



Research Article

Current status of eucalyptus gall wasp and its native parasitoids in Karnataka

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ABSTRACT: Roving survey was conducted during 2010-11 to assess impact of native parasitoids on eucalyptus gall wasp in Belgaum, Dharwad, Haveri, Davangere, Chitradurga, Tumkur and Bengaluru Rural districts of Karnataka, India. It was observed that the gall incidence declined drastically since its outbreak in 2007 due to the activity of native parasitoids. Activity of native parasitoids was more in southern districts. Among the native parasitoids *Megastigmus dharwadicus* Narendran *et al* was the most dominant. The eucalyptus gall wasp which had become a production constraint during 2007 threatening the productivity of paper and pulp industry is efficiently kept under check by the native parasitoids.

KEY WORDS: Eucalyptus gall wasp, *Leptocybe invasa*, *Megastigmus dharwadicus*, *Aprostocetus gala*

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INTRODUCTION

Eucalyptus is economically important for timber, fiber, shelter and livestock. It meets the requirements of people, industries and has helped to reduce pressure on natural forests. There is a high demand for the eucalyptus wood in India for various purposes (Sexena, 1991). First reported from Middle East during 2000, eucalyptus gall wasp, *Leptocybe invasa* Fisher & La Salle (Hymenoptera: Eulophidae) wreaked havoc on eucalyptus plantations throughout the world (Mendel *et al.*, 2004). In India, it was first reported during 2001 (Anon., 2007) which subsequently spread to neighboring states of Andhra Pradesh, Tamil Nadu, Kerala (Jacob *et al.*, 2007), Maharashtra, Goa, Gujarat, Madhya Pradesh (Kumar *et al.*, 2007), Delhi, Haryana, Jammu and Kashmir, Orissa and Uttarakhand (personal observations).

In Karnataka, the gall wasp is reported to have damaged 25 lakh eucalyptus saplings in the nurseries of two major wood based industries, West Coast Paper Mills Ltd., Dandeli and Harihara Polyfibres, Harihar. Since its outbreak in 2007, studies on biology (Ramanagouda *et al.*, 2010), seasonal incidence (Kavitha Kumari, 2009; Harish Kulkarni, 2010), management (Vastrad *et al.*, 2011) and host plant resistance (Basavanagoud *et al.*, 2010) have been conducted at the Department of Agricultural Entomology, College of

Agriculture, Dharwad. At national level, efforts were also made to introduce exotic parasitoids to manage the eucalyptus gall wasp. The literature is replete with many examples of native parasitoids exploiting the exotic hosts. Among the several native parasitoids reported on eucalyptus gall wasp, *Megastigmus* sp. was the most dominant (Vastrad *et al.*, 2010). This species was later described as *M. dharwadicus* (Narendran *et al.*, 2010). Investigations on the impact of native parasitoids on the incidence of gall wasp were conducted during 2010-11 and reported in this paper.

MATERIALS AND METHODS

A roving survey was conducted in different districts of Karnataka viz., Dharwad (Vaddarahatti and Dhaddikamalapur), Belgaum (Kulwalli and Kittur), Haveri (Ranebennur), Davanagere (Harihar), Chitradurga (J. G. Halli, Hiruyur and Chitradurga), Tumkur (Tumkur, Sira and Dabaspet) and Bengaluru Rural (Doddaballapur, Mukkenahalli and Rajankunte) districts during 2010-11. In each location, thirty centimeter shoots from 10 infested eucalyptus plants were randomly collected. The samples were kept separately from top, middle and bottom portion and the observations on different gall stages were recorded (Mendel *et al.*, 2004). Based on the number of gall stages recorded at each location, mean

gall incidence was worked out for each district. Later, the same samples were kept in pin holed polythene bags for pest and parasitoid emergence. The adult emergence of the pest and parasitoids was recorded daily till the cessation of adult emergence. The adults that emerged were from the pupal or late pupal stages since the pest and the parasitoid completes their life cycle in ~ 120 and 40 days respectively. The per cent parasitization was worked out by using the following formula (Kim *et al.*, 2008).

$$\text{Per cent parasitization} = \frac{\text{No. of parasitoid adults emerged}}{\text{Total no. of adults (gall wasp + parasitoids)}} \times 100$$

RESULTS AND DISCUSSION

The gall incidence and adult emergence of *L. invasa* was maximum during March, 2010. However, there was drastic reduction in the gall incidence and adult emergence of *L. invasa* in all the areas subsequently surveyed during July, 2010 and January, 2011. Similarly, emergence of native parasitoids (*M. dharwadicus* and *A. gala*) was high during July, 2010 and January, 2011 compared to March, 2010.

