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Immatures of *Parandra* (*Tavandra*) *longicollis* Thomson, 1861 and comments on the larvae of Parandrinae (Coleoptera: Cerambycidae)

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Immatures of *Parandra (Tavandra) longicollis* Thomson, 1861 and comments on the larvae of Parandrinae (Coleoptera: Cerambycidae)

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Abstract. The last larval instar and pupa of *Parandra (Tavandra) longicollis* Thomson, 1861 are described and illustrated. The taxonomy and morphology of immatures of Parandrinae are discussed. A key to larvae and synopsis table to known immatures of Parandrinae are provided.

Key words. Key, larva, Parandrini, pupa, longhorned beetle

Introduction

Parandrinae Blanchard, 1845 (Coleoptera, Cerambycidae) comprise 19 genera and 119 species mostly in tropical regions (Santos-Silva et al. 2010; Bouyer et al. 2012; Bezark and Monné 2013). The subfamily is divided into two tribes: Erichsoniini Thomson, 1861, with only the monotypic genus *Erichsonia* Westwood, 1849, and Parandrini Blanchard, 1845, composed of the remaining genera (Santos-Silva et al. 2010; Bouyer et al. 2012; Bezark and Monné 2013). Traditionally, the species of Parandrinae were described under *Parandra* Latreille, 1802 and after recent taxonomic revisions the classification of the subfamily was considerably modified (Quentin and Villiers 1972; Villiers 1980; Santos-Silva 2002; Santos-Silva and Shute 2009; Santos-Silva et al. 2010; Bouyer et al. 2012).

The immature stages of Parandrinae are poorly known, however, they were very important for the positioning of the subfamily among cerambycids, especially related to Prioninae (e.g., Osten-Sacken 1862; Lameere 1885; Craighead 1915, 1923; Napp 1994). Despite the importance of larval morphology for higher definition and phylogenetic position of Parandrinae, no study supports the internal classification for the genera due to the limited diversity of known taxa. This lack of information combined with the systematic importance of the immatures shows the necessity of studies on taxonomy of larvae and pupae. Larvae of only nine species are described (author of description in square brackets): *Parandra (Parandra) glabra* (De Geer, 1774) [Heller 1904; Duffy 1960; Costa et al. 1988], *Parandra (Hesperandra) expectata* Lameere, 1902 [Zajciw 1974], *Birandra (Birandra) punctata* (White, 1853) [Duffy 1960], *Birandra (Yvesandra) tavakiliani* (Santos-Silva, 2002) [Lingafelter and Micheli 2004], *Neandra brunnea* (Fabricius, 1798) [Osten-Sacken 1862; Craighead, 1915, 1923, 1950; Duffy 1953b; Švácha in Švácha and Danilevsky 1987], *Komiyandra shibatai* (Hayashi, 1963) [Nakamura et al. 1976, translated to English by Santos-Silva et al. 2010], *Archandra caspia* (Ménétriés, 1832) [Iljin 1916; Švácha in Švácha and Danilevsky 1987], *Acutandra gabonica* (Thomson, 1858) [Duffy 1957] and *Hawaiiandra puncticeps* (Sharp, 1878) [Duffy 1953a] (Table 1).

From *Parandra (Tavandra)* Santos-Silva, 2003 the only immature known is the pupa of *Parandra (Tavandra) villei* Lameere, 1885 (described as *Parandra polita* Say, 1835 by Lameere (1885), description addendum by Lameere (1902)). The larva of *Parandra (Tavandra) longicollis* Thomson, 1861, described herein, is the first for the subgenus.

Parandra (T.) longicollis was recorded from Argentina to the United States (Monné 2006; Bezark and Monné 2013), although Chemsak (1996) has formally excluded the species from the North America fauna. Santos-Silva and Martins (2010) and Santos-Silva and Lezama (2010) argue that some records of the species for Central and North America are probably due to a misidentification of *Parandra (Tavandra) polita* and/or *Parandra (Tavandra) brachyderes* Lameere, 1902.

Material and Methods

Nine larvae of *P. longicollis* were collected on a rotten trunk at a fragment of Atlantic Forest in Ribeirão Preto, São Paulo state, southeastern Brazil. Eight larvae were fixed in ethanol 70^o GL and one larva was reared to adult. The reared larva was maintained on a dish with fragments of rotten wood for 120 days. The pupal period lasted 10 days. The larvae are housed in Coleoptera Immatures Collection and the adult is in the general collection of the Museu de Zoologia da Universidade de São Paulo (MZSP).

The specimens were examined under a Carl Zeiss Discovery V8 stereomicroscope and Carl Zeiss Axioskop microscope. Illustrations were produced via camera lucida attached to both instruments. Measurements were obtained by ocular micrometer. Photographs were taken on a Zeiss AxioCam MRc 5 video camera attached to a Carl Zeiss Discovery stereomicroscope. Illustrations and photographs were edited in Adobe Photoshop CS5.

The morphologic nomenclature follows Costa et al. (1988) and Lawrence (1991a, b).

The discussion on the morphology of immatures of Parandrinae is based on the available data in the literature (Table 1).

For comparisons and morphological notes we examined the material of *P. (P.) glabra* housed in MZSP, including those studied by Costa et al. (1988):

Material examined. BRAZIL, *Minas Gerais*: Santa Bárbara (Serra do Caraça - Tanque Grande), 8.xii.1981, Exp. MZSP col., 9 larvae (1 reared to adult), 2 pupae, 2 adults (MZSP 8579, 8581-8583). *Rio de Janeiro*: Nova Friburgo (Muri), 05–09.i.1981, Exp. MZSP col., 6 larvae (2 larvae reared to pupae and 2 reared to adults), 3 adults (MZUSP 8762, 8576-8578). *São Paulo*: Salesópolis (Estação Biológica de Boracéia), 29.iv.1992, Exp. MZUSP col., 4 larvae, 1 adult (MZUSP 8687); 20–22.iv.1982, 19 larvae, 1 adult (MZSP 8588); 16–18.i.1980, 3 larvae, 2 adults (MZUSP 8585); 20–21.xi.1980, 1 larva (reared to adult) (MZUSP 8586).

Results

Parandra (Tavandra) longicollis Thomson, 1861

(Fig. 1–24)

Larva description. Length: 33–34 mm. Body (Fig. 1–3) cylindrical, slightly compressed dorsoventrally. Color yellowish-white, mandibles, peristomium and spiracles dark brown.

Head (Fig. 5–7) dorsoventrally compressed, anterolateral area setose, frontal suture and endocarinae present, coronal suture paired by medial furrow. Stemmata absent. Gula (Fig. 6) narrow. Occipital foramen divided by tentorial bridge. Epistoma with transverse row of setae, 3 long setae on each side. Clypeus (Fig. 8) glabrous, transverse, trapezoidal. Labrum (Fig. 8) cordiform with lateral and anterior areas setose and 2 long medial setae; one longitudinal shallow depression on each side. Epipharynx (Fig. 9, 10) with anterior area setose, medial area with 2 rows of setae, some internal setae chisel-like; medial area with small sclerite bearing 8 sensilla, and 2 posterior sensilla; posterior area with sparse sensilla and pair of sclerites, each one with 6 sensilla; tormae well developed. Preoral area with dense membranous seta-like ornamentation. Mandibles (Fig. 14–18) almost symmetrical; proximal area of external side rugose, scarcely setose; incisor wedge-like, acuminate, with 3 internal striae; molar with internal and dorsal coarsely striated area, and internal shallow depression with some fine furrows. Maxillae (Fig. 11, 12) with cardo anteriorly prominent and setose; stipes setose; palpifer with posteroventral sclerite; mala prominent, rounded, setose, with external and internal sclerite; palpi with 3 palpomeres; I with 2 dorsal small setae, 2 external setae, 1 externoventral microseta, 2 internoventral setae, 2 ventral sensilla, 2–7 ventral punctures; II with 4 dorsal setae, 2 externoventral setae, 1 internoventral seta, 1 ventral sensillum, 5 ventral punctures, III with 1 lateral large seta-like sensillum, 1 lateral puncture, and apex bearing 1 medial large sensillum at middle and about 18 small peripheral sensilla. Hypopharynx (Fig. 10, 11) with shallow longitudinal depression, lateral sides with small microspined ornamentation (magnification higher than 100 \times), proximal area with sparse sensilla. Labium (Fig. 10–12) with submentum glabrous or with 3 short and thin medial setae; mentum medially setose, lateral sides with small rough ornamentation, posterior sclerite well developed; prementum with posterior sclerite well developed; ligula

