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鳥取県と岡山県におけるアズキ（*Vigna angularis* var. *angularis*）野生種のモニタリングと収集

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Monitoring and Collecting of the Azuki Bean (*Vigna angularis* var. *angularis*) Genepool in Tottori and Okayama Prefectures, Japan 22rd-24th September 1999

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要　約

アズキ野生型-雑草型-栽培型複合を生息域内で効率的に保存するための方法を開発する目的で，今までに国内に自生する集団の調査を行ってきた．RAPD分析およびAFLP分析によって，鳥取県の野生型および雑草型の混生集団はその近辺から収集した野生型のみの集団や雑草型のみの集団よりも遺伝的多様性の大きいことが明らかになったので[1) 2)]，長期的なモニタリングを想定している．今回，1999年９月22日から９月24日にかけて混生集団の動態を調査したところ，集団の分布パターンに変化がみられた．さらに，鳥取市周辺および鳥取県から岡山県にかけて探索を行い，新たにアズキ野生型-雑草型-栽培型複合を形成する集団を見いだした．今回調査した地域には様々なタイプの集団が数多く存在することがわかった．

Summary

From 22nd to 24th September, 1999 key populations of the *Vigna angularis* complex in Tottori prefecture were visited to record changes compared since previous visits. These same populations have been subjected to

detailed laboratory analysis by the RAPD and AFLP methodologies[1) 2)]. In addition, a more detailed survey of populations of the *Vigna angularis* complex was made around Tottori city and between Tottori and Okayama. Distinct changes were observed in populations monitored and new population types were observed. This trip reconfirmed the abundance and diversity of the *V. angularis* complex populations in the region visited. On the way to Tottori the Kyoto herbarium was visited and data on a total of 142 herbarium specimens of *Vigna* and *Vicia* were recorded.

KEY WORDS : *Vigna angularis,* genetic resources, *in-situ* conservation

1. Monitoring populations（モニタリング集団）

Populations that had been visited previously were re-visited to monitor changes.

Population 99-27 (97041 - wild and 97042 weedy)

This population was visited in 1997. Due to cutting of the herbaceous vegetation just prior to the visiting this site this population had been destroyed on the river levees where samples were collected in 1997. However, many plants were growing in patches around a factory and as regenerated plants (after cutting) near cultivated fields. Wild plants were found growing within a field of cultivated azuki for the first time.

The small patch of indeterminate weedy azuki (97042) was in the same location as in 1997 but at the time of this visit pods were immature. The general farming in the area was similar to 1997.

Populations 97046 (47)

We have visited this population on 3 occasions because this population is the clearest representative of the complex population type we have found in Japan.

Several changes were observed in this population and its surroundings.

1. The hybrid swarm patch within the population observed in 1998 was not seen this time in the same place. However, in another part of the population a patch of individuals that resemble a hybrid swarm was observed. On checking the pods and seeds of individuals in this patch many pods had one or two undeveloped seeds suggesting a degree of sterility.

2. The small field in the middle of this population which for the previous two years had been planted with azuki beans this year was planted with strawberries and *Brassica*. However, volunteer azuki beans were found growing in this small field.

2. Future plans（将来の計画）

Based on our observations in Tottori prefecture (鳥取県) over 3 years it seems that the populations are safe unless there is major construction and this seems unlikely since these two populations are near large rivers and beside intensely farmed areas.

While the habit appears relatively stable, population 97046/47 appears highly variable from year to year. Field observations backed up by laboratory studies have shown that the genetic diversity of complex

