Zoosystematica Rossica, 18(2): 246–259 *25 December 2009*

Morphological variability and species borders in the genus *Rhizopulvinaria* (Homoptera: Coccinea)

I.A. Gavrilov

I.A. Gavrilov, Zological Institute, Russian Academy of Sciences, Universitetskaya Emb. 1, St. Petersburg 199034, Russia. E-mail: coccids@gmail.com

The species considered in the genus *Rhizopulvinaria* were revised on the base of morphological and ecological data. Significant intraspecific morphological variability was shown for *Rh. artemisiae* s. l. The mode of life and reproductive biology of this species is briefly discussed. The majority of nominal species of *Rhizopulvinaria* described by different authors are considered to be morphological varieties of a single species *Rh. artemisiae* Signoret, 1873. Thus, the following species are placed in the synonymy of *Rh. artemisiae*: *Rh. retamae* (Hall, 1923), *Rh. halli* Borchsenius, 1957, *Rh. turkestanica* (Arkhangelskaya, 1931), *Rh. grassei* (Balachowsky, 1936), *Rh. dianthi* (Bodenheimer, 1943), *Rh. nevesi* (Gómez-Menor Ortega, 1946), *Rh. armeniaca* Borchsenius, 1952, *Rh. grandicula* Borchsenius, 1952, *Rh. hissarica* Borchsenius, 1952, *Rh. megriensis* Borchsenius, 1952, *Rh. minima* Borchsenius, *Rh. pyrethri* Borchsenius, 1952, *Rh. spinifera* Borchsenius, 1952, *Rh. transcaspica* Borchsenius, 1952, *Rh. turkmenica* Borchsenius, 1952, *Rh. variabilis* Borchsenius, 1952, *Rh. virgulata* Borchsenius, 1952, *Rh. viridis* Borchsenius, 1952, *Rh. polispina* Matesova, 1960, *Rh. quadrispina* Matesova, 1960, *Rh. solitudina* Matesova, 1960, *Rh. zaisanica* Matesova, 1960, *Rh. arenaria* Canard, 1967, *Rh. gracilis* Canard, 1967, *Rh. maritima* Canard, 1967, *Rh. saxatilis* Canard, 1967, *Rh. rhizophila* Bazarov, 1963, *Rh. saxosa* Shmelev, 1971, *Rh. zygophylli* Bazarov & Shmelev, 1975, *Rh. ucrainica* Tereznikova, 1981.

Key words: scale insects, soft scales, morphology, systematics, thelytoky, Homoptera, Coccinea, *Rhizopulvinaria*, *Rhizopulvinaria artemisiae,* new synonyms

INTRODUCTION

A Palaearctic genus *Rhizopulvinaria* Borchsenius, 1952 recently encounted 31 nominal species (Ben-Dov, 1993; ScaleNet, www.sel.barc.usda.gov/scalenet/scalenet.htm). With rare exceptions, the authors described the species basing on single pooply preparated old females, often without any differential diagnosis, and in all cases without any estimation of morphological variability. In the result of this situation, the work with the group was hard or even impossible over tentlus years. Further still even with the type specimens in hand, coccilodogists were not capable to identify newly collected material. Since the majority of the described *Rhizopulvinaria* "species" is the result of activity of soviet coccidologists and their material is kept in the Zoological Institute of the Russian Academy of Sciences I considered that my duty is to carry out comparative morphological investigation of this material, initially to make the united key, usable by the coccidologists theirselves as well as by the applied entomologists. In addition, during two visits to the Museum National d'Histoire Naturelle in Paris I had a possibility investigate the type series of species described by the French authors, along with the material received from Israel. My tree-year work with these species, several unsuccessful attempts to compile keys basing on different groups of characters, analysis of all available slides (more than 200) and all publications conserning *Rhizopulvinaria* spp. led me to the conclusion that numerous nominal species should be synonymized. It is interesting that the similar situation has already repeated several times over soft scales research history. It is sufficient to recollect the vast series of synonyms of *Parthenolecanium corni* (Bouché, 1844), *Pulvinaria vitis* (Linnaeus, 1758) or synonymization of numerous species of the genus *Eriopeltis* Signoret, 1872 described by Borchsenius (1956) (Danzig, 1975). However in contrast to the above mentioned examples *Rhizopulvinaria* is distinguished by the particularly extreme variability of the main morphological characters, including the characters that are usually very important in soft scales systematics. As a result this article is not only an attempt to synonymize the numerous names of species rank but also to analyse the morphological variability revealed by different authors.

Abbreviations: ZIN, Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia; MNHN, Muséum National d'Histoire Naturelle, Paris, France.

TAXONOMIC PART

Rhizopulvinaria Borchsenius, 1952

Rhizopulvinaria Borchsenius, 1952: 301. Type species *Rhizopulvinaria virgulata* Borchsenius, 1952, by original designation.

Rhizopulvinaria: Matesova, 1960; Hodgson, 1994; Pellizzari, Fontana, 1999.

Adult female. Body broadly oval, usually 2–4 mm long. Durung oviposition dorsal surface cuticle strongly protrudes and body develops hemispheric or even nearly spheric form. In living female body colour usually greenish-brown. Eyes poorly developed, often inconspicuous. Antennae 7–8-segmented. Legs thin; each with characteristic sclerotization in the region of tibiotarsal joint; claw with denticle. Claw digitals obliquely cut on apex. Anal ring with 6 flagellate setae (notes by Archangelskaya, 1931 and Borchsenius, 1952, 1957 that *Rh. megriensis* and *Rh. turkestanica* possess 8 flagellate setae seem to be doubtful). Multilocular pores (with 7–8 loculi each) nearly 6 µm in diameter group around vagina, form transverse rows on posterior abdominal segments and occur solitary on anterior abdominal sternits and thoracical sternits. Spiracle pores (with 5 loculi, rarely with 6–7 loculi each) 5–6 µm in diameter, form bands between each spiracle and body margin. Preopercular pores 4–6 µm in diameter, usually form sparse group in front of the anal plates. These pores vary in number in a great extent; in many specimens, especially in badly preparated females can be fully inconspicuous. Simple discoidal pores approximately 2 µm in diameter spread everywhere on dorsal body surface. Oval pores occur on ventral head surface and along ventral body margin. Tubular ducts of three sizes: small ducts approximately 1.5 µm wide and 4 µm long; middle-sized ducts nearly 3 µm wide and 7 µm long, and large ducts, approximately 3 µm wide and 15 µm long form wide band along body margin on ventral surface of thorax and abdomen, while middle-sized ducts are usually more numerous closer to body margin, and large ducts are more numerous closer to inner side of the band. Marginal setae form one, more rarely doubling row along the whole length of body margin. Anterior and posterior spiracle setae vary greatly in form and size (Fig. 2). Small conical setae located everywhere on dorsal body surface.