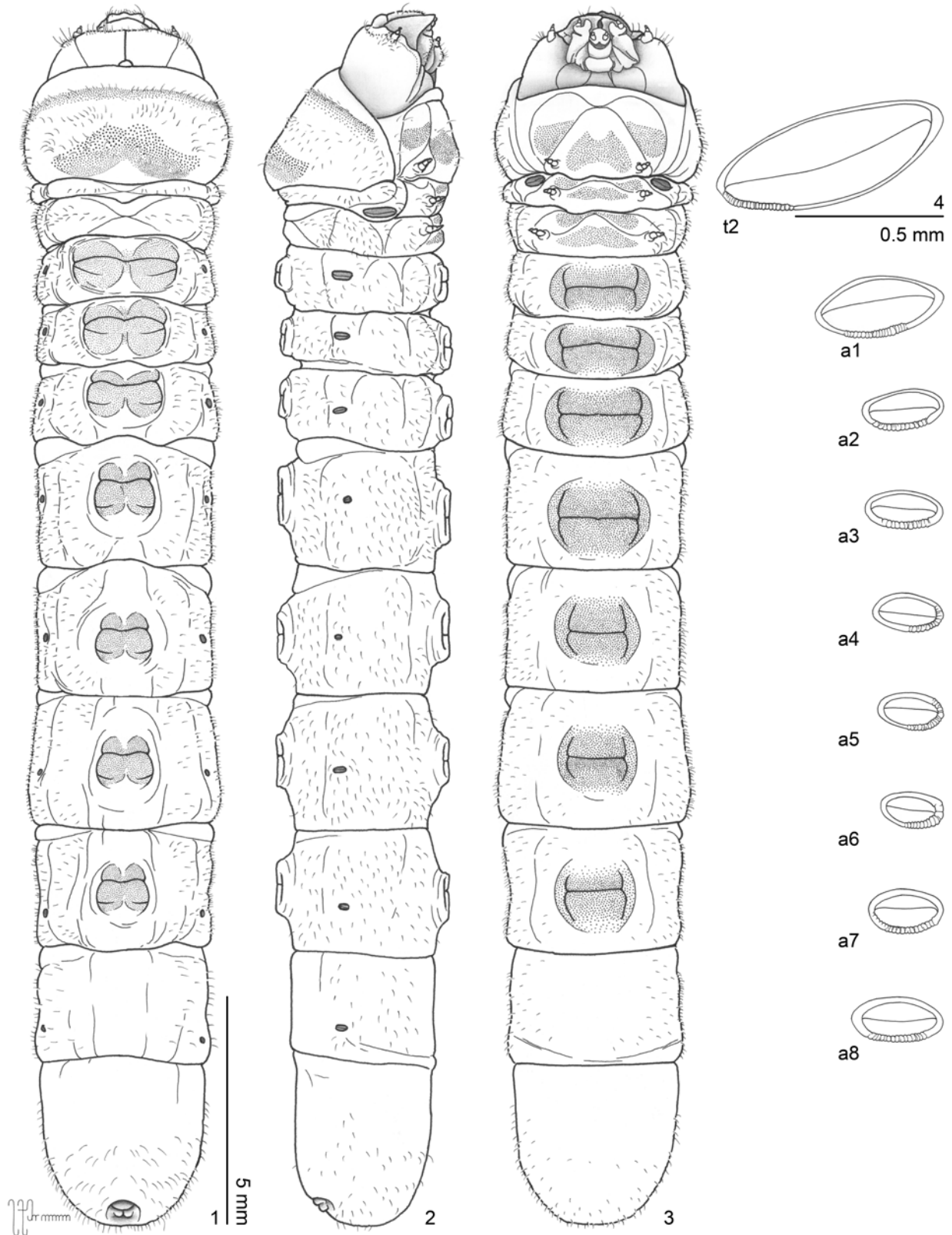


Figure 1–4. *Parandra (Tavandra) longicollis*. Larva. **1)** dorsal. **2)** lateral. **3)** ventral. **4)** spiracles (same position of Fig. 2), a1–8=abdominal spiracles 1–8; t2=mesothoracic spiracle.

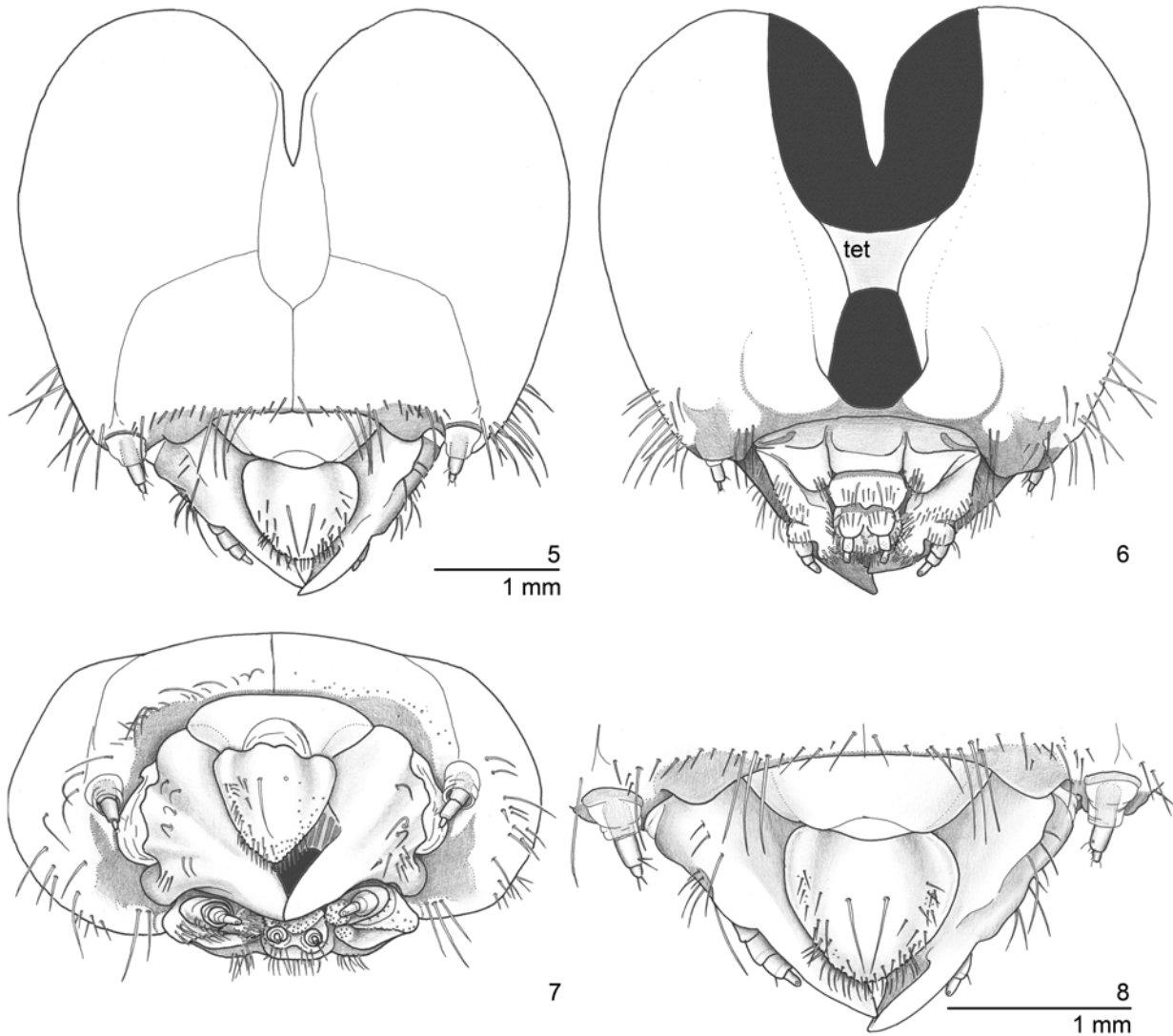


Figure 5–8. *Parandra (Tavandra) longicollis*. Larva, head. **5)** dorsal. **6)** ventral. **7)** frontal. **8)** dorsal, detail, tet=tentorial bridge.

broad, anterior border rounded, anterior area scarcely setose, lateroposterior area densely setose, some internal setae chisel-like; palpiger prominent, with 4 setae, 1 large sensillum and few scarce punctures, lateral sides with small rough ornamentation; palpi with 2 palpomeres, I with 2 ventral small setae, 1 ventral sensillum, 5 ventral punctures; II with 1 lateral puncture and apex bearing similar ornamentation than maxillary palpomere III. Antennae (Fig. 13) with 3 antennomeres; I mostly hidden by membranous antennifer, with 4 ventrodiscal sensilla; II with 3 ventral setae, 3 distal setae, 1 distal sensillum, 1 distal puncture, 1 ventrodiscal annular sensorial appendage; III minute with 2 ventral punctures and apex bearing 3 setae, 2 sensilla (1 very small), 1 puncture.

