

**A new species of *Cephaloleia* from Panama with description of larva and first record of orchid-feeding in *Cephaloleiini* (Coleoptera: Chrysomelidae: Cassidinae)**

Lukáš SEKERKA<sup>1)</sup>, Donald WINDSOR<sup>2)</sup> & Charles L. STAINES<sup>3)</sup>

<sup>1)</sup>Department of Zoology, Faculty of Science, University of South Bohemia, Branišovská 31, CZ-370 05, České Budějovice, Czech Republic, e-mail: sagrinae@seznam.cz

<sup>2)</sup>Smithsonian Tropical Research Institute, MRC 0580-12, Apartado 0843-03092, Panamá, República de Panamá, e-mail: windsord@si.edu

<sup>3)</sup>Department of Entomology, MRC 187, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013-7012, U.S.A., e-mail: staines@si.edu

**Abstract.** *Cephaloleia orchideivora* sp. nov. is described and figured from Panama including larva, host plants and biology. This is the first *Cephaloleia* species known to be associated with Orchideaceae.

**Keywords.** Coleoptera, Chrysomelidae, entomology, taxonomy, new species, host plant, Orchideaceae, Panama, Neotropical Region

### Introduction

The genus *Cephaloleia* Chevrolat, 1837 is one of the most speciose genera in Cassidinae having 201 described species (STAINES 2011). *Cephaloleia* is a purely Neotropical genus distributed from Mexico to subtropical Argentina. Most species are associated with Zingiberales (mainly the families Heliconiaceae and Maranthaceae). Other plant families utilized include Arecaceae, Bromeliaceae, Costaceae, Poaceae and Zingiberaceae. The associations between *Cephaloleia* beetles and their host plants have been reviewed in several recent papers: STAINES (2004), MCKENNA & FARRELL (2005), MESKENS et al. (2008, 2011), GARCÍA-ROBLEDO et al. (2010, 2013, in print). Countries with highest species richness include Brazil (72 species), Costa Rica (61 species), Panama (57 species) (STAINES 2011), the latter two representing diversity hot spots for neotropical Zingiberales (MCKENNA & FARRELL 2006). Mesoamerican *Cephaloleia* species were revised by STAINES (1996) and larvae of five species were described

by MAULIK (1932)<sup>1)</sup> and GARCÍA-ROBLEDO et al. (2010). During our studies of Panamanian Cassidinae we discovered a new *Cephaloleia* species which is a feeding associate of at least four species of Orchideaceae and thus represents a novel and undescribed feeding association for the genus as well as the entire subfamily. The description of the adult and larva, and aspects of the biology and ecology are given below.

### Material and methods

Adults and larvae were collected from sampled plants and were studied using methods of standard comparative morphology. All given label data are in their original spelling; a vertical bar (|) separates data on different rows, a double vertical bar (||) separates different labels. Additional information about the label or explanatory notes are given in the square brackets.

Photos of adult specimens (Figs 1–3) were taken using Leica S8Apo stereomicroscope with Leica 10447367 0.63× photo tube with Nikon Coolpix 4500 and Nikon MDC Lens as 15–20 separate images and then composed in Helicon Focus software. Figures 8–11 were taken using Wild MP5 stereomicroscope; 12–13 with Nikon Eclipse E600 compound microscope and with Nikon DS-Ri1; 14–16 and 19 with Zeiss EVO 40 Scanning Electron microscope; 17–18 with Olympus Fluoview FV 1000 confocal microscope.

Larvae used for description were cleared in KOH and slide mounted. Measurements were taken with an ocular micrometer mounted in a 10× Wild Stereoscope eyepiece and cross calibrated with either a Hope 6in steel precision scale (0.5 mm) or a Swift Objective micrometer (0.01 mm).

Studied specimens are deposited in the following collections:

|      |  |
|------|--|
| BMNH | Museum of Natural History, London, United Kingdom;                                   |
| DBET | Department of Biodiversity and Evolutionary Taxonomy, University of Wrocław, Poland; |
| DWCP | Donald Windsor voucher collection, Ciudad de Panamá, República de Panamá;            |
| LSCL | Lukáš Sekerka collection, Liberec, Czech Republic;                                   |
| NMPC | National Museum, Prague, Czech Republic;   |
| STRI | Smithsonian Tropical Research Institute, Ciudad de Panamá, República de Panamá;      |
| UPPC | University of Panama, Ciudad de Panamá, República de Panamá;                         |
| USNM | National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA.  |

<sup>1)</sup> MAULIK (1932) described larvae of two species, *C. belti* Baly, 1885 and *C. mauliki* Uhmann, 1930, however the larva of the former belongs to a *Chelobasis* species as it has explanate margin above head divided into two flaps (GARCÍA-ROBLEDO et al. 2010). This character is typical for the tribe Arescini and we know of no Cephaloleiini larvae with such a division. For a proper description of *C. belti* larva see GARCÍA-ROBLEDO et al. (2010). The figure and description given by MAULIK (1932) thus belongs either to *Chelobasis perplexa* (Baly, 1858) or *Ch. bicolor* Gray, 1832. MAULIK (1933) described another onisciform larva from Costa Rica and attributed it just to *Cephaloleia*. According to the description it is definitely a Cephaloleiini larva but it would be difficult to place it even to genus as no biological information was given and larvae of relatively few Cephaloleiini species are well described.

