

This article was downloaded by:[NEICON Consortium]
On: 11 September 2007
Access Details: [subscription number 781557153]
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Journal of Natural History

Publication details, including instructions for authors and subscription information:
<http://www.informaworld.com/smpp/title~content=t713192031>

A review of the species of **Calvia** (Coleoptera: Coccinellidae) from the Indian subcontinent, with descriptions of two new species

R. G. Booth ^a

^a International Institute of Entomology, An Institute of CAB International, London, UK

Online Publication Date: 01 June 1997

To cite this Article: Booth, R. G. (1997) 'A review of the species of **Calvia** (Coleoptera: Coccinellidae) from the Indian subcontinent, with descriptions of two new species', *Journal of Natural History*, 31:6, 917 - 934

To link to this article: DOI: 10.1080/00222939700770451

URL: <http://dx.doi.org/10.1080/00222939700770451>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

© Taylor and Francis 2007

A review of the species of *Calvia* (Coleoptera: Coccinellidae) from the Indian subcontinent, with descriptions of two new species

R. G. BOOTH

*International Institute of Entomology, An Institute of CAB International,
56 Queen's Gate, London SW7 5JR, UK*

(Accepted 15 October 1996)

The species of *Calvia* Mulsant (Coleoptera: Coccinellidae) from the Indian subcontinent are reviewed. The southern part of the Himalayas is a region of high biodiversity for this genus. They are generally predators of aphids and psyllids on trees and shrubs, although other prey have also been recorded. A key to the species based predominantly on external characters is presented. Two species, *C. championorum* and *C. flaveola* are described as new. *Calvia durgae* Kapur, *C. trilochana* Kapur, *C. pinaki* Kapur, *C. pasupati* Kapur, and *C. connexa* Miyatake are synonymized under *C. shiva* Kapur. *Calvia andrewesi* (Weise) is shown to be a valid species, not a synonym of *C. punctata* (Mulsant). Lectotypes are designated for *C. vishnu* (Crotch), *C. krishna* (Crotch), *C. buddha* (Crotch), *C. andrewesi* (Weise) and *C. sykesii* (Crotch).

KEYWORDS: Coleoptera, Coccinellidae, *Calvia*, taxonomy, morphology, Himalaya, India, Pakistan, Nepal, Bhutan.

Introduction

The genus *Calvia* Mulsant contains 20 or more species distributed throughout the Palaearctic and Oriental regions, and of which a single species, *C. quatuordecimpunctata* (Linnaeus), occurs widely in the northern half of North America. In general, they are predators of aphids and psyllids, although other prey have also been recorded. Some *Calvia* species and, in particular, *Calvia quindecimguttata* (Fabricius) are known to feed on the eggs, larvae and pupae of various leaf-beetles, Chrysomelidae (Kanervo, 1946). They are more usually associated with trees and shrubs than herbaceous vegetation.

For many years, specimens have been submitted to the International Institute of Entomology for identification. One of the purposes of this paper is to describe one pale species which was submitted for identification on various occasions in the 1980's. Iablokoff-Khnzorian (1982) provided a key to 15 *Calvia* species based almost entirely on characters of the male genitalia, and another to 17 species based on various external characters. This paper concentrates on the species of the Indian subcontinent for the following reasons. Eight of the nine species names unknown to Iablokoff-Khnzorian (1982) belong to this region. They can all now be interpreted and are dealt with below. Many species of *Calvia* are endemic to the Himalayan region. They are keyed out below based predominantly on external characters.

In addition to the twelve species dealt with in this paper, the other currently recognized species are *C. decemguttata* (Linnaeus) and *C. quindecimguttata* (Fabricius), both widely distributed across the Palaearctic, *C. rosti* (Weise) from the Caucasus, *C. chinensis* (Mulsant), *C. hauseri* Mader and *C. septenaria* Mulsant from China, *C. muiri* (Timberlake) from China and Japan, and *C. anomala* (Crotch) from Ambon, Indonesia (Iablokoff-Khnzorian, 1982). *Calvia parvinotata* (Miyatake) and *C. shirozui* (Miyatake) were regarded as a synonym of *C. muiri* and a subspecies of *C. quindecimguttata* respectively by Iablokoff-Khnzorian (1982) and *C. sicardi* Mader was unknown to him. A revision of the Asiatic *Calvia* species is clearly still required.

Unless stated otherwise, all material is deposited in The Natural History Museum, London.

Prey information

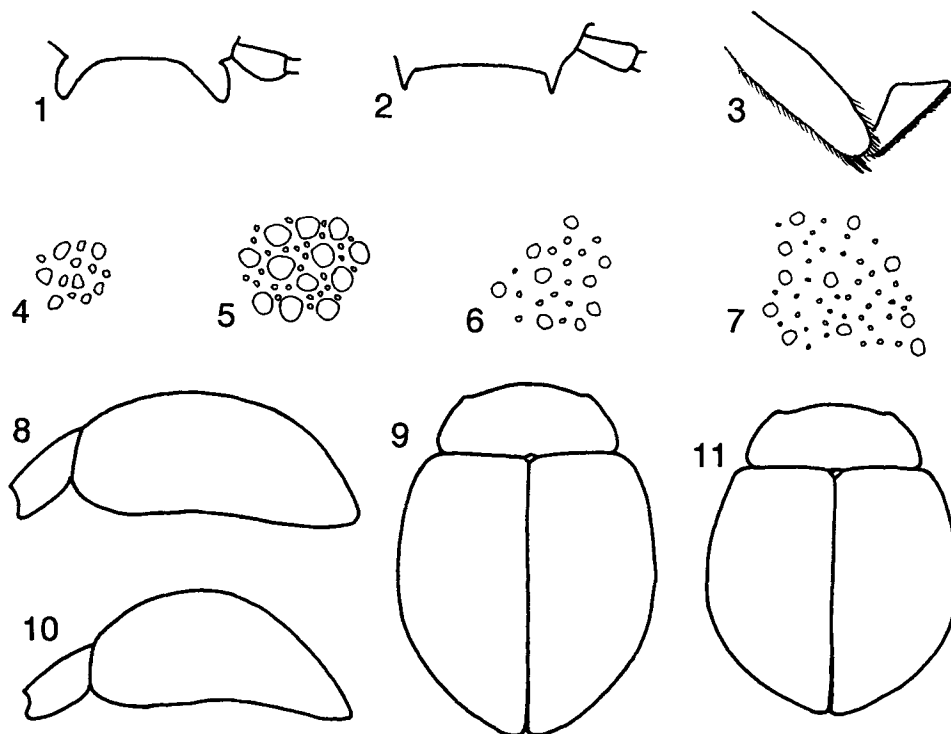
Although prey lists for *Calvia* species were published by Gordon (1985) and Iablokoff-Khnzorian (1982), there seems to be very little information on prey for *Calvia* species from the Indian subcontinent. Agarwala and Ghosh (1988) reviewed the prey records of aphidophagous Coccinellidae in India and, although they referred to 27 species of the subfamily Coccinellinae, they had no records for *Calvia*. Wadhi and Parshad (1980), however, recorded an unidentified *Calvia* species from *Alnus* trees which were heavily infested with *Aphis craccivora* Koch at Ghara, Nepal. Singh and Singh (1985) noted *Calvia trilochana* Kapur (see *C. shiva* Kapur below) adults as predators of two species of aphid on *Quercus dealbata* in Manipur, India. *Calvia punctata* (Mulsant) has been recorded as a predator of *Chromaphis juglandicola* on walnut leaves in Jammu and Kashmir, India (Pawar and Parry, 1989). It has also been found with four species of aphid on cotton in northern Afghanistan (Stolyarov *et al.*, 1974). Phaloura and Singh (1991) listed *Calvia albida* and *C. durgae* (see *C. shiva* below) among six coccinellid species preying on the aphid, *Mollitrichosiphum alni* Ghosh *et al.* on Indian alder in Uttar Pradesh and Sikkim, India. Label data from specimens examined in this study also indicate aphids, psyllids and sometimes other Homoptera as prey. These host records are summarized in Table 1.