Pronotum prominent backward, longer than meso- and metanotum combined, anterior area with transverse band of small asperities (magnification higher than $80\times$), posterior area with large asperities decreasing in size backward; basisternum with 3 areas with dense asperities (2 anterolateral, 1 postero-medial); sternellum not separated from posterior part of basisternum. Meso- and metanotum with X-shaped furrow; meso- and metasternum with presternum-basisternum suture sinuous, asperities thinner and similarly distributed to those of prosternum. Legs (Fig. 19–20) with 5 podomeres; coxa broad with some internal asperities, 3–4 setae, 1 internal sensillum; trochanter narrow, membranous, barely defined; femur cylindrical with 4 internal setae, 1 external seta, 1 anterior seta, 1 internal sensillum; tibia

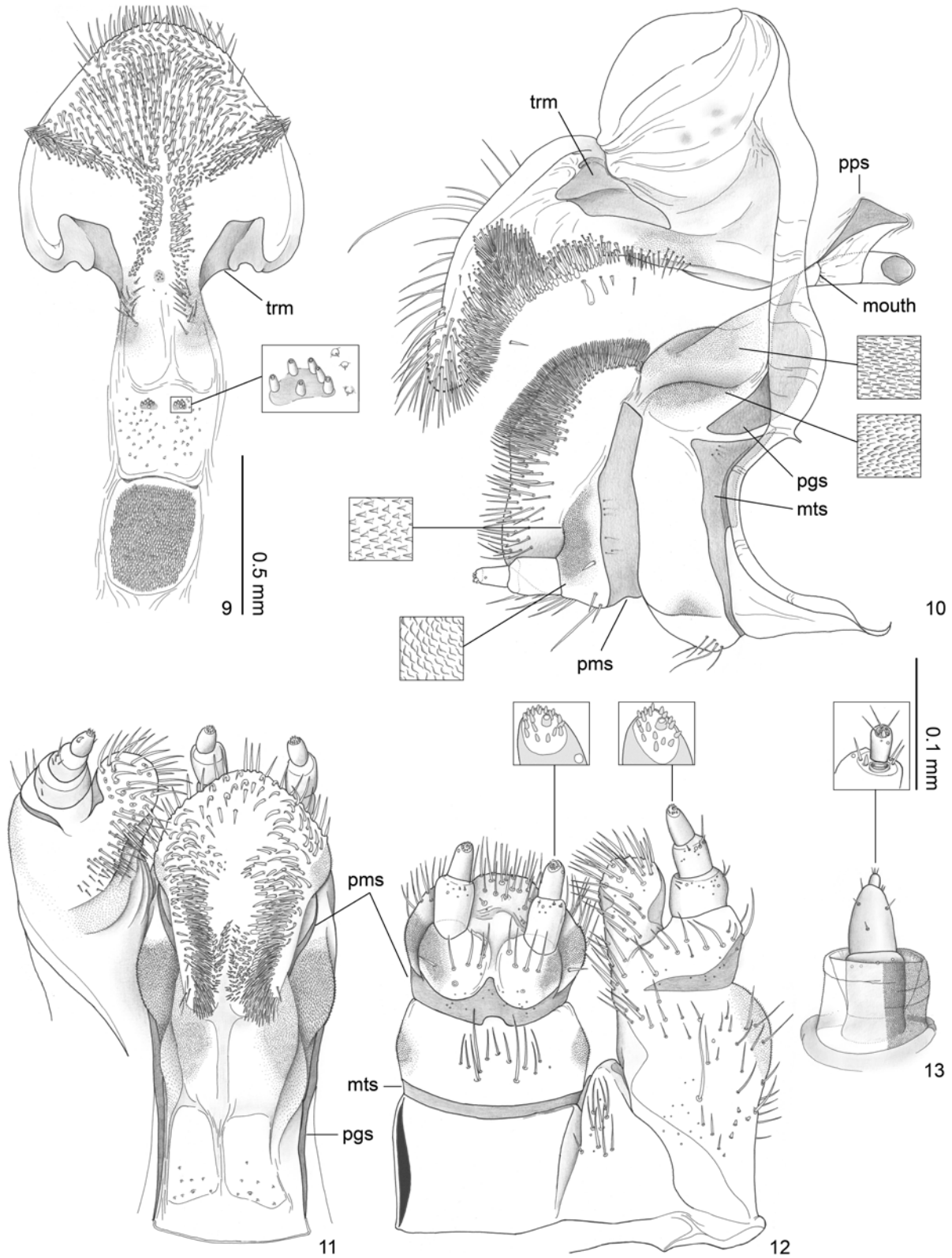


Figure 9–13. *Parandra (Tavandra) longicollis*. Larva. **9)** epipharynx. **10)** cibarium (lateral, mandibles and maxillae removed). **11)** hypopharynx and left maxilla (dorsal). **12)** labium and left maxilla (ventral). **13)** antenna (dorsal ornamentation of antennifer removed); mts=mentum sclerite; pgs=pharyngeal sclerite; pms=prementum sclerite; pps=posterior piece of pharyngeal sclerite; trm=tormae.

