

23. Kar, R. K. and Saxena, R. K., *Palaeobotanist*, 1976, **23**, 1–15.
24. Bessey, E. A., *Morphology and Taxonomy of Fungi*, The Blakiston Company, Philadelphia, 1950, pp. 1–790.
25. Thiessen, F. and Sydow, H., *Ann. Mycol.*, 1917, **15**, 389–491.
26. Alexopoulos, C. J., Mims, C. W. and Blackwell, M., *Introductory Mycology*, John Wiley, New York, 1996, pp. 1–632.
27. Webster, J., *Introduction to Fungi*, Cambridge University Press, Cambridge, 1993, pp. 1–669.
28. Ambwani, K., Sahni, A., Kar, R. K. and Dutta, D., *Rev. Micropaleontol.*, 2003, **46**, 67–71.

ACKNOWLEDGEMENTS. R.K.K. is grateful to the DST, New Delhi for sanctioning a project and R.K. thanks DST, New Delhi for the award of Fast-Track Young Scientist Project. We thank the Director, Birbal Sahni Institute of Palaeobotany, Lucknow for providing infrastructural facilities.

Received 20 March 2004; revised accepted 5 September 2004

R. K. KAR<sup>1,\*</sup>  
N. SHARMA<sup>2</sup>  
RATAN KAR<sup>1</sup>

<sup>1</sup>Birbal Sahni Institute of Palaeobotany, Lucknow 226 007, India

<sup>2</sup>Department of Botany, Lucknow University, Lucknow 226 007, India

\*For correspondence.  
e-mail: rk\_kar@yahoo.com

## Brown lacewing, *Micromus igorotus* Banks – a potential predator of sugarcane woolly aphid

Sugarcane, a major industrial crop grown over 5.9 and 3.1 lakh ha in Maharashtra and Karnataka, is being threatened by a sucking pest, sugarcane woolly aphid (SWA), *Ceratovacuna lanigera* Zehntner (Aphididae: Homoptera). Nymphs and adults of SWA congregate on the ventral surfaces of leaves along the midrib and desap resulting in drying up of the leaves. Besides, honeydew excreted by the aphid covers the upper surface of lower leaves on which sooty mould develops, making the leaf photosynthetically less or non-functional.

This pest has been reported to be widespread in the Philippines, Indonesia (Java), Taiwan, Malaysia, Japan (Ryukyu Archipelago) and India among 23 South-east Asian countries. The first report from India was in 1958 from Cooch Behar, West Bengal<sup>1</sup> followed by the Northeastern States and Uttar Pradesh<sup>2</sup> in 1974 and then from Assam and Nagaland<sup>3</sup> in 1995. The woolly aphid made its sudden entry in epidemic form in Maharashtra and Karnataka in July and September 2002 respectively. After its first appearance in Athani, Belgaum district, Karnataka, it spread to Chikkodi, Raibag, Hukkeri, Gokak taluks in the same district and Mudhol and Jamakhandi taluks of Bagalkot district. By the middle of 2003 the aphid had moved down to Davanagere and Shimoga districts.

Faster rate of multiplication due to parthenogenetic reproduction by both apterous and alate forms makes it difficult to contain the pest through artificial interventions. Natural suppression factors

hold the key to the management of the pest on sustainable basis. Among the 40 natural enemies reported, 30 predators dominate the scenario followed by parasitoids (6) and pathogens (4). During our survey for composition and abundance of bio-control agents in Karnataka in 2003, a dozen predators were found preying on SWA.

*Dipha aphidivora* (Meyrick), a lepidopteran carnivore, was found in close association with the aphid in all sugarcane-growing areas in varying abundance. Syrphids and hemerobiids were also found preying in severe form in isolated places adjoining forest ecosystem (Sunadoli). Hemerobiid predators, in large numbers were found preying heavily on SWA at Sunadoli village (20 km from Gokak

taluk, Belgaum district) during August 2003 (Figure 1). Sugarcane that was heavily infested by the aphid was cleared-off completely by the predator in about a period of 10 days over an area of 4 ha, which was not treated with insecticides. Overwhelmed by this episode, growers dispensed with pesticide for the management of the pest. No mobile stage of the predator was seen in the invaded fields during our visit. The farmers informed us that the predator disappeared as food (aphid) was not available. However, intensive search for the predator revealed the presence of pupae in cocoons at the base of the plant that was loosely covered by dried leaf sheaths (Figure 2a and b). A large collection of cocoons was made and brought to the laboratory for emer-



Figure 1. Larvae feeding on sugarcane woolly aphid.



**Figure 2.** *a*, Pupation on the inner surface of basal leaf sheath. *b*, Close-up of pupal cocoons inside leaf sheath. *c*, Brown lacewing, *Micromus igorotus* Banks.

gence of adult (Figure 2c). The adults were identified as *Micromus igorotus* Banks. Concurrently, the adults that emerged in the laboratory were released at five locations each of Dharwad and Belgaum districts. At all these locations, the predator established and preyed on SWA within 20 days, proving its potential as a promising natural enemy. Subsequent surveys also revealed the activity of *M. igorotus* in sugarcane ecosystem at a number of places.

Four species of hemerobiids have so far been reported<sup>4-6</sup>. *M. igorotus* has been recorded on SWA both in India and elsewhere. Information on biology either on SWA or other host insects is lacking. Preliminary studies on the biology of *M. igorotus* revealed that the predator requires about 25 days to complete its life cycle. Fecundity ranged from 110 to 170 over a period of 16–18 days. While the larval (feeding) period was short (5–7 days) with three larval instars, adult continued to feed for 16–18 days. Both the

feeding stages (larvae and adults) have feeding potential of 20–25 aphids/day. No cannibalism was observed, which is a common phenomenon in green lacewings (Chrysopidae).

Mass multiplication of *M. igorotus* is in progress both in the laboratory and in natural breeding nurseries in field at the University of Agricultural Sciences, Dharwad.

1. Basu, A. N. and Banerjee, S. N., *Indian Agric.*, 1958, **2**, 89–112.
2. Ghosh, A. K., *Indian Agric.*, 1974, **18**, 135.
3. Tripathi, G. M., *Indian Sugar*, 1995, **44**, 838–841.
4. Aarakaki, N., *Appl. Entomol. Zool.*, 1992, **27**, 159–162.
5. Cheng, W. Y., Wang, Z. T., Hung, T. H. and Hung, J. K., *Rep. Taiwan Sugar Res. Inst.*, 1992, 139, 19–31.
6. Ishida, M., *J. Formosan Sugar Planters Assoc.*, 1928, **6**, 1–28.

**ACKNOWLEDGEMENTS.** We thank Dr John D. Oswald, Texas A&M University, USA for

identification of the predator. We also thank the Government of Karnataka for financial support extended in undertaking investigation of sugarcane woolly aphid management.

Received 6 February 2004; revised accepted 15 June 2004

S. LINGAPPA<sup>1,\*</sup>  
R. K. PATIL<sup>2</sup>  
VIDYA MULIMANI<sup>3</sup>  
G. K. RAMEGOWDA<sup>3</sup>

<sup>1</sup>University of Agricultural Sciences,  
Dharwad 580 005, India

<sup>2</sup>Main Agricultural Research Station,  
University of Agricultural Sciences,  
Dharwad 580 005, India

<sup>3</sup>Department of Agricultural Entomology,  
Agricultural College,  
Dharwad 580 005, India

\*For correspondence.

e-mail: druasd@sancharnet.in