

## Genetic Relationship between Kadazans and Fifteen other Southeast Asian Races

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### RINGKASAN

*Analisa jarak genetik yang berasas kelima tanda-tanda genetik biokimia berpolimorfik telah dibuat untuk menentukan jarak-jarak genetik diantara bangsa Kadazan dan limabelas bangsa lain yang tinggal di Asia Tenggara. Orang-orang Kadazan dijumpai lebih dekat dengan orang-orang Iban, Paivan, Visayan, Ifugao, Atyal, Melayu Asli, Dayak Darat, Tagalog dan China Selatan bila dibandingkan dengan orang-orang Batak, Senoi, Bunun, Melayu, Aeta dan India Selatan. Bandingan frekuensi gen untuk beberapa tanda-tanda genetik biokimia baru seperti glutamat piruvat transaminase larut, glioksalase I dan esterase D telah dibuat diantara orang-orang Kadazan dan hanya beberapa bangsa-bangsa Asia Tenggara yang telah dianalisisakan untuk tanda-tanda baru tersebut. Dalam kesah tanda-tanda dalam mana data tidak ada untuk lain-lain bangsa Asia Tenggara, frekuensi gen dalam orang-orang Kadazan telah dibandingkan dengan frekuensi gen dalam bangsa-bangsa dari lain-lain daerah dalam dunia ini.*

### SUMMARY

*Genetic distance analysis based on five polymorphic biochemical genetic markers was done to determine the genetic distance between Kadazans and fifteen other races living in Southeast Asia. Kadazans were found to be closer to Iban, Paivan, Visayan, Ifugao, Atyal, Aboriginal Malays, Land Dayak, Tagalog and Southern Chinese than they are to Bataks, Senoi, Bunun, Malays, Aetas and Southern Indians. Gene frequency comparisons for several new biochemical genetic markers such as soluble glutamate pyruvate transaminase, glyoxalase I and esterase D were made between Kadazans and those few Southeast Asian races which had been analysed for these new markers. In case of those markers in which no data is available for other Southeast Asian races, the Kadazan gene frequencies were compared to those of races found elsewhere in the world.*

### INTRODUCTION

Kadazans or Dusuns form the largest ethnic group in Sabah, one of two Malaysian states located on the island of Borneo; the other state is Sarawak. According to the Malaysia Official Year Book 1975, there are 211,250 Kadazans in a total population of 804,149 in Sabah.

The ethnic affinities of the Kadazans are uncertain. Some anthropologists, for example, Williams (1965), believe that Kadazans are physically, linguistically and culturally closer to a number of native groups in the Philippines and Formosa (Taiwan) than to the native peoples of neighbouring Sarawak and Kalimantan (Indonesian Borneo). These anthropologists think the Kadazans are descended from a second wave of migration of Indo-Malayan food-raisers, which, about 3000 years ago, moved from south China

and north Vietnam through Taiwan and the Philippines to northern Borneo and the Celebes. The natives of Sarawak and Kalimantan, however, are believed to have originated from a first wave of migration slightly earlier, which spread across mainland Southeast Asia into northern India and down the Malay Peninsula into Sumatra, Java and south Borneo and from there to Sarawak (Williams, 1965; Harrison, 1964). Other anthropologists, however, hold the view that the Kadazans migrated to northern Borneo from the Malay Peninsula only a few centuries ago (Provencher, 1975). Therefore, the Kadazans are indeed an interesting ethnic group for genetic investigations.

In this paper, the results of genetic distance analysis based on five polymorphic biochemical genetic markers between Kadazans and fifteen other races living in Southeast Asia are presented. Gene frequency comparisons for several new

biochemical genetic markers are made between Kadazans and those few other Southeast Asian races in whom data are available for these new markers.

## MATERIALS AND METHODS

A list of gene frequencies for biochemical genetic markers that are available for all sixteen races under consideration namely Kadazans from Sabah, Malays, Senoi, Aboriginal Malays, Chinese and Indians from Peninsular Malaysia, Land Dayaks and Ibans from Sarawak, Atyal, Bunun and Paiwan from Taiwan, Aetas, Tagalog, Visayan and Ifugao from the Philippines and Bataks from Sumatra was compiled and is presented in Table I. Data are available for seventeen biochemical genetic markers in Kadazans (Tan *et al.*, 1979). The data for Ibans and Land Dayaks, the two main groups of indigenous people in Sarawak are from Ganesan *et al.* (1975, 1976), the data for Atyal, Bunun and Paiwan, three endogamous groups of Taiwan aborigines from Fong (1974), the data for the four Philippines races from Omoto *et al.* (1978) and that for Bataks from McDermid *et al.* (1973).