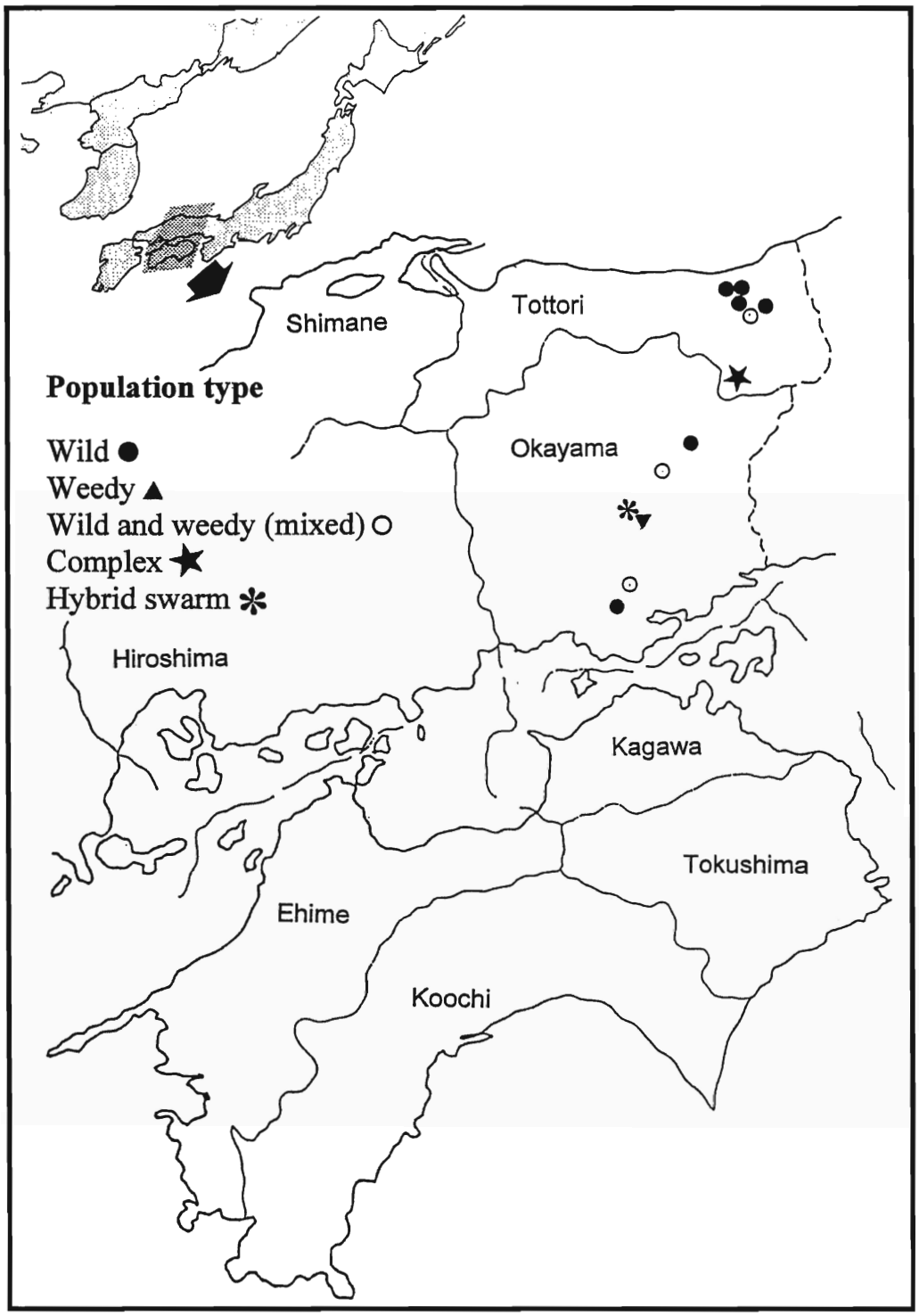

Fig. 1 Collecting and monitoring of *Vigna angularis* complex populations in Tottori and Okayama Prefectures.
鳥取および岡山におけるアズキ野生一雑草集団の収集とモニタリング

Table 1 Pod length and seed weight of individual plant samples in hybrid swarm population 99-37
雑種集団99-37から収集した各個体の英長と種子重

Plant no.	Pod length (mm)	10 seed weight (g)
99-37-1	68	0.38
99-37-2	70	0.38
99-37-3	68	0.11
99-37-4	80	0.33
99-37-5	66	0.11
99-37-6	58	0.15
99-37-7	70	0.34
99-37-8	50	0.15
99-37-9	53	0.15
99-37-10	65	0.16
99-37 cultivated	96	1.29

populations make them most appropriate for long term monitoring and *in-situ* conservation research.

