

A Pictorial Key to the Freshwater Cyclopoid Copepods from Korea

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Abstract – A pictorial key to total 46 species belonging to 15 genera of two subfamilies in the family Cyclopidae is provided as a result of the serial researches on the freshwater cyclopoid copepods in South Korea.

Key words : Taxonomy, pictorial key, Cyclopidae, Cyclopoida, freshwater Copepoda, Korea

INTRODUCTION

The accurate identification of zooplanktons including cyclopoid copepods is one of the indispensable prerequisites for limnological study and the various works for nature conservation. However, the morphological characters of freshwater cyclopoid copepods are usually so minute and subtle that even the experiencing specialists can only identify the sibling species under the microscope with high power resolution after dissecting the mouthparts. Furthermore, they often exist as the pre-maturing copepodite stage IV or V mixed with adults, or as only copepodites in the diapause season (Lee *et al.* 2005b). Moreover, recently lots of the representative freshwater cyclopoid species such as *Eucyclops serrulatus* and *Mesocyclops leuckarti* have been reclassified on the basis on the so-called 'microcharacters' (Van de Velde 1984) like spinular arrangement on antennal basis or maxillular palp, and they turned out to be the species complex composed of many cryptic species according to the various geographical regions (*see* Guo 2000; Ishida 2002; Ueda and Reid 2003; Lee *et al.* 2005a, b).

In South Korea, Kim and Chang (1989) first dealt with

the freshwater cyclopoid copepods taxonomically, and thereafter several faunistic studies were accomplished sporadically (Yoo and Lim 1989; Kim and Chang 1991; Chang *et al.* 1998; Lee *et al.* 2004, 2005a, b). However, the overall classification of the taxon has not yet been fully made.

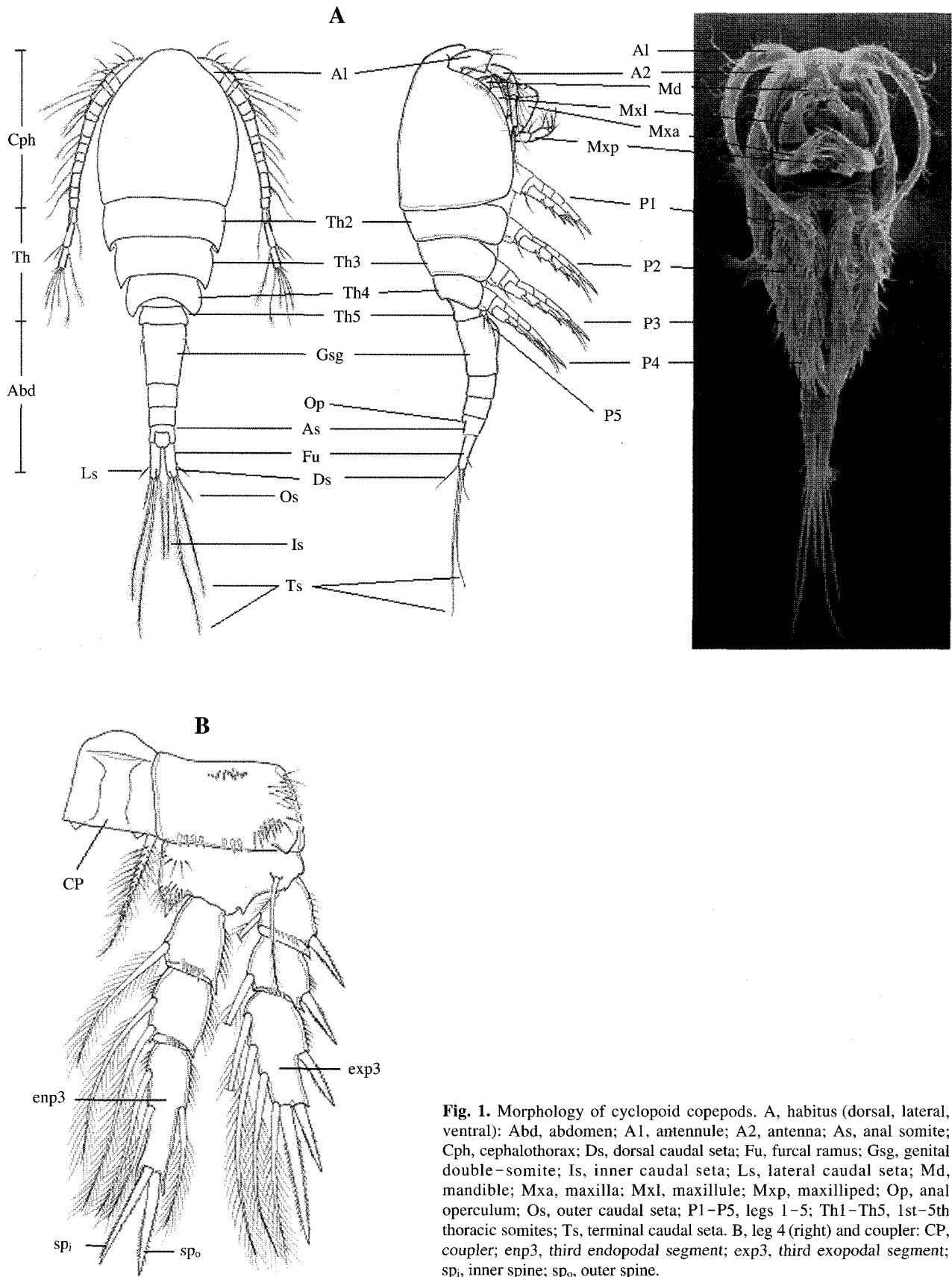
The authors participated in the Eco-Technopia 21 Project, KIEST since 2002, which aimed at the reclassification of the freshwater cyclopoid copepods from South Korea and developing the practical molecular biomarkers for environmental monitoring. As a result, we have confirmed total 46 species belonging to 15 genera of the family Cyclopidae, and made out a pictorial key for the easy and quick identification of limnological scientists and non-specialists of the copepod taxonomy.

MATERIALS AND METHODS

Materials consist of cyclopoid specimens collected from various freshwater habitats (total 306 localities) in South Korea during the period from December, 2002 to May, 2005, and 164 samples stocked in the specimen room of the Department of Biology, Daegu University stocked since 1987.

Samplings were made mostly with a dipnet of 64 μm mesh aperture from the various freshwater habitats. Copepods were fixed and stored in 4% buffered formalin.

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Specimens were dissected and mounted in lactophenol on H-S slide (Shirayama *et al.* 1993), a recent variation of Cobb slide, after the treatment in a solution of 5% glycerin–95% ethylalcohol for 1~2 days, then observed using a differential interference contrast microscope (Olympus BX51) equipped with Nomarski optics.

