

Scale insects (Hemiptera: Coccoomorpha) on apple and neighbouring plants in Eastern Georgia (Sakartvelo)

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ABSTRACT

Surveys of the scale insect fauna of East Georgia were carried out in vegetation season (from March to November) during the years 2017 and 2018. A total of fifty-five apple orchards were studied in Kartli and Kakheti regions; 7 of them in Kakheti region and 48 in Shida Kartli region (Gori, Kareli). In Shida Kartli, most apple orchards had been sprayed heavily with chemicals (14 to 22 times). In 2 unsprayed orchards, intensive settlements (level 3) of San Jose scale, *Comstockaspis perniciosus* (Comstock) (Hemiptera: Diaspididae) was noted – Kheltubani (42°04'02"N, 44°09'42"E) and Kere (42°10'31"N, 44°04'51"E). *Comstockaspis perniciosus* was found in 50 % of the branches and twigs and also on the leaf petioles. As for the remaining orchards, the scale insect infestations in Sasireti and Gombori were less intense (level 2), whilst in 19 apple orchards the infestations were very low (level 1). Additionally, neighbouring fields were searched for scale insects. All plants around the apple orchards were searched and checked visually. In total, 51 species of scale insects were recorded: Acanthococcidae (2 spp.), Asterolecaniidae (1 sp.), Coccidae (13 spp.), Cryptococcidae (1 sp.), Diaspididae (18 spp.), Eriococcidae (2 spp.), Kermesidae (1 sp.), and Pseudococcidae (13 spp.).

Keywords: Diaspididae, Asterolecaniidae, Pseudococcidae, Coccidae, Kermesidae Apple orchard.

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Introduction

Scale insects (Hemiptera: Coccoomorpha) are small and hardly visible sap-sucking insects [1, 2, 3]. There are about 8000 species in the world [11]. They have soft bodies covered with a waxy test or wax like filaments [1]. The waxy test protects the insect from drying, and unfavorable environmental conditions and from pesticides [1, 2, 3]. Scale insects have well pronounced sexual dimorphism [1]. Males are more typical insects-like, with wings and legs, whereas females have no wings at all and are often legless [1, 2, 3]. Male scale insects have complete metamorphosis, whereas female development is paedomorphic (adults resemble nymphs) [1]. Some scale insects have remarkable diversity in their genetic systems (e.g., parthenogenesis, hermaphroditism, and paternal genome elimination),

chromosome number, sperm structure, and types of endosymbiosis [2]. The female lays eggs (oviparity) in a cavity under her body or within a waxy covering (ovisac) that may be attached to her body, or the eggs may be retained in the reproductive tract until they are ready to hatch (ovoviviparity) [1, 2, 3]. The mobile first-instar nymphs, called crawlers, are the main dispersal agents for scale insects; other immature instars generally are sessile [1, 2, 3]. The number of generations a year varies often within species and ranges from one to up to seven or eight [1]. Scale insects feed from the phloem or parenchyma, and their host associations range from monophagous to polyphagous [1, 2, 3]. Sap removal is the main cause of plant damage, but a few species of mealybugs and armored scales also transmit plant pathogens or toxins that may further reduce plant vigor and eventually kill the host [1, 2, 3]. They are

pests of fruit trees, vineyards, and ornamental plants [1, 2, 3]. Mealybugs and soft scales excrete honeydew, which is consumed by ants and the ants protect them from parasites and predators in exchange, i.e. have a mutualistic relationship [2, 3]. Honeydew often accumulates on leaves and fruit where saprophytic sooty molds grow, causing the blackness [4].