Morphological variability

It turned out to be impossible to arrange any morphologically isolated series of females from the variety of morphological forms of *Rhizopulvinaria* which are described as separate species as it can be seen from Fig. 2. Practically all morphological variations described occur in every region, where more or less significant collections were made: South France, Transcaucasia, Middle Asia.

The basic morphological characters used by different authors for designating of *Rhizopulvinaria* "species" are briefly discussed below.

1) Size and form of marginal and spiracle setae vary in *Rhizopulvinaria* so significantly that sometimes it is difficult to arrange a uniforme selection even from representatives of one population. Examples of such

variability are demonstrated in Fig. 2. Significant mosaic variability of these characters also takes place rather often.

2) Presence of one or two rows of marginal setae turnes out to be a rather relative character in detal view, because, on the one hand, these conical setae are always arranged in staggered rows, on the other hand, conical spines of the second row often poorly distinguished from ventral flagellate setae.

3) Number of quinquelocular pores between spiracle and body margin is one of the most variable characters not only in *Rhizopulvinaria*, but also in other soft scales.

4) Size characteristics. In papers concerning coccid morphology numerous metrical data are given very often, up to the size of numerous flagellate setae on body surface. Basing on these data the authors try to substantiate the independence of one or another species even without any other qualitative structural differences between analized selections of specimens. According to my experience the majority of the metrical characters that are the most applied in coccidology are poorly suitable for taxonomical conclusions. So, I have united approximate sizes of some morphological structures in different nominal *Rhizopulvinaria* species in the Table. Still the following considerations should be kept in mind while analyzing both this table data and metrical data of the other authors.

a) Considering small size of coccids, the authors perform all measurements under the microscope with the help of the ocular-micrometer. In this case the using of the special object-micrometer is necessary for initial data of the scale factor. Though it seems that some authors calculate the scale factor by multiplying of optical power of different microscope lens, that leads inevitably to significant deviations from the real data.

b) No author calculates the error of their optical device itself, while it can differ significantly depending on the microscope model.

c) No author takes into account rather significant errors originating from different position of the organ on the microslide. When the organ lyes on the angle to the slide plane instead of parallel position it's apparent size (for example, while measuring the legs) can differ from the real in tens micrometers.

d) Many metrical characteristics of coccids depend on age of the analyzed female. In the majority of species female size increase several times during the oviposition period. It mainly refers to the whole body volume, distance between parts of body, in particular between conical and flagellate setae, but seems to have no effect on size of legs, conical and flagellate setae, anal lobes and other strongly sclerotized structures.

e) Preparating features of the material also have some influence on error in metrical characteristics. For example, strong softening of cuticular structures resulting from long-term treatment with hot alkali can lead to stretching of intersegmental cuticular membranes in different dergree that naturally influences on size of the organ. That is most evident by the example of antennae, that can demonstrate on the slide either densely joined segments, or widely dispersed ones, with poorly stained intersegmental membranes.

f) According to my observations, the range of individual variability itself reaches up to 30–40 μm in legs measurements even in several specimens from one collection series preparated in a similar way.

g) Metrical characteristics can also depend on the host plant.

It seems that metrical data are practically never congruent in descriptions of the same species by different authors owing exactly to those above listed error sources.

Rather serious deviations in external morphology connected with parasitism of hymenopteran parasitic wasps nymphs in coccid females also should be taken into account, as it is shown, for example, in Danzig (1980). Unfortunately traces of parasit activity sometimes cannot be revealed in preparated material and therefore there is no way to take into consideration their possible impact on morphological deviations under review.

Table. Approximate size (µm) of some morphological structures in *Rhizopuivinaria* nominal species. Marginal setae length was mesuared on the thorax between the anterior and posterior spiracles.

Species name, material	Antenna length	Hind leg length		Thoracical marginal setae length	Spiracle setae length
		trochanter +femur	tibia +tarsus		
Rh. artemisiae s. str. (6 females, coll. Canard)	290–310	180–200	230–250	18–25	10–22
=*Rh. arenaria* (paralectotypes)	250–270	160–170	175–185	15–22	15–40
=*Rh. armeniaca* (lectotype and paralectotypes)	425–475	330–350	415–425	25–37	30–37
=*Rh. dianthi* (lectotype and 2 paralectotypes)	300–330	220–250	280–290	25–27	15–27
=*Rh. gracilis* (paralectotypes)	200–230	150–170	190–200	20–30	30–40
=*Rh. grandicula* (lectotype)	300–310	190–200	240–250	27–37	17–25
=*Rh. grassei* (paratype)	320–350	240–270	320–350	25–27	37–52
=*Rh. halli* (after Ezzat, Hussein, 1967)	353?	271?	275?	40?	30?
=*Rh. hissarica* (lectotype)	320–330	265–270	320–330	?	?
=*Rh. maritima* (paralectotype)	220	150	180	18–23	10–15
=*Rh. megriensis* (lectotype and paralectotype)	300–335	225–250	275–300	20–27	18–29
=*Rh. minima* (lectotype and paralectotype)	300–320	220	265	22–27	15–17
=*Rh. nevesi* (after Pellizzari, Fontana, 1999)	216–240?	151–170?	196–210?	9–21?	6–14?
=*Rh. pyrethri* (lectotype and paralectotype)	230	150–160	180–190	18–25	15–18
=*Rh. quadrispina* (2 paratypes)	260–270	150–180	190–200	27–32	24–26
=*Rh. retamae* (coll. by Ben-Dov from Israel)	310	210	300	22–35	18–20
=*Rh. saxatilis* (4 females, coll. by Canard)	370–380	200–220	230–260	23–32	25–36
=*Rh. solitudina* (lectotype)	290	180	240	32–37	15–22
=*Rh. spinifera* (lectotype)	260	200	220–230	20–27	30–37
=*Rh. transcaspica* (lectotype and paralectotype)	250–270	180–190	220–230	20–25	18–32
=*Rh. turkmenica* (lectotype and paralectotype)	320–330	250–260	300–330	30–40	27–50
=*Rh. ucrainica* (paratype)	270–280	170–180	190–200	25–27	20–23
=*Rh. variabilis* (lectotype and paralectotype)	265–275	160–175	180–200	25–30	25–36
=*Rh. virgulata* (lectotype and paralectotypes)	380–430	300–350	350–375	37–42	12–20
=*Rh. viridis* (lectotype and 3 paralectotypes)	210–220	150–160	180–190	18–25	23–30
=*Rh. zaisanica* (lectotype and paralectotype, only one (fore) leg present)	250–285	150, 180	175, 200	20–27	30–42
=*Rh. zygophylli* (2 females without antennae and legs, coll. Bazarov)	?	?	?	37–45	20–22

