

ON THE INDIAN SPECIES OF *RODOLIA* MULSANT
(COLEOPTERA—COCCINELLIDAE).

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Species of *Rodolia* Mulsant (1850) are important as predators of mealybugs, some of which are notorious for their injury to plants. *Rodolia cardinalis* Mulsant is a classical example of a species that has been successfully introduced into several countries against the cottony-cushion scale, *Icerya purchasi* Maskell. A campaign against the latter, in South India, has been in progress for some time, and a number of local Coccinellid predators, collected by the staff responsible for the work, were sent for identification to the Commonwealth Institute of Entomology. The present study is based mainly on this material, and also on that in the British Museum (Natural History). All the known Indian species are redescribed and three new ones added to the list.

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Rodolia Mulsant, 1850, p. 902.

Genotype: *Rodolia ruficollis* Mulsant.

Crotch (1874) was the first to fix *R. ruficollis* Mulsant as the type of the genus. Owing apparently to an error in the posthumous printing of his work, *ruficollis* appeared on the next page under the genus *Vedalia* Mulsant (and conversely, the genotype of the latter under *Rodolia*). This confusion seems to have led Gorham (1901) to propose *Rodolia rubea* Mulsant as the type. The opinion is held here that *ruficollis*, which is one of the species included in *Rodolia* by Mulsant when he described the genus, remains the type and the fact that it appeared under *Vedalia* in Crotch's monograph should not disqualify it from being regarded as the genotype of *Rodolia*.

A brief description of the genus is as follows:—

Small to moderately large, pubescent COCCINELLINAE. Body shortly oval to hemispherical; head rather large, transverse; eyes large, finely faceted and pubescent, not emarginate or notched on the inner margin; epistoma weakly emarginate at the anterior border, and obliquely notched laterally to expose the bases of antennae which are short, nearly as long as the distance between the two eyes, eight segmented, the first two segments being large and oval, the next three short and slender, and the apical three forming a more or less fusiform club; labrum well-developed, transverse, convex and sub-rounded on the anterior and lateral margins. Pronotum nearly twice as broad as long, convex, deeply emarginate anteriorly, anterior angles broad or rather narrowly rounded, lateral margins rounded or nearly straight, basal margin devoid of any border, rounded except for a short truncate part in the middle opposite the scutellum; elytra wider than pronotum, moderately to strongly convex, rounded at the shoulders, very narrowly margined along the external border; epipleurae wide, especially in the basal half, concave, inclined and devoid of foveae; prosternum nearly as wide as the pair of coxae which almost conceal it except for a very narrow anterior margin and the medium part which is more or less sharply raised anteriorly, inclined posteriorly and variously shaped in different species; abdomen with six visible sternites; abdominal lines complete, bow-shaped and hardly extending to the middle of the segment; legs sufficiently robust, nearly compressed, femora sulcate or deeply

furrowed distally, tibiae obliquely furrowed and angular at the middle of the external margin; tarsal claws bifid with the inner division shorter than the outer.

The chief features which distinguish the genus from other closely related genera of the tribe are: the absence of any emargination of the eyes, the narrow and weakly developed prosternum and the median part of which is raised anteriorly, and the furrowed tibiae with the external margin angled.

Excepting the shape, colouration and size, there are few reliable external characters by which closely related species may be distinguished from one another. Generally speaking the pubescence is moderately long and dense and the punctuation fine and close and a little finer on the pronotum than on elytra. However, the genitalia in both sexes offer excellent diagnostic characters.