All drawings and measurements were made with the aid of a camera lucida. Some figures were cited from the previous papers on the Korean freshwater cyclopids: *Eucyclops serrulatus* species group from Lee *et al.* (2005b); *Ochridacyclops coreensis* from Lee *et al.* (2004); *Acanthocyclops tokchokensis* from Kim and Chang (1991); *Mesocyclops leuckarti* species group from Lee *et al.* (2005a).

Morphological terms and abbreviations used in the pictorial key follow the conventional ones frequently used in the taxonomy of freshwater cyclopoid copepods as shown in Fig. 1 and its figure legend.

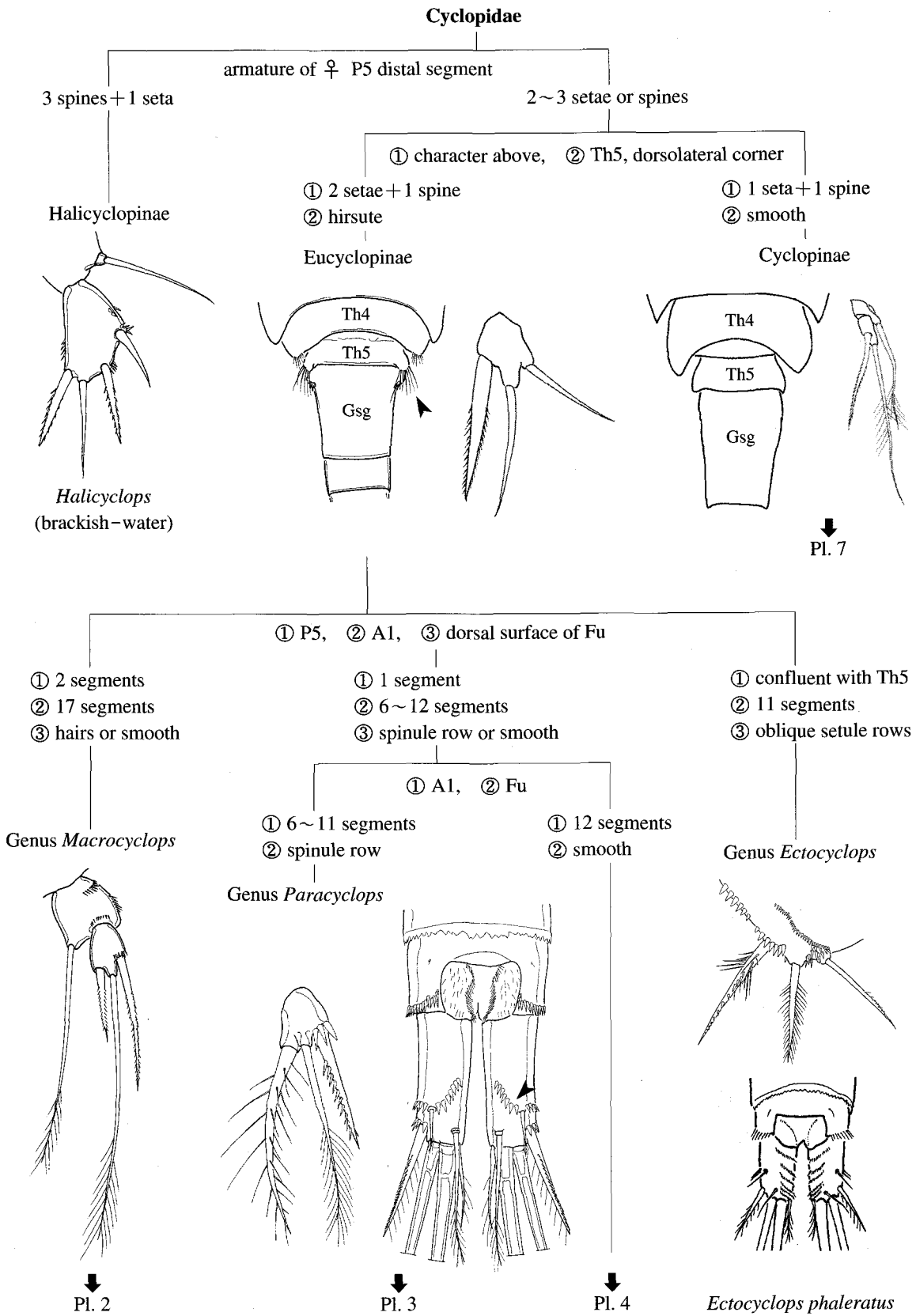
RESULTS

1. List of Freshwater Cyclopoid Copepods from Korea

- Order Cyclopoida Burmeister, 1834
 Family Cyclopidae Dana, 1846
 Subfamily Eucyclopinae Kiefer, 1927
 Genus *Macrocyclops* Claus, 1893
1. *Macrocyclops fuscus* (Jurine, 1820)
 2. *Macrocyclops distinctus* (Richard, 1887)
 Genus *Eucyclops* Claus, 1893
 4. *Eucyclops serrulatus* (Fischer, 1851)
 5. *Eucyclops roseus* Ishida, 1997
 6. *Eucyclops speratus* (Lilljeborg, 1901)
 7. *Eucyclops ohtakai* Ishida, 2000
 8. *Eucyclops pacificus* Ishida, 2000
 9. *Eucyclops tsushimensis* Ishida, 2001
 10. *Eucyclops macruroides* (Lilljeborg, 1901)
 11. *Eucyclops macruroides denticulatus* (Graeter, 1903)
 Genus *Tropocyclops* Kiefer, 1927
 12. *Tropocyclops* sp. 1
 13. *Tropocyclops* sp. 2
 14. *Tropocyclops* sp. 3
 Genus *Paracyclops* Claus, 1893
 15. *Paracyclops fimbriatus* (Fischer, 1853)
 16. *Paracyclops chiltoni* (Thompson, 1882)
 17. *Paracyclops affinis* (Sars, 1863)
 Genus *Ochridacyclops* Forbes, 1897
 18. *Ochridacyclops coreensis* Chang, 2004
 Genus *Ectocyclops* Brady, 1904
 19. *Ectocyclops phaleratus* (Koch, 1838)
 Subfamily Cyclopinae Dana, 1913
 Genus *Cyclops* Müller, 1776
 20. *Cyclops vicinus* Uljanin, 1875
 21. *Cyclops kikuchii* Smirnov, 1932
 Genus *Megacyclops* Kiefer, 1927
 22. *Megacyclops viridis* (Jurine, 1820)
 Genus *Acanthocyclops* Kiefer, 1927
 23. *Acanthocyclops vernalis* (Fischer, 1853)
 24. *Acanthocyclops sensitivus* (Graeter and Chappuis, 1914)
 25. *Acanthocyclops tokchokensis* Kim and Chang, 1991
 Genus *Diacyclops* Kiefer, 1927
 26. *Diacyclops bicuspidatus* (Claus, 1857)
 27. *Diacyclops thomasi* (Forbes, 1882)
 28. *Diacyclops crassicaudis* (Sars, 1863)
 29. *Diacyclops disjunctus* (Tallwitz, 1927)
 30. *Diacyclops languidoides* (Lilljeborg, 1901)
 31. *Diacyclops nanus* (Sars, 1863)
 Genus *Microcyclops* Claus, 1893
 32. *Microcyclops varicans* (Sars, 1863)
 33. *Microcyclops rubellus* (Lilljeborg, 1901)
 34. *Microcyclops longiramus* Shen and Sung, 1965
 Genus *Cryptocyclops* Sars, 1927
 35. *Cryptocyclops bicolor* (Sars, 1863)
 36. *Cryptocyclops javanus* (Kiefer, 1929)
 Genus *Itocyclops* Reid and Ishida, 2000
 37. *Itocyclops yezoensis* (Ito, 1953)
 Genus *Mesocyclops* Sars, 1914
 38. *Mesocyclops leuckarti* (Claus, 1857)
 39. *Mesocyclops pehpeiensis* Hu, 1943
 40. *Mesocyclops dissimilis* Defaye and Kawabta, 1993
 41. *Mesocyclops woutersi* Van de Velde, 1987
 42. *Mesocyclops mariae* Guo, 2000
 Genus *Thermocyclops* Kiefer, 1927
 43. *Thermocyclops crassus* (Fischer, 1853)
 44. *Thermocyclops taihokuensis* (Harada, 1931)
 45. *Thermocyclops dybowski* (Lande, 1890)
 46. *Thermocyclops uenoi* Ito, 1952