Many scale insects are economically important pests of agriculture, horticulture, and forestry [1]. The major scale insect pests worldwide are mealybugs (Pseudococcidae), but other serious pests include some armoured scales (Diaspididae), soft scales (Coccidae), lac insects (Kerriidae), and ice-ryines (Monophlebidae) [1, 2]. Many scale insects have been considered to be important pests for Georgian agriculture [4]. Scale insects have a considerable number of natural enemies. The most important predators of scale insects are ladybird beetles (Coleoptera: Coccinellidae); especially species of *Rodolia* spp, *Chilocorus* spp, and *Cryptolaemus* spp. [1]. The main parasitoids of scale insects are chalcidoid wasps, especially species of Aphelinidae (e.g., species of *Aphytis*, *Encarsia*, and *Coccophagus*) and Encyrtidae (e.g., species of *Anagyrus*, *Microterys*, *Leptomastix*, and *Metaphycus*), although some scale insects are attacked by flies that may be either parasitic (e.g., Cryptochaetidae) or egg predators (e.g., a few Cecidomyiidae) [2, 3]. The parasitoid complex of various scale insects had been studied from Georgia [5, 6, 7, 8, 9], however many pestiferous scales still remain poorly studied, in terms of their natural enemies.

Scale insects may act as pests to any kind of the plants [10]. In the case of apple, they settle on trunk, branches, twigs, leaves and fruits [10]. Both armored scales and soft scales settle on the surface of the apple fruit [10]. Yellow, red and brown gouts appear on the damaged skin of the fruit and therefore, such product loses visual effect [4]. Apple is a very important crop because its fruit contains many minerals and vitamins thus, it has curative traits [11]. Out of various types of fruits, apple takes the biggest part in human nutrition ration [11]. Apple is the most cultivated crop in the Eastern part of Georgia (mainly in Kartli region), but apple gardens and isolated trees can be seen in the western part as well, such as Racha and Imereti regions [personal observation]. According to the FAO data 68.600 tons of apples were harvested in Georgia in 2013 [12]. Apple productivity can be reduced because of diseases and pest insects, particularly the scale insects. In the surroundings of intensive apple production region

(Kartli) there is a diverse composition of agricultural and wild plants, such as cherry, apricot, plum, willow, poplar and wild apple.

In Georgia are three main groups of scale insects: armored scale insects (Diaspididae), which are represented by 90 species belonging to 38 genera, mealybugs (Pseudococcidae) with 71 species belonging to 31 genera and the soft scale insects (Coccidae) with 43 species belonging to 23 genera [13].

Twenty seven scale insect species related to apple (*Malus domestica* L. and *Malus orientalis* L., Rosaceae) have been recorded around the world [14]. According to the literature data of Hadzibeyli [4], 15 apple (*Malus* sp.) related species have been revealed in Georgia. Japoshvili [6] recorded three species of coccids on apple: *Lepidosaphes ulmi*, *Comstockaspis perniciosus* (as *Quadraspidiotus perniciosus*) and *Phenacoccus* sp. (i.e. *Ph. mespili*).

In this study our goal was to determine the scale insect fauna of the apple orchards and its neighboring plants in East Georgia, to investigate their current composition, conditions and importance.

Materials and methods

Surveys of the scale insect fauna of East Georgia were carried out during 2017 and 2018 vegetation seasons. Fifty-five apple orchards had been studied in Kartli and Kakheti regions. Field trips started on 7th of May and end on 23 of September. There were 10 trips, each for 3 days. Fifteen random apple trees were studied in each garden and neighboring plants around apple orchards.

Invasion intensity of each tree was done by 5 point system, 0 points means that there are no pests on the plant, 1 point – there are separate pest units on leaves, branches or trunk, 2 points – 25% of leaves and branches are populated with scale insects, 3 points – scale insects are present on 50% of the leaves, and also on fruits and branches, 4 points – the plant is almost entirely covered with scale insects, fall of leaves and fruits, withering of the branches is also visible [4].

From each damaged tree 5 cm² of the damaged bark was taken. Damaged 10 cm long twigs and fruits were collected and placed in packages, which were labelled. In the laboratory, a few specimens (about 20 individuals) were taken from the plant carefully. Specimens were stored in 70% ethanol (for morphological studies). Slide mounting was done according to Wilkey's method [1]. Species identification were done by using different keys [1, 15, 16].

Apple (*Malus* sp.) pests are indicated with one asterisk in the text. New records for Georgia are indicated with two asterisks. The numbers of slide mounted material are shown in brackets.

