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Newsletter

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Trypano-tolerant Cattle under genetic studies at ILRAD Ranch
(Photo by T. Imada at ILRAD)

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TARC
TROPICAL AGRICULTURE RESEARCH CENTER

Challenge to International Collaboration in Animal Science

Shozo Watanabe

Identification of factors required for the promotion of collaboration

The Tropical Agriculture Research Center (TARC) celebrated its 20th anniversary on June 11,1990. In initiating TARC's activities it was hoped that the requirements of counterpart institutes in developing countries could be met through the expertise of TARC's researchers. However, it was soon realized that for the development of tropical agriculture the experience of the Japanese researchers was not readily applicable to the ecological and socio-economic conditions prevailing in the third world, hence the need to accumulate related knowledge and technology.

Research collaboration in crop science has dominated the activities of TARC because some crops, especially rice, shared a similar monsoonal climate and cultural tradition with the developing countries. The development of collaborative research in animal science, however, took a different direction from that of crop science. On the other hand, collaboration in animal health started early as compared with that in animal production. The former involved basic and universal methodology in veterinary science while the latter was hampered by the site-specific nature of animal production science, for which related expertise was lacking in addition to the immaturity of basic animal science at the early stage of collaboration.

Accumulation of experience to meet the needs of the developing countries and transfer of basic technology for agriculture are a prerequisite for the promotion of international collaborative research.

Challenge to international collaboration

During the recent two decades animal production science in Japan has been stimulated by industrial growth and the researchers had the opportunity to accumulate expertise in the field of breeding, reproduction, nutrition, feed technology, processing of products, etc. They are now fully prepared and could actively participate in collaboration in international agricultural research. International collaboration falls into two categories: bilateral relations between Japan and a particular country and multilateral relations between Japan and International Agricultural Research Centers (IARCs) which benefit people beyond national and continental boundaries. The need for up-stream research is now being increasingly felt in collaborative research both for bilateral and multilateral relations. Especially in the latter case IARCs aim at the creation of a "Center of Excellence" in the mandate area. Therefore, I believe, that the time has come for Japanese animal scientists to undertake collaborative research, especially with IARCs.

Importance of animal production in developing societies

The gross value of production of major agricultural commodity groups compiled by CGIAR-TAC provides a quantitative assessment of the importance of animal production in developing countries. In the percentage of annual gross value production by region, livestock accounted for 17% of the total, while crops, forestry and fisheries for 58%, 20% and 4%, respectively. Relative share of livestock for the Asia/Pacific region, Sub-Saharan Africa, Latin America/Caribbean and West Asia/North Africa is 15%, 11%, 23% and 27%, respectively. The contribution of livestock production in the gross value production of 12 major agricultural commodities in developing countries (US$ million) is shown here: rice (70465), fuelwood, non-conif. (45769), sawlogs, non-conif. (44430), milk (38970), wheat (27542), banana/plantain (24107), maize (21664), pigs (21496), cotton (16319), beef/buffalo (16181), sweet potato (14864). The sum of the values of total livestock production was 103,869 in comparison to that of major six food grains, 144,029.

Increase in food production will indeed be a necessary but not a sufficient condition for sustained economic and agricultural development. As for the alleviation of food shortage and poverty in the short-term and self-reliance in the long-term, particular attention should be given to the socioeconomic function of livestock production which creates jobs and income, and then meets the growing demand of the products. Hunger and poverty alleviation, and prevention of environmental degradation will require a substantial effort on a much broader front in the global agricultural research system during the coming decades. Major needs of international research in animal production are presented below.

Animal nutrition and feed resource development

Large and small ruminants in the tropical countries are affected by the seasonal deficiency in feed in both quantity and quality. Improvement of the feed resource base is essential in the developing countries and regions. Along with the increase of crop production further utilization of crop residues and by-products may alleviate the deficiencies in feed. Generally the dry matter digestibility of crop residues especially straws stands at a too critical level to be qualified as practical feed for the requirement of ruminant maintenance. The improvement of the digestibility of the crop residues by chemical and physical treatments of low cost and easy application for the developing countries should be emphasized. Also priority should be given to resource development of non-conventional crop residues for feed such as palm press fiber, oil palm trunk and other lignocellulose-rich biomass products. Besides the general improvement of feeding and management, strategic feed supplementation must be studied in all the regions to enhance sustained production.

Development of fodder crops, pastures and shrubs resistant to drought and pests is of paramount importance in all the regions. The possibility of using these fodders during the dry season through the creation of a feed bank has been demonstrated in West Africa. Multipurpose trees, which are fast-growing and fix nitrogen offer a considerable potential for use in mixed crop-livestock production systems. They provide high quality fodder for livestock, fertilizer in the form of mulch, fuelwood, poles and building timber, shade and shelter from wind. Such plants are superior to herbaceous species in that they are more persistent, give higher forage yields, are more tolerant of mismanagement and are better able to remain high-quality forage under stress conditions without concomitant degradation of the ecosystems.