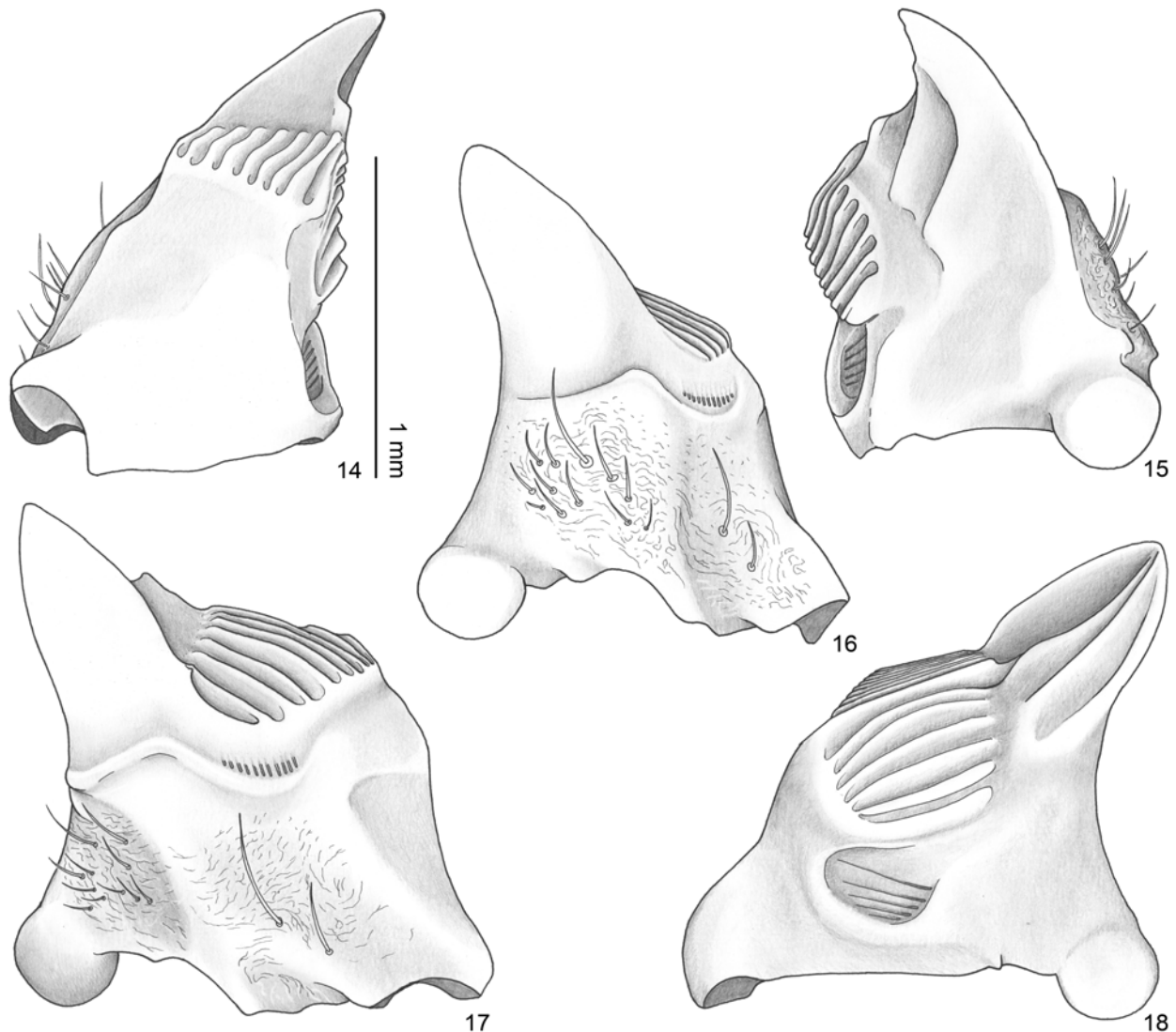


Figure 14–18. *Parandra (Tavandra) longicollis*. Larva, left mandible. 14) dorsal. 15) ventral. 16) external. 17) dorsoexternal. 18) internal.

cylindrical with 3–4 internal setae, 1 external seta, and apex with 1–3 microsetae and 3 setae; tarsungulus narrowed proximally, acuminate, rugose. Thoracic spiracle (Fig. 4) ventrolateral, fusiform, twice larger than abdominal spiracles.

Abdominal segments I–VIII with lateral spiracles (Fig. 4); I–VII with dorsal and ventral ambulatory ampullae with small asperities; dorsal ampullae with 2 laterolongitudinal and 2 transverse furrows, posterior medially incomplete; ventral ambulatory ampullae with 2 laterolongitudinal and 1 transverse furrows; segment IX large, distally rounded; X reduced as peripheral anal lobes.

Female pupa description. Length: 20 mm. Body (Fig. 21–23) cylindrical to fusiform. Color yellowish-white. Spiracles with elliptical dark peritreme, except abdominal spiracle VIII.

Head opisthognathous, vertex not or slightly exposed on dorsal view, epistomal and clypeolabral suture slightly defined. Mandibles prominent; maxillary palpi exposed on ventral view; labial palpi hidden on ventral view. Antenna posteriorly directed, partially exposed in dorsal view, extending over profemur-tibial articulation, apex not or slightly extending over mesofemur-tibial articulation.

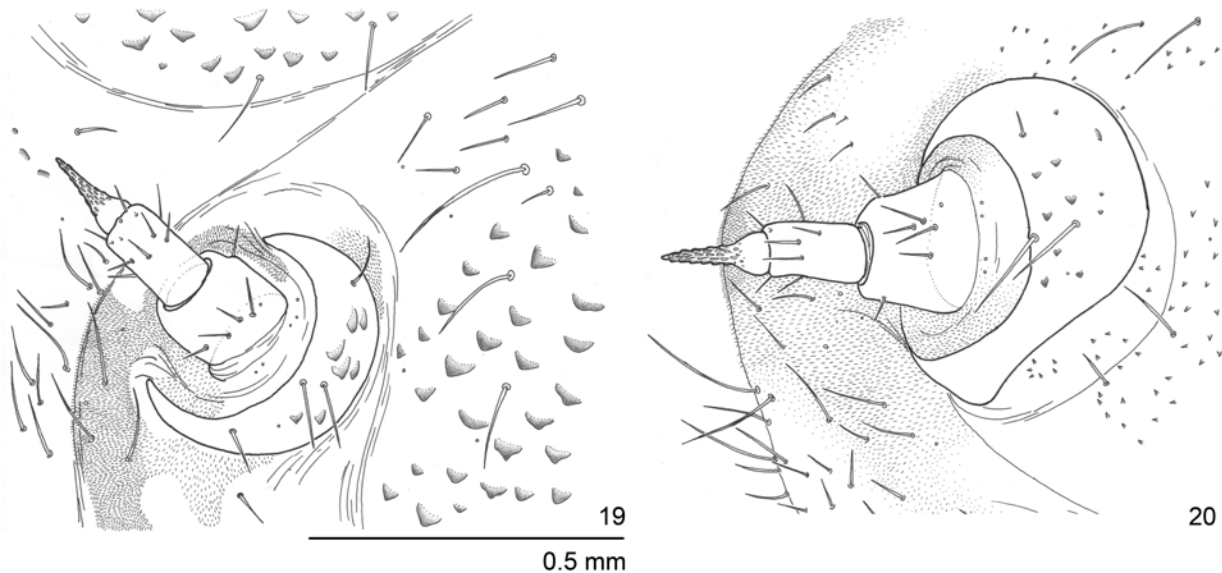


Figure 19–20. *Parandra (Tavandra) longicollis*. Larva, legs. **19)** prothoracic. **20)** mesothoracic.

Thorax. Pronotum almost square, laterals with small spines bearing subapical seta. Mesonotum glabrous, without spines; scutellum posteriorly acuminated. Metanotum with spines distributed on a U-shaped area, spines bearing subapical seta; with slightly defined alacristae. Mesoventrite small, prominent. Elytral theca extending beyond abdominal segment III. Legs dorsoventrally compressed, metafemur-tibial articulation extending as far as elytral theca, metacoxae with posteroexternal angle exposed in lateral view. Mesothoracic spiracle exposed between hypomerion and anterior part of elytra.

Abdomen with 9 well-defined segments; tergites II–VII with lateral lobes and transverse groove; laterals of abdominal tergites I–VII and abdominal lobes II–VII with small spines bearing subapical seta; tergites I–VIII with laterodorsal spiracles, spiracle VIII as cuticular invagination; tergite VIII glabrous; tergite IX with 2 acute small urogomphi; sternite I small; sternite IX with 2 lateral lobes divided by longitudinal fold; tergite and sternite IX separated by transverse fold that encloses anal opening.

Material examined. BRAZIL, *São Paulo*: Ribeirão Preto (Estação Ecológica de Ribeirão Preto - Mata Santa Tereza), 21°13'33" S; 47°51'21" W, 22.v.2009, G. Biffi and E.A. Nascimento col. (8 larvae, 1 larva reared to adult) (MZSP 10.243).

Discussion

Immatures of Parandrinae

The immatures of Parandrinae resemble those of Prioninae. Both can be differentiated from other Cerambycidae larvae by: head wider behind the middle (sides of head parallel or converging posteriorly in Lamiinae); sides of epicranium fused at least in anterior half (wholly separated in Lepturinae and Disteniinae); mandibles with oblique cutting edge; tentorial bridge in same plane as hypostoma (i.e., occipital foramen apparently divided into an anterior and posterior portion) (also present in Cerambycinae); maxilla-labial complex attached to hypostoma by little more than width of gula; leg with 5 podomeres (absent or with 1 or 2 podomeres on Lamiinae) (Craighead 1923; Duffy 1953b; Švácha and Danilevsky 1987).

The larvae of Parandrinae can be distinguished from Prioninae by the following differences (Prioninae characters within parenthesis and our comments within square brackets): epistoma not projected over clypeus (usually projected over clypeus); ocelli present or absent [present only in *Birandra (B.) punctata*] (present or absent); postcondylar process absent (present); subfossal process absent (present); labrum cordiform to lanceolate (cordiform, lanceolate, oblong or oval), with 2 or 4 medial long setae (usually

without distinct medial setae); antennomere II cylindrical (cylindrical or barrel-like), apex transversally truncate (obliquely truncate); basisternum divided by V-shaped furrow anteriorly (division variable); pleural disc absent (present); ambulatory ampullae with asperities (ampullae without asperities); spiracular chambers extending beyond peritreme (chambers absent or small and not extending beyond outer border of peritreme); abdominal segment X reduced to small anal lobes (reduced or not) (Craighead 1923; Duffy 1953b, 1957).

