

An overview of *Takahashia japonica*: present distribution, host plants, natural enemies and life-cycle, with observations on its morphology

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Abstract

The Asiatic string cottony scale, *Takahashia japonica* (Cockerell) (Hemiptera, Coccoomorpha, Coccidae), was first detected in Europe (Italy) in 2017 and is now established in three European countries. Based on thorough bibliographic research, updated data on its world distribution, host plants and natural enemies are reported. Moreover, according to recent literature, its current systematic placement within the Family Coccidae is discussed. The morphology of first- and second-instar nymphs are described and illustrated using SEM micrography. Some previously undescribed morphological characters of the living second-instar female and the pre-reproductive female are described and illustrated. The life cycle of this species in North Italy is outlined.

Key words: Hemiptera, Coccidae, Asiatic string cottony scale.

Introduction

The Asiatic string cottony scale, *Takahashia japonica* (Cockerell) (Hemiptera, Coccoomorpha, Coccidae), was noticed for the first time in Europe (North Italy, in the Milano and Varese districts) in May 2017, when the long, conspicuous, white ovisacs secreted by adult females appeared hanging from twigs and branches of broad-leaved trees growing in urban parks and amenity areas (Limonta and Pellizzari, 2018). At that time, the extent of the infested area was about 40 square kilometres. This species was also recorded in Great Britain (Malumphy *et al.*, 2019; Tuffen *et al.*, 2019).

The arrival of this exotic species in Italy stimulated this study to gather information on its distributional area, host plants, natural enemies and systematic position, which are reported below. Moreover, the morphology of its nymphal stages and pre-reproductive female is described, and its life cycle in North Italy is outlined.

Materials and methods

Based on original papers, the literature on *T. japonica* was thoroughly checked to compile as much information as possible on its world distribution, host plants and natural enemies.

Observations on the scale insect life cycle were carried out in Cerro Maggiore, Rescaldina and Legnano (Milano Province) between January and November 2018. Samples were collected every fortnight in the winter (January, February, November) and weekly from March to the end of October. Occasional observations were also carried out in the autumn of 2020 and spring of 2021. Six ornamental host plants, *Liquidambar styraciflua* L., *Morus nigra* L., *Albizia julibrissin* Durazz., *Carpinus betulus* L.,

Celtis australis L., *Acer pseudoplatanus* L., growing in public areas were monitored.

Nymphal instars were slide-mounted according to the protocol described by Ben-Dov and Hodgson (1997). Their morphological description follows alpha-taxonomic approaches. Young adult females were kept alive in the laboratory for further observation.

Results

Host plants

T. japonica is a parthenogenetic, highly polyphagous species living on broad-leaved trees and shrubs. According to Garcia Morales *et al.* (2016), the species has been observed on plants belonging to 28 species in 14 families. Of these, 12 new host plants were recorded in Italy (Limonta and Pellizzari, 2018). Moreover, Clausen (1931) recorded colonies of *T. japonica* on *Citrus* sp., Choi (2016) added records on *Cornus officinalis* (Cornaceae), *Pyrus serotina* (Rosaceae), and *Salix glandulosa* (Salicaceae), Wang *et al.* (2016) added *Acer buergerianum* (Sapindaceae), *Loropetalum chinense* (Hamamelidaceae) and *Robinia pseudoacacia* (Fabaceae). These data bring the known host plants of *T. japonica* to a total of 35 species in 17 families (table 1).

Geographic distribution

T. japonica is an Asiatic species. It is reported in Japan, South Korea and the Chinese provinces of Hubei, Hunan, and Shanxi (Kwon *et al.*, 2005; Garcia Morales *et al.*, 2016). Moreover, Tang (1984), Xie *et al.* (2006), and Wang *et al.* (2016) reported its presence also in the Chinese provinces of Beijing, Henan, Jiangsu, Anhui, Jiangxi and Zhejiang. Hence, its presently known distribution covers most of Eastern China. Clausen (1931)

Table 1. Host plants of *T. japonica* (from Garcia Morales *et al.*, 2016; Choi, 2016; Wang *et al.*, 2016).

