ceedings of the International Workshop on Biological Control of Heliothis, New Delhi, 1985, pp. 197–228.
5. Armes, N. J., Jadhav, D. R. and Lonergan, P. A., Proceedings of the World Cotton Research Conference-I, Brisbane, Australia, 1994, pp. 533–552.
6. Kranthi, K. R., Kranthi, S., Ali, S. and Banarjee, S. K., *Curr. Sci.*, 2000, **78**, 1001–1004.
7. Heckel, D., *Biol. Technol.*, 1994, **4**, 405–408.
8. Albert, Z. G., Pfister, R. M. and Dean, D. H., *Gene*, 1990, **93**, 49–54.
9. Lowry, D. H., Roseborough, A. L. and Randall, R. J., *J. Biol. Chem.*, 1951, **193**, 265–275.
10. Sims, S. R., Berberich, S. A., Nida, D. L., Segalini, L. L., Leach, J. N., Ebert, C. C. and Fuchs, R. L., *Crop Sci.*, 1996, **36**, 1212–1216.
11. Armes, N. J., Bond, G. S. and Cooter, R. J., *Nat. Res. Inst. Bull.*, 1992, 57.
12. Finney, D. J., *Probit Anal.*, Cambridge University Press, Cambridge, 1971, 3rd edn, p. 318.
13. Ross, G. E. S., *Maximum Likelihood Program: The Numerical Algorithms Group*, Rothamsted Experiment Station, Harpenden, UK, 1977.
14. Forrester, N. W., Cahill, M., Bird, L. J. and Layland, J. K., *Bull. Entomol. Res.*, 1993, **1**, 1–132.
15. Kranthi, K. R., Armes, N. J., Rao, N. G. V., Raj, S. and Sundaramurthy, V. T., *Pesticide Sci.*, 1997, **50**, 91–98.
16. Roush, R. T. and Miller, G. L., *J. Econ. Entomol.*, 1986, **79**, 293–298.
17. Georghiou, G. P. and Taylor, C. E., Proceedings of the 15th International Congress of Entomology, Washington DC, 1976, pp. 759–785.
18. Gujar, G. T., Archana Kumari, Vinay Kalia and Chandrashekar, K., *Curr. Sci.*, 2000, **78**, 995–1001.
19. Fitt, G. P., *Annu. Rev. Entomol.*, 1989, **34**, 17–52.
20. Mahaffey, J. S., Bradley, J. R. and Van Duyn, J. W., Proceedings of the Belt-wide Cotton Conference, 1995, vol. 4, pp. 563–571.
21. Forrester, N. and Pyke, B., *Aust. Cotton Grower*, 1997, **18**, 23.
22. Daly, J. C., *Biocontrol Sci. Technol.*, 1994, **4**, 563–571.
23. Daly, J. C. and Fitt, G. P., World Cotton Research Conference-I, Athens, Greece, 1998, p. 182.
24. Federici, B. A., *Calif. Agric.*, 1998, **52**, 14–20.
25. Litchfield, D. H. and Wilcoxin, F., *J. Pharmacol. Exp. Ther.*, 1949, **96**, 99–103.

ACKNOWLEDGEMENT. We thank Dr Daniel R. Zeigler, Ohio State University, US for providing the Cry1Ac over-expressing clone. This research work was supported by the DBT, GOI project grants to BF. Thanks are also due to Department of Agricultural Entomology, UAS Dharwad for providing infrastructure facilities and all those scientists who helped us during the visit to different locations across south India for *H. armigera* collection. We thank Dr G. T. Gujar, IARI, New Delhi, for his useful suggestions during the study and encouragement.

Received 23 October 2002; revised accepted 18 March 2003

B. FAKRUDIN*
P. R. BADARI PRASAD
S. H. PRAKASH
K. B. KRISHNAREDDY
B. V. PATIL†
M. S. KURUVINASHETTI

Department of Biotechnology, University of Agricultural Sciences, Dharwad, Krishinagar, Dharwad 580 005, India
†*Department of Agricultural Entomology, University of Agricultural Science, College of Agriculture, Raichur 584 101, India*
**For correspondence.*
e-mail: fakru_b@yahoo.com

Restoration of *Eremostachys superba* Royle ex Benth. – a critically endangered species

The Botanical Survey of India was the first to report the threatened status of *Eremostachys superba*, a member of Lamiaceae in the *Indian Plant Red Data Book*[1]. This report may have gone unnoticed if Rao and Garg[2] had not raised an alarm regarding the further deteriorating status of the species at Mohand (Dehradun), its type locality in 1994 and highlighted the need for conservation measures. The highly endangered nature of *Eremostachys superba* was also highlighted by the press[3,4].

