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## Description of female nymphal instars and adult female of *Kermes echinatus* Balachowsky (Hemiptera, Coccoidea, Kermesidae) based on specimens from Crete and mainland Greece, with a discussion on geographical variation

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### Summary

The first-instar nymph, second- and third-instar female nymphs and the adult female of *Kermes echinatus* Balachowsky (Hemiptera, Coccoidea, Kermesidae) are described and illustrated; micrographs of morphological details are also provided. The species was collected on the island of Crete (Greece) and on mainland Greece, new localities for this species, and are compared with Israeli specimens from where it was originally described.

**Key words:** gall-like scales, *Quercus coccifera*, *Q. ilex*, *Kermes vermilio*

### Introduction

Balachowsky (1950) provided the first identification keys to European and West Mediterranean *Kermes* species (*K. vermilio* Planchon, *K. roboris* (Fourcroy), *K. ilicis* (Linnaeus), *K. bacciformis* Leonardi, and *K. quercus* (Linnaeus)) based on first-instar nymphs, whose morphological characters are stable and reliable. A few years later, the same author (Balachowsky, 1953) gave detailed descriptions of the first-instar nymphs of three new species from Israel, namely *Kermes echinatus* Balachowsky, *K. palestiniensis* Balachowsky and *K. spatulatus* Balachowsky, and briefly described the external appearance of post-reproductive females. However, he also observed that these three new species could be junior synonyms of *K. biblicus* (Bodenheimer), *K. greeni* Bodenheimer, and *K. nahalali* Bodenheimer, also described from Israel but based on post-reproductive females only. In fact, Spodek *et al.* (2012), studying type material and new collections, synonymised *K. palestiniensis* with *K. greeni* and described the first-instar nymph and adult female of this species.

In April 2010 and again on June 2011, specimens of a *Kermes* species were collected off *Quercus coccifera* L. on the island of Crete (Greece). In spring 2011, on the basis of 1<sup>st</sup>-instar morphology, the species was identified as *K. echinatus*. At that time, the species was known only from Israel and had not been collected since its description (Balachowsky, 1953). The collecting of fresh material provided an opportunity to study and describe the nymphs and also the young adult female, still unknown. In late 2012, in April 2013 and in April, May and June 2014, George Stathas (Highest Educational Institute, Kalamata, Greece), provided us with abundant material belonging to *K. echinatus*, collected on *Quercus ilex* L. in mainland Greece (Athens and Kalamata) (Stathas *et al.*, 2013). At the end of 2012, Spodek and Ben-Dov (2012) published a re-description of the first-instar nymph and adult female of *K. echinatus*, based on syntypic and topotypic material and new collections off *Q. calliprinos* (Webb) in Israel.

Very recently, Spodek and Ben-Dov (2014) published a valuable taxonomic revision of the Kermesidae of Israel that included a further re-description of adult female and first instar *K. echinatus* plus descriptions of all the male and female developmental stages of this species.

However, it was found that the Greek specimens of *C. echinatus* varied somewhat from the Israeli specimens

## Comparison of the morphology of *K. echinatus* collected in different localities.

The records of *K. echinatus* from Crete and mainland Greece (Athens and Kalamata) and the loan of *K. echinatus* specimens from Israel along with their description and drawings (Spodek & Ben-Dov, 2012; 2014) has offered an opportunity to highlight minute morphological differences between specimens from the isolated population on Crete with those from mainland Greece and Israeli. With regard to first-instar morphology, the three populations do not exhibit substantial differences. The presence of a very small denticle on the claw was noticed on specimens of all three populations. All the first-instar specimens have long apical trichoid setae on antennal segments V and VI. Some specimens from Greece have marginal spines slightly shorter and less bent than in those from Crete and Israel. All first-instar specimens have a small trilocular pore near each scape (as is usual in *Kermes* species) (Baer & Kosztarab, 1985; Liu & Shi, 1995; Pellizzari *et al.*, 2011) although not mentioned by Spodek and Ben-Dov (2012; 2014). Moreover, most first instars from Crete and Greece have a pore with 3–5 loculi on the margin of the prothorax and another one on the margin opposite the anterior spiracle but these pores were not observed in the Israeli crawlers either by us or by Spodek and Ben-Dov (2014). According to the latter authors, this character is present only in first-instar *K. hermonensis*. Second- and third-instar female nymphs of all three populations (Crete, Greece, Israel) have frontal lobes, as in *K. vermilio*. Adult females from both Crete and Greece differ from those from Israel mainly in having a greater number of dorsal and ventral tubular ducts.

