

Descriptive Study of the Species *Eudiaptomus Vulgaris* (Schmeil, 1896) Belong to Genus *Eudiaptomus* (Kiefer, 1932) , from the Al-Hussainiya River in the Holy Karbala Governorate

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PAPER INFO

Received: 12.09.2025

Accepted: 19.10.2025

Published: 31.12.2025

keywords:

Eudiaptomus vulgaris, Diaptomidae, morphology, taxonomy, ecological observations, Iraq



Abstract

After determining the date and location of sample collection, this study examined the external morphology of the species. Samples were collected from the Al-Hussainiya River, located north of Karbala Governorate. The genus *Eudiaptomus vulgaris* is widely distributed across various aquatic systems. Species identification was based on morphological characteristics of the body, including overall shape and specific diagnostic features such as the number and structure of antennae, the arrangement of spines on the basal segment of the antennule, the morphology of the fifth peduncle, and the structure of the caudal branches. This study aims to represent one of the few detailed taxonomic studies on members of the order Calanoida in Iraq, contributing to the enrichment of biodiversity records for freshwater zooplankton. Moreover, the precise description of this species provides a valuable reference for future ecological assessments and water quality monitoring, as such organisms serve as important bio indicators in aquatic ecosystems. Due to the scarcity of detailed taxonomic research on species of the order Calanoida, this study highlights the importance of clarifying their taxonomic status. This was achieved by examining their external morphology, diagnosing and describing their structures, and providing illustrative drawings of their body parts.

DOI: 10.53851/psijk.v2.i8.28-34

Table 1. Abbreviation Table

NOMENCLATURE		NOMENCLATURE	
AbSo	Abdominal Somatic	Enp	Endopod
An So	Anal Somatic	Exp	Exopod
A1	Antenna	FuR	Furcal Rami
A2	Antennule	PrCx	Pre Coxa
Bs	Base	Md	Mandible
GS Seg	Genetic Segment	Mxp	Maxilliped
Ceph	Cephalothorax	Mx	Maxilla
Cx	Coxa	Mxl	Maxillule
Ur	Urosoma	P1	1 rd Pereopoda
Se	Seta	P2	2 rd Pereopoda
Sp	Spine	P3	3 rd Pereopoda
Seg	Segment	P4	4 th Pereopoda
So	Somatic	P5	5 th Pereopoda
Cl	Claws	Pr	Prosoma
Cx Ep	Coxa Epipodite		

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1. INTRODUCTION

Arthropods represent one of the largest phyla of the animal kingdom, comprising over 1.5 million described species. They exhibit diverse ecological roles as herbivores and carnivores, supported by physiological and behavioral adaptations that allow them to exploit varied nutritional and environmental resources (Zhang & Liu, 2013; Matthew *et al.*, 2013). Among them, crustaceans inhabit aquatic and semi-terrestrial environments, often found under damp stones or in decaying organic matter (Nkwoji, 2016). Although traditionally considered a subphylum, some researchers regard crustaceans as a distinct phylum, given their inclusion of all hexapod lineages (Ji *et al.*, 2018). The scientific study of crustaceans is termed Malacostracology (Martín *et al.*, 2014). Copepods are minute planktonic crustaceans widely distributed in inland waters such as rivers, lakes, ponds, and groundwater (Kobayashi *et al.*, 2018; Sanoamuang & Dabseepai, 2021). Freshwater copepods are classified into three main orders: Cyclopoida, Harpacticoida, and Calanoida, with calanoids dominating pelagic zones of ponds, estuaries, and lakes. Within inland waters, the family Diaptomidae is the most species-rich group of calanoids (Ding *et al.*, 2024). Their distribution and diversity are strongly influenced by

2. MATERIALS AND METHODS

About seven samples were collected from the holy Karbala governorate from the Al-Hussainiya River in the north of the governorate on Thursday, September 19, 2024, at 2:00 PM. The Net method was used to collect the samples (with holes diameter of 335 micrometers). The samples were examined and isolated, then preserved in 80% ethanol alcohol with 20% glycerin in glass bottles. After that, the species were fixed using lactic acid with the addition of Rose Bengal red dye to clarify the body parts. A conventional dissection microscope was used to dissect the specimen. Using two micro-pins, the body was separated from the prosoma to the caudal region,

