Bulletin of Insectology ***61*** *(2): 343-348, 2008*
ISSN 1721-8861

Chestnut gall wasp (*Dryocosmus kuriphilus*): spreading in Italy and new records in Bologna province

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Abstract

The chestnut gall wasp *Dryocosmus kuriphilus* Yasumatsu poses one of the most serious threats to chestnut cultivation in the world. After Asia and North America this pest may be spreading throughout Europe. In Italy, as a result of the movement of infested plant material, the natural ability of the species in spreading, and due to the uninterrupted continuity of chestnut stands, the phytophagous, 6 years after its introduction, is already colonizing Italy's most important chestnut - growing regions.

Key words: Chestnut gall wasp, *Dryocosmus kuriphilus*, establishment, Italy, *Castanea sativa*.

Introduction

Dryocosmus kuriphilus Yasumatsu (Hymenoptera Cynipidae) is considered to be one of the greatest causes of damage to the species of the genus *Castanea* at a worldwide level and is classified by the European and Mediterranean Plant Protection Organization (EPPO, 2005) as a quarantine organism. It is a pest of Chinese origin which attacks exclusively chestnut trees inducing the formation of galls on new spring shoots, thus disrupting twig growth and resulting in severe plant decline and drastic yield reductions (Kato and Hijii, 1997). The larvae feed within the galls in spring, the adults emerge in summer and lay theirs eggs inside the buds, in which the first instar larvae overwinter until the following season (EPPO, 2005), making detection difficult by simple external plant inspection. In Japan, Korea and the United States, countries where the gall wasp was introduced accidentally and has been widespread for sometime (Rieske, 2007), it has caused vast damage to chestnut - growing. More recently *D. kuriphilus* has been detected in Nepal (Abe *et al.*, 2007) and also in Europe: first in Italy in 2002 (Brussino *et al*., 2002) and three years later in Slovenia (Seljak, 2006) and France (EPPO, 2007). The European chestnut (*Castanea sativa* Mill.) is one of the most important broad-leaved species in Italy: chestnut stands amount to 788,400 hectares that represents 9% of the Italian forests, (INFC, 2005) and are present in each of the twenty Italian regions. Chestnut growing for fruit and wood production has a valuable role in the local economy of mountainous and hilly areas in many regions, notably Campania, Lazio, Piedmont, Tuscany and Emilia-Romagna. The European Community has issued a directive on emergency measures to be taken in order to impede the pest's introduction and spreading in the state member regions based: on the banning of the exchange of plant material coming from zones where the insect's presence is known; on monitoring the region and on the demarcation of infestation hotspots. The insect's means of spreading has been linked to the transport of infected plant material used for propagating purposes, to active flight of adults augmented by wind and accidental transport by man. Despite the research carried out in order to fight the insect using pesticides (Picciau, 2006) and the selection of resistant cultivars (Botta *et al.*, 2006), the most effective means of control of the pest is the classical biological control based on the use of the natural enemy *Torymus sinensis* Kamijo (Hymenoptera Torymidae) (Moriya *et al.*, 2003). The control using *T. sinensis* was initiated in Japan in the 80's and has been successfully established in both Asia and the United States (Cooper and Rieske, 2007) and recently a release program in Italy has been started (Quacchia *et al.*, 2008).

Spreading in Italy

Piedmont (2002)

In spring 2002 in chestnut orchards in the municipal districts of Boves e Peveragno, situated in the foothills of the Cuneo province, chestnut plant neoplasm were collected and subsequently identified as being the *D. kuriphilus* galls (Brussino *et al.*, 2002). It is likely that the pest reached Piedmont some years earlier transported on nursery stock plants. In the following years the infestations spread rapidly in the province: in 2003 the hotspots expanded by 10 km both westwards and eastwards and about 5-10 km northwards and southwards; in 2004 the advancement measured about 4 km northwards and westwards and 12 km eastwards, while in 2005 the expansion proceeded over 20 km in a north easterly direction, and 5-10 km in the other directions (Bosio, 2006). In the last few years the number of galls per plant also increased notably (Provincia di Cuneo, 2004), with a variable loss of 40-70% in fruit production observed in the highly infested orchards. The rate of yield reduction reported depends on many factors, like the chestnut cultivar and the rainfall trend (Bosio, personal communication). From 2005 to 2008 new hotspots were reported in all the provinces of Piedmont and was noticed a serious expansion of the previously recorded infested zones (Provincia di Cuneo, 2005; 2006; 2007; 2008; figure 1.2, table 1).

