

Morphology and Systematics of the Adult Male of *Lopholeucaspis japonica* (Cockerell) (Coccinea Diaspididae).

Морфология и систематика взрослого самца японской палочковидной щитовки *Lopholeucaspis japonica* (Cockerell) (Coccinea Diaspididae).

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KEY WORDS: Coccinea, Diaspididae, *Lopholeucaspis japonica*, adult male, description, key.

КЛЮЧЕВЫЕ СЛОВА: Кокциды, щитовки, японская палочковидная щитовка *Lopholeucaspis japonica*, взрослый самец, описание, определительная таблица.

ABSTRACT: The article includes the description of the adult male of *Lopholeucaspis japonica*, diagnosis of the tribe Leucaspidini, to which this species belongs, and the key to all described males of Leucaspidini.

РЕЗЮМЕ: В статье описывается морфология взрослого самца японской палочковидной щитовки *Lopholeucaspis japonica*, приводятся диагноз трибы Leucaspidini, к которой принадлежит данный вид и определительная таблица всех описанных самцов трибы Leucaspidini.

Armoured scale insect *Lopholeucaspis japonica* (Cockerell, 1897) is well known as a pest of various citrus, fruit and other cultural trees in many countries of South and East Asia, South Europe, North and South America [Borchsenius, 1966]. But, in spite of that, the adult male morphology of this species is not sufficiently studied until our days. The investigators pointed out only its general body form, size and colour, not paying attention to the detailed structure [Kosarzewska, 1956; Konstantinova, Kosarzewska, 1990]. Only the thoracic segments morphology is investigated in details [Ezzat, 1956].

The present article contains the detailed morphology description of the adult male of *L. japonica* and its distinguishing characters on the basis of the material collected by the author.

Terminology for the structural details and the description plan is used after Ghauri [1962], Russian terms are given mainly after Bustshik [1958]. All dimensions are given in microns, the averages are bracketed.

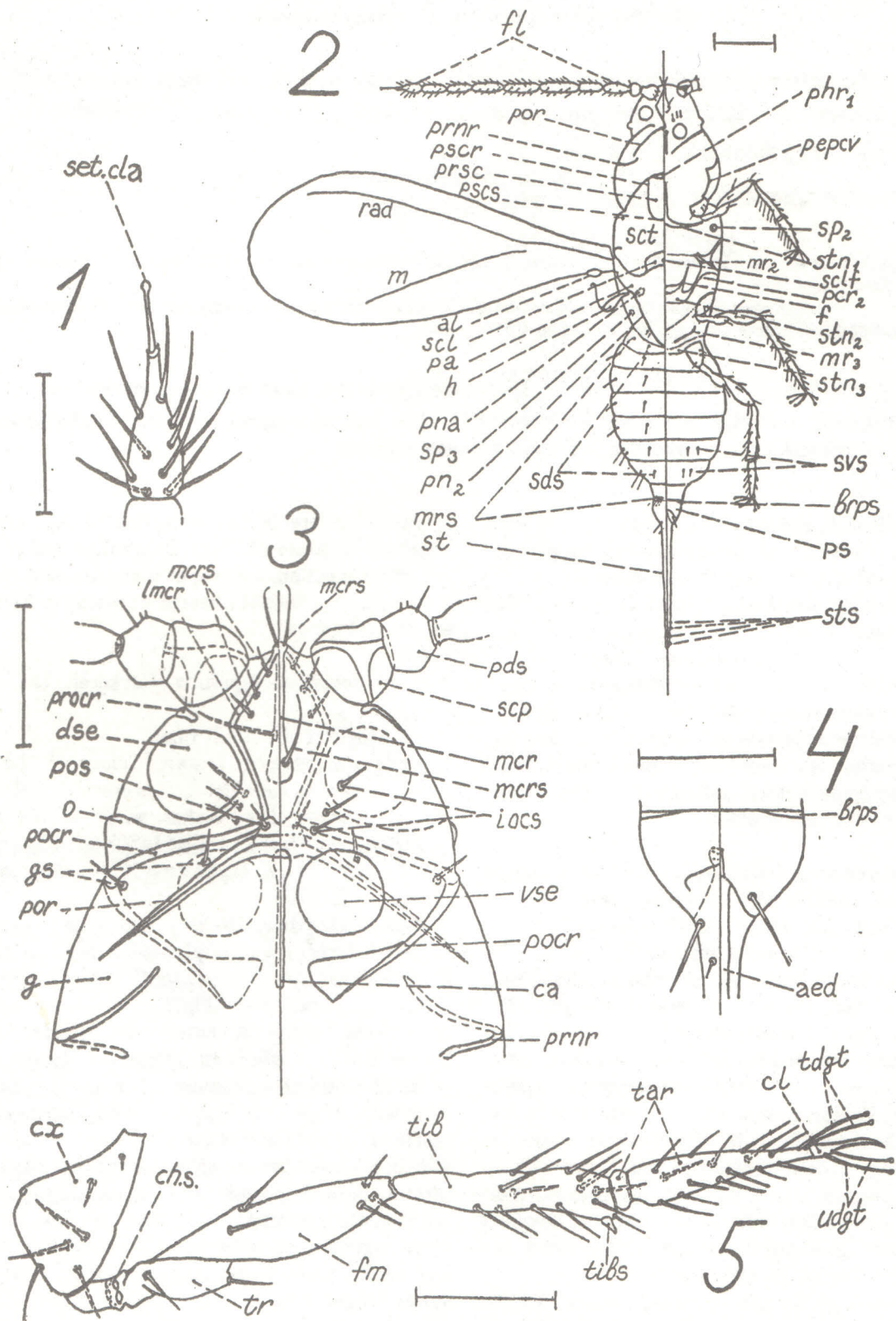
Materials are in the collection of All-Russian Research Institute of Plant Quarantine and in the author's collection, some specimens are sent to the Zoological Institute of Russian Academy of Sciences, St. Petersburg.

