

and direct regeneration was achieved only from shoot explants. Except greening of the callus, all efforts to induce organogenesis *via* callus have not succeeded.

The authors are grateful to Prof. G. M. Reddy, for facilities and to Mr. M. Namadeva Chary for assistance. CSIR Fellowship to PA is duly acknowledged.

18 August 1982; Revised 16 November 1982

1. Satsangi, A. and Mohan Ram, H. Y., *Phytomorphology*, 1965, 15, 26.
2. Srivastava, P. S., *Curr. Sci.*, 1971, 40, 337.
3. Linsmaier, E. M. and Skoog, F., *Physiol. Plant.*, 1965, 18, 100.
4. Murashige, *Annu. Rev. Plant Physiol.*, 1974, 25, 135.

RESPONSE OF BARLEY (*HORDEUM VULGARE*) TO INOCULATION WITH *AZOSPIRILLUM BRASILENSE*

K. V. B. R. TILAK AND B. N. MURTHY
Division of Microbiology and Division of Genetics,
Indian Agricultural Research Institute, New Delhi
110 012, India.

THE occurrence of *Azospirillum brasilense* as a micro-aerophilic, non-symbiotic nitrogen fixer in association with the roots and stems of different cul-

tivars of barley has been recently reported¹. Beneficial response of barley to inoculation with *Azospirillum brasilense* under low input technology has also been reported². As barley is grown mainly as a poor man's crop, this finding is of much significance and needs more detailed study regarding the response of different cultivars of barley to inoculation with *Azospirillum*. With the recent emphasis over the production of hul-less types³ of high nutritional quality for human consumption, this information is valuable in achieving higher yields in these types. An attempt has therefore been made to assess the effects of seed inoculation with specific strains of *A. brasilense* on the yield of improved varieties of hulled barley along with those of hul-less strains and also on the population of *Azospirillum* associated with the rhizosphere.

A field experiment was conducted during *Rabi* season of 1981-82 under the same agronomic practices of normal cultivation. Two varieties of hul-less barley (62-25-7, 1845-10-5-25-8-4) and two hulled types (DL-85, 2052-3-1) were used. The soil was sandy-loam with pH 7.3. The seeds of barley were treated with a carrier-based (soil:farm yard manure = 1:1) inoculum containing efficient strain of *A. brasilense*⁴ isolated from the roots of specific varieties by following the methods described earlier². The treatments were replicated thrice.

The inoculated organism was enumerated at 45 days after seedling following the most-probable-number method⁵. The number of *Azospirillum* was estimated in the rhizosphere soil and the grain yield recorded during crop maturity⁶ (130 days of crop growth).

The results (table 1) showed that the hul-less types,

TABLE I

Grain yield (q/ha) and population level of *Azospirillum* ($\times 10^3$ /g soil) in rhizospheres of barley
(mean of three replicates)

| Treatment (variety) | Grain yield | | | <i>Azospirillum</i> population | | |
|-------------------------|-------------|------|---------------------------|--------------------------------|-----|---------------------------|
| | UI | I | Per cent increase over UI | UI | I | Per cent increase over UI |
| <i>Hul-less strains</i> | | | | | | |
| 62-26-7 | 17.4 | 21.9 | 25.9 | 2.2 | 15 | 582 |
| 1845-10-5-25-8-4 | 14.8 | 18.0 | 21.7 | 3.2 | 35 | 994 |
| <i>Hulled varieties</i> | | | | | | |
| DL-85 | 27.7 | 30.9 | 11.6 | 0.1 | 1.5 | 1150 |
| 2052-3-1 | 19.3 | 24.5 | 26.7 | 0.2 | 2.0 | 852 |
| C.D. at 5% | 5.3 | | | 0.1 | | |