Results

We investigated 55 apple orchards, 7 of them are in Kakheti region and 48 in Shida Kartli region (Gori, Kareli). In Shida Kartli most apple orchards were sprayed by chemicals. Intensive infestations of scale insects (3 points - scale insects were on 50% of the branches, twigs and also on leaf petioles) were found in 2 orchards at Kheltubani (42°04'02"N, 44°09'42"E) and Kere (42°10'31"N, 44°04'51"E). These orchards were not sprayed with oil-based reagents. As for the rest of the orchards, in Sasireti and Gombori scale insect infestations were 2 points, 19 apple orchards have a 1 point infestation, and the remaining 32 apple orchards there were none, or they were found only on separate trees. See diagram below.

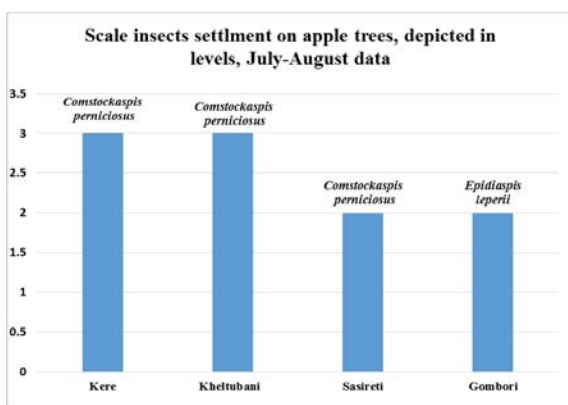


Fig. 1. Scale insect settlement on apple trees. On the graph blue colored columns show points of species settlement in the orchards.

List of species of scale insects in Kartli and Kakheti region:

Family- Acanthococcidae
Genus- Acanthococcus Signoret

1. *Acanthococcus aceris* Signoret
Material examined: 1 ♀, Khintsvisi, *Acer* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, 9.VIII.2017, Coll. No: 86. 3 ♀♀, Tsemi (Borjomi), 28.VIII.2017, *Acer* sp., Leg. M. Batsankalashvili, Coll. No: 166. Rusiani, 15.VIII.2017, *Acer* sp., M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 131.

Genus- *Anophococcus* (Signoret)

2. *Anophococcus agropyri* (Borchsenius)
Material examined: 5 ♀♀, Kintsvisi, 9.VIII.2017, Poaceae, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 80. 2 ♀♀, Vaziani-Gombori-Telavi road (41°44.23'N, 45°7.403'E), 15.VIII.2017, *Agropyron* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 120.

Family- Asterolecaniidae

Genus- *Bambusaspis* Cockerell

3. *Bambusaspis bambusae* (Boisduval)
Material examined: 2 ♀♀, Botanical garden of Tbilisi, *Bambusa* sp. 3.VIII.2017, M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 23.

Family- Coccidae

Genus- *Ceroplastes* Gray

4. *Ceroplastes floridensis* (Comstock)**
Material examined: 1 ♀, Botanical garden of Tbilisi, 3.VIII.2017, *Eriobotrya japonica*, M. B. Kaydan, G. Japoshvili, M. Batsankalashvili Coll. No: 32. 2 ♀♀, Botanical garden of Tbilisi, *Laurus* sp., 3.VIII.2017, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili Coll. No: 37; 3 ♀♀, Isani, 12.VIII.2017, *Laurus nobilis*, M. B. Kaydan, G. Japoshvili, M. Batsankalashvili Coll. No: 102.

5. *Ceroplastes rusci* (Linnaeus)**
Material examined: 4 ♀♀, Tbilisi, Abanotubani, 3.VIII.2017, *Prunus laurocerasus*, Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No: 31.

Genus- *Coccus* Linnaeus

6. *Coccus hesperidum* (Linnaeus)
Material examined: 4 ♀♀, Tbilisi, Rustaveli Avenue, 1.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, Kirkitadze, Coll. No: 11. 3 ♀♀, Botanical garden of Tbilisi, 3.VIII.2017, *Laurus* sp.; Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 37. 2 ♀♀, Abanotubani, 3.VIII.2017, *Magnolia grandiflora*, Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No: 49.

7. *Coccus pseudomagnoliarum* (Kuwana)
Material examined: 1 ♀, Mtskheta, 1.VIII.2017, *Celtis* sp., Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No: 43.