Lopholeucaspis japonica (Cockerell, 1897).

DESCRIPTION. Adult male.

Only winged form known. Colour of body of living specimens dark violet, of preserved in alcohol ones pale brown, head darker, wings whitish hyaline. Body length 1014-1159 (1076) including genitalia, which 286-325 (313) long. Width at mesothorax 157-196 (175).

Head (Fig.3) roundly conical; length from apex to median body of postoccipital ridge (Fig.3, por) 78-95 (85), width across genae (Fig.3, g) 118-179 (150). Midcranial ridge (Fig.3, mcr) narrow apically, widened basally on ventral head surface; dorsal lateral branches (Fig.3, lmcr) well developed; with midcranial setae (Fig.3, mcrcs): 2 (longest) - ventrally on widened portion, 2 - apically and 3 pairs - along inside of dorsal lateral branches. Postoccipital ridge (Fig.3, por) well developed; transverse median body strong, with 2 postoccipital setae (Fig.3, pos); anterior arms comparatively long, narrow, basally close together; posterior arms long, narrow, weak curved, 2.7 times longer than anterior arms and 3.7 times longer than width of median body. Genae (Fig.3, g) weak separated, with 2 pairs of genal setae (Fig.3, gs). Dorsal eyes (Fig.3, dse) widely separated from each other (12-26 (17) apart), 38-46 (42) in diameter; ventral eyes (Fig.3, vse) close together (2-



Figs. 1-5. *Lopholeucaspis japonica* (Cockerell, 1897): 1. Terminal antennal joint (set.cla - apical seta). 2. Dorsal (left side) and ventral (right side) general view (al - alar lobe, brps - basal ridge of penial sheath, f - furca, fl - 3-9 antennal joints, m - median vein, mr₂ - marginal ridge of basisternum, mr₃ - marginal ridge of metasternum, mrs - marginal setae, pa - postalar, pcr₂ - praecoxal ridge, pepcv - proepisternum + cervical sclerite, phr₁ - mesoprephragma, pn₂ - postnotal sclerite, pna - postnotal apophysis, por - postoccipital ridge, prnr - pronotal ridge, prsc - prescutum, ps - genital segment (penial sheath), pscr - prescutal ridge, rad - radial vein, scl - scutellum, scf - foramen, sct - scutum, sds - submarginal dorsal setae, sp₂ - spiracle on mesothorax, sp₃ - spiracle on metathorax, st - style, stn₁ - prosternum, stn₂ - basisternum, stn₃ - metasternum, sts - sensillae on style, svb - submarginal ventral setae). 3. Head, dorsal (left side) and ventral (right side) view (ca - cranial apophysis, dse - dorsal eye, g - gena, gs - genal setae, iocs - interocular setae, lmcr - dorsal lateral branch of midcranial ridge, mcr - midcranial ridge, mcis - midcranial setae, o - tubercular ocellus, pds - 2nd antennal joint (pedicel), pocr - postocular ridge, por - postoccipital ridge, pos - postoccipital seta, prnr - pronotal ridge, procr - preocular ridge, scp - 1st antennal joint (scape), vse - ventral eye). 4. Base of genital segment, dorsal (left side) and ventral (right side) view (aed - aedeagus, brps - basal ridge of penial sheath). 5. Fore leg, dorsal view (ch.s - chain of sensillae, cl - claw, cx - coxa, fm - femur, tar - tarsum, tdgt - tarsal digitules, tib - tibia, tibs - tibial apical spur, tr - trochanter, udgt - ungular digitules). Scale: in Figs. 1, 3-5 - 50 microns, Fig. 2 - 100 microns.