Gall incidence

Gall intensity was maximum during March 2010 (9.10 to 27.85 galls per 30 cm shoot length) compared to the gall intensity recorded during subsequent survey. Considerable decline in gall incidence (4.93 to 8.05) was noticed during July, 2010 and during January 2011 (1.40 to 2.89). The decline in gall incidence during July 2010 and January 2011 was consistent in all the districts surveyed (Fig. 1).

Adult emergence

Leptocybe invasa

During March 2010, the emergence of *L. invasa* adults was minimum in all other districts except Dharwad (122.5) and Belgaum (123.0) districts (Fig. 2). Similar trends were noticed during July 2010 and January 2011. In Dharwad and Belgaum districts drastic reduction in emergence of *L. invasa* adults was evident during July 2010 (11.50 and 62.50 respectively) and January 2011 (0.0 and 0.50 respectively) (Fig. 3 & 4).

Megastigmus dharwadicus

Emergence of *M. dharwadicus* was maximum in Belgaum (48.5) and minimum (1.71) in Bengaluru rural districts during March 2010 (Fig. 2). Compared to March

2010, adult emergence during July 2010 was high in Bengaluru Rural (75.75), Haveri (55.0) and Tumkur districts (51.67), while it was low in Dharwad (11.0) and Belgaum (8.50) (Fig. 3). During January 2011, adult emergence increased substantially in Chitradurga (23.00) and Belgaum (29.50) districts while no adult emergence was noticed in Haveri and Davanagere and declined considerably in Tumkur (0.50) and Bengaluru Rural (46.50) districts (Fig. 4).

Aprostocetus gala

The adult emergence of *A. gala* was very low in all the districts surveyed. During March 2010, adult emergence ranged from 1.66 to 23.50 in Dharwad, Belgaum and Tumkur (Fig. 2). However, adult emergence was noticed only in Belgaum (3.00) during July, 2010 and Bengaluru rural (9.50), Belgaum (2.00) and Chitradurga districts (1.50) during January, 2011 (Fig. 3 & 4).

Per cent Parasitization

Megastigmus dharwadicus

Though no consistent trend was noticed, the per cent parasitization gradually reached its peak during January 2011. No parasitoid activity was recorded in Haveri and Davanagere during March 2010 and January 2011, however, these districts recorded 93.22 and 50.00 per cent parasitization during July 2010. In Chitradurga district, the per cent parasitization increased to 50.00 (July 2010) and 86.76 per cent (January 2011) from the nil parasitization recorded in March 2010. Dharwad district also recorded a gradual increase in parasitization starting from 22.29 (March 2010) which rose to 50.00 during July 2010 and reached 100.0 per cent during January 2011. Initially, Belgaum district recorded 26.52 per cent parasitization during March 2010 which declined to 20.73 per cent (July 2010) and rose sharply to reach its peak (46.09 per cent) during January 2011. Tumkur and Bengaluru Rural districts recorded maximum parasitization of 82.69 and 91.82 per cent respectively during July 2010, compared to 33.33 and 38.85 per cent, respectively during January, 2011 (Fig. 5, 6 & 7).

Aprostocetus gala

Compared to *M. dharwadicus* the activity of *A. gala* was very low in all the districts surveyed. While no parasitoid activity was observed in Haveri, Davanagere, Chitradurga and Bengaluru Rural districts during March 2010, Tumkur, Dharwad and Belgaum recorded 15.08, 10.86 and 5.15 per cent parasitization respectively. Similarly, no parasitization was recorded during July 2010 in all the districts surveyed except Belgaum (2.83 per cent). During January 2011, Bengaluru rural,

