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A historical ramble on hammerhead flatworms (Platyhelminthes, Tricladida, Bipaliinae)

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Abstract

During the early 1820s and late 1890s, several Dutch scientists (one was actually German but appointed in The Netherlands) paid attention to hammerhead land flatworms, either in the form of unpublished drawings, by collecting specimens, or by means of taxonomic publications. Most of the material concerned specimens from the former Dutch East Indies. The workers involved were Kuhl, van Hasselt, Loman, and Weber, with the latter two scientists contributing to the studies that resulted in the magnificent land planarian monograph produced in 1899 by Ludwig von Graff. The present paper sketches the historical links between all of these workers and includes previously unpublished drawings as well as a recently unearthed handwritten letter from 1890.

Keywords

Dutch East Indies – historical links – Kuhl – land planarians – Loman – van Hasselt – von Graff – Weber

Introduction

Hammerhead flatworms (Bipaliinae von Graff, 1896) form a group of land planarians that immediately stand out from any other kind of land flatworm, or other invertebrate, by their hammerhead-shaped,

reniform, or crescent-shaped head. Furthermore, generally the species are very colourful and provided with longitudinal stripes or transverse bands. The Bipaliinae are widely distributed as they occur in Madagascar, India, East Asia, Southeast Asia, and Japan (cf. Solà et al., 2023, fig. 1).

Further, a number of species, inadvertently transported from their country of origin by human agency to other countries, are now considered to be invasive species in these places (cf. Sluys, 2016; Carbayo, 2026). Among the latter, the best-known species is *Bipalium kewense* Moseley, 1878, which occurs on every continent, except Antarctica, and on many islands; it has been reported from many localities, mostly from hothouses, but in suitable climates it also occurs outdoors (Carbayo, 2026 and references therein).

There are about 195 nominal species of Bipaliinae (cf. Solà et al., 2023, table 2), which are grouped into six genera, viz., *Bipalium* Stimpson, 1857, *Novibipalium* Kawakatsu, Ogren & Froehlich, 1998, *Humbertium* Ogren & Sluys, 2001, *Umbo-tectum* Solà & Sluys, 2023, *Vermiviatum* Solà & Sluys, 2023, and *Diversibipalium* Kawakatsu, Ogren, Froehlich & Sasaki, 2002. Almost one-half of these species are grouped into the “collective” genus *Diversibipalium* because of the absence of any information on their genital anatomy and histology, which is essential for taxonomic identification and classification.

One of these species of *Diversibipalium* is *D. kuhlui* (Loman, 1890) and another *D. hasseltii* (Loman, 1890). The last-mentioned worker, Loman, described several other species of Bipaliinae, for example *Diversibipalium weberi* (Loman, 1890). In these three cases, Loman dedicated the species to two brilliant and promising young zoologists who met a premature death (Heinrich Kuhl, 1797–1821; Johan Conrad van Hasselt, 1797–1823) and the world-famous professor of zoology at the University of Amsterdam and the first director

of the Zoological Museum Amsterdam (Max W.C. Weber, 1852–1937). Apart from the fact that Weber’s name forms the specific epithet of the name of a species of hammerhead flatworm, there are also other links between Weber and land flatworms and their researchers, which will be explicated below, together with historical connections between Kuhl, van Hasselt, and Loman, among others.

Kuhl and van Hasselt

The name of Heinrich Kuhl is hardly ever mentioned separately from his companion Johan Conrad van Hasselt, so much so that among the initiated simple mention of “KvH” suffices to know what is at stake (an abbreviation that will be used here). Kuhl was born in Hanau, near Frankfurt am Main, in Germany, but in 1816, he continued his career at the University of Groningen, The Netherlands (Klaver, 2007). Van Hasselt was born in Doesburg in The Netherlands and also started his academic studies in 1816 at the University of Groningen (Klaver, 2007).

Kuhl and van Hasselt were the first naturalists to be appointed in 1820 as members of the Dutch “Natuurkundige Commissie” (Commission for the Study of the Natural Sciences) and given the task to enlarge knowledge of the natural products of the Dutch East Indies (comprising most of present-day Indonesia) (Klaver, 2007; van Wingerden, 2023). This governmental research body, the “Natuurkundige Commissie”, was operational between 1820–1850.