**TABLE 1.** Comparison of some morphological characters in the first instars (sex not determined), female nymphal instars, adult females and second-instar males of *K. vermilio* Planchon, *K. echinatus* Balachowsky and *K. hermonensis* Spodek & Ben-Dov. Data for *K. hermonensis* are from Spodek & Ben-Dov (2014).

instar	<i>K. vermilio</i>	<i>K. echinatus</i>	<i>K. vermilio</i>	<i>K. echinatus</i>	<i>K. vermilio</i>	<i>K. echinatus</i>	<i>K. vermilio</i>	<i>K. echinatus</i>
	Number and shape of marginal spines		legs		Antennae		Frontal lobes	
1 <sup>st</sup> -instar	58–72, conical	62–68, conical, slender, bent	Present, well developed		6 segmented		absent	absent
2 <sup>nd</sup> -instar female	68–74	58–64	Small, tubercle-like		5 segmented	1–3 segmented	present	present
3 <sup>rd</sup> -instar female	132–222	52–64	Small, tubercle-like	Absent	2–3 segmented	Monomeric, tubercle-like	present	present
Adult female	146–266	60–68	Absent		Monomeric, tubercle-like		absent	absent

## Conclusion

It is clear that the Mediterranean oaks (*Q. ilex*, *Q. calliprinos*, *Q. coccifera*, *Q. ithaburensis*, *Q. look*, *Q. suber*) host a complex of *Kermes* species (e.g. *K. bacciformis* Leonardi, *K. biblicus* (Bodenheimer), *K. echinatus*, *K. greeni* Bodenheimer, *K. hermonensis*, *K. ilicis* (Linnaeus), *K. vermilio*). Currently some of these species appear to be restricted to Israel, but this is likely to be due to a lack of collecting and difficulty in identification. The surveys on *Q. coccifera* carried out in 2010–2011 on the island of Crete led to the first records outside of Israel of *K. greeni* (Pellizzari *et al.*, 2011) and of *K. echinatus*, demonstrating that these species are more widespread than previously known. The recent records of *K. echinatus* in mainland Greece and of *K. hermonensis* in South-eastern Turkey (Stathas *et al.*, 2013; Kaydan *et al.*, 2014) extend the known distribution of these species.

Although slight morphological differences were noted between the Greek and Israeli *Kermes echinatus* complex in this study, we consider that these are due to intraspecific variability among geographically isolated populations rather than differences at the species level. Nevertheless, molecular analysis of specimens from different locations are planned to help in a better understanding of this complex.