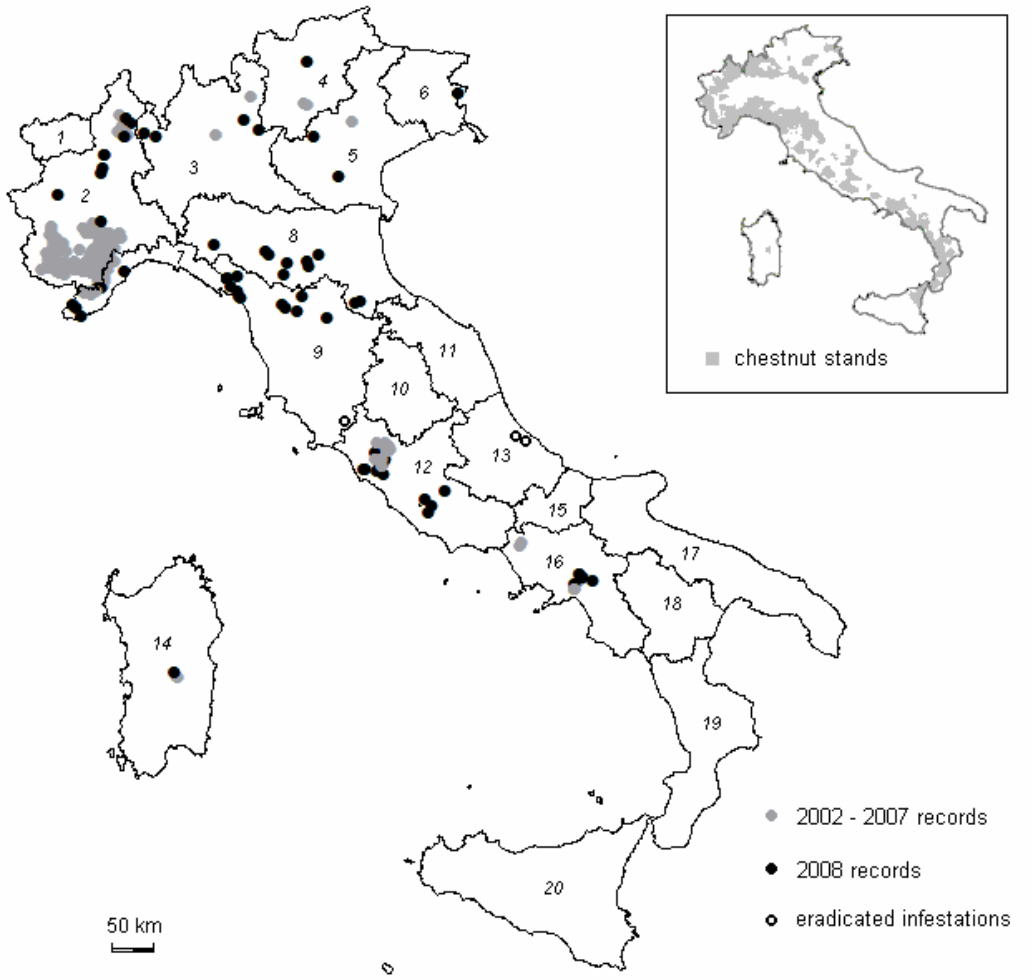

Figure1. Spreading of chestnut gall wasp in Italy. Regions situated in the Alps. 1: Aosta Valley; 2: Piedmont; 3: Lombardy; 4: Trentino-Alto Adige/Sudtirol; 5: Veneto; 6: Friuli-Venezia Giulia; 7: Liguria. Regions located in the Northern and Central Apennines. 8: Emilia-Romagna; 9: Tuscany; 10: Umbria; 11: Marche; 12: Lazio. Regions located in the Southern Apennines and in the islands. 13: Abruzzo; 14: Sardinia; 15: Molise; 16: Campania; 17: Apulia; 18: Basilicata; 19: Calabria; 20: Sicily.