Genus- *Eriopeltis* Signoret

8. *Eriopeltis festucae* (Boyer de Fonscolombe)
Material examined: 2 ♀♀, Vaziani-Gombori-Telavi road (41°44'13.80"N, 45°7'24.18"E), 15.08.2017, *Agropyron* sp., Leg.

- M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 120. 2 ♀♀, On the road between Ujarma and Paldo (41°48'18.36"N, 45°08'54.12"E), *Agropyron* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 125.
Genus- *Neopulvinaria* Hadzibeyli
9. *Neopulvinaria innumerabilis* (Rathvon)
Material examined: 1 ♀, Tbilisi, Rustaveli Avenue, *Fraxinus* sp., 1.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 12.
Genus- *Parthenolecanium* Sulc
10. *Parthenolecanium corni* (Bouche)
Material examined: 3 ♀♀, Tbilisi, Vake Park, *Quercus* sp., 1.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 5. 1 ♀, Vera Park, 1.VIII.2017, *Celtis* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 16; 1♀, Botanical garden of Tbilisi, *Fraxinus* sp., Leg. M. B. Kaydan, M. Batsankalashvili Coll. No: 51. 1 ♀, Sasireti, 8.VIII.17, *Cydonia oblonga*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 64; 1 ♀, Doesi, 8.VIII.17, *Prunus persica*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 68. Kareli, 9.VIII.17, *Prunus divaricata*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 69; 2 ♀♀, Doesi, (41°56'4.14"N, 44°13'43.56"E), *Prunus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 72; 3 ♀♀, Kintsvisi, 9.VIII.17, *Corylus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 85; 1 ♀, Karaleti, 9.VIII.17, *Cornus sanguinea* subsp. *australis* Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 90; 1 ♀, Near to Mukhrovani (41°47'01.80"N, 45°09'23.82"E) 15.VIII.2017, *Crataegus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 112. 2 ♀♀, Road between Vaziani and Mukhrovani (41°44'13.80"N, 45°07'24.18"E), 15.VIII.2017, *Prunus armeniaca*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 122. 2 ♀♀, Tianeti, 16.VIII.2017, *Fraxinus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 140;
Genus- *Physokermes* Targioni Tozzetti
11. *Physokermes piceae* (Schrank)
Material examined: 1 ♀, Kintsvisi, 9.VIII.2017, *Picea* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 82.
Genus- *Pulvinaria* Targioni Tozzetti
12. *Pulvinaria floccifera* (Westwood)
Material examined: 1 ♀, 3 ♀♀, Botanical garden of Tbilisi, 3.VIII.2017, *Taxus* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 38, 39. 3 ♀♀, Gori, 8.VIII.2017, *Tilia* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 60.
13. *Pulvinaria juglandii* Hadzibeyli
Material examined: 1 ♀, Tiniskhidi, 9.VIII.2017, *Juglans regia*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 56.
14. *Pulvinaria peregrina* Ben-Dov
Material examined: 2 ♀♀, Gori, 8.VIII.2017, *Platanus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 81. 3 ♀♀, Telavi, 16. VIII.2017, *Platanus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 136). Telavi, 16.VIII.2017, *Tilia* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 137.
15. *Pulvinaria vitis* (Linnaeus)
Material examined: 3 ♀♀, Sasireti, 8.VIII.2017, *Vitis vinifera*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 65.
Genus- *Shpaerolecanium* Sulc
16. *Shpaerolecanium prunastri* (Boyer de Fonscolombe)
Material examined: 3 ♀♀, Karaleti, 9.VIII.2017, *Prunus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 83. 1 ♀, Karaleti, 9.VIII.2017, *Prunus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 87; 2 ♀♀, Kareli, 9.VIII.2017, *Prunus divaricata*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 88.
Family- Cryptococcidae
Genus- *Cryptococcus* Douglas
17. *Cryptococcus fagisuga* Lindinger
Material examined: 1 ♀, Kintsvisi, 9.VIII.2017, *Fagus orientalis*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 79.
Family- Diaspididae
Genus- *Carulaspis* MacGillivray
18. *Carulaspis carueli* (Signoret)
Material examined: 2 ♀♀, Tbilisi, Rustaveli Avenue, 1.VIII.2017, *Juniperus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 7; 1 ♀, Vera Park, 1.VIII.2017,