Dr. Shozo Watanabe, Professor, Kagoshima University. ILCA Board Member

Graduated from Dept. of Veterinary and Animal Science, Tokyo University, joined MAFF and carried out research at Tohoku and Chugoku Agr. Exp. Stas., and at the National Institute of Animal Industry in the following fields: crossbreeding between Japanese Black and Holstein cattle, physiology and genetics of livestock, endocrine aspects of adaptation in new-born calf and lactating cow, feeding and management, and behavior (1953-85). Research fellow on adrenocorticoid metabolism at Worcester Foundation For Experimental Biology, U.S.A. (1962-63). Conducted surveys on livestock production in Asian and African countries. Assumed Director, Division of Animal Feeding and Management, National Institute of Animal Industry (1980-85) then Director General of the Institute (1985-88). Appointed as Professor of Animal Science, Kagoshima University (since 1988). Member of Board of Trustees, International Livestock Centre For Africa (ILCA), CGIAR(since 1989).

Germplasm improvement and breeding

Tropical livestock are generally well-adapted to the local environment and are disease-resistant but of low productivity with slow growth, long parturition intervals, small body size, etc.. Breed improvement strategies appropriate for smallholder production systems shoud be developed urgently. Identification and multiplication of disease and pest-resistant animals require special attention in Asia, Sub-Saharan Africa and Latin America/Caribbean. Introduction and evaluation of superior sheep and/or goat breeds should be attempted in the regions other than Latin America/Caribbean. Also evaluation of crossbreeding systems is urgently needed in the same regions. As for germplasm conservation for endangered breeds, cryopreservation technique should be adopted.

Animal health and reproduction

Substantial population size of ruminants and pigs is already observed in developing countries. The existing population size of the animals compensates for the low fertility, high mortality and low offtake. Especially for meat purpose, reproduction and maintenance of number are a prerequisite for securing high offtake and productivity. If the high mortality of infant animals and later loss could be reduced, economic advantages would be considerable in every region. The strong demand for research on animal health has been identified, particularly with respect to tsetse-borne diseases in Sub-Saharan Africa, tick-borne diseases in Asia, Sub-Saharan Africa and Latin America/Caribbean. Reproductive diseases and endoparasites in ruminants have to be studied in all the regions. Improved constraints analysis with respect to reproduction requires particular attention in Asia and Sub-Saharan Africa.

Development of production systems for sustainable resource management

Herd and flock management systems under increasing pressure on land and forage resources should be developed in Asia and Sub-Saharan Africa. Testing of cost-effective methods for assessing the contribution of trees and shrubs to production systems requires special attention. Management principles of agroforestry systems are essential. Multiple systems for crop/livestock/trees also have to be developed urgently.

Lesser Mouse Deer propagated in UPM, Serdan, Malaysia (Photo by H. Kudo, at UPM)

– From Jungle to Laboratory-Challenge –

The Smallest Ruminant, Lesser Mouse Deer as a New Experimental Laboratory Animal.

H. Kudo, K. Fukuta, Y. W. Ho, N. Abdullah and S. Jalaludin.

Although the study of the nutritional physiology of herbivorous domestic animals such as ruminants is very important in the field of veterinary and zootechnical sciences, studies on small herbivorous laboratory animals have not been carried out for comparative purpose.

The family *Tragulidae* comprises the three Asian species of mouse deer or chevrotain, genus *Tragulus*, and the water chevrotain of Africa, *Hyaemoschus aquaticus*. The behavior of the tragulids is of particular interest because of the remarkable similarity in the morphology and ecology of the tragulids and the caviomorph rodents of South America. The mouse deer, despite its name, is not closely related to the true deer. The larger mouse deer, *Tragulus napu*, weighs about 3 to 5 kg. The lesser mouse deer, *Tragulus javanicus*, is among the smallest (40-48 cm long, weighing 1.6-2.0 kg) of all hoofed animals. The mouse deer is not only the smallest hoofed animal; it is also the smallest ruminant. The ruminants include cattle, sheep, deer, goats, giraffes and antelopes. They are so named because, instead of having a simple stomach like ours, their stomach is divided into three or four compartments, the largest of which is the rumen where anaerobic fermentation takes place due to the presence of a complex community of microorganisms. The rumen of the mouse deer is S-shaped and spirally twisted and the omasum is vestigial. The ratio of reticulo-rumen volume is larger than that of cattle and sheep. The mouse deer probably represents a stage in the evolution of the true deer and cattle which has fossilized in the tropical rainforest. Since mouse deer live in both primary and secondary forests and are active only at night or at dusk, they are less likely to be seen. The body color of the lesser mouse deer is reddish-brown with an unbroken white stripe running from the jaw to the shoulder. Males do not have antlers but instead they have well-developed canines which extend beyond the upper lip. They occur in Southeast Asia and all the Sunda Islands. The mouse deer reach sexual maturity at about 4 to 5 months of age and adult size at five months. The canines of the young male do not extend beyond the upper lip until the animals are about 9 to 10 months old. The females of the mouse deer are known to have a post-partum estrus and they resume estrus at approximately 14 day intervals unless they become pregnant which may compensate for their relatively long gestation period (about 160 days). Usually, one young is born, occasionally two, and they are active within 30 min after birth. The size of the new offspring is fairly large (120 to 180 g) in relation to that of the mother animal. Infant mortality among the mouse deer in the laboratory is unusually high with a large number of still-born fetuses. Fighting between captive male and female mouse deer leading to mortality of the adults and young is also observed.