## Results

### *Cephaloleia orchideivora* sp. nov.

**Type material.** HOLOTYPE, ♂, glued: 'PANAMA: Chiriqui | LaFortuna; 1200m | 8°45'N; 82°15'W | 12 - V [handwritten] -199[printed]7[handwritten] | D.M. Windsor [white, printed and cardboard label]' (USNM). PARATYPES: PANAMA: Chiriquí: 2 paratypes, glued: with same label as holotype, one with following additional label 'ex. Elleanthus | Orchidac. [white, handwritten and cardboard label]' (DWCP); paratype, glued: 'PANAMA: Chiriqui | LaFortuna; 1200m | 8°45'N; 82°15'W | 20 - I [handwritten] -199[printed]7[handwritten] | D.M. Windsor [white, printed and cardboard label]' (DWCP); paratype, glued: 'PANAMA: Chiriqui | La Fortuna, 9-1100m | Rio Hornito Trail | 8°45'N, 82°14'W | 15 - II [handwritten] -199[printed]8[handwritten] | D.M. Windsor [white, printed and cardboard label] || Orchid [white, handwritten and soft label]' (DWCP); 2 paratypes, glued: 'PANAMA, Chiriqui | Fortuna, Rio Hornito | Tr, N 8 47', W 82 13' | 1100m, 21-vii-2009 | D Windsor; L Sekerka [white, printed and cardboard label] || ex Elleanthus | Orchidac. [white, handwritten and soft label]' (DWCP); paratype, in ethanol: 'Epidendrum werkli | 21 VII 09 CRH [= Camino Rio Hornito] [white, handwritten and cardboard label]' (DWCP); paratype, glued: 'PANAMA Chiriquí prov. | La Fortuna - Rio Hornito trail | 8°47'N, 82°13'W, 1100 m | cloud forest 21.vii.2009 | ORCH: Epidendrum sp. | L. Sekerka & D. Windsor lgt. [green, printed and cardboard label]' (LSCL); 10 paratypes, glued and one in ethanol: 'PANAMA: Chiriqui | La Fortuna, 9-1100m | Rio Hornito Trail | 8°45'N, 82°14'W | 12 - II [handwritten] -199[printed]2010[handwritten] | D.M. Windsor [white, printed and cardboard label]' (DWCP, UPPC); 5 paratypes, glued: 'PANAMA Chiriquí prov. | La Fortuna: Rio Hornito | 8°42.58'N, 82°13.48'W, 1180 m | montane forest | ORCH: Epidendrum wercklei | L. Sekerka lgt. 3.-4.x.2010 [green, printed and cardboard label]' (BMNH, LSCL, NMPC); paratype, in ethanol: 'PANAMA, CHIRIQ | Quijada, Fortuna | 1200 m., | Windsor-200[printed]1-AG-5 | ex. orchid [white, handwritten and cardboard label with black frame]' (DWCP); 3 paratypes, glued: 'PANAMA Chiriquí prov. | La Fortuna: Quijada del Diablo | 8°42.07'N, 82°13.36'W, 1200 m | montane forest | ORCH: Epidendrum wercklei | L. Sekerka lgt. 5.ix.2010 [green, printed and cardboard label]' (LSCL); 3 paratypes, glued: 'PANAMA Chiriquí prov. | La Fortuna: Quijada del Diablo | 8°42.07'N, 82°13.36'W, 1200 m | montane forest | ORCH: Epidendrum wercklei | L. Sekerka lgt. 8.ix.2010 [green, printed and cardboard label]' (LSCL); paratype, glued: 'PANAMA Chiriquí prov. | La Fortuna: Quijada del Diablo | 8°42.07'N, 82°13.36'W, 1200 m | montane forest | ORCH: Epidendrum wercklei | L. Sekerka lgt. 7.x.2010 [green, printed and cardboard label]' (LSCL). BOCAS DEL TORO: paratype, in ethanol: 'PANAMA, Bocas d T | Palo Seco Tr. Km 63 | 8 48' N; 82 13' W | 18 ix 2008 | D Windsor; L Sekerka [white, printed and cardboard label]' (DWCP); paratype, in ethanol: 'Panama | B.d.T. | 900 m | 3 II 2007 | D.W. | Cephaloleia | irregularis [white, handwritten and cardboard label]' (DWCP). COCLÉ: paratype, glued: 'Panamá: Coclé Prv. | 9-1000m, Caracoral | 8°37'N, 80°7'W; | 27 March 1993 | D.M. Windsor [white, printed and cardboard label]' (LSCL); paratype, glued: 'PANAMA: Cocle Prv. | La Mesa ab. El Valle | Cerro Caracoral | 15 Nov 92; el. 850 m | col. H. Stockwell [white, printed and cardboard label]' (DWCP). PANAMÁ: two paratypes, glued: 'PANAMA Panamá prov. | PN Chagres: Cerro Jefe | 9°13.7'N, 79°23.0'W, 950 m | montane forest | ORCH: Epidendrum sp. | L. Sekerka lgt. 22.x.2010 [green, printed and cardboard label]' (LSCL); paratype, glued: 'Cerro Campana, 800 m | Panamá Prov., R. P. | 29 Apr. '70 [handwritten] | H. P. Stockwell [white, printed and cardboard label] || ♀ [white, printed and cardboard label]' (USNM).

