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On-farm safeguard of biodiversity, genetic piracy and farmers' rights: principles, state of the art, problems

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Summary

The authors are interested in the genetic diversity of agricultural species in that *in situ*/on-farm conservation of these resources (mainly the local varieties) is scantly developed with respect to the *in situ* conservation of wild resources and species related to cultivated plants; their interest is also justified by the fact that the on-farm conservation of cultivated plants requests a new approach if compared with the conservation methods of natural habitats and ecosystems. Furthermore, the genetic diversity of the agricultural species is basic for the future evolution of the agri-ecosystems as was in the past. The success of on-farm conservation strategy of the plant genetic resources depends on several issues: why should this type of conservation be envisaged? Which are the objectives of on-farm conservation? How can national and international agricultural organizations promote this form of conservation? Which are the legal and institutional issues concerning on-farm conservation? Answers cannot be conclusive. They vary with the time, crops, economic and market conditions, social conditions, agricultural systems, etc. This paper is not intended to answer all the above questions. It provides indications and tries to contribute to the discussion on on-farm conservation for specific regions, crops, local varieties and cropping systems. The social and private value of traditional varieties is very high both for farmers, for local communities and for the plant breeders or other researchers of the conventional sector. Although most of the genetic diversity of local varieties is represented in *ex situ* collections, the landraces and the knowledge of agricultural practices still have a great *in situ* and on-farm value. A great emphasis will be laid on the "rights of farmers and of local communities", who supply the germplasm in that without an equal and right distribution of benefits also to the farmers the activities of conservation, maintenance and development of PGR will not be boosted. The authors argue that the "farmers' rights", within an international context, is one of the most urgent problems to solve for political, environmental, scientific, economic and ethical reasons. To this end, the major results of the latest international debates are reported (with the involvement of FAO, UNEP, UNESCO, UNDP, WTO, UPOV, TRIPS, WIPO, NGO, etc.) along with the provisions and/or mechanisms to reward the work of both farmers and the local communities.

Key words: genetic resources; conservation; plant diversity.

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1. *In situ*/on-farm conservation of the plant genetic resources

Biologists and naturalists have long recognized the existence of geographical areas diverse and rich in plant genetic resources (PGR); N.I. Vavilov (1926) was one of the first scientists who caught the importance of germplasm for the improvement of cultivated plants. Later, after the economic and technological changes, it was also noticed that these plant genetic resources were endangered. Several authors voiced the fear on the possible loss of traditional varieties or landraces from the areas of origin/diversity of domesticated plants.

The scientific efforts for the PGR conservation have focused on the collection of the genetic material and its *ex situ* conservation; several national and international institutions have been set up along with "gene banks" which contain million accessions of germplasm (more than 6 million) at very low temperatures (-10/20°C). The *ex situ* conservation of accessions in the gene banks (seed banks, botanical gardens, research collections, field collections) is a technical and economic advantage for the breeders, suppliers and users of the germplasm. This type of conservation has definitely contributed to the success of several national and international genetic breeding programmes with significant productive increases of the major crops (wheat, maize, rice, soybean, potato, barley, etc.) as shown by the first "Green revolution". However, while the genetic banks will keep on playing their specific role, the "biological evolution", which is a continuous source of new biodiversity, will not be achieved with cold-conserved material and under hard vacuum. It can occur just in the open field through the dynamics, the contact and interaction of the various forms of life in the agroecosystems.

The latest decades of PGR collection and *ex situ* conservation in the gene banks and of advanced agricultural research have changed the viewpoints that faded into the background *in situ*/on-farm conservation in favour of *ex situ* methods. Conservation approaches are no longer an alternative: they are viewed as complementary approaches. It has been recognized that these methods deal with different aspects of PGR and none of them is alone sufficient to conserve the genetic diversity of our planet. Secondly, no doubt that conventional agriculture and genetic diversity are not tied and that development in agriculture is not incompatible with the on-farm maintenance of agrobiodiversity. Third, apart from direct funds, there exist several mechanisms which promote the on-farm maintenance of PGR and of old local varieties; nowadays, we do have the chance to understand the biological and social dynamics of these landraces, to predict their decline and to invent all the mechanisms and the methods to augment their direct

and potential value. Over the last years, national and international programmes of PGR conservation and protection have laid emphasis on *in situ*/on-farm conservation of the genetic diversity also supported by projects and programmes of UNESCO, UNDP, UNEP, Global Environmental Plan of the World Bank, etc. concerning on-farm conservation of PGR including wild ancestors and related species of cultivated plants in Turkey, Ethiopia, Peru, Lebanon, Jordan, etc..