Consequently, considering all above listed arguments it can be stated that the majority of the nominal "species" of *Rhizopulvinaria* demonstrate one *continued* row of variability of the basic characteristics of external morphology and should be considered as one polymorphic species *Rhizopulvinaria artemisiae* s. l. Moreover, there are no other biological reasons for considering the concerned morphae as separate spesies. All of them inhabit roots or lower parts of stems of semi-desert and desert plants, most often on species of the genus Artemisia and other Asteraceae, more rarely on representatives of Caryophyllaceae and Chenopodiaceae; all possess similar morphological appearance; build similar ovisacs, demonstrate telitokous mode of reproduction with rarely emerging single males in separate populations. In fact the majority of the morphae described has any real range of distribution and is usually noted anywhere except the type locality. In contrary, the distribution of the genus is rather common (South Europe and Mediterranean zone, the Middle East and Middle Asia), but is not at all comparable to the range of other substantively large coccid genera, that are distributed on different continents as a rule. May be a further special research of *Rhizopulvinaria* ecology, physiology, reproductive biology and cytogenetics will reveal some "microspecies" that correspond to morphological descriptions of one or another species of the previous authors but now I see no reasons for such separation. Except for *Rh. artemisiae* s. l. I leave species status only for *Rh. narzykulovi* that (according to the description) differs from the former by a rather significant qualitative character (see below).

Rhizopulvinaria artemisiae (Signoret, 1873) (Fig. 1)

Pulvinaria artemisiae Signoret, 1873: 31; Borchsenius, 1952: 302; 1957: 278 (*Rhizopulvinaria*); Canard, 1968: 91; Pellizzari, Fontana, 1999 (*Rhizopulvinaria*).

Pulvinaria retamae Hall, 1923: 17, **syn. nov.**

Rhizopulvinaria retamae: Borchsenius, 1952a: 302, 1957: 259.

Ctenochiton artemisiae Hall, 1926a: 15; Ezzat & Hussein, 1967: 395

Rhizopulvinaria halli Borchsenius, 1957: 279, **syn. nov.**

Pulvinaria artemisiae turkestanica Archangelskaya, 1931: 81. Type material is apparently lost.

Rhizopulvinaria turkestanica: Borchsenius, 1952: 302, 1957: 267.

Eulecanium grassei Balachowsky, 1936: 56, **syn. nov.** *Lectotype* (designated here): MNHN, female, **France**, "Plage de Pierrefitte, env. Balanyuls [sur-Mer and Cerbere, on Anethum foeniculum] 4979.1 P.-O., IV 1933, P. Grassé". *Paralectotypes*: 24 females (23 in MNHN and 1 in ZIN); same data as lectotype.

Rhizopulvinaria grassei: Borchsenius, 1957: 280; Canard, 1966: 445.

Pulvinaria dianthi Bodenheimer, 1943: 12, **syn. nov.** *Lectotype* (designated here): Volcani Centre, Israel; female, **Iraq**, Ruwanduz gorge, on roots of Dianthus sp., 11 Oct. 1942. *Paralectotypes*. Volcani Centre, Israel; 2 females, same data as lectotype.

Rhizopulvinaria dianthi: Borchsenius, 1952: 302, 1957: 261.

Lecanopsis nevesi Gómez-Menor Ortega, 1946: 88, **syn. nov**.

Rhizopulvinaria nevesi: Pellizzari & Fontana, 1999: 17.

Rhizopulvinaria armeniaca Borchsenius, 1952: 306, **syn. nov.** *Lectotype* (designated here): ZIN; female, "**Armenia**, *Megri Region*, Legvaz, lower parts of stem, 28 May 1947, coll. N. Borchsenius, slide 300–50. *Paralectotypes*. ZIN, 2 females, same data as lectotype; 1 female, **Armenia**, *Gegart*, 13 Aug. 1948, coll. N. Borchsenius, slide 510–51.

Rhizopulvinaria armeniaca: Borchsenius, 1957: 263.

Rhizopulvinaria grandicula Borchsenius, 1952: 314, **syn. nov.** *Lectotype* (designated here): ZIN; female, **Armenia**, Megri, lower parts of stem [?Artemisia sp.], 25 May 1947, coll. N. Borchsenius, slide 200–47. *Paralectotypes*. ZIN; 6 females, same data as lectotype; 3 females, **Armenia**, Korchevaniskoye Gorge, same date as lectotype, lower parts of Artemisia stem; 5 females, **Armenia**, around Erevan, Arthemisia roots, 20 May 1947, coll. N. Borchsenius, 4 slides 131–48 (ZIN).

Rhizopulvinaria grandicula: Borchsenius, 1957: 276.