- Cupressus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 8; 2 ♀♀, Vera Park, 1.VIII.2017, *Juniperus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 17.
Genus- *Chionaspis* Signoret
19. *Chionaspis salicis* (Linnaeus)
Material examined: 2 ♀♀, Near to Tetrtsklebi (41°51'53.82"N, 45°17'21.12"E), *Salix* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 129.
Genus- *Chrysomphalus* Ashmead
20. *Chrysomphalus dictyospermi*
Material examined: Tbilisi, Agricultural University of Georgia, Leg. M. Batsankalashvili (150).
Genus- *Comstockaspis* MacGillivray
21. *Comstockaspis perniciosus* (Comstock)*
Material examined: 3 ♀♀, Ateni, 30.VIII.2017, *Malus domestica*, Leg. M. Batsankalashvili Coll. No: 167. 3 ♀♀, Variani, 1.VIII.2017, *Malus domestica*, Leg. M. Batsankalashvili Coll. No: 168; 1 ♀, Tbilisi: Vera Park, 1.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 10. 3 ♀♀, Sasireti, 8.VIII.2017, *Prunus persica*, M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 63. 1 ♀, Sasireti, 8.VIII.2017, *Cydonia oblonga*, M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 64. 3 ♀♀, Doesi, 8.VIII.2017, *Prunus persica*, M.B.Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 68. 2 ♀♀, Sasadilo (41°52'20.34"N, 45°08'18.72"E), 16.VIII.2017, *Pyrus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 141. 1 ♀, Between Tetrtsklebi and Telavi (41°53'12.24"N, 45°21'47.40"E), 15.VIII.2017, *Elaeagnus rhamnoides*, Leg. M.B.Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll.No: 116; 1 ♀, Between Mejvriskhevi and Kvarkheti, 31.VIII.2017, *Malus domestica*, Leg. M. Batsankalashvili, Coll. No: 169. 1 ♀, Kheltubani (42°04'1.68"N, 44°09'41.70"E), 30.VIII.2017, *Prunus persica*, Leg. M. Batsankalashvili; Coll. No: 172; 1 ♀, Kheltubani (42°04'1.68"N, 44°09'41.70"E), 30.VIII.2017, *Malus domestica*, Leg. M. Batsankalashvili, Coll. No: 173; 3 ♀♀, Kere (42°10'31.08"N, 44°04'50.58"E), 22.IX.2017, *Prunus persica*, Leg. M. Batsankalashvili, G. Kirkitadze, Coll. No: 182; 1 ♀, Betlemi (41°59'2.94"N, 44°00'1.86"E), 22.IX.2017, *Malus domestica*, Leg. M. Batsankalashvili, G. Kirkitadze, Coll. No: 187; 2 ♀♀, Sasireti (41°55'35.22"N, 44°18'23.10"E), 8.VIII.2017, apple orchard, *Malus domestica*, Leg. M.B.Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 200; 2 ♀♀, Doesi, (41°56'4.14"N, 44°13'43.56"E), 8.05.2017, apple orchard, *Malus domestica*, Leg. M. Batsankalashvili, G. Kirkitadze Coll. No: 212; 1 ♀, Tiniskhidi (41°59'24.96"N, 44°04'18.42"E), 7.05.2017, apple orchard, *Malus domestica*, Leg. M. Batsankalashvili, G. Kirkitadze Coll. No: 213.
Genus- *Diaspidiotus* Berlese
22. *Diaspidiotus marani* (Zahradnik)
Material examined: 2 ♀♀, Tbilisi, Vake Park, 1.VIII.2017, *Fraxinus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 19; 1 ♀, Sasireti, 8.VIII.2017, *Juglans regia*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze Coll. No: 67.
23. *Diaspidiotus ostreaeformis* (Curtis)
Material examined: 1 ♀, Tiniskhidi (41°59'24.96"N, 44°04'18.42"E), 8.VIII.2017, *Prunus domestica*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 62.
24. *Diaspidiotus uvae* (Comstock)**
Material examined: 3 ♀♀, Tiniskhidi, 9.VIII.2017, 41°59'24.96"N, 44°04'18.42"E, *Juglans regia*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 56.
Genus- *Epidiaspis* Cockerell
25. *Epidiaspis leperii* (Signoret)*
Material examined: 3 ♀♀, Tbilisi, Vake Park, *Malus sylvestris*, 1.VIII. 2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 13. 3 ♀♀, Rusiani, *Malus domestica*, 15.VIII.2017, Leg. M.B.Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 132; 2 ♀♀, Sasadilo (41°52'20.34"N, 45°08'18.72"E), *Pyrus* sp., 16.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 141; 2 ♀♀, Askilauri, apple orchard (41°51'58.74"N, 45°10'5.64"E), 3.VI.2017, *Malus domestica*, Leg. M. Batsankalashvili, G. Kirkitadze, Coll. No: 202; 3 ♀♀, Zemo Chochevi, apple orchard, (41°54'29.82"N, 44°20'4.20"E), 7.V.2017, *Malus domestica*, Leg. M. Batsankalashvili, G. Kirkitadze, Coll. No: 216.
Genus – *Kuwanaspis* MacGillivray
26. *Kuwanaspis pseudoleucaspis* (Kuwana)
Material examined: 3 ♀♀, Botanical garden