Two day old infant Lesser Mouse Deer born in Tsukuba (Photo by K. Fukuda, at NIAH)

Recently, Universiti Pertanian Malaysia has established a small mouse deer colony and has initiated some studies on the microbial population and activity in the rumen of the mouse deer. Preliminary studies indicated that very active cellulolytic bacteria are present in the rumen of the mouse deer. This finding is not surprising as highly cellulolytic rumen microorganisms are essential for the breakdown of fastidious fibrous jungle forages which serve as the natural diet of the mouse deer. Their feeding style is very selective and they utilize a wide range of plant species, very often eating only a particular part of plants. Their small mouths allow them to select parts of plants unlike the larger ungulates.

The rumen microbiology laboratory at Universiti Pertanian Malaysia in collaboration with the laboratory animal research group at the National Institute of Animal Health is currently attempting to establish breeding colonies of mouse deer. Although further investigations on the digestive physiology and breeding of this smallest ruminant are required, it may be possible to introduce this animal as a pilot and/or bioassay test animal for domestic ruminants. This attempt may help to conserve the wildlife.

≪Breeding≫

Efficient Production of Wheat Haploids through Intergeneric Crosses

*M. N. Inagaki and M. Tahir**

The collaborative research project with the International Center for Agricultural Research in the Dry Areas (ICARDA), undertaken during the period 1986 - 1990, placed emphasis on the improvement of cereal germplasm using the haploid breeding method. The objective of the project on cereal haploid production was to develop breeding methods that could accelerate the release of new varieties, as complementary tools for conventional breeding programs.

Some intergeneric crosses of bread wheat (*Triticum aestivum* L.) with wild barley *Hordeum bulbosum* L. result in the formation of wheat embryos after preferential elimination of *H. bulbosum* chromosomes from hybrid zygotes. However, the success of fertilization depends on the wheat genotypes that are used for the crosses. Unfortunately, most bread wheat genotypes of West Asia and North Africa could not be crossed with *H. bulbosum*, and did not produce haploid plants.

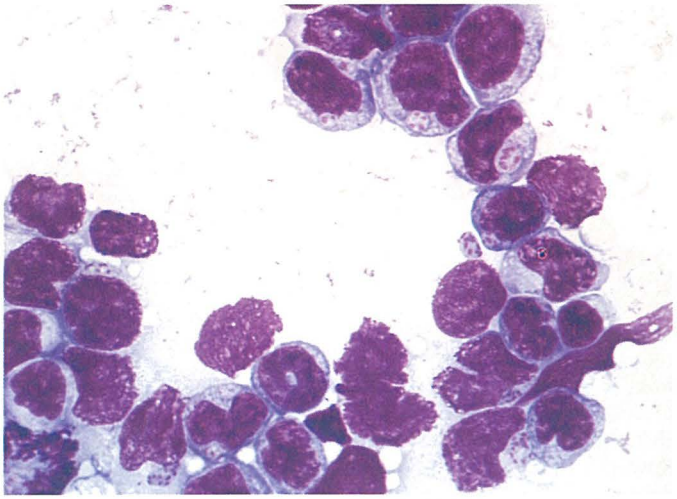
In order to overcome the cross-compatibility barrier of wheat, the alternative use of pollen of maize and the application of plant hormones were attempted. Four check varieties of bread wheat were used as female parents. Pollen parents consisted of mixed pollen of tetraploid *H. bulbosum* clones and maize genotypes. On each of the two consecutive days after pollination, wheat culms with pollinated spikes were needle-injected with a 100 ppm solution of 2,4-D. After two weeks of pollination, the embryos formed were aseptically cultured on an artificial medium and grown to plants. All the four varieties including non-crossable varieties with *H. bulbosum* produced embryos only when crossed with maize, followed by the application of 2,4-D. All the plants examined cytologically were euhaploids having a complement of 21 chromosomes. Overall frequency of haploid production using 20 bread wheat genotypes from West Asia and North Africa was as high as 9.5 % of the wheat florets pollinated.

This work clearly demonstrates that maize pollination with subsequent 2, 4-D application onto bread wheat florets results in the efficient production of embryos capable of regenerating haploid plants even for the genotypes not crossable with *H. bulbosum*, hence promoting the practical application of the haploid breeding method to bread wheat improvement program.

Ref.: Japan. J. Breed. 40:209-216 (1990)
In "Biotechnology in Agriculture and Forestry, Vol. 13, Wheat", Springer-Verlag, Berlin (1990):448-459.

