started in Indonesia.

In order to develop a better knowledge about the stream ecosystem, the first requirement are informations considering the composition and distribution of macroinvertebrates, in order to allow students to study the Javanese macroinvertebrates on a lower taxonomic level (e.g. family & subfamilies), a pictorial field guide was done to provide a manual to identify most macroinvertebrate

found in a stream. This field guide is the first manual on macroinvertebrates in Javanese streams and is based on an extensive sampling program, which started in June 1993 and lasted until April 1995.

STUDY SITE

The Awu stream is situated on the volcanic mountain, Mt. Slamet (3428 m) in Central Java (Fig. 1). The study site JAVADAT I is situated at the upper reaches of the Awu (about 1200 m a.s.l., 108° E, 7° S) located primarily in a rain-forest region. Like many Indonesian streams, the Awu flows downstream through densely populated and highly cultivated areas. The study site JAVADAT II is located 5 km downstream of JAVADAT I at about 800 m a.s.l., characterized by steep banks, occasionally exceeding 10 m high, which border the stream over the whole of its length. Below JAVADAT II, the Awu flows through cultivated landscape and densely populated residential areas, before it enters the Java Sea near the town of Tegal. The flow of the Awu averages 1.11 m/s with a range of 0.28 to 2.72 m/s. The climate is tropical with annual rainfall in excess of 1000 mm, being drier between July and October. Water temperatures in the Awu stream range from 16 °C to 20 °C at JAVADAT I, and from 22 °C to 31 °C at JAVADAT II.

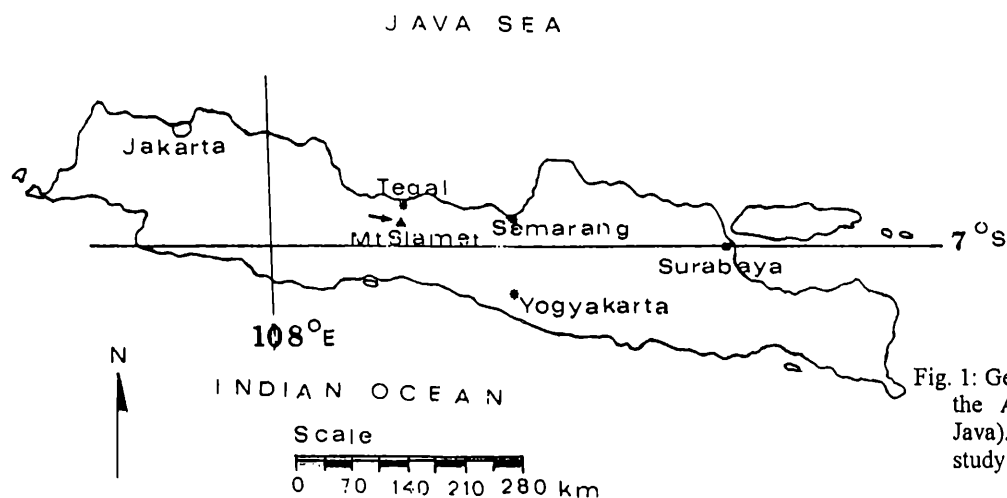


Fig. 1: Geographical position of the Awu stream (Central Java). Arrow: JAVADAT study site

SAMPLING

The benthic macroinvertebrates described in this field guide were collected from different stream zones (e.g. riffles, pools, amongst cobbles and boulders, over a streambed of gravel and sand). Quantitative sampling was carried out monthly from June 1993 through December 1993 and from April 1994 through April 1995. The fauna was sampled using a modified Hess sampler with a 100 µm mesh net (area: 2.83 dm²). All the substrate within the sampler was manually disturbed, so that the animals were washed into a sieve attached to the end of the net. The animals were preserved in 70 % ethanol, and sorted later under 12 x - 50 x magnification using a Wild Stereo-Microscope.

DIAGRAM AND KEY TO THE BENTHIC MACROINVERTEBRATES

The following figures show a diagrammatic presentation to the larvae and nymphs of benthic macroinvertebrate orders (Fig. 2) and to the families of Diptera (Fig. 3), both modified from Tachet et al. (1991), and to the subfamilies of larval Chironomidae (based on Schmid 1991) (Fig. 4). Some drawings in the Diptera-key are missing because identification of Javanese specimens is still in process and certain families were not found now (Anthomyiidae, Athericidae, Dolichopodidae, Ephydriidae, Scatophagidae and Secomyzidae). The drawing will be added in the next part of the key. The keys to the families of the order Diptera (based on Schmid 1994) are dichotomously organized.