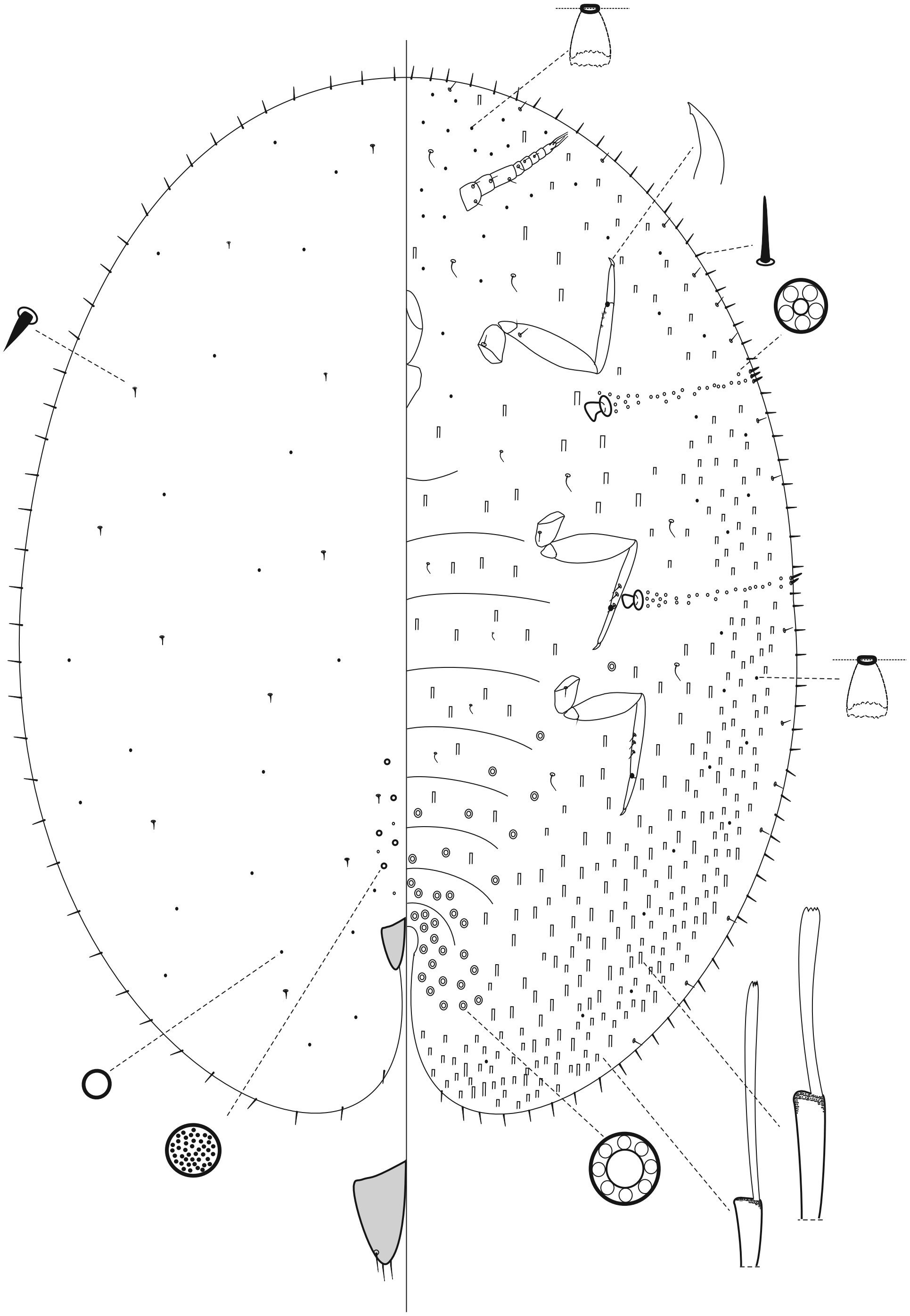

Fig. 1. Schematic drawing of *Rhizopulvinaria artemisiae* s. l.

Rhizopulvinaria hissarica Borchsenius, 1952: 314, **syn. nov.** *Lectotype* (designated here): ZIN; female, **Tadjikistan**, *Varzob Distr.*, Gushary Village surroundings, on Dianthus sp., 19 July 1944, coll. N. Borchsenius", slide 508–51.

Rhizopulvinaria hissarica: Borchsenius, 1957: 275.

Rhizopulvinaria megriensis Borchsenius, 1952: 307; 1957: 265, **syn. n.** *Lectotype* (designated here): ZIN, female, **Armenia**, Nachichevan-Dara [canyon], on saltwort [undetermined shrub of Chenopodiaceae], 26 June 1947, coll. N. Borchsenius, slide 83–47, in black circle. *Paralectotypes*: ZIN, female, on the same slide; female, on separate slide with same data, slide 83–48.

Rhizopulvinaria minima Borchsenius, 1952: 310; 1957: 269, **syn. n.** *Lectotype* (designated here): ZIN; female, **Kyrghyzstan**, *Syr-Darya Prov.*, Taldy-Bulak, on Astragalus sp., 13 June 1910, coll. A. Kiritshenko, slide 302–50, in black circle. *Paralectotypes*: ZIN; female, on same slide; female, **Tadjikistan**, *Isfara Distr.*, slopes of hills to the south of Vorukh Village, 10 Sept. 1944, coll. N. Borchsenius, slide 51b–51.

Rhizopulvinaria pyrethri Borchsenius, 1952: 313; 1957: 273, **syn. nov.** *Lectotype* (designated here): ZIN; female, **Kazakhstan**, *Western Kazakhstan Prov.*, steppe in Borbastau River vicinity [70 km from Ural'sk City], on Pyrethrum sp., 9 June 1950, coll. M. Kratets, slide 523–50, in black circle. *Paralectotype*: ZIN; female, on same slide.

Rhizopulvinaria spinifera Borchsenius, 1952: 305, **syn. nov.** *Lectotype* (designated here). ZIN; female, "**Georgia**, *Borzhomi*, on roots of Achillea sp., 24 Sept. 1949, Z. Khadzhibeyli, slide 78–50", in black circle. *Paralectotype*: ZIN; female, on same slide.

Rhizopulvinaria spinifera: Borchsenius, 1957: 261.