Key to species of *Calvia* from the Indian subcontinent

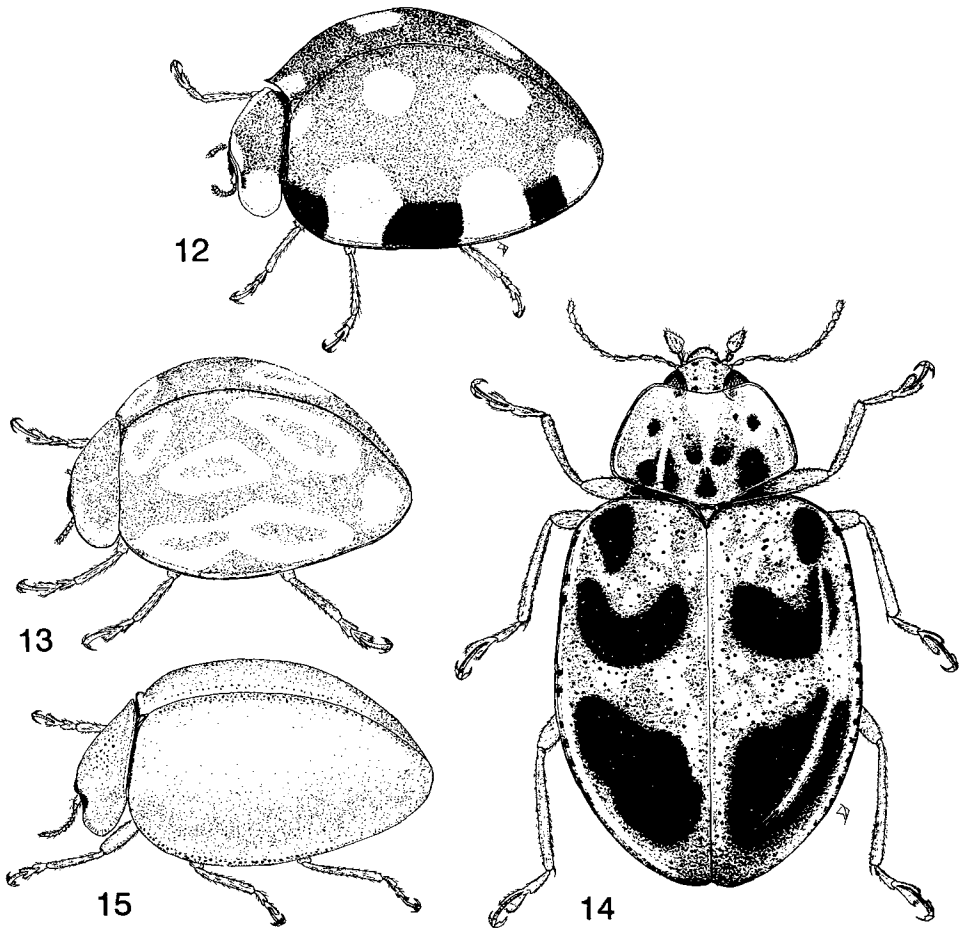
- 1 Anterior margin of clypeus deeply concave, lateral projections relatively broad (Fig. 1). Disc of elytra chestnut brown with three off-white to yellow spots, lateral margin broadly black, interrupted by three large yellow spots (Fig. 12). Punctuation and sculpture of elytra and pronotum on disc very similar, at most pronotal punctures closer than those on elytra. Male genitalia (Figs 16–21) *tricolor* Korschefsky
- Anterior margin of clypeus broadly truncate, lateral projections relatively narrow (Fig. 2). Elytral coloration not as above. Punctuation and sculpture of elytra and pronotum sometimes similar, but usually very different 2
- 2 Apices of meso- and metatibiae without a pair of apical spurs, although a small, single spur present on mesotibiae. Body size c. 4–5 mm long and antennae elongate, with all segments longer than broad. Male median lobe, etc. (Fig. 22) *shiva* Kapur
- Apices of meso- and metatibiae with a pair of apical spurs (Fig. 3). Body size usually >5 mm long; if less, then antennae shorter with segments 9 and 10 quadrate to transverse 3

Table 1. Host records for *Calvia* species from the Indian subcontinent and adjacent regions. Unless indicated otherwise, all species are Aphididae (*sensu lato*).

Species	Prey association	Source
<i>C. tricolor</i>	Eggs of <i>Urostylis punctigera</i> Westwood (Pentatomoidea: Urostylidae)	Korschevsky, 1940
<i>C. shiva</i>	<i>Tuberculatus indicus</i> Ghosh, <i>Cervaphis quercus</i> Takahashi <i>Mollitrichosiphum alni</i> Ghosh <i>et al.</i>	Singh and Singh, 1985 Phaloura and Singh, 1991
<i>C. vulnerata</i>	Undetermined aphids	Data label
<i>C. punctata</i>	Undetermined aphids, psyllids, scale insects <i>Aphis gossypii</i> Glover, <i>Aphis craccivora</i> Koch, <i>Acyrtosiphon gossypii</i> Mordvilko, <i>Myzus persicae</i> (Sulzer) <i>Chromaphis juglandicola</i> (Kaltenbach)	Data labels Data labels Stolyarov <i>et al.</i> , 1974
<i>C. breiti</i>	<i>Adelges</i> (Adelgidae)	Pawar and Parry, 1989 Data labels
<i>C. albida</i>	<i>Mollitrichosiphum alni</i> Ghosh <i>et al.</i> <i>Vesiculaphis</i>	Phaloura and Singh, 1991 Data label
<i>C. flaveola</i>	Undetermined aphids Walnut aphid <i>Macrosiphoniella pseudoartemisiae</i> Shinji	Data labels Data labels Data label

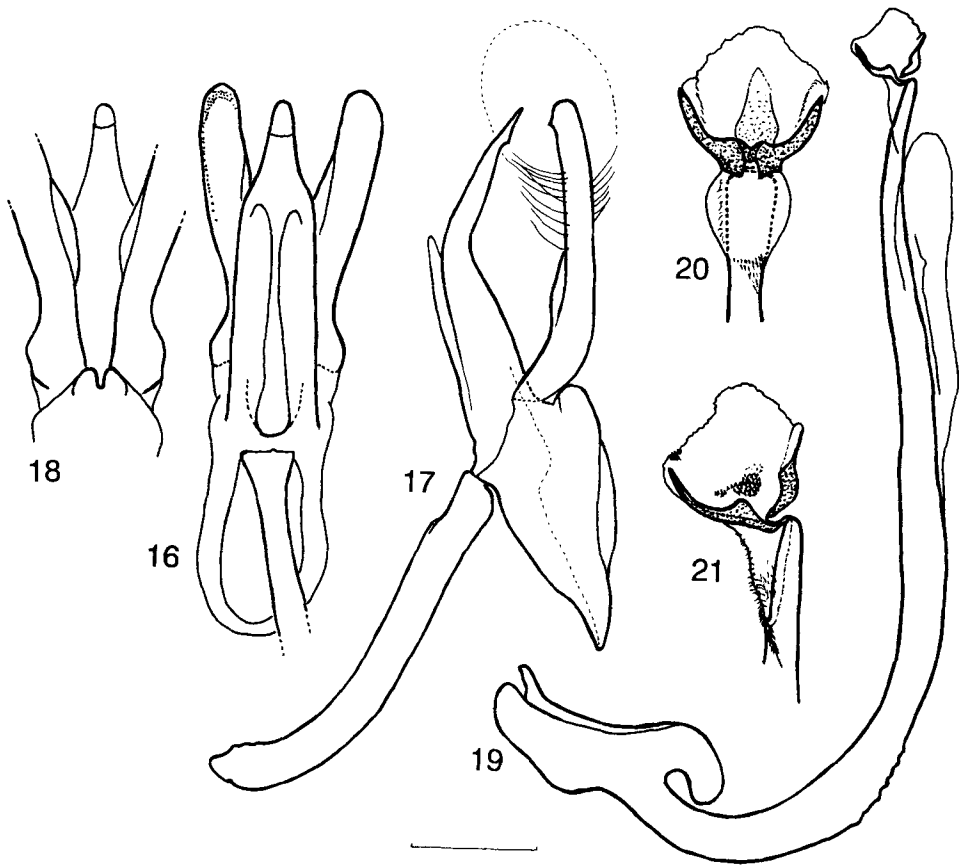


FIGS 1–11. Characters of *Calvia* spp.: (1) *C. tricolor*, clypeus; (2) *C. quatuordecimguttata*, clypeus; (3) *C. quatuordecimguttata*, tibial spurs; (4) *C. quatuordecimguttata*, elytral punctation; (5) *C. monosha*, elytral punctation; (6) *C. vulnerata*, elytral punctation; (7) *C. punctata*, elytral punctation; (8) *C. punctata*, outline (lateral); (9) *C. punctata*, outline (dorsal); (10) *C. andrewesi*, outline (lateral); (11) *C. andrewesi*, outline (dorsal).