Parandrinae pupae may be distinguished from Prioninae (within parenthesis) by the head opisthognathous (prognathous, hypognathous or opisthognathous); scape directed backward (directed backward, laterally or forward); antennae extending to between pro- and mesofemur (generally extending to at least first abdominal segment, and often recurved beneath body), moniliform (never moniliform, sometimes serrate or pectinate); prothorax without lateral tubercles (often with lateral tubercles), lateral border smooth (smooth, denticulate or serrate); abdominal segment IX with a pair of urogomphi (with or without urogomphi); abdomen without gin-traps (often with gin-traps), abdominal sternites glabrous (glabrous or setose); pronotum, metanotum, abdominal tergites I–VII and lateral abdominal lobes with small spines (dorsal ornamentation variable) (Craighead 1923; Duffy 1953b, 1957; Nakamura 1981).

Remarks on the immatures of *Parandra (Tavandra) longicollis*

The larva of *Parandra (Tavandra) longicollis* resembles the basic forms described for Parandrinae. Moreover, based on the larva descriptions of Parandrinae species presented so far, all of them seem quite similar and distinguished only by slight differences. Most of these available data are insufficient to enable the recognition of the species and discuss further morphological issues. However, the detailed morphological study of the larvae of *P. (T.) longicollis* and *P. (Parandra) glabra*, and the comparisons with the data on literature indicate remarkable differences within them.

The main diagnostic characters for *P. (T.) longicollis* are (1) the sternellum not separated from the posterior part of basisternum (Fig. 3) (separated in *P. (P.) glabra* (Fig. 25), *P. (Hesperandra) expectata*, *Neandra brunnea*, *Komiyandra shibatai* and *Archandra caspia*, but not mentioned for the other species) and (2) epipleura of abdominal segments VII–IX not projected laterally (strongly protuberant in *P. (P.) glabra* (Fig. 26), *P. (H.) expectata*, *N. brunnea*, *A. caspia*, *Acutandra gabonica* and *Hawaiiandra puncticeps*). *Parandra (T.) longicollis* lacks the transverse rows of asperities on meso- and metathoracic and first abdominal sternum. Such asperities are present on *P. (P.) glabra* (Fig. 25) and *Birandra (Birandra) punctata*, but absent in species of other subgenera within the same genera, like *P. (H.) expectata* and *Birandra (Yvesandra) tavakiliani*. Other authors did not explicitly comment this character, but it is unlikely to be present on the remaining described species.

Parandra (T.) longicollis and *P. (P.) glabra* have similar ornamentation on epipharynx, with a medial sclerite bearing 6 sensilla, 2 medioposterior sensilla, and posterior area with numerous sparse sensilla. *Parandra (T.) longicollis* presents 2 posterior sclerites, each bearing 6 sensilla while *P. (P.) glabra* presents a transverse sclerite bearing 15 sensilla.

The descriptions of the antennae usually include proportions among the antennomeres or indicate merely which segment is the largest. This character seems misleading since the antennae can be mostly retracted and the first antennomere can be covered by the membranous antennifer (e.g. Fig 13), appearing to be smaller than it is. Furthermore, the membranous antennifer was mistakenly confused as the first antennomere, leading to consideration of the antenna as 4-segmented (e.g., Osten-Sacken 1862, Zajciw 1974, Lingafelter and Micheli 2004). The shape of antennomeres and sensorial appendages, and chaetotaxy seem to be more useful to establish homologies. In *P. (T.) longicollis*, *P. (P.) glabra* and *Archandra caspia* the sensorial appendage is flat or annular, in contrast with *N. brunnea*, *Acutandra gabonica* and *H. puncticeps* in which it is somewhat swollen, dome-like. In *P. (H.) expectata* the sensorial appendage is indistinct. *P. (T.) longicollis*, *P. (P.) glabra* and *N. brunnea* present 3 setae at the apex of third antennomere, while *Acutandra gabonica* and *K. shibatai* present, apparently, just one.

Another conflicting issue is regarding to the segmentation of the legs. Leg with 5 podomeres was described by Costa et al. (1988) and Švácha (Švácha and Danilevsky 1987), with 4 podomeres by Osten-Sacken (1862), Zajciw (1974) and Lingafelter and Micheli (2004), and with 3 podomeres by Nakamura et al. (1976). In fact the legs observed in *P. (T.) longicollis* and *P. (P.) glabra* are 5-segmented, as described by Švácha for Parandrini. The main controversy about the definition of the leg segments may lie in the difficulty in recognition of the inconspicuous trochanter, which is minute, annular and barely pigmented.

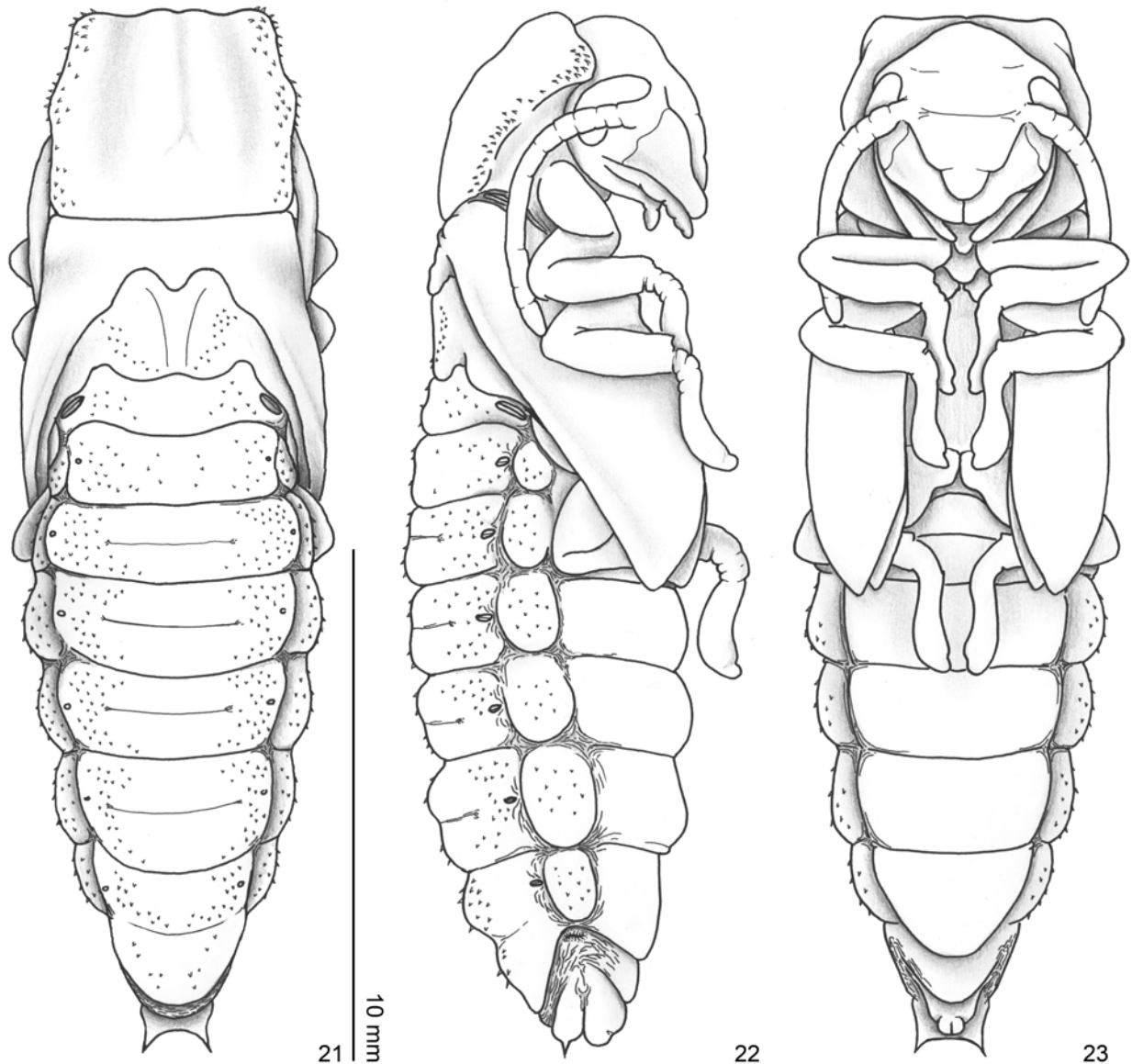


Figure 21–23. *Parandra (Tavandra) longicollis*. Female, pupa. **21)** dorsal. **22)** lateral. **23)** ventral.