Rhizopulvinaria transcaspica Borchsenius, 1952: 316, **syn. nov.** *Lectotype* (designated here): ZIN; female, **Turkmenistan**, Nebit-Dag Canyon, 2 May 1947, coll. N. Borchsenius, in black circle. *Paralectotypes*: female, on same slide; female, "[**Turkmenistan**], around Krasnovodsk, on Artemisia stems, 30 Apr. 1947, coll. N. Borchsenius", slide 207–48.

Rhizopulvinaria transcaspica: Borchsenius, 1957: 277.

Rhizopulvinaria turkmenica Borchsenius, 1952: 304; 1957: 259, **syn. nov.** *Lectotype* (designated here): ZIN; female, "**Turkmenistan**, *Ashkhabad Distr.*, Firyuza Canyon, on rhizome of Aster altaicus, 1 June 1940, coll. N. Borchsenius, slide 327–50, in black circle. *Paralectotype*: female, on same slide.

Rhizopulvinaria variabilis Borchsenius, 1952: 311, **syn. nov.** *Lectotype* (designated here): ZIN; female, [**Russia**], *Stalingrad* [*Volgograd*] *Prov.*, Experimental-meliorative Station Valuyskaya, Artemisia sp. roots, 5 June 1949, coll. Frolova, slide 252–50, female in black circle. *Paralectotypes*: ZIN; 3 females on same slide.

Rhizopulvinaria variabilis: Borchsenius, 1957: 271.

Rhizopulvinaria virgulata Borchsenius, 1952: 309, **syn. nov.** *Lectotype* (designated here): ZIN, female, **Turkmenistan**, Nebit-Dag, canyon, 1 May 1947, coll. N. Borchsenius, slide 216–48. *Paralectotypes*: ZIN; 2 females on one slide, **North Persia**, *Shakhrud*, 25 May 1914, coll. A. Kiritshenko, slide 512–51.

Rhizopulvinaria virgulata: Borchsenius, 1957: 266; Hodgson, 1994: 516.

Rhizopulvinaria viridis Borchsenius, 1952: 312; 1957: 272, **syn. n.** *Lectotype* (designated here): ZIN; female, **Ukraine**, *Crimea*, Sudak, 1929, female in black circle. *Paralectotypes*. ZIN; 3 females on the same slide; 10 females (5 females on each of 2 slides without numbers) with the same label data; 6 females, *Crimea* [on] Artemisia, coll. N. Borchsenius, 1930, slide without number; 2 females, *East Crimea*, Tuak, 15 Sept. 1937, coll. N. Kiritshenko, slide 138.

Rhizopulvinaria polispina Matesova, 1960: 197, **syn. nov.** *Lectotype* (designated here): ZIN, female, **Kazakhstan**, *East-Kazakhstan Prov.*, left shore of the river Irtysh, on Artemisia roots, 19 May 1954, coll. G. Matesova", slide 281, female in black circle. *Paralectotype*: ZIN, female, on same slide.

Rhizopulvinaria quadrispina Matesova, 1960: 201, **syn. nov.** *Lectotype* (designated here): ZIN; female, "**Kazakhstan**, [*Alma-Ata Prov.*], left shore of the river Ili in its middle flow, on *Salsola* sp. roots, 31.V.1952, G. Matesova", slide 156, female in black circle. *Paralectotype*: ZIN, female, same slide.

Rhizopulvinaria solitudina Matesova, 1960: 202, **syn. nov.** *Lectotype* (designated here): ZIN; female, "**Kazakhstan**, *Karaganda Prov.*, Betpak-Dala Desert, near Balkhash Lake, on Artemisia sp. roots, 26 May 1956, coll. Matesova, slide 477. *Paralectotype*: female, on separate slide, but same data and same slide number as lectotype.

Rhizopulvinaria zaisanica Matesova, 1960: 199, **syn. nov.** *Lectotype* (designated here): ZIN, female, "**Kazakhstan**, *Zaysan Distr.*, Kenderlik, on Artemisia sp. roots, 5 June 1954, coll. G. Ya. Matesova", slide 305. *Paralectotypes*: ZIN; 2 females, on separate slide, but same data and same slide number as lectotype.

Rhizopulvinaria arenaria Canard, 1967b: 170, **syn. nov.** *Lectotype* (designated here): MNHN; female, "[**France**], Saint-Cyprien-Plage (P.-O.), Dianthus pyrenaicus, 17 May 1966, coll. M. Canard. *Paralectotypes*: MNHN, 9 females, same data as lectotype.

Rhizopulvinaria gracilis Canard, 1967b: 179, **syn. nov.** *Lectotype* (designated here): MNHN; female, "[**France**], Courbon – B.A., on Dianthus virgineus, 14 Sept. 1965, coll. M. Canard. *Paralectotypes*: MNHN, 6 females, same data as lectotype.

Rhizopulvinaria maritima Canard, 1967a: 159, **syn. nov.** *Lectotype* (designated here): MNHN; female, "[**France**], Helichrysum stoechas, Plage du Racou (P.-O.), 26 May 1965, Canard. *Paralectotypes*: 10 females (9 MNHN and 1 ZIN), same data as lectotype.

Rhizopulvinaria saxatilis Canard, 1967b: 176, **syn. nov.** *Lectotype* (designated here): MNHN; female, [**France**], Portel (Aude), on Dianthus virgineus, 7 Febr. 1966, coll. M. Canard. *Paralectotypes*: MNHN, 4 females, same data as lectotype.

Rhizopulvinaria rhizophila Bazarov, 1963: 41, **syn. n.**

Rhizopulvinaria saxosa Shmelev, 1971: 61, **syn. nov.**

Rhizopulvinaria zygophylli Bazarov & Shmelev, 1975: 110, **syn. nov.**

Rhizopulvinaria ucrainica Tereznikova, 1981: 147, **syn. nov.** *Holotype*. ZIN, **Ukraine**, *Crimea*, on upper part of root of crucifer plant, 19 June 1963, coll. E. Tereznikova, slide 1894.