In order to improve our monitoring of populations in Tottori prefecture (鳥取県) we plan to conduct collaborative research with Dr. Nobuya Kobayashi, Kobe University (神戸大学) with the following objectives:

a. Setting up permanent monitoring transects and/or quadrats to measure genetic change over time in key populations.

b. Determining the extent of natural outcrossing in *Vigna angularis* and monitor insects visiting flowers.

c. Determining the comparative yield components of wild, weedy and cultivated *V. angularis*.

d. Obtaining precise information on the life cycle of wild, weedy and cultivated azuki in the same area particularly with respect to the time and duration of flowering.

This collaboration will begin from year 2000. To help in these studies we will develop a range of new markers to use in our field work.

3. Population states（集団の分類）

Based on this collecting trip the number of types of population of the azuki bean complex we have observed has increased and we can now distinguish the following types of populations:

1. The cultigen;
2. Wild populations (99-31)；
3. Weedy populations;
4. Complex populations:
   a. consisting of wild, weedy plants and the cultigen in a complex environment;
   b. wild and weedy plants mixed in a population (differences in flowering time may be why they retain their identity);

c. hybrid swarm - population which gives the appearance of a segregating population with many plant types within the population.

4. Hybrid swarm population（雑種集団）

Within our main Tottori monitoring population (97046/47) we observed what appeared to be a small hybrid swarm in 1998 and again during this trip in a different location. However, at Kawaguchi (川口), Tatebe-cho (建部町), Okayama prefecture (岡山県) we found a population less than 3m away from an azuki bean field (with 2 cultivars) which resembled a hybrid swarm (99-37). Individual pod length and seed weight confirms the impression in the field that this population is a hybrid swarm (Table 1). The population was on the sides and in a depression which had standing water. The population was divided into two parts with some plants on a steep soil bank and some in the wet depression. Next to this hybrid swarm was an area dominated by *Glycine soja*.

Based on seed weight the individuals could readily be divided into two groups those with a 10 seed weight of 0.1-0.2g and those with a seed weight of 0.3-0.4g (Table 1). Pod length was not so clearly divided into two groups though the mean pod length of smaller seeded individuals was 60mm compared to 72mm for the larger seeded individuals. The population was not large, about 20m^2, and small and large seeded individuals were not clearly in separate into different parts of the population. While their was some variation in pod color - black and tan - seeds of all individuals inspected were black.

5. Transition from Tottori to Okayama（鳥取から岡山にかけてみられた集団の変化）

The trip clearly showed a transition across Honshu (本州). In the north wild soybeans are less common than wild azuki bean. Wild/weedy azuki populations are generally larger in the north than in the south. The plants in Okayama (岡山) appeared to be maturing earlier than those in Tottori (鳥取).

6. Insect activity（訪花昆虫）

Field observations indicated that wild Vigna angularis had an abundance of bee which are pollinators of azuki bean. This suggests that cross pollination between population types in the same area may occur. However precise ecological data needs to be obtained.

7. References（参考資料）

1）Xu, R.Q., N. Tomooka, D. A. Vaughan and K. Doi (2000a) The Vigna angularis complex: Genetic variation and relationships revealed by RAPD analysis, and their implications for in-situ conservation and domestication. Genet. Resour. Crop Evol. 47 : 123-134.

2）Xu, R. Q., N. Tomooka and D. A. Vaughan (2000b) AFLP markers for characterizing the azuki bean complex. Crop Sci. 40 : 808-815.

Table 2 A list of collected samples in Tottri and Okinawa prefectre, Japan,1999.
鳥取および岡山県で収集した作物近縁野生種遺伝資源，1999.

