

***Carduelicoris stehliki*, a new genus and species of Pentatomidae  
(Hemiptera: Heteroptera) from Madagascar**

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KMENT P. 2013: *Carduelicoris stehliki*, a new genus and species of Pentatomidae (Hemiptera: Heteroptera) from Madagascar. In: KMENT P., MALENOVSKÝ I. & KOLIBÁČ J. (eds.): Studies in Hemiptera in honour of Pavel Lauterer and Jaroslav L. Stehlik. *Acta Musei Moraviae, Scientiae biologicae* (Brno) 98(2): 415–432. – *Carduelicoris stehliki* gen. et sp.nov. (Hemiptera: Heteroptera: Pentatomidae: Pentatominae) is described from Madagascar and placed in the tribe Halyini. The new genus differs markedly from all the remaining Madagascar representatives of the tribe by the produced, apically dentate humeral angles of the pronotum. The new taxon is dedicated to Jaroslav L. Stehlik, the doyen of the Czech and Slovak heteropterology, on the occasion of his 90th birthday. Diagnostic characters of the tribe Halyini are discussed.

**Keywords.** Heteroptera, Pentatomoidea, Halyini, new genus, new species, taxonomy, Madagascar

**Introduction**

The fauna of the superfamily Pentatomoidea (Hemiptera: Heteroptera) of Madagascar was monographed by CACHAN (1952), covering all families except Cydnidae. Madagascan Pentatomoidea received very little attention during the next fifty years, most of which was only a minor component of more widely conceived research. Concerning taxonomy, nomenclature and distribution of Pentatominae, LESTON (1953a), SCHOUTEDEN (1954), DAY (1965), ORIAN (1965), GREATHEAD (1968), LINNAVUORI (1973, 1975), COULLLOUD (1989), AHMAD (1995), RIDER (1998a, b, 2007), GÖLLNER-SCHIEDING (1999) and ŠTYS & EXNEROVÁ (2003) provided contributions on various topics. A few revisions devoted solely or partly to Madagascan taxa were published in recent years, documenting the reborn interest in the highly endemic heteropteran fauna of the island (KMENT 2008, 2011, 2012; KMENT & JINDRA 2009; FERRARI *et al.* 2010). Finally, ARNOLD (2011) attempted to erect a new genus, *Jostenicoris*, to accommodate the Afrotropical and Madagascan species of the Palaeotropical genus *Agaeus* Dallas, 1851 and placed in the tribe Strachiini, while the genus *Agaeus* s. str. as recognized by him is limited to the Oriental Region and in his opinion it belongs to the tribe Halyini. However, as ARNOLD (2011) failed to provide any description or definition of his new genus, *Jostenicoris* Arnold, 2011 remains unavailable name (see ICZN 1999: 13.1.1) and must be listed as a junior synonym of *Agaeus* being a *nomen nudum*.

In this paper I provide description of an additional new genus and species, one of the many necessary steps for compiling an updated monograph of Pentatomidae of Madagascar.

### Material and methods

In quoting the labels of the type specimens, a slash (/) is used to divide data on different rows of one label, a double slash (//) is used to divide data on different labels, authors' comments are given in square brackets [], and the following abbreviations are used: hw = handwritten, p = printed. Unless stated otherwise, the described labels are white.

The specimens examined are deposited in the following collections:

BMNH	.....	Natural History Museum, London, United Kingdom
MNHN	.....	Muséum national d'Histoire naturelle, Paris, France
MMBC	.....	Moravian Museum, Brno, Czech Republic
NMPC	.....	National Museum, Praha, Czech Republic

Measurements were taken from dry-mounted specimens under a MBS-10 stereomicroscope using an ocular micrometer. The following dimensions were measured: body length (from apex of mandibular plates to apex of membrane), head length (from apex of mandibular plates to anterior margin of pronotum), head width (maximum width across eyes), interocular width (between inner margins of compound eyes), length of each antennal segment (maximum length), pronotum length (medially in most exposed, anterodorsal view), pronotum width (maximum width between processes on humeral angles), scutellum length (medially from base to apex), scutellum width (maximum width at base), and abdomen width (maximum width across hypopleurites III).

Dissections of genitalia and all line drawings were made under a Leica MZ75 stereomicroscope with a camera lucida. Non-coated specimens were examined by Hitachi S-3700N environmental electron microscope at the Department of Paleontology, National Museum in Prague. Habitus photographs were taken using a Canon MP-E 65 mm macro lens attached to a Canon EOS 550D camera and stacked from multiple layers using the Helicon Focus 5.1 Pro software.