Family	Species	Validation source
Altingiaceae	<i>Liquidambar styraciflua</i>	Limonta and Pellizzari, 2018
Betulaceae	<i>Alnus japonica</i>	Limonta and Pellizzari, 2018
	<i>Carpinus betulus</i>	
Cannabaceae	<i>Celtis australis</i>	Limonta and Pellizzari, 2018
	<i>Celtis sinensis</i>	Takahashi and Tachikawa, 1956
Cornaceae	<i>Cornus officinalis</i>	Choi, 2016
Ebenaceae	<i>Diospyros kaki</i>	Limonta and Pellizzari, 2018
Ericaceae	<i>Rhododendron schlippenbachii</i>	Suh, 2020
	<i>Albizia julibrissin</i>	Limonta and Pellizzari, 2018
	<i>Lespedeza</i> sp.	De Lotto, 1968
Fabaceae	<i>Lespedeza bicolor</i>	Suh, 2020
	<i>Robinia pseudoacacia</i>	Wang <i>et al.</i> , 2016
	<i>Styphnolobium japonicum</i>	Limonta and Pellizzari, 2018
	<i>Loropetalum chinense</i>	Wang <i>et al.</i> , 2016
Hamamelidaceae	<i>Loropetalum chinense</i>	Wang <i>et al.</i> , 2016
Juglandaceae	<i>Juglans regia</i>	Limonta and Pellizzari, 2018
Magnoliaceae	<i>Magnolia kobus</i>	Suh, 2020
	<i>Magnolia obovata</i>	Takahashi and Tachikawa, 1956
	<i>Morus</i> sp.	Cockerell, 1896
Moraceae	<i>Morus alba</i>	Varshney, 1992
	<i>Morus nigra</i>	Limonta and Pellizzari, 2018
Rosaceae	<i>Cydonia oblonga</i>	Limonta and Pellizzari, 2018
	<i>Malus pumila</i>	Suh, 2020
	<i>Prunus cerasifera</i>	Limonta and Pellizzari, 2018
	<i>Prunus glandulosa</i>	Suh, 2020
	<i>Prunus salicina</i>	Takahashi and Tachikawa, 1956
	<i>Prunus tomentosa</i>	Suh, 2020
	<i>Pyrus serotina</i>	Choi, 2016
Rutaceae	<i>Citrus</i> sp.	Clausen, 1931
Salicaceae	<i>Salix chaenomeloides</i>	Takahashi and Tachikawa, 1956
	<i>Salix glandulosa</i>	Choi, 2016
Sapindaceae	<i>Acer negundo</i>	Suh, 2020
	<i>Acer buergerianum</i>	Wang <i>et al.</i> , 2016
	<i>Acer pseudoplatanus</i>	Limonta and Pellizzari, 2018
	<i>Acer pseudosieboldianum</i>	Suh, 2020
Ulmaceae	<i>Ulmus davidiana</i>	Suh, 2020
	<i>Zelkova serrata</i>	Hodgson, 1994
Vitaceae	<i>Parthenocissus tricuspidata</i>	Suh, 2020

listed *T. japonica* among the species harmful to Citrus trees in Taiwan. The presence of *T. japonica* in India (Uttar Pradesh state) was reported by Varshney (1992). According to slides labelled “*Takahashia japonica* (Cock.), April 1910, on Mulberry, det. F. Laing” reported on the GBIF website (GBIF, 2021) (figure 3a), *T. japonica* is also present in Kumaon, Uttarakhand state.

In Europe, *T. japonica* was first detected in North Italy in 2017 on broad-leaf trees in parks and gardens (Limonta and Pellizzari, 2018). Presently its Italian distribution covers the districts of Varese, Monza and Brianza, Milano and, more recently, Como (Lombardy region). In 2019, *T. japonica* was recorded in Great Britain (England, Berkshire) (Malumphy *et al.*, 2019). In both cases the species was first noticed two years before its official detection. In June 2020, the presence of *T. japonica* in Croatia (Pula, Istrian peninsula) was reported in a local magazine (Glas Istre, 11.06.2020). The photos provided leave no doubt of the identity of this unique species. The presence of *T. japonica* in Croatia was officially

reported in June 2021 (Landeka *et al.*, 2021). The latter is the third new country record of *T. japonica* in Europe in just a few years.

Morphology

De Lotto (1968) and Hodgson (1994) described the morphology of the adult female in detail. Their descriptions are based only on slide-mounted specimens sent to them for study by the California State Department of Agriculture, Sacramento, the U.S. National Museum, Washington, USA, and Dr S. Takagi, Japan. Previous authors did not describe the appearance of the living nymphal instars and pre- and post-reproductive females nor the morphology of nymphal instars.

First-instar nymph

Slide-mounted specimens: body oval, flattened, about 740 µm long and 325 µm wide (mean from 4 measurements taken from 4 individuals). Marginal setae short, distributed on each side of the body as follows: 6 between

the head apex and anterior spiracular setae, 2 between anterior and posterior spiracular setae, 8 between posterior spiracular setae and anal cleft. Spiracular cleft each with 3 short spiracular spines, all the same size and shape, conical with blunt apices.