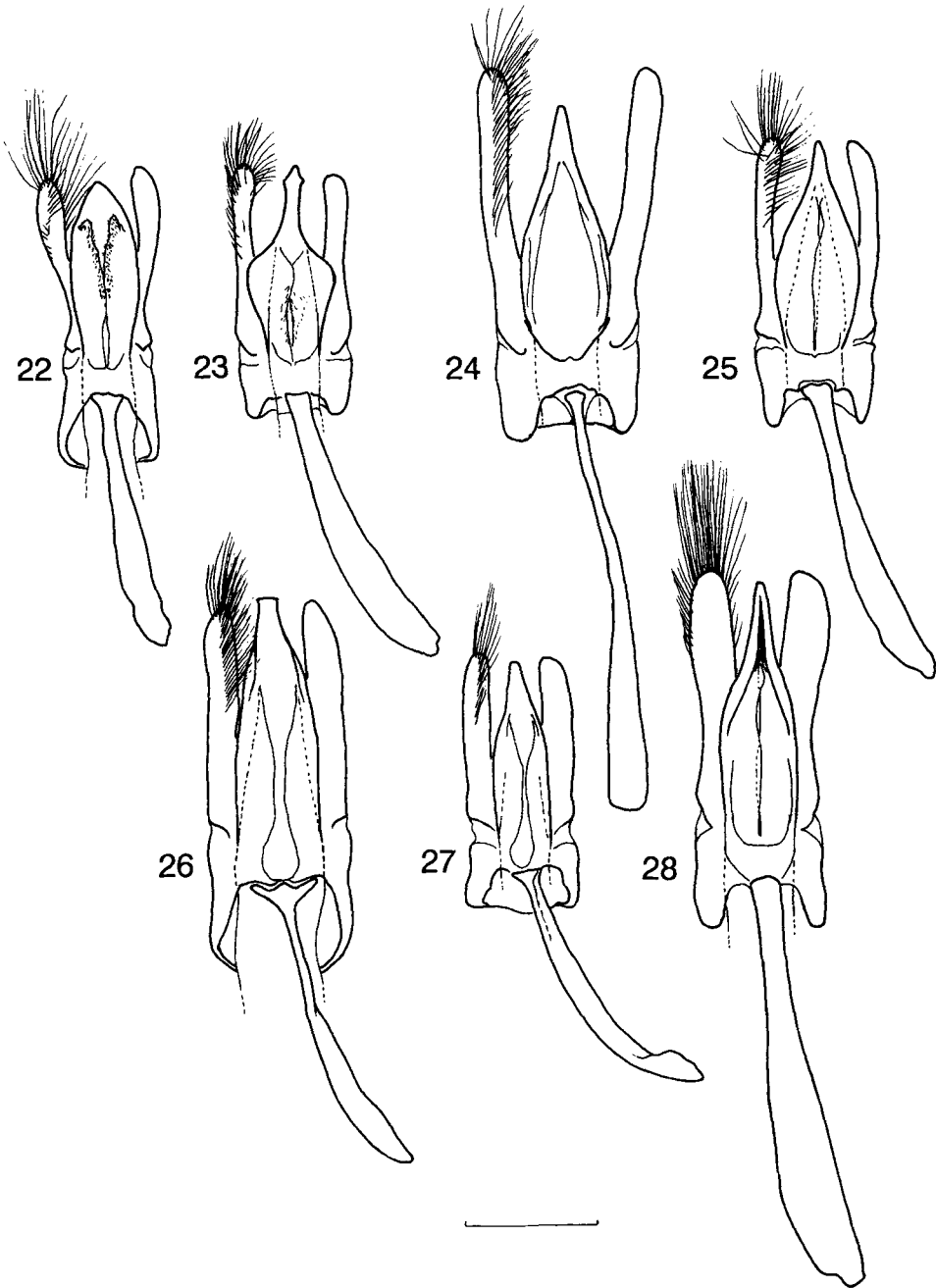
Figs 12-15. Habitus drawings of *Calvia* spp.: (12) *C. tricolor*; (13) *C. vulnerata*; (14) *C. breiti*; (15) *C. flaveola*.

- 3 Pronotum shining between punctures, contrasting with head where frons between eyes is microreticulate 4
- Pronotum duller, interstices, at least on disc, microreticulate as on frons, without obvious contrast between the two 8
- 4 Elytral punctation on disc uneven, punctures variable in size but rather close together and interstices rather convex (Fig. 4). Elytral coloration either yellowish-brown with seven well-defined pale yellow spots (arranged 1-3-2-1) or reddish-pink to yellowish-pink with seven black spots (arranged 2-2-2-1). Body length c. 4-6 mm. Male median lobe, etc. (Fig. 23) *quatuordecimguttata* (Linnaeus)
- Elytral punctation on disc clearly double, a mixture of large and small punctures, either with larger punctures close and deep, interstices convex with small punctures (Fig. 5), or larger punctures more widely separated and interstices flatter (Figs 6, 7). Coloration very variable, usually with six or fewer spots (if with seven spots then arrangement different) 5
- 5 Larger elytral punctures close and deep, interstices convex with small punctures (Fig. 5). Elytral coloration black with basal and external margins narrowly yellow and with five large yellow spots arranged 2-2-1, or spots partly joined laterally into bands. Male median lobe, etc. (Fig. 24) *monosha* Bielawski



Figs 16–21. Male genitalia of *C. tricolor*: (16) Median lobe, parameres, trapes (ventral); (17) same (lateral); (18) parameres (dorsal); (19) siphon; (20) siphon, detail of apex (ventral); (21) same (lateral). Scale marker = 0.5 mm, Figs 16–19; 0.25 mm, Figs 20, 21.

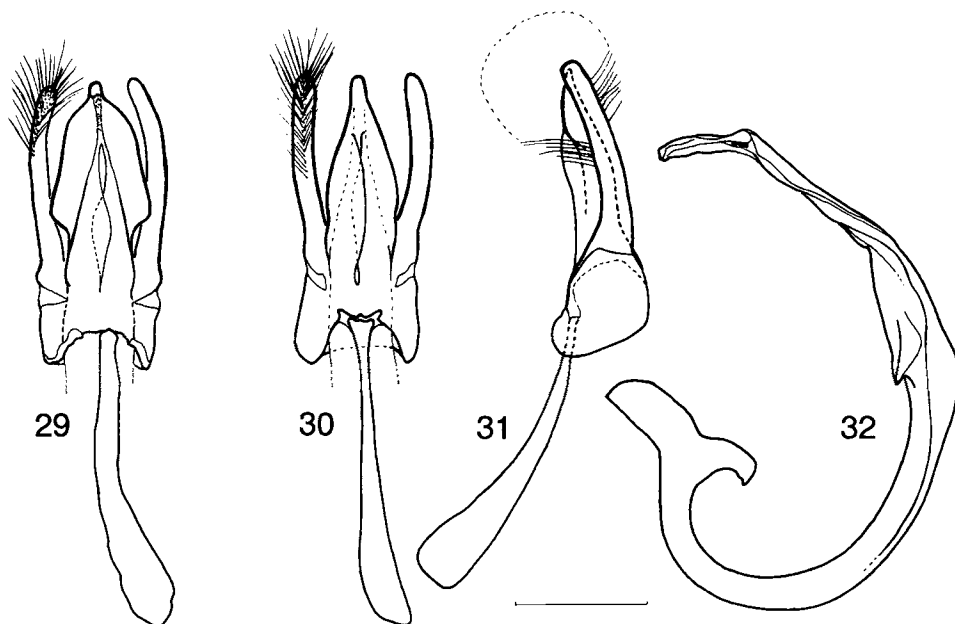
- Larger elytral punctures more widely separated and interstices flatter (Figs 6, 7). Elytral coloration variable, but not as above 6
- 6 Large elytral punctures on disc generally closer, separated on average by slightly more than one diameter, usually with a single row of small punctures between adjacent large punctures (Fig. 6). Elytral coloration variable, but background colour almost always yellow to yellowish-brown, rarely black, usually with six spots arranged as Fig. 13, spots either yellow or black, with or without a paler or darker outer ring. If spots absent then elytra with narrow black suture and black sublateral line. If elytra entirely black, except for fine rufous outer margin, then pronotum unicolorous orangey brown. Male median lobe, etc. (Fig. 25) *vulnerata* (Hope)
- Large elytral punctures on disc more widely spaced, separated on average by about two diameters, usually with a double row of small punctures between adjacent large punctures (Fig. 7). Elytral coloration very variable, from entirely pale yellow to black or with a variable number of spots, but usually six (arranged 3-2-1), front three in a transverse subbasal band. Black sublateral line never present. If elytra entirely black, except for fine rufous outer margin, then pronotum black medially and yellow laterally 7
- 7 Elytra less strongly convex (Fig. 8), generally longer in proportion to breadth (Fig. 9). Species currently known from the more northern parts of the subcontinent. Median lobe of male genitalia with very broad, explanate sides (Fig. 29) *punctata* (Mulsant)



FIGS 22-28. Median lobe, parameres, trapes (ventral view) of *Calvia* spp.: (22) *C. shiva*; (23) *C. quatuordecimguttata*; (24) *C. monosha*; (25) *C. vulnerata*; (26) *C. breiti*; (27) *C. sykesii*; (28) *C. albida*. Scale marker = 0.5 mm.