Taxonomic Remarks. I had no opportunity to become acquainted with the type material of *Rh. artemisiae* s. str. kept in the Museum of Natural History in Vienna. Hence taking into account that Signoret didn't make total coccid slides, which are basic for species description in modern coccid taxonomy, his material are poorly suitable for comparison with the other subsequently described species. The most detailed modern description of the species is given in the paper of Canard (1968), that is based on material collected in France. I analyzed six females from Canard's collection belonging to one population. In those females marginal setae of conical form with more or less pointed apex are arranged in one, somewhere doubling row. Spiracle setae of conical form, notably shorter than the marginal ones. Comparing of this material and Canard's description and also short description by Signoret himself (Signoret, 1873) with recent redescription of *Rhizopulvinaria nevesi* (Gómez-Menor Ortega) (Pellizzari, Fontana, 1999) leave no doubt that two above mentioned species are synonyms, while the observed minor morphological differences (different number of spicacle pores) are connected with common geographical and individual variability.

Females of *Rh. retamae* from Israel differ from the rest of the material in practically ideal cylindrical form of marginal setae with bluntly rounded. Hence very similar in form marginal setae are also demonstrated by *Rh. armeniaca* while in the last species along with cylindrical ones also present conical setae of common elongated conical form.

Rh. virgulata and *Rh. zygophylli* are notable among all other collections for large legs and long marginal setae. Though the same large legs are shown also by *Rh. armeniaca*, while it's marginal setae are of middle for this species.

Notes by Borchsenius (1952, 1957) that *Rh. transcaspica* lacks spiracle setae merely implies that spiracle setae are indistinguishable from marginal both in form and size.

Notes of Archangelskaya (1931) and Borchsenius (1952, 1957) that *Rh. megriensis* and *Rh. turkestanica* differ from the other species in anal ring possessing eight flagellate setae are hardly verified basing on the available slides. Furthermore, Borchsenius himself did not consider this character as a differential one.

Females of *Rh. grassei* are distinguished from the other material by relatively large spiracle setae that are notably bigger than marginal setae. Though separate spiracle

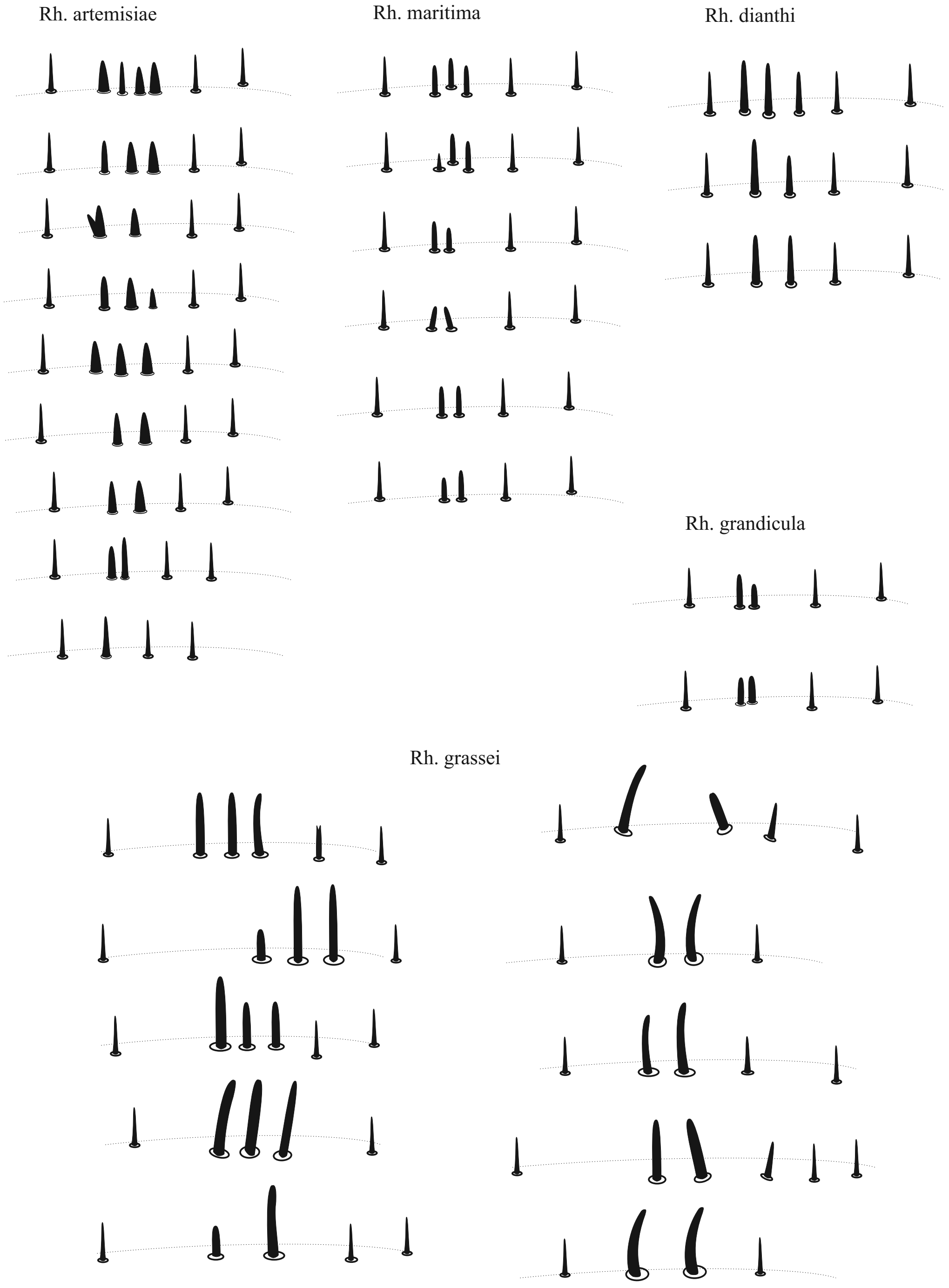

Fig. 2. *Rhizopulvinaria artemisiae* s. l., size and form variability of marginal and spiracle setae.