* International Center for Agricultural Research in the Dry Areas (ICARDA), P.O.Box 5466, Aleppo, Syria

Seeds set in bread wheat self-pollinated (right) and cross-pollinated with maize (left) after two weeks of pllination. (Photo by M. N. Inagaki, TARC)



Bovine Lymphocites infected with T. parva parva Muguga (Photo by M. Kishima, NIAH)

≪Animal Health≫

Characterization of *Theileria parva* Shizont Antigens by Two-dimensional Western Blotting

*Masato Kishima and Thomas T. Dolan**

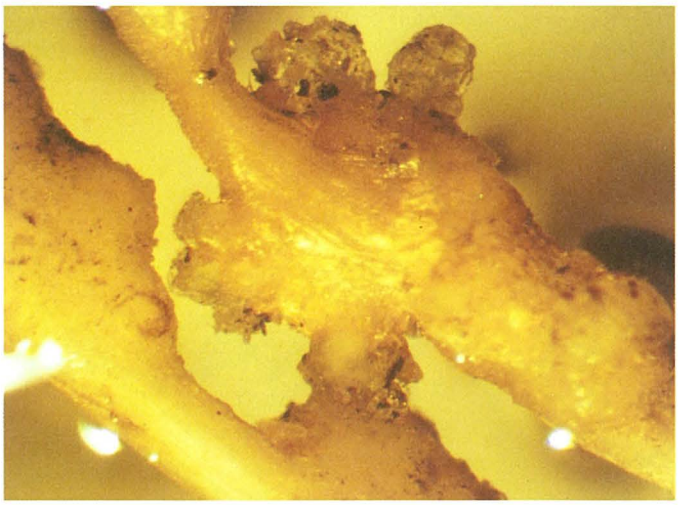
Theileria parva is a protozoan parasite transmitted by a brown ear tick, *Rhipicephalus appendiculatus*, which causes an acute and fatal lymphoproliferative disease of cattle in East and Central Africa called East Coast Fever (ECF). There are three subspecies of *T. parva* including *T. p. parva, T. p. bovis* and *T. p. lawrencei*. The subspecies can be distinguished based on the clinical reactions and characteristics of the parasites in cattle. The disease caused by *T. p. bovis* in cattle is generally milder than those caused by *T. p. parva* or *T. p. lawrencei. T. p. lawrencei* is a buffalo-derived parasite which is similar in virulence to *T. p. parva,* but produces fewer shizonts and piroplasms in cattle than are seen in *T. p. parva* infection. However, the subspecies are morphologically and serologically indistinguishable. Furthermore, immunofluorescence test using anti-shizont monoclonal antibodies, DNA hybridization and two-dimensional polyacrylamide gel electrophoresis which enable to detect the heterogenicity between the stock of *T. parva* did not afford a clear distinction between the subspecies. Immunization of cattle against ECF by infection and treatment method with a combination of *T. parva* parasite and long-acting tetracyclines induces good protection against challenge with the same stock of the parasite or heterologous stock having an identical monoclonal antibody reaction profile with that of the stock used for initial immunization. Moreover, it has been also demonstrated by Western blotting that dominant antigens were present in *T. parva* and the molecular mass (Mr) of the antigens varied among the *T. parva* stocks. These observations suggest that antigenic diversity exists among *T. parva* stocks and clear understanding of the heterogenicity in *T. parva* stocks would be required for the development of a better vaccination program against ECF.

In the present study, two-dimensional gel electrophoresis was combined with Western blotting and the humoral immune responses of cattle to *T. p. parva* (Mugura, Mariakani, Marikebuni and Uganda), *T. p.* bovis Boleni and *T. p. lawrencei* 7014 were investigated by this method. Sera were obtained from cattle which were immunized or challenged with each *T. parva* stock. T cell blasts infected with each *T. parva* stock were used as antigens after solubilization with a sample buffer containing high molar urea.

* ILRAD, P.O. Box 30709 Nairobi, Kenya

Isoelectric points of polymorphic immunodominant molecule (PIM) of shizont which induced major antibody responses in cattle ranged from acidic to basic. In the case of, for example, Muguga-infected cattle, antibodies were produced against acidic antigens with an Mr of 86kDa in an early stage of infection. As the infection progressed, antibodies were also produced against neutral and basic antigens with the same Mr. Molecular masses of PIM of each stock were as follows: *T. p. parva* Muguga, 86kDa; Mariakani, 83kDa; Marikebuni, 83kDa; Uganda, 83kDa; *T. p. bovis* Boleni, 83kDa; *T. p. lawrencei* 7014, 100kDa. The two-dimensional Western blotting patterns of *T. p. parva* Mariakani and Uganda were very similar. Among nine cattle infected with *T. p. parva* Muguga, four cattle produced antibodies to the basic antigen with a Mr of 32kDa. Three *T. parva* subspecies antigens reacted with a serum obtained from an animal which was immunized with *T. p. parva* Muguga. Two-dimensional Western blotting patterns of *T. parva* were compared using sera obtained from cross-challenged cattle. However, it was difficult to find out unique shizont proteins in *T. parva* for strain characterization.

Since all the animals responded to PIM, it is considered that PIM may be a useful antigen for diagnosis.



Root-knots of mungbean formed by M. javanic (Photo by Y. Toida)

Females of Meloidogyne javanica invading mungbean root. (Photo by Y. Toida)

≪Plant Protection≫

Cultural Control of Java Root-knot Nematode Attacking Mungbean in Thailand

Y. Toida, S. Keereewan and T. Murakami

Although the Java root-knot nematode, *Meloidogyne javanica*, has been considered to be one of the most harmful nematodes to crops, in Thailand as well as in other countries of the tropics, effective and economic methods of control of the nematode have not been established yet. Recently the heavy damage of tobacco or mungbean plants caused by this nematode has prompted us to study methods for the prevention of nematode attacks.