3. RESULTS AND DISCUSSIONS

3.1. TAXONOMIC POSITION OF THE SPECIES UNDER STUDY:

(Linnaeus, 1758); (Kiefer, 1932).
 Kingdom: Animalia (Linnaeus, 1758)
 Phylum: Arthropoda (Latreille, 1772)
 Class: Crustacea (Brunnich, 1772)
 Order: Calanoida (Sars, 1903)
 Family: Diaptomidae (Baird, 1850)
 Genus: *Eudiaptomus* (Kiefer, 1932)
 Species: *Eudiaptomus vulgaris* (Schmeil, 1896)

3.2. ECOLOGICAL OBSERVATIONS

Water temperature: 45
 Air temperature: 30
 PH: 7.33
 Salinity: 0.023

environmental factors, particularly temperature (Kumar & Krishnan, 2021), salinity (Beaver *et al.*, 2019), and pH (Cai *et al.*, 2021). *Eudiaptomus*, a representative genus of Diaptomidae, is widely recognized in freshwater systems (Bradford, 2002; Walter & Boxshall, 2010). The evolutionary history of invertebrates has shaped the current diversity of multicellular animals, estimated at 35–37 phyla, with vertebrates representing only one subphylum. Of the ~1.16 million described multicellular animal species, only about 50,000 (5%) are vertebrates, while invertebrates dominate both aquatic and terrestrial ecosystems (Bertrand & Escriva, 2022). The high adaptability observed in invertebrates, as evidenced by the moderate species richness, serves as a key indicator of their selective responses to environmental pressures and their adaptive alignment with specific ecological conditions (Mizhir & Jasim, 2022). Invertebrate models are particularly valuable for exploring fundamental biological processes across phyla. For example, nitric oxide signaling has been analyzed in mollusks (Kashimoto, 2021; Setiamarga *et al.*, 2021), though further insights require the development of innovative, non-traditional methodologies (Miglioli *et al.*, 2021)

where the fifth somatic segment joins the caudal region. The body appendages were then separated in order, starting from the first tentacle to the fifth foot appendage. A camera lucida was used to photograph the appendages, which were mounted on a compound microscope at different magnifications depending on the clarity of the specimen. The image was redrawn on Triss paper, showing the finest details, and recording the scale of each image. The specimens were identified using a set of the following taxonomic Keys (Korovchinsky, 2018; Jordi, 2000; Thorp & Covich, 2010).

Body (Figure 1): The overall length of the body, measured from the apex of the cephalic region to the terminal edge of the caudal ramus, is 1.40 mm.

Prosoma (Pr) (Figure 1): Oval in shape with slightly wavy terminal edges, while the anterior border is rounded. It includes the cephalothorax and four body segments, the fourth of which also has a wavy terminal. It contains a single central eye at the front of the head. A pair of very long lemmas extending across the ends of the caudal ramus connects the head region.

Urosoma (Ur) (Figure 1): consists of four segments: the genital segment, two ventral segments, and the anal segment to which the pair of caudal branches are attached. The caudal branches are short and similar, and each branch is attached to four feathery caudal ridges of equal length.

Antennule (A1) (Figure 1) : (15) segments of varying shape and size. Some segments contain spines and thorns, according to the following order: (Seta, Se) (Spine, Sp). 1(0), 2(0), 3(1sp), 4(1sp, 1se), 5(1sp, 1se), 6(1sp), 7(0), 8(1se), 9(2se), 10(1se), 11(0), 12(0), 13(0), 14(1sp), 15 (3 se).

Antenna (A2) (Figure 1) : The basal segment is rectangular in shape, bearing two spines, connected to it are the outer (Exopod: Exp) and inner foot (Enpopod: Enp) branches. The Exp consists of 10 square segments of different sizes. The first, second, fourth, seventh, and eighth segments are free of spines and hairs. The third, fifth, and sixth segments each bear one hairy hair, while the last segment bears four hairy hairs of equal length. The Enp: consists of two segments, the first is medium-sized, almost square in shape, free of spines and hairs. The second is small in size and bears three hairy hairs.