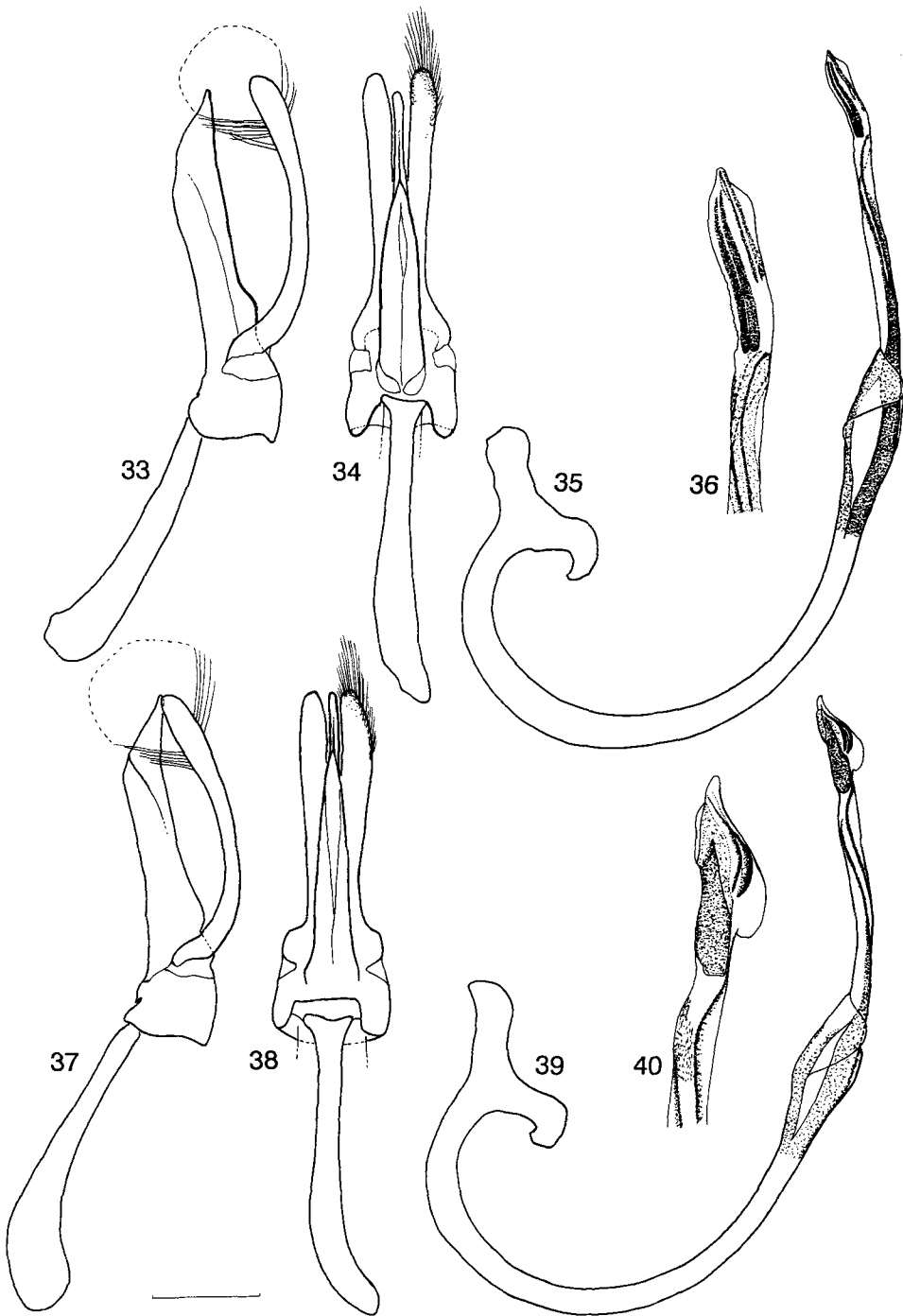
- Elytra relatively shorter (Fig. 11) and more strongly convex (Fig. 10). Species currently known from southern India; Nilgiri and Anaimalai Hills, Kerala/Tamil Nadu. Median lobe of male genitalia narrower (Fig. 30) *andrewesi* (Weise)

8 Elytral punctation clearly double, a mixture of large and small punctures, larger

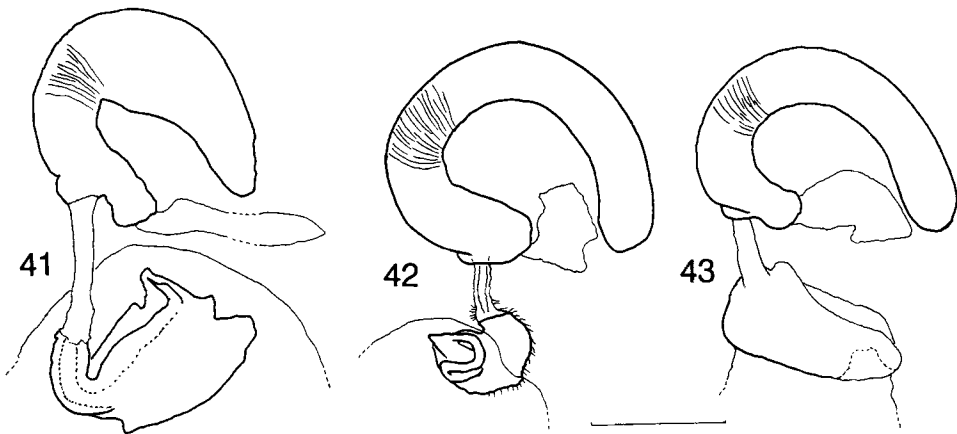


Figs 29–32. Male genitalia of *Calvia* spp.: (29) *C. punctata*, median lobe, parameres, trabes (ventral); (30) *C. andrewesi*, median lobe, parameres, trabes (ventral); (31) *C. andrewesi*, same (lateral); (32) *C. andrewesi*, siphon. Scale marker = 0.5 mm.

- punctures more widely spaced, on average separated by about two diameters (as Fig. 7). Ground colour dull brownish-yellow to greenish-yellow with bold dark brown markings or with two or three small dark brown spots 9
- Elytral punctation even or uneven, if uneven then punctures variable in size and without such obvious contrast between large and small punctures. Coloration yellow to brownish-yellow, sometimes mottled or with paler yellow stripes, but never with obvious dark markings nor with small, dark brown spots 10
- 9 Elytra rather oblong in shape, pronotum only weakly transverse, both with bold irregular darker markings (Fig. 14). Male median lobe, etc. (Fig. 26) *breitii* Mader
- General shape as for other *Calvia* species, elytra oval, strongly rounded at sides and pronotum broadly transverse. Elytra with two or three small dark brown spots. Male median lobe, etc. (Fig. 27) *sykesii* (Crotch)
- 10 Prosternal process convex, without carinae. Coloration yellow to brownish-yellow, often with numerous slightly paler or darker spots forming a mottled pattern on elytra. Sixth visible sternite of male subtruncate or weakly emarginate medially. Median lobe of male genitalia shorter and broader (Fig. 28). Spermatheca bulkier and sperm duct relatively longer (Fig. 41) *albida* Bielawski
- Prosternal process convex, but with carinae either well developed or weak to obsolete. Coloration yellow to brownish-yellow, either uniform or with three paler longitudinal stripes on elytra. Sixth visible sternite of male with deeper emargination medially. Median lobe of male genitalia long and slender (Figs 34, 38). Spermatheca more slender and sperm duct relatively shorter (Figs 42, 43) 11
- 11 Smaller species, 5.7–6.6 mm long. Prosternal process generally with well-developed carinae. Narrowed apical portion of median lobe of male genitalia shorter (Fig. 38), apex of siphon broader (Fig. 40). Base of bursa copulatrix with larger, weakly sclerotized area (Fig. 43) *flaveola* sp. nov.
- Larger species, 6.5–8.0 mm long. Prosternal process generally with weak to obsolete carinae. Narrowed apical portion of median lobe of male genitalia longer (Fig. 34),



FIGS 33–40. Male genitalia of *C. championorum*, holotype: (33) median lobe, parameres, trabes (lateral); (34) same (ventral); (35) siphon; (36) details of siphon apex. Male genitalia of *C. flaveola*, paratype. (37) median lobe, parameres, trabes (lateral); (38) same (ventral); (39) siphon; (40) details of siphon apex. Scale marker = 0.5 mm, Figs 33–35, 37–39; 0.25 mm, Figs 36, 40.