That Kuhl and van Hasselt were appointed at such a young age was based on the fact that they had already shown to be remarkably knowledgeable zoologists who had produced notable publications and also had met with highly prominent naturalists at the time, such as Lamarck, Geoffroy St. Hilaire, Latreille, Cuvier, and von Humboldt. The short careers of both Kuhl and van Hasselt have been described by Klaver (2007) and van Wingerden (2023), who also list the publications of both young men. In addition, Klaver (2007) lists the taxa described by Kuhl and van Hasselt, as well as the taxa that were named in honour of them. However, none of the taxa in these lists concerns land flatworms.

Loman

Jan Cornelis Christiaan Loman (1856–1929) was a high school biology teacher in Amsterdam who was also a productive scientist. He published not only on flatworms but also on harvestmen (Opiliones) and water bears (Tardigradida). Later in his career, he specialized on sea spiders (Pycnogonida), on which he authored 24 publications (Bakker & Sabroux, 2026).

The names of Kuhl and van Hasselt enter the flatworm literature when Loman (1887) used two unpublished drawings of KvH in describing *Bipalium vittatum* and *B. marginatum*, albeit without providing any details about their anatomy. As authorities for both species Loman mentioned “Kuhl & v. Hasselt, 1822.” In a postscript to his paper, Loman (1887) mentioned that the natural history museum in

Leiden, presently Naturalis Biodiversity Center (NBC), had also uncovered the short notes that KvH had made in regard to these drawings, which were transcribed in his paper. Nevertheless, these authority assignments by Loman were never applied in subsequent taxonomic literature as the drawings and notes of KvH concerned basically unpublished sources. Therefore, *B. vittatum* and *B. marginatum* have always received “Loman, 1887” as authority and date of publication. The original KvH figures are still stored at NBC (see below) but, thus far, I have been unable to trace the short KvH notes reproduced by Loman (1887).

Loman (1887) mentions that he examined almost 600 histological slides of two species described in his paper, viz., *Bipalium javanum*, and *B. sumatrense*. Unfortunately, only 24, or maximally 41, of these slides are presently still housed in the collections of NBC (17 slides carry no names and may concern other, non-Bipaliinae land flatworms). From these two species it is only for *B. javanum* that preserved specimens are still present in the collections of NBC, since for *B. sumatrense* Loman had access to only one specimen, which was used for the preparation of histological sections.

In his description of the new species *B. javanum*, Loman (1887) published his own drawing of the external appearance of the species, as he had collected the animals himself in 1882 on Java. However, he notes that one of the KvH drawings concerns the same species. On the respective drawing, KvH had jotted the species name *Sphyrocephalus niger*, which was used also in their unpublished notes (cf. Loman,