**Larval material.** Larvae were collected from three different sites (Quijada del Diablo, El Vivero and Samudio Trail), all between 1100 and 1200 m elevation in the La Fortuna Reserve. One mature larva (21.vii.2009, DWCP) and two mature and four younger instars (5.ix.2010, LSCL and DBET) were collected from these sites and preserved in ethanol. One mature larva collected on Cerro Jefe (22.x.2010, DWCP) and one recently emerged, first instar larva from Quijada del Diablo (23.xii.2012, DWCP) were cleared in KOH and slide mounted.

**Adult diagnosis.** The new species is most similar to *Cephaloleia irregularis* Uhmann, 1930 described from a mountainous locality, Coronado (1400–1500 m), Limón province, Costa Rica. *Cephaloleia orchideivora* sp. nov. differs by the mostly regularly punctate elytra (irregularly in *C. irregularis*), the completely yellow and broad explanate margin of elytra (narrow and

dark metallic brownish-green in *C. irregularis*), the anterior margin of pronotum emarginate (straight in *C. irregularis*), and the pronotum with triangular metallic spot (reverse V-shaped in *C. irregularis*).

**Description of adult.** Measurements (n = 16): length of body 5.48–6.89 mm (mean 6.20 mm), width of body 2.41–3.11 mm (mean 2.69 mm), length/width of body ratio 2.14–2.42 (mean 2.31), length of pronotum 1.06–1.37 mm (mean 1.23 mm), width of pronotum 1.55–2.08 mm (mean 1.82 mm), width/length of pronotum ratio 1.43–1.53 (mean 1.48). Body elongate-oval and subconvex (Figs 1, 3).

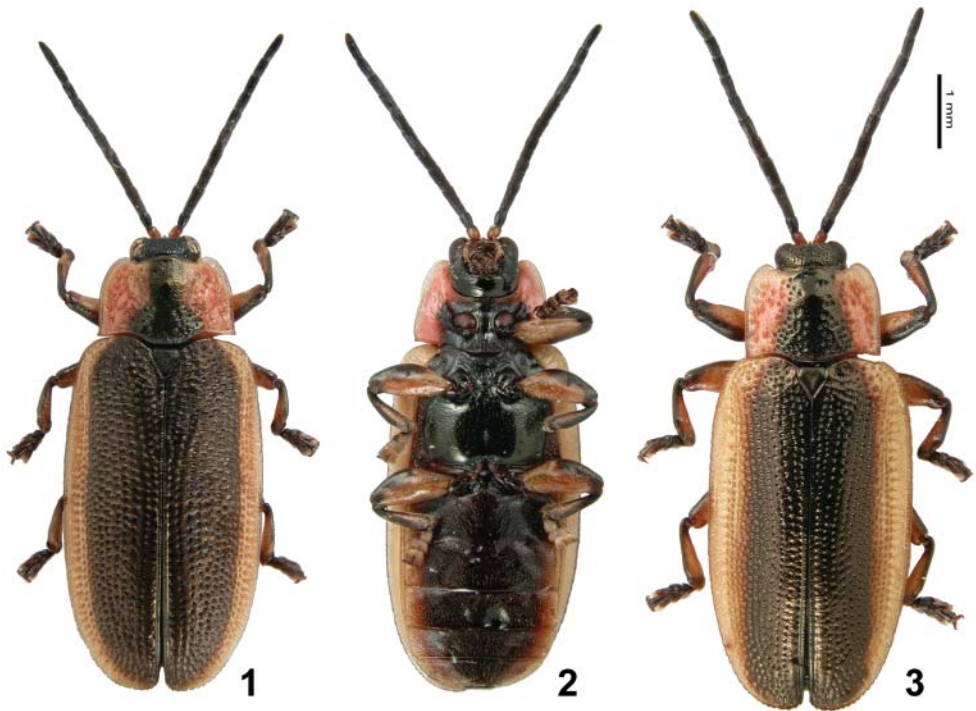
Head metallic olive-green sometimes with bluish or violet reflection. Mouthparts, antennal insertions and first antennomere rust-colored, remaining antennomeres black. Pronotum yellow (dry specimens) to pink (live and ethanol preserved specimens) with large triangular olive-green spot along midlength reaching to basal and apical margins. The spot is usually with more or less distinct lateral emargination. Scutellum and elytral disc olive-green, explanate margin yellow to penultimate interspace. Thorax mostly black with episterna brownish or yellowish. Abdomen brown-black variegated with distinct broad yellow outer margin. Coxa rust-colored, trochanters pitchy-brown, tibia and femur internally yellow and externally black, tarsi black.