Venter: antennae each 6-segmented, apical segment with 8 setae, apical seta longer than others (figure 1a). Crumena without loop, reaching the level of hind coxae. Spiracular pores, each trilocular or quadrilocular, distributed in a row of 4-6 pores between each spiracle and margin, with 2 interantennal setae and pairs of short setae submedially on each of the last 5 abdominal segments. Legs well developed, each tarsus of mesothoracic and metathoracic legs with three short setae and one long seta; tarsal digitules much longer than claw, slightly knobbed at apex. Claw without denticle, claw digitules longer than claw, one slightly knobbed at apex, the other with a slightly expanded apex.

Dorsum: anal plates triangular with rounded angles, with 1 long apical seta and 2 short setae (figure 1b).

Second instar female nymph

Live specimen oval, brown, with small subtriangular lobes on body margins and a prominent dorsal longitudinal carina; dorsum covered by thin glassy wax plates (figure 2a, 2b, 2e, 2f).

Slide-mounted specimen about 875 µm long and 530 µm wide (mean from 4 measurements taken from 4 overwintering individuals). Body shape broadly oval. Marginal setae spinose, numbering about 100-110 on each side of the body; spiracular clefts each with 3 spiracular spines same shape and size as marginal spines (figure 1c, 1d).

Venter: antennae, each 7-segmented, second and third segments separated by a slight indentation.

Setae: with 2 interantennal setae, one pair of long setae medially on each of the last 5 abdominal segments, and short setae along body submargin. Labium with 4 pairs of short setae. Crumena without loop, reaching level of ventral pregenital setae. Spiracular openings small. Quinquelocular spiracular pores numbering 4-10, forming a single row between spiracle and spiracular setae, usually with 3-5 pores near the spiracular setae and 2 or 3 near the spiracular atrium (figure 1e). Legs well developed.

Dorsum: tubular ducts forming a sparse submarginal band, 1 or 2 pores wide (figure 1c) and present on head between antennae. Anal plates, each subtriangular, with 4 setae.

Pre-reproductive and reproductive adult female

Body sub-oval to rounded, 5-7 mm long, 4-5 mm wide, slightly convex. In life, the body of the young pre-reproductive female is pale green-yellow with a longitudinal red stripe on the middle of the dorsum. Dorsum covered by short white wax curls (figure 3c). Later, when the mature female is ready to secrete its ovisac, the dorsal wax curls disappear, the body colour changes to yellow-ochre, and the red stripe slowly darkens (figure 3d, 3e). Often with 3 marginal lobes on each side of the body (figure 3a), but later these disappear as the body expands to become oval and convex; nevertheless, very small lobes can still persist on the body margin (figure 3d, 3e, 3f). On

dorsal integument, many scattered small hollows mark the positions of dorsal tubular ducts (figure 3d).

The ventral tubular ducts secrete the very long ovisac. The first secreted wax adheres to the twig where the female is settled. As oviposition progresses, additional wax is secreted; the female's venter leans on the ovisac and is gradually pushed upwards, while the ovisac becomes longer day by day, forming a wax loop that can reach 7 cm long between the twig and the female abdomen (figure 3e).

Post-reproductive adult female

After oviposition, the female's body is about 8-9 mm long and 5 mm wide, and a uniform pale brown colour. The body appears flaccid, empty, stretched and misshapen, probably due to the weight of the ovisac hanging from the abdomen. At the end of oviposition, the female with its long ovisac hangs from the twig, being connected with the host only by the stylets.

Comments

It has been suggested that the many dorsal tubular ducts in the *T. japonica* adult female could be involved in the secretion of an ovisac covering the dorsum of the female itself, as in adult female Filippinae and Eriopeltinae (Hodgson, 1994). However, based on our observations of live young adult females, the many dorsal tubular ducts secrete small white wax curls on the dorsum of the pre-reproductive female (figure 3c); these curls disappear when the female starts to secrete the ovisac. A similar situation can be observed in other pre-reproductive coccid females, such as *Pulvinariella mesembryanthemi* (Vallot).

Life cycle: outline

T. japonica is a monovoltine parthenogenetic species. Its life cycle is characterised by the migrations of first-instar crawlers from twigs to leaf undersides in May-June, and second instar nymphs from leaves to twigs in September-October, to overwinter.

After overwintering, the nymphs resume activity from March onwards and reach the length of about 1.5 mm and 0.5 mm wide. The moult to the adult female occurs at the same overwintering site. The first moults occur in early April, and the whole population reaches the adult stage over about ten days. The adult female's body size increases quickly from about 1.5 mm long to 6-7 mm long and 5 mm wide and becomes slightly convex in the adult reproductive female. In this growing phase, the adult pre-ovigerous females feed and produce honeydew droplets.

Oviposition starts in late April and goes on until early May. Females settled on the twigs secrete the long egg-sacs that can reach 6-7 cm in length over several days. Egg-sacs produced by females kept in the laboratory were usually 2.5-4.0 cm long. Fecundity is high: about 1200 eggs were counted in a 1 cm length of ovisac, so the estimated fecundity in the laboratory was over 4000-5000 eggs/female.