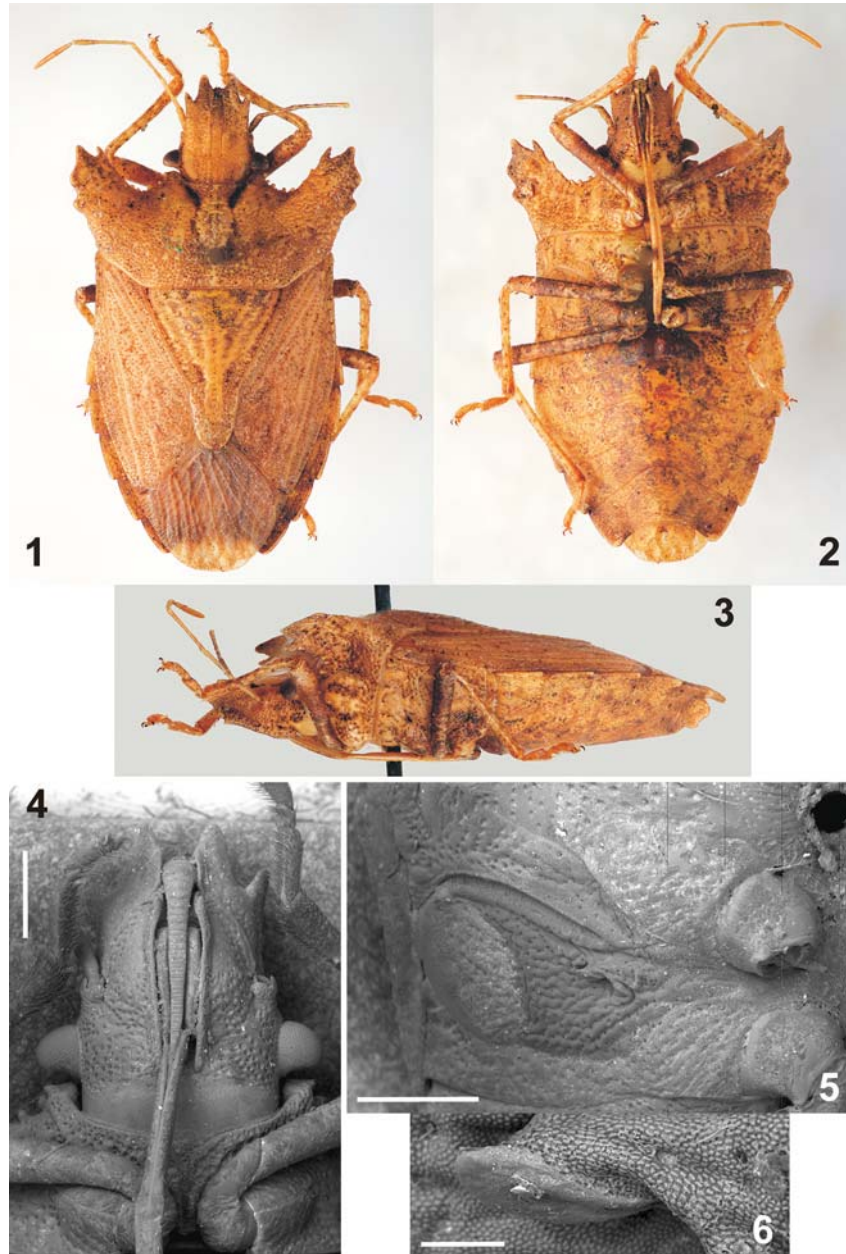
For the study of genitalia, specimens were softened in distilled water, and the male pygophore or female abdomen were removed under the stereomicroscope using sharp forceps, then put into concentrated solution of KOH and heated (but not as much as to boil). After the KOH treatment, the pygophore or abdomen were washed in distilled water and dissected under the stereomicroscope. The dissected phallus and female genitalia were subsequently stored in plastic microvials with glycerol attached to the same pin as the specimen. The general morphological terminology follows mostly TSAI *et al.* (2011); parts of the thoracic scent efferent system of the metathoracic scent glands are named in accordance with KMENT & VILÍMOVÁ (2010) and those of pygophore according to SCHAEFER (1977).

### Results

#### *Carduelicoris* gen.nov.

**Type species.** *Carduelicoris stehliki* sp.nov., by present designation.

**Description.** Body mostly parallel-sided with strongly prominent humeral angles (Figs 1–3).



**Figs 1–6.** *Carduelicoris stehliki* gen. et sp.nov. 1–3 – habitus of the male holotype (body length 15.4 mm) in dorsal (1), ventral (2) and lateral (3) view; 4 – head in ventral view (magnification 23 $\times$ ); 5 – meso- and metapleuron with the external scent efferent system of the metathoracic scent gland (magnification 30 $\times$ ); 6 – detail of peritreme and mycoid microsculpture of evaporatorium (magnification 250 $\times$ ). Scale bars: 1 mm (4, 5), 0.1 mm (6).

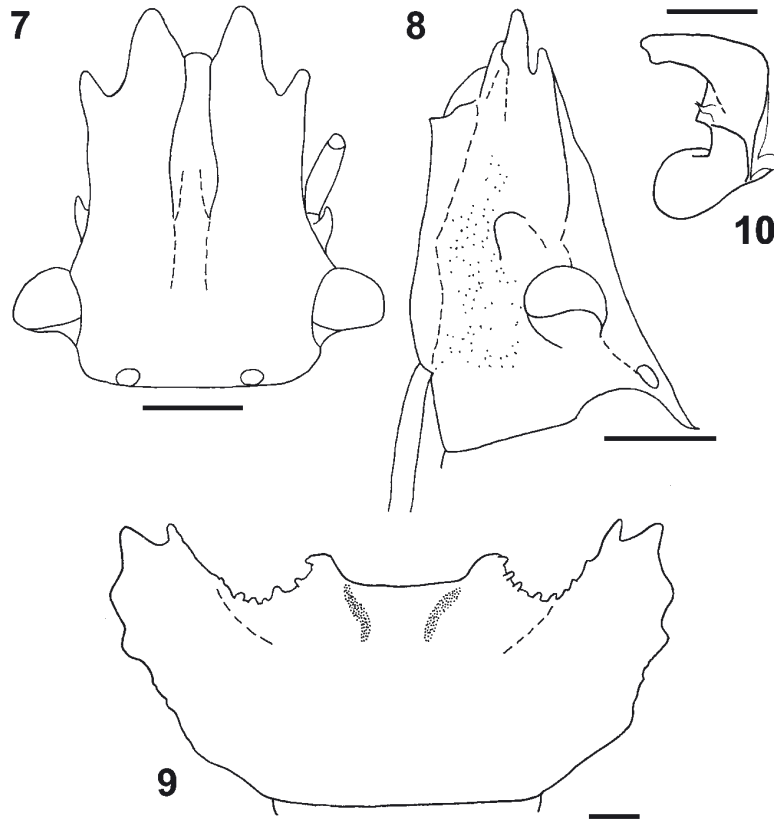
Head parallel-sided, compound eyes relatively small, conically protruding from head outline (Figs 1–2, 4, 7). Clypeus much shorter than mandibular plates, apically free (Fig. 7). Mandibular plates strongly, subtriangularly produced anteriorly of clypeus, obtusely rounded apically, anterolaterally with one additional subapical, pointed tooth-like projection, divided from the apical portion by a narrow U- to V-shaped incision (Figs 1, 4, 7). Ocelli small, situated much posteriorly of eyes, at the anterior margin of pronotum (Fig. 7). Antenniferous tubercle small, greatly concealed by mandibular plates, therefore only lateral extremity visible in dorsal view (Figs 1, 7). Antennae slender, antennal segments straight, narrowly cylindrical, IIa, IIb and III slightly wider apically (Fig. 1); antennal segment I shortest and stoutest; lengths of antennal segments:  $I < IIa \leq IV < IIb = III$ . Bucculae long and narrow, anteriorly truncate, anteroventrally sharply rectangular, posteriorly narrowed and slightly rounded (Fig. 8). Rostrum 4-segmented, reaching between metacoxae; lengths of rostral segments  $IV < I < II = III$ ; segment I concealed by bucculae in rest (Fig. 4).