Pronotum transverse, 1.5 times broader than long, anterior margin deeply emarginate behind head, emargination in the middle convex. Anterior angles of pronotum broadly rounded, lateral margins almost parallel-sided, slightly widened in the basal third in some specimens. Tubercle with sensilla situated in corners of anterior emargination. Disc of pronotum coarsely and sparsely punctate with large shiny impunctate areas. Punctures deeply impressed, foveolate. Lateral margin only slightly explanate, distinctly separated from disc by deep impression and extreme outer margin swollen. Surface smooth and shiny, area with metallic spot distinctly micro-reticulate.

Scutellum subpentagonal, smooth, impunctate and micro-reticulate.

Elytra feebly convex, flat. Elytral base slightly sinuate, broader than base of pronotum. Humeral angles broadly rounded. Punctuation coarse and sparse, mostly regular. Punctures deeply impressed and foveolate. Scutellar row very long, extending to basal fourth. Scutellar row and rows 1–5 and 8–10 regularly arranged in rows, 7 and 8 with numerous confused punctures on lateral slope. Between rows 7 and 8 there is an additional, more or less regular, row of punctures extending from about midlength of elytra to the apex. Interspaces between puncture rows narrow, 0.5–1.0 times as wide as puncture diameter. Intervals broad, 1–2 times wider than puncture diameter, second interval widest, about 4 times wider than puncture diameter. Surface of intervals and interspaces smooth, shiny and micro-reticulate. Punctuation gradually coarser from suture to lateral rows. Row 10 twice as coarse as remaining lateral rows. Lateral margin of elytra distinctly explanate, as broad as 1/6 of elytron, slightly declivous. Its surface smooth, shiny and micro-reticulate, sometimes with 1–3 isolated punctures in basal fourth, otherwise impunctate. Extreme outer margin slightly swollen, distinctly serrate, particularly in apical fifth. Denticles obsolete, with short seta on tip. Apex of epipleura bare.

Vertex of head densely and coarsely punctate, punctures along the middle have tendency to form short striae. Frons impunctate but distinctly micro-reticulate. Clypeus very short, typical for *Cephaloleia*. Eyes normal, gena well visible. Antennae, long, filiform, moderately thick



Figs 1–3. *Cephaloleia orchideivora* sp. nov. 1 – dorsal aspect (Chiriquí population); 2 – ventral aspect; 3 – dorsal aspect (Cerro Jefe population).

and reaching beyond humerus. Pedicel and scapus cylindrical, smooth and shiny, only sparsely pubescent; remaining antennomeres elongate, densely setose and micro-reticulate. Third antennomere 2.3 times longer than second and 1.5 times than fourth. Terminal antennomere 1.6 times longer than 10th with rounded apex. Length ratio of antennomeres: 100 : 111 : 257 : 175 : 167 : 150 : 155 : 147 : 152 : 133 : 217. Prosternal process broad, between coxae smooth and shiny with deep sulcus along midlength, apex broadly explanate, micro-reticulate and with 7–9 sulci. Mesothorax smooth, micro-reticulate. Metathorax mostly smooth and shiny, its surface appears polished and with several punctures situated basolaterally, each puncture with moderately long golden seta. Metepisterna coarsely punctate. Abdomen finely and densely punctate and covered with adherent setae. Suture between abdominal sternite 1 and 2 complete. Last visible sternite slightly emarginate in male and deeply emarginate in female.

Legs short, robust, claws divergent and simple.

**Variability of adults.** Individuals from the Chiriquí population (Fig. 1) are relatively uniform with minor variability present only in the shape and size of the pronotal spot and elytral serration. Some specimens have denticles very obsolete (visible only under higher magnification) thus the margin appears nearly smooth. On the other hand some specimens, particularly those from central Panama, have distinctly serrate outer margin of elytra.

Specimens from central Panama (Fig. 3) (Cerro Campana, Cerro Caracoral and Cerro Jefe) also differ in slightly coarser punctation overall, pronotal spot always triangular and large, lateral sides of elytra yellow to 8<sup>th</sup> row, slightly narrower pronotum and second antennomere slightly shorter. However, we consider these characters as intraspecific variability. Particularly, punctation and surface of elytra is quite often finer in west Panamanian casidine populations than in central and eastern.

**Etymology.** The specific epithet arises from the plant family Orchidaceae and Latin “*voro*” = feed.

**Egg.** The egg of *C. orchideivora* sp. nov. is light yellow, membranous, flat, semitransparent, 2.5 mm in length and 1.5 mm in width (n = 5) bearing no maternal adornments (Figs 4, 8).

**Larval diagnosis.** The larva of *C. orchideivora* sp. nov. can be distinguished from the four species described by GARCÍA-ROBLEDO et al. (2010) by the following character combination: dorsum medially ridged<sup>2)</sup>, lacking setae, prothorax with central and lateral areas shallowly rugose, prothorax carinate and venter shallowly rugose. One or two pairs of elongate, sclerotized plates, located medially on the prothorax (Fig. 12) distinguish *C. orchideivora* larvae from most if not all other *Cephaloleia* species. Degree of pigmentation in these structures is variable, darkening noticeably with age of first instar larva and reaching greatest density in the second instar. An additional pair of narrower, elongate sclerotized plates are present on the terminal tergite (fused abdominal segments 8 and 9) of most second-instar larvae. Larva of *C. mauliki* Uhmann, 1930 described by MAULIK (1932) lacks these plates and differs in stemmata arranged in one line of four and one line of two (two lines of three in *C. orchideivora*, Fig. 13) and mandibles sharply tridentate (shallowly quadridentate in *C. orchideivora*, Figs 14–15).