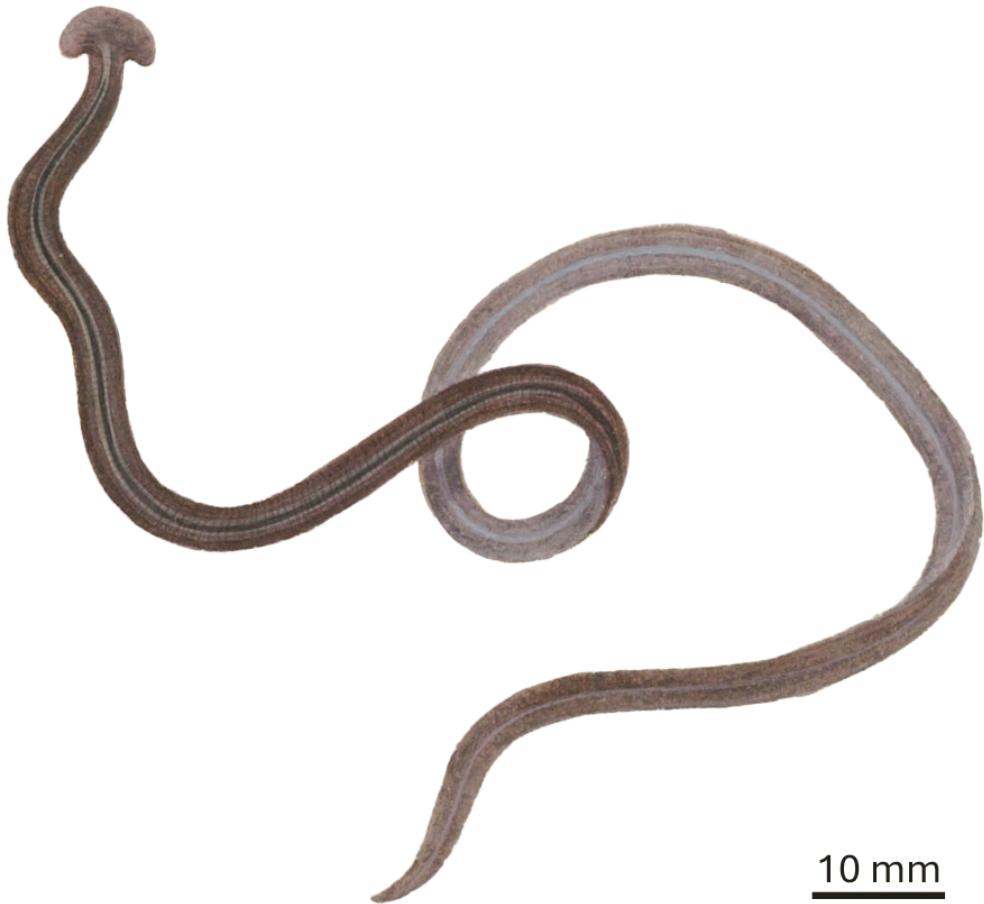


FIGURE 1 *Bipalium javanum*. Reproduction of drawing made by G.L. Keultjes (cf. NNM001000467 in Gasso, E., Stork, L., Weber, A. et al. ed., *Natuurkundige Commissie Archives Online*. Leiden: Brill, 2020. doi:10.1163/isbn.9789004336865. Collection of Naturalis Biodiversity Center, Leiden, The Netherlands).

1887). In point of fact, the KvH drawing is more beautiful than the one published by Loman (Fig. 1). This may be since on their trip to the East Indies KvH were accompanied by professional artists, including Gerrit Laurens Keultjes (1786–1821) (Klaver, 2007; van Wingerden, 2023).

At first sight, it is somewhat confusing that the two KvH sheets of paper including the flatworm drawings (see also below)

specify at their lower right-hand corners: “G.L. Keultjes/a. maurevert/fecit” and “G.L. Keultjes/ E. Bik/fecit”. This refers to two other artists from the “Natuurkundige Commissie”, viz., Antoine Maurevert (dates of birth and death unknown), who assisted between 1821–1823, and Jannes Theodorus Bik (1796–1895), who assisted between 21 March 1823–September 1823 (van Wingerden, 2023). In order to be able to

determine which artist produced the multiple drawings on the sheets, the name of one artist is preceded by a small plus sign, which is also placed near one or more of the drawings.

At this point, it is opportune to mention that the KvH name *Sphyrocephalus niger* enters the taxonomic literature in a paper by Bleeker (1844), together with their names *Sph. marginatus*, *Sph. albo-coeruleus*, *Sph. unistriatus*, and *Sph. vittatus*. Although Loman (1887) mentions this, it is generally overlooked, presumably because the paper by Bleeker is written in Dutch and the names are *nomina nuda*. The generic name *Sphyrocephalus* is a junior synonym of *Bipalium*, as the former was first officially coined by Schmarda in 1859, while the name *Sphyrocephalus* mentioned by Bleeker (1844) concerns a *nomen nudum*, a situation clearly explained by von Graff (1899). It is clear that Bleeker copied the generic name from the KvH drawings and notes, so that it must be concluded that KvH in 1820–1821 and Schmarda in 1859 independently struck upon the name *Sphyrocephalus* in order to allude to the hammerhead-shaped heads of these terrestrial planarians.

In 1890 Loman describes another species of *Bipalium*, viz., *Bipalium claviforme* Loman, 1890 (currently classified under *Diversibipalium*). He had three specimens collected by Weber the external appearance of which was similar to an unpublished KvH drawing. But this conclusion was contested by von Graff (1899), who found that two of Loman's three specimens did not match the KvH drawing at all, while one specimen resembled the drawing but most likely concerned a juvenile specimen

of *B. vittatum*. Among the KvH drawings in the archives of NBC I have been unable to trace a drawing that matches, more or less, the figure of *D. claviforme* published by Loman (1890, Pl. 12, fig. 5), which seems to corroborate von Graff's conclusion.