Pronotum transversely subhexagonal, with strongly produced humeri (Figs 1–2, 9). Anterior margin as wide as head across eyes, concave, embracing postocular portion of head. Anterolateral angles prominent, directed anteriorly, apically truncate, approaching posterior surface of compound eyes, anteriorly with denticle directed laterally. Anterolateral margins of pronotum deeply, roundly concave, not carinate, bearing 6–11 small callose denticles of variable shape (also varying between left and right sides of pronotum, see Fig. 9) distributed from anterolateral angle to the first triangular lobe of humeral angles. Humeri produced into large, lobe-like projection, projecting distinctly anteriorly of eye, apically widely rounded and flattened, with four projections, the first (anterior) one narrowly triangular, acute, the second (apical) one narrowly lobate and apically rounded, the third and fourth (posterior) ones short, broadly lobate and rounded; pronotal margin between second and third lobe shallowly concave to nearly straight (Fig. 9). Lateral margins of pronotum weakly converging posteriorly of humeral projections towards base of corium, there forming an obtuse angle and continuing obliquely towards base of scutellum; posterolateral angle obtuse; posterior margin transversal, straight. Pronotal disc highest along its posterior margin and towards apices of humeral angles, rather steeply sloping towards anterior margin (Fig. 3); pronotal disc anteriorly with two longitudinal depressions leading from cicatrices approximately towards anterolateral angles, diverging anteriorly (Figs 1, 9).

Scutellum (Fig. 1) triangular, lateral margins in frenal (= anterior) portion nearly straight, regularly narrowing towards apices of clavi, there slightly concave; postfrenal (= apical) portion of scutellum long, almost parallel-sided, broadly rounded apically. Scutellar disc elevated basally (Fig. 3), sloping laterally and posteriorly, apical portion flat.

Hemelytra (Fig. 1) reaching or slightly surpassing apex of abdomen. Clavus narrow. Corium laterally slightly widening towards segment III, then slightly narrowing towards apex, reaching middle of hypopleurite (= outer laterotergite) VI in rest; apical angle of corium narrowly rounded. Membrane widely rounded apically, veins subparallel.

Thoracic pleura and sterna. Mesosternum anteriorly with short, wedge-shaped keel narrowing posteriorly; mesosternum posteriorly and metasternum flat, not grooved. Ostiole of metathoracic scent glands situated in inner third of metapleuron width (Fig. 5), drop-



**Figs 7–10.** *Carduelicoris stehlki* gen. et sp.nov. 7–8 – head: 7 – dorsal view (male from Sandringato); 8 – lateral view (female from Périnet). 9 – pronotum (male holotype, antero-dorsal view). 10 – paramere. Scale bars: 1 mm (7, 8, 9), 0.5 mm (10).

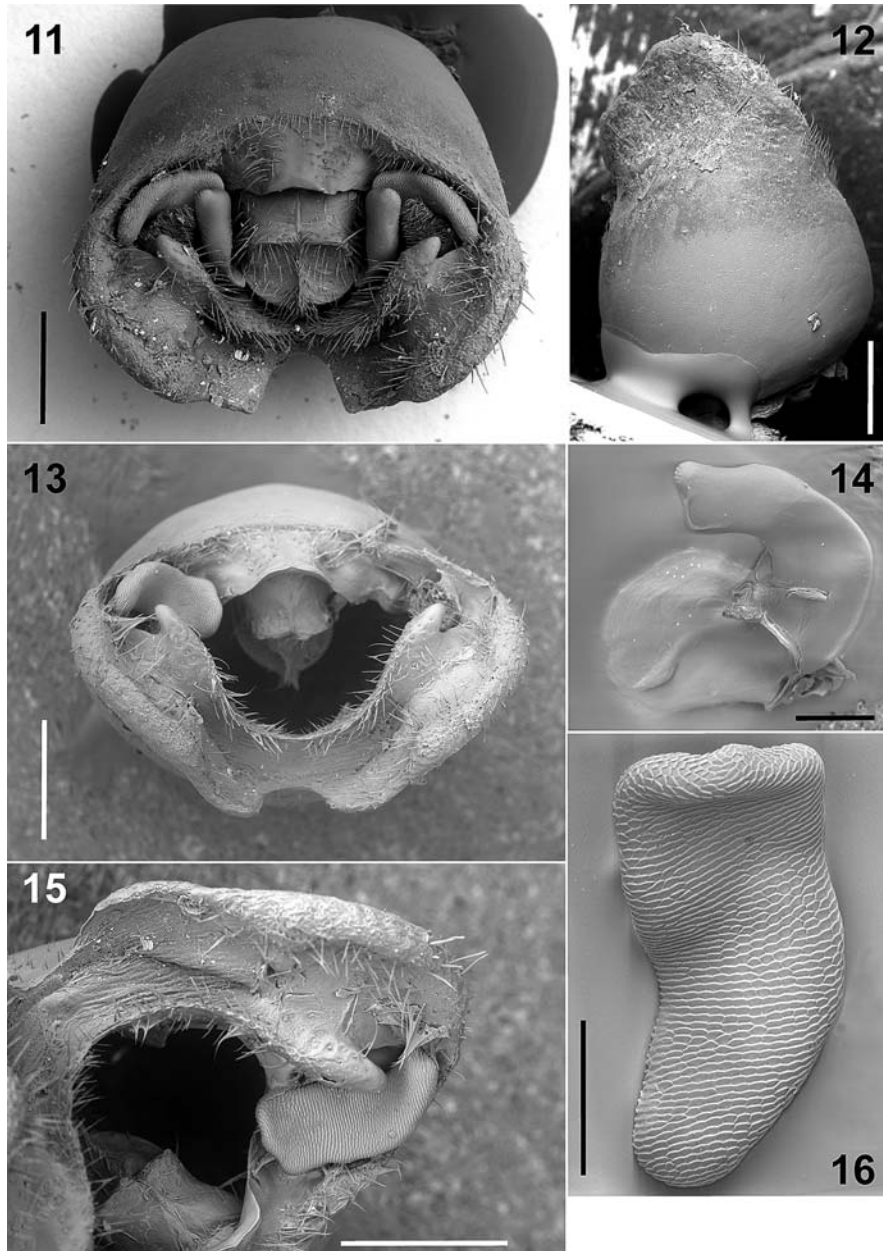
shaped, facing laterad, accompanied with short spout (about 2–3 times of ostiole length), narrowly rounded apically, directed laterad, with peritremal surface facing posteriad, with narrow median furrow in its basal half (Fig. 6); vestibule gibbose, elevated above surrounding pleuron; vestibular scar missing; periostiolar depression not developed; metapleural evaporatorium large, covering anterior and central parts of metapleuron, narrowing and reaching mesad between meso- and metacetabulum and laterad along metathoracic spiracle; mesopleural evaporatorium small, limited to postero-mesal portion of mesopleuron between metathoracic spiracle and mesopleural sulcus (Fig. 5); gyrification of metapleural evaporatorium well-developed, mesopleural evaporatorium mostly flat; metepimeral pseudosuture developed; metathoracic spiracle long and narrow (Fig. 5).