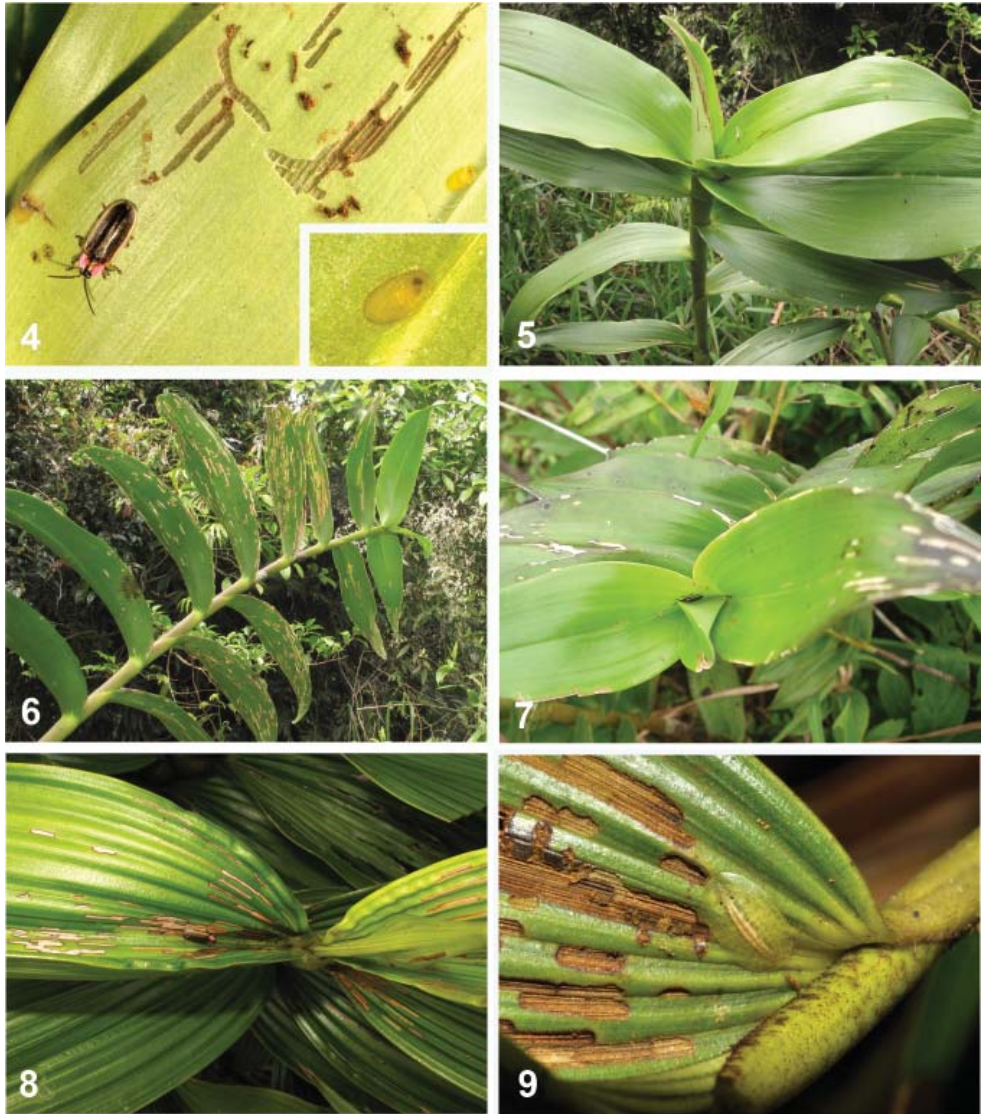
**Description of larva. Measurements.** Upon emergence from the egg and before feeding first instar larva measured 2.3 by 1.3 mm (length by width) (n = 1); older first instar larvae 4.1 by 2.2 mm (n = 3), and second instar larvae 7.9 by 4.4 mm (n = 3). Body of greatest width at abdominal segment 3.

**Color and size.** Recently emerged first instar largely translucent and without pigmentation, while older first instar larvae have two dull, cream-colored, longitudinal stripes flanking a transparent region (gut) extending longitudinally along the midline. Margins are largely translucent, venter entirely transparent. Second instar differs from first by having one or two elongate, darkly-pigmented areas on the dorsal surface of the prothorax and one on the final abdominal segment. The body of both live and fresh ethanol preserved specimens have two conspicuous pink longitudinal stripes extending from mid-prothorax to abdominal segment 6, and groups of darker, greenish cells near spiracles, yellowing toward the margin. Body color in older specimens white bordered by transparent fringe, dorsum shallowly rugose, with an elevated medial ridge. Older ethanol preserved larvae turns to white or creamy color.