Campania (2005)

On 9th of May 2005 gall infested branches were identified in chestnut groves near Serino, in the Picentini Mountains in the Avellino province: after subsequent verification it emerged that numerous young plants coming from Piedmont and potentially infested were present in two nurseries in the vicinity (Ziccardi, 2005). Monitoring carried out in spring and summer 2008 showed that the insect has been rampant in this area (Borrelli, 2008), to the extent that the minister of agricultural politics was asked to declare a state of natural calamity (Comunità Montana Terminio Cervialto, 2008). The gall wasp is now present in the provinces of Avellino, Salerno and Caserta (Regione Campania, 2008; Servizio Fitosanitario Regione Campania, 2008a; 2008b; figure 1.16, table 1).

Lazio (2005)

On 31st of May 2005, three weeks after detection in the Campania region, galls were discovered on young chestnut plants in chestnut groves in the municipality of Canepina, in the Cimini Mountains in the Viterbo province, in the vicinity of an orchard established using plant material coming from a nursery which obtained its stock from nurseries in the province of Cuneo (Paparatti and Speranza, 2006). In the last few years the insect considerably increased its presence in Lazio, with new infestations recorded in 2007 and 2008 in the provinces of Viterbo and Rome (Regione Lazio, 2008; figure 1.12, table 1).

Abruzzo (2005)

In spring 2005 infested propagation plant material was detected in two nurseries situated respectively in the provinces of Pescara and Chieti. All plants at risk were destroyed before adult emergence and the infestations were considered as being eradicated by the phytosanitary service of the Abruzzo region (Di Donato, personal communication; figure 1.13, table 1).

Tuscany (2005)

After an initial alarm in 2005, as a result of infested material being discovered in a nursery in the Grosseto province, the insect was subsequently considered absent

Table1. Locations where *D. kuriphilus* has been detected from 2002 to 2008. The table shows the year of the first record for each area.

Region	Province	Area	Record	Location
Piedmont	Cuneo	all the Province	2002	
"	Asti	Langa Astigiana	2007	7 municipal districts
"	"	Monferrato Astigiano	"	San Damiano d'Asti
"	Alessandria	Orba Valley	"	Bistagno
"	Vercelli	Sesia Valley	"	Civiasco
"	"	Viverone Lake	"	Borgo d'Ale
"	Verbano Cusio Ossola	Orta Lake	"	8 municipal districts
"	"	Ossola Valley	"	Anzola d'Ossola
"	Novara	Orta Lake	"	6 municipal districts
"	Biella	Viverone Lake	2008	Cavaglià
"	"	Prealpi Biellesi Mountains	"	Ronco Biellese, Valdengo
"	Turin	Susa Valley	"	Almese
Campania	Avellino	Picentini Mountains	2005	7 municipal districts
"	Salerno	"	"	Fisciano
"	Caserta	Roccamonfina Hill	"	Teano, Caianello
Lazio	Viterbo	Cimini Mountains	"	9 municipal districts
"	"	hills east toVico Lake	2007	Fabrica di Roma, Carbognano
"	"	hills South to Cimini Mountains	"	Barbarano Romano
"	"	hills North to Bracciano Lake	2008	3 municipal districts
"	Rome	Castelli Romani	"	3 municipal districts
"	"	Tolfa Mountains	"	Tolfa, Allumiere
"	"	Bracciano Lake	"	Bracciano, Canale Monterano
"	"	Aniene Valley	"	Bellegra
Abruzzo	Chieti	Teatine Hills	2005	Ripa Teatina*
"	Pescara	hills near Pescara	"	Moscufo*
Tuscany	Grosseto	Tufo area	"	Pitigliano*
"	Massa Carrara	Lunigiana and Riviera Apuana	2008	6 municipal districts
"	Pistoia	hills around Pistoia	"	3 municipal districts
"	Florence	hills near Florence	"	Pontassieve
"	Prato	Bisenzio Valley	"	Cantagallo
Lombardy	Bergamo	Seriana Valley	2006	Albino
"	Brescia	Camonica Valley	"	Sonico
"	"	"	2008	Esine
"	"	Caffaro Valley	"	Bagolino
"	Varese	Varese and Comabbio Lakes	"	Ternate, Venegono Superiore
Liguria	Savona	High Bormida Valley	2007	10 municipal districts
"	"	coastal hills	2008	Quiliano
"	Imperia	High Arroscia Valleys	"	7 municipal districts
"	"	Argentina and Nervia Valleys	"	3 municipal districts
"	"	coastal hills	"	Sanremo
Sardinia	Nuoro	Gennargentu Mountains	2007	3 municipal districts
Veneto	Treviso	Mount Grappa	"	Cavaso del Tomba
"	Padova	Euganei Hills	2008	Cinto Euganeo
"	Vicenza	Leogra Valley	"	Torrebelvicino
Trentino-AA/Sudt.	Trento	High Valsugana	2007	Pergine Valsugana, Civezzano
"	Bolzano	Oltradige	2008	Terlano
Emilia-Romagna	Parma	High Ceno Valley	"	Bardi
"	Reggio Emilia	Enza and Dolo Valleys	"	Carpineti, Casina
"	Modena	Frignano	"	Pavullo nel Frignano, Sestola
"	Bologna	Reno Valley	"	Monte San Pietro, Marzabotto
"	"	hills South to Bologna	"	Bologna
"	Forlì-Cesena	Bidente Valley	"	Santa Sofia, Galeata
Friuli-Venezia G.	Udine	Prealpi Giulie Mountains	"	unknown

