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## Short Communication

## Does the giant tree rhododendron need conservation priority?

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## ABSTRACT

The giant tree rhododendron (*R. protistum* var. *giganteum*) is one of the most famous plants in China, and is critically endangered. As previous conservation efforts only focused on the two recorded populations of this variety, key issues regarding relatedness to *R. protistum* var. *protistum* still remain. Our field investigations and SSR analysis of the two varieties in China and Nepal suggest that the two varieties are not significantly different, and we suggest that limited conservation resources could be better used elsewhere given the numerous endangered plants urgently needing protection in China. We suspect that the problems we identified in this study will also apply to many other taxa in developing countries identified as endangered on the basis of incomplete information.

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## 1. Introduction

China has great plant diversity, however, a recent study of Chinese higher plants suggests that as many as 10.84% species may be threatened (Qin et al., 2017). With so many plant species needing conservation action with limited financial support (Ma et al., 2013, 2014), it is necessary to prioritize species that are genuinely under threat.

*Rhododendron protistum* var. *giganteum*, the giant tree rhododendron, is the largest rhododendron in the world, and is critically endangered (IUCN, 2017). Conservation of this plant has attracted significant financial support in recent years. However, previous research calling for immediate conservation action has focused solely on the two recorded populations of this variety without considering its relationship to the variety from which it was originally split, *R. protistum* var. *protistum* (Ma et al., 2012; Shen et al., 2015; Wu et al., 2014, 2017).

## 2. Material and methods

We conducted field investigations into the two varieties from 2014 to 2016, and we reject the key characters previously used for distinguishing them. The underside of the leaf is entirely covered by a dense indumentum in *R. protistum* var. *giganteum*, and this is supposedly marginal or absent in *R. protistum* var. *protistum* (Wu et al., 2005). However, we found that

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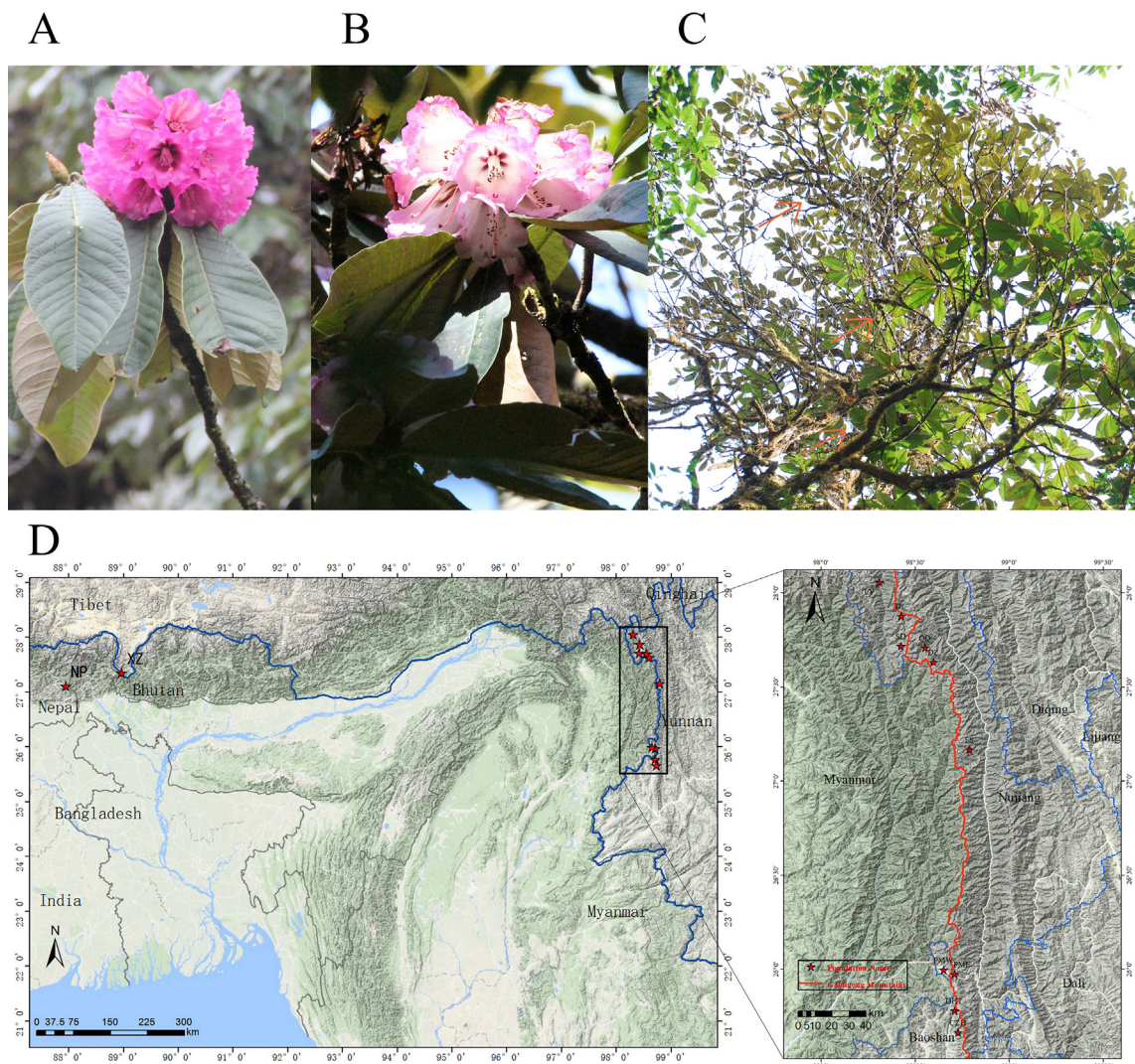
leaves with these characters can often be observed within a single plant (Fig. 1C). Additionally, flower color and corolla length also proved useless for distinguishing between *R. protistum* var. *giganteum* and *R. protistum* var. *protistum* (File A2, File A3).

We also performed genetic diversity and population genetic structure analyses across 12 populations and a total of 260 individuals, including both varieties in China and Nepal. Analyses were performed using 10 expressed sequence tag simple sequence repeat (EST-SSR) loci developed from RNA sequencing of *R. protistum* var. *giganteum* using Illumina HiSeq2500 (Table A5; File A1).

### 3. Results

For the 10 selected EST-SSRs, the number of alleles per locus ranged from 6 to 16, with an average of 10.2 per locus.  $H_o$  ranged from 0.16 to 0.751, (average 0.418), and  $H_e$  from 0.266 to 0.873, (average 0.638) (Table A6). The percentage of polymorphic loci per population ranged from 90% to 100% with an average of 95%. The average value of  $H_o$  at the population level was 0.42 (0.247–0.505) and that of  $H_e$  was 0.515 (0.292–0.678). Private SSR alleles present in 11 populations ranged from 1 to 12 with an average of 3.5 (Table A6).

Analyses of molecular variance (AMOVA) for the 260 samples suggested that 57% of genetic variance existed among and 43% within populations.  $F_{st}$  among populations was 0.234 and  $N_m$  among populations was 0.818. The value of  $\Delta K$  was found



**Fig. 1.** The morphological characteristics and known localities of two varieties of *Rhododendron protistum*. (A) Individual with deep purple-red corolla. (B) Individual with corolla that is creamy-white tinged with rose, taken in population DHT, from where the holotype was collected (C) An individual from below, showing leaf undersides. The top arrow shows leaves with continuous indumentum, the middle arrow leaves with a tomentum restricted to a marginal band, and the bottom arrow shows leaves without indumentum. (D) Locations of the 12 known populations of *R. protistum*. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

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