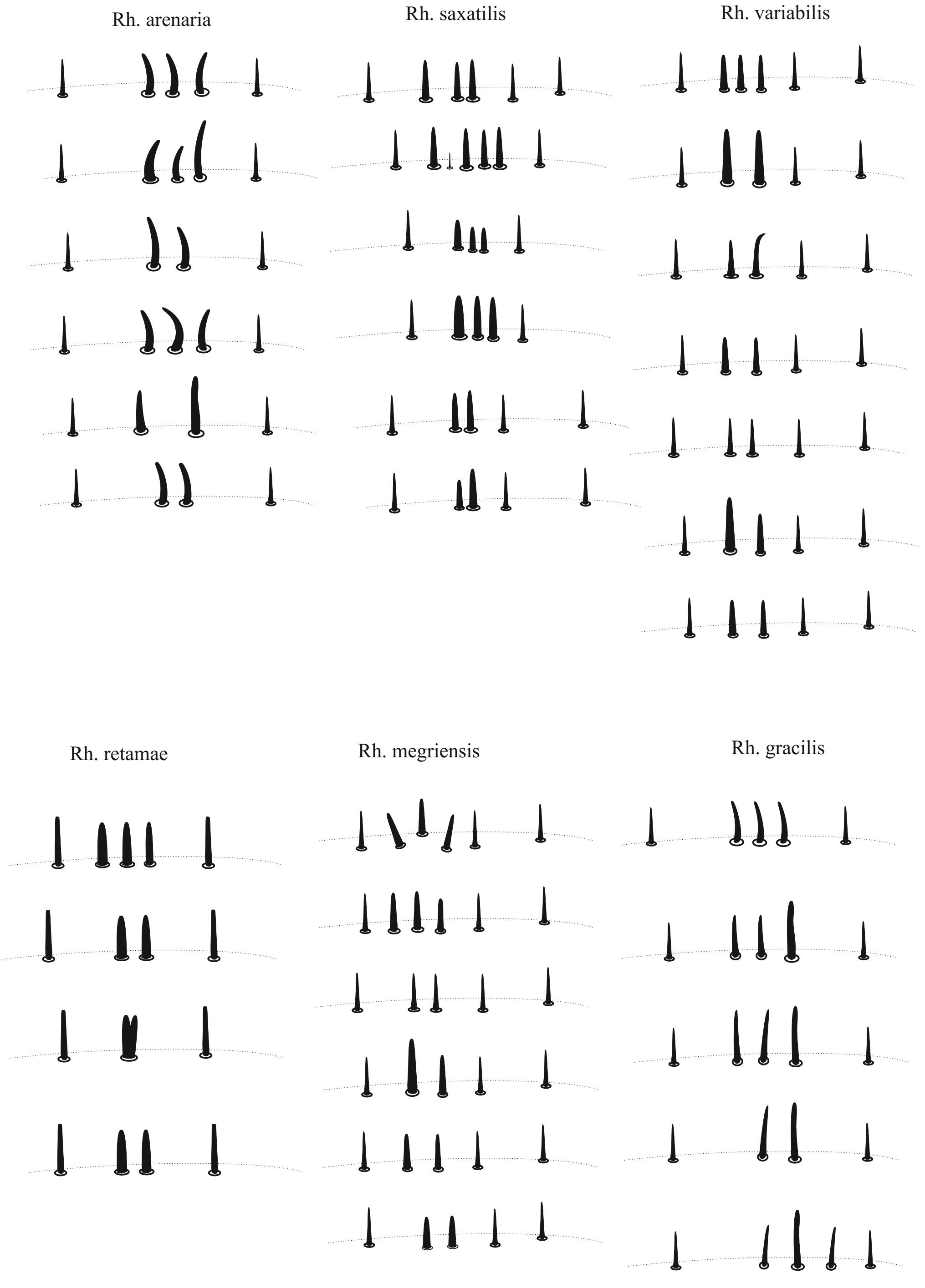

Fig. 2. (*continued*).

setae of those females are of size rather common for *Rh. artemisiae* s. l. (see Fig. 2).

The lectotype and the paralectotype of *Rh. hissarica* are preparated in such a manner that lack maginal and spiracle setae and in addition the paralectotype lacks legs. Judging from the figure, description by Borchsenius and available type material this "species" has no special differences from *Rh. artemisiae* s. l.

I had no opportunity to study material of *Rh. halli*, *Rh. rhizophila* and *Rh. saxosa* though it is clear judging from their descriptions that characters of their outer morphology conform completely to *Rh. artemisiae* s. l. variability range.

Material. The type specimens of all species for which the lectotypes are designated. Different personal collections that were conventionally determined by different coccidologists as *Rh. turkestanica*, *Rh. grassei*, *Rh. armeniaca*, *Rh. grandicula*, *Rh. hissarica*, *Rh. megriensis*, *Rh. minima*, *Rh. pyrethri*, *Rh. spinifera*, *Rh. transcaspica*, *Rh. variabilis*, *Rh. viridis*, *Rh. arenaria*, *Rh. gracilis*, *Rh. maritima*, *Rh. saxatilis* and *Rh. zygophylli*; totally 200 slides from South France and former USSR. Six females of *Rh. artemisiae* s. str., **France**, Sept. 1968, coll. M. Canard. Two females of *Rh. retamae*, **Israel**, Nir Yitshah, on Pithyranthus tortuosus, 12 Jan. 1979, coll. Y. Ben-Dov. The holotype of *Rh. ucrainica*.

Distribution. South Europe and Mediterranean zone, Canary Islands (apparently introduced), Caucasus, lower Volga region, the Near East, Middle Asia, Mongolia.

Mode of life. It lives on roots and lower parts of stems of perennial steppe and semi-desert dicotyledons, more often on *Artemisia*, *Diathus*, *Salsola*, more rarely on *Helichrysum*, *Alyssum*, *Euphorbia*, *Teucrium*, *Santolina*, etc.