Legs. Femora narrowly clavate, widest subapically, unarmed. Tibiae narrowest medially, slightly widening towards base and apex; lateral surface of tibiae sulcate. Tarsi 3-segmented, tarsomere 2 shortest.

Abdomen widest across posterolateral angles of laterotergite III (Figs 1–2). Connexivum mostly not covered by corium, posterolateral angles of laterotergites obtusely rectangular, slightly protruding from the body outline (Fig. 1). Sternite III medially with two low longitudinal tubercles divided from each other by a shallow groove; remaining sternites evenly convex.

Male genitalia. Pygophore (Figs 11–13) approximately as high (2.0 mm) as wide (2.0 mm); ventral wall slightly constricted under ventral rim in lateral view (Fig. 12). Ventral rim widely and shallowly concave, medially with deep and narrow U-shaped incision (Figs 11, 13). Ventral rim infolding wide and conspicuous, medially concave, dorsally continuing in a large, conical, dorsolaterally directed projection of ventral plus lateral rims (Figs 11, 13, 15). Lateral rim ridge-like, both lateral rim and lateral rim infolding fused with ventral rim and its infolding. Dorsal rim simple, medially not infolded, forming a rhomboid extension (Fig. 11); dorsal rim infolding reduced, producing articulated dorsal processes transversely elongate, mesally subtruncate, laterally rounded and bent caudally (Figs 11, 13, 15); outer surface of dorsal plate with specific mesh-like microsculpture (Fig. 16). Paramere sockets not developed. Parameres (Figs 10, 14) with basal apodeme large and elliptic, apical part of paramere flattened, hook-shaped, directed dorsad within pygophore at rest (Fig. 11), apex truncated, bearing scale-like microsculpture laterally (Figs 11, 14). Phallus (Figs 17–22) with phallosome short and thick, barrel-shaped, strongly sclerotized, with distinctly protruding hinge; conjunctiva with two pairs of dorsal processes: first pair (dcp1) elongate, laterally sclerotized, second pair (dcp2) membranous, fused along midline into a single short, bulb-shaped lobe provided with two small dorsal projections; a pair of ventral conjunctival processes (vcp) (= median penial plates sensu GROSS 1975) sclerotized, dorsally fused, ventrally produced into a pair of large and broad lobes, embracing a thin tubular vesica curved ventrad, hardly visible between lobes of vcp; endophallic reservoir restricted approximately to apical two-thirds of inner lumen of phallosome.

Female genitalia. External structures. Terminalia as in Figs 23–24. Valvifers VIII (vf8) medially straight, adjacent to each other, laterotergites IX (lt9) directed obliquely at rest, basally parallel-sided, apically nearly parabolic; valvifers IX (vf9) well-exposed at rest, trapezoid, with a pair of elongate, basolaterally directed arms; triangulin missing. Genital tracts (Fig. 25) partly desintegrated during dissection. Gynatrium with a pair of small, well-distinguishable ring sclerites (Figs 24–25: rs) and a pair of additional, elongate sclerites situated caudad of ring sclerites; spermathecal opening (Figs 24–25: so) associated with an elongate sclerite (arcus, Figs 24–25: arc). Spermatheca (Fig. 25) with proximal duct relatively long, somewhat shorter than distal invagination of spermathecal duct, thin; spermathecal dilation (sd) large, spherical, inside milky, not transparent (possibly artefacts); distal invagination of spermathecal duct ('sclerotized rod') robust, basally and apically widened; intermediate part (ip) straight and narrow, provided with proximal (pfl) and distal flanges (dfl), apical receptacle (ar) small, spherical, bearing two processes (Fig. 25).



**Figs 11–16.** *Carduelicoris stehliki* gen. et sp.nov. 11–13 – pygophore: 11 – intact, dorso-posterior view (magnification 45×); 12 – lateral view (magnification 47×); 13 – dissected, posterior view (magnification 50×). 14 – paramere (magnification 120×). 15–16 – dorsal plate of pygophore *in situ* (15, magnification 75×) and detail of microsculpture (16, magnification 210×). Scale bars: 0.5 mm (11, 12, 13, 15), 0.2 mm (14, 16).

**Differential diagnosis.** The new genus differs from all other Madagascan Pentatomidae by combination of the shape of head (anteocular spine missing; clypeus distinctly shorter than mandibular plates but apically free; mandibular plates parallel-sided laterally, produced and narrowly rounded apically, with one subapical lateral tooth) and pronotum with protruding humeral angles curved anterolaterad, apically widely rounded and bearing small lobes and denticles on their margin. The male genitalia are peculiar within Halyini by presence of dorsal plates of pygophore. See also Discussion below.

**Etymology.** The generic name is composed of the Latin noun *carduelis*, *-is*, meaning “Goldfinch” in English and “stehlík” in Czech (viz also *Carduelis carduelis* Linnaeus, 1758) and the Latinized Greek noun *coris*, meaning true bug; gender is masculine. The name is dedicated to Jaroslav L. Stehlík, the doyen of the Czech and Slovak heteropterology, on the occasion of his 90th birthday.

**Included species.** Monotypic.

*Carduelicoris stehliki* sp.nov.

(Figs 1–26)

**Type locality.** East Madagascar, Sandrangato (at road from Moramanga to Anosibe an'Ala), 19°06'15"S 48°14'36"E (see Fig. 26).