KEY TO THE LARVAE OF AQUATIC DIPTERA (Modified from Schmid, 1994)

- 1 a. Head capsule complete, always outside thorax or retracted within first thoracic segment 2
- b. Head capsule reduced posteriorly, head partly or completely retracted within first thoracic segment 3
- 2 a. Mandibles and other sclerotized mouth parts opposed, moving in a horizontal plane Suborder NEMATOCERA 4
- b. Mandible replaced by mouth-hooks, moving in a vertical plane. Head sometimes retractile into the prothorax Suborder BRACHYCERA 17
- 3 a. Spiracles at posterior end of body usually bordered by 2 to 6 elongated lobes. Head capsule incomplete, partly sclerotized, retractile into the prothorax Tipulidae 7
- b. No spiracles at posterior end of body. Head capsule not sclerotized, permanently retracted into the prothorax Suborder CYCLORHAPHA 21
- 4 a. Body dorso-ventrally flattened. Abdominal segments with less than 8 ventral suckers serially arranged or with 8 ventral suckers and body elliptical in shape 5
- b. Body not dorso-ventrally flattened. Abdominal segments without suckers and body cylindrical in shape 6
- 5 a. Thorax distinct from head and first abdominal segment. Ventral suckers at the apices of pseudopods Deuterophlebiidae
- b. Thorax fused with head and first abdominal segment. Ventral suckers at sixth abdominal segment Blephariceridae
- 6 a. Body with numerous long filiform or leaflike processes Cylindrotomidae
- b. Body without filiform or leaflike processes 7
- 7 a. Body with spiracular disc surrounded by 4 to 8 lobes 8
- b. Body without spiracular disc surrounded by lobes 9
- 8 a. Spiracular disc surrounded by 6 - 8 lobes. Head capsule broad Tipulinae
- b. Spiracular disc surrounded by at most 6 lobes. Head capsule slender Limoniinae
- 9 a. Pseudopods (prolegs) lacking on body 10
- b. Pseudopods present on body, at least as terminal hooks 13

- 10 a. Thoracic segments fused into an enlarged complex which is distinctly wider than the abdominal segments. Spiracles either at the body segment or at short or long respiratory siphon..... Culicidae
- b. Thoracic segments separated and/or not wider than abdominal segments11
- 11 a. Thoracic and abdominal segments secondarily divided into 2 or 3 subdivisions..... Psychodidae
- b. Thoracic and abdominal segments not secondarily divided..... Ceratopogonidae
- 12 a. Pseudopods (prolegs) present on the anal and usually on the prothoracic segment, otherwise reduced.....13
- b. Pseudopods (prolegs) present on the intermediate body segments or only confined to prothorax15
- 13 a. Pseudopods unpaired.....14
- b. Pseudopods paired..... Chironomidae
- 14 a. A pair of respiratory tubes present on the prothorax and a single respiratory opening posteriorly.....Thaumaleidae
- b. Respiratory tubes and opening absent. All body segment with fleshy protuberances and/or long hairs..... Ceratopogonidae
Forcipomyiinae
- 15 a. Pseudopods only present on prothorax. Apex of abdomen with an adhesive disc.Simuliidae
- b. Pseudopods situated on the intermediate body segments. Apex of abdomen without adhesive disc16
- 16 a. Abdominal segments 1 to 3 each with a pair of pseudopods. Abdomen terminating in a long, segmented respiratory tube.....Ptychopteridae
- b. Abdominal segments 1 and 2 each, or abdominal segment 1 only with a pair of pseudopods. Abdomen without a long respiratory tube..... Dixidae
- 17 a. Free part of head capsule not retractile into prothorax. Body dorsoventrally flattened. Integument shagreened and often striated. No creeping welts..... Stratiomyidae
- b. Free part of head capsule retractile into prothorax. Body not dorsoventrally flattened. Integument not shagreened. Body with creeping welts or pseudopods.....18
- 18 a. Body cylindrical. Abdominal segments with a griddle of small pseudopods which may bear hooks or which may be reduced to fleshy swellings. Respiratory chamber situated in a vertical cleft..... Tabanidae
- b. Body not always cylindrical, never with more than 1 pair of pseudopods on each abdominal segment. Posterior spiracles not in a vertical cleft.....19
- 19 a. Apex of abdomen with a pair of caudal processes which are longer than the pseudopods. Abdominal segments with pseudopods..... Athericidae
- b. Apex of abdomen without caudal processes or caudal processes distinctly shorter than pseudopods20
- 20 a. Pseudopods as transverse ventral creeping welts on abdominal segments. Metacephalic rods expanded posteriorly Dolichopodidae
- b. Pseudopods paired with apical crotchets. If pseudopods as transverse ventral creeping welts then metacephalic rods slender posteriorlyEmpididae
- 21 a. Mouth-hooks vestigial. Spiracles close together at the apex of partly sclerotized tube..... Syrphidae
- b. Mouth-hooks distinct. Spiracles in well separated discs either at body surface or at the apex of a tube22
- 22 a. Spiracular disc surrounded by several lobes posteriorly Sciomyzidae
- b. Spiracular disc without such lobes.....23
- 23 a. Mouth hooks serrate, palmate or digitate. Posterior respiratory opening consists of 2 small slits at the apices of 2 sharp spines or 2 long retractile tubes.....Ephydriidae
- b. Mouth-hooks simple. Posterior respiratory opening at the apex of short tubercles.....24
- 24 a. Posterior spiracle with 2 slits of the usual type and with a third situated at the apex of a sharp spine..... Scatophagidae
- b. Posterior spiracle without spine-like processAnthomyiidae

