

## Variation in the Inflorescence of Cultivated American Ginseng (*Panax quinquefolium* L.)

J.T.A. Proctor

*Department of Horticultural Science, University of Guelph*  
*Guelph, Ontario, Canada N1G 2W1*  
(Received March 28, 1986)

## 栽培美國人蔘의 花序形質 變異

J.T.A. Proctor

(1986년 3월 28일 접수)

### Abstract

Variations in the inflorescence of Oriental ginseng (*Panax ginseng* C.A. Meyer) have been placed in 6 groups; only 2 of these groups, a complete simple hemispherical terminal umbel, and a simple umbel with several branched pedicels below it on the peduncle were found in cultivated American ginseng. Apical peduncle reflexing and associated peduncles shortening were observed in a few plants.

### Introduction

When American ginseng (*Panax quinquefolium* L.) seed were selected in the wild in Ontario, Canada about a century ago and cultivated under wooden shade the criterion for selection was the size of the aerial portion of the plant. These plants were the parents of the present 200 hectare Ontario cultivated ginseng industry. Little selection of plants has been made and there has been no plant breeding. It seems likely that in the future growers will demand plants that, among other things, are high yielding, give roots of excellent quality, and are resistant to disease, particularly to root rot which is the major problem in ginseng cultivation<sup>6)</sup>.

In our work<sup>3,5,6)</sup> we have observed differences in ginseng plants, particularly in the inflorescences. We do not know of any records of morphological differences in cultivated American ginseng. Hu<sup>2)</sup> reported differences for American ginseng growing wild in the United States. Choi and Shin<sup>1)</sup> have published data for Oriental ginseng (*Panax ginseng* C.A. Meyer) in which they placed differences in inflorescences in 6 groups or types. The purpose of this study was to examine the variation in the inflorescence of cultivated American ginseng plants with a view to establishing a data base that might be of use of future improvement of this crop.

## Materials and Methods

In late July and early August of 1984 commercial plantings of American ginseng (*Panax quinquefolium* L.) in the Waterford area of southern Ontario<sup>5)</sup> were visited. At each of four farms 400 3-year-old and 400 4-year-old plants were examined. There were 40 plants in each of 10 replicates (blocks). The inflorescence of each plant was classified in one of the 6 groups according to Choi and Shin<sup>1)</sup>. Peduncle length of 20 plants of each age at each farm was measured.

## Results and Discussion

The predominant inflorescence in both ages of plants was the Type I of Choi and Shin<sup>1)</sup> which is a complete simple hemispherical terminal umbel (Table 1 and Fig. 1). There was some variation between farms and this was particularly evident in the 4-year-old plants at Grower E. This particular grower has had previous problems with plants grown in this same block of land. We have proposed that some of the observed problems in root growth on this farm may be due to boron deficiency<sup>7)</sup>.

The other type of inflorescence found in American ginseng was the Type III of Choi and Shin<sup>1)</sup>, a simple umbel with several branched pedicels below it on the peduncle (Fig. 1). It accounted for less than 20% of the inflorescences (Table 1) except with Grower E where it reached 30.7%.



**Fig. 1.** Photograph of the two major types of inflorescences of cultivated American ginseng. On the left is a complete simple terminal hemispherical umbel (Type I) of Choi and Shin (1982) and on the right a simple umbel with several branched pedicels below it on the peduncle (Type III of Choi and Shin, 1982).

Our findings with inflorescences of cultivated American ginseng of only two Types (I and III) differ greatly from the classification of Oriental ginseng into six distinct groups<sup>1)</sup>. However, in both ginsengs Type I was predominant. In Oriental ginseng Type I was the major (67.3% vs. 87.2% for American) whereas Type III was quite minor, 3.7% compared to 12.8% for 3-year-old and 18.1% for 4-year-old American (Table 1).

**Table 1.** Percent distribution of two types of American ginseng inflorescences in three and four-year-old plants at different grower locations

Grower Location	Percent of inflorescences			
	3-year-old		4-year-old	
	Type I	Type III	Type I	Type III
A	91.0 a <sup>z</sup>	9.0 a		
B	90.2 a	9.7 a	88.2 b	11.8 b
C	85.0 b	15.0 b	87.3 b	12.7 b
D	82.5 b	17.5 b		
E			69.3 a	30.7 a
F			83.0 b	17.0 b
Mean	87.2	12.8	81.9	18.1

<sup>z</sup> Mean separation within column by Duncan's multiple range test, 5% level.

The greater number of types of inflorescences in Oriental ginseng indicate a greater diversity, possibly genetic, in the Oriental species. This greater variation in inflorescences of *Panax ginseng* parallels other variations in this species e.g. yellow and orange-yellow berried mutants<sup>4)</sup> not reported in *Panax quinquefolium*.

One type of variation not reported by Choi and Shin<sup>1)</sup> for Oriental ginseng but observed in American ginseng is shown in Figure 2. The apical portion of the peduncle was reflex-



**Fig. 2.** Peduncle shortening and reflexing (right 2) observed in some Type I inflorescences.

ed and there was an associated shortening of the peduncle. This type of peduncle variation was most prevalent at Grower E (1.75% of the plants) and may be associated with boron deficiency (see above) or some other unidentified problem.

Peduncle length varied between farms and was greatest in 4-year-old plantings (range from 12.7 to 17.9 cm, Table 2). Peduncle length of both ages of plants was correlated with the percent Type III inflorescence ( $r = 0.60$ ): the longer the peduncle, (excluding Grower E) the more Type III.

**Table 2.** Peduncle length of American ginseng on three and four-year-old plants at different grower locations

Grower Location	Peduncle length (cm)	
	Plant age	
	3-year-old	4-year-old
A	16.1 $\pm$ 0.5 <sup>y</sup> a <sup>z</sup>	15.6 $\pm$ 0.5 b
B	14.1 $\pm$ 0.6 b	12.7 $\pm$ 0.4 c
C	14.0 $\pm$ 0.4 b	
D	13.3 $\pm$ 0.4 b	
E		15.1 $\pm$ 0.5 b
F		17.9 $\pm$ 0.3 a

<sup>y</sup>  $\pm$  Standard error of the mean.

<sup>z</sup>Mean separation within year by Duncan's multiple range test, 5% level.

## Literature Cited

1. Choi, K. T. and H. S. Shin : *Korean J. Ginseng Sci.* **6**: 67 (1982).
2. Hu, S. Y.: In: Korean Ginseng Research Institute(ed.), Proceedings of the Third International Ginseng Symposium, Seoul, Korea, pp. 171 (1980).
3. Hughes, B. R. and J. T. A. Proctor : *J. Amer. Soc. Hort. Sci.* **106**: 167 (1981)
4. Park, H.: In: Korean Ginseng Research Institute (ed.), Proceedings of the Third International Ginseng Symposium, Seoul, Korea, pp. 151 (1980).
5. Proctor, J. T. A.: In: Korean Ginseng Research Institute (ed.), Proceedings of the Third International Ginseng Symposium, Seoul, Korea, pp. 39 (1980).
6. Proctor, J. T. A.: In: J. T. A. Proctor (ed.), Proceedings of the Sixth North American Ginseng Conference, University of Guelph, Ontario, Canada, pp. 12 (1984).
7. Proctor, J. T. A. and J. C. Lee : In: E. Jones and C. Kring (eds.), Proceedings of the Fifth National Ginseng Conference, Lexington, Kentucky, pp. 62 (1983).