2. A Pictorial Key to the Freshwater Cyclopoid Copepods from Korea

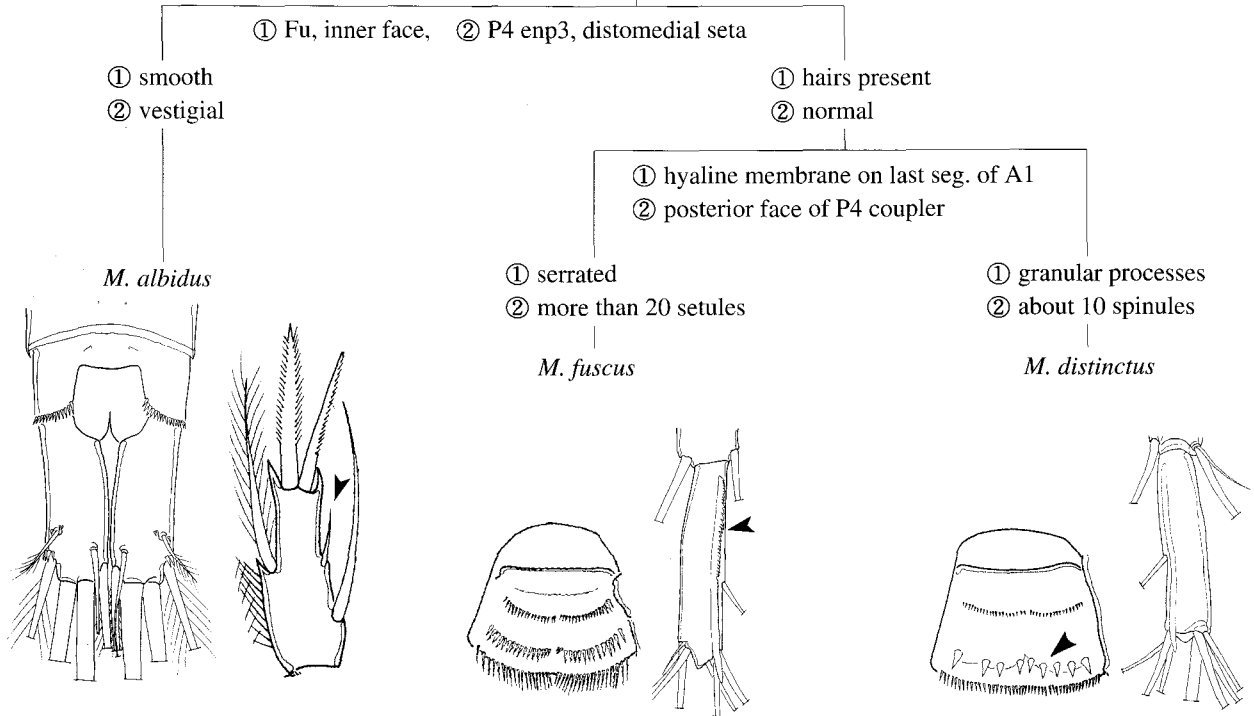
Pl. 1



(from Pl. 1)

Pl. 2

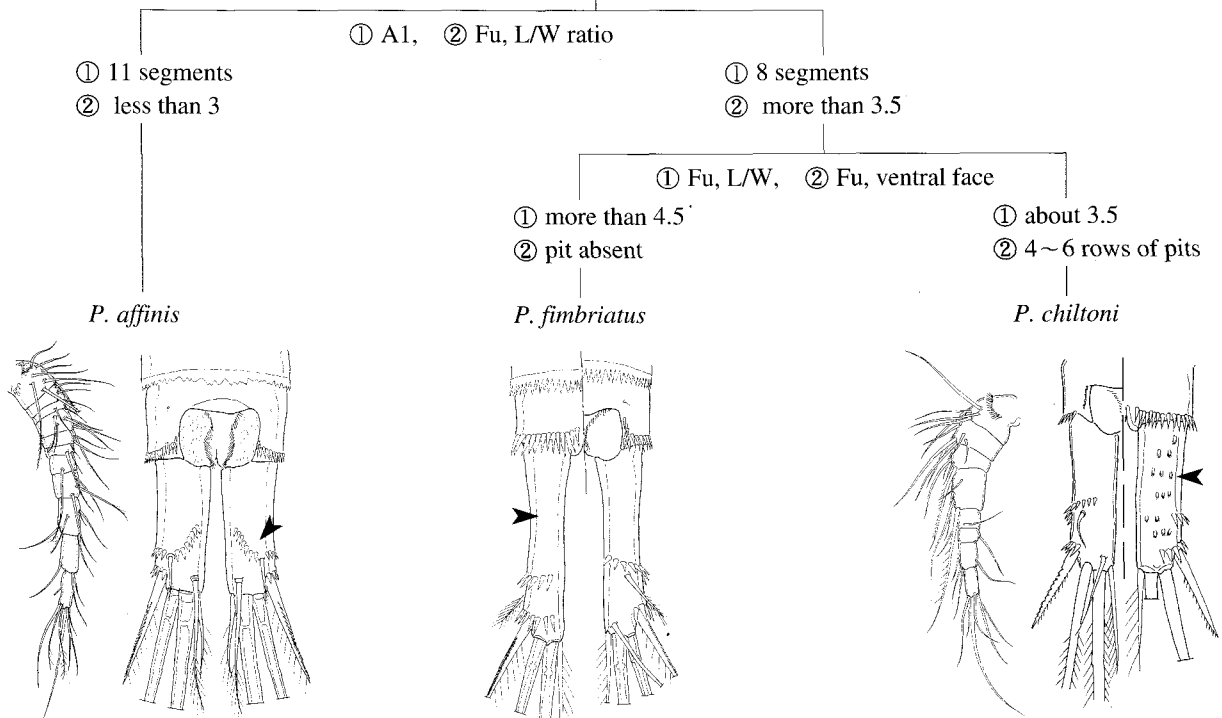
Genus *Macrocylops*



(from Pl. 1)