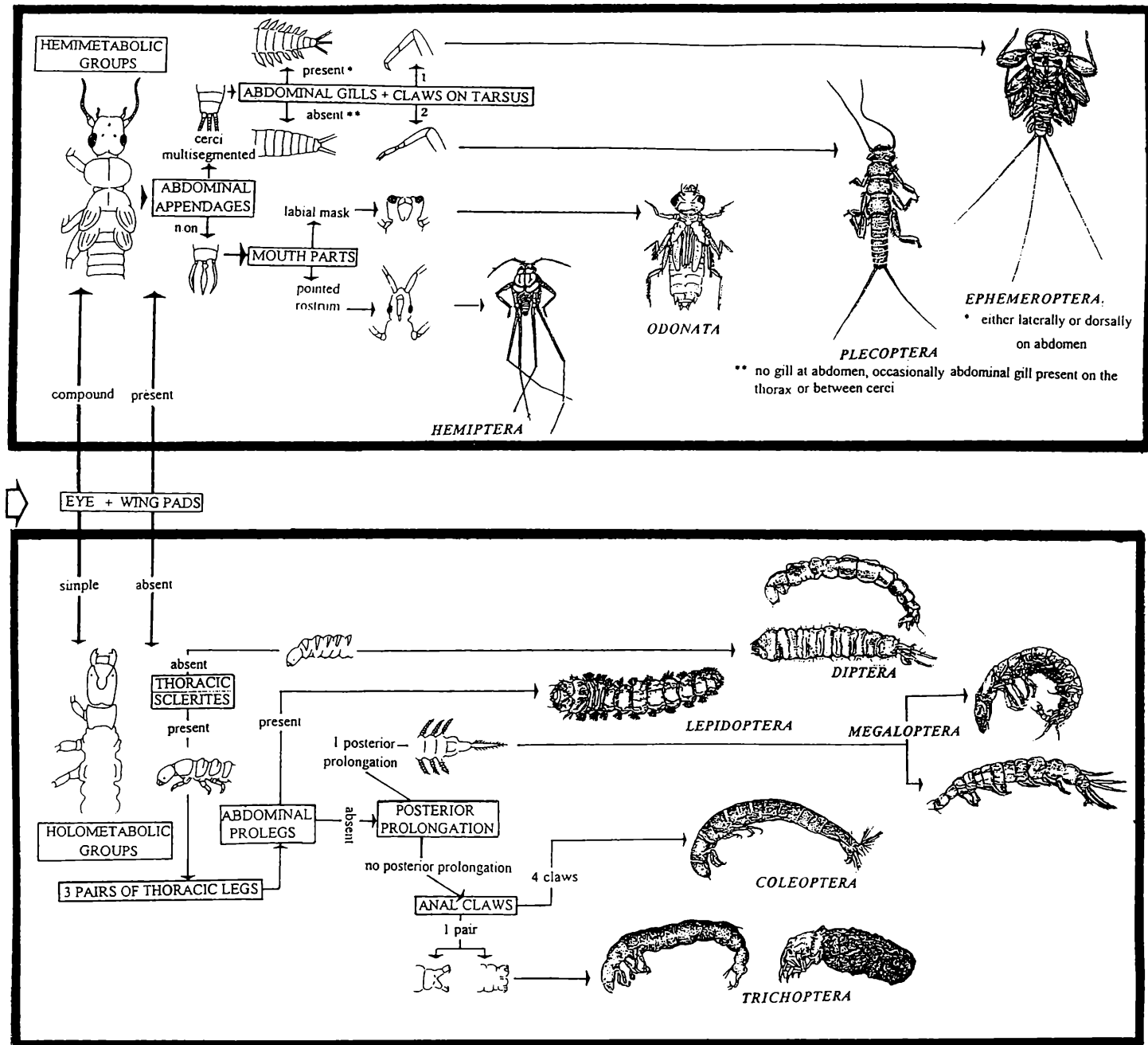


Fig. 2: Diagram to the larva of aquatic insects (order) (Modified from Tachet et al. 1991).