The 3-segmented leg described by Nakamura et al. (1976) may refer only to the femur, tibia and tarsungulus. Zajciw (1974) also describes the prothoracic coxae almost meeting medially in *P. (H.) expectata*. In this case, the coxae might be barely distinct and may be confused with the anterolateral portions of basisternum. The tarsungulus presents slight differences among the species. In *P. (T.) longicollis* it is narrowed proximally and then acuminate, almost totally covered by imbricate spines. In *P. (P.) glabra*, *P. (H.) expectata*, *N. brunnea*, *H. puncticeps* and *K. shibatai* they are stouter and regularly acuminate, with imbricate spines only on apical third or half.

The comparisons of the mandibles are possible only for *P. (T.) longicollis*, *P. (P.) glabra*, *N. brunnea* and *A. caspia*. They are robust and almost symmetrical. In the three species the incisor is wedge-shaped, acuminate and with three internal striae. The molar presents an internal shallow depression with some fine furrows (also present in *P. (P.) glabra*. In *P. (T.) longicollis* these areas are coarsely striated while in *P. (P.) glabra*, *N. brunnea* and *A. caspia* they are finely striate. In contrast with the illustration presented by Costa et al. (1988, pl. 127, Fig. 15, 16, 18), the external side of the molar is rugose, but not much excavate or with large punctures.

Comparing the larva of *P. (T.) longicollis* with that of *P. (P.) glabra* it is possible to recognize other slight differences (*P. (P.) glabra* characters within parentheses): maxillae with a group of setae concentrated on internal side of cardo (shorter setae more distributed through cardo); labium with mentum bearing a pair of long setae and a group of smaller setae medially (a pair of long setae and smaller setae broadly distributed), each palpifer with 4 setae (many more setae).

The pupa of *P. (T.) longicollis* resembles the other known Parandrinae pupae (Table 1). In fact, it is quite similar to them and no remarkable diagnostic characters were found.

Only few characters are comparable among the pupae of *P. (T.) longicollis*, *P. (P.) glabra* and the descriptions of the remaining species. The mesonotum is smooth and glabrous on *P. (T.) longicollis*, *P. (T.) villei*, *Hawaiiandra puncticeps*, *Neandra brunnea* and *P. (P.) glabra* (according to Costa et al. (1988) - see discussion below), while it bears spines on *P. (H.) expectata*, *Archandra caspia* and *P. (P.) glabra* (according to Duffy (1960)). The urogomphi are short, acute and divergent in *P. (T.) longicollis*, *P. (T.) villei*, *P. (P.) glabra* and *N. brunnea*, and it is long and robust in *Birandra (B.) punctata* (Fig. 27), truncate in *H. puncticeps*, and convergent in *P. (H.) expectata*.

Unfortunately, the material and descriptions available for the species are scarce and preclude further comparisons among them. Most of the available data are useful for species diagnosis, as given:

Head of *H. puncticeps* with 2 tubercles (head of Parandrinae generally smooth); and abdomen oblong, with segments III–VI distinctly enlarged; abdomen of *P. (T.) villei* with tergite I very narrow, tergite VIII larger than long and presence of longitudinal fold on tergites III–VII; (generally the abdomen is conical, with tergite I well developed, and tergite VIII as long as or longer than wide).

On the immatures of *Acutandra gabonica* and *Parandra (Parandra) glabra*

The larva of *A. gabonica* was described by Duffy (1957) based on specimens from São Tomé Island (São Tomé and Príncipe). However, the occurrence of the species for that country was rejected by Bouyer et al. (2012) who recorded only three species for São Tomé Island. Duffy's material possibly belongs to some of those three species than *A. gabonica*. Their most probable identity is *Acutandra oremansi* Bouyer, Drumont and Santos-Silva, 2012 due to a coincidence on label (local, date and collector) of the larvae material and of some paratypes of the species. The identification of that material has to be revised.

Parandra (Parandra) glabra is a widely recorded species on Central and South America known by a wide range of morphological and chromatic variations on the adults. It is hypothesized that such differences may be related either to populational variations within the same species, or to a very closely related species complex, for which there are no discrete patterns to support a division of species and with some of the forms corresponding to species claimed to be junior synonyms of *P. (P.) glabra* (see discussion on Cardona-Duque et al. (2010)).

Duffy (1960) described and illustrated the immatures of *P. (P.) glabra* based on specimens from Trinidad and Tobago (possibly from the form *Attelabus glaber* De Geer, 1774, the type species of *Parandra* (Tavakilian 2000)) and from south and southern Brazil and Argentina (possibly from the forms of junior synonyms of *A. glaber*); however, he did not indicate possible morphological differences within larvae of such different regions. Morphological differences are observed when comparing the descriptions presented by Duffy (1960) and Costa et al. (1988), who examined only specimens from southeastern Brazil. The differences indicate that the authors were not dealing with the same species (or the same form). For Duffy (1960), the antennae of the larvae of *P. (P.) glabra* are "long, fleshy, scarcely retractile; segment 2 the longest and bearing segment 3 and a supplementary process [sensorial appendage]; segment 3 strongly elongate". Otherwise, Costa et al. (1988) interpret the antenna of the larvae as (translation) "short and 3-segmented; antennifer membranous and well developed; 1st segment is the longest; 2nd long with short setae, the distal spatulate; with a distal annular sensorial appendage; 3rd segment minute with 3 distal setae". Other slight differences can be observed when comparing the figures presented for the species by each author, such as the shape of head capsule and frontal suture. However, these differences may be related to the interpretation of each author, and may not indicate they are distinctive characters. Further, the pupae described by both authors also present some slight differences. The study of the specimens of *P. (P.) glabra* from southeastern Brazil (specimens from Costa et al. (1988), MZSP) provided more comparable characters for those described by Duffy (1960), as given (MZSP specimens within parenthesis): scutellum with few spines (scutellum smooth); metanotum with several spines [more than 12]