Рис. 1-5. *Lopholeucaspis japonica* (Cockerell, 1897): 1. Вершинный членик усика (set.cla - булавовидная хета). 2. Общий вид сверху (левая сторона) и снизу (правая сторона) (al - выступ югальной области, brps - базальное ребро генитального сегмента, f - вилка, fl - 3-9 членики усика, m - медиальная жилка, mr₂ - боковое ребро мезостернума, mr₃ - боковое ребро метастернума, mrs - краевые хеты, pa - закрыловой мембранозный участок, pcr₂ - прекоксальное ребро, pepcv - проэпистернум + шейный склерит, phr₁ - мезопрефрагма, pn₂ - постнотальный склерит, pna - постнотальный апофиз, por - головная вилочка, prnr - пренотальное ребро, prsc - прескутум, ps - генитальный сегмент, pscr - ребро прескутума, rad - радиальная жилка, scl - скутеллум, scf - форамен, sct - скутум, sds - дорзальные хеты, sp₂ - дыхальце среднегруди, sp₃ - дыхальце заднегруди, st - стилус, stn₁ - простернум, stn₂ - мезостернум, stn₃ - метастернум, sts - сенсиллы стилуса, svb - вентральные хеты). 3. Голова, вид сверху (левая сторона) и снизу (правая сторона) (ca - глазной апофиз, dse - верхне-боковой глаз, g - щека, gs - хеты щеки, iocs - срединные хеты, lmcr - верхне-боковая ветвь межантенальной полоски, mcr - межантенальная полоска, mcis - хеты межантенальной полоски, o - боковой глаз, pds - 2 членик усика, procr - головная вилочка, pos - хета головной вилочки, prnr - пронотальное ребро, prnr - предглазное ребро, scp - 1 членик усика, vse - нижний глаз). 4. Основание генитального сегмента, вид сверху (левая сторона) и снизу (правая сторона) (aed - эдеагус, brps - базальное ребро генитального сегмента). 5. Передняя нога, вид сверху (ch.s - кольцо сенсилл, cl - коготок, cx - тазик, fm - бедро, tar - лапка, tdgt - тарзальные пальчики, tib - голень, tibs - шпик вершины голени, tr - вертлуг, udgt - коготковые пальчики). Масштаб: на Рис. 1, 3-5 - 50 микрон, на Рис. 2 - 100 микрон.

17 (8) apart), 36-46 (40) in diameter. Tubercular ocelli (Fig. 3, o) present, sometimes not clear. 3 pairs of interocular setae (Fig. 3, iocs) arranged in oblique rows in front of ventral eyes. Preocular ridges (Fig. 3, procr) produced dorsally and ventrally. Postocular ridges (Fig. 3, pocr) dorsally completely exposed, ventrally considerably extended backward, with weak-chitinized triangular plate. Cranial apophysis (Fig. 3, ca) 50-62 (58) long, apically widened, almost reach to level of frontal side of ventral eyes.