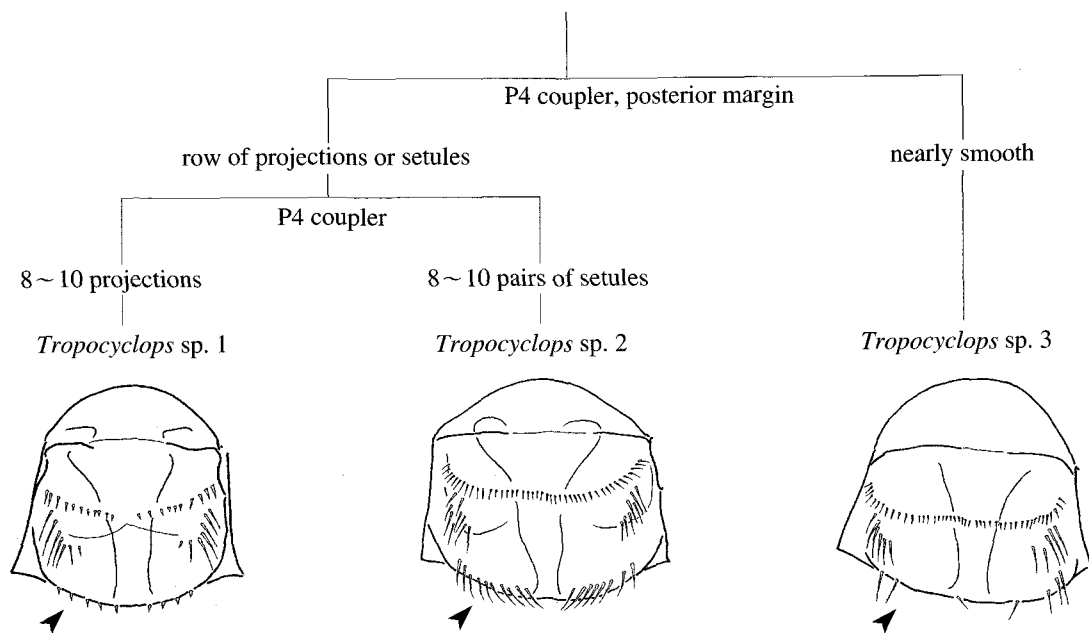
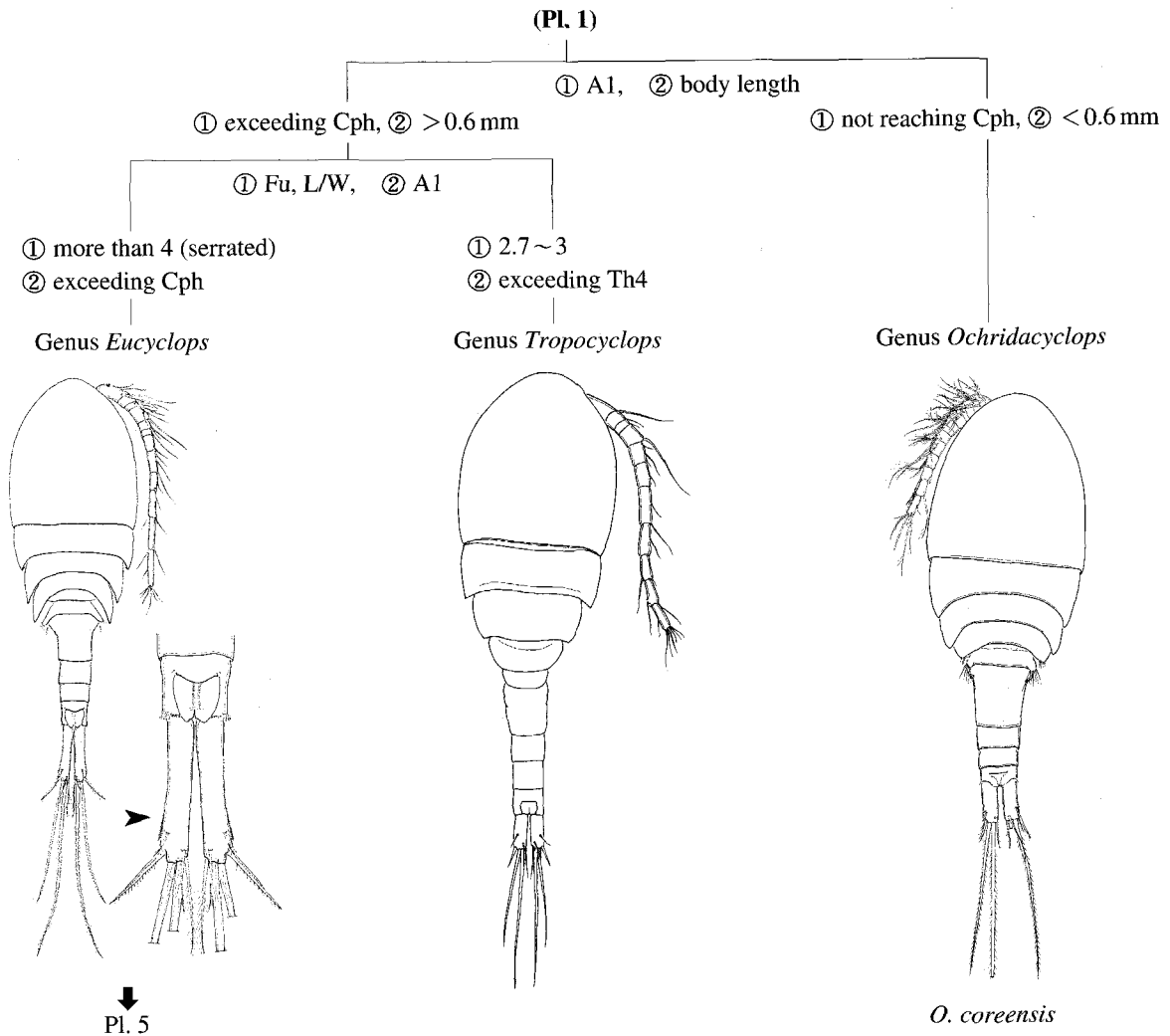
Pl. 3

Genus *Paracyclops*



(from Pl. 1)