The Biodiversity Convention provides a strong justification to on-farm conservation: article eight addresses *in situ* conservation and item 8 (j) argues that the knowledge, innovations, traditional habits and life styles of the local communities are relevant for the on-farm conservation and the use of cultivated plants and domestic animals may play a significant role, not only for the maintenance of the agrobiodiversity, but also as a component of sustainable development programmes.

The complementarity of both approaches is based on the argument that PGRs include much more than simple alleles, gene complexes or genotypes of a plant population. Apart from the landraces, they also include parental wild species, related species, perennials and species with recalcitrant seeds (which can hardly be included in *ex situ* collections), agroecological relationships (gene flow between populations and different species, adaptability, relations among predators, pests, symbionts, insects and diseases) and human factors (systems of paysant knowledge, practices related to genetic diversity, cultural traditions, local habits, human selection, etc.). These are the constituents of a common system of cropping evolution which engenders new PGR. A crucial difference between the two conservation approaches is that the *ex situ* system preserves the original status of the genetic material (constant gene frequency and genotype identity) in order to prevent their loss or degeneration; in contrast, *in situ*/on-farm method keeps a system alive and in evolution (dynamic evolution) thereby allowing the loss and addition of new elements in the agroecosystem (the gene frequencies are allowed to fluctuate in response to the selective pressures exerted by the environment).

In situ/on-farm conservation is intended to encourage farmers and local communities (mainly marginal and poor agricultural areas) from cultivating, selecting and managing local varieties; all that should involve not only alleles and genotypes, but also the evolutionary processes and the local knowledge systems. Furthermore, the success of such conservation approach can be estimated based on the use of the local germplasm (landraces) in the genetic breeding programmes (which lead to the

breeding of new varieties) and on the exchange of varieties within and between different communities. As for the rice, Tab. 1 reports the international flows of landraces. Not a single country reported in the table is self-sufficient; many countries depend on other germplasm; in Bangladesh, only 4 varieties are local out of 233 landraces (less than 2%); only India and the USA have exploited several rice landraces (39.8% and 67.4% respectively). A few countries export their landraces: Taiwan, US, China and Thailand; conversely, many others import large amounts of germplasm from abroad: Bangladesh, Pakistan, Nepal, Nigeria, Vietnam, India, Indonesia (Altieri and Merrick, 1987; Heyn and Waldman, 1992; Brush, 1995; 1999; Brown, 1999).

Tab. 1. Summary of the international flows of rice landraces (from D. Gollin, 1998)

COUNTRY[1]	(A) Number of landraces used in the set-up of varieties	(B) Native landraces	(C) Foreign landraces	(D) Landraces used in other countries	$\frac{D-C}{A}$
Bangladesh	233	4	229	10	0.940
Brazil	460	80	380	43	0.733
Burma	442	31	411	9	0.919
China	888	157	731	2.052	+ 1.488
India	3.917	1.559	2.358	1.749	0.155
Indonesia	463	43	420	420	0.000
Nepal	142	2	140	0	0.986
Nigeria	195	15	180	0	0.923
Pakistan	195	0	195	10	0.949
Philippines	518	34	484	299	0.357
Sri Lanka	386	64	322	57	0.687
Taiwan	20	3	17	669	+32.600
Thailand	154	27	127	220	+ 0.604
United States	325	219	106	2.420	+ 7.120
Vietnam	517	20	497	89	0.789

[1] In the last column, numbers above 1 indicate that the country is a major supplier of landraces; negative numbers indicate that the country imports landraces to obtain bred varieties

2. Promoting the on-farm conservation of the plant genetic resources

In situ/on-farm conservation shall be promoted for several reasons:

the key elements of the PGRs can not be collected and conserved out of their environment of origin, diversification and adaptation, that is to say where they have developed their distinctive traits;

a continuous evolution of the system may guarantee the production of new PGR and of a new genetic variability for future generations;

it is necessary to complement and support the collections kept in the *ex situ* genetic banks;

in situ/on-farmconservationareasareimportantnaturalfieldlaboratories, which play a basic role in the design and evaluation of technologies for a sustainable,environmentally-friendly,low-energyinput productions;