FIGS 41–43. Spermatheca of *Calvia* spp.: (41) *C. albida*; (42) *C. championorum*; (43) *C. flaveola*. Scale marker = 0.25 mm.

apex of siphro more slender (Fig. 36). Base of bursa copulatrix with small, well-sclerotized region at end of sperm duct (Fig. 42) *championorum* sp. nov.

***Calvia tricolor* Korschefsky**

(Figs 1, 12, 16–21)

Calvia (Anisocalvia) tricolor Korschefsky, 1940: 2, Syntype [examined]

This species is distinct from all other Indian Coccinellidae in its dorsal coloration (Fig. 12). The very distinctive male genitalia, illustrated here for the first time, are shown in detail in Figs 16–21. The structure of the siphro (Fig. 19), in particular the apex and the lack of a median swelling or lateral wings (cf. Figs 32, 35, 39), suggests that this species does not properly belong in *Calvia*. The relatively short antennae, <0.66 the width of the head and the deeply concave anterior margin of the clypeus (Fig. 1) also support this notion. However, the species does not fit comfortably into any other Oriental genus. For example, it shares characters with *Synona* Pope and *Coelophora* Mulsant (including *Lemnia* Mulsant) but lacks distinct hypomeral foveae. As it has not been possible to examine the female genitalia, it seems best to leave the species in *Calvia* for the time being, until more material becomes available for study.

Material examined

Two specimens, both from the United States National Museum. **India:** Syntype unsexed, 'Bagdogra Range, Kurseong, Bengal, N. C. Chatterjee 24.vi.1935 / On *Michelia champaca* / 704 / TYPUS [printed on orange-red card] / Korschefsky Collection 1952'. One ♂, 'Assam, Shillong vi.1945 beating bushes *J. Unyal* / GH Dieke Coll'n 1965'.

Comments

Korschefsky (1940) described this species from an unrecorded number of specimens from three localities in Bengal. With the record from Shillong, Meghalaya, this species appears to be restricted to northeast India and is poorly known. It was unknown to Iablokoff-Khnzorian (1982) who gave a brief description taken from the original.

***Calvia shiva* Kapur**
(Fig. 22)

- Calvia shiva* Kapur, 1963: 40, Holotype male [examined]
Calvia durgae Kapur, 1963: 42, Holotype female [examined] Syn. nov.
Calvia trilošana Kapur, 1963: 42, Holotype male [examined] Syn. nov.
Calvia pinaki Kapur, 1963: 43, Holotype male [examined] Syn. nov.
Calvia pasupati Kapur, 1963: 45, Holotype male [examined] Syn. nov.
Calvia connexa Miyatake, 1985: 17, Holotype male [not examined] Syn. nov.

This species is distinct from other *Calvia* species in lacking a pair of apical tibial spurs on the metatibiae, and the single spur present on the mesotibiae is a most unusual character in the Coccinellidae. Although there is some doubt about the species' generic placement, it is probably best to retain it within *Calvia* for the time being pending a more detailed study of its true position.

This is a very variably coloured species and I have no hesitation in establishing the above synonymic list. Examination of Kapur's holotypes and a series of specimens from Mandal, Uttar Pradesh, India, the latter comprising five colour forms, showed that a single species was involved. The differences in the genitalia which Kapur (1963) attributed to his species can largely be explained by slight distortions of the genitalia which occurred during slide preparation. Freshly dissected material from Mandal and Kumaon, Uttar Pradesh matched very closely with Miyatake's detailed and accurate drawings of the genitalia for *C. connexa*. A black form with pale elytral margins, similar to the illustration of *C. connexa* but without the pale centre, was present in the Mandal series. Habitus figures of the species were included by Kapur (1963) and Miyatake (1985).

Material examined

Sixteen specimens. **India:** Holotypes of *C. shiva*, *C. durgae*, *C. trilošana*, *C. pinaki* and *C. pasupati*, all Sikkim, Singhik, 5000 ft 24.iv.1924 Maj. R. W. G. Hingston; Uttar Pradesh, West Bhatkot, Kumaon 4000 ft May 1920 H. G. Champion; Uttar Pradesh, Sukhatal, Kumaon, 8000 ft May 1920 H. G. Champion; Uttar Pradesh, Bhatkot, Ranikhet H. G. Champion; Uttar Pradesh, Mandal, various dates, CIE A18353 and CIE A19155. This species is also recorded from Godavari, Nepal (Miyatake, 1985).

Comments

The genitalia drawings for *Calvia trilošana* given by Iablokoff-Khnzorian (1982) do not appear to apply to the present species. Iablokoff-Khnzorian's (1979, 1982) synonymy of *C. pasupati* with *C. duodecimmaculata* (Gebler) is erroneous.

***Calvia quatuordecimguttata* (Linnaeus)**
(Figs 2-4, 23)

- Coccinella 14-guttata* Linnaeus, 1758: 367, Syntype [not examined]
Calvia quatuordecimguttata: Mulsant, 1846: 140
Coccinella 12-maculata Gebler, 1832: 76, Syntype [not examined] (name preoccupied), synonymized by Belicek, 1976: 327
Oenopia dorsonotata Mulsant, 1850: 424, Lectotype [examined], synonymized by Booth and Pope, 1989: 353

This is a very widespread and variably coloured Holarctic species which just extends into the more northerly regions of the Indian subcontinent. The material

examined belonged to the *dorsonotata* colour form which has much smaller black spots than the typical *duodecimmaculata* form. Under this latter name, Iablokoff-Khnzorian (1982) also recorded the species from the Himalayas. *Oenopia dorsonotata* was originally described from Bengal from material in F. W. Hope's collection, and the lectotype was designated by Booth and Pope (1989).

Material examined from Indian subcontinent

Five specimens. NEPAL: Kathmandu 4500 ft 20.v.-23.vi.1983 M. J. D. Brendell. BHUTAN: Thimphu 4.iii.1985 CIE A16905. [INDIA]: Lectotype, unsexed, of *Oenopia dorsonotata*, 'Bengal' (Oxford University Museum).

Comments

Recent authors, for example Gordon (1985) and Sasaji (1985) have followed Belicek (1976) in regarding *C. duodecimmaculata* as a synonym of *C. quatuordecimguttata*, and the same was implied by Booth and Pope (1989) when they synonymized *C. dorsonotata* with *C. quatuordecimguttata*.

***Calvia monosha* Bielawski**

(Figs 5, 24)

Calvia monosha Bielawski, 1979: 122, Holotype male [examined]

This species was described from near Wangdi Phodrang, Bhutan, based on three specimens. Bielawski described the species in detail and figured its body shape and colour pattern, male and female genitalia, antenna and elytral punctation. Although he gave the body length as 7.3–7.6 mm long, suggesting that this species was much larger than the above and following three species, I measured the specimens at 6.7–7.0 mm long, i.e. scarcely longer than *C. vulnerata*. The dense elytral punctation (Fig. 5) will separate this species from others in the region. This species was not referred to by Iablokoff-Khnzorian (1982).

Material examined

Three specimens. **Bhutan**: Holotype and Paratypes, 1 ♂, 1 ♀ 21 km O Wangdi Phodrang 15.vi.1972 (Holotype and ♂ paratype in Naturhistorisches Museum, Basel; ♀ paratype in Polska Akademia Nauk, Warsaw).