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## References

- Baer, R.G. & Kosztarab, M. (1985) Studies on the morphology and systematics of scale insects - No. 12. II. A morphological and systematic study of the first and second instars of the family Kermesidae in the Nearctic region (Homoptera: Coccoidea). *Bulletin of the Virginia Polytechnic Institute and University Research Division*, 85, 119–261.
- Balachowsky, A.S. (1950) Les *Kermes* (Hom. Coccoidea) des chênes en Europe et dans le bassin Méditerranéen. *Proceedings of the International Congress of Entomology*, 8, 739–754. [Stockholm]
- Balachowsky, A.S. (1953) Sur les *Kermes* Boitard (Hom. Coccoidea) des chênes du bassin oriental de la Méditerranée. *Revue de Pathologie Végétale et d'Entomologie Agricole de France*, 32, 181–189.
- Ben-Dov, Y. & Hodgson, C.J. (1997) Collecting and mounting. In: *Soft Scale Insects - Their Biology, Natural Enemies and Control*. Vol. 7A. Elsevier, Amsterdam & New York, pp. 389–395.
- Ben-Dov, Y., Miller, D.R. & Gibson, G.A.P. (2014) ScaleNet: a database of the scale insects of the World. Available from: <http://www.sel.barc.usda.gov/Scalenet/Scalenet.htm> (accessed 1 May 2014)
- Borchsenius, N.S. (1960) *Fauna of USSR, Homoptera, Kermococcidae, Asterolecaniidae, Lecanidodiaspididae, Aclerididae*. Akademiia Nauk SSSR, Zoologicheskii institut (Series), Leningrad, 282 pp. [in Russian]
- Bullington, S.W. & Kosztarab, M. (1985) Studies on the morphology and systematics of scale insects - No. 12. I. Revision of the family Kermesidae (Homoptera) in the Nearctic region based on adult and third instar females. *Bulletin of the Virginia Polytechnic Institute and State University Agricultural Experiment Station*, 85, 1–118.
- Kaydan B., Bolu H., Spodek M., Ben-Dov, Y. & Turul, A.F. (2014) *First record of Kermes hermonensis Spodek & Ben-Dov (Hemiptera: Sternorrhyncha: Coccoidea: Kermesidae) in Turkey*. *Journal of the Entomological Research Society*. [in press]
- Leonardi, G. (1920) *Monografia delle cocciniglie Italiane*. Della Torre, Portici, 555 pp. <http://dx.doi.org/10.5962/bhl.title.1703>
- Liu, Y. (1995) A new species of *Kermes* (Homoptera: Coccoidea: Kermesidae) from China (In Chinese; Summary In English). *Entomotaxonomia*, 17, 267–270.
- Liu, Y. & Shi, Y. (1995) Two new species of *Kermes* (Homoptera: Coccinea: Kermesidae), with a key to the young adult females of known species of *Kermes* from China. *Insecta Mundi*, 9, 155–163.
- Marotta, S. & Tranfaglia, A. (1999) A new morphological structure on *Kermes vermilio* (Planchon) (Hemiptera: Coccoidea: Kermesidae). *Entomologica*, 33, 133–138.
- Pellizzari, G., Porcelli, F., Seljak, G. & Kozár, F. (2011) Some additions to the Scale insect fauna (Hemiptera: Coccoidea) of Crete with a check list of the species known from the island. *Journal of Entomological and Acarological Research*, 43 (3), 291–300.
- Pellizzari, G., Porcelli, F., Convertini, S. & Marotta, S. (2012) Description of nymphal instars and adult female of *Kermes vermilio* Planchon (Hemiptera, Coccoidea, Kermesidae), with a synopsis of the European and Mediterranean species *Zootaxa*, 3336, 36–50.
- Podsiadlo, E. (2012) Morphology of second instar nymphs of *Kermes quercus* (Linnaeus) (Hemiptera: Kermesidae). *Polskie Pismo Entomologiczne*, 81, 35–42. <http://dx.doi.org/10.2478/v10200-011-0061-9>
- Stathas, G.J., Kartsonas, E.D. & Skouras, P.J. (2013) First record of *Kermes echinatus* on *Quercus ilex*. *Entomologia Hellenica*, 22 (1), 19–22.
- Spodek, M. & Ben-Dov, Y. (2012) Morphology of the first-instar nymph and adult female of *Kermes echinatus* Balachowsky, with a comparison to *K. vermilio* Planchon (Hemiptera, Coccoidea, Kermesidae). *ZooKeys*, 246, 11–26. <http://dx.doi.org/10.3897/zookeys.246.3766>

- Spodek, M. & Ben-Dov, Y. (2014) A taxonomic revision of the Kermesidae (Hemiptera: Coccoidea) in Israel, with a description of a new species. *Zootaxa*, 3781 (1), 1–99.  
<http://dx.doi.org/10.11646/zootaxa.3781.1.1>
- Spodek, M., Ben-Dov, Y. & Protasov, A. (2012) Taxonomy of *Kermes greeni* Bodenheimer (Hemiptera: Coccoidea: Kermesidae) with a new synonymy. *Zootaxa*, 3545, 67–75.
- Sternlicht, M. (1969) *Kermes bytinskii* n. spec. (Coccoidea, Kermesidae) in Israel and observations on its life history. *Israel Journal of Entomology*, 4, 251–270.