---

<sup>2)</sup> This character is, however, possibly an artifact caused by dehydration. We have observed many *Cephaloleia* larvae and they would have such dorsal ridge only in case of low humidity. It is also caused sometimes by quick dehydration in absolute alcohol.





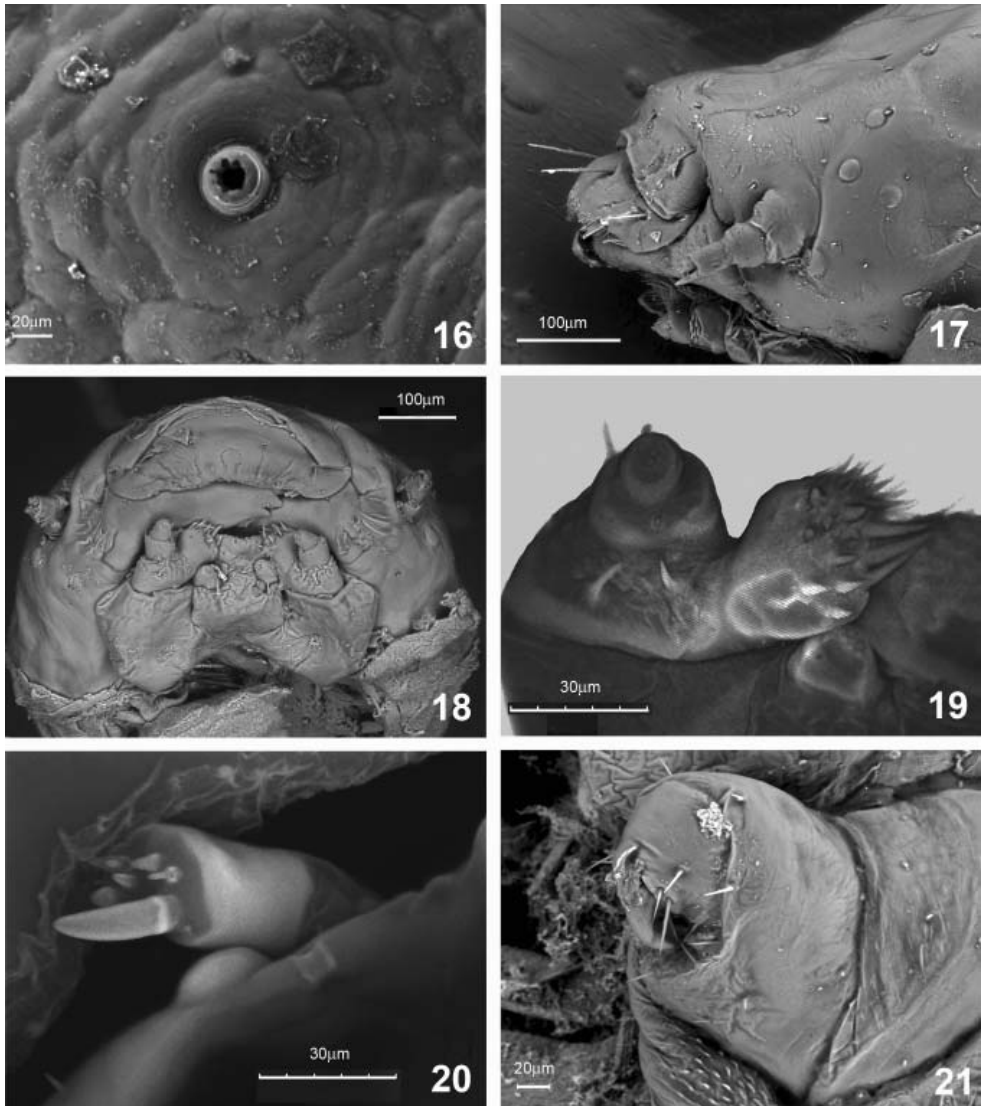
Figs 4–9. Host plants of *Cephaloleia orchideivora* sp. nov. 4 – adult, feeding damage and egg on *Oerstedella exasperata* leaf held for several days in a plastic container; 5 – *O. exasperata* with damaged semi-closed terminal leaf hiding adult specimen; 6 – *O. exasperata* showing massive damage by the beetle; 7 – *O. exasperata* with adult in typical position in the axil between first and second leaves; 8 – *Elleanthus* cf. *robustus*, apical new growth with adult specimen; 9 – larva on near axil of youngest leaf of *Elleanthus* sp. on Cerro Jefe.



Figs 10–15. Egg and larva of *Cephaloleia orchideivora* sp. nov. 10 – egg containing nearly fully developed larva on *Oerstedella* leaf; 11 – freshly emerged first instar larva, live and prior to feeding; 12 – second instar larva fully grown; 13 – dissected head of first instar larva showing the location and conformation of the stemmata; 14 – mandible dissected, embedded in Hoyers medium and viewed through a compound microscope; a fourth tooth, deeper in the preparation and less focused appears between the second and third teeth; 15 – lateral view of the opposing mandible and its shallowly lobed teeth and concave mesal surface. All scale bars equal to 1 mm.