***Calvia vulnerata* (Hope)**

(Figs 6, 13, 25)

Coccinella vulnerata Hope, 1831: 31, Lectotype [examined]

Calvia vulnerata: Korschefsky, 1932: 529

Coccinella uniramosa Hope, 1831: 31, Lectotype [examined], synonymized by Booth and Pope, 1989: 367

Calvia flaccida Mulsant, 1853: 151, Lectotype [examined], synonymized by Booth and Pope, 1989: 368

Anisocalvia vishnu Crotch, 1874: 145, Lectotype here designated [examined], synonymized by Booth and Pope, 1989: 368

Anisocalvia krishna Crotch, 1874: 145, Lectotype here designated [examined], synonymized by Booth and Pope, 1989: 368

Anisocalvia buddha Crotch, 1874: 145, Lectotype here designated [examined], synonymized by Booth and Pope, 1989: 368

This is a variably coloured Himalayan species. The range of colour varieties, as indicated by the list of synonyms, is largely due to the colour variation of the spots

and their immediately surrounding borders. In all the spotted forms, the positions occupied by each spot is constant, a feature also noted by Crotch (1874) in his original descriptions. The typical *vulnerata* form is shown in Fig. 13. A specimen from Kurseong, West Bengal, with almost entirely black elytra had a typical arrangement of black spots just discernable when viewed from below. Only the *uniramosa* form with a black sublateral stripe does not conform to the above pattern. The *vishnu*, *krishna* and *buddha* colour forms were illustrated by Iablokoff-Khnzorian (1982), although his figures for the median lobe of the two former forms do not agree very closely with that in Fig. 25.

Material examined

Twenty-five specimens. **India:** Lectotypes of *Anisocalvia vishnu*, *A. krishna* and *A. buddha* all 'India Orient'; Lectotype of *Calvia flaccida* Northern India Deyrolle (University of Cambridge); Sikkim, Mungphu E. F. T. Atkinson; West Bengal, Kurseong Inde Verschraeghen 1904; Uttar Pradesh, West Bhatkot, Kumaon 4000 ft May 1920 H. G. Champion; Delhi, 22.iii.1946, CIE 11518, feeding on aphids on *Dalbergia sissoo* leaf. **NEPAL:** Lectotypes of *Coccinella vulnerata* and *C. uniramosa* Hardwicke Bequest; Terai, Bardia 330 m 23.ii.1984 M. G. Allen; Kathmandu District, Gokarna 4500 ft 7.vi.1983 M. J. D. Brendell; Kathmandu British Embassy 4500 ft 20.v.-23.vi.1983 M. J. D. Brendell.

Comments

The above synonymic list was established by Booth and Pope (1989) who also designated lectotypes for Hope's two species. The lectotype of *Calvia flaccida* in the University of Cambridge Crotch Collection was designated by Gordon (1987). Crotch's three species are represented in The Natural History Museum by apparently unique syntypes from Alexander Fry's collection. A male specimen fitting the description of *Anisocalvia vishnu* and labelled 'Type [circular, red bordered Museum label] / 39211 [Fry catalogue label] / TYPE / India Orient / Vishnu Cr [Crotch's hand] / Fry Coll. 1905-100', is hereby designated as the lectotype of *Anisocalvia vishnu* Crotch. A female specimen fitting the description of *Anisocalvia krishna* and with the same labels as the preceding specimen except '39221 / Krishna Cr [Crotch's hand]', is hereby designated as the lectotype of *Anisocalvia krishna* Crotch. A female specimen fitting the description of *Anisocalvia buddha* and with the same labels as the preceding specimens except '39223 / Buddha Cr. [Crotch's hand]', is hereby designated as the lectotype of *Anisocalvia buddha* Crotch.

Calvia punctata (Mulsant)

(Figs 7-9, 29)

Harmonia punctata Mulsant, 1853: 143, Lectotype [examined]

Calvia punctata: Korschefsky, 1932: 524

Propylea obversepunctata Mulsant, 1853: 156, Lectotype [examined], synonymized by Bielawski, 1963: 17

This is another very variably coloured species, with elytra ranging from entirely dull yellow to black. Pale specimens are usually spotted, with a basic pattern of six black spots (arranged 3-2-1), or with the number of spots reduced. Some pale specimens have spot positions marked only by darker rings. Specimens with black elytral ground colour may have six pale spots (arranged 3-2-1) or with a pattern of pale areas. The median lobe of the male genitalia is characteristic (Fig. 29).

Material examined

Thirty-seven specimens. **India:** Lectotypes of *Harmonia punctata* and *Propylea obversepunctata* Northern India Deyrolle (University of Cambridge); Uttar Pradesh, Ranikhet, Kumaon H. G. Champion; Uttar Pradesh, W. Almora Divn, Kumaon various dates H. G. Champion; Uttar Pradesh, S. Garhwal, Kumaon 6500 ft H. G. Champion; Uttar Pradesh, Joshimath 25.iii.1985 CIE A17174, with aphids; Jammu and Kashmir, Srinagar 30.ix.1939 A. P. Kapur; Jammu and Kashmir, Srinagar 8.vi.1977 CIE A10431, pred on aphids on Ulmus; Jammu and Kashmir, Srinagar 30.vi.1975 CIE A12741. **Pakistan:** Gilgit 25.vi.1962 CIE 18503, feeding on psyllid on *J. regia*; Otroro 16.viii.1962 CIE 18897, on scale on *P. excelsa*; Parachinar 1.iii.1962 CIE 18235. **Afghanistan:** Babur Garden, Kabul 5.ix.1983 CIE A15369, feeding on aphids on pear.

This species is also recorded from the Central Asian States of the former Soviet Union (Iablokoff-Khnzorian, 1982).

Comments

The above two lectotypes are in the University of Cambridge Crotch collection and were designated by Gordon (1987).

Calvia andrewesi (Weise) stat. rev.

(Figs 10, 11, 30–32)

Anisocalvia andrewesi Weise, 1908: 220, Lectotype here designated [examined]

Calvia andrewesi: Korschefsky, 1932: 521

This species is very similar to *Calvia punctata* (Mulsant) in size and punctuation, but is noticeably more convex in lateral view (Fig. 10) and more strongly rounded in dorsal view (Fig. 11). The male genitalia (Figs 30–32) also clearly show that it is a valid species, separate from *C. punctata*, and not a synonym of the latter as considered by Iablokoff-Khnzorian (1979, 1982). There are differences in both the siphon and the median lobe of the male genitalia for the two species. In *C. andrewesi*, the sides of the median lobe are only narrowly expanded (Fig. 30), whereas in *C. punctata*, the median lobe is greatly expanded (Fig. 29). In addition, *C. andrewesi* is currently known only from the Nilgiri and Anaimalai Hills, Kerala / Tamil Nadu, in southern India, whereas *C. punctata* is a northern species.

Material examined

Five specimens. **India:** Lectotype ♀ [here designated], 'Type [red bordered, circular printed label] / 474 [red ink] / Anamalai Hills, S. India [printed] / Anamalais [printed] / Andrewes Bequest B.M. 1922–221 [printed] / Anisocalvia Andrewesi m [Weise's handwriting]'. Paralectotype ♀, 'Anamalais [printed] / Type [printed on pink card] / Anisocalvia Andrewesi m [Weise's handwriting]' (Humboldt-Universität, Berlin). One ♀, 'Cotype [green bordered, circular printed label] / Anamalai Hills, S. India / Anamalais / Andrewes Bequest B.M. 1922–221'. Two ♂♂, Nilgiri Hills G. F. Hampson.

Comments

Weise (1908) based his description of this species on four specimens with unmarked elytra and one specimen with elytral markings from 'Anamalais' from H. E. Andrewes' collection. There are two specimens of this species from Andrewes'

collection in The Natural History Museum. The specimen with Weise's determination label is here designated as the lectotype. The second female, labelled as a cotype, is excluded from the original syntype series (ICZN Art. 72(b) (i)) because it has dark elytral markings and was referred to in the original description as 'aber. a'. There is only a single female syntype of this species from Weise's collection in the Museum für Naturkunde, Humboldt-Universität, Berlin (M. Uhlig, *personal communication*), and this has been examined and labelled as a paralectotype. Iablokoff-Khnzorian's (1982) remark about the type of *C. andrewesi* being in Berlin is not here taken to be an adequate lectotype designation. The whereabouts of the two remaining original syntypes are not known.

Calvia breiti Mader

(Figs 14, 26)

Calvia (Anisocalvia) breiti Mader, 1932: 6, Syntype [not examined]

This is a very characteristic Himalayan species, separated from all other Indian species by its rather oblong shape and coloration (Fig. 14).

