

Research articleSubmitted: April 28th, 2017 - Accepted: November 24th, 2017 - Published: December 29th, 2017**Ecology and life history of *Paratomapoderus brachypterus* in Gabon (Coleoptera: Attelabidae)**Silvano BIONDI^{1,*}, Carlo MASSARONE², Cosmin-Ovidiu MANCI³¹ Via G.E. di Velo 137, 36100 Vicenza, Italy - silvano_biondi@libero.it² Vicolo del Frantoio 8, 50060 San Godenzo (FI), Italy - carlo.massarone@gmail.com³ PostRestant, OP Tomesti, Tomesti (IS), Romania - cosminom@gmail.com

* Corresponding author

Abstract

On the base of data collected during four expeditions in Gabon (West Africa) from 2012 to 2016, the authors provide new information on trophic activity and reproductive behaviour of *Paratomapoderus brachypterus* (Voss, 1926) (Attelabidae: Apoderinae, Hoplapoderini), with emphasis on leaf-roll realisation; host plant, leaf roll, larva and pupa are illustrated for the first time.

Key words: Attelabidae, *Paratomapoderus*, Gabon, *Combretum*, biology, host plant, distribution, Afrotropic.

Introduction

Tomapoderus Voss, 1926, *Paratomapoderus* Voss, 1926 and *Parapoderus* Voss 1926 (that Legalov (2007) regards as a synonym of *Paratomapoderus*) are nearly exclusively African genera, together including more than one hundred species. Their systematics is still unclear and is in need of a revision. Voss (1926a, 1926b) subdivided the different lineages nearly exclusively on the base of presence and shape of what he called “abdominal lobes” (“*Abdominal-lappen*”); however, as demonstrated by Biondi (2005), this character is not stable and is inadequate for a systematic purpose. Furthermore, the high intraspecific variability in the chromatic pattern led in the past to the description of several taxa both as species and infraspecific ranks: this is also the case of *Paratomapoderus brachypterus* (Voss, 1926). Voss (1937: 290) clearly recognised the high variability of this species (“... diese Art in der Färbung sehr veränderlich ist”), however described a number of subspecific taxa (Voss 1926b, 1928, 1929, 1937, 1939, 1953).