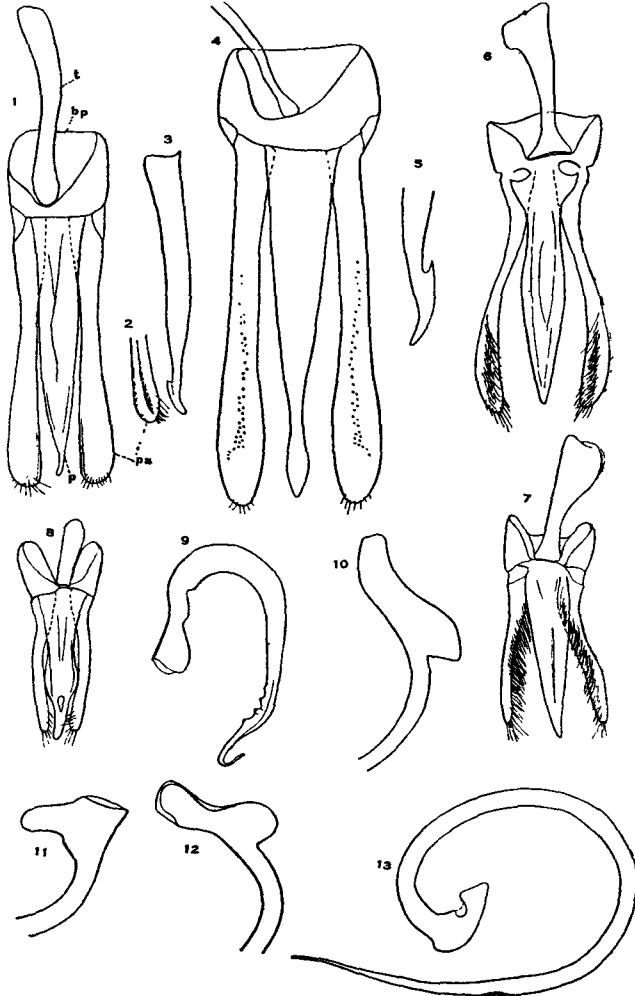
KEY TO THE SPECIES.

1. Elytra reddish brown to carmine-red, with black spots.....2
 Elytra usually uniformly yellowish brown, brown, reddish or carmine-red, rarely fuscous, sometimes fuscous only along the margins or at the apices.....4
2. Body sub-hemispherical, 3.25 mm. long, elytron with one small black spot situated a little anterior to the middle and as distant from the suture as its own diameter (South India).....*netara*, **sp.n.**
 Body obtusely oval or sub-ovate, with more than one spot on elytron.....3
3. Body obtusely oval, usually 3.8-4.3 mm. long; head black; pronotum with a black band at the base; elytra with black sutural and apical borders, and each with two black spots: one curved round the inner side of the shoulder-boil, and the other discal, at 3/5ths the length of elytron and appearing as if composed of two fused spots (widely distributed over the world; in India mainly in the South).....*cardinalis* (Mulsant)
 Body sub-ovate; usually 4.8-5.0 mm. long; head not black; pronotum with a small transverse band (as if formed of two fused spots) in the middle of the base; elytron with three spots: two (roundish) placed transversely a little before the middle and one (oval) in the apical third of elytron (North India).....*guerini* (Crotch)
4. Body shortly oval and slightly narrowed posteriorly, 5.5-6 mm. long; elytra entirely or partly testaceous, reddish testaceous, nearly red or light piceous, sometimes only the margins or part of them fuscous; punctuation fine and close; median part of prosternum narrowed and less conspicuously raised anteriorly (widely distributed).....*fumida* Mulsant
 Body sub-hemispherical, not narrowed posteriorly, median part of prosternum more distinctly raised.....5
5. Body small, nearly 2.3 mm. long; head, pronotum and greater part of elytra reddish testaceous to carmine-red, the apical third and lateral border of elytra dark brown (South India).....*minima*, **sp.n.**
 Body medium to large, over 3.0 mm. long.....6
6. Body nearly 6 mm. long, head and pronotum orange-yellow, elytra reddish brown, with the external border orange (North India)...*ruficollis* Mulsant
 Body less than 5.5 mm. long, head, pronotum and elytra uniformly coloured...7
7. Body 4.8-5.2 mm. long, rusty, opaque and matt, finely and closely punctate and with long, yellowish and less dense pubescence; anterior angles of pronotum broadly rounded (Andaman Islands).....*andamanica* Weise
 Body 3.4-2.5 mm. long, upper surface shiny, anterior angles of pronotum narrow; pubescence denser and shorter.....8

8. Body larger (3-4 mm. long), pubescence greyish or slightly yellowish, and close; elytral punctures obsolete (India and Ceylon).....*breviuscula* Weise

Body smaller (3 mm. long), reddish or carmine-brown, pubescence yellowish, elytral punctures impressed (Central and South India).....*amabilis*, **sp.n.**

The differences in the structure of the genitalia have not been included in the above key, as these can best be observed and compared with the diagrams given in the paper. *Rodolia cardinalis* (Mulsant) is an introduced species in India and is too well-known to be redescribed. *R. rufopilosa* (Mulsant) has not been included in the key because it probably is not an Indian species, although Gorham (1901)



Figs. 1-9.—Parts of male genitalia. (1) *Rodolia fumida*, t (trab), bp (basal plates), p (penis) pa (paramera); (2) lateral view of apex of parameron; (3) lateral view of penis; (4) *R. andamanica*; (5) lateral view of apex of penis. (6) *R. breviscula*; (7) *R. amabilis*, sp.n; (8) *R. minima*, sp.n.; (9) siphon.