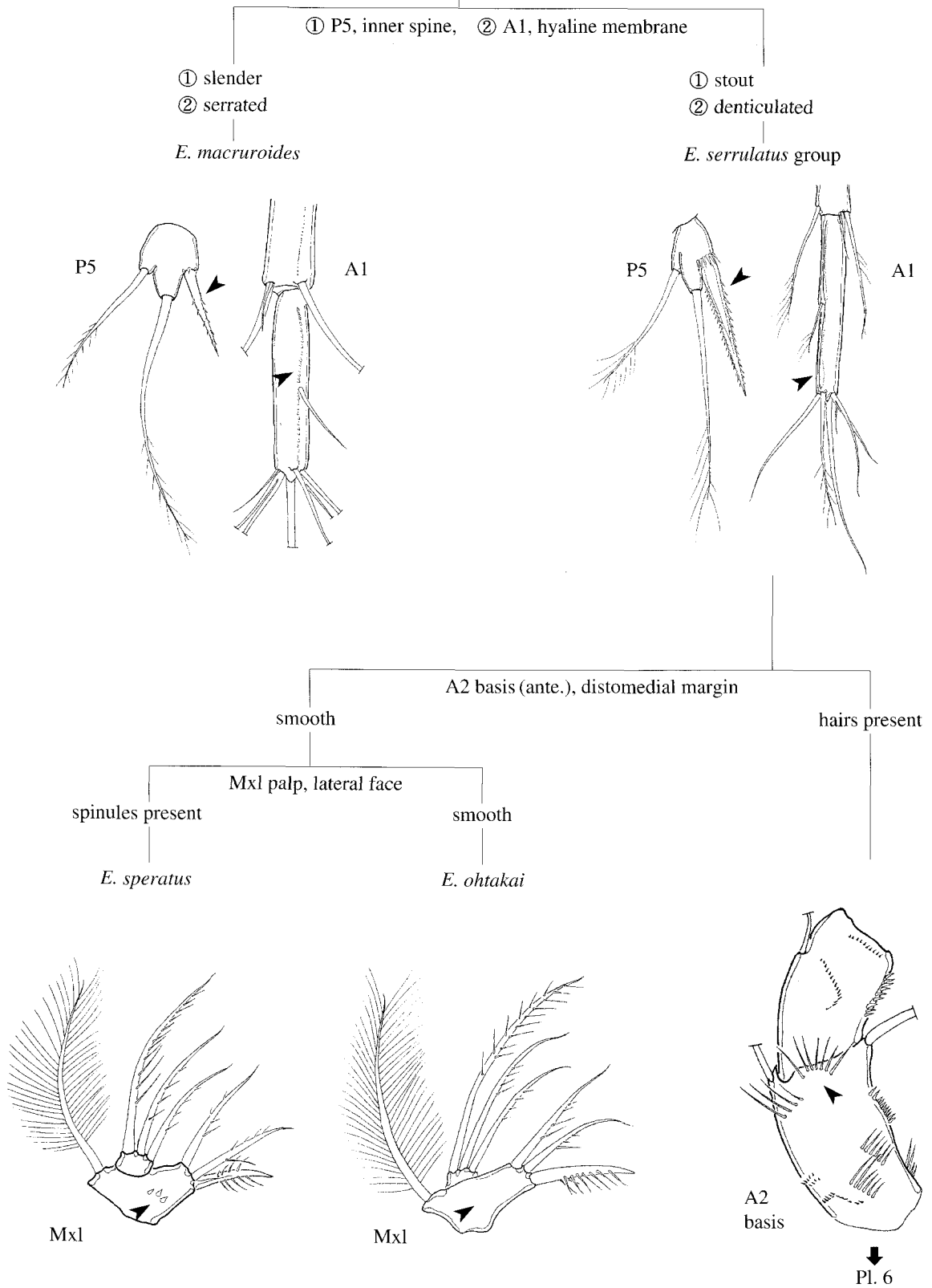
Pl. 4



(from Pl. 4)

