

MORPHOMETRICAL CHARACTERISATION OF *A. CERANA* IN YUNNAN PROVINCE OF CHINA

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A b s t r a c t

A. cerana Fabr. is widely distributed throughout the various geographic regions and climatic zones of Yunnan province in China, but the subspecific variation and the relation to other subspecies is not well documented. This study aims for a morphological characterisation of *A. cerana* in Yunnan, to document its variation, and to compare with data from several neighbour countries.

A hundred and twenty honey bee samples were collected throughout Yunnan Province from 14 sites which covered altitudes from 100 m to 2680 m and various climactical regions, (38 morphometric characters recommended by Ruttner (1988) were measured. Data were analysed by factor analysis, discriminate analysis and cluster analysis, and compared with measurements of *A. cerana* samples Beijing, Japan, Korea, Thailand, India, Burma, Vietnam and Nepal taken from the morphometric data bank in Oberursel.

Factor analysis including samples from neighbouring regions showed a high degree of variation in the samples of Yunnan, which cover a wide range of the morphometric space. Measures were highly correlated with environmental variables. In particular, factor 1 which is mainly correlated to measurements of size was clearly correlated to altitude ($r = 0.78$, $P < 0.005$). Twenty-one single morphometric characters correlated significantly with the environmental variables altitude, rainfall, temperature and latitude. In general, size characters correlated positively with altitude and latitude and negatively with rainfall and temperature, while pigment characters showed the opposite trend.

Factor analysis indicated that Yunnan bees could be divided into two groups, one from the low altitude (< 1600 m) subtropics region below 25° latitude, the other from the high altitude (> 1600 m) temperate zone above 25° latitude. A dendrogram derived from cluster analysis using average linkage supports the subdivision of Yunnan bees into the same two groups. In this analysis, the high-altitude group includes the bee group from Nepal, Vietnam and Beijing, with the exception of Sayinpan which groups outside close to the Birma and Thailand *A. cerana*.

Study showed that morphology of *A. cerana* in Yunnan was highly variable with a strong relationship to environmental variables. Yunnan bees were separate from *A. cerana* from Thailand, Birma and India, but bees from the northwestern high-altitude areas showed close relationships to *A. cerana* from Nepal, Beijing and North Vietnam.

Keywords: *Apis cerana*, China, morphology.