Figs. 10-12. Siphonal capsules. (10) *R. andamanica*; (11) *R. breviscula*; (12) *R. fumida*.

Fig. 13. Siphon of *R. amabilis*.

(All magnifications $\times 33$.)

records it from Belgaum (India). This material from Belgaum, in Mr. H. L. Andrewes' collection, now in the British Museum, has been examined, and also several examples of the species from China (including what is believed to be the type) and Penang, as mentioned by Crotch (1874), and it is not considered that the Belgaum material is *rufopilosa*. The most obvious differences are the shortly oval, less convex and smaller body of the Belgaum examples which seem to belong to *R. fumida*, as against the sub-hemispherical, strongly convex and larger body of *R. rufopilosa*, which is 6.1 mm. long.

***Rodolia fumida* Mulsant (figs. 1-3, 12 and 15).**

Rodolia fumida Mulsant, 1850, p. 904.

Rodolia roseipennis Mulsant, 1850, p. 904; Crotch, 1874, p. 281.

Rodolia arethusa Mulsant, 1853, p. 254; Crotch, 1874, p. 281.

Rodolia testicolor Mulsant, 1853, p. 255; Crotch, 1874, p. 281.

Body shortly oval, slightly narrowed posteriorly, moderately convex; coloration very variable, being rose-red, reddish-brown, brown or dark brown. Weise (1892) lists the following varieties which, judging from the extensive material examined, occur with equal frequency in North and South India:—

var. *a*: elytra entirely testaceous, reddish testaceous or rose-red (*roseipennis* Mulsant).

var. *b*: as in var. *a*, but sutural, and basal margins and anterior part of lateral margin dark brown.

var. *c*: as in var. *a*, but elytra dark except in the discal area.

var. *d*: elytra entirely dark brown or piceous.

Dorsal surface with pubescence whitish grey or light yellow; punctation fine, close and shallow, a little finer on the head and pronotum than on the elytra; pronotum with the lateral margins rounded and the anterior angles broadly rounded; shoulder-boil of elytra more or less distinct; median part of prosternum nearly twice as long as broad, gradually narrowing and only slightly raised anteriorly; sixth abdominal sternite shallowly emarginate at the apex, more widely so in male than in female; male genitalia as shown in figs. 1-3 and 12, the shape of the long and spatulate paramera, tapering penis and the bi-lobed siphonal capsule being characteristic; the two parts of ninth sternite of female elongate, gradually narrowing to a rounded apex; spermatheca bulbous with a narrow and short base (fig. 15).

Length 5.5-6 mm., width 4.4-2 mm.

GEOGRAPHICAL DISTRIBUTION:—Type locality: Bengal; also recorded from Madagascar (*Sicard*, 1909). The examples examined are from the following localities:—

INDIA: Assam: Sylhet; Manipur (*Doherty*). Bengal: North Bengal; Darjeeling (*G. Rogers*). United Provinces: Almora (*H. G. Champion*); Ranikhet (*H. G. C.*); Sitapur (*H. G. C.*). Punjab: Murree Hills (*H. Roberts*); Lahore, -xii.1912 (*B. Das*); Lahore, feeding (?) on Aphids on peach, 4.ii.1936 (*A. P. Kapur*); Delhi, feeding on Aphids and Coccids on cowpea, 4.vii.1938 (*A. P. Kapur*); Delhi, larva and adult feeding on *Icerya* sp., 5.vii.1945 (*M. Bose*). Sind: Karachi (*T. R. Bell*). Nagpur, feeding on giant mealybug, 9.vii.1944 (*V. P. Rao*). Belgaum (*H. L. Andrewes*). Nilgiri Hills (*H. L. Andrewes*).

Ceylon: Balaogoda (1,775), 13-16.iii.1882 (*G. Lewis*); Hambantota, 31.x.1908, 7.xi.1908 (*T. B. Fletcher*).