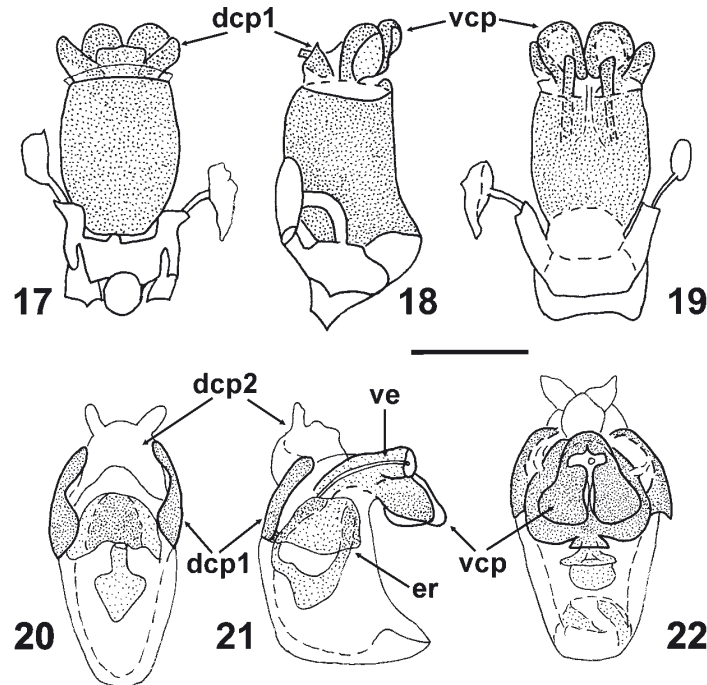
**Type material.** Holotype: ♂ (Figs 1–3), ‘Sandrangato [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // Brit.Mus. / 1965-338 [p] // ♂ [p] // Genus not / in B. M. [hw] / W.E.China det. 196[p]4[hw] // HOLOTYPUS / CARDUELICORIS / STEHLIKI / sp. nov. / det. P. KMENT 2013 [p, red label]’ (BMNH) (the specimen pinned through pronotum, left hind leg and right antennal segments III and IV missing).

Paratypes (3 ♂♂ 2 ♀♀): ♂, ‘Sandrangato [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // MUSEUM PARIS [p] // ♂ [p]’ (MNHN); ♂, ‘Sandrangato [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // MUSEUM PARIS [p] // ♂ [p] // Genus not / in B. M. [hw] / W.E.China det. 196[p]4[hw]’ (MNHN) (detached pygophore glued on a piece of card attached to the same pin); ♂, ‘Sandrangato [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // ♂ [p]’ (NMPC) (dissected pygophore and parameres glued on a piece of card and phallus stored in a small plastic microvial with glycerol attached to the same pin); ♀, ‘Sandrangato [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // Brit.Mus. / 1965-338 [p] // ♀ [p]’ (BMNH); ♀, ‘Sandrangato [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // MUSEUM PARIS [p] // ♀ [p]’ (MNHN) (abdominal dorsum, venter and antennomere IV glued on a piece of card, dissected female genitalia placed in a plastic microvial with glycerol attached to the same pin); ♀, ‘Périnet [p] // INSTITUT / SCIENTIFIQUE / MADAGASCAR [p] // MUSEUM PARIS [p] // ♀ [p]’ (MNHN). Each paratype bearing the following identification label: ‘PARATYPUS / CARDUELICORIS / STEHLIKI / sp. nov. / det. P. KMENT 2013 [p, red label]’; 1 ♂ 1 ♀, ‘MADAGASCAR, 2007, / Lakato env., near Andasibe-Mantadia N.P., Z. Mráček leg., 9.–10.i. [p] // ‘♂’ or ‘♀’ [p]’ (MMBC).

**Description.** Coloration beige, head posteriorly and pronotum anteriorly tinged with yellow; femora, base of abdomen, and apices of humeral angles brown (Figs 1–2); apical portions of tarsal claws and abdominal spiracles black; abdominal dorsum and ventral side of hemelytra beige; membrane translucent, very slightly infumate, with brown veins.

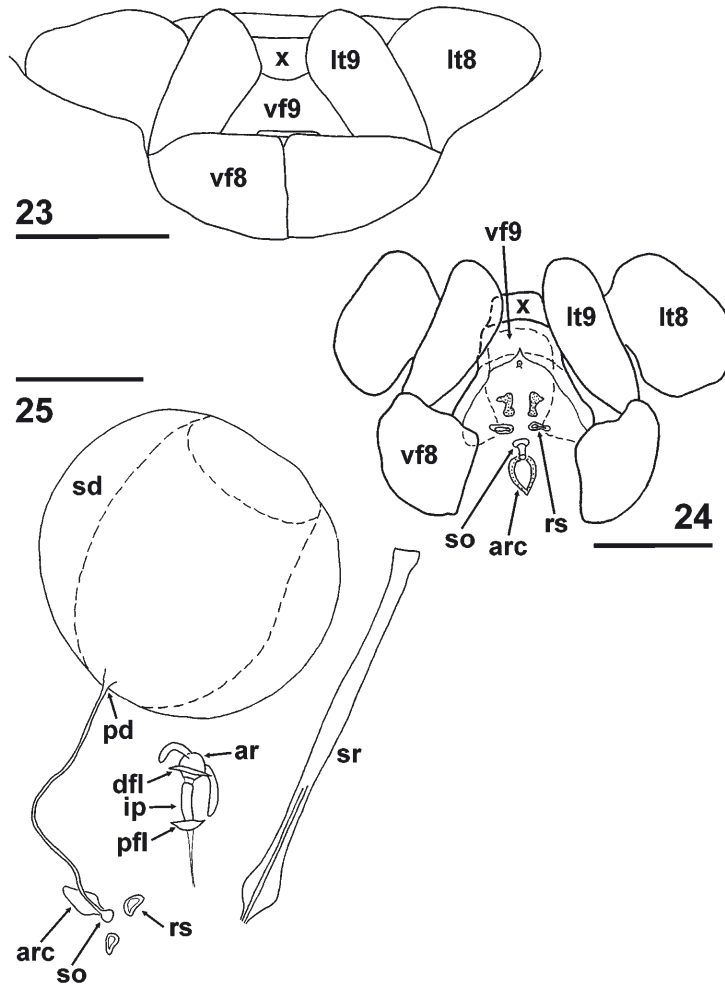
**Vestiture.** Body glabrous; antennal segments IIb and III apically with short and sparse setae, entire antennal segment IV densely covered with short and fine pale setae intermixed with somewhat longer and stouter brownish setae; labium ventrally, ventral surface of femora and basal portion of tibiae with sparse short pale setae; tibiae apically and tarsi densely covered with longer and stouter brownish setae (Fig. 4). Body dorsally covered with small, shallow punctures, mostly concolorous beige, but sometimes brown