Maxillule (Mx1) (Figure 1): It consists of the triangular coxa with one pinnate coxae and one spine. Connected to it, is the coxal epipodite which in turn bears four pinnate coxae and a spine, the base which bears one pinnate coxae, to which are attached the branches of the outer (Exopod: Exp) and inner (Enpopod: Enp) feet. (Exp) is a single segment bearing seven terminal coxae of equal length. The (Enp) is a single segment bearing five long coxae.

Maxilla (Mx2) (Fig1) : Single branched consisting of the first Coxa ilium, the Basal, rectangular in shape with three feathery ridges, Enp consists of three irregularly shaped segments. The first bears a single feathery ridge, the second is triangular in shape, free of ridges and spines, and the third holds three feathery ridges.

Mandible (Md) (Figure 1): It consists of the gnathobase (Gb) which is irregular to square in shape, the basal segment is square in shape and small in size to which the outer (Exopod: Exp) and inner (Enpopod: Enp) foot branches are attached, Exp consists of five segments of different shapes and sizes, the fifth segment bears four pinnate combs. The Enp consists of two irregular segments, the first is irregular in shape and bears one pinnate comb while the second has eight long pinnate.

Maxilliped (Mxp) (Figure 1): Single branch consisting of the Coxa, which bears two feathery peduncles, the Bases, which bears four feathery peduncles. Endopod consists of five segments of different shapes and sizes. The first, second, and fourth segments are free of peduncles and spines. The second segment bears two feathery peduncles, and the last segment bears three long peduncles.

1stPedigerous (P1) (Figure 2): The segment between the iliac crest and the coxa and the base is square-shaped, a small segment, to which the branches of the

outer (Exopod: Exp) and inner (Endopod: Enp) feet, are attached. The Exp consists of three segments, of which the first bears one peduncle, and the third bears four peduncles. The Enp consists of three segments, of which the first and second segments each bear a peduncle and a spine, while the third segment bears four peduncles.

2ndPedigerous (P2) (Figure 2): The segment between the iliac crest I cx and the coxa is square in shape, while the base is an irregular segment to which the branches of the outer (Exopod: Exp) and inner (Endopod: Enp) feet are attached. The Exp consists of three segments, of which the first bears a small spine and one feathery crest, the second bears two feathery crests, and the third bears four feathery crests of equal length. The Enp consists of two segments, of which the first segment is rectangular in shape and small in size with one feathery crest, while the second segment bears four feathery crests of equal length.

3rdPedigerous (P3) (Figure 2) : The interiliac segment I cx is almost rectangular with multiple curves, the Coxa is square in shape, the base is square in shape, the outer (Exopod: Exp) and inner (Endopod: Enp) branches of the feet are connected to it. The Exp consists of three segments, of which the first segment is free of spines and thorns, the second has one small spine, and the third bears four thorns. The Enp consists of three segments, of which the first and third segments bear one feather thorn, and the second segment has two feather thorns of equal length.

4thPedigerous (P4) (Figure 2): The interiliac segment (I cx) is sandy in shape. The coxa is square. The base is an irregular (semi-rectangular) segment with a spine. The outer (Exopod: Exp) and inner (Endopod: Enp) are peduncles of equal length. The Enp consists of consists of three segments. The first and second segments have a single peduncle, and the third has two peduncles of equal length.

5thPedigerous (P5) (Fig2): is symmetrical in shape and varies in size. It consists of the coxa that have one of seta and spine, the base, and the exopod, which consists of two segments. The first segment bears a spine, and the second has a terminal claw.

4. CONCLUSIONS

Through this research, it is recommended to conduct a molecular study concerning the species of the order Calanoida due to their environmental importance. From the results obtained, it is concluded that crustaceans and consequently other zooplankton live under environmental pressures that develop from pollution and various human activities, and this requires more attention to preserve the aquatic environment and the organisms that live in it.