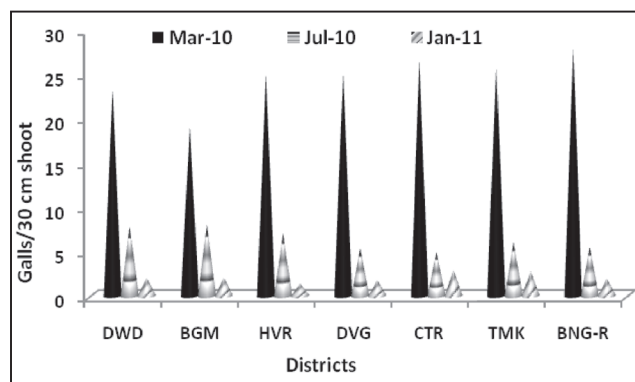


Fig. 1. Gall incidence in different locations of Karnataka

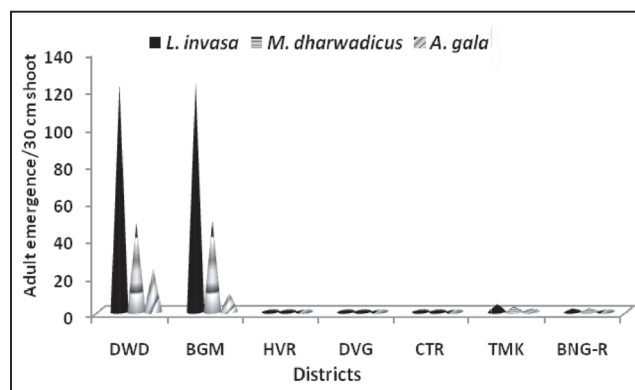


Fig. 2. Adult emergence during March 2010

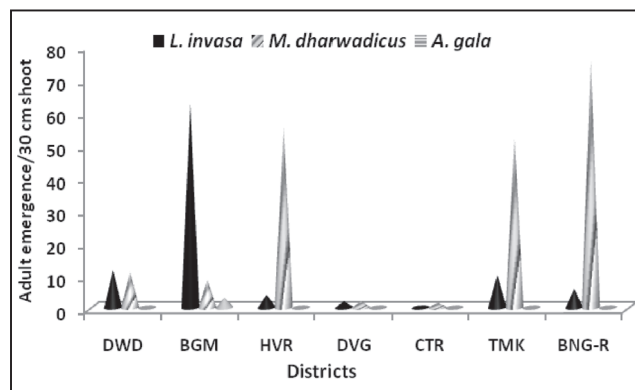


Fig. 3. Adult emergence during July 2010

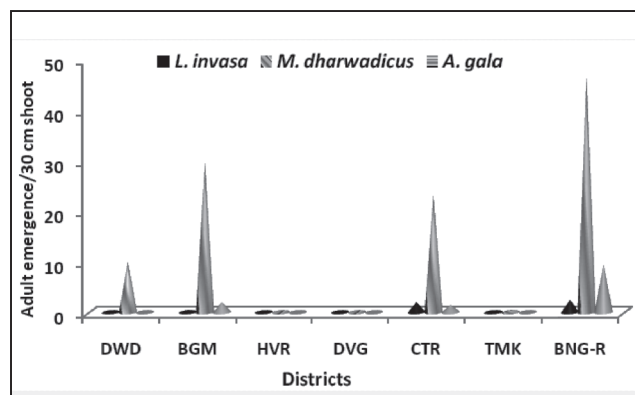


Fig. 4. Adult emergence during January 2011

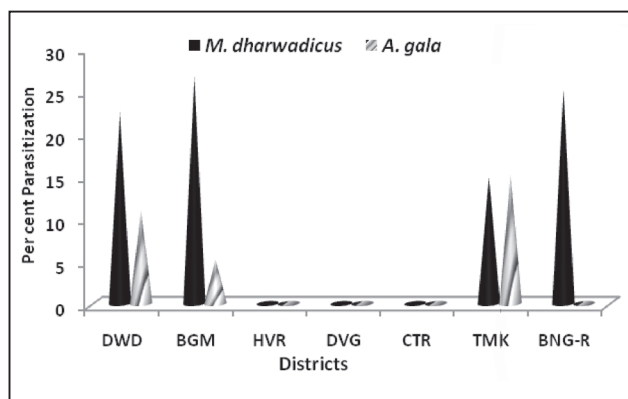


Fig. 5. Per cent parasitization by native parasitoids during March 2010

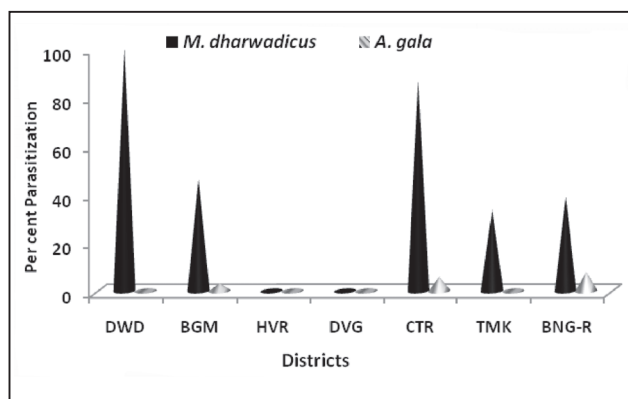


Fig. 6. Per cent parasitization by native parasitoids during July 2010

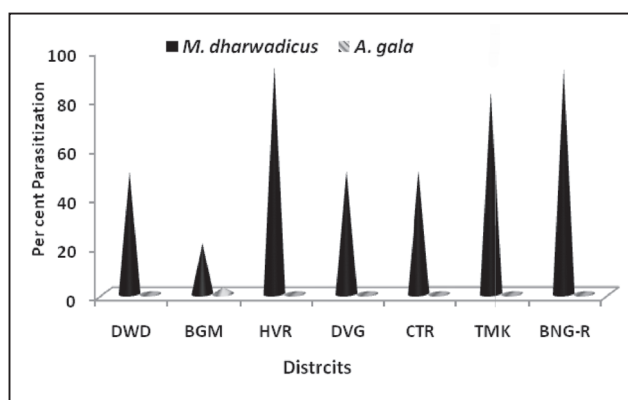


Fig. 7. Per cent parasitization by native parasitoids during January 2011

DWD – Dharwad; BGM – Belgaum; HVR – Haveri;
DVG – Davangere; CTR – Chitradurga;
TMK – Tumkur; BNG-R – Bengaluru Rural

Chitradurga and Belgaum districts recorded 7.87, 5.77 and 3.12 per cent parasitization respectively (Fig. 5, 6 & 7).