**Figs 17–22.** Phallus of *Carduelicoris stehliki* gen. et sp.nov. 17–19 – intact, 20–22 – inflated; 17, 20 – dorsal view, 18, 21 – lateral view, 19, 22 – ventral view. Abbreviations: dcp1–2 – dorsal conjunctival processes 1 and 2, er – endophallic reservoir, vcp – ventral conjunctival processes, ve – vesica. Scale bar: 0.5 mm.

or black. Two longitudinal depressions anteriorly on pronotum with bottom densely covered with black punctures (Figs 1, 9), adjacent surface between and laterad of the depressions slightly raised, callous and sparsely punctured. Scutellar disc laterally on each side with two more or less apparent longitudinal, callous, raised lines, posteriorly merging with a single, wide median longitudinal callosity occupying about one median third of scutellum length (Fig. 1); apex of scutellum not callous. Clavus basally with 5 rows of punctures, anterior four of them rather irregular, continually merging into a single row reaching claval apex; the posteriormost (fifth) row along posterior claval margin ending approximately in claval mid-length. Corium along claval fold and cubital vein (Cu) with slightly raised unpunctured longitudinal lines, surrounding punctures organised in more or less regular lines; corium medially (between claval fold and Cu) with irregularly distributed punctures and unpunctured areas (Fig. 1). Posterolateral angles of laterotergites with minute yellowish callosities. Body ventrally irregularly punctured, punctures shallow to deep, concolorous to black; bases of mesopleura, metapleura and sternites III and IV medially with deep black punctures (Fig. 2). No waxy secretion was observed anywhere on the body.



**Figs 23–25.** Female genitalia of *Carduelicoris stehliki* gen. et sp.nov. 23–24 – external female terminalia (23 – intact, 24 – dissected); 25 – internal female genitalia. Abbreviations: ar – apical receptacle of spermatheca, arc – arcus, dfl – distal flange, ip – intermediate part of spermatheca, It8–9 – laterotergites VIII–IX, pd – proximal duct of spermatheca, pfl – proximal flange, rs – ring sclerite, sd – spermathecal dilation, so – sclerite surrounding spermathecal orifice, sr – sclerotised rod, t8 – tergite VIII, vf8–9 – valvifers VIII–IX, x – segment X. Scale bars: 1 mm.

Measurements (in mm; median (minimum–maximum)). Males (n = 4, for antennal segments: II – n = 3, III and IV – n = 2): Body length 16.4 (15.7–16.5); head length 3.53 (3.37–3.58); head width 3.37 (3.37–3.47); interocular width 2.25 (2.15–2.25); lengths of antennal segments: I – 0.97 (0.92–1.02), IIa – 1.33 (1.33–1.43), IIb – 1.94 (1.94–2.0), III

– 1.94–2.04, IV – 1.43–1.53; pronotum length 3.58 (3.47–3.68); pronotum width 9.45 (9.20–9.50); scutellum length 5.57 (5.31–5.62), scutellum width 4.34 (4.29–4.60); abdomen width 8.43 (8.18–8.58).

Females (n = 3, for antennal segment III n = 1, antennal segment IV missing in all specimens): Body length 17.1 (16.6–17.8); head length 3.68 (3.68–3.78); head width 3.47 (3.47–3.47); interocular width 2.35 (2.25–2.35); lengths of antennal segments: I – 0.92 (0.92–1.02), IIa – 1.33 (1.33–1.43), IIb – 1.94 (1.94–1.94), III – 1.94; pronotum length 3.68 (3.58–3.68), pronotum width 9.61 (9.50–10.32); scutellum length 5.72 (5.52–6.23); scutellum width 4.80 (4.50–4.91); abdomen width 8.89 (8.79–9.30).

**Variability.** Males and females do not differ externally except for terminalia; females seem to be slightly larger than males. Regardless of the sex, the specimens differ in shape and number of denticles on the anterolateral margins and humeral angles of the pronotum, and in the shape of the apical lobes of the humeral angles (e.g., the margin between the second and third lobe is slightly concave to straight), which are usually also variable between the left and right sides of the body (Fig. 9). There are also slight differences in the pattern of callosities and punctures on both dorsal and ventral surfaces of the body.

**Etymology.** The new species is dedicated to Jaroslav L. Stehlik.

**Biology.** Unknown.

**Distribution.** Known only from three localities in eastern Madagascar in the zone of tropical rain forests, Sandrangato (the type locality), Périnet (18°55'39"S, 48°24'52"E), and Lakato (19°11'S, 48°26'E (Fig 26).

## Discussion

### Tribal placement of *Carduelicoris* gen.nov.

Using the key to tribes of Madagascar Pentatominae by CACHAN (1952), *Carduelicoris* gen.nov. belongs to 'groupe II' of tribes including Nealeriini, Memmiini, Phricodini, Halyini, Amyntorini, Triplatygini and Rolstoniellini (= Compastini), being characterised mostly by shape of the head and absence of a tubercle at base of abdomen. Within 'groupe II', CACHAN (1952) placed the genera with 2-segmented tarsi in the tribe Nealeriini, and those with 3-segmented tarsi and 4-segmented antennae in the Memmiini and Phricodini. The remaining genera, sharing 3-segmented tarsi and 5-segmented antennae (the most common combination of characters in Pentatomidae), were divided among four tribes (Halyini, Amyntorini, Triplatygini and Rolstoniellini).

Although Halyini is one of the best known taxa within Pentatominae, diagnosis of this group is very problematic (cf. GROSS 1976: 252). In most of treatments, Halyini are defined based on few morphological characters in reference to the local fauna under study (e.g. DISTANT 1902, CACHAN 1952, ROLSTON & McDONALD 1979, ABBASI 1986, DERJANSCHI & PÉRICART 2006, MEMON *et al.* 2011), but none of them apply for all the known genera included in this taxon. GROSS (1976) addressed this problem in detail, giving the following external characteristics of the tribe: mostly large species with

elongate body-shape; characteristic shape of head (mandibular plates sometimes produced in front of the clypeus as spinose or irregularly truncate lobes or not; antenniferous tubercles in some species armed exteriorly with a hook-like process, in others not); antennae 5-segmented (in some genera 4- or even 3-segmented); pronotum hexagonal, with humeral angles frequently armed (sometimes as spines, sometimes as horn-like processes); scutellum always triangular (but large and reaching apex of abdomen in Afrotropical *Mezessea* Linnavuori, 1982: see LINNAVUORI 1982); hemelytra and hind wings fully developed (except Australian *Tinganina* Bergroth, 1909); hypopleurites frequently strongly spined posteriorly; rostrum sometimes very long, almost reaching the apex of the abdomen, only rarely (if ever) failing to reach base of abdomen; abdominal venter often with longitudinal groove to receive the long rostrum. In addition, DISTANT (1902) and ABBASI (1986) pointed out the head distinctly longer than broad (though sometimes its length being subequal to the width) and prominent eyes, and DISTANT (1902) and DERJANSCHI & PÉRICART (2006) noted that the antennal insertions are separated from the eyes by a distance at least equal to eye diameter. The shape of the peritreme of the metathoracic scent gland is also considerably variable within the tribe (see e.g. CACHAN 1952 and LINNAVUORI 1982). LESTON (1953b) suggested that the tribe Halyini might be defined on the basis of presence of wax glands.