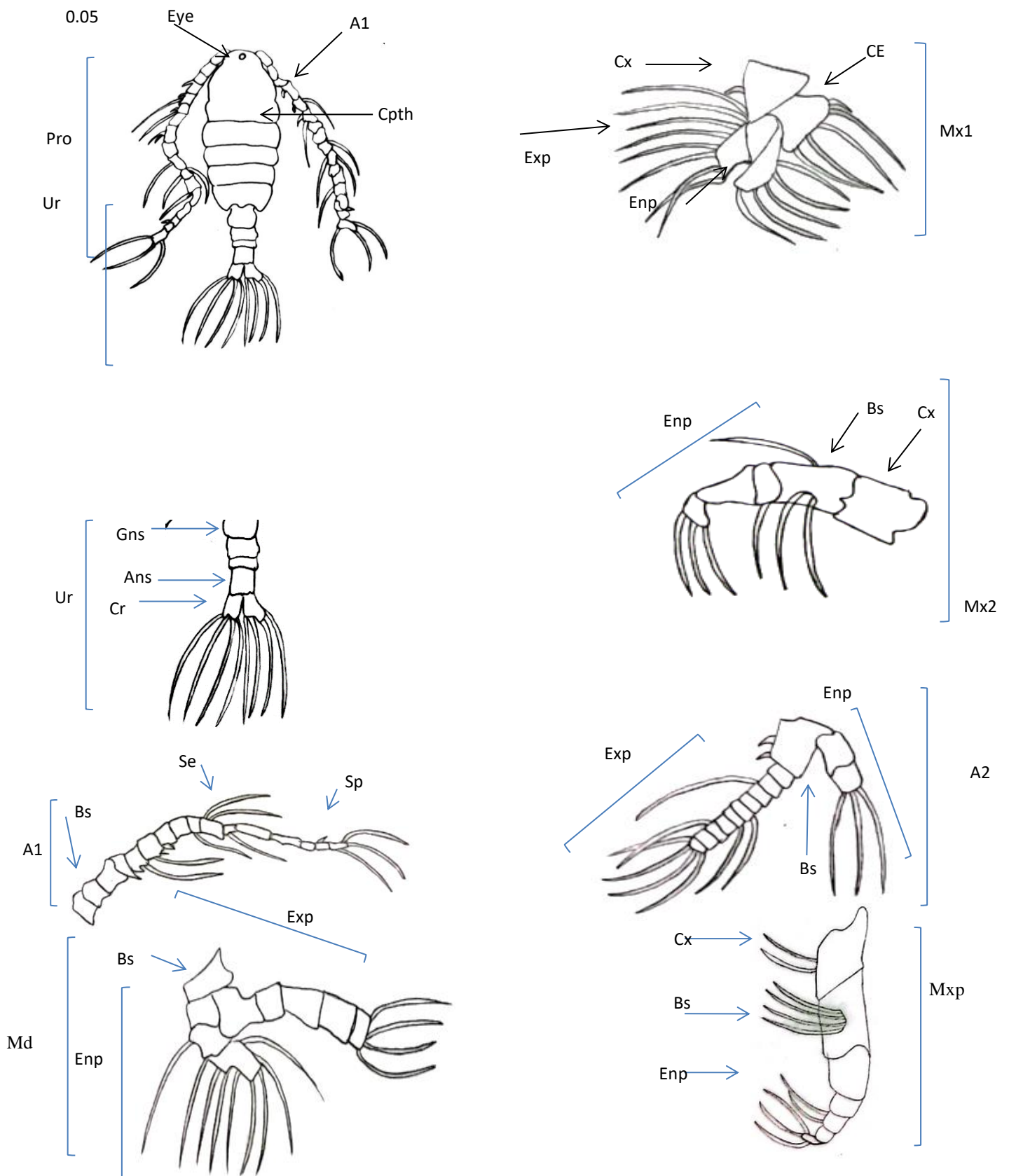


Figure 1 : *Eudiaptomus vulgaris* (Schmeil, 1896) Adult female: Pr-prosoma, Ur-urosome, A1- antennule, A2-antenna , Mx1- Maxillule, Mx2- Maxilla, Md-mandible ,Mxp - Maxilliped