The application of organic materials was studied as one of the integrated methods of control to prevent the contamination of ecosystems or the environment by the excessive use of chemicals. Organic materials such as compost, cow dung, or silkworm feces were used for the control of the nematodes. Three hundred g of each dry organic material was mixed with soil severely infected with *M. javanica* in large concrete pots (80cm diameter and 50cm depth) from the surface to a 10cm depth.

After an interval of 2 weeks, seeds of mungbean (Chainat 60) were sown in the soil. The nematode density before and after the application of each organic material and the yield of mungbean 3 months after sowing were investigated to compare the effect of the application of each organic material and chemical (Furadan) or the absence of treatment.

The population density of *M. javanica* parasitizing mungbean plants after the application of organic materials decreased significantly, whereas the density increased substantially in the case of chemical application or in the absence of treatment. In contrast, the density of the free-living nematodes increased in the case of organic material application and decreased in the case of chemical application or in the absence of treatment.

Yield of mungbean 3 months after the application of organic materials was significantly larger than that in the case of chemical application or the absence of treatment. Plant height of the crop in the case of organic material application was also higher than that in the case of chemical application or in the absence of treatment. Mortality of mungbean plants in the case of organic material application was lower than that when chemicals were applied or in the absence of treatment.

These results suggest that the application of a large quantity of organic materials, 200kg per 10a, at least based on the experiments described above, is required to control the Java root-knot nematode in mungbean fields.

Organic materials are considered to alter the physical and chemical properties of soil resulting in an environment unsuitable for nematodes as well as to produce some substances that kill pest nematodes during the decomposition process. Accordingly, the application of organic materials is preferable to that of chemical nematicides which contaminate the environment and destroy the ecosystems. For example, the results of our experiments showed that the density of the free-living nematodes which act as natural enemies of pest nematodes decreased. Therefore, today, the practical use of organic materials including silkworm feces, a large amount of which is mostly discarded by farmers, is considered to be very important for the control of pest nematodes and as amendment or fertilizer in Thailand.

Nematode density and yield of mungbean after application of organic materials

Treatment	Rate of decrease of *M. javanica* (%)	Rate of increase of free-living nematodes (%)	Weight of mungbean seeds (g)
Silkworm feces	41	454	8.0 a
Compost	59	675	5.2 ab
Cow dung	83	451	4.6 ab
No treatment	579	129	2.4 b
Chemical (Furadan)	617	30	2.8 b

The Genetic Diversity of Mungbean in Asia

N. Tomooka[1], C. Lairungreang[2], P. Nakeeraks[2], Y. Egawa[3] and C. Thavarasook[2]

Introduction

Mungbean (*Vigna. radiata* (L.) Wilczek) is an important pulse crop cultivated traditionally throughout Asia. Since mungbean is a short-duration legume, it has been incorporated into various cropping systems, serves as an excellent source of protein for the people and improves soil conditions.

Mungbean accounts for about 12% of the total pulse production in South and Southeast Asia. Its production in these regions increased at a growth rate of 4.5%, against a growth rate of only 0.5% for total pulses production from 1976 to 1986. The utilization of mungbean has been increasing in most of the Asian countries despite a general decline in the consumption of pulses. In Thailand, mungbean is produced not only for local consumption but also for exportation.

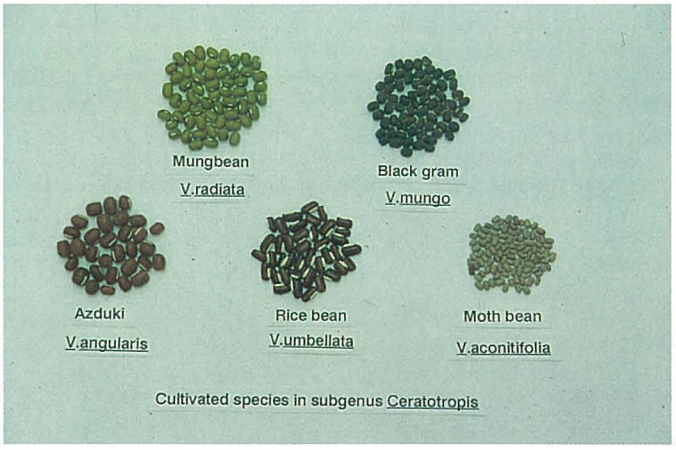
Mungbean is consumed mainly as a beansprout and as a vermicelli in Thailand. Producing area of mungbean corresponds to that of maize, since mungbean is mostly cultivated after maize in the late rainy season. Planted area of mungbean increased sharply during 1976 and 1977 in Thailand and a large amount of mungbean started being exported. However, its productivity is still low under the low input cultural practices of the small holders in the tropics. It is thus essential to improve the productivity by means of plant breeding. For this, it is important to use a wide range of genetic resources.

Against this background, the cooperative project between Tropical Agriculture Research Center (TARC), and Chainat Field Crops Research Center, Field Crops Research Institute, D.O.A., Thailand was initiated in June, 1987.