Most of the characters mentioned above are quite weakly defined and they are difficult to use in deciding whether a particular species belongs to Halyini or not. The shape of the head is usually elongate in the tribe, but the genera are too diverse in respect of this character to make a clear-cut definition. Several characters (5-segmented antennae, hexagonal pronotum, triangular scutellum, fully developed wings) are clearly plesiomorphic within Pentatomidae and occur in the majority of the other tribes too. Most of the apparent apomorphies (spined lateral margin of the abdomen, long labium, grooved abdominal venter) occur sporadically in several other tribes as well. Wax glands are also not unique to the halyines (ROLSTON & McDONALD 1979). In spite of these problems, still Halyini apparently forms a clade of taxa of quite similar general habitus, but they are difficult to define based on external characters.

According to GROSS (1976), Halyini can be well-defined only on the base of male genitalia, especially the phallus: the pygophore strongly tends to be laterally produced into a pair of robust or acute spinous or horn-like processes directed posteriad, sometimes subdivided (in other species the lateral lobes are only incipient or truncate); the phallus is always with strongly sclerotized phallotheca (= phallosoma *sensu* GROSS 1975) which is generally quite small in size in relation to conjunctiva, and in many taxa with transparent apical thecal shield surrounding the dorsal opening of the theca; conjunctiva large, frequently distinctly longer than the theca and very frequently with 2 or 3 pairs of conjunctival processes present, some of them can be secondarily subdivided or fused along midline in other taxa (see also MEMON *et al.* 2011); the ventral conjunctival processes (= median penial plates *sensu* GROSS 1975) small and directed downwards, only their ventral apices are usually external to the conjunctiva, sometimes adjacent or even fused ventrally; the gonopore always opens between the ventral conjunctival processes and the vesica does not protrude beyond them. On the other hand, parameres

vary a great deal within the tribe (GROSS 1976, MEMON *et al.* 2011) and can be even reduced (in *Solomonius* group, see WALL 2007).

In GROSS's (1976) opinion, the female spermatheca of Halyini is of typical pentatomid pattern, its apical receptacle bearing two short tubular processes. However, the apical receptacle lacks any processes in *Carenoplastus* Jakovlev, 1882 and *Lodosocoris* Ahmad et Afzal, 1986 (MEMON *et al.* 2011) while other genera have three, four or even a larger number (up to 16) of processes (*Paranevisanus* Distant, 1908: see MEMON *et al.* 2011). Moreover, MEMON *et al.* (2006) documented the infraspecific variability of the shape and number of spermathecal processes in Pakistani *Halys sindillus* Memon, Meier et Manan, 2006.

Considering the data summarised above, there is no wonder that the authors providing comprehensive treatments of Halyini (WALL 2004, MEMON *et al.* 2011) found no clear-cut synapomorphies for defining the tribe.

Within the Madagascan fauna, *Carduelicoris* gen.nov. fits to Halyini in the shape of the head, sharing with typical forms of the tribe the elongate head with mandibular plates not particularly enlarged and foliaceous (in contrast with Triplatygini and Rolstoniellini), but usually bearing prominent denticles or spines (in contrast with the unarmed head of Amyntorini) (CACHAN 1952). The prominent humeral angles of pronotum were mentioned as characteristic for Halyini by GROSS (1976); however, none of the Madagascan genera of Halyini treated by CACHAN (1952) (nor any other Halyini genus known to me) has the humeral angles of the pronotum reaching so far anteriad and being apically lobate or spinous. Such shape of humeral angles is otherwise characteristic for the endemic Madagascan tribe Triplatygini (see CACHAN 1952; KMENT 2008, 2012), the Oriental genus *Rolstoniellus* Rider, 1997 (= *Compastes* Stål, 1867, Rolstoniellini) (DISTANT 1902, YANG 1935), or the Chinese *Brachymna humerata* Chen, 1989 (Sephelini) (CHEN 1989), but I consider these similarities as parallelisms. Considering the genital characters, both male (strongly sclerotised phallosome, number of conjunctival processes, shape of ventral conjunctival processes, and especially the gonopore opening between the ventral conjunctival processes and the vesica not protruding beyond them (see GROSS 1976)) and female genitalia (shape and number of processes of the apical receptacle of spermatheca, shape of the sclerotised rod) of *Carduelicoris* gen.nov. seem to fit into the variability of genitalic structures known in this group, except for the presence of the dorsal processes<sup>1)</sup> in pygophore which seems quite exceptional within the Halyini, since they are apparently missing in most members of the tribe (e.g., GROSS 1972, 1976; GHAURI 1982; ABBASI 1986; LINNAVUORI 1982; WALL 2007; MEMON & AHMAD 2008; TSAI & RÉDEI 2009; FAN 2011; MEMON *et al.* 2011; FAN & LIU 2013). Dorsal processes are sclerotized appendages of the intersegmental membrane between

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<sup>1)</sup>This structure is termed variously in the literature: **superior lateral processes** (SHARP 1890), **genital plate** (e.g. BAKER 1931; McDONALD 1966, 1986), **dorsal process** (LESTON 1954, DAVIDOVÁ-VILÍMOVÁ & MCPHERSON 1992), **processus supérieurs** (DUPUIS 1951, 1970), **superior process** (FERRARI *et al.* 2010), **pseudoclasper** (MCDONALD 1974, 1976, 1982; FAN 2011), **pygophoral plate** (ROLSTON & McDONALD 1979), **parandrium** (GROSS 1975, 1976), **dorsal plate** (LINNAVUORI 1982, KMENT & JINDRA 2009), or **genital cup process** (BARCELLOS & GRAZIA 2003).