Antennae 10-jointed, 476-543 (514) long, 8.8 times longer than cranial apophysis. Length and width of joints as follows:

Joint	1	2	3	4	5	6	7	8	9	10
Length	19-34	14-22	48-53	53-67	60-72	53-70	55-70	43-55	56-65	48-55
Width	(27)	(18)	(50)	(60)	(67)	(62)	(67)	(52)	(62)	(51)
↓	31-36	24-29	14-19	14-19	14-22	17-19	17-19	17-19	19-22	17-19
	(35)	(26)	(17)	(17)	(17)	(18)	(18)	(18)	(20)	(19)

First joint or scape (Fig. 3, scp) membranous except wide ridge on ventral side; without setae. Second joint or pedicel (Fig. 3, pdc) with one long and 2 short setae. 3-rd - 9-th joints (Fig. 2, fl)

somewhat cylindrical, narrowed basally and apically, with 6-8, 9-15, 14-20, 15-18, 14-19, 16-17 and 14-17 setae respectively. Setae on 3-rd joint 2 times longer than width of this joint. 10-th terminal joint (Fig. 1) with narrowly elongated apex, with 11 simple setae and 1 apical seta (Fig. 1, set. cla) with large basal plate and mace-shaped apex. Pair of small sensillae occurs near base of apical seta.

Thorax. Length from median body of postoccipital ridge (Fig. 2, por) to apex of postnotal sclerite (Fig. 2, pn₂) 381-448 (404). Spiracles (Fig. 2, sp_{2,3}) present on meso- and metathorax.

Prothorax. Pronotal ridges (Fig. 2-3, prnr) well

developed. Median pronotal sclerite and pronotal setae absent. Proepisternum + cervical sclerite (Fig. 2, pepcv) well defined. Prosternum (Fig. 2, stn₁) with longitudinal median ridge 67-89 (75) long, and

weak chitinized transverse triangular sclerite with thin lateral supporting ridges.

Mesothorax. Mesoprephragma (Fig.2, phr₁) distinctly bilobed, with shallow wide notch on front side. Prescutum (Fig.2, prsc) subquadrangular, well chitinized; with longitudinal median groove and well chitinized prescutal ridges (Fig.2, pscr), without setae. Prescutal suture (Fig.2, pscs) weak developed. Scutum (Fig.2, sct) well chitinized, with longitudinal median groove and 1 short lateral seta on each side. Median and prescutellar setae absent. Scutellum (Fig.2, scl) 26-34 (30) long and 86-94 (90) wide, very strong chitinized; with small oval not clear foramen (Fig.2, sclf). Postnotum with postnotal sclerite (Fig.2, pn₂), postnotal apophysis (Fig.2, pna) well chitinized, and membranous postalare (Fig.2, pa) and large triangular area. Basisternum (Fig.2, stn₂) well developed, 82-91 (86) long, 158-185 (173) wide, without median ridge. Praecoxal ridges (Fig.2, pcr₂) narrow. Marginal ridges (Fig.2, mr₂) well developed only at sides, so that basisternum weak circumscribed anteriorly. Furca (Fig.2, f) well developed, with wide base and 2 long gradually narrowed to apex anterolateral processes, which not reach anterior margin of basisternum.

Metathorax membranous; with 2 short setae at each side. Marginal (with praecoxal) ridges (Fig.2, mr₃) weak developed. Metasternum (Fig.2, stn₃) represented by weak chitinized transverse sclerite.

Wings oblong, 739-784 (774) long, 302-330 (313) wide; thin, membranous except small chitinized alar-lobe (Fig.2, al) on posterior side near base; radian (Fig.2, rad) and median (Fig.2, m) veins well developed, median one interrupted at its base; common stem 140-185 (170) long.

Halteres (Fig.2, h) 48-60 (56) long, 14-17 (16) wide, mace-shaped, with narrow stem and very long, apically hooked seta, which reach towards alar-lobe of wing and catch on it.

Legs (Fig. 5) well developed, of almost equal length. Length of joints as follows:

Coxa (Fig.5, cx) conical, with 2 short and 4 long setae. Trochanter (Fig.5, tr) subcylindrical, narrowed and wrinkled at middle, with 2 long setae and chain of 5 oval sensillae (Fig.5, ch.s). Femur (Fig.5, fm) mace-shaped, middle and hind femur wider than fore one; connected with trochanter along almost apical half of latter; with 5 setae. Tibia (Fig.5, tib) subcylindrical, narrowed near base; fore one weak «S» - shaped and with strong apical spur (Fig.5, tibs); with 11-16 setae. Seta inside at apex of hind tibia 1.32 times longer than latter wide. Tarsus (Fig.5, tar) 2-jointed, basal joint short, disc-like, apical one long, conical, with 11-15, 14-17 and 20-23 setae on fore, middle and hind tarsus respectively. Tarsal digitules (Fig.5, tdgt) not longer than claw. Claw (Fig.5, cl) weak curved in apical part. Ungular digitules (Fig.5, udgt) longer than claw.