* eradicated infestations.

in this region (Marziali, personal communication) as the infected material had been promptly destroyed preventing any adult emergence and spreading. On 6th of June 2008, however, the pest was again detected in the Tuscany region (ARSIA Toscana, 2008a). Monitoring showed that the pest is present in four provinces: Massa Carrara, Pistoia, Florence and Prato (ARSIA Toscana, 2008b; 2008c; figure 1.9, table 1).

Marche (-)

Although pest detections were reported but not confirmed during 2005 (Aebi *et al*., 2006), on October 2008 the chestnut gall wasp was officially considered to be absent in the region by the phytosanitary service of Marche (Flamini, personal communication; figure 1.11, table 1).

Lombardy (2006)

In 2006 the gall wasp was found in Lombardy, where two hotspots were affirmed in chestnut orchards grown using infested propagating nursery stock; situated in the provinces of Bergamo and Brescia (Servizio Fitosanitario Regione Lombardia, 2006). Results from the monitoring carried out in 2008 show that the infested areas mentioned have heavily intensified (L'Eco di Bergamo, 2008): new infestations were reported in the provinces of Brescia and also Varese (Spatola, 2008; figure 1.3, table 1).

Liguria (2007)

In April 2007 insect attacks were reported in the province of Savona, where it had spread from the bordering Piedmont region (Confederazione Italiana Agricoltori, 2007). In 2008 pest infestations have invaded numerous chestnut groves in the provinces of Savona and Imperia (Regione Liguria, 2008; figure 1.7, table 1).

Sardinia (2007)

Throughout 2007 detections were received from Sardinia, on western slopes of the Gennargentu Mountains in the province of Nuoro (Regione Autonoma della Sardegna, 2007) almost certainly as a result of using infested nursery stock from other regions for propagation purposes. Now the infestations have reached other chestnut groves in the same area (Regione Autonoma della Sardegna, 2008; figure 1.14, table 1).

Veneto (2007)

A gall wasp hotspot was identified in spring 2007 in an orchard situated in the Treviso province (Regione Veneto, 2007). In 2008 numerous new hot spots were recorded in chestnut orchards and coppices situated in the provinces of Padova and Vicenza (Regione Veneto, 2008; figure 1.5, table 1).

Trentino-Alto Adige/Südtirol (2007)

Two groves comprising Euro-Japanese hybrids, situated in the province of Trento, were proven to be infested by the pest during checks carried out in 2007 (Salvadori *et al.*, 2007). In May 2008 the insect was also detected in the Bolzano province (Provincia Autonoma di Bolzano, 2008; figure 1.4, table 1).