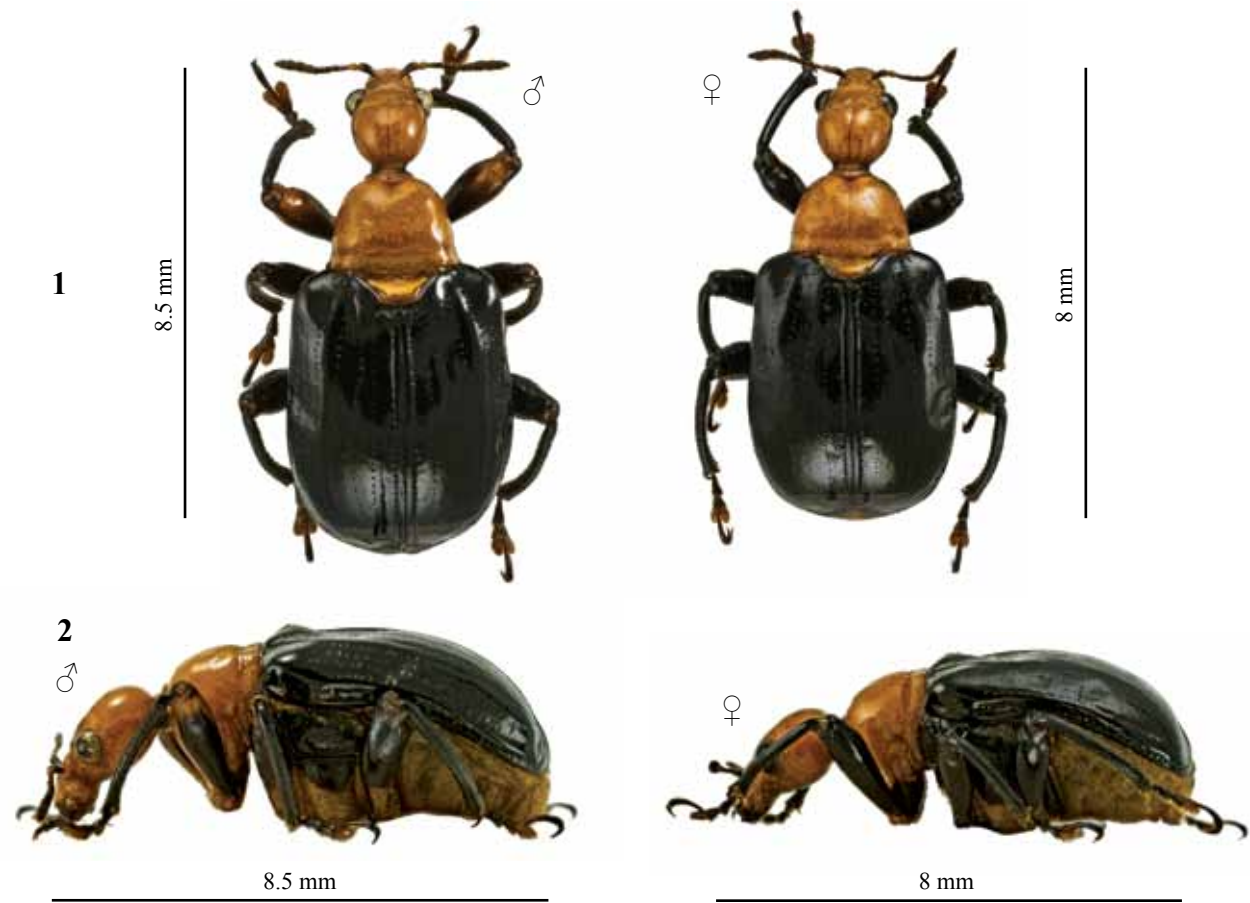
Concerning African Apoderinae nearly nothing is known about their ecology and ethology and the only information available are restrict to the agronomic implication of some species, with emphasis on the host plants: *Parapoderus fuscicornis* (Fabricius, 1792) is reported as feeding on *Anacardium occidentale* in Benin (Agboton et al. 2014), *Terminalia ivoriensis* in Ghana (Voss 1973) and on rice in Ivory Coast and Sierra Leone (Heinrichs & Barrion 2004); *Parapoderus submarginatus* (Gyllenhal,

1839) is given as a pest on *Eucalyptus maculata* in South Africa (Anonymous 1976); *Parapoderus flavoebenus* (Thomson, 1858) is reported as feeding on *Terminalia superba* and *Khaya ivorensis* in Cameroon (Foahom 2002), or *Theobroma cacao* in Ghana (Cotterell 1927) and Ivory Coast (Alibert 1951); again in Ivory Coast *Parapoderus clivicollis* (Marshall, 1948) is reported as feeding on *T. cacao* (Alibert 1951). *Tomapoderus (Pseudapoderus) ghesquierei* Voss, 1939, from Democratic Republic of the Congo, feeds on *Crudia* (Fabaceae) (Voss 1939); *Parapoderus pseudotolerans* Voss, 1926 is given on *Combretum* sp. in Sierra Leone (Voss 1937). In the collection of the first author one specimen of *Parapoderus balteus* Voss, 1922 from Pretoria (South Africa) shows collecting label that reports *Combretum* sp. as host.

Systematics and distribution

Voss (1926b) described *Parapoderus brachypterus* and in the same year (Voss 1926a) erected the genus *Paratomapoderus*; this species has been then moved by him (Voss 1937) to *Paratomapoderus*.