BURMA: Ruby mines (*Doherty*).

***Rodolia ruficollis* Mulsant, 1850, p. 903 (fig. 14).**

Body large, sub-hemispherical; head and pronotum orange-yellow, elytra reddish brown with the external border orange; underside obscurely reddish yellow or brown; pubescence yellowish, moderately long, semi-erect, and dense; punctation fine and close, more impressed on elytra than on pronotum; median part of prosternum elongate, slightly narrowed and raised anteriorly; male genitalia not known; sixth sternite in female entire; the two parts of the ninth gradually narrowing to a sub-rounded apex, spermatheca large and globular distally, with a moderately long trunk which is wider at the base (fig. 14).

Length 5·8-6·1 mm., width 5·3-5·6 mm.

GEOGRAPHICAL DISTRIBUTION :—Type locality : Bengal. The examples examined are from the following localities :—

INDIA : Assam, Patkai Mountains (*Doherty*); Nilgiri Hills (*H. L. Andrewes*).

***Rodolia guerini* (Crotch).**

Vedalia guerini Crotch, 1874, p. 282.

Rodolia immsi Weise, 1912, p. 120.

Rodolia 6-maculata Korschefsky, 1940, p. 2 (**syn. nov.**).

Body shortly oval, slightly narrow posteriorly; convex; dorsal surface reddish brown to testaceous with a sub-transverse and black or ill-defined, fuscous marking at the middle of the base of pronotum and three black to piceous spots on each elytron, two of these placed transversely a little anterior to the middle of elytron and the third, which is larger, in the centre of the apical half of elytron. Usually the elytral spots are well defined, rounded or slightly oval, sometimes they are indistinct in outline and piceous. Underside slightly paler than the upper and dark brown in parts of metathorax. Pubescence greyish white, fairly long and dense; punctation on the whole distinct, close and fine, more so on the head and pronotum than on elytra where a few slightly coarser punctures are irregularly dispersed (as seen under high magnification). Pronotum with the anterior angles a little narrower than in *fumida*; shoulder-boil of elytron rather distinct; prosternum nearly twice as long as wide, slightly narrowed and raised anteriorly; the sixth abdominal sternite weakly emarginate in male and entire in female. Male genitalia very much like that of *fumida* but with the lateral margins of penis sub-parallel except very near the narrowed apex.

Length 4·8-5·0 mm., width 4·0 mm.

GEOGRAPHICAL DISTRIBUTION :—Type locality : Pondicherry; South India (Dehra Dun, United Provinces, India, for *immsi* and *6-maculata*). The examples examined are from Dehra Dun (*E. P. Stebbing*) and Haldwani district, United Provinces (*H. G. Champion*).

REMARKS. In Korschefsky's (1931) catalogue, *immsi* is regarded as synonymous with *guerini*. The form *6-maculata* also appears to be the same as *guerini* and the presence of a few slightly coarser elytral punctures in the former is the only important difference that one can note in their descriptions. Such punctures are present in all the specimens labelled *guerini* in the collection studied.

***Rodolia andamanica* Weise, 1901, p. 93 (figs. 4, 5, 10 and 16).**

Body sub-hemispherical, upper and underside uniformly rusty or light testaceous opaque and matt; pubescence yellowish, short and dense; head and pronotum very finely and closely punctate, elytra with similar but slightly coarser punctures; pronotum with the lateral margins and the anterior angles broadly rounded; elytra without a defined shoulder-boil; prosternum narrow, distinctly twice as long as wide, slightly narrowed and raised anteriorly; the sixth abdominal sternite entire

in the females and notched in the male. Male genitalia as shown in figs. 4, 5 and 10; penis abruptly narrowed before the apex, paramera broad and spathulate, and siphon broadly curved with the apex drawn out in the form of a long thread; spermatheca in the female as shown in fig. 16.

Length 4.8-5.2 mm., width 4.5-4.8 mm.

GEOGRAPHICAL DISTRIBUTION :—Type locality : Andaman Islands. The examples examined are also from the Andaman Islands (*Roepstorff*).