There are two KvH drawings of *Bipalium* that thus far also remained unpublished, but for two reasons these do, most likely, not concern the presumed *D. claviforme* specimen mentioned by Loman. The first reason is that they do not resemble Loman's figure of *D. claviforme* (Fig. 2A, B). Second, each of these KvH drawings is accompanied by a sampling locality that is not mentioned by Loman (1890), viz., Harriang and Poulou-sari. Loman's specimens came from Buitenzorg (currently Bogor) in the province of West-Java, where the volcano Pulu-sari is also located, while Harriang concerns a locality in the far western province of Bantam on Java.

Von Graff

Two of the KvH specific epithets were rescued from oblivion because Loman (1887) used these to describe *B. marginatum* and *B. vittatum* on the basis of the correct reproduction of the unpublished KvH drawings; copies of the originals are provided in Fig. 3. Shortly thereafter, Weber collected in 1888 new specimens of *B. marginatum* and sent these to Ludwig von Graff (1851–1924), the doyen of turbellarian studies, who subsequently detailed their anatomy in his –still unsurpassed– monograph on terrestrial planarians (von Graff, 1899). The anatomy of *B. vittatum*

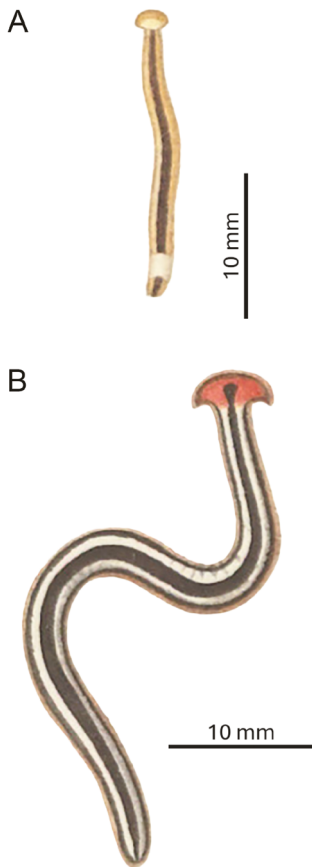


FIGURE 2
Reproduction of KvH figures concerning worms from Harriang (A) and Poulou-sari (B). Drawings made by A. Maurevert (cf. NNM001000467 in Gasso, E., Stork, L., Weber, A. et al. ed., *Natuurkundige Commissie Archives Online*. Leiden: Brill, 2020. doi:10.1163/isbn.9789004336865. Collection of Naturalis Biodiversity Center, Leiden, The Netherlands).

was never studied and, therefore, it is presently ranked under *Diversibipalium*.

With respect to *B. marginatum*, there are several issues that deserve some further attention. Since 1974 the former von Graff collection is now housed in the Natural History Museum in Vienna, Austria

(NHMW) and includes the type material of *B. marginatum*, consisting of 184 glass slides. However, von Graff returned some preserved specimens to Weber at the former Zoological Museum Amsterdam (ZMA). As a result, these syntype specimens now form part of the collections at NBC.

In his monograph, von Graff (1899) includes no less than six figures concerning the external appearance of *B. marginatum* (Plate XII, figs 1–4; Plate XIX, figs 21–22). Only one figure is based on a preserved specimen from the former ZMA and, thus, being a specimen originally collected by Weber, viz., figure 4 on plate 12. This figure does indeed resemble the KvH drawing of a live specimen published by Loman (1887) (Fig. 3). The other figures in von Graff (1899) are different and may represent two or three other species, as experience generally has learned that among hammerhead flatworms, external appearance closely corresponds with species status (Kawakatsu et al., 2005). But this experience runs counter to the conclusion of Müller (1907) that the copulatory apparatus of *Bipalium jansei* von Graff, 1899 is the same as that of *B. marginatum* and that, thus, the former represents only a colouration variety of the latter. Indeed, the external appearance of a live specimen of *B. jansei* (von Graff, 1899, Pl. 12, fig. 30) does not resemble that of *B. marginatum*, while Müller (1907) remarks that the ventral colouration does not correspond with the type specimen of *B. jansei* that he was allowed to section histologically. But he also admits that this could be the result of discolouration due storage in alcohol. In principle, it would be possible to resolve