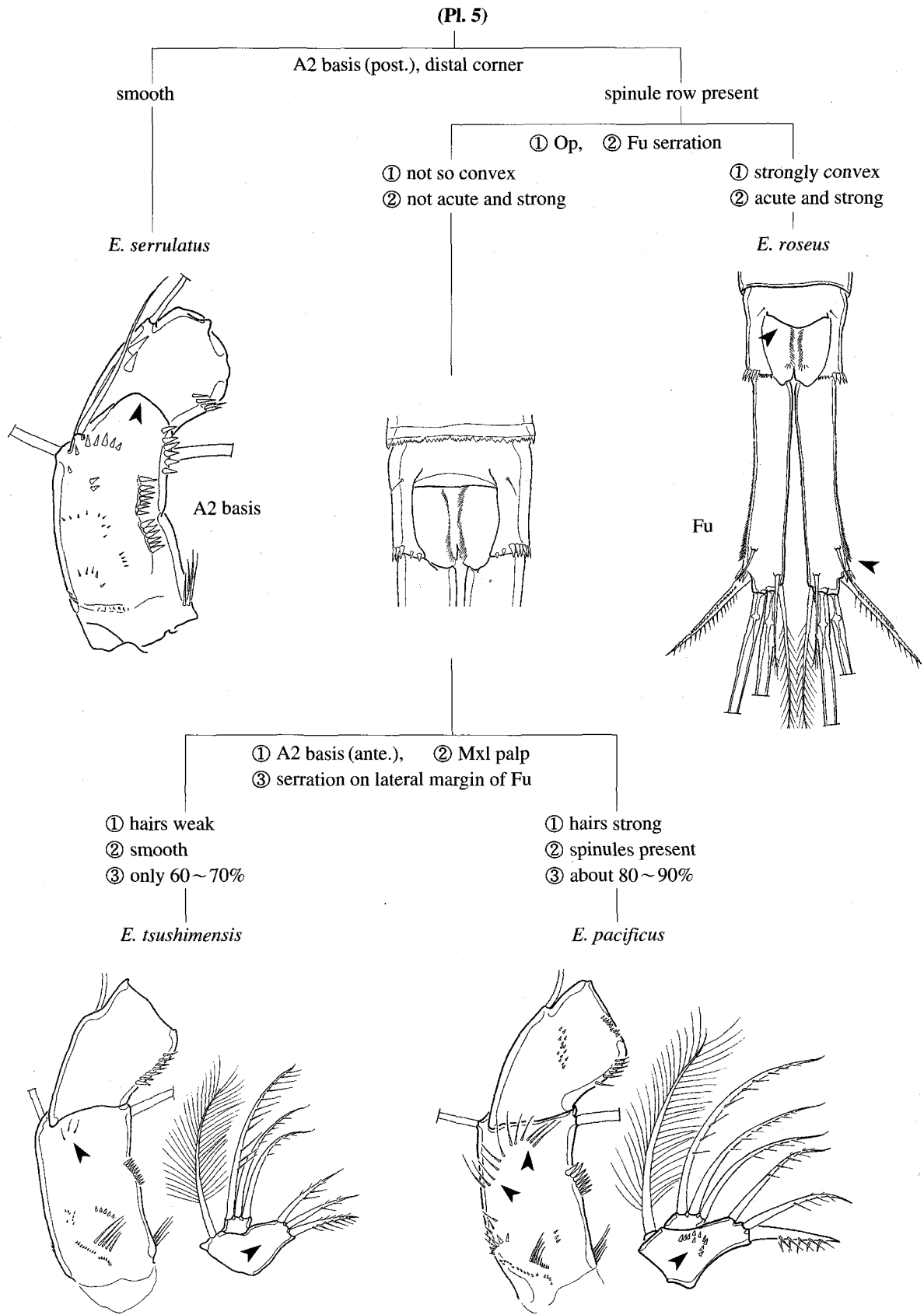
Pl. 5

Genus *Eucyclops*



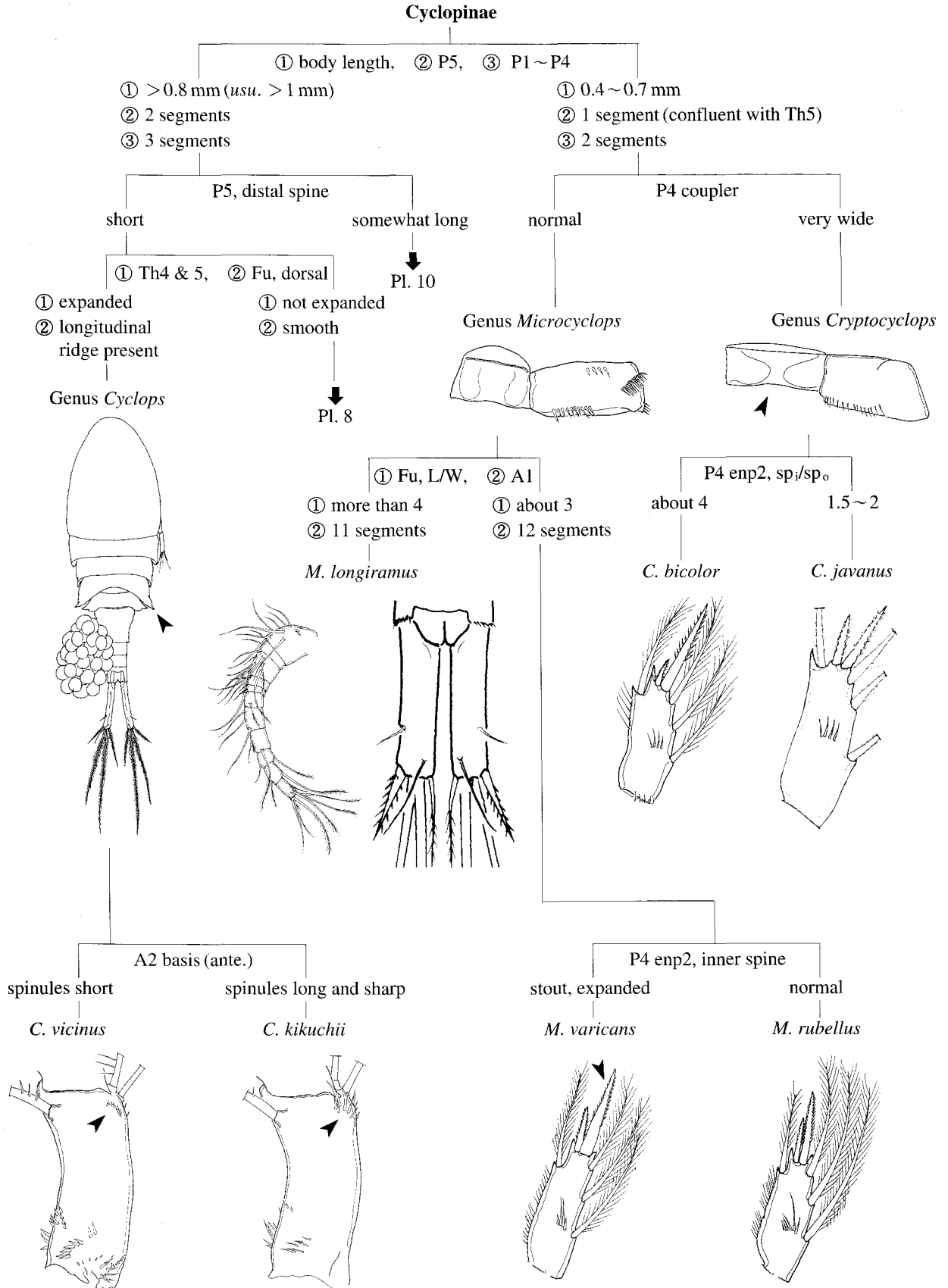
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Pl. 6



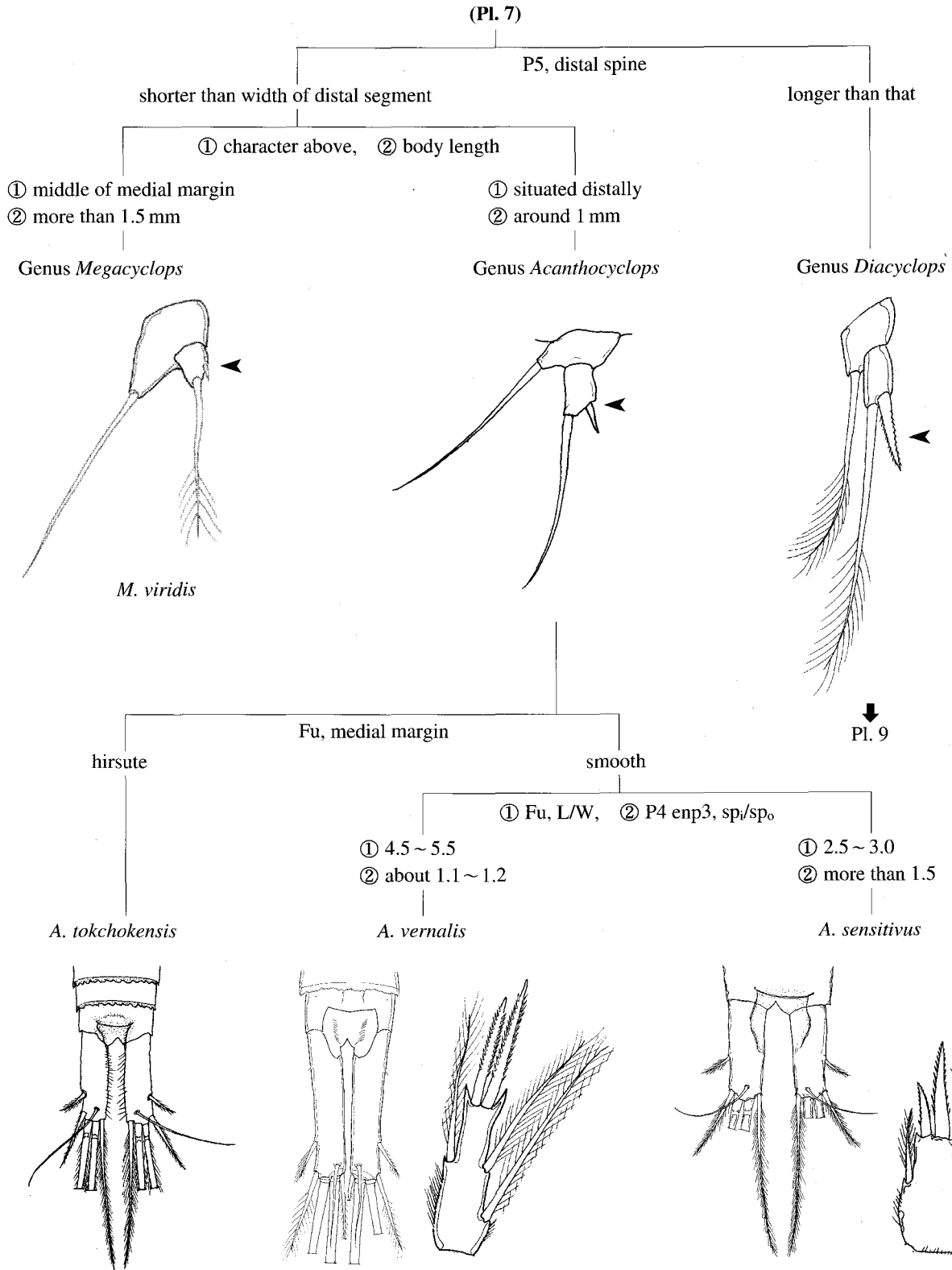
(from Pl. 1)