Subgenus *Ceratotropis* of *Vigna*

There are seven subgenera under the genus *Vigna*. Mungbean belongs to the subgenus *Ceratotropis* of the genus *Vigna*. Subgenus *Ceratotropis* is also called Asian *Vigna* because of its geographical distribution. This *Ceratotropis* subgenus is an extremely homogeneous taxonomic group. Thus it can be considered to include a wide range of genetic resources for mungbean breeding. However very few wild species belonging to the subgenus *Ceratotropis* have been collected and evaluated. Considering the genetic erosion occurring rapidly worldwide, it is urgent to collect and evaluate wild species within the subgenus *Ceratotropis*.

Some key characters of the subgenus *Ceratotropis* are: (1) Peltate stipules (2) Yellow asymmetric flower (3) Keel and style curved to the left (4) Pocket on the leftside of the keel (5) Style prolonged beyond the stigma (stigma lateral) by a long straight beak.



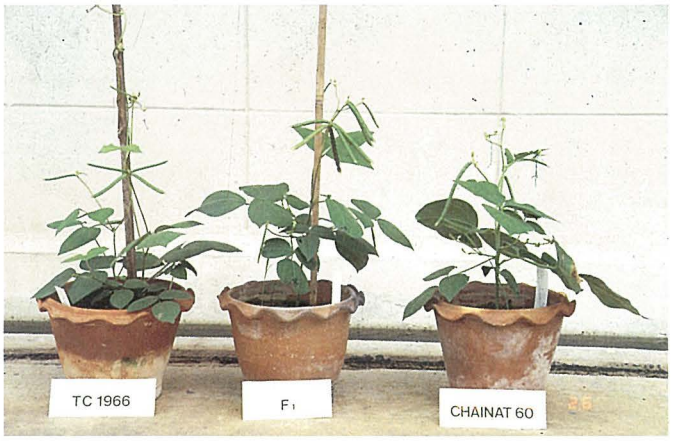
Five cultivated species in Vigna Subgenus Ceratotropis

1) Tropical Agriculture Research Center, Tsukuba
2) Chainat Field Crops Research Center, Chainat, Thailand
3) Dep. of Genetic Resources I, National Institute of Agrobiological Resources, Tsukuba

Yellow flower of Subgenus Ceratotropis.

The pocket of the keel is a key character.

Subgenus *Ceratotropis* can be subdivided into two groups by the seedling characters, i.e., (1) Mungbean group and (2) Azuki group. Mungbean group shows epigeal germination (hypocotyl elongates and cotyledon appears above the ground) and has primary leaf with short petiole. Azuki group shows hypogeal germination (cotyledon does not appear above the ground) and has primary leaf with long petiole. Since the natural distribution of Mungbean group and Azuki group overlaps in Southeast Asia, Thailand is located on a very suitable position for collecting wild species of subgenus *Ceratotropis*.



F1 plant of TC1966 x Chainat 60 grew normally with vital F2 seeds (Photo by N. Tomooka)

Breeding of Bruchid-Resistant Mungbean

Bruchid-resistant mungbean line was successfully developed using wild mungbean germplasm. Bruchids laid many eggs on the seed surface of the resistant line but the larvae died after they finished boring the hole through the seed coat and began eating the cotyledon.

Bruchids are the most serious pests attacking mungbean seeds during storage. There are two species of bruchids distributed in Thailand, i.e., Azuki bean weevil (*Callosobruchus chinensis*) and Cowpea weevil (*C. maculatus*). A single major gene showing complete resistance to these bruchid beetles was found in one accession (TC1966) of wild ancestral form of mungbean, *V. radiata var. sublobata*. This gene was incorporated into Chainat 60 (a recommended cultivar in Thailand). There were no genetic barriers found between the wild (TC1966) and cultivated mungbean (Chainat 60). F_1 plant grew normally and produced vital F_2 seeds.

Backcrossing was initiated using cultivated mungbean (Chainat 60) in F_2 generation to improve the agronomic characters. Seed coat color started segregating in F_2BC_1 seed generation. Only green seeds were selected in this stage. Consecutive

General Affairs Divisions

Mr. Mitsuo Shimizu, Director

General Affairs Division of TARC was inaugurated on 16 April 1991, in order to strengthen the administrative capacity of TARC on a long-term basis, so as to upgrade the management of the research programmes for the promotion of agriculture, animal husbandry and forestry in the tropics and subtropics.

When TARC was established in 1970, both General Affairs and Accounting Sections were able to meet the administrative requirements of TARC. However, along with the increase in the number of TARC staff on duty overseas, widening of the scope of the research fields and diversification of the research activities of TARC in the tropics, the administrative tasks also became more complicated. To meet these requirements, the new Division was established.

In this regard, the TARC General Affairs Div. provides four unique posts: Overseas Duty Officer, Overseas Accounting Officer, Chief of Overseas Finance and of Overseas Maintenance, who are responsible for supporting overseas research officers of TARC on duty, in terms of health care, social security, accounting and management of equipment.

The General Affairs Division will make its utmost efforts to further enhance the efficiency of the activities of TARC overseas.