In the environment, egg hatching occurs in early June, and crawlers move to the undersides of leaves, where they settle on the veins. During this migration, the crawlers can be easily carried by the wind, insects or birds to other conterminous host plants. In late August-September, the population consists of second instar nymphs,

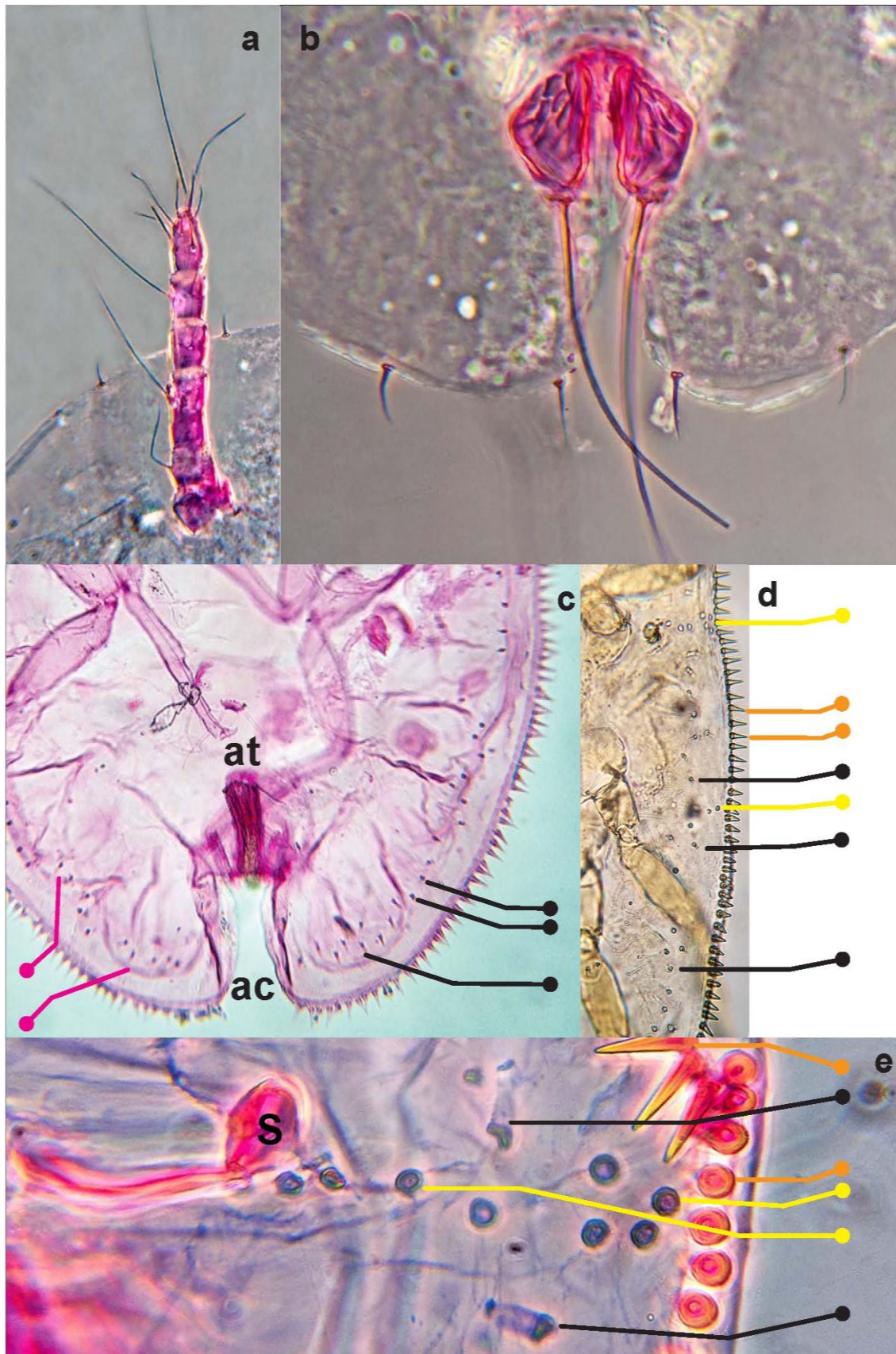


Figure 1. *T. japonica*. First-instar nymph: (a) antenna, (b) anal plates. Second-instar nymph, (c) posterior half of body: at - anal tube, ac - anal cleft, (left side) purple spots indicate dorsal processes, (right side) black spots indicate tubular ducts; (d) middle region submargin - orange spots indicate marginal spines, black spots indicate ventral submarginal glands, yellow spots indicate spiracular disc-pores; (e) venter of spiracular region - black spots indicate submarginal tubular ducts; orange spots indicate marginal spines and basal sockets; yellow spots indicate spiracular disc-pores each with 3-5 loculi, S - spiracle.