As a follow-up of Rao and Garg's report[2], we initiated extensive explorations of Jammu Shiwaliks in 1996, as the species was also reported from this area[5]. Up to 2001 we located five populations of the species containing about 1,300 (ref 6) individuals. In April 2003, one large population of approximately 2,000 individuals was discovered in Sunderbani (District Rajouri) area about 80 km in the north-west of Jammu. The latest discovery has swollen the number to a total of 3,300 plants in nature. This report reviews the present status of the species to indicate its restoration.

One of the reasons for reduction in plant number is the use of root tubers for curing mastitis and restoration of milching process in cattle, including cows and buffaloes (Figure 1 *a*, *b*)[7]. The other cause is low fruit and seed set largely due to pollinator limitation.

In view of the magnitude of threat which the species is facing and its status, a number of measures were tried for its conservation. We have been able to raise plants *ex situ* from seeds and tubers collected from their natural habitat in the University Conservatory. At present more than 1000 plants have been raised (Figure 1 *c*).

Ex situ plants perform well and produce well-filled seeds (35%). Seeds have been distributed to several National Institutes and Universities in India including Departments of Botany at the Guru Nanak Dev University (GNDU), Amritsar; Delhi University (DU), Delhi; Osmania University (OU), Hyderabad; DBS College, Dehradun; Regional Research Laboratory, Jorhat; Botanical Survey of India (BSI) Northern Circle, Dehradun and Indian Botanic Garden, Howrah (Kolkata); State Forest Research Institute (SFRI), Janipura (Jammu) and National Bureau of Plant Genetic Resources (NBPGR), Delhi for cryopreservation.

The species is reported to be doing well at GNDU, DU, DBS College, BSI northern circle, Dehradun and SFRI, Janipura (Jammu). The species has been multiplied *in vitro* by Sunnichen and Shivanna[8] out of a seed sample provided

Figure 1. ***a***, ***b***, Processing of rootstock for treating sick cattle tubers entire (***a***), mashed and mixed with cattle feed (***b***). ***c***, *Ex situ*-raised plants in full bloom in the University Conservatory.

to them in 1997. Attempts are being made to mobilize the State Forest Department for *in situ* conservation. Department of Gardens and Parks, J&K and Army authorities have shown keenness to promote this plant as a garden ornamental. The plant has already found place as an ornamental in some domestic gardens of Jammu province.

1. Jain, S. K. and Shastry, A. R. K., *The Indian Plant Red Data Book, I*, Botanical Survey of India, 1984, p. 90.
2. Rao, R. R. and Garg, A., *Curr. Sci.*, 1994, **67**, 80–81.
3. *The Hindu*, 10 March 1997.
4. *The Daily Excelsior*, 17 October 1997.
5. Sharma, B. M. and Kachroo, P., *Flora of Jammu and Plants of Neighbourhood*, Bishen Pal Singh Mahendra Pal Singh, Dehradun, 1981, vol. 1, p. 264.
6. Verma, S., Ph D thesis, University of Jammu, Jammu, 2001.
7. Koul, A. K., Mangotra, R. and Verma, S., *Curr. Sci.*, 1997, **73**, 313–314.
8. Sunnichen, V. G. and Shivanna, K. R., *Curr. Sci.*, 1998, **74**, 699–702.

ACKNOWLEDGEMENTS. We thank the ministry of Environment and Forests, Govt. of India and State Council of Science and Technology, J&K for financial support; the Head, Department of Botany, University of Jammu for providing the necessary facilities. S. V. thanks CSIR, New Delhi for providing SRF. Drs Namrata Sharma, Veenu Kaul and an anonymous reviewer are acknowledged for suggestions.

Received 21 February 2003; revised accepted 3 May 2003

SUSHEEL VERMA*
RANI MAGOTRA
A. K. KOUL

Department of Botany,
University of Jammu,
Jammu 180 006, India
**For correspondence.*
e-mail: eremurus@rediffmail.com