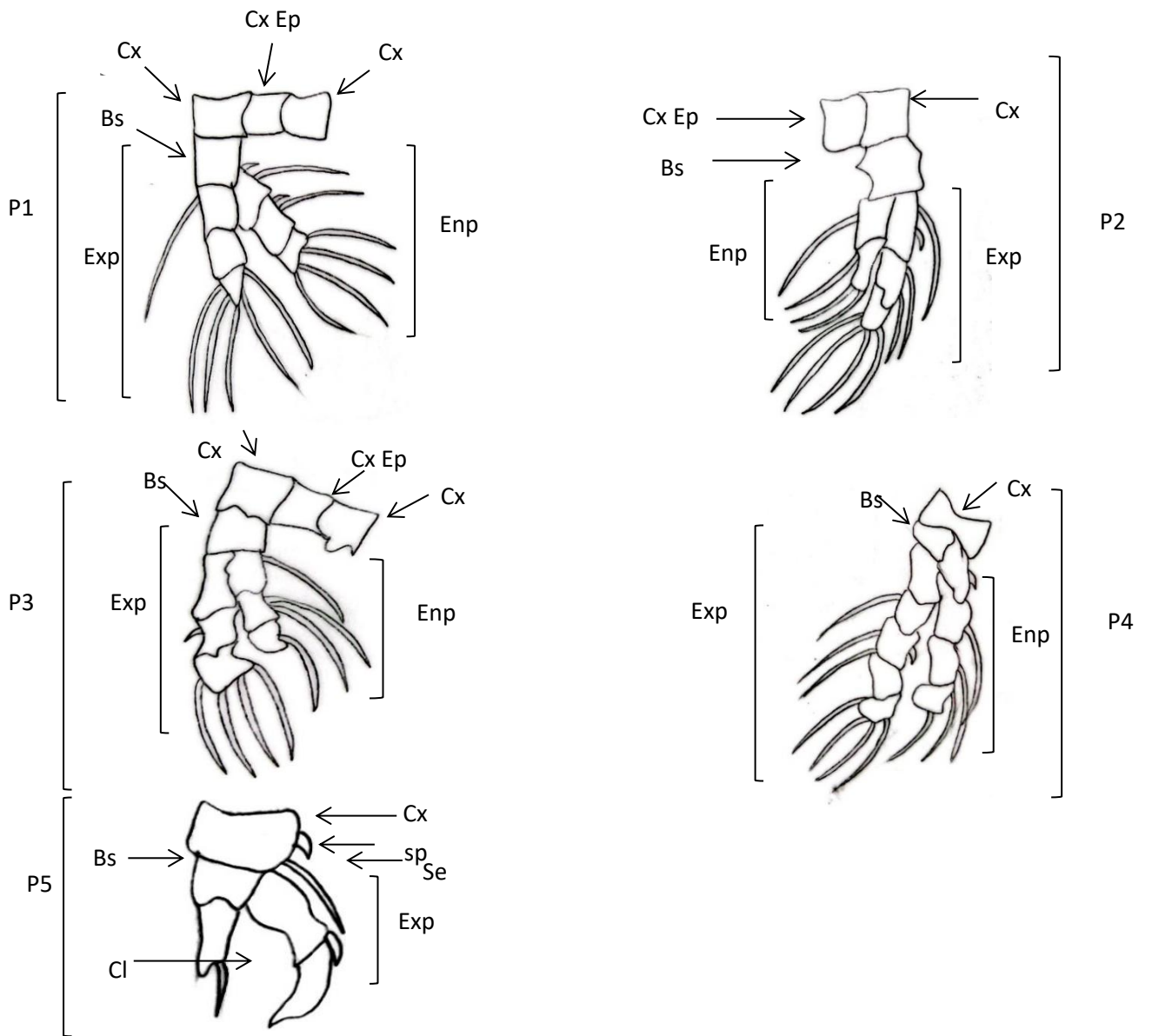


Figure 2 : *Eudiaptomus vulgaris* (Schmeil, 1896) : (P1)-1stPedigerous , (P2) -2ndPedigerous , (P3)- 3rdPedigerous , (P4)- 4ndPedigerous , (P5)- 5ndPedigerous

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