- of Tbilisi, 3.VIII.2017, Bambusoideae, M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 24.
Genus- *Lepidosaphes* Shimer
27. *Lepidosaphes malicola* (Borchsenius)
Material examined: 7 ♀♀, Kareli, 9.VIII.2017, *Juglans regia*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 70; 4 ♀♀, Vaziani-Gombori-Telavi road (41°44'13.80"N, 45°07'24.18"E), 15.VIII.2017, *Populus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 117; 3 ♀♀, Tianeti, 16.VIII.2017, *Fraxinus*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 140.
28. *Lepidosaphes ulmi* Linnaeus*
Material examined: 5 ♀♀, Tbilisi, Isani, 12.VIII.2017, *Vitis vinifera*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 97; 1 ♀, Apple orchard of Tianeti, 16.VIII.2017, *Malus domestica*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 152.
29. *Lepidosaphes conchiformis*
Material examined: 2 ♀♀, Tbilisi, Vake Park, 1.VIII.2017, *Quercus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 5
Genus- *Leucaspis* Signoret
30. *Leucaspis pusilla* Law
Material examined: 2 ♀♀, Tbilisi, Vake Park, 1.VIII. 2017, *Pinus nigra*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 22; 4 ♀♀, Botanical garden of Tbilisi, 3.VIII. 2017, *Pinus nigra*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 33.
Genus- *Mercetaspis* Gomez-Menor Ortega
31. *Mercetaspis sureyana* (Bodenheimer)
Material examined: 5 ♀♀, Gori, 9.VIII.2017, *Astragalus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 73.
Genus- *Parlatoria* Targioni Tozzetti
32. *Parlatoria oleae* (Colvee)
Material examined: 2 ♀♀, Tbilisi, Vera Park, 1.VIII.2017, *Crataegus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 9; 4 ♀♀, Vake Park, near to Turtle Lake, 1.VIII.2017, *Rhamnus pallasii*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 20; 2 ♀♀, Uplistsikhe, 9.VIII.2017, *Prunus armeniaca*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 66; 4 ♀♀, Uplistsikhe, 9.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 77; 2 ♀♀, Tbilisi, Isani, 12.VIII.2017, *Prunus domestica*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 94; 2 ♀♀, Tbilisi, Isani, 12.VIII.2017, *Rosa canina*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 101; 1 ♀, Apple orchard of Zemo Choche-ti, 8.VIII.2017, *Prunus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 103; 1 ♀, Telavi, 16.VIII.2017, *Mespilus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 144.
Genus- *Pseudaulacaspis* MacGillivray
33. *Pseudaulacaspis pentagona* (Targioni Tozzetti)
Material examined: 1 ♀, Tbilisi, Isani, 12.VIII.2017, *Ribes* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 99.
Genus- *Salicicola* Lindinger
34. *Salicicola archangelskyae* (Archangelskaya)
Material examined: 6 ♀♀, Tbilisi, Rustaveli avenue, 1.VIII.2017, *Fraxinus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 12; 3 ♀♀, Botanical garden of Tbilisi, 1.VIII.2017, *Fraxinus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No: 51; 5 ♀♀, Tbilisi, Isani, 12.VIII.2017, *Syringa vulgaris*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 95.
Genus- *Unaspis* McGillivray
35. *Unaspis euonymii* (Comstock)
Material examined: 2 ♀♀, Mtskheta, Armazi, 18.VII.2017, *Euonymus* sp., Leg. M. Batsankalashvili, Coll. No: 194.
Family- Eriococcidae
Genus- *Eriococcus* Targioni Tozzetti
36. *Eriococcus williamsi* Danzig
Material examined: 2 ♀♀, Botanical garden of Tbilisi, 3.VIII.2017, *Buxus balearica*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 29; 4 ♀♀, Tkibuli, 13.VIII.2017, *Buxus* sp., Leg. G. Kirkitadze, Coll. No: 159.
Genus- *Rhizococcus*
37. *Rhizococcus lactucae* (Borchsenius) **
Material examined: 1 ♀, Near to Mukhrovani (41°47'1.80"N, 45°09'23.82"E), 15.VIII.2017, *Centaurea* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 108.
Family- Kermesidae
Genus- *Kermes* Boitard