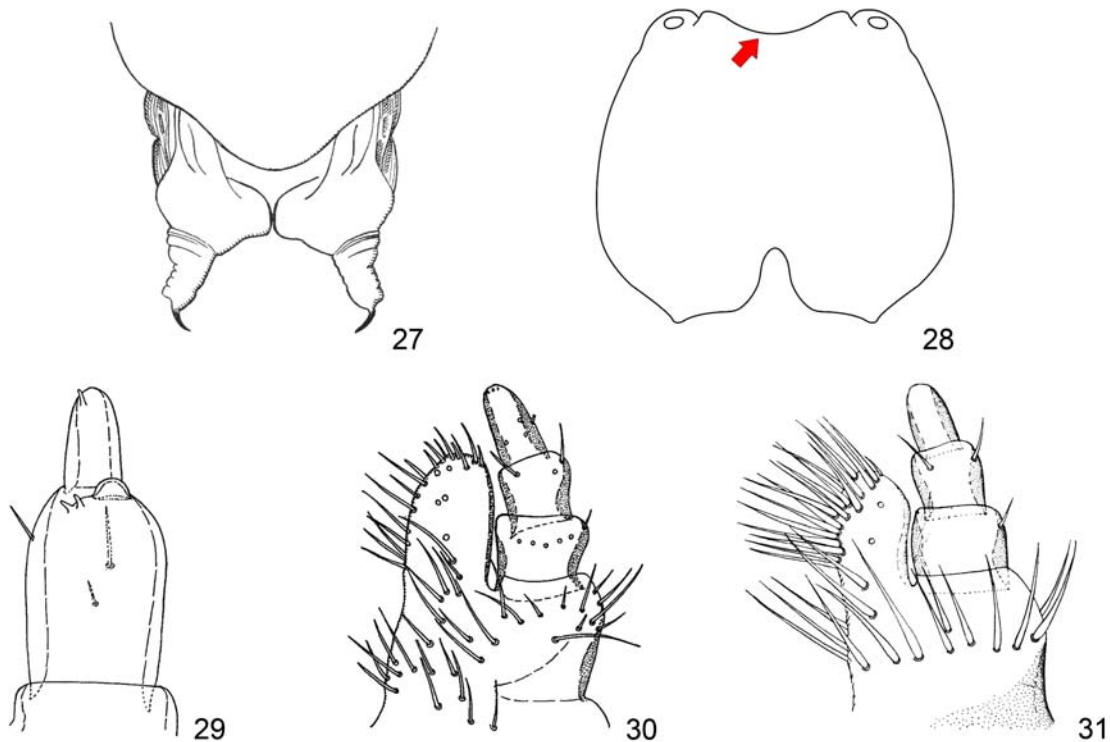
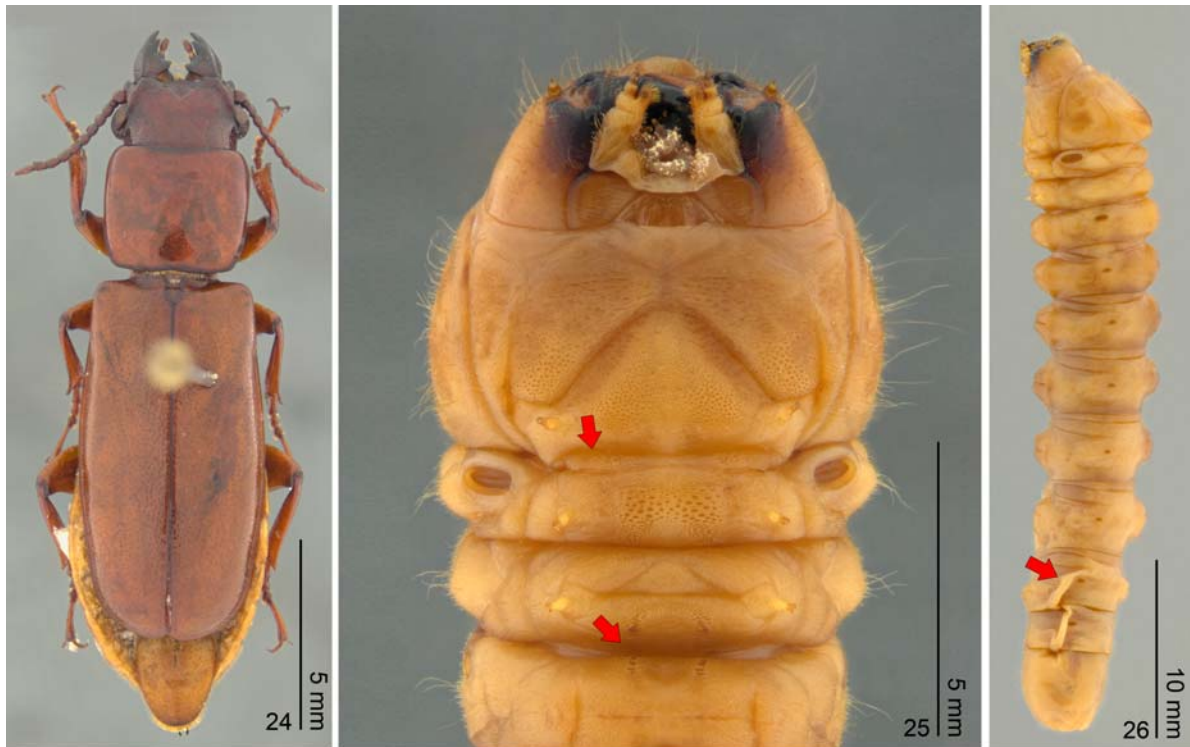


Figure 24–31. Parandrinae. **24)** *Parandra (Tavandra) longicollis*, female, adult habitus. **25–26)** *Parandra (Parandra) glabra*, larva. **25)** head and thorax (ventral). **26)** habitus (lateral). **27)** *Birandra (Birandra) punctata*, urogomphi of pupa (modified from Duffy 1960). **28)** *Komiyandra shibatai*, cranium of larva (emphasis on the backward directed epistoma) (modified from Nakamura et al. 1976). **29–30)** *Hawaiiandra puncticeps*, larva. **29)** antenna. **30)** maxilla (modified from Duffy 1953a). **31)** *Acutandra gabonica*, maxilla of larva (modified from Duffy 1957).

Table 1. Species of Parandrinae with immature forms described. L: larva; P: pupa.

Species	name used	Stage	References	Locality
	<i>Parandra glabra</i>	L	Heller 1904	Brazil
<i>Parandra (Parandra) glabra</i> (De Geer, 1774)	<i>Parandra (Archandra) glabra</i>	L, P	Duffy 1960	Trinidad and Tobago, Argentina, Brazil
	<i>Parandra (Hesperandra) glabra</i>	L, P	Costa et al. 1988	Brazil
<i>Parandra (Tavandra) villei</i> Lameere, 1885	<i>Parandra polita</i>	P	Lameere 1885	Ecuador
<i>Parandra (Tavandra) longicollis</i> Thomson, 1861	<i>Parandra (Tavandra) longicollis</i>	L, P	this paper	Brazil
<i>Parandra (Hesperandra) expectata</i> Lameere, 1902	<i>Parandra (Archandra) expectata</i>	L, P	Zajciw 1974	Brazil
<i>Birandra (Birandra) punctata</i> (White, 1853)	<i>Parandra (Parandra) punctata</i>	L, P	Duffy 1960	Guyana
<i>Birandra (Yvesandra) tavakiliani</i> (Santos-Silva, 2002)	<i>Parandra tavakiliani</i>	L	Lingafelter and Micheli 2004	Puerto Rico
	<i>Parandra brunnea</i>	L	Osten-Sacken 1862	USA
	<i>Parandra brunnea</i>	L	Craighead 1915	North America
	<i>Parandra brunnea</i>	P	Craighead 1923	North America
<i>Neandra brunnea</i> (Fabricius, 1798)	<i>Parandra brunnea</i>	L	Craighead 1950	USA
	<i>Parandra brunnea</i>	L	Duffy 1953b	North America
	<i>Parandra (Neandra) brunnea</i>	L	Švácha and Danilevsky 1987	Germany (introduced)
<i>Komiyandra shibatai</i> (Hayashi, 1963)	<i>Parandra shibatai</i>	L	Nakamura et al. 1976	Japan
	<i>Parandra caspia</i>	L, P	Iljin 1916	Iran (North)
<i>Archandra caspia</i> (Ménétries, 1832)	<i>Parandra (Archandra) caspia</i>	L	Švácha and Danilevsky 1987	Iran, Azerbaijan
<i>Acutandra gabonica</i> (Thomson, 1858)	<i>Parandra (Parandra) gabonica</i>	L	Duffy 1957	São Tomé and Príncipe
<i>Hawaiiandra puncticeps</i> (Sharp, 1878)	<i>Parandra puncticeps</i>	L, P	Duffy 1953a	Hawaii, USA
<i>Parandra</i> sp	<i>Parandra</i> sp	P	Duffy 1953b	undetermined

(metanotum with ten or fewer spines) and the anterior ones much larger than remainder (spines without size variation), abdominal tergites II–VI with transversal fold (IV–VI with transversal folds).

Key to world species of Parandrinae larvae

1. Meso- and metathoracic and first abdominal sternum with transversal rows of asperities (Fig. 25) **2**
— Meso- and metathoracic and first abdominal sternum without transversal rows of asperities **3**
- 2 (1). Stemmata absent (South America) ***Parandra (Parandra) glabra***
— Stemmata present, barely visible (Guyana) ***Birandra (Birandra) punctata***
- 3 (1). Labrum with a transversal series of four long setae medially **4**
— Labrum with a pair of long setae medially **5**
- 4 (3). Epistoma arched backward (Fig. 28) (Japan) ***Komiyandra shibatai***
— Epistoma strait (Puerto Rico) ***Birandra (Yvesandra) tavakiliani***
- 5 (3). Sensorial appendage of antenna distinct **6**
— Sensorial appendage of antenna indistinct (Brazil) ***Parandra (Hesperandra) expectata***
- 6 (5). Third antennomere distinctly small, about 0.3 times as large as the second antennomere **7**
— Third antennomere 0.4 times as large as the second or larger **8**
- 7 (6). Basisternum not separated from sternellum; epipleura of last three abdominal segments not prominent; internal and dorsal areas of mandible coarsely striated; sensorial appendage of antenna flat or annular (Fig. 12, detail) (Brazil) ***Parandra (Tavandra) longicollis***