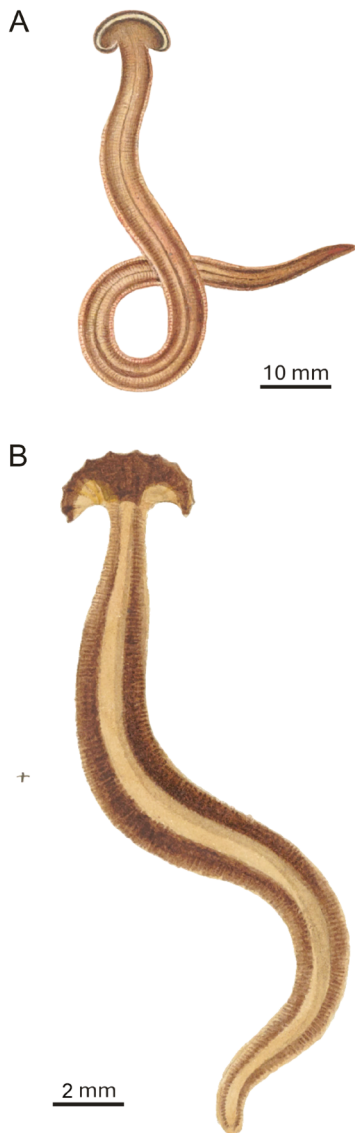


FIGURE 3
Reproduction of KvH figures concerning *Bipalium marginatum* (A) and *B. vittatum* (B). With respect to (B), Loman (1887) mentions that he had found KvH notes that this figure was not drawn at its natural size, in contrast to the other figures, and that the length of the live worm was only about 2 cm. Drawings made by G.L. Keultjes (cf. NNM001000467 in Gasso, E., Stork, L., Weber, A. et al. ed., *Natuurkundige Commissie Archives Online*. Leiden: Brill, 2020. doi:10.1163/isbn.9789004336865. Collection of Naturalis Biodiversity Center, Leiden, The Netherlands).

this taxonomic conundrum, since the 15 glass slides with histological sections of *B. jansei* are also stored in the NHMW.

Weber

In the foreword to his 1899 monograph on land planarians, von Graff specifically lists Max Weber among those persons who made available to him much of the material as well as the most valuable material; the number of species concerned is specified in the list of material examined at the end of the book (p. 570), mentioning some 15 species of Bipaliinae, among others. Von Graff writes that this material belongs to the ZMA, to which much of it was indeed returned.

Weber was a well-travelled zoologist. For example, together with his wife he travelled during a period of one year in 1888–1889 through the Indonesian archipelago, visiting the islands of Sumatra, Java, Sulawesi, and Flores (Schilthuizen & Vonk, 2020). In his letters to his friend Coenraad Kerbert (1849–1927) in Amsterdam Weber relates that presumably he had found five new species of *Bipalium* (Reitsma, 2012). The land planarians collected during this Indonesian expedition were described by Loman (1890). In the context of his travels to the East Indies it is interesting to note that Weber apparently had a “hero-worship” for Kuhl and van Hasselt (Thompson, 1938, p. 348). Then, just before Weber became the first director of the ZMA, the married couple made a collecting trip of seven months through South Africa from July 1894–January 1895 (Schilthuizen & Vonk, 2020). As far as I can determine, no land planarians were collected.