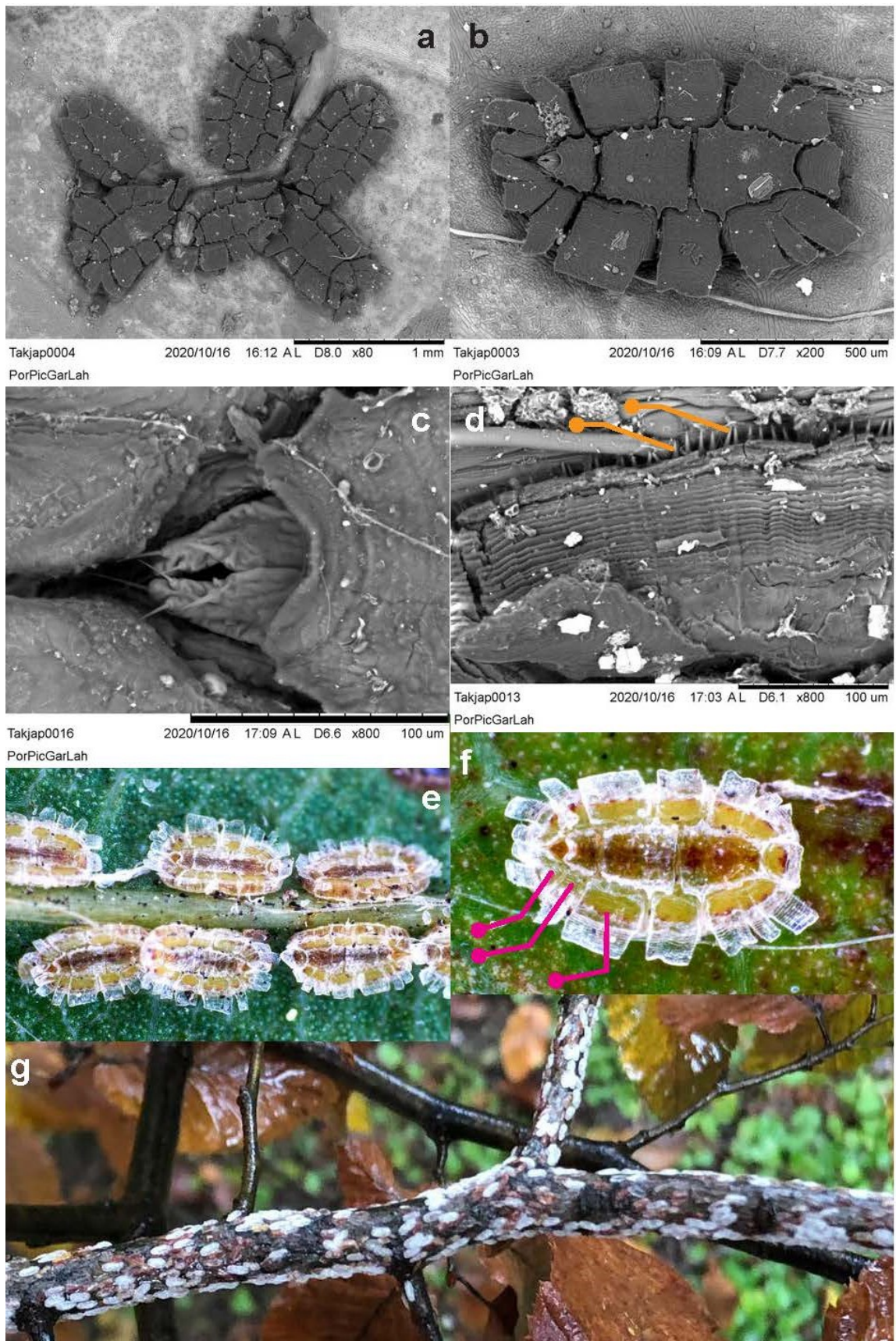


Figure 2. *T. japonica*. Scanning electron micrographs: (a) (b) second-instar nymphs on leaf undersides, covered with wax plates; (c) anal plates; (d) orange spots indicate marginal spines above the glassy wax. Photographs: (e) second-instar nymphs covered with glassy, transparent wax plates; (f) purple spots indicate dorsal body processes (lobes) visible through the glassy transparent wax plates; (g) overwintering second-instar nymphs on host plant twig.