Paratomapoderus brachypterus (Figs 1, 2) is a species associated to rainforests occurring in Cameroon (Voss 1926b), Gabon (Voss 1929), Equatorial Guinea (Voss 1926b), Democratic Republic of the Congo (Voss 1939) and Angola (Voss 1937); all known localities are given in the distribution map (Fig. 3).



Figs 1-2 – Habitus of *Paratomapoderus brachypterus* (photo C.O. Mancini).

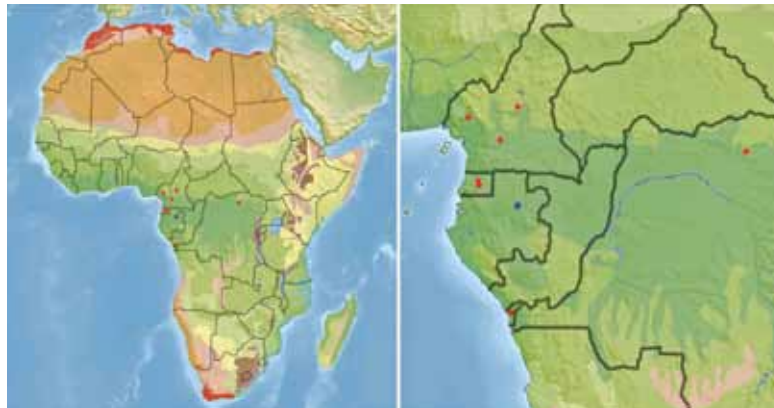


Fig. 3 – Known distribution of *Paratomapoderus brachypterus*. Red dots: localities obtained by literature, blue dot: locality of the observations (Gabon: Ipassa).

Material and methods

Study site

All nine specimens observed in the field and collected come from the same locality (Fig. 4):

Gabon: Ogooué-Ivindo, Makokou, Ipassa, 500 m, 00.30.43N, 12.48.12E.

Collected specimens: 1 ♂, 1-15 Dec 2013, S. Biondi leg.; 1 ♀, 14-24 Mar 2015, C. Massarone leg.; 4 ♀♀ and 1 ♂, 15-25 Jun 2016, S. Biondi & C. Massarone legg.; 1 ♀ bred from leaf roll, Jun 2016, S. Biondi leg. (all in the private collection of the first author); 1 ♂, 15-25 Jun 2016, E. Ruzzier leg. (deposited in The Natural History Museum, London).



Fig. 4 – Habitat of *Paratomapoderus brachypterus*: forest track near Ipassa Station (photo S. Biondi).



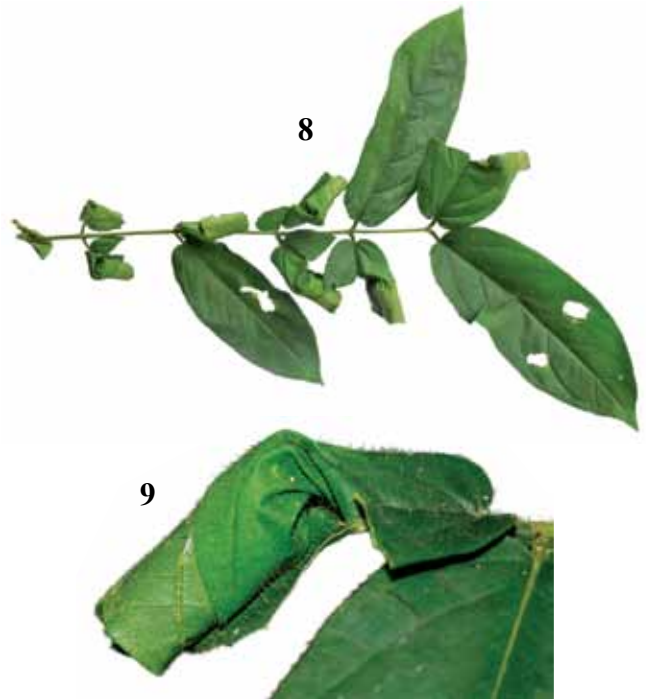
Fig. 5 – Host plant bush of *Paratomapoderus brachypterus*: *Combretum* Loebl., 1758 sp. (Myrtales: Combretaceae) (photo S. Biondi).