Emilia-Romagna (2008)

First detections were made in May 2008. Galls were found in numerous sites in the Apennine Mountains: in the provinces of Reggio Emilia (Servizio Fitosanitario Emilia-Romagna, 2008), Modena, Forlì-Cesena, Parma (Regione Emilia-Romagna, 2008) and Bologna. The attacks in the chestnut groves are intense concerning plants of all ages but also widespread on chestnut coppice woods at the edges of chestnut orchards (figure1.8, table 1).

Friuli-Venezia Giulia (2008)

In August 2008 the gall wasp was noticed in some chestnut stands in the Prelapi Giulie Mountains (Zandigiacomo, *in litteris*), not far from the Slovenia border, where *D. kuriphilus* was already reported (Seljak, 2006; figure 1.6, table 1).

New records in the Bologna province (Emilia-Romagna region)

We have revealed the presence of *D. kuriphilus* in some locations in the Bologna province (figure 2, table 1). In the municipality of Monte San Pietro (figure 2.6) two plants in adult chestnut groves, about three kilometres from each other, were hit with a few galls (44°23'10.3"N, 11°09'26.2"E and 44°22'01.1"N, 11°08'07.1"E). In the area of Marzabotto (44°20'22.4"N; 11°'27.8"E) (Lolli, personal communication) ten plants in an adult chestnut grove were found to be infested (figure 2.11). On the hills surrounding Bologna (44°27'05.0"N, 11°19'37.6"E) a heavy infestation in a chestnut wood was detected resulting in all the plants on the stand being hit with galls (figure 2.1). This amounts to 5,000 m^2 of abandoned chestnut coppice about seven kilometres away from other chestnut groves; so the use of propagation material as a cause of infestation can be excluded. These cases show how colonisation of the Apennine Mountains through active adult insect flight is already taking place.

Conclusions

In Italy the spreading of the chestnut gall wasp has been brought about as a result of two factors: natural dispersal by flight, causing expansion of the infested areas, and extensive transferral and exchange of infected nursery plant material, which creates new satellite populations which has, as a consequence, notably increased the speed of colonisation. The rate of expansion observed in Piedmont is similar to that seen in the United States, where it has also reached 25 km per year (Rieske, 2007). The characteristics of some recently detected infestations, such as those found in the region Emilia-Romagna, show that the presence of *D. kuriphilus* is not limited to new hotspots caused by the movement of infested material. The insect has in actual fact already started colonizing several chestnut orchards and coppices in the Apennine regions through active flight of adults and has also spread in many areas situated in the Alpine regions. The ease in which the pest is spreading