38. *Kermes vermilio* (Planchon)**
Material examined: 5 First instar larvae, Telavi, 16.VIII.2017, *Quercus ilex*, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze (138).
Family- Pseudococcidae
 Genus- *Antonina* Signoret
39. *Antonina crawi* Cockerell
Material examined: 3 ♀♀, Botanical garden of Tbilisi, 3.VIII.2017, *Bambusa* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 24.
 Genus- *Dysmicoccus* Ferris
40. *Dysmicoccus angustifrons* (Hall)
Material examined: 2 ♀♀, Near to Mukhrovani (41°47'1.80"N, 45°09'23.82"E), 15.VIII.2017, *Centaurea* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 108; 1 ♀, Vaziani-Gombori-Telavi road (41°44'13.80"N, 45° 7'24.18"E), 15.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 118.
 Genus- *Heliococcus* Sulc
41. *Heliococcus glacialis* (Newstead)
Material examined: 1 ♀, Askilauri, 15.VIII.2017, *Melilotus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 105.
42. *Heliococcus sulcii* Goux
Material examined: 3 ♀♀, Tbilisi, Rustaveli avenue, 1.VIII.2017, *Berberis* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No: 6; 1 ♀, Abanotubani, 03.VIII.2017, *Berberis soulieana*, Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No: 30.
43. *Heliococcus bohemicus* (Sulc)
Material examined: 3 ♀♀, Gori, 9.VIII.2017, Poaceae, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:75.
 Genus- *Phenacoccus* Cockerell
44. *Phenacoccus pumilus* Kiritschenko
Material examined: 2 ♀♀, Gori, 9.VIII.2017, *Thymus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:55; 2 ♀♀, Near to Mukhrovani (41°47'1.80"N, 45° 9'23.82"E), 15.VIII.2017, Apiaceae (Umbellifera), Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:110; 3 ♀♀, Vaziani-Gombori-Telavi road (41°53'12.24"N, 45°21'47.40"E), Apiaceae, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:113; 4 ♀♀, Vaziani-Gombori-Telavi road (41°53'12.24"N, 45°21'47.40"E), 15.VIII.2017, herbaceous plant, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:114; 2 ♀♀, Vaziani-Gombori-Telavi road (41°53'12.24"N, 45°21'47.40"E), 15.VIII.2017, Apiaceae, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:115.
45. *Phenacoccus tergrigoriana* Borchsenius**
Material examined: 1 ♀, Botanical garden of Tbilisi, 3.VIII.2017, *Amaranthus retroflexus*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:47; 1 ♀, Askilauri, 15.VIII.2017, *Melilotus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:105; 1 ♀, Bochorma (41°54'54.48"N, 45°07'21.12"E), 15.VIII.2017, Herbaceous plant, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:106; 2 ♀♀, Near to Mukhrovani (41°47'01.80"N, 45°09'23.82"E), 15.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:109; 3 ♀♀, Vaziani-Gombori-Telavi road (41°44'13.80"N, 45°07'24.18"E), 15.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:119; 1 ♀, Bochorma (41°54'54.48"N, 45° 7'21.12"E), 16.VIII.2017, Brassicaceae, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:123; 3 ♀♀, Bochorma (41°54'54.48"N, 45° 7'21.18"E), 16.VIII.2017, Brassicaceae, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:124; 2 ♀♀, Bochorma (41°54'54.48"N, 45°07'21.18"E), 16.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:127; 3 ♀♀, Tianeti-Zaridzebi-Zhinali road (42°08'18.96"N, 44°48'54.06"E), 16.VIII.2017, Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:128; 5 ♀♀, Tbilisi, Isani, *Daucus sativus*, 19.VIII.2017, G. Kirkitadze, Coll. No: 162; 1 ♀, Botanical garden of Tbilisi, 3.VIII.2017, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:164.
46. *Phenacoccus transcaucasicus* Hadzibeyli*
Material examined: 3 ♀♀, Tbilisi, Vake Park, 1.VIII.2017, *Buxus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:14; 2 ♀♀, Botanical Garden of Tbilisi, 03.08.2017, *Fraxinus* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:45; 5 ♀♀, Sasireti, 8.VIII.2017, *Prunus persica*, Leg. M.