Material examined

Twenty-two specimens. **India:** Sikkim, Lachung June 1960, feeding on *Adelges* on hemlock; Sikkim, Lachung 20.xii.1961, feeding on *Adelges* on spruce; Uttar Pradesh, Chakrata Division 7000 ft vi.1928 H. G. Champion; Himachal Pradesh, Dalhousie H. E. Andrewes; Himachal Pradesh, Kadrula, Bashahr 9000 ft H. G. Champion. **Pakistan:** Murree Hills, Thobba H. Roberts. **Nepal:** Kathmandu District, Phulcoki 8800 ft 27–31.v.1983 M. J. D. Brendell. **Bhutan:** Thimphu CIE A17186 (in Department of Agriculture, Bhutan).

Mader (1932) described this species from Manali Kulu, Himachal Pradesh, India.

Calvia sykesii (Crotch)

(Fig. 27)

Anisocalvia sykesii Crotch, 1874: 146, Lectotype here designated [examined]

Calvia sykesii: Korschefsky, 1932: 529

This species seems to be rarely collected, but is apparently not restricted to the Himalayan region in India. Kapur (1963) recorded it from Darjeeling, West Bengal and Shillong, Meghalaya, and Iablokoff-Khnzorian (1982) recorded it from Mount Everest and from Tiruchchirapalli, Tamil Nadu. The species was also recorded from Bharmikh, West Sikkim by Wadhi and Parshad (1982). All the specimens seen in The Natural History Museum are fairly constant in maculation and differ only in the strength of the green coloration remaining after death. The species is light green when alive (Kapur, 1963).

Material examined

Nine specimens. **India:** Lectotype ♀ Dukhun Sykes; Assam W. F. Badgley; West Bengal, Kurseong Inde Verschraeghen 1904; West Bengal, Darjeeling 29.iv.1918 H. Stevens; West Bengal, Darjeeling 7000 ft 25–31.iii.1924 and 1–14.vi.1924 Miss Wetherall; Deccan, India G. E. Bryant. **Nepal:** Taplejung District, Sangu c. 6200 ft 1961–62 R. L. Coe; Chautara District, Nauling Lekh, 9500 ft 11–20.vi.1983 M. J. D. Brendell.

Comments

In the original description, Crotch (1874) gave no indication of the number of specimens he had seen in the India Museum. A single female syntype in The Natural History Museum is hereby designated as the lectotype. It is labelled 'Type [circular, red-bordered printed Museum label] / Duk = hun. Col. Sykes / Ind. Mus. 79.64. / TYPE Anisocalv. sykesii Crotch'. Part of the collections of the India Museum, the East India Company Museum, came to the British Museum in 1879.

Calvia albida Bielawski

(Figs 28, 41)

Calvia albida Bielawski, 1972: 308 Holotype male [not examined]

This is another Himalayan species. Although it is similar in general appearance to the two following species, Bielawski's original description, in particular his figures of the genitalia, leave no doubt about its correct identity.

Material examined

Thirteen specimens. **India:** Sikkim, Gangtok 9.ii.1985 CIE A16784, ex *Vesiculaphis* sp. on bamboo; Manipur Doherty; West Bengal, Kurseong Inde Verschraeghen 1904; Uttar Pradesh, Mandal 14 and 16.vi.1985 CIE A18126, A18353, A18525 and A19776.

Bielawski (1972) described this species from Likhu Khola Tal and Jiri, Nepal.

Comments

Notes on the separation of this and the following species are given below.

Calvia championorum sp. nov.

(Figs 33–36, 42)

Length 6.5–8.0 mm, 5.5–6.5 mm broad, only weakly convex dorsally, sides of pronotum and elytra explanate. Upperparts dull yellow to brownish-yellow, sometimes elytra with weak suggestion of paler longitudinal stripes, one adjacent to suture, one discal, one sublateral; pronotum with very weakly suggested browner M-shaped mark medially; underside and mouthparts, especially metasternum, slightly darker brownish-yellow, mes- and metepisterna and epimera paler yellow than metasternum; claws and apices of mandibles alone darker brown.

Head with frons very finely punctured, punctures separated by 2–4 diameters, but slightly coarser adjacent to eyes, intervals with fine reticulate microsculpture. Pronotum with punctation and sculpture similar to that on frons, punctures slightly more coarse adjacent to side margins. Elytral punctation on disc moderately fine but uneven, punctures separated by c. 1.5–3 diameters, largest punctures at most twice diameter of smallest, all punctures coarser laterally and apically; intervals slightly dull to shining, somewhat irregular, with weak to obsolete reticulation or with weak surface bloom apparent at higher magnification ($\times 80$).

Prosternal process convex, with weak to almost obsolete carinae restricted to basal region of process. Sterna very sparsely and finely punctured. Meso- and metatibiae with pair of apical spurs. Abdomen finely, sparsely and more or less evenly punctured, shining with rather obsolete microsculpture. Male with fifth visible sternite truncate, sixth clearly notched medially; female with fifth and sixth visible sternites entire.

Male genitalia (Figs 33–36), median lobe slender in ventral view, siphon swollen at base of apical third with pair of wings well developed, apex with two pairs of slender sclerotized rods. Female genitalia (Fig. 42), cornu slender, sperm duct short, leading to well-developed sclerotized area at base of bursa.

Type material

HOLOTYPE ♂, **India:** Uttar Pradesh, S. Garhwal, Kumaon, 6500 ft H. G. Champion / G. C. Champion B.M. 1927–409.

PARATYPES 4 ♂♂, 14 ♀♀, **India:** 4 ♀♀, same data as holotype; 1 ♂, 1 ♀, Uttar Pradesh, Nainital Division, Kumaon Sept. 1917 H. G. Champion; 2 ♂♂, 7 ♀♀, Uttar Pradesh, W. Almora Division, Kumaon, June, August 1917, and undated H. G. Champion; 2 ♀♀, Uttar Pradesh, Gori Valley, Kumaon, 7000 ft H. G. Champion; 1 ♂, Uttar Pradesh, U. Gumti Valley, W. Almora Division April 1919 H. G. Champion.

Etymology

This species is named for father and son, G. C. and H. G. Champion.

Comments

This species is very similar to *Calvia albida* Bielawski externally, but the two species are readily separable by their genitalia. In *C. albida*, the elytral punctation is generally rather more even although some specimens scarcely differ in punctation from *C. championorum*; the elytra of the former also have a weak mottled pattern of small either slightly paler or slightly darker spots against the pale yellow background colour. In *C. albida*, the prosternal process is convex, entirely lacking carinae, and the apex of the sixth visible tergite of the male is only weakly emarginated, not distinctly notched medially. Notes on the separation of *C. championorum* and *C. flaveola* are given under the latter species.

Calvia flaveola sp. nov.

(Figs 15, 37–40, 43)

Length 5.7–6.6 mm, 5.0–5.5 mm broad, only weakly convex dorsally, sides of pronotum and elytra explanate (Fig. 15), but less strongly so than in *C. championorum*, body form proportionally slightly narrower than *C. championorum*. Upper parts pale yellow to brownish-yellow, sometimes elytra with three broad brighter yellow stripes, one adjacent to suture, one discal, one sublateral, the sutural and sublateral stripes joined at apex. Underside pale yellow, metasternum usually slightly browner.

Head with frons finely punctured, punctures separated by 1.5–3 diameters, intervals with fine reticulate microsculpture. Pronotal punctures fine, separated by 1.5–3 diameters, intervals with reticulate to weakly transverse microsculpture on disc, but becoming obsolete laterally where surfaces are more shining. Elytral punctation on disc somewhat uneven with a mixture of various sized punctures separated by c. 1–3 diameters, largest punctures about twice diameter of smallest, all punctures coarser laterally, intervals generally shining, without reticulate microsculpture, but a weak surface bloom sometimes visible at high magnification ($\times 80$).

Prosternal process convex basally, flatter apically, with well-developed prosternal carinae extending anteriorly to middle of prosternum. Sterna very sparsely and finely punctured. Meso- and metatibiae with pair of apical spurs. Male with fifth visible sternite truncate, sixth with broad notch medially; female with fifth and sixth visible sternites entire.

Male genitalia (Figs 37–40), median lobe slender in ventral view, narrow apical portion shorter than in *C. championorum*, siphon swollen at base of apical third, with well-developed pair of wings, apical region with stout ventral sclerotized base and pair of curved dorsal rods. Female spermatheca (Fig. 43), cornu slender, sperm duct short with relatively large, weakly sclerotized area at base of bursa copulatrix.

Type material

HOLOTYPE ♂, **India**: Uttar Pradesh, Joshimath 3.iv.1984 N. Debnath / Sp. b160, assoc. with aphids, CIE A17293/ Pres. by Comm. Inst. Ent. B.M. 1985–1.