UI: Uninoculated; I: Inoculated with *A. brasilense*

in general, harboured about 16 times more *Azospirillum* population in the rhizosphere than the hulled ones. A comparison of the quantitative estimation of bacterial numbers between treated and untreated plant rhizosphere revealed the effects of inoculation in increasing the population. It is interesting to note that inoculation brought about 7-11 and 9.5-13 fold increase in bacterial numbers in plant rhizosphere of hul-less and hulled types of barley, respectively. It is evident from the table that the hulled barleys yielded more than that of hul-less types used in the present study. The seed inoculation with *A. brasilense*, in general, increased the grain yield over that of the uninoculated control. The increase in yield due to seed inoculation over the control ranged from 21.7-25.9 and 11.6-26.7% with hul-less and hulled types of barley, respectively. But it is interesting to point out that the grain yield of the inoculated hul-less barleys is almost on par with that of the uninoculated hulled varieties, which may be attributed to the presence of *Azospirillum* in larger numbers in the rhizosphere of hul-less plants. Fixation of higher amounts of nitrogen in hul-less types of barley has been reported recently.¹ The hul-less varieties are reported to possess high protein content, being derived from a complex cross involving Hyproly³, a high protein and high lysine hul-less barley identified from a World Barley Collection in 1970⁶. It is not known whether the increase in bacterial numbers in the plant rhizosphere of inoculated hul-less barley has resulted in increase protein compared to grain yield.

Our sincere thanks are due to Dr. S. Ramanujam, Division of Genetics, Dr. N. S. Subba Rao, Division of Microbiology and to Dr. H. K. Jain, Indian Agricultural Research Institute, New Delhi for their keen interest and providing facilities in the present studies.

19 July 1982; Revised 25 November 1982

1. Tilak, K. V. B. R. and Murthy, B. N. *Curr. Sci.*, 1981, 50, 496.
2. Subba Rao, N. S., Tilak, K. V. B. R., Lakshmi-kumari, M. and Singh, C. S. *First Natl. Symp. Barley* (ICAR) held at IARI, Karnal, 1979.
3. Sastry, L. V. S. and Murthy, B. N., *Curr. Sci.*, 1979, 48, 729.
4. Tarrand, J., Krieg, N. R. and Dobereiner, J. *Can. J. Microbiol.*, 1978, 24, 967.
5. Alexander, M. In *Methods of soil analysis.*, II ed. C. A. Black *et al.*, 1965, p. 1467.
6. Munck, L., Karlson, K. E. and Hagberg, G. In *Barley genetics* II ed. R. Nilan, Washington State Univ. Press, Pullman, 1971, p. 544.