6



7



8

9

Figs 6-9 – Leaf rolls of *Paratomapoderus brachypterus* on *Combretum* and alimentation holes; **6**, leaf rolls with cut from the left and from the right side (photo C. Massarone).

During the 2016 expedition, 67 leaf rolls of *P. brachypterus* were collected; only six were found to contain larvae or pupae and in only one case we were able to obtain the imago (a female). None of the remaining rolls contained viable eggs and in several cases parasitoid damages have been observed. The high mortality rate is probably due to the action of the recently described *Poropoea africana* Laudonia & Viggiani, 2017 (Hymenoptera Trichogrammatidae), emerged from some of the leaf rolls collected in Ipassa (Laudonia et al. 2017).

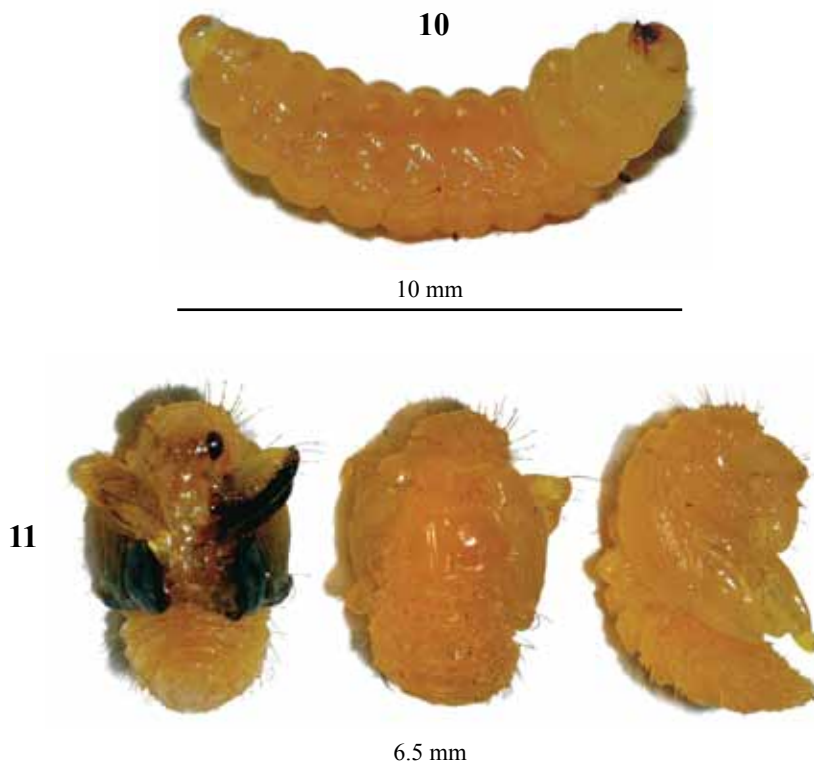
All adults were collected during the day by hands or by sweeping vegetation. Photos in the environment were done using Canon PowerShot SX40 HS and Pentax K20D equipped with Pentax D FA 100mm Macro objective. About 70 photos of the mounted specimens were taken with Canon EOS 7D and the lens Canon MP-E 65mm f/2.8 1-5x, and were then stacked with Zerene Stacker software. For all photos the post-processing (mostly cleaning) was done with Adobe Photoshop CS6.

Results

In all cases observed, the hostplant of *P. brachypterus* is a species of *Combretum* Loefl. (Myrtales, Combretaceae); this shrubby plant is common along tracks and forest paths of the investigated area (Fig. 5). *Paratomapoderus* adult

specimens feed of leaves tissues causing circular round holes on the leaf page and rarely affecting leaf ribs (Figs 6–9).