Malays are the majority of the lowland indigenous people; Senoi and Aboriginal Malays are two of the three aboriginal groups of Peninsular Malaysia. Chinese and Indians living in Peninsular Malaysia are mostly the descendants of Southern Chinese and Southern Indian immigrants respectively. The data for these inhabitants of Peninsular Malaysia are from Lie-Injo (1976), the data for ADA are from Welch *et al.* (1975, 1978). The biochemical genetic markers for which gene frequency information is available for all sixteen populations are PGM I, ADA, 6PGD, haptoglobin and transferrin. These gene frequencies were obtained through the use of the appropriate electrophoretic phenotyping technique for each of the above genetic markers, followed by gene counting since they are all codominant markers.

From the above data the genetic distance between Kadazans and each of the other fifteen ethnic groups were computed following the procedure outlined by Sphuler (1972) based on the model of Cavalli-Sforza and Edwards (1967). In the computation of genetic distances following this procedure, only gene frequencies were needed, not sample size.

## RESULTS AND DISCUSSION

The results are shown in Table 2. The genetic distances indicate that Kadazans are closer to Ibans, Paiwan, Visayan, Ifugao, Atyal, Aboriginal Malays, Land Dayaks, Tagalog and

Southern Chinese than to Bataks, Senoi, Bunun, Malays and Aetas (Philippine Negritos). However, Kadazans are much closer to these Southeast Asian populations than they are to Southern Indians. All these Southeast Asian populations except Senoi and Negritos are Southern Mongoloids or Palaeo-Mongoloids. "Pure" Senoi are thought to be Veddooids but present-day Senoi are probably the descendants of past interbreeding between "pure" Senoi and Negritos, some of the Mongoloid races and perhaps even Indians (Provencher, 1975). Southern Indians are Dravidians; whereas Negritos, a pygmy race, were the first of the present races to settle in Southeast Asia (Provencher, 1975).

The genetic distances obtained do not tell us which of the two anthropological hypotheses regarding Kadazan ethnic affinities is more likely to be correct. The distances, however, do establish the genetic affinity of the Kadazans to the other Southeast Asian peoples, especially to the Mongoloid group. Perhaps further studies of these other peoples, using such recently described, highly polymorphic markers like s-Gpt, glyoxalase I and esterase D for which the Kadazans had been screened may prove useful.

So far, screening for these relatively new markers in Southeast Asian populations has only been done for the Aetas (Omoto *et al.*, 1978) and the three major racial groups of Peninsular Malaysia: Malays, Chinese, and Indians. For glyoxalase I, the Kadazan *GLO*<sup>1</sup> frequency of 0.300 is close to that for Aetas (0.244) (Omoto *et al.*, 1978) and Indians (0.287) but slightly higher than that for Malays (0.196) and Chinese (0.200) (Teng *et al.*, 1978b). The *Gc*<sup>1</sup> frequency for Kadazans is close to that for Malays (Kenrick and Douglas, 1967), Chinese, Indians (Kirk *et al.*, 1963) and Taiwanese aborigines (Fong, 1974), all frequencies being around 0.85, but it is higher than that for Aetas (0.627) (Omoto *et al.*, 1978). The *ESD*<sup>1</sup> frequency of 0.472 for Kadazans is lower than the frequency found by Tan and Teng (1977) for Malays (0.658), Chinese (0.597) and Indians (0.735) and that found by Omoto *et al.* (1978) for Aetas (0.779), Tagalog (0.692), Visayan (0.716) and Ifugao (0.572). A similar situation exists for s-Gpt, where the *GPT*<sup>1</sup> frequency for Kadazans is 0.265 whereas that for Tagalog is 0.324, for Visayan 0.340, for Ifugao 0.490 (Omoto *et al.*, 1978), for Malays 0.343, for Chinese 0.471 and for Indians 0.437 (Tan and Teng, 1977). However, it is higher than that for Aetas (0.143). In the case of red cell acid phosphatase, the *ACP*<sub>1</sub><sup>1</sup> frequency of 0.369 for Kadazans is close to that of 0.329 for Malays (Chan and Dhaliwal, 1973) and 0.382 for Atyal (Fong, 1974); it is higher than the frequency for Batak (0.241) (McDermid *et al.*, 1973), Chinese

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surprising as none was observed in 868 Malays, 575 Chinese, 488 Indians, 123 Senoi and 132 Aboriginal Malays from Peninsular Malaysia (Teng and Lie-Injo, 1977; Tan and Teng, 1978).

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