Born in Hokkaido in 1934. Started his career at MAFF as Officer of Yakumo and Kutchan Forestry Stations. Administrative duties at National Institute of Agricultural Sciences, Agr. Res. Council Secretariat, and Chugoku Agr. Exp. Station during 1968-84. He was Overseas Accounting Officer of TARC (1984-86) and was Deputy Director, Tsukuba Office of Agr. Res. Council Secretariat (1988-91).

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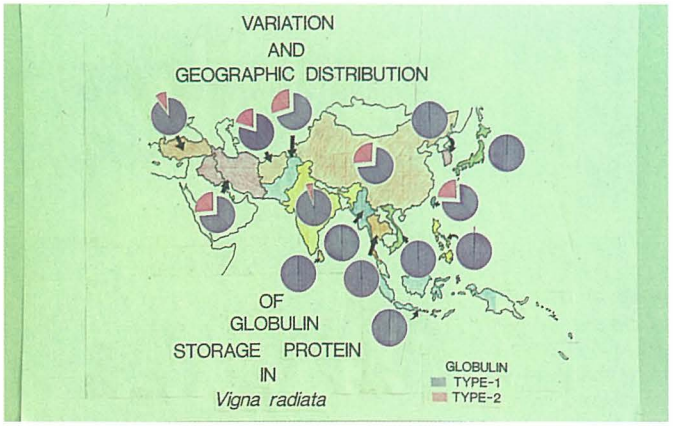
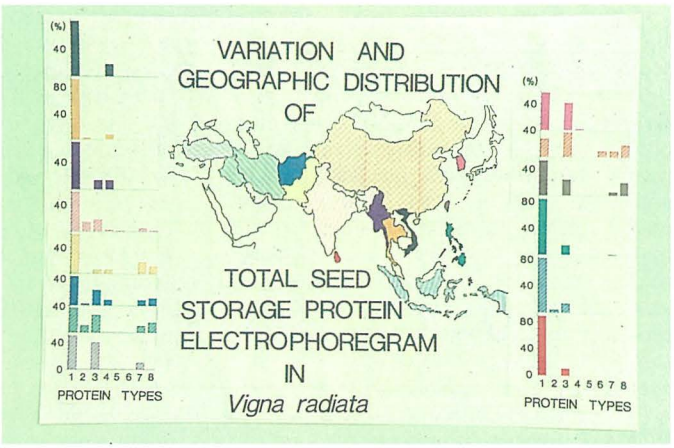
backcrossing was conducted to further improve the agronomic characters of the resistant line. In the F_3BC_3 generation, agronomic characters inducing seed yield, seed size and days to flowering reached the level of recommended cultivars.

Geographical Distribution of Growth Types in Mungbean

Evaluation of genetic diversity within germplasm collections is important to plant breeders to identify genes for particular traits. Four hundred ninety seven local mungbean strains collected from various countries were evaluated for growth characteristics and classified into eight growth types. Growth type classification was performed by examining the frequency distribution of 1) number of days from sowing to 50% flowering, 2) stem length and 3) number of lateral branches. A clear geographic cline could be recognized in the geographic distribution of the growth types. The strains consisting of tall plants with high-branching habit and late maturity (Growth type 4) were predominantly cultivated in areas of low latitudes (Indonesia and Thailand). At the intermediate latitudes (Taiwan and the Philippines), the predominant type consisted also of tall plants but changed to low-branching habit (Growth type 1 and 2). The maturity span of many strains from the Philippines was shorter compared to that of the strains from Taiwan. At high latitudes (Korea, Afghanistan and Iran), the predominant type changed to short plants with an early maturity and low-branching habit (Growth type 5). The strains from India showed the largest diversity in terms of growth type variation. It was considered that the strains showing the most appropriate growth type for breeding high-yielding early varieties suitable for the intensive cropping systems in Thailand were predominantly distributed in



Geographic distribution of globulin type 2 strains



Geographic distribution of total protein types

the Philippines. Since the strains from India showed the largest diversity in the growth characteristics, it was suggested that a desirable source of genes such as those for disease and insects resistance could most probably be found in the strains from India.

Center of Genetic Diversity and Dissemination Pathways of Mungbean

Seed protein of 590 local strains of mungbean, collected throughout Asia, was analyzed by SDS-polyacrylamide gel electrophoresis. Eight protein types were recognized, based on the combination of four albumin bands and three globulin bands. Frequency distribution of each protein type strain from each region showed a clear geographical cline. These data reflected the center of genetic diversity and dissemination pathways of mungbean. The center of genetic diversity in seed protein is located in Western Asia (Afghanistan-Iran-Iraq area). Mungbean is considered to have been domesticated in India. Mungbean would have spread mainly to the east by two routes. One route led to Southeast Asia from India. Strains consisting of a few protein types with a predominant protein type 1 disseminated from India to the Southeast Asian countries. Thus the strain composition in the Southeast Asia is very simple and homogeneous. Another pathway would have been the route known as the Silk Road. By this route, mungbean strains spread from Western Asia to China and Taiwan. Complete absence of strains with protein types 7 and 8 in Southeast Asia strongly suggests that this Silk Road route was involved, as evidenced by the distribution of globulin type 2-strains.