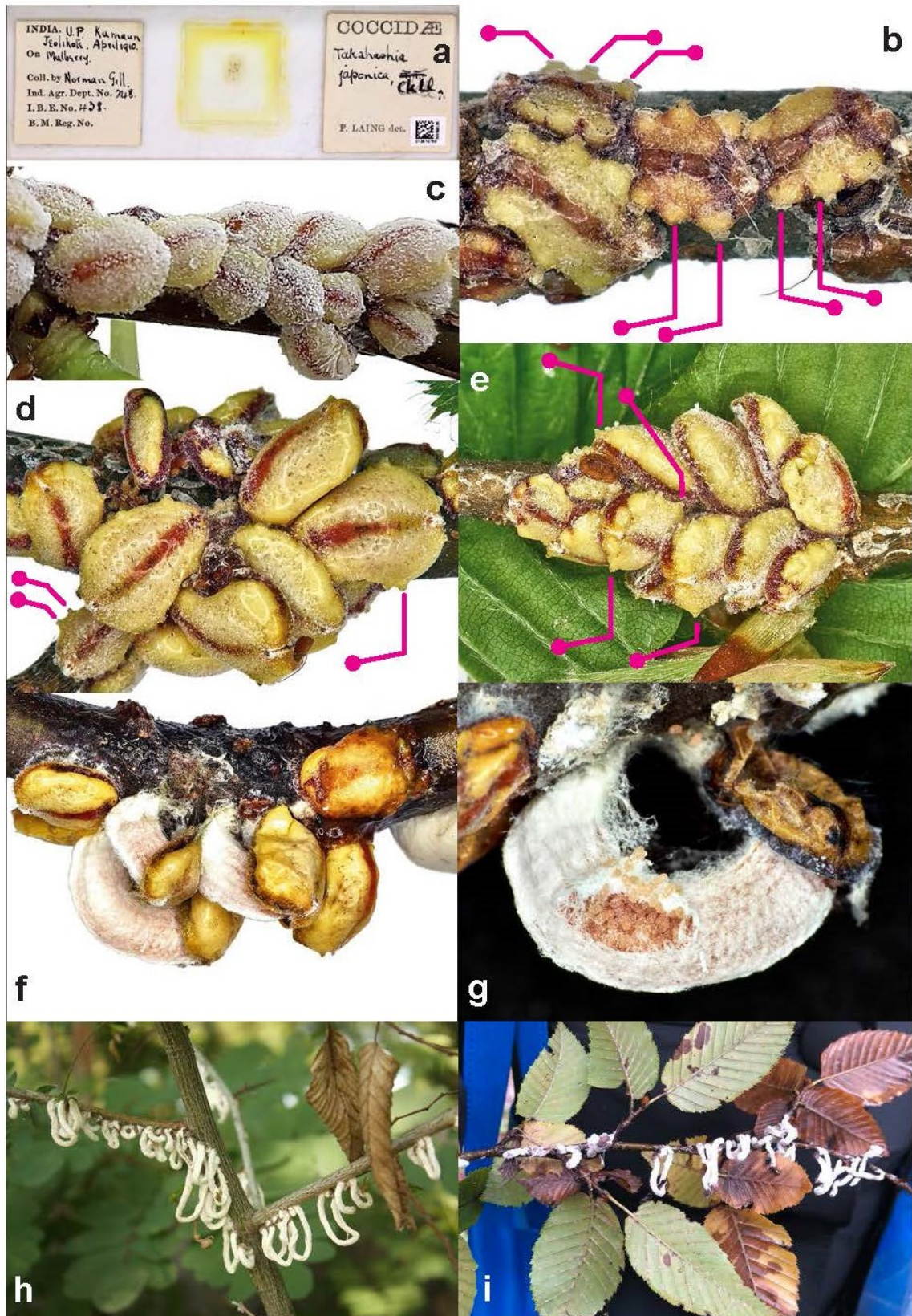


Figure 3. *T. japonica*. (a) a slide-mounted adult female from India, Laing det. (from GBIF website, GBIF, 2021). (b) Young pre-reproductive females - purple spots indicate dorsal processes. (c) Young pre-ovigerous females covered by white wax curls (photograph E. Rossi). (d) (e) pre-reproductive females grouped on a twig, small marginal lobes are still visible (indicated by purple spots). (f) (g) Ovipositing females: (g) an opened ovisac with eggs inside; (h) reproductive females with their striking loop-shaped ovisacs hanging from twigs in May (photograph G. Maspero); (i) empty ovisacs still present in October.

each about 1.3 mm long. From September to October, the second-instar nymphs migrate gradually from the leaf undersides to the twigs, settling to overwinter (figure 2g). Overwintering second-instar nymphs are brown and covered by transparent wax plates (figure 2a, 2b, 2e, 2f).

Systematic position

Based on the presence of the ovisac, *T. japonica* was considered a member of the subtribe Pulvinariina in the subfamily Coccinae, despite the species having only one type of ventral tubular duct and lacking tibiotarsal sclerites. Tang *et al.* (1990) and Tang (1991) erected the new subtribe Takahashiina for this species, distinguished from members of the Pulvinariina by the marginal setae being spine-like in *T. japonica* rather than hair-like.