***Rodolia breviscula* Weise, 1892, p. 26 (figs. 6, 11 and 21).**

Body hemispherical, testaceous on the upper and under sides; pubescence greyish white or light yellow, semi-erect, moderately long and dense; punctuation fine, close and rather shallow, a little finer on the head and pronotum than on elytra; pronotum with the lateral margins only slightly rounded and the anterior angles acute; prosternum nearly as long as broad at the base, slightly narrowed and raised anteriorly; sixth abdominal sternite in male fairly deeply emarginate at the apex, in female entire; male genitalia as shown in figs. 6 and 11; penis slightly narrowed between the base and the middle of its length; ninth sternite in female long and tapering, spermatheca (fig. 21) sausage-like and curved to form three-fourths of a circle.

Length 3.25-4.0 mm., width 2.7-3.3 mm.

GEOGRAPHICAL DISTRIBUTION :—Type locality : Mandar (Chota, Nagpur, Central Provinces, India); also recorded from Ceylon (*Korschefsky*, 1931). The examples studied are from the following localities :—

INDIA : South India : Shevaroy, Yergaud (4,500 ft.), April-May, 1931 (*Y. Rao*); Udipi, South Kanara, feeding on *Drosichiella* sp., 8.v.1944 (*V. P. Rao*); Sarapanemane, South Kanara, feeding on *Icerya* sp., 10.v.1944 (*V. P. Rao*); Chandramalai Estate, Nelliampathy Hills, feeding on *Drosichiella* sp., on *Citrus* sp., 22.iv.1944 (*V. P. Rao*); Anakapulle, feeding on *Icerya* sp. attacking *Achras sapota*, 16.vi.1944 (*V. C. Upadhyayula*); Shimoga, feeding on *Icerya seychellarum* Westwood, 7.viii.1944 (*Kumar*); Devarshola, feeding on *Icerya aegyptiaca* Douglas, 17.xii.1944 (*V. P. Rao*); Kodanari Estate, Kukul Valley, feeding on *Icerya purchasi* Maskell, 8.vi.1944 (*V. P. Rao*); Chittamannar, 1947; Travandrum, 1947.

CEYLON : Peradeniya, -i.1910 and -xii.1918; Ragalla, predacious on *I. purchasi*, 10.xi.1917 (*J. C. Hutson*).

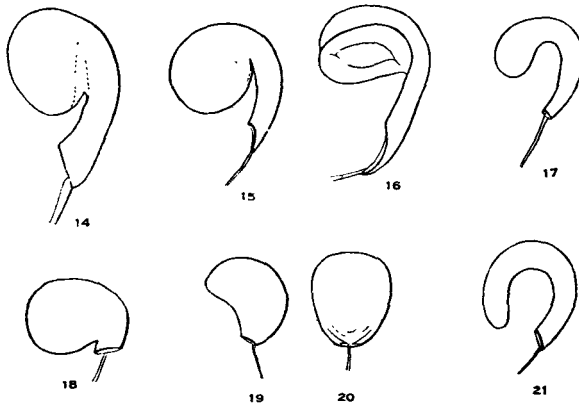
***Rodolia amabilis*, sp. n. (figs. 7, 13 and 18).**

Body sub-hemispherical, usually uniformly reddish brown with a slight tinge of carmine, sometimes brown; pubescence yellowish, short, semi-erect and moderately dense; punctuation very fine, close and rather obsolete; pronotum with the lateral margins slightly rounded and the anterior angles narrow; prosternum nearly as long as wide and raised anteriorly; sixth abdominal sternite in male more distinctly emarginate than in female; male genitalia as shown in figs. 7 and 13, the compact row of long hairs on the entire inner margin of paramera being very characteristic; female, with the ninth sternite long and tapering to a pointed apex, spermatheca (fig. 18) large, shortly oval, except for a short and narrow basal part.

Length 3.25 mm., width 3.0 mm.

TYPE in the British Museum; locality : South India, Mysore State, Bhatteshally, feeding on *Icerya purchasi* Maskell, 24.v.1947 (Plant Protection Adviser, India).

PARATYPES: 12, in the British Museum, the Indian Museum (Plant Protection Adviser's bequest), and in the author's collection. Of these, five have the same data as the type; the remainder were also feeding on *I. purchasi* and have the following data. South India, Mysore State, Bangalore, 25.xi.1944 (*V. P. Rao*); Thavarekere, 1.xii.1944 (*V. P. Rao*); Talliar, 1.i.1944 (*V. P. Rao*); Periakulam, 19.ix.1944 (*G. S. Chelladorai*).