During the day, no adult rolling a leaf has been observed, suggesting that this activity could occur mainly at night. Anyhow, the leaf folding mode is analogous of what observed for many other Apoderinae; particularly, the cutting mode and the leaf roll final structure correspond with what has been observed for *Apoderus coryli* and *Apoderus jekelii* by Egorov (1989) in Russia and by Park in Korea (Park et al. 2014). The leaf is cut at its basal third with a transverse incision; the incision develops from one of the lateral margins (no cut direction preferred) of the leaf up to the central vein (Fig. 6). The apical part is then folded along the central vein and rolled on itself starting from the apex; it is during this process that the egg is deposited. For all cases observed, to each roll corresponds a single egg, larva or pupa. It is worthy noting that no leaf roll has been observed on the soil and no proof exists demonstrating that the central leaf nerve is chopped off after the roll realisation as happens in several members of the family. In this case, the central vein, being partially intact, allows the leaf to maintain fluid circulation, thus preserving turgidity and preventing desiccation. From the egg hatches a larva that develop feeding of the leaf tissues; the mature larva (Fig. 10) is about 10 mm long, apodous and yellow. The pupa, about 6.5 mm long, has the same colour of the larva and



Figs 10-11 – **10**, mature larva of *Paratomapoderus brachypterus* (photo C. Massarone). **11**, pupa of *Paratomapoderus brachypterus* in ventral (beginning of pigmentation), dorsal and lateral view (photo C. Massarone).

becomes darker close to the adult emergence (Fig. 11); the adult emerges perforating the wall of the roll. Basing of the short time available for observation during our expeditions, we are not able to establish the precise number of generations that *P. brachypterus* could have in a year; however fast development of larvae and pupae observed and adult specimens collected during March, June and December, suggest the existence at least of 2-3 generations per year.

Acknowledgements – The Authors thank Antonio Durante and Piero Carlino (Museo di Storia Naturale del Salento, Calimera, Lecce, Italy; MSNS) as organisers and leaders in the Gabonese expeditions. Permission to visit and collect in Gabonese parks was obtained through a convention between the Centre National de la Recherche Scientifique et Technologique du Gabon (CENAREST) and the MSNS. The support from the Institut de Recherche Agronomiques et Forestières (IRAF) and from the Institut de Recherches en Écologie Tropicale (IRET) was fundamental for the success of our project and we are most grateful to our colleagues Daniel Franck Idiata (Commissaire Général of the CENAREST), Auguste Ndoutoume-Ndong (Director of IRAF), Alfred Ngomanda (Director of IRET), Joseph Vivien Okouyi Okouyi (Conservator of Ivindo National Park) and Aurélie Flore Koumba Pambo (Commission Scientifique sur les Autorisations de Recherche of the CENAREST). A special thank to Thomas Couvreur (Montpellier) and Olivier Lachenaud (Jardin Botanique de Meise, Bruxelles) for the host plant identification; to Olaf Jäger (Staatliches Museum für Tierkunde, Dresden) and Bernd Jäger (Museum für Naturkunde Berlin) for the images of *P. brachypterus* types and to Enrico Ruzzier (The Natural History Museum, London) for suggestions provided during the manuscript preparation. We are also grateful to three anonymous reviewers for their useful additional suggestions.