Abdomen. Length from apex of postnotal sclerite (Fig.2, pn₂) to basal ridge of penial sheath (Fig.2, brps) 235-308 (264), maximum width at level of 3rd segment 196-252 (224). Setae on each side: 1 submarginal dorsal (Fig.2, sds) on 1-7 segments, marginal (Fig.2, mrs): 1 - on 1-5, 2 - on 6-7, 4 - on 8 segment, 2 submarginal ventral (Fig.2, svs) on 6-7 segments.

Genital segment (penial sheath) (Fig.4) with conical base and long narrow style (Fig.2, st), gradually narrowed to apex. Basal ridge of penial sheath (Fig.4, brps) developed only laterally. Aedeagus (Fig.4, aed) thin and slightly shorter than style. 1 long seta ventrally on conical base, 1 long one at side of basal part of style and 1 short one dorsally at basal part of style apically from long seta at each side. Style 1.20 times longer than abdomen wide. 4 pairs of sensillae (Fig.2, sts) very small, not clear, distributed over terminal part of style, which 5.5 times shorter than total genital segment length.

MATERIAL. 6 slides with 12 adult males, which

leg	coxa	trochanter	femur	tibia	tarsus	claw	average total
1	53-70 (62)	58-67 (62)	84-103 (92)	89-96 (91)	65-82 (76)	22-26 (24)	(382)
2	53-62 (59)	53-58 (55)	86-96 (91)	98-108 (104)	82-91 (84)	19-29 (25)	(393)
3	38-50 (44)	58-65 (61)	94-108 (101)	96-106 (101)	79-84 (80)	22-26 (23)	(382)

were bred in the laboratory 28.8.-02.9.1992 from living colonies of *L. japonica* on the bark of *Betula pubescens*, collected on 27.8.1992 in Dagomys, near Sochi, Krasnodar region, Russian Federation.

REMARKS. Male specimens were attributed to *L. japonica* as this species was the only one of scale insects (adult female specimens have been mounted and investigated) found in the colonies from which they were bred.

Tribe Leucaspidini includes 16 genera, from which 5 (namely *Leucaspis*, *Lopholeucaspis*, *Anamaspis*, *Salicicola* and *Suturaspis*) are widely distributed [Borchsenius, 1966]. Adult males of 4 widely spread species from 3 genera have been satisfactorily described [Bustshik, 1958; Ezzat, 1956; Jancke, 1955]. The diagnosis of the tribe Leucaspidini and the key to species are proposed forth below on the basis of the characters of the subtribe Leucaspidina [Ghuri, 1962], descriptions and figures of *Leucaspis pusilla* Loew, 1883; *L. pini* (Hartig, 1839); *Salicicola kermanensis* (Lindinger, 1905) [Bustshik, 1958; Jancke, 1955] and my own observations of *Lopholeucaspis japonica*. Male of *Leucaspis senilobata* Green, 1929 is not mentioned in the key because of the insufficient description [Jancke, 1955].

Tribe Leucaspidini

DIAGNOSIS. Pronotal ridges and dorsal lateral branches of midcranial ridge present. Tubercular ocelli absent or present, in the latter case strong apical spur on fore tibia always present.

Key to species

- 1(6). Fore tibia with 1 or 2 strong apical spurs.
2(3). 2nd antennal joint with 1 long seta, 3rd one 3 times longer than wide, 48-53 mcr long, with 6-

8 setae, which twice longer than width of the joint. Tubercular ocelli present. 1 apical spur on fore tibia.....

..... *Lopholeucaspis japonica* (Cockerell, 1897).

- 3(2). 2nd antennal joint with 2 setae, 3rd one 4-5 times longer than wide, 72-124 mcr long, without setae or with setae which equal, slightly longer or shorter than width of this joint. Tubercular ocelli absent. 2 apical spurs on fore tibia.

- 4(5). 3rd antennal joint without setae or with 1-2 ones, 72 mcr long.....

..... *Leucaspis pusilla* Loew, 1883.

- 5(4). 3rd antennal joint with at least 11 setae, 124 mcr long.....

..... *Leucaspis pini* (Hartig, 1839).

- 6(1). fore tibia without apical spurs, 2nd antennal joint with 2 setae, 3rd one 3 times longer than wide, 52 mcr long, with 4-5 setae which shorter than width of this joint

..... *Salicicola kermanensis* (Lindinger, 1905).

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