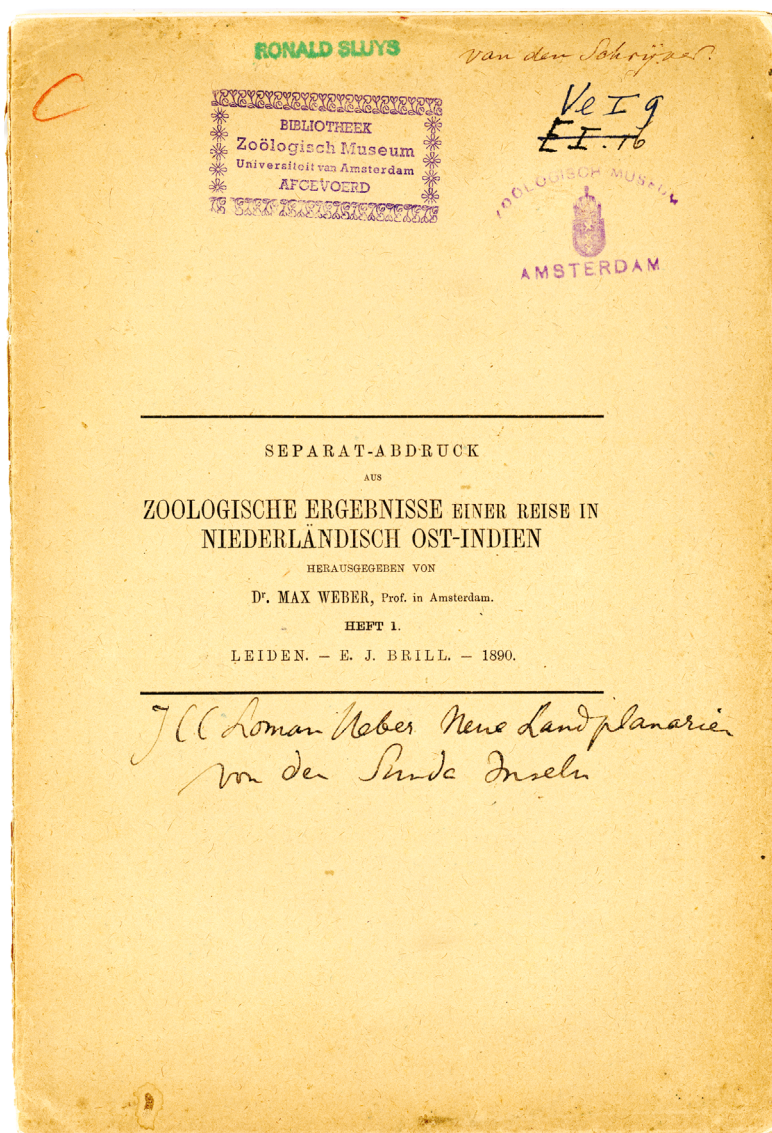


FIGURE 4 Cover of the reprint of the 1890 publication by Loman. On the right-hand top is written "van den Schrijver" (from the Author).

Weber sent von Graff not only material that he had collected himself and that mostly had been worked up by Loman, but he also made available material that Loman apparently had deposited in the ZMA. For example, Weber sent von Graff the only specimen of *Bipalium moseleyi*

Loman, 1887 that Loman had received from the museum department of the zoological garden in Amsterdam (cf. von Graff, 1899, p. 442), a kind of forerunner of the ZMA. It is evident that Loman had a close connection with the ZMA and notably with Max Weber. When Loman had published a