Hodgson (1994) suggested that *Takahashia* could be a member of the subfamily Filippiinae, based on the presence of only one type of ventral tubular duct and the lack of tibiotarsal sclerites. A few years later, Miller and Hodgson (1997), in their cladistic analysis, found a close association between the two subfamilies Eulecaniinae and Filippiinae. *T. japonica* has the six main morphological character states of the Eulecaniinae as diagnosed by Hodgson (1994), apart from its long ovisac.

Recently Choi and Lee (2019) presented the first molecular phylogeny of the family Coccidae based on DNA fragments of a mitochondrial gene (COI), nuclear ribosomal RNA genes (18S and 28S), and elongation factor-1 α (EF-1 α). Their analysis indicated that *T. japonica* is closely related to the Eulecaniinae species considered in their study [namely *Ericerus pela* Chavannes, *Eulecanium cerasorum* (Cockerell), *Eulecanium kuwanai* (Kanda), *Eulecanium* sp., *Physokermes jezoensis* Siraiwa and *Rhodococcus sariuoni* Borchsenius]. These species form a distinct monophyletic group with high support, with *T. japonica* as a sister group. Choi and Lee (2019) concluded that even if few taxa of the Filippiinae were included in their analyses, their data suggest that *T. japonica* is closely related to species of the Eulecaniinae.

Natural enemies

Parasitoids

According to the Universal Chalcidoidea Database (Noyes, 2019), there are records of Hymenoptera Encyrtidae associated with *T. japonica*: six species of parasitoids in the native range of *T. japonica* (table 2); and two hyperparasites, *Cheiloneurus claviger* Thompson (widely distributed in the Palearctic region), and the Asiatic *Cerapteroceroides japonicus* Ashmead.

Until recently, *Encyrtus sasakii* Ishii (Hymenoptera Encyrtidae) was known as a parasitoid of *T. japonica* and a few other oriental Coccidae such as *R. sariuoni*, *E. kuwanai* and *Eulecanium giganteum* (Shinji). Then Chesters *et al.* (2012) demonstrated that *E. sasakii* was, in fact a cryptic species complex, comprised of three lineages sharing a similar morphology but highly divergent at the molecular level, corresponding to specimens that had emerged from four different coccid hosts. A few years later, Wang *et al.* (2016), in their detailed study of *E. sasakii* complex based on morphometry, molecular analysis and biological data, formally separated from the *E. sasakii* complex and described new the species *Encyrtus*

eulecaniumiae Wang et Zhang (emerged from *E. kuwanai* and *E. giganteum*) and *Encyrtus rhodococcusiae* Wang et Zhang; both species are parasitoids of *R. sariuoni*. *E. sasakii* was shown to be a specific parasitoid of *T. japonica* (Wang *et al.*, 2016). So far, no parasitoid has been recorded on *T. japonica* in North Italy.

Predators

In North Italy, larvae and adults of the Asiatic invasive coccinellid *Harmonia axyridis* (Pallas) and the native *Adalia bipunctata* (L.) (Coleoptera Coccinellidae) have been noticed to be active in trees infested by *T. japonica*. *H. axyridis* is a generalist predator with a comprehensive dietary range that consists mainly of aphids but includes coccids, psyllids and adelgids. However, it also preys on the larvae of native coccinellids like *A. bipunctata* (Burgio *et al.*, 2002). Long-term studies demonstrated a strong decline of *A. bipunctata* in response to the *H. axyridis* invasion, mostly on broadleaved trees (Masetti *et al.*, 2018; Kenis *et al.*, 2020). The impact of these predators on the Italian population of *T. japonica* has not been assessed yet.

Discussion and conclusions

Three European new country records of *T. japonica* in a four-year interval (Italy, Great Britain and Croatia) indicate that this species could expand its range in Europe, primarily due to the import and trade in ornamental trees. In Italy, five years after its detection, the first infested area (Lombardy region) has expanded slightly, and the level of infestation is high. Still, so far, no new infestation foci in other Italian regions have been reported.

Heavy infestations of *T. japonica* on twigs cause die-back and necrosis of buds, which is mostly harmful to newly planted young trees. Despite some heavy infestations, no real impact on plant vigour has been noticed in fully grown trees. The production of honeydew is limited. From late April onwards (when the females start oviposition) the trees assume a striking and unsightly appearance due to the many conspicuous white ovisacs hanging from the twigs and branches, reducing their aesthetic value and causing concern among citizens. Moreover, the ovisacs persist on the plants long after the eggs have hatched and are still present in winter, so the unsightly appearance persists.