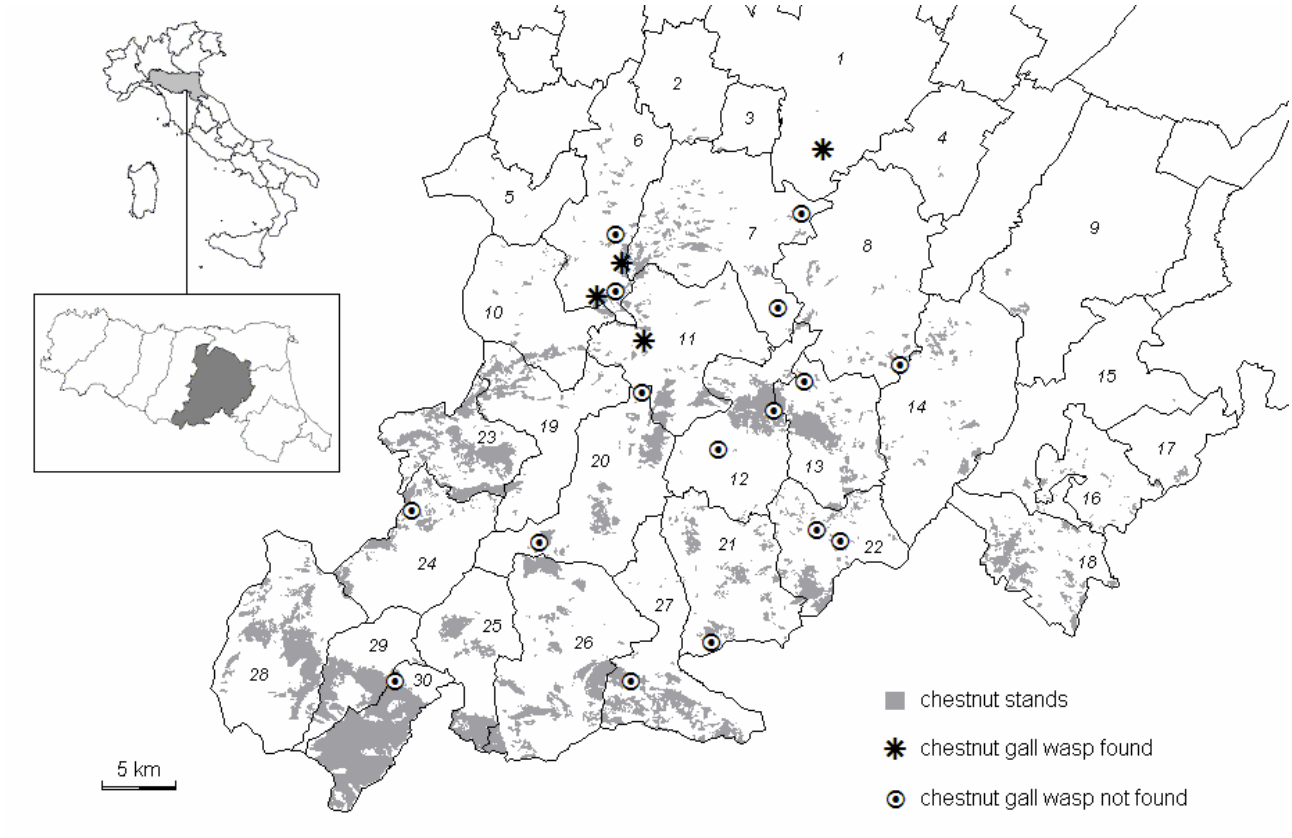

Figure 2. Records of chestnut gall wasp in the Bologna province (Emilia-Romagna region). Municipal districts with chestnut stands. 1: Bologna; 2:Zola Predosa; 3: Casalecchio di Reno; 4: San Lazzaro di Savena; 5: Castello di Serravalle; 6: Monte San Pietro; 7: Sasso Marconi; 8: Pianoro; 9: Castel San Pietro; 10: Savigno; 11: Marzabotto; 12: Monzuno; 13: Loiano; 14: Monterenzio; 15: Casalfiumanese; 16: Fontanelice; 17: Borgo Tossignano; 18: Castel del Rio; 19: Vergato; 20: Grizzana Morandi; 21: S. Benedetto Val di Sambro; 22: Monghidoro; 23: Castel d'Aiano; 24: Gaggio Montano; 25: Castel di Casio; 26: Camugnano; 27: Castiglione dei Pepoli; 28: Lizzano in Belvedere; 29: Porretta Terme; 30: Granaglione.

in Italy is also owed to the vastness and continuity of the chestnut stands in our country. Currently the insect is already established in eleven Italian regions (figure 1) and has hit the most historically important Italian chestnut-growing areas.

Acknowledgements

The authors thank Dr Giovanni Bosio (Settore Fitosanitario Regione Piemonte, Torino, Italy), Dr Antonio Di Donato (Agenzia Regionale per i servizi di Sviluppo Agricolo in Abruzzo, Pescara, Italy), Dr Lorenzo Marziali (Istituto Sperimentale per la Zoologia Agraria di Firenze, Italy), Dr Lucio Flamini (Agenzia Servizi Settore Agroalimentare delle Marche, Ancona, Italy), Prof Pietro Zandigiacomo (Dipartimento di Biologia Applicata alla Difesa delle Piante, Università di Udine, Italy) and Germano Lolli (chestnut grower in Bologna, Italy), for supplying useful information about the chestnut gall wasp records in Italy. We thank also the Phytosanitary Service of Emilia-Romagna region.

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Received September 23, 2008. Accepted October 23, 2008.