References

- Agboton C., Onzo A., Ouessou F.I., Goergen G., Vidal S., Tamò M. 2014. Insect fauna associated with *Anacardium occidentale* (Sapindales: Anacardiaceae) in Benin, West Africa. *Journal of Insect Science*, 14 (229): 1–11.
- Alibert H. 1951. Les insectes vivant sur les cacaoyers en Afrique Occidentale. *Mémoires de l'Institut français d'Afrique noire* 15: 1–171.
- Anonymous 1976. Report for 1975/76. Wattle Research Institute, South Africa 29: 1–111.
- Biondi S. 2005. A new genus and species of Hoplapoderini from Madagascar (Coleoptera: Attelabidae: Apoderinae). *Zootaxa*, 1089: 37–47.
- Cotterell G.S. 1927. Minor pests of cacao. *Bulletin of the Department of Agriculture, Gold Coast*, 13: 100–106.
- Egorov A.B. 1989. The behavioural peculiarities of leaf-rolling weevils (Coleoptera: Attelabidae) during preparation of food for the progeny (in Russian). *Chteniya Pamyati Alekseyeva Ivanovicha Kurentsova*, 1-2: 64–101.
- Foahom B. 2002. Insect pest incidence on timber tree species in natural forest in South Cameroon. *Tropenbos Cameroon Documents*, 12: XVI+52 pp.
- Heinrichs E.A., Barrion A.T. 2004. Rice-feeding insects and selected natural enemies in West Africa: biology, ecology, identification. Los Baños (Philippines): International Rice Research Institute and Abidjan (Côte d'Ivoire): WARDA – The Africa Rice Center. 243 pp.
- Laudonia S., Viggiani G., Biondi S. 2017. A new species of *Poropoea* Förster (Hymenoptera Trichogrammatidae) from Africa. *ZooKeys*, 658: 81–87.
- Legalov A.A. 2007. Leaf-rolling weevils (Coleoptera: Rhynchitidae, Attelabidae) of the world fauna. *Agro-Siberia, Novosibirsk*, 523 pp.
- Park J., Lee J.E., Park J.K. 2014. Leaf cutting-patterns and general cradle formation process of thirteen Apoderinae (Coleoptera: Attelabidae) in Korea: Cradles of Attelabidae in Korea I. *Entomological Research*, 42(2012): 63–71.
- Voss E. 1926a. Die Unterfamilien Attelabinae und Apoderinae (Col. Curc.) (18. Beitrag zur Kenntnis der Curculioniden). *Stettiner Entomologische Zeitung*, 87(1): 1–89 + pls IV–VI.
- Voss E. 1926b. Die Unterfamilien Attelabinae und Apoderinae (Col. Curc.) (18. Beitrag zur Kenntnis der Curculioniden). *Stettiner Entomologische Zeitung*, 87 (2): 141–197.
- Voss E. 1928. Einige weitere Attelabinae und Apoderinae (Col. Curc.) (26. Beitrag zur Kenntnis der Curculioniden). *Entomologische Blätter*, 24(3): 112–120.
- Voss E. 1929. Neue Attelabinae und Apoderinae, vorwiegend aus Afrika und dem tropischen Asien, nebst Bemerkungen zu einigen bekannten Arten (Col., Curc.) (22. Beitrag zur Kenntnis der Curculioniden). *Deutsche entomologische Zeitschrift*, 1928(5): 362–374.
- Voss E. 1937. Die Apoderinae des Kongo-Gebiets (Col. Curc.) (68. Beitrag zur Kenntnis der Curculioniden). *Revue de Zoologie et Botanique Africaines*, 29(3): 282–309.
- Voss E. 1939. Ergänzende Beschreibungen und Fundortsangaben von Rhynchitinen, Apoderinen und Cossoninen aus dem Kongo-Gebiet (Col. Curc.) (83. Beitrag zur Kenntnis der Curculioniden). *Revue de Zoologie et Botanique Africaines*, 32(3-4): 337–347.
- Voss E. 1953. Curculionidae: Oxycoryninae, Belinae, Archolabinae, Attelabinae, Apoderinae. In: Hincks, W.D. (Ed.). *Coleopterorum Catalogus Supplementa*, 144, 110: 1–19 [pars 144] + 1–34 [pars 110].
- Voss E. 1973. Some West African weevils including two new species. *Ghana Journal of Agricultural Science*, 6(1): 59–62.