

## CHAPTER 4

### MATERIALS AND METHODS

#### 4.1 Specimen collections

Eighteen taxa of *Cassia* s.l. grew in Thailand were used for morphometric analyses. They are both indigenous and introduced species. All specimens were collected from the wild or cultivated plants from known localities in Thailand (Larsen, Larsen and Vidal, 1984) during June 2000 to May 2002. (Figure 4.1). Plants were determined based on key to species in Larsen et al. (1984). Specimens of each taxon were proved for identity by comparison to the voucher specimens deposited at BCU and BKF (Herbarium abbreviations according to Holmgren and Holmgren, 2003). Thirty specimens of each taxon were collected, including leaves, inflorescences and fruits (Figure 4.2). All measurements of macroscopic characters were carried out using electronic digital caliper (Keiba, model Three).

#### 4.2 Details of each taxon

Description and other information, including vernacular name for each taxon was prepared, and based solely on specimens collected in this thesis. Pressed and dried plant specimens were prepared as described in Boonkerd et al. (1987) and deposited at BCU.

#### 4.3 Data analysis

Five hundreds and eight (508) specimens were used for all analyses. In general, thirty-two quantitative characters of both vegetative and reproductive parts (Table 4.1) were subjected to factor, discriminant and cluster analyses. Otherwise will be noted in relevant text.

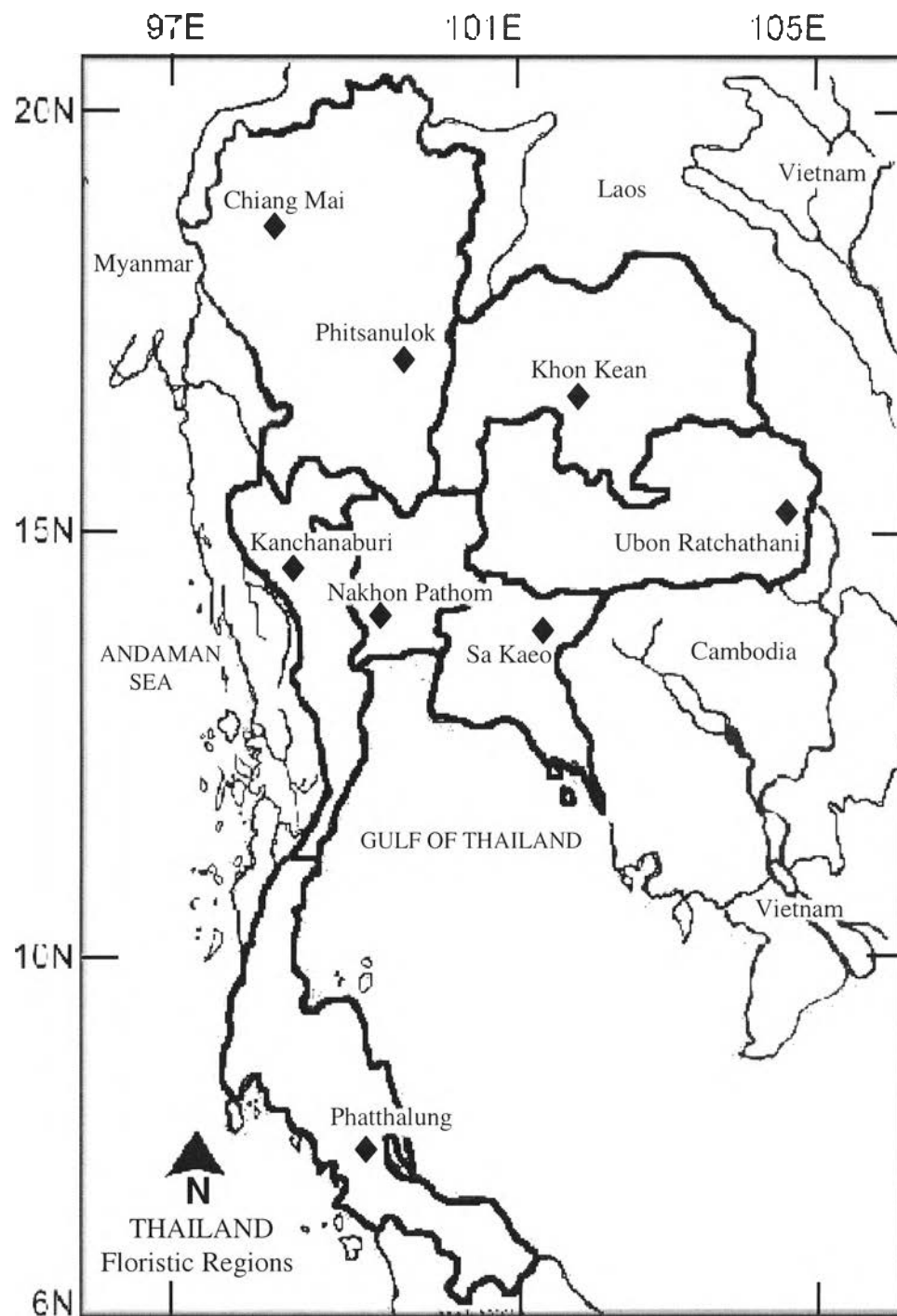


Figure 4.1 Collecting sites of *Cassia* s. l.



**Figure 4.2** Preparation of dried plant specimens for measurements by digital caliper

Factor analysis was applied with no *a priori* grouping of specimens. First, all variables were standardized and the correlation matrix for all variables was computed. Then, in factor extraction, linear combination was calculated by principal component analysis (PCA) in order to find the number of factor. To transform complicated matrices into simpler matrices, factor rotation will be made. Finally, scores for each factor can be computed for each case. Procedure Data Reduction and Factor in SPSS/PC for Windows, release 9.0 (Anonymous, 1998) were used to run PCA.

A sequential, agglomerative, hierarchical and nested (SAHN) clustering (Sneath and Sokal 1973) was performed using average taxonomic distance and the unweighted pair-group method with arithmetic averages (UPGMA) implemented in NTSYS-pc package version 2.10m (Applied Biostatistics Inc., 1986-2000) to place individual specimens into groups. To reduce the effects of different scales of measurement for different characters, the values for each character were standardized using procedure STAND.

A subset of characters that maximized differences among the groups determined by cluster analysis was selected by stepwise discriminant analysis. To characterize mean differences among the species used canonical discriminant analysis to acquire insight into group differences and to estimate character weights from correlations between canonical variables and original variables. Procedure CLASSIFY in SPSS/PC for Windows, release 9.0 (Anonymous, 1998) was used to analyze a set of discriminant analysis.

#### **4.4 Comparison of qualitative morphological characters of the *Cassia* s. l.**

Qualitative morphological characters of the 18 taxa are tabulated and discussed with the result from numerical analysis for their importance in clarifying the taxonomic status of the *Cassia* s. l.