Cooperative Research with ILRAD on Theileriosis

T. Minami

The International Laboratory for Research on Animal Diseases (ILRAD) is one of the research institutes with which TARC is promoting cooperative research programs in tropical or sub-tropical regions. ILRAD which was established by the CGIAR in 1973 is located in Nairobi, Kenya. The fundamental objective of the CGIAR is to contribute to the increase of food production in developing countries through the promotion of agricultural research and related activities. The primary target of ILRAD is to develop safe, effective and economical control methods of tsetse fly-transmitted trypanosomiasis and tick-transmitted East Coast Fever (ECF), a virulent form of theileriosis. These two parasitic diseases seriously affect the livestock industry in the African continent. Main research activities, therefore, consist of basic research for the development of vaccines, while other methods of control are also being explored.

Concerning these two diseases, ILRAD's scientists carry out advanced research in the fields of parasitology, pathology, cell biology, immunology, biochemistry, molecular biology and electron microscopy. Recently, programs aimed at the promotion of research on epidemiology and socioeconomics have also been initiated. In Africa, domestic animals are the major source of livelihood and form the basis of farming systems. This new research group is assessing the impact of improved control methods of livestock diseases and attempts to develop sustainable agricultural production systems in Africa. To develop new control methods against ECF and African animal trypanosomiasis, ILRAD conducts collaborative studies with prominent laboratories worldwide. To improve ILRAD's research activities a Research Review Committee comprising the Director of Research and the Laboratory Coordinators was established in 1988. In addition, ILRAD has been making every effort to increase the number of experts in national agricultural research organizations, especially in Africa.

The Laboratory has been receiving financial support from the donor members of CGIAR including Japan which also directly funds ILRAD. The facilities and research equipment in ILRAD are modern, and communication among the staff members is also excellent. Furthermore, ILRAD operates a large ranch at Kapiti Plain, 70 kilometers from Nairobi, where about 2700 Boran cattle are bred and most of the cattle are used for the research and training programs.

Progress made during 1980 - 90

During the past 10 years collaborative research between ILRAD and TARC was focused on strain characterization within the framework of the Epidemiology and Experimental ECF Control Project for the development of *in vitro* methods of classification of *Theileria* strains into antigenic groups and the analysis of their cross-protective potential *in vivo* in order to develop an effective ECF vaccine.

The first achievement was the development of an indirect fluorescent antibody test using anti-schizont monoclonal antibodies for the selection of *Theileria parva parva* strains. The most suitable material for this method was obtained from schizont-infected lymphoid cells taken from infected cattle and cultured cells. At present, this technique is widely used for the characterization of strains of *T. p. parva*, *T. p. lawrencei* and *T. p. bovis* in Africa, although the monoclonal antibody profile alone is not sufficient to classify *Theileria* parasites into groups due to cross-protection reactions in cattle.

Another experiment was carried out to develop *Theileria* clones by transplanting a small number of kinetes into uninfected ticks. This technique enabled to obtain tick salivary gland acini with low rates of *Theileria* infection more reliably than by using naturally fed ticks. Cloned parasites are required to analyze the possible role of genetic recombination in antigenic diversity.

Analysis of *T. p. parva* antigen recognized by anti-schizont monoclonal antibodies was also conducted using SDS-PAGE and Western-blotting methods. The results obtained agreed well with the profiles of the monoclonal antibody reactions.

For the past five years, cooperative studies have concentrated on the analysis of parasite proteins at the molecular biology level. One of the research topics dealt with the purification of shizonts from infected lymphoid cells by treating parasitized cells with aerolysin. Purified parasite proteins were also analyzed using two-dimensional gel electrophoresis. It was revealed that the five protein spots observed in gels prepared from a *T.p. lawrencei* parasite were absent in the gels prepared from *T.p. parva* strains. The same technique has also been applied for the characterization of Japanese *T. sergenti*, *T. orientalis* and *T. buffeli* strains.

Sampling of lymphoid cells from parotid lymphnode by biopsy (at ILRAD) (photo by M. Eguchi, NIAH)

TARC Internationl Symposium 1991 on Ruminant Feed Resources and Nutrition in the Tropics in Tsukuba

TARC is pleased to announce that the preparation for the TARC International Symposium 1991 are proceeding well. As announced earlier (Newsletter, Jan. 1991), the Symposium will be held on 24 and 25 September 1991, at Tsukuba Center for Institutes in Tsukuba, Ibaraki, Japan, under the title "Utilization of Feed Resources in Relation to Nutrition and Physiology of Ruminants in the Tropics". The official visits to some institutes in Tsukuba Science City are now being planned for 26 September 1991.

The tropical countries are presently faced with various kinds of nutritional constraints on the production of ruminant livestock, which are caused by a shortage of feed supply, low quality of roughage, climatic stresses, etc. On the other hand, these countries have a potential to utilize various kinds of fibrous feed resources such as crop residues and other agricultural by-products. It is therefore relevant to discuss the status of feed resources and animal production in these countries, the strategies of the organizations covering these areas for enhancing the productivity from available resources, and the problems which limit the efficient use of available feed resources technically or socio-economically.

The Symposium consists of three main sessions. 1)The Country Reports 2)The Strategy Reports of RAPA/FAO, ILCA, ACIAR and TARC. 3)The Scientific Papers.

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