Parthenogentic species. In some populations (South France, Armenia, Tadjikistan) empty scales of males were discovered (Canard, 1968; Borchsenius, 1957; Bazarov, 1963). However, it is not known if these scales belonged to *Rhizopulvinaria* males or to any other coccid species and it is not clear if these males originate from bisexual reproduction or are produced by parthenogentic females. Special research of a population from Astrakhan showed that there were no males in progeny of the treated females (Gavrilov, Trapeznikova, 2008, as *Rh. variabilis*). The initial stages of embryo development (at least up to the germ band invagination) pass inside of mother's body. The species seemingly have one generation per year throughout it's distribution range, with mature females hibernating.

The chromosome number was determined as 2n=28 for a thelytocous population from Astrakhan (Gavrilov, 2007; Gavrilov, Trapeznikova, 2008, as *Rh. variabilis*).

Rhizopulvinaria narzykulovi Bazarov & Shmelev, 1975

(Fig. 3)

Bazarov & Shmelev, 1975: 107. *Holotype* and *paratypes*: Western Pamirs, Oksu River, Vill. Kyzylrabat surroundings, on roots and upper part of roots of *Artemisia*, 23.VII.1966, G. Shmelev coll.

Material. It is noted in the primary description that the holotype is stored in the Zoological Institute of the Russian Academy of Sciences, though it is not true. I also know nothing about the paratypes that should be stored in the Institute of Zoology and Parasitology of the Academy of Sciences of Tadjikistan according to the species authors statement.

Taxonomical note. Judging from the figure and description from the article of Bazarov and Shmelev (1975), this species differ from *Rh. artemisiae* s. l. in possessing of peculiar submarginal tubercles each bearing a small cylindriral duct at the base (Fig. 3). Because of lack of the available material this statement seems untestable. Among *Rhizopulvinaria* studied by me no one possessed such tubercles, though similar structures are occur in representatives of the other soft scales genera.

ACKNOWLEDGEMENTS

The author is profoundly grateful to Dr. Danièle Matile-Ferrero (Museum Nationla d'Histoire Naturelle, Paris) for the possibility

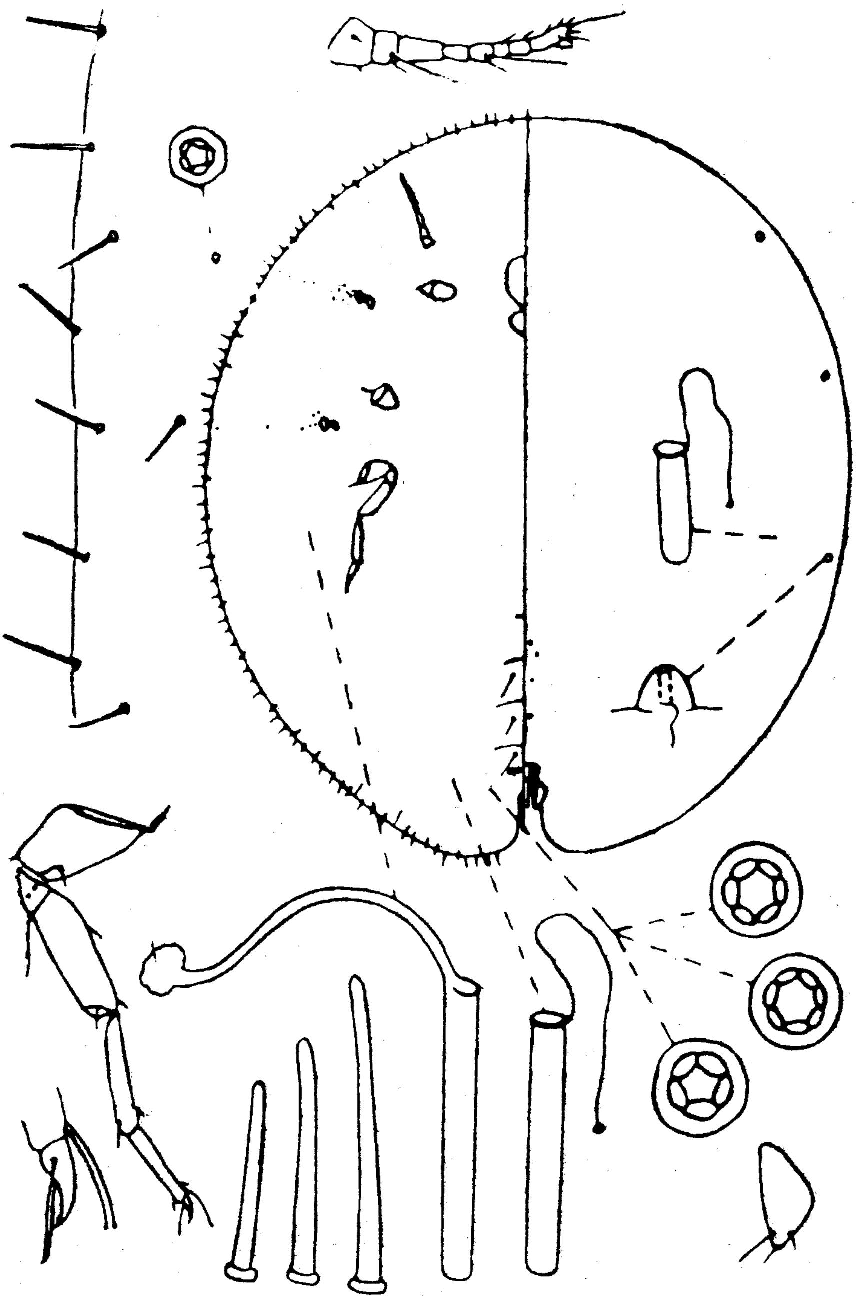

Fig. 3. *Rhizopulvinaria narzykulovi*, after Bazarov & Shmelev (1975).

to become acquainted with the Museum collections and great help in remaking of the old *Rhizopulvinaria* slides, and also to Dr. Yair Ben-Dov, Volkani Center, Israel for providing *Rh. dianthi* and *Rh. retamae* material. The research was supported by an INTAS PostDoctoral Fellowship grant 06–1000014–5959, grants of Russian Foundation for Basic Researches 09-04-91229-CT_a and 08-04-00787, and by a special grant of the Government of St. Petersburg.

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Received 10 October 2009 / Accepted 1 December 2009.