segments IX and X (LESTON 1954) supposed to give support to parameres (LINNAVUORI 1982). These structures occur in number of genera of Asopinae, Edessinae, and Pentatominae (e.g. in the tribes Aeliini, Aeptini, Antestiini, Bathycoeliini, Cappaeini, Carpocorini, Caystrini, Diemeniini, Euryaspidini, Eysarcorini, Myrocheini, Nezarini, Pentatomiini, Procliticini, Sephelini, and Strachiini), and most probably evolved several times independently in different evolutionary lineages (see e.g. BAKER 1931; McDONALD 1966, 1974, 1976, 1982, 1986, 1995; McDONALD & EDWARDS 1978; GROSS 1975, 1976; ROLSTON & McDONALD 1979; LINNAVUORI 1982; DAVIDOVÁ-VILÍMOVÁ & MCPHERSON 1992; BARCELLOS & GRAZIA 2003; KMENT & JINDRA 2009; FERRARI *et al.* 2010; FAN 2011). *Carduelicoris* gen.nov. differs from *Triplatyx* Horváth, 1904 and *Anoano* Cahan, 1952 of Triplatygini also in the absence of the triangulin; both latter genera have the triangulin well-developed (KMENT 2008, 2012).

Considering all the characters, *Carduelicoris* gen.nov. is placed here within Halyini, and the characters shared with Triplatygini are considered either symplesiomorphic (short spout-shaped peritreme, abdominal base without conical tubercle) or convergent (prominent humeral angles of pronotum).

#### Diversity of Halyini in the Afrotropical Region and Madagascar

Halyini (including Memmiini, see LINNAVUORI 1982 for the synonymy) is one of the diverse and species-rich tribes of Pentatominae, including 84 genera and about 400 species (LINNAVUORI 1982, WALL 2007, MEMON & AHMAD 2008, FAN & LIU 2013, RIDER 2013) with most species distributed in the Oriental and Australian Regions, also with considerable diversity in the Afrotropical Region, Madagascar, the southern areas of the Palearctic Region, and with two endemic genera in North and Central America (CACHAN 1952; GROSS 1972, 1976; LINNAVUORI 1982; ABBASI 1986; LARIVIÈRE 1992, 1994; CASSIS & GROSS 2002; RIDER 2006; WALL 2007; MEMON *et al.* 2011; etc.). The continental African fauna of Halyini was partly reviewed by LINNAVUORI (1982), who divided the African genera into two groups: (1) *Atelocera* group limited to the Afrotropical Region and extending to Yemen and Madagascar, comprising the genera *Atelocera* Laporte, 1833, *Memmia* Stål, 1865, *Mezesse* Linnavuori, 1982, *Pseudatelus* Linnavuori, 1982, and *Scribonia* Stål, 1865, and (2) *Halys* group, considered by LINNAVUORI (1982) as of Oriental origin, including the genera *Halys* Fabricius, 1803, *Erthesina* Spinola, 1837 (both shared with the Oriental Region), *Coenomorpha* Dallas, 1851 (widely distributed in tropical Africa), *Eurus* Dallas, 1851, *Orthoschizops* Spinola, 1850 (both endemic to South Africa), and *Anolcus* Bergroth, 1893 (endemic to East Africa). Compared with continental Africa, the Madagascan fauna of Halyini is more diversified and highly endemic, with eleven of the thirteen genera and apparently all 40 described species restricted exclusively to the island: *Abadia* Cahan, 1952 (1 species), *Acuticeps* Cahan, 1952 (1 species), *Artiazontes* Distant, 1881 (1 species), *Bourginia* Cahan, 1952 (1 species), *Carduelicoris* sp.nov. (1 species), *Dalpada* Amyot et Serville, 1843 (16 species), *Halys* (1 species), *Memmia* (6 species), *Nesagaeus* Bergroth, 1906 (1 species), *Nesobius* Bergroth, 1906 (2 species), *Solenogaster* Reuter, 1867 (1 species), *Vadonidea* Cahan, 1952 (2 species), and *Zaplutus* Bergroth, 1893 (6 species) (CACHAN 1952, this

paper). However, the Madagascan Halyini remain poorly known, especially in respect of the detailed structures of the male and female genitalia. For example, the Madagascan species currently accommodated in *Dalpada* seem heterogenous even for a superficial look, and apparently they represent at least three separate genera, neither of them being congeneric with the Oriental *Dalpada aspersa* Amyot et Serville, 1843, the type species of *Dalpada*; the same may be true also for the Madagascan and Afrotropical *Halys* species. It is also probable that the endemic Madagascar tribe Nealeriini, including the genera *Nealeria* Bergroth, 1893 (2 species) and *Paraleria* Reuter, 1887 (1 species), both of Halyini-like habitus and apparently differing from the latter tribe only by the presence of 2-segmented tarsi, also belongs to the same evolutionary lineage and is therefore merely a subgroup of a more broadly defined Halyini (see also WALL 2004). In the future, a thorough revision is needed to clarify the identity of the Madagascan genus-group taxa currently placed to Halyini and their phylogenetic and zoogeographic relationships with other Afrotropical and Oriental taxa.

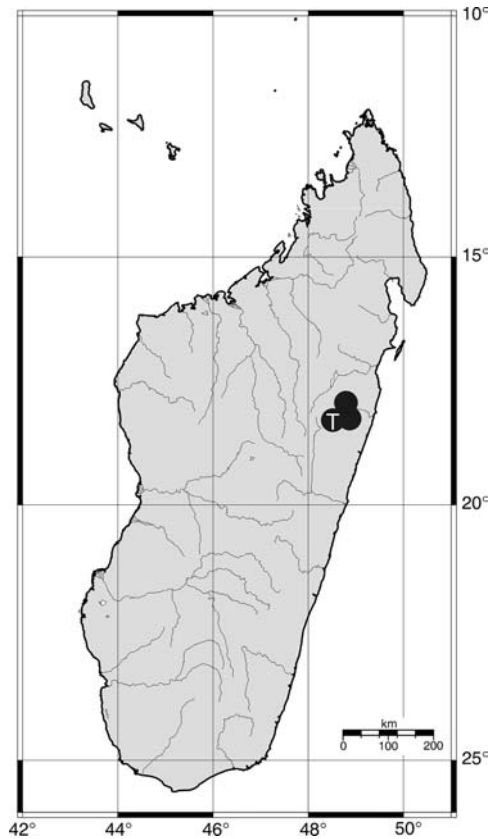


Fig. 26. Distribution map of *Carduelicoris stehliki* gen. et sp.nov. (type locality marked with T).

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