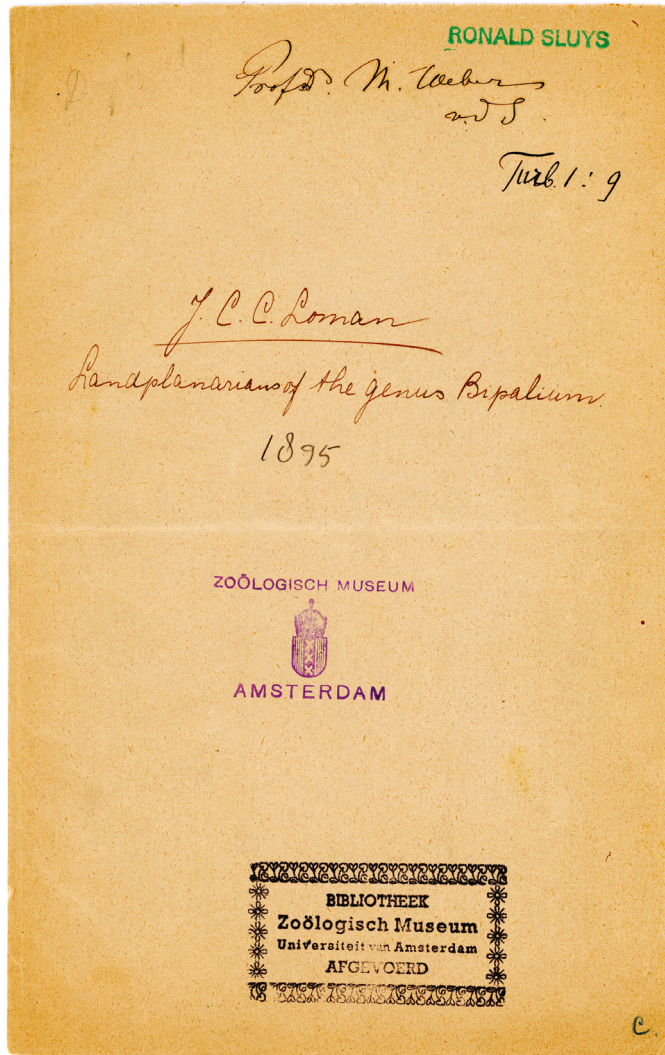


FIGURE 5 Cover of the reprint of the 1895 publication by Loman. On the top is written "Prof. Dr. M. Weber" and below Weber's name "v.d S.", being the abbreviation of "van de Schrijver" (from the Author).

paper, he sent an offprint to Weber (some of which do now form part of my personal library; Figs 4, 5). Weber not only made his specimens available to Loman but also his hand-coloured sketches of the animals (Loman, 1890).

Von Graff was not only grateful to Weber but also to Loman, who sent him

specimens as well as histological slides, in recognition of which he named the species *Bipalium lomani* von Graff, 1899 (currently ranked under *Diversibipalium*).

The involvement of Weber in von Graff's studies on land planarians is not only apparent from what is mentioned in the 1899 monograph but comes to the fore

Zoo-loge

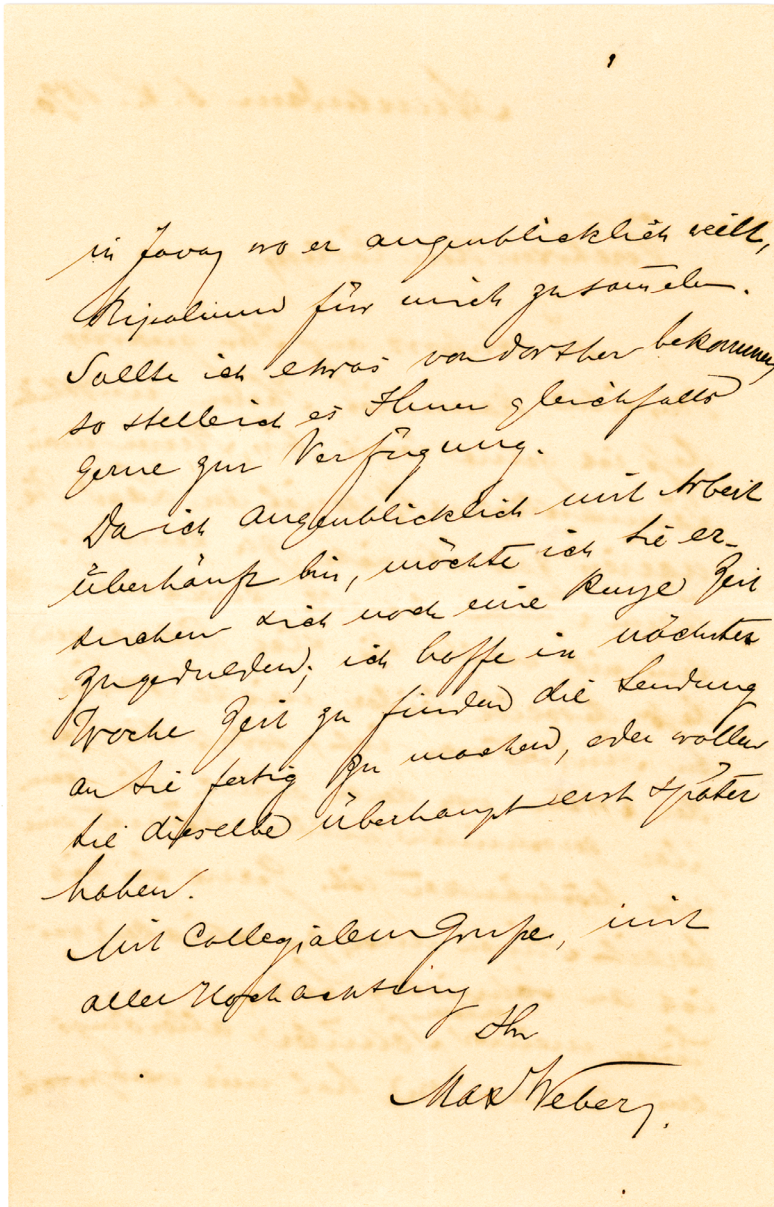
12.60
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17.97

Amsterdam 6. V. 1890.