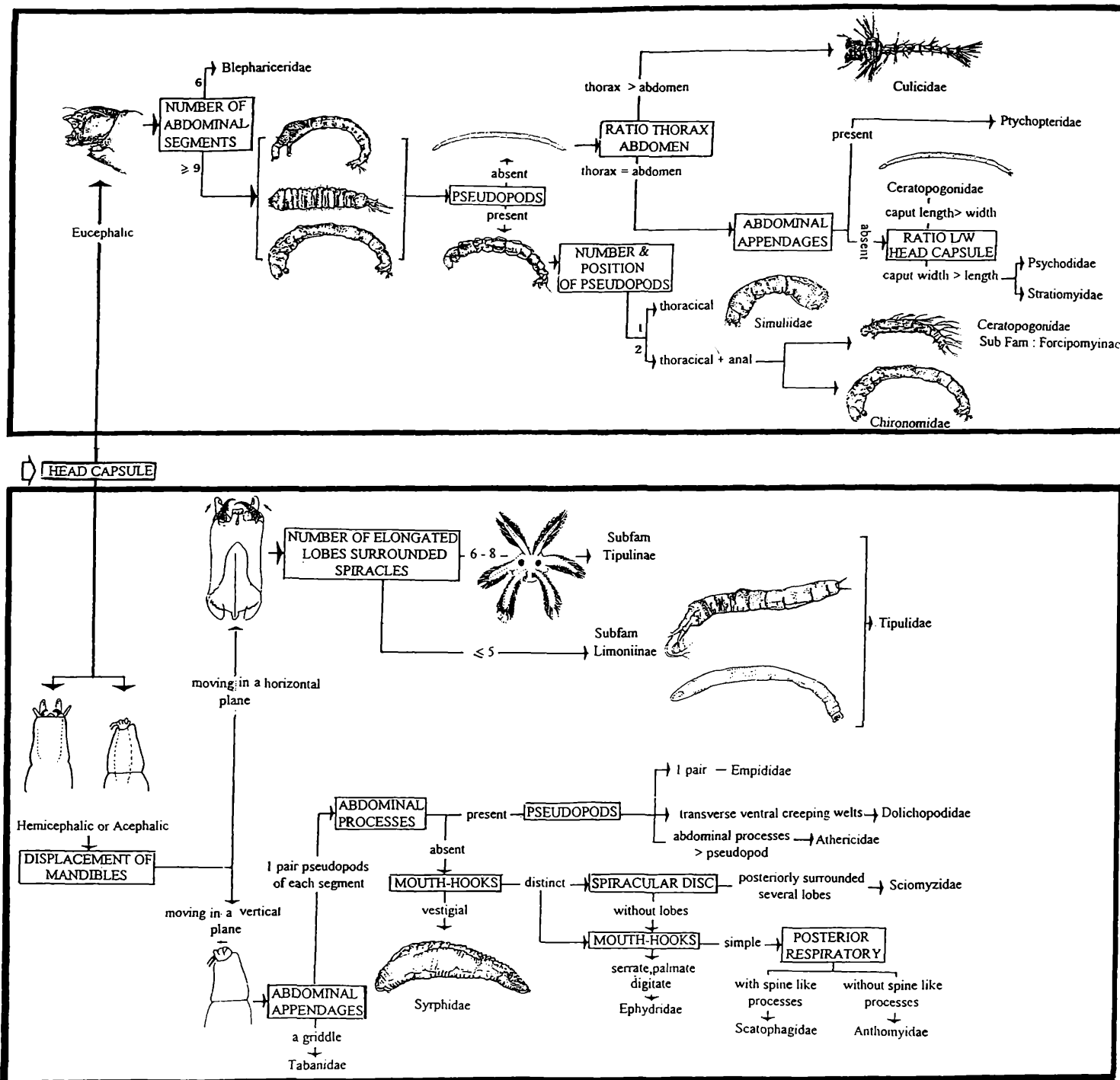


Fig. 3: Diagram to the families of Diptera (larva) (Modified from Tachet et al. 1991).