- Basisternum separated from sternellum (similar to Fig. 25); epipleura of last three abdominal segments prominent; internal and dorsal areas of mandible finely striated; sensorial appendage of antenna swollen (similar to Fig. 29) (North America) *Neandra brunnea*
- 8 (6). Sensorial appendage of antenna flat or annular (similar to Fig. 12, detail) (Iran)
..... *Archandra caspia*
- Sensorial appendage of antenna swollen (Fig. 29) 9
- 9 (8). Maxilla with long and thick setae concentrated on internal side of mala and forming a transverse row on palpifer (Fig. 31) (São Tomé and Príncipe) *Acutandra gabonica*
- Maxilla with setae thinner and more evenly distributed (Fig. 30) (Hawaii)
..... *Hawaiiandra puncticeps*

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Literature Cited

- Bezark, L. G., and M. A. Monné. 2013.** Checklist of the Oxypeltidae, Vesperidae, Disteniidae and Cerambycidae, (Coleoptera) of the Western Hemisphere. 2013 Edition (updated through 31 December 2012). 484 p. Available from: <http://plant.cdfa.ca.gov/byciddb/checklists/WestHemiCerambycidae2013.pdf> (Accessed 17 September 2013).
- Bouyer, T., A. Drumont, and A. Santos-Silva. 2012.** Revision of African Parandrinae (Coleoptera, Cerambycidae). *Insecta Mundi* 241: 1–85.
- Cardona-Duque, J., A. Santos-Silva, and M. Wolff. 2010.** Parandrinae (Coleoptera: Cerambycidae) de Colombia. *Revista Colombiana de Entomología* 36: 135–157.
- Chemsak, J. A. 1996.** Illustrated Revision of the Cerambycidae of North America. Volume I. Parandrinae, Spondylidinae, Aseminae, Prioninae. Wolfsgarden Books, Burbank, 1: i–x + 150 p.
- Costa, C., S. A. Vanin, and S. A. Casari-Chen. 1988.** Larvas de Coleoptera do Brasil. Museu de Zoologia, Universidade de São Paulo; São Paulo. 282 p., 165 pl.
- Craighead, F. C. 1915.** Larvae of Prioninae. Contributions toward a classification and biology of the North American Cerambycidae. United States Department of Agriculture 107: 1–24.
- Craighead, F. C. 1923.** North American cerambycid larvae: a classification and the biology of North American cerambycid larvae. Canada Department of Agriculture, Technical Bulletin, N. S. 27: 1–239.
- Craighead, F. C. 1950.** Insect Enemies of Eastern Forests. USDA Miscellaneous Publications; Washington D. C. 679 p.
- Duffy, E. A. J. 1953a.** The immature stages of Hawaiian Cerambycidae, with a key to larvae. *Proceedings of the Hawaiian Entomological Society* 15: 135–158.
- Duffy, E. A. J. 1953b.** A monograph of the immature stages of British and imported timber beetles (Cerambycidae). British Museum (Natural History); London. 350 p.
- Duffy, E. A. J. 1957.** A monograph of the immature stages of African timber beetles (Cerambycidae). British Museum (Natural History); London. 338 p.

- Duffy, E. A. J. 1960.** A monograph of the immature stages of Neotropical timber beetles (Cerambycidae). British Museum (Natural History); London. 327 p.
- Heller, K. M. 1904.** Brasilianische Käferlarven, gesammelt von Dr. Fr. Ohaus. Stettiner Entomologische Zeitung 65: 381–401.
- Ijgin, B. S. 1916.** Observations sur *Parandra caspia* Mén. (Coleoptera, Cerambycidae); description de sa larve et de sa nymphe. Revue Russe d'Entomologie 16: 286–298.
- Lameere, A. A. L. 1885.** Contribution à l'histoire des métamorphoses des longicornes de la famille des Prionidae. Mémoires de la Société Royale des Sciences de Liège, Deuxième Série 11: 1–13.
- Lameere, A. A. L. 1902.** Révision des prionides (Première mémoire-Parandrides). Annales de la Société Entomologique de Belgique 46: 59–111.
- Lawrence, J. F. 1991a.** Order Coleoptera. p. 144–658. *In*: Stehr, F. W. (Ed.). Immature insects. Volume 2. Kendall / Hunt Publishing Company; Dubuque. 975 p.
- Lawrence, J. F. 1991b.** Cerambycidae (Chrysomeloidea) (including Disteniidae, Hypocephalidae, Oxypeltidae, Parandridae, Spondylidae, Vesperiidae). p. 556–561. *In*: Stehr, F. W. (Ed.). Immature insects. Volume 2. Kendall / Hunt Publishing Company; Dubuque. 975 p.
- Lingafelter, S. W., and C. J. Micheli. 2004.** New species of Cerambycidae (Coleoptera) from Puerto Rico with records and notes for other species. Journal of the New York Entomological Society 112: 37–55.
- Monné, M. A. 2006.** Catalogue of the Cerambycidae (Coleoptera) of the Neotropical Region. Part III. Subfamilies Parandrinae, Prioninae, Anoplodermatinae, Aseminae, Spondylidinae, Lepturinae, Oxypeltinae, and addenda to the Cerambycinae and Lamiinae. Zootaxa 1212: 1–244.
- Nakamura, S. 1981.** Morphological and taxonomic studies of the cerambycid pupae of Japan (Coleoptera: Cerambycidae). Miscellaneous Reports of Hiwa Museum for Natural History 20: 1–159.
- Nakamura, S., K. Kojima, and S. Okajima. 1976.** Notes on the Larva of *Parandra shibatai* Hayashi (Coleoptera, Cerambycidae), with Key to the Subfamilies of Japanese Cerambycidae Larvae. Kontyû 44: 228–233.
- Napp, D. S. 1994.** Phylogenetic relationships among the subfamilies of Cerambycidae (Coleoptera - Chrysomeloidea). Revista Brasileira de Entomologia 38: 265–419.
- Osten-Sacken, C. R. 1862.** Description of some larvae of North American Coleoptera. Proceedings of the Entomological Society of Philadelphia 1: 105–130.
- Quentin, R. M. and A. Villiers. 1972.** Un nouveau Parandrinae de Madagascar (Col. Cerambycidae). Bulletin de la Société Entomologique de France 77: 208–209.
- Santos-Silva, A. 2002.** Notas e descrições em Parandrini (Coleoptera, Cerambycidae, Parandrinae). Iheringia, Série Zoologia 92: 29–52.
- Santos-Silva, A., D. Heffern, and K. Matsuda. 2010.** Revision of Hawaiian, Australasian, Oriental, and Japanese Parandrinae (Coleoptera, Cerambycidae). Insecta Mundi 130: 1–120.
- Santos-Silva, A., and H. J. Lezama. 2010.** Contribuição para o conhecimento dos Parandrini da Costa Rica e do Panamá (Coleoptera, Cerambycidae, Parandrinae). Revista Brasileira de Entomologia 54: 399–405.
- Santos-Silva, A., and U. R. Martins. 2010.** Subfamília Parandrinae. Tribo Parandrini. pp. 5–79. *In*: Martins, U.R. (Org.). Cerambycidae sul-americanos (Coleoptera): Taxonomia. Volume 11. Sociedade Brasileira de Entomologia, São Paulo, 271 p.
- Santos-Silva, A., and S. Shute. 2009.** The identity of *Parandra laevis* Latreille, 1804 and nomenclatural changes in the Parandrinae (Coleoptera: Cerambycidae). Zookeys 25: 19–35.
- Švácha, P., and M. L. Danilevsky. 1987.** Cerambycoidea larvae of Europe and Soviet Union (Coleoptera, Cerambycoidea). Part 1. Acta Universitatis Carolinae, Biologica 30: 1–176.
- Tavakilian, G. L. 2000.** Les Parandrinae de Guyane (Coleoptera, Cerambycoidea). Coléoptères 6: 147–174.
- Villiers, A. 1980.** Coléoptères Cerambycidae des Antilles françaises. I. Parandrinae, Prioninae, Lepturinae. Annales de la Société entomologique de France (N.S.) 16: 133–157.
- Zajciw, D. 1974.** Descriptions of larva and pupa *Parandra (Archandra) expectata* Lam. 1902 (Coleoptera, Cerambycidae, Parandrinae). Revista Brasileira de Biologia 34: 101–104.

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