PARATYPES 8 ♂♂, 13 ♀♀, 18 unsexed: 4 ♂♂, 6 ♀♀, 12 unsexed, **Pakistan**: Punjab, Murree Hills, Thobba, undated or vi.1888 H. Roberts; 1 ♀, Punjab, Khyra Gully H. Roberts; 2 ♂♂, 4 unsexed, **India**: Uttar Pradesh, Kumaon, W. Almora H. G. Champion; 1 ♀, 1 unsexed, Uttar Pradesh, Joshimath 17.vi.1990 IIE A21302, pred on *Macrosiphoniella pseudoartemisiae* on *Artemisia vulgaris*; 2 ♀♀, Uttar Pradesh, Joshimath 4.v.1985 CIE A17174, assoc. with aphids; 1 unsexed, N.W. Province H. E. Andrewes; 1 ♀, Jammu and Kashmir, Anantnag vi.1942 A. P. Kapur, on walnut aphids; 1 ♂, 1 ♀, Kashmir Valley 20.vii.1983 CIE A15632, pred aphids on walnut; 1 ♀, India CIE A12459; 1 ♂, **Burma**: Haka, Chin Hills, U. Burma 1.viii.1910 F. E. Venning.

Etymology

The specific name is from the Latin diminutive *flaveolus* (yellow) and refers to the colour of the species.

Comments

This species is very similar to, but generally smaller than *C. championorum* and *C. albida*. Its size, slightly narrower body form and more shiny appearance will generally separate it from most examples of *C. championorum* and *C. albida*, but individual variation in all three species precludes the use of these as good key characters. The presence of prosternal carinae will separate it from all *C. albida*, but not always from *C. championorum*. The male and female genitalia provide reliable separation of all three species.

Acknowledgements

I am grateful to R. D. Gordon (USDA, c/o United States National Museum, Washington), M. Uhlig (Museum für Naturkunde, Humboldt-Universität, Berlin), S. A. Ślipiński and T. Huflejt (Polska Akademia Nauk, Instytut Zoologii, Warsaw) and M. Brancucci (Naturhistorisches Museum, Basel) for the loan of type and other material, and to W. A. Foster and G. MacGavin for permission to examine material in the University of Cambridge Zoology Museum and the Oxford University Museum respectively. Space and facilities during this study were kindly provided by the Department of Entomology, The Natural History Museum, London. I also wish to thank my colleague G. J. du Heaume for the habitus drawings.

References

- AGARWALA, B. K. and GHOSH, A. K., 1988, Prey records of aphidophagous Coccinellidae in India. A review and bibliography, *Tropical Pest Management*, **34**, 1–14.
- BELICEK, J., 1976, Coccinellidae of western Canada and Alaska with analyses of the transmontane zoogeographic relationships between the fauna of British Columbia and Alberta (Insecta: Coleoptera: Coccinellidae), *Quaestiones Entomologicae*, **12**, 283–409.

- BIELAWSKI, R., 1963, Beiträge zur Kenntnis der Coccinelliden von Afghanistan. III, *Lunds Universitets Årsskrift* (N.F. 2), **59**(4), 1–21.
- BIELAWSKI, R., 1972, Die Marienkäfer (Coleoptera: Coccinellidae) aus Nepal, *Fragmenta Faunistica*, **18**, 283–312.
- BIELAWSKI, R., 1979, Ergebnisse der Bhutan-Expedition 1972 des Naturhistorischen Museums in Basel Coleoptera: Fam. Coccinellidae, *Entomologica Basiliensia*, **4**, 83–125.
- BOOTH, R. G. and POPE, R. D., 1989, A review of the type material of Coccinellidae (Coleoptera) described by F. W. Hope, and by E. Mulsant in the Hope Entomological Collections, Oxford, *Entomologica Scandinavica*, **20**, 343–370.
- CROTCH, G. R., 1874, *A revision of the coleopterous family Coccinellidae* (London: E. W. Janson), 311 pp.
- GEBLER, F., 1832, Notice sur les Coléoptères qui se trouvent dans le district des mines de Nertchinsk, dans la Sibérie orientale, avec la description de quelques espèces nouvelles, *Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou*, **2**, 23–78.
- GORDON, R. D., 1985, The Coccinellidae (Coleoptera) of America north of Mexico, *Journal of the New York Entomological Society*, **93**, 1–912.
- GORDON, R. D., 1987, A catalogue of the Crotch collection of Coccinellidae (Coleoptera), *Occasional Papers on Systematic Entomology*, **3**, 1–46.
- HOPE, F. W., 1831, Synopsis of the new species of Nepal insects in the collection of Major General Hardwicke, in J. E. Gray, *The Zoological Miscellany* (London), pp. 21–32.
- IABLOKOFF-KHNZORIAN, S. M., 1979, Genera der paläarktischen Coccinellini (Coleoptera. Coccinellidae), *Entomologische Blätter für Biologie und Systematik der Käfer*, **75**, 37–75.
- IABLOKOFF-KHNZORIAN, S. M., 1982, *Les Coccinelles Coléoptères-Coccinellidae* (Paris: Boubée), 568 pp.
- KANERVO, V., 1946, Tutkimuksia lepän lehtikuoriaisen, *Melasoma aenea* L. (Col., Chrysomelidae), luontaisista vihollisista, *Annales Zoologici Societatis Zoologicae Botanicae Fennicae Vanamo*, **12**(3), 1–206.
- KAPUR, A. P., 1963, The Coccinellidae of the third Mount Everest expedition, 1924 (Coleoptera), *Bulletin of the British Museum (Natural History) Entomology*, **14**, 1–48.
- KORSCHESKY, R., 1932, Fam. Coccinellidae, *Coleopterorum Catalogus*, pars **120**, 225–659.
- KORSCHESKY, R., 1940, Vier neue Coccinelliden der Alten Welt, *Entomologische Blätter für Biologie und Systematik der Käfer*, **36**, 1–3.
- LINNAEUS, C., 1758, *Systema Naturae*. Editio decima (Holmiae), 824 pp.
- MADER, L., 1932, Zur Kenntnis einiger Coccinelliden, *Entomologischer Anzeiger*, **12**, 5–7.
- MIYATAKE, M., 1985, Coccinellidae collected by the Hokkaido University Expedition to Nepal Himalaya, 1968 (Coleoptera), *Insecta Matsumurana* (New series), **30**, 1–33.
- MULSANT, E., 1846, *Histoire naturelle des coléoptères de France. Sulcicolles.—Sécouripalpes*. (Paris: Maison), 280 pp.
- MULSANT, E., 1850, Species des coléoptères trimères sécouripalpes, *Annales des Sciences Physiques et Naturelles, d'Agriculture et d'Industrie, Lyon* (2), **2**, 1–1104.
- MULSANT, E., 1853, Supplément à la monographie des coléoptères trimères sécouripalpes, *Annales de la Société Linnéenne de Lyon* (N.S.), **1**, 129–333.
- PAWAR, A. D. and PARRY, M., 1989, Record of natural enemies of important fruit pests in Ladakh (J & K), *Indian Journal of Plant Protection*, **17**, 291–292.
- PHALOURA, S. P. S. and SINGH, T., 1991, Coccinellid (Coleoptera) fauna associated with Indian alder *Alnus nepalensis* D. Don., *Uttar Pradesh Journal of Zoology*, **11**, 79–80.
- SASAJI, H., 1985, *Family Coccinellidae*, No. 26 of *Check-list of Coleoptera of Japan* (Tokyo: The Coleopterists' Association of Japan), 24 pp.
- SINGH, K. C. and SINGH, T. K., 1985, Aphidophagous coccinellids of North Eastern India: Manipur-1, *Entomon*, **10**, 291–295.
- STOLYAROV, M. V., SUGONJAEV, E. S. and UMAROV, S. A., 1974, [Dynamics of a cotton field arthropod community in northern Afghanistan (the case for an integrated control program for cotton pests). 1], *Entomologicheskoe Obozrenie*, **53**, 245–257. [In Russian, English translation in *Entomological Review*, **53**(2), 1–10]
- WADHI, S. R. and PARSHAD, B., 1980, Some new records of Coccinellidae from Nepal Himalayas, *Bulletin of Entomology*, **21**, 144–147.
- WADHI, S. R. and PARSHAD, B., 1982, Some new records of Coccinellidae from Sikkim State, *Bulletin of Entomology*, **23**, 5–8.
- WEISE, J., 1908, Coleopteren aus Ostindien, *Stettin Entomologische Zeitung*, **69**, 213–230.