Total parasitization

In general the parasitoid activity was more in southern, districts (Tumkur, Chitradurga and Bengaluru Rural). Total parasitization (*M. dharwadicus* and *A. gala*) during March 2010 ranged from 25.00 (Bengaluru Rural) to 33.16 per cent (Dharwad) while no parasitoid activity was observed in Haveri, Davanagere and Chitradurga districts. During July 2010, high level of parasitoid activity ranging from 23.56 (Belgaum) to 93.22 (Haveri) per cent was recorded in all the districts. However, no parasitoid activity was noticed in Haveri and Davanagere districts during

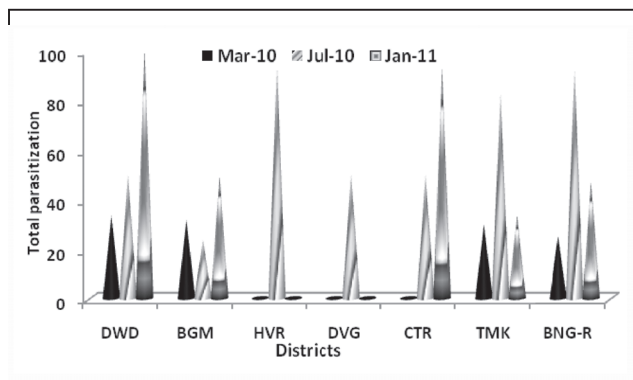


Fig. 8: Total parasitization by native parasitoids in Karnataka

January 2011 while Dharwad, Chitradurga, Belgaum and Bengaluru Rural districts recorded 100.0, 92.53, 49.21 and 46.72 per cent parasitization respectively (Fig. 8).

Though eucalyptus gall wasp was first reported during 2001-02, large scale outbreak occurred during 2007 (Anon., 2007 a). Various authors have reported severe gall incidence in India (Jacob *et al.*, 2007; Kumar *et al.*, 2007). The gall incidence recorded during the present study was lower compared to those reported earlier. Similarly, adult emergence of *L. invasa* recorded during 2008 and 2009 (Kavitha Kumari, 2009; Harish Kulkarni, 2010) was also more compared to the present study. Commensurate with the high levels of gall incidence, the emergence of *L. invasa* recorded during the initial survey (March 2010) was also high (1.0 to 122.50) which drastically declined during subsequent surveys (02 to 62.50 and 0.50 to 2.50 during July 2010 and January 2011 respectively). However, emergence of parasitoids *M. dharwadicus* and *A. gala* was higher compared to those reported earlier (Harish Kulkarni, 2010). Among the native parasitoids encountered during the present study *M. dharwadicus* was the most dominant. Per cent parasitization by *M. dharwadicus* ranged from 14.81

to 26.52 during March 2010 and it increased drastically during subsequent surveys (20.73 to 93.22 and 33.33 to 100.0 per cent during July 2010 and January 2011 respectively). Total per cent parasitization due to *M. dharwadicus* and *A. gala* increased over a period of 10 months. During March 2010 the total per cent parasitization ranged from 00.0 to 33.16 which rose to 23.56 to 93.22 during July 2010 and reached its peak during January 2011 (0.0 to 100.0 per cent). The impact of the higher levels of parasitization was evident through the drastic decline in gall intensity (less than 2 galls per 30 cm shoot) in all the districts surveyed. Thus, contrary to the earlier report (Protasov *et al.*, 2008) the present findings suggest that *M. dharwadicus* is an efficient natural enemy of *L. invasa*.

Native *Megastigmus* species are known to parasitize *L. invasa* in Italy, Turkey and Israel (Viggiani *et al.*, 2000; Protasov *et al.*, 2008) and India (Vastrad *et al.*, 2010). It was reported that *Megastigmus* species was not originally associated with *Eucalyptus*, being a local species it has adapted to develop on *L. invasa* (Protasov *et al.*, 2008). However, the insect species which act as local hosts for *Megastigmus* spp. need to be explored. Eucalyptus gall wasp which was a production constraint during 2007 threatening the productivity of paper and pulp industry is now efficiently kept under check by these native parasitoids in Karnataka.

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