Pl. 7



(from Pl. 7)

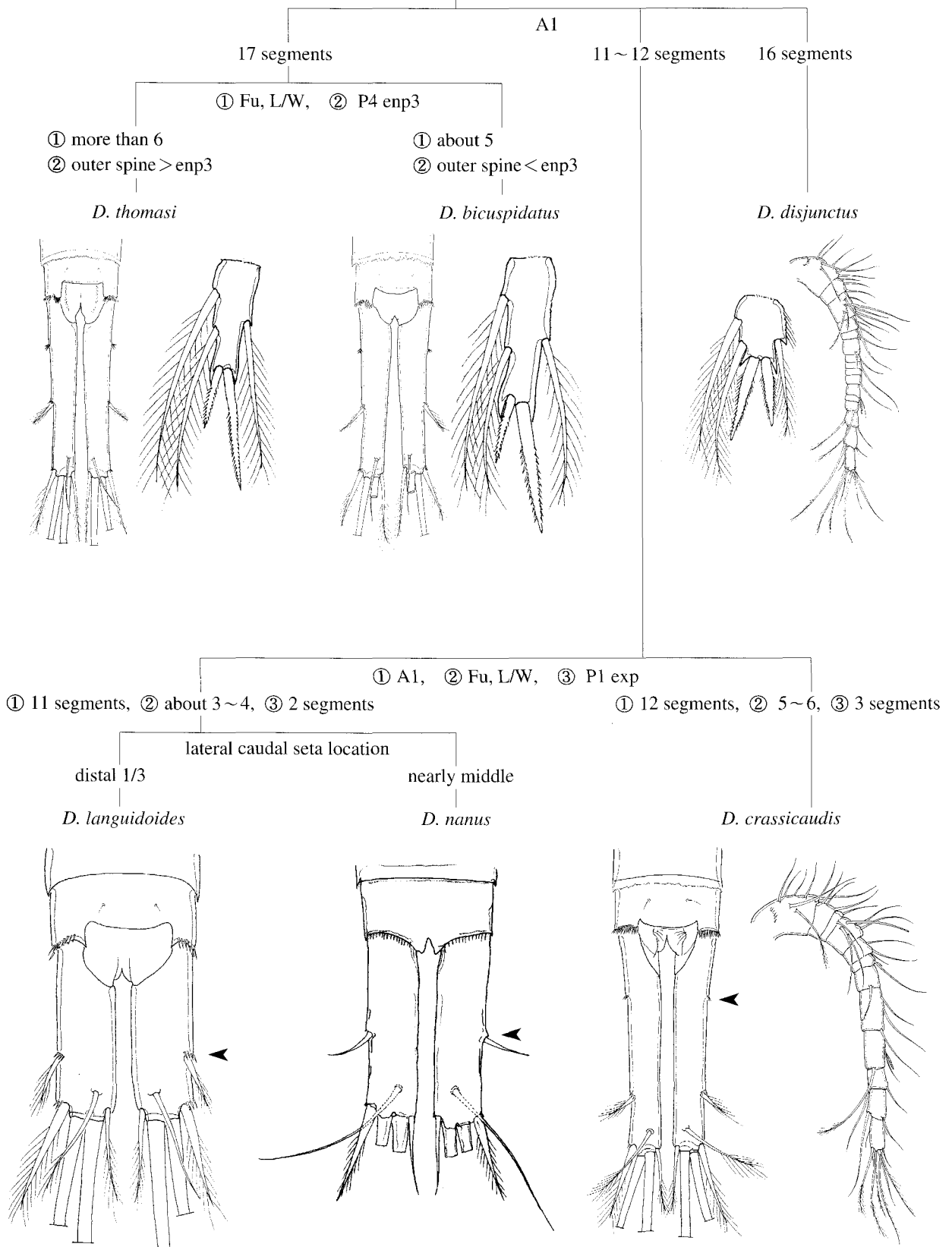
Pl. 8



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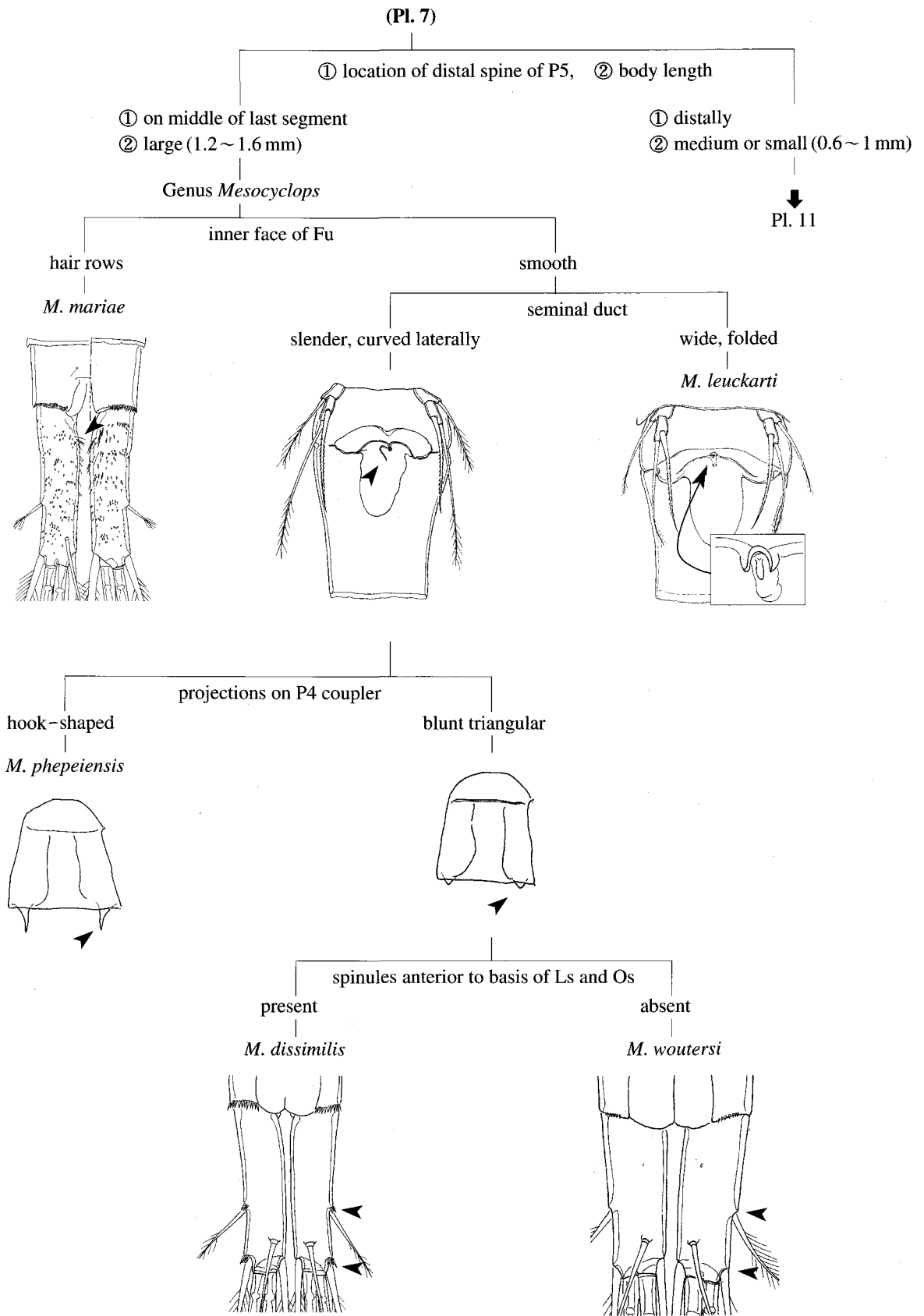
Pl. 9