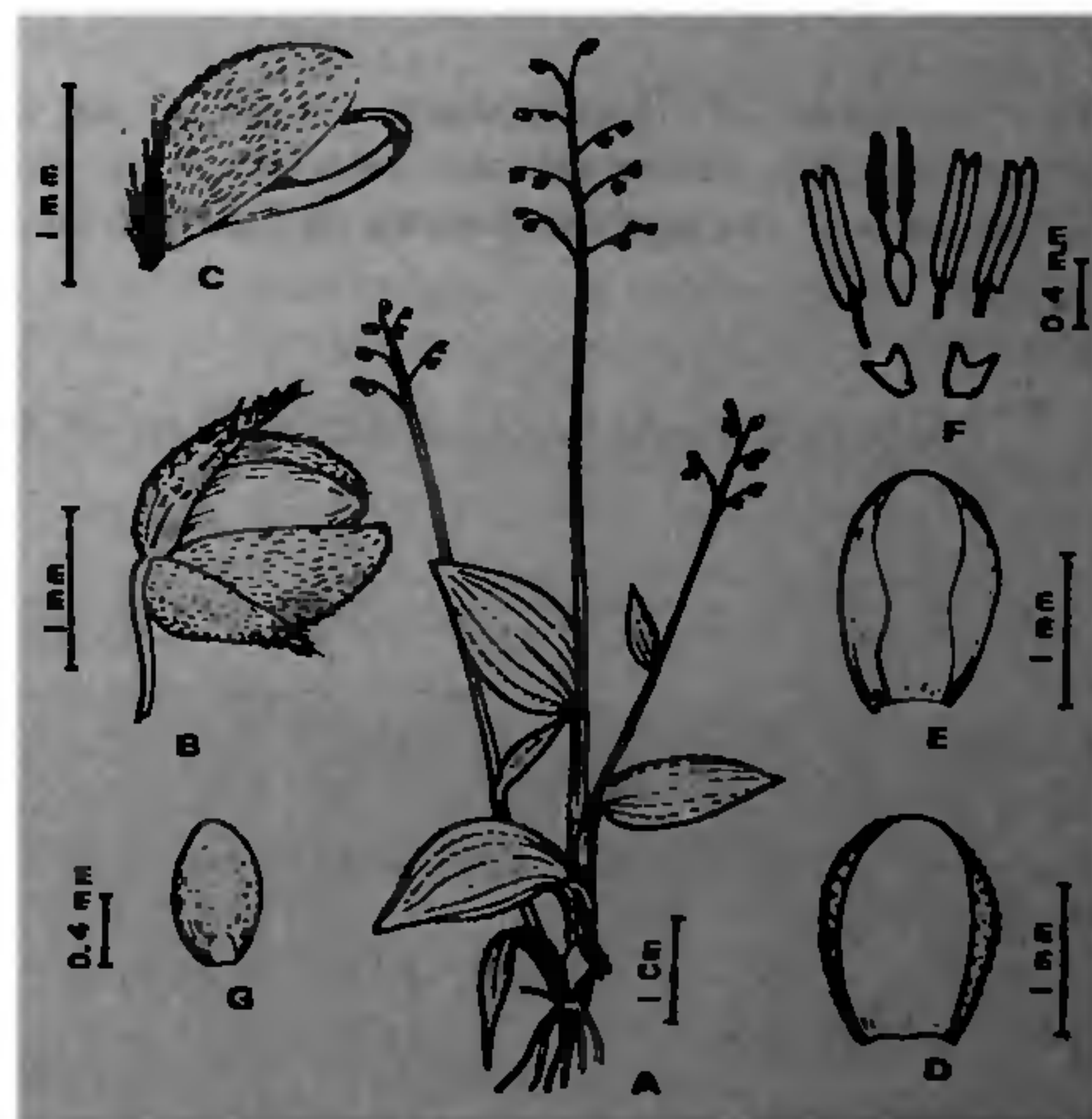
A NEW SPECIES OF ISACHNE (POACEAE) FROM KARNATAKA, INDIA

K. GOPALAKRISHNA BHAT AND C. R. NAGENDRAN
Department of Botany, University of Mysore,
Manasa Gangotri, Mysore 570 006, India.

ISACHNE veldkampii K. G. Bhat and C. R. Nagendran, *sp. nov.* Affinis *I. myosotis* Nees et *I. mysorensis* Sundara Raghavan sed foliorum vaginis et laminis glabris, annulis glandulosis supra panicularum ramos, pilis lanuginosis ad lemmatum basim et duobus flosculis bisexualibus differt.

Allied to *I. myosotis* Nees and *I. mysorensis* Sundara Raghavan, but it differs in having glabrous leaf sheaths and blades, glandular bands in the branches of the panicle, woolly hairs at the base of the lemmas and two bisexual florets.

A glabrous annual, 3-8.5 cm high. Culms slender; nodes glabrous; internodes covered by sheaths. Leaves upto 15×7 mm, ovate, base decurrent into the sheath, glabrous on both surfaces or scabrous above on nerves, nerves many, midrib obscure, margins serrulate, throat glabrous or with few hairs; ligule obscure; sheaths glabrous. Panicle 7-12 mm long and 6-10 mm wide, open; peduncle exerted from the uppermost sheath, upto 4 cm long; branches short, upto 5 mm long, with 1-3 spikelets, with glandular



Figures A-G. *Isachne veldkampii* K. G. Bhat and C. R. Nagendran *sp. nov.* A. Habit; B. Spikelet; C. Upper lemma and palea (side view); D. Upper lemma; E. Upper palea; F. Flower; G. Grain.