Figs. 14-19, 21.—Lateral views of spermathecal capsules. (14) *Rodolia ruficollis*; (15) *R. fumida*; (16) *R. andamanica*; (17) *R. netara*, sp. n.; (18) *R. amabilis*, sp. n.; (19) *R. minima*, sp. n.; (21) *R. breviscula*, sp. n.

Fig. 20.—Front view. *R. minima*, sp. n.

(Free-hand drawings of no fixed magnifications.)

***Rodolia netara*, sp. n. (fig. 17).**

Sub-hemispherical, head carmine-red to dark brown, pronotum and elytra carmine-red, except for a rounded black spot on each elytron. The spot is small, its diameter being about one-fourth the greatest width of elytron, and lies a little anterior to the middle of the suture and nearly as far from the suture as its own diameter; underside carmine-red, fuscous at the metathorax and the median part of femora or with the greater part of metathorax, abdominal sternites and legs piceous. Pubescence light yellow, rather short, sub-erect and dense; punctation uniformly fine, close and impressed; the lateral margins of pronotum slightly rounded and the anterior angles acute and sub-rounded; prosternum a little longer than wide, slightly narrowing and raised anteriorly, sub-rounded at the apex; the sixth abdominal sternite slightly emarginate in female, spermatheca (fig. 17) expanded and rounded at the apical fourth, strongly bent in the middle and narrowed towards the base. Male not known.

Length 3.25 mm., width 3.0 mm.

TYPE in the British Museum; locality: South India, Munnar, feeding on *Icerya purchasi* Maskell, 1947 (Plant Protection Adviser, India).

PARATYPES: One with the same data as the type, in the Indian Museum (P. P. A.'s bequest), the other from the same locality and host, 22.i.1944 (*V. P. Rao*) in the author's collection.

REMARKS. Close to *amabilis*, from which it may be distinguished by the presence of the black spots and by the structure of the genitalia.

***Rodolia minima*, sp. n. (figs. 8, 9, 19 and 20).**

Body sub-hemispherical, rather obtusely rounded towards the apex; head and pronotum carmine-red, elytra for the most part like the pronotum but with the

lateral margins and the apical third dark brown or piceous; underside usually carmine-red, metathorax sometimes dark brown; pubescence yellowish to light grey, short, dense and rather woolly in appearance; punctation fine and close, slightly less fine and rather more impressed on the elytra than on the head and pronotum; pronotum with the lateral margins slightly rounded and the anterior angles acute; prosternum nearly as wide as long, slightly narrow anteriorly and raised; sixth abdominal sternite emarginate in male and only weakly so in female; male genitalia as shown in figs. 8 and 9. The narrowed apex of penis curved downwards and the dentulation of siphon are characteristic; in female the ninth sternite narrowed towards the apex and rounded only on the external margin near the apex, spermatheca (figs. 19 and 20) broadly reniform and obovate in the lateral and front views respectively.

Length 2.35 mm., width 2.0 mm.

TYPE in the British Museum; locality: South India, CoTy, feeding on *Icerya purchasi* Maskell, 5.v.1947 (Plant Protection Adviser, India).

PARATYPES. Six with the same data as the type; of these, one is in the British Museum, three are in the Indian Museum (P. P. A.'s bequest), and two in the author's collection.

REMARKS. On account of the different form of its siphon, this species does not appear to be closely related to any of the others dealt with here.

References.

- CROTCH, G. R. (1874). A revision of the Coleopterous family Coccinellidae. 311 pp.
- GORHAM, H. S. (1901). Stettin. ent. Ztg., **62**, p. 211.
- KORSCHESKY, R. (1931). Coccinellidae I.—Coleopt. Cat., Berlin, **118**, 224 pp.
- . (1940). Ent. Blätt., **36**, p. 2.
- MULSANT, E. (1850). Species des coléoptères trimères sécuripalpes.—1104 pp.
- . (1853). Opuscules entomologiques, **3**, pp. 205.
- SICARD, A. (1909). Ann. Soc. ent. Fr., **78**, p. 117.
- WEISE, J. (1892). Ann. Soc. ent. Belg., **36**, pp. 16-30.
- . (1901). *Ibid.*, **45**, pp. 91-96.
- . (1912). Arch. Naturgesch., **78**, A12.