Verehrter Herr College

In Antwort auf Ihr geehrtes Schreiben kann ich Ihnen mittheilen, daß ich gerne bereit bin Ihnen mein/sämmtliches Material an Land-Plannarien zur Ansicht zu senden. Wenn Ihnen dasselbe zugegangen sein wird, werden Sie sich überzeugen, daß dasselbe leider nicht reich/an Individuen ist; sodaß die Zahl/der Arten, von denen event. ein Exemplar zerschnitten werden könnte, eine/sehr beschränkte ist. Gerne bin ich bereit Ihnen auch zu schicken, was ich an Schnitten habe. Einer meiner ^{früheren} Schüler, allerdings/ ein Botaniker, hat mir versprochen

FIGURE 6A Reproduction of Weber's letter from 1890 to Ludwig von Graff; front page. Transcription: Amsterdam 6. V. 1890/Verehrter Herr College,/In Antwort auf Ihr geehrtes/Schreiben kann ich Ihnen mittheilen/daß ich gerne bereit bin Ihnen mein/sämmtliches Material an Land-Pla-/narien zur Ansicht zu senden./Wenn Ihnen dasselbe zugegangen/sein wird, werden Sie sich überzeugen/daß dasselbe leider nicht reich/an Individuen ist; sodaß die Zahl/der Arten, von denen event. ein Exem-/plar zerschnitten werden könnte, eine/sehr beschränkte ist. Gerne bin ich bereit Ihnen auch zu schicken, was/ich an Schnitten habe./Einer meiner früheren Schüler, allerdings/ ein Botaniker, hat mir versprochen/



in Java wo er augenblicklich weilt,
 Bivalium für mich zu sammeln.
 Sollte ich etwas von dorthier bekommen
 so stelle ich es Ihnen gleichfalls
 gerne zur Verfügung.
 Da ich augenblicklich mit Arbeit
 überhäuft bin, möchte ich Sie er-
 suchen sich noch eine kurze Zeit
 zu gedulden; ich hoffe in nächster
 Woche Zeit zu finden die Sendung
 an Sie fertig zu machen, oder wollen
 Sie dieselbe überhaupt erst später
 haben.
 Mit collegialem Gruße, mit
 aller Hochachtung
 Ihr
 Max Weber.

FIGURE 6B Reproduction of Weber's letter from 1890 to Ludwig von Graff; back. Transcription: in Java
 wo er augenblicklich weilt,/ Bivalium für mich zu sammeln./Sollte ich etwas von dorthier
 bekommen,/so stelle ich es Ihnen gleichfalls/gerne zur Verfügung./Da ich augenblicklich mit
 Arbeit/überhäuft bin, möchte ich Sie er-/suchen sich noch eine kurze Zeit/zugedulden; ich
 hoffe in nächster/Woche Zeit zu finden die Sendung/an Sie fertig zu machen, oder wollen/Sie
 dieselbe überhaupt erst später/haben./Mit collegialem Gruße, mit/aller Hochachtung/ Ihr/
 Max Weber.

also in a letter by Weber that I recently purchased from an antiquarian bookshop in Vienna (Fig. 6 A, B). In this letter from 1890, Weber writes that he shall be pleased to make available to von Graff all of his land planarian material, not only preserved specimens but also the histological sections that he has in his possession. Further, he expresses the hope that a botanical colleague will collect *Bipalium* species on Java and if so, that Weber would gladly also make this material available to von Graff. That Weber indeed sent material and that von Graff used it is apparent from what has been mentioned already in the above.

Von Graff also expressed his appreciation of Weber's help by sending him a copy of his land planarian monograph, in which he included a separate sheet of paper on which he expressed his gratitude. For many years I have had and used this particular volume in my office at the ZMA.

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