No.	Coll. date	Coll. No.	Species	Japanese standard	Status	Site	Collecting site	Latitude /longitude
1	9/23	CED990027	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	1	国府、岡益 (Okamasu, Kokufu, Tottori pref.)	N35-27-27.8 E134-17-45.1
2	9/23	CED990028	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	mixed	2	船岡町 (Funaoka, Tottori pref.)	N35-23-21.2 E134-15-01.4
3	9/23	CED990029	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	3	河原町、赤子田 (Akagota, Kawahara, Tottori pref.)	N35-25-47.5 E134-12-12.6
4	9/23	CED990030	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	4A	河原町、美穂 (Miho, Kawahara, Tottori pref.)	N35-26-53.7 E134-12-11.2
5	9/23	CED990031	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	4B	河原町、美穂 (Miho, Kawahara, Tottori pref.)	N35-26-53.7 E134-12-11.2
6	9/24	CED990032	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	mixed	5A	智頭町、はじ (Haji, Chitou, Tottori pref.)	N35-13-52.5 E134-13-48.2
7	9/24	CED990033	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	5B	智頭町、はじ (Haji, Chitou, Tottori pref.)	N35-13-52.5 E134-13-48.2
8	9/24	CED990034	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	6	津山市、草加部 (Kusakabe, Tsuyama, Okayama pref.)	N35-05-23.7 E134-04-24.3
9	9/24	CED990035	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	mixed	7	津山市、さら (Sara, Tsuyama, Okayama pref.)	N35-01-52.5 E133-58-00.4
10	9/24	CED990036	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	weedy	8	建部町、高浜 (Takahama, Tatebe, Okayama pref.)	N34-52-58.7 E133-54-16.8
11	9/24	CED990037	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	mixed	9	建部町、川口 (Kawaguchi, Tatebe, Okayama pref.)	N34-52-55.0 E133-54-07.0
12	9/24	CED990038	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	mixed	10	御津町、宇垣 (Ugaki, Mizu, Okayama pref.)	N34-46-56.2 E133-55-45.4
13	9/24	CED990039	*Vigna angularis* var *nipponensis*	ヤブツルアズキ	wild	11	岡山市、横尾 (Yokoo, Okayama, Okayama pref.)	N34-43-20.0 E133-50-22.0

Altitude (m)	Habitat	Shading	Disturbance	Population size	Growth stage	Soil	Seed sample	Herbarium	rhizobium	Remarks
60	edge of field	open	medium	scattered over several ha	flowering	clay	11 ind.	yes	no	around field
110	in waste land	open	high	500m^2	flowering	clay	13 ind.	yes	yes	
80	at edge of road	open	high	150m^2	flowering	clay	bulk	no	no	next to rice field
80	edge of irrigation stream	open	high	500m^2	flowering	clay	bulk	yes	no	
80	in very wet paddy fields	open	medium	1000m^2	flowering	clay	bulk	no	no	
390	in paddy fields, abandoned field	open	high	20m^2	flowering	silt	bulk	yes	yes	flower color: yellow
400	edge of mountain	open	high	scattered over several ha	flowering	clay	bulk	no	no	farmland and road side in abandoned fields
330	at edge of road	open	high	20m^2	mature	clay	bulk	no	no	surrounding area rice paddies
	at edge of rail way	open	high	500m^2	flowering	stoness	bulk	yes	yes	
230	in very wet paddy fields	open	high	500m^2	flowering	silt	7 ind. + bulk	yes	yes	abandoned field
220	in very wet waste land	open	high	500m^2	flowering	clay	10 ind. + bulk	yes	yes	
170	in waste land	open	high	scattered over 2ha	flowering	clay	2 ind.	no	no	
250	with lawn grass beside stream	open	high	1m^2	mature	clay	bulk	no	no	

鳥取県と岡山県におけるアズキ（*Vigna angularis* var. *anglaris*）野生種のモニタリングと収集

Left cultivated azuki, center wild azuki, right soybeans. Since both wild and cultivated azuki bean are flowering at the same time the possibillty of hybridization between these forms is high. (In fields of various crops near Okaeki-bashi (岡益橋), Kokufu-cho (国府町), Tottori Prefecture (鳥取県), Japan)

Weedy (right) and wild (left) azuki plant types growing in a mixed population around gravelly waste land at Funaoka (船岡), Funaoka-cho (船岡町),Tottori prefecture (鳥取県).

長野県と新潟県におけるソラマメ（*Vicia*）属野生種の探索と収集

Vicia nipponica growing in shade beneath tall trees at edge of an area of newly constructed farm buildings. Tatsuno-cho (辰野町), Nagano prefecture (長野県) (CED99042).

Vicia unijuga growing among bushes on rock garden at watershed parking area Ono (小野), Nagano prefecture (長野県) (CED99041).

Vicia venosa habitat at 1285 m on Mount Hakuba (白馬山) at Renge Onsen (蓮華温泉) , Itoigawa (糸魚川市), Niigata prefecture (新潟県) (CED99044).