**Dorsum.** Basal prothorax elevated medially, sloping evenly toward anterior margin, surface shallowly rugose and medially bearing fields of sclerotized nonpigmented or pigmented cells, divided by diagonal anterior carina, sparsely placed microsetae; lateral margins rugose, terminating in a membranous fringe composed of chitinous rods of uniform breadth, surface populated by numerous minute spinules and a smaller number of longer setae (cf. MAULIK 1932, for a more detailed description of the fringe). Meso- and metathoracic segments elevated medially, shallowly rugose with sparse microsetae. Abdominal tergites 1–8 without carinae, shallowly rugose, bearing sparsely placed microsetae. Spiracles (Fig. 16) annular with crenulate peritreme, located equidistant between median and margin. Eighth abdominal spiracle located near margin between tergites 8–9. Separation of tergites 8 and 9 indistinct, margin rounded apically.





Figs 16–21. Larva of *Cephaloleia orchideivora* sp. nov. 16 – first abdominal spiracle; 17 – lateral view of head (second instar); 18 – ventral surface of same head, maxilla, maxillary palps, labium and labial palps, antenna and clypeus (lacking setal fringe); 19 – maxilla; 20 – apical segment of the antenna; 21 – leg.

**Venter.** Surface of expanded segments smooth to shallowly tuberculate. Prothoracic spiracle opening to ventral surface between legs 1 and 2. Head (Figs 17, 18) surface smooth with 5 large and one small stemmata on each side; clypeus with surface smooth, basally with 4 long-stout setae and apically with margin densely fringed with short robust setae unequal in length; maxillary palp (Fig. 19) with two palpomeres, basal palpomere

with 2 isolated setae, apical palpomere with one lateral seta, terminating with 11 short sensillae; maxilla robust, clavate, with two stout setae at base of palpomere and apically fringed with setae unequal in length and stoutness; labium densely setose; labial palp with one palpomere, terminated by approximately eight short sensillae; antenna (Fig. 20) with three antennomeres, apical antennomere bearing one long, stout conical sensillum, seven short sensillae and one short seta. All thoracic and abdominal segments shorter than wide, surface smooth, concave and joined to adjacent segments by transverse sutures. Femur of leg (Fig. 21) wider and shorter than subconical tibiotarsus, the latter bearing one stout claw and 10 setae at apex.

**Comments on larval morphology.** The larva of *Cephaloleia orchideivora* (Figs 11, 12) conforms closely to the basic “onisciform” Cephaloleiini ground plan described first by MAULIK (1932) and later for four species by GARCÍA-ROBLEDO et al. (2010). The larva cuts a transverse slit in one end of the egg and exits without consuming any part of the chorion. Larval thoracic and abdominal segments are well defined, extended, laterally flattened and terminated by a continuous membranous fringe (laterally-fused setae) which appears to form a hermetic seal maintained between the larva, both active and resting, and its glabrous substrate. The prognathous head is strongly retracted and attached to the ventral surface of the prothorax and thereby is concealed from direct view at all times and from all angles. Three to four stemmata are visible in dorsal view through the cuticle of the prothorax of the first instar larva (Fig. 11). Due to increased thickness and pigmentation of the epidermis and more lateral presentation on the head, stemmata are usually not visible in dorsal view of the second instar larva (Fig. 12). However, by manipulating or dissecting the head from its ventral position, a cluster of 6 stemmata (one most ventral far smaller) is readily apparent on each side of the vertex (Fig. 13) just posterior to the base of the antenna in both first and second instar larvae. Mandibles (Figs 14, 15) are shallowly quadri-dentate with a widened concave mesal surface.

**Host plants.** Orchideaceae: *Elleanthus* cf. *robustus* (Rchb. f.) Rchb. f., *Elleanthus* sp., *Epidendrum werklei* Schltr., *Oerstedella exasperata* (Rchb. f.) Hågsater, *Oerstedella wallisii* (Rchb. f.) Hågsater.

**Ecological observations.** The species lives in montane cloud forests from 800 to 1200 m a.s.l. Most specimens were collected in the windy pass called ‘Quijada del Diablo’ where the Rio Hornito trail begins in the La Fortuna Reserve in Chiriquí Province, western Panama. The locality is characterized by sparse and shrubby forest with stands of terrestrial orchids including the three known host plants, *Elleanthus* cf. *robustus*, *Epidendrum werklei* and *Oerstedella exasperata*. Other terrestrial orchids present include *Epidendrum radicans* Lindl., *Oncidium* spp., and *Sobralia* spp., however, these were uniformly without feeding traces. The other localities where the new species was collected are Cerro Campana, Cerro Caracoral and Cerro Jefe, isolated mountains in central Panama where the vegetation is sparse, open and rather low. The label data from the specimen from Cerro Campana does not record any host plant or habitat.

Specimens from Cerro Jefe were feeding on a small *Epidendrum*-like epiphytic orchid growing about 4 m above ground level. While the plant was not flowering, it was clear from vegetative characters that it was distinct from either host plant species in Chiriquí. It

had distinct warts on leaf sheaths and reddish scales on stem, characters found in the genus *Oerstedella* Rchb. f. The stem was similar to *O. wallisii* which grows abundantly on Cerro Jefe, however, we cannot assign it with certainty as our plant was without flowers. Nearby, on another occasion we found larvae on an epiphytic *Elleanthus* species.