- B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:63; 4 ♀♀, Isani, 12.VIII.2017, *Prunus persica*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:100. 3 ♀♀, Tbilisi, Apple orchard of Agricultural University of Georgia, 19.VIII.2017, *Malus domestica*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:149.
Genus- *Planococcus* Ferris
47. *Planococcus ficus* (Signoret)
Material examined: 4 ♀♀, Abanotubani, 3.VIII.2017, *Platanus* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:44; 2 ♀♀, Tbilisi: Isani, 12.VIII.2017, *Punica granatum*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No: 92; 3 ♀♀, Tbilisi: Isani, 12.VIII.2017, *Ficus carica*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:98.
48. *Planococcus vovae* (Nasonov)
Material examined: 3 ♀♀, Tbilisi, Rustaveli avenue, 1.VIII.2017, *Juniperus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:7; 5 ♀♀, Vake Park, 1.VIII.2017, *Cupressus* sp., Leg. M. B. Kaydan, M. Batsankalashvili, G. Kirkitadze, Coll. No:21; 4 ♀♀, Botanical garden of Tbilisi, 3.VIII.2017, *Cupressus* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:34; 3 ♀♀, Botanical garden of Tbilisi, *Cupressus sempervirens* f. *pyramidalis*, Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili, Coll. No:35.
Genus- *Pseudococcus* Westwood
49. *Pseudococcus comstocki* (Kuwana)
Material examined: 3 ♀♀, Mtskheta, 2.XI.2017, *Morus alba*, Leg. M. Batsankalashvili, Coll. No: 196; 3 ♀♀, Tbilisi, David Agmashenebeli avenue, 22.VIII.2017, *Catalpa*, Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No:161.
50. *Pseudococcus longispinus* (Targioni Tozzetti)
Material examined: 3 ♀♀, Botanical garden of Tbilisi: Orangery, 3.VIII.2017, *Dracaena* sp., Leg. M. B. Kaydan, G. Japoshvili, M. Batsankalashvili Coll. No:25.
51. *Pseudococcus viburni*
Material examined: 3 ♀♀, Tbilisi, Abanotubani, 3.VIII.2017, *Prunus laurocerasus*, Leg. M. B. Kaydan, M. Batsankalashvili, Coll. No:31.

As a result, it was found out that in Kartli gardens is commonly widespread *Comstockaspis pernicioso*.

Altogether 51 scale insect species were collected. 6 species (3, 06 %) proved to be new to the Georgian fauna: *Ceroplastes floridensis* (Comstock), *Ceroplastes rusci* (Linnaeus), *Diastpidiotus uvae* (Comstock), *Rhizococcus lactucae* (Borchsenius), *Kermes vermilio* (Planchon), *Phenacoccus tergrigorianae* Borchsenius.

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