Genus *Diacyclops*



(from Pl. 7)

Pl. 10

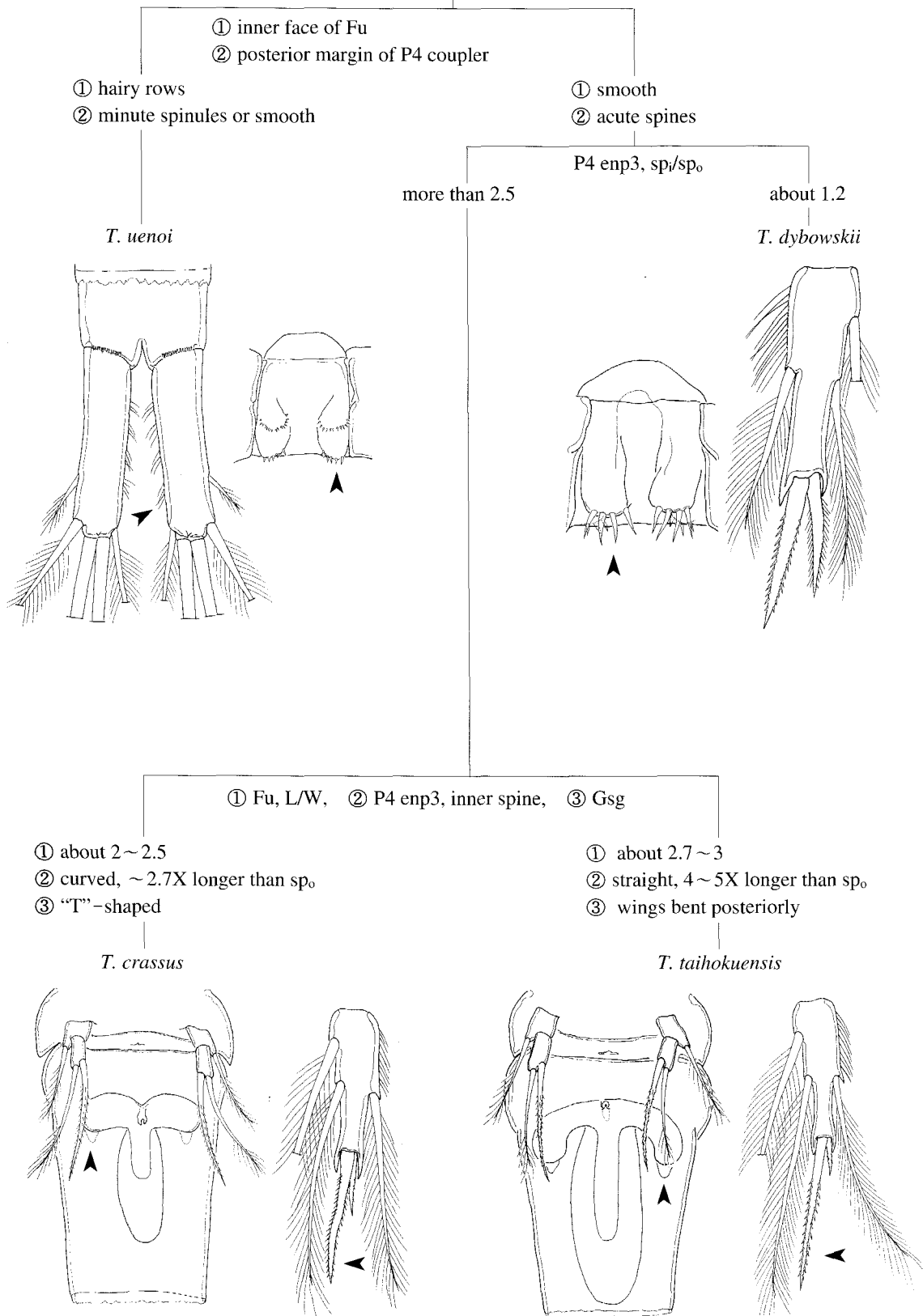


Pl. 11

(from Pl. 10)

Pl. 11

Genus *Thermocyclops*



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