In Europe two other exotic coccid species, both producing white waxy egg-sacs, are reported as invasive pests of ornamental and amenity trees in urban environments. They are *Pulvinaria kuwacola* Kuwana (= *P. hydrangeae* Steinweden), which secretes an elongate ovisac on leaf undersides, and *Pulvinaria regalis* Canard, which produces round ovisacs on tree trunks and large branches. Their first arrival in Europe (both in France) occurred in 1965 (*P. kuwacola*) and 1968 (*P. regalis*) (Canard, 1965; 1968). Subsequently these species colonized many European countries (Garcia Morales *et al.*, 2016). In each new country where they established, after an initial concern for plant vigour due to the heavy infestation levels of the new exotic pests, any attempt at control was deferred because no real damage to the infested trees was observed.

Table 2. Hymenoptera Encyrtidae species parasitoids of *T. japonica* (from Noyes, 2019; Suh, 2019; Wang *et al.*, 2016).

Encyrtidae	Distribution	Hosts
<i>Aphycoides fuscipennis</i> (Ashmead)	China, Mongolia, Japan, Russia (Far east)	Coccidae: <i>Eulecanium cerasorum</i> (Cockerell) <i>Eulecanium giganteum</i> (Shinji) <i>Eulecanium kostiyevi</i> Borchsenius <i>Eulecanium paucispinosum</i> Danzig <i>Takahashia japonica</i> (Cockerell)
<i>Aphycoides lecaniorum</i> Tachikawa	Japan	Coccidae: <i>Parthenolecanium</i> sp. <i>Lecanium</i> sp. <i>Takahashia japonica</i> (Cockerell)
<i>Cerapteroceroides japonicus</i> Ashmead	China, Japan, India, Pakistan, Russia	Coccidae: <i>Ceroplastes rubens</i> Maskell <i>Pulvinaria aurantii</i> Cockerell <i>Pulvinaria floccifera</i> (Westwood) <i>Eulecanium giganteum</i> (Shinji) <i>Marsipococcus marsupialis</i> (Green) <i>Metaceronema japonica</i> (Maskell) <i>Pulvinaria aurantii</i> Cockerell <i>Pulvinaria floccifera</i> (Westwood) <i>Pulvinaria idesiae</i> Kuwana <i>Takahashia japonica</i> (Cockerell) Eriococcidae: <i>Acanthococcus tokaedae</i> (Kuwana) Lecanodiaspididae: <i>Psoraleococcus quercus</i> (Cockerell) Pseudococcidae: <i>Phenacoccus aceris</i> (Signoret) <i>Phenacoccus pergandei</i> Cockerell Triozidae: <i>Trioza cinnamomi</i> Boselli <i>Trioza remota</i> Foerster
<i>Encyrtus sasakii</i> Ishii	China, Japan, Korea	Coccidae: <i>Takahashia japonica</i> (Cockerell)
<i>Metaphycus albopleuralis</i> (Ashmead)	Japan	Coccidae: <i>Eulecanium cerasorum</i> (Cockerell) <i>Eulecanium kuwanai</i> Kanda <i>Takahashia japonica</i> (Cockerell)
<i>Microterys rufofulvus</i> Ishii	China, Japan	Coccidae: <i>Ceroplastes japonicus</i> Green <i>Ceroplastes rubens</i> Maskell <i>Pulvinaria aurantii</i> Cockerell <i>Eulecanium kuwanai</i> Kanda <i>Takahashia japonica</i> (Cockerell)

Moreover, after an initial population explosion immediately after the new exotic insect introduction the scale populations slowly decreased (Hippe and Frey, 1999; Trierweiler and Balder, 2005), mostly due to the adaptation of native natural enemies to new prey. On *P. regalis* in England, Germany and Switzerland, the parasitoids *Coccophagus lycimnia* (Walker), *Coccophagus obscurus* Westwood, *Coccophagus scutellaris* (Dalman), and *Coccophagus semicircularis* (Forster) (Hymenoptera Aphelinidae) were recorded (Hippe and Frey, 1999); whereas on *P. kuwacola*, the widespread *C. lycimnia* and the Asiatic *Coccophagus shillongensis* Hayat et Singh were recorded in Italy and Serbia respectively (Pellizzari Scaltriti, 1976; Dervišević *et al.*, 2021).

Possibly the same sort of outcome may occur in Italy with the recent arrival of *T. japonica*. So far, its impact on urban trees has mostly involved some honeydew production and the unsightly appearance of infested trees from the oviposition period onwards (eight or nine months of the year). Pruning off most of the infested twigs and branches in winter, when the overwintering nymphs are clearly visible (figure 2g) or in spring (April–May), before the eggs hatch, are suggested to reduce infestations.

The next few years will determine the role of *T. japonica* in the European environments: whether it is simply another established species, or whether it will become a new dangerous invasive pest.

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