Larval feeding damage is similar to that of the adult and is mostly present as narrow strips, often but not always paralleling leaf venation in smooth-leaved orchids (Figs 4–7) or as broader strips in species with pleated leaves (Figs 8, 9). Adult beetles are mostly hidden in the terminal leaf or between the terminal leaf and the base of last fully exposed leaf (Fig. 7). During the night adults also feed on the open leaf surface and sometimes the damage can be massive (Fig. 6). Adults lay eggs singly along the mid-vein of the terminal semi-closed leaf. The larva feeds on the top surface of the second or third newest leaves and shelters at the semi-closed leaf base (Fig. 9) in all host plant species. As the leaf expands and opens the larva moves to feed on the next newer leaf.

**Distribution.** Panama (Bocas del Toro, Chiriquí, Coclé and Panamá provinces).

### Acknowledgements

We thank Panama's ministry of the environment (ANAM) for collecting (SE/AP-7-10) and export (SEX/AP-2-09) permission; to STRI for support in conducting field research. We also thank K. Silvera (STRI, Panama) for identification of the host plants; Duane McKenna (University of Memphis, USA) for photos of the *C. irregularis* holotype; and reviewers Lech Borowiec and Carlos García-Robledo for valuable comments improving the manuscript. The paper was supported by the grant no. 04-135/2010/P of the University of South Bohemia.

### References

- GARCÍA-ROBLEDO C., ERICKSON D. L., STAINES C. L., ERWIN T. L. & KRESS W. J. (2013): Tropical plant – herbivore networks: reconstructing species interactions using DNA barcodes. *PLOS One* **8**: e52967. doi:52910.51371/journal.pone.0052967.
- GARCÍA-ROBLEDO C., HORVITZ C. C. & STAINES C. L. 2010: Larval morphology, development, and notes on the natural history of *Cephaloleia* “rolled-leaf” beetles (Coleoptera: Chrysomelidae: Cassidinae). *Zootaxa* **2610**: 50–68.
- GARCÍA-ROBLEDO C., KUPREVICZ E. K., STAINES C. L., KRESS W. J. & ERWIN T. L., in press: Using a comprehensive DNA barcode library to detect novel egg and larval host plant associations in *Cephaloleia* rolled-leaf beetles (Coleoptera: Chrysomelidae). *Biological Journal of the Linnean Society*, DOI: 10.1111/bj.12115.
- MAULIK S. 1932: On the structure of larvae of hispine beetles. – II. *Proceedings of the Zoological Society of London* **1932**: 293–322.
- MAULIK S. 1933: On the structure of larvae of hispine beetles. – IV. *Proceedings of the Zoological Society of London* **1933**: 935–939.
- McKENNA D. D. & FARRELL B. D. 2005: Molecular phylogenetics and evolution of host plant use in the Neotropical rolled leaf ‘hispine’ beetle genus *Cephaloleia* (Chevrolat) (Chrysomelidae: Cassidinae). *Molecular Phylogenetics and Evolution* **37**: 117–131.
- McKENNA D. D. & FARRELL B. D. 2006: Tropical forests are both evolutionary cradles and museums of leaf beetle diversity. *Proceedings of the National Academy of Sciences of the United States of America* **103**: 10947–10951.
- MESKENS C., WINDSOR D. & HANCE T. 2008: A comparison of hispine beetles (Coleoptera, Chrysomelidae, Cassidinae) associated with three orders of monocot host plants in Lowland Panama. *International Journal of Tropical Insect Science* **27**: 159–171.

- MESKENS C., MCKENNA D., HANCE T., & WINDSOR D. 2011: Host plant taxonomy and phenotype influence the structure of a neotropical host plant-hispine beetle food web. *Ecological Entomology* **36**: 480–489.
- STAINES C. L. 1996: The genus *Cephaloleia* (Coleoptera: Chrysomelidae) in central America and the West Indies. *Revista de Biología Tropical, Special Publication* **3**: 1–73 + 14 pl.
- STAINES C. L. 2004: Cassidinae (Coleoptera, Chrysomelidae) and Zingiberales: a review of the literature. Pp. 307–319. In: JOLIVET P., SANTIAGO-BLAY J. A. & SCHMITT M. (eds): *New Developments in the Biology of Chrysomelidae*. SPB Academic Publishing, The Hague, The Netherlands, 803 pp.
- STAINES C. L. 2011: Catalog of the hispines of the World (Coleoptera: Chrysomelidae: Cassidinae). Online publication available from: [http://entomology.si.edu/Collections\\_Coleoptera-Hispines.html](http://entomology.si.edu/Collections_Coleoptera-Hispines.html) (last accessed November 2012).
- UHMANN E. 1930: Hispinen aus Costa Rica aus der Ausbeute des Herrn Ferd. Nevermann. 20. Beitrag zur Kenntnis der Hispinen (Col. Chrys.). *Folia Zoologica et Hydrobiologica* **1**: 209–256.