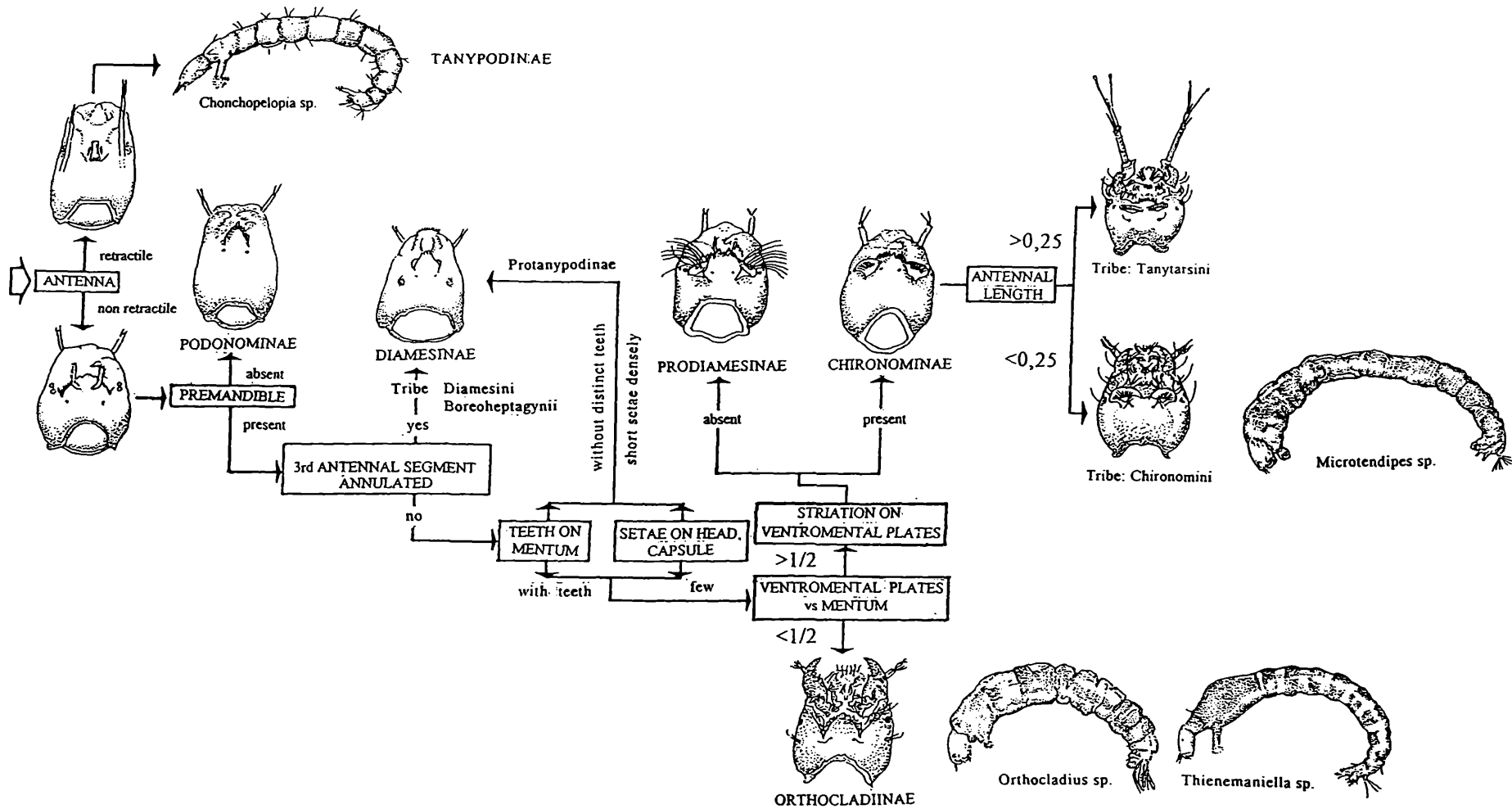


Fig. 4: Diagram to the subfamilies of Chironomidae (Based on Schmid 1993).

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