it allows to preserve the allele and genotype richness as well as the knowledge of the systems and farming practices which secure the diversity and information about the direct and indirect uses of PGR;

on-farm strategy maintains a unique type of germplasm, above all for the marginal areas, with a special adaptability to the local environment both for the genetic variability, for the resistance to biotic and abiotic stresses, and for the phenological and quality characteristics, of the typical local productions;

on-farm conservation encourages farmers in their work of cultivation, selection and management of local varieties with a view to accruing their direct, indirect and potential value. While assessing the genetic diversity within and between crops, they take account of various factors such as: heterogeneous soils, production conditions, risk factors, market demand, habits and customs for the products, popular traditions, etc. A wheat grower in Turkey, a maise grower in Mexico, a potato grower in Peru, a rice grower in Thailand have several types of seeds available; for hilly sides, mountain, fertile plain, irrigated and rainfed areas, for family or local use and urban markets, for the nutrition of human beings and domestic animals, etc.

on-farm conservation is important for the beneficial impact of landraces on the environment and for the benefits stemming from PGR, which do not fall in the consumption and use of productions (direct value), among which: a) keeping the relationship involved in the evolutionary process of crops and ecological balance; b) cropping systems and traditional agricultural systems (multiple cropping, crop

rotation, green manuring and burying of crop residues, etc.); c) potential value bound to the future use of PGR to meet the needs of both producers and consumers;

to complement and support the collections of *ex situ* genetic banks. Unfortunately, all the forms of conservation are vulnerable and *ex situ* methods are exposed to several risk factors: genetic drift within collections, safety problems, political and economic instability, genetic erosion of gene banks, temporary or insufficient financial support, obsolete instruments, etc. All that can induce an irreversible damage which may directly affect the conservation, regeneration, evaluation and use of germplasm collections, as happened to some prestigious gene banks (i.e. Vavilov's collections in the former USSR). The geographical areas where the on-farm maintenance of PGR is successful are potential reserves for PGR collections for the future generations. *In situ*/on-farm approach complements the *ex situ* maintenance in that it preserves a stock of genetic diversity which is relevant for the agricultural sectors which are not backed up by public breeding programmes for commercial purposes;

local varieties are usually superior in marginal environments and in low energy input cropping conditions; they are very stable, provide better quality productions and may be used directly to obtain typical local products in specific cropping areas;

to respect the mandate of the Biodiversity Convention negotiated in Rio in 1992 and ratified by more than 160 countries and that of Agenda 21 adopted by UNCED in June 1992.

The strategies for the on-farm conservation of ancient local varieties and to increase their private and social value encompass market-oriented methods and activities which are not bound to the market. They include the development of market outlets, the prestige of typical local productions through promotion campaigns, rural exhibition on diversity, local gastronomy, exhibitions, which enhance the value of local crops not only for the protection of the biological resources but also for the discovery of cultural peculiarities, the enhancement of the rural environment and the development of ecotourism. In Italy (including Apulia), the demand for typical plant products, especially organic products certified by quality trademarks, is steadily growing among consumers. The Denomination of Origin and Geographical Indication, protected by the European Community registration, assign an 'added value' to the specific productions deriving from the historical, geographical and cultural link encompassed in the geographical name associated with the typical plant

or animal product. In 1992, two Regulations were issued on the quality of typical products as a result of a radical change in the European Agricultural Policy: Regulation 2081, on the Denomination of Protected Origin (PDO) and on the Indication of Protected Geographical origin (PGI) of agricultural and food products, and Regulation 2082, which regards the attestation of agricultural and food products having a specific character.

The setting up of PDO and PGI has enabled to pursue three basic objectives:

a greater protection and information of the consumer who is more aware while choosing a product;

a greater protection of growers/producers, of their typical products from frauds or usurpations;

a greater development of specific local productions leading to the diversification of local varieties and typical local productions and to a re-evaluation of the work of farmers and rural communities. Tab. 2 (updated in February 2000) reports all the Italian recognized PDO and PGI, distinguished by product category. Tab. 3 reports the list (incomplete) of local varieties of Southern Italy (including Apulia) which deserve further protection and development in their growing areas (Oldfield and Alcorn, 1987; Frankel and Brown, 1995).

3. Initiatives to develop local varieties and agri-food products typical of Southern Italy (including Apulia)

While debating of the future of agriculture, emphasis is increasingly laid on two objectives: the quality of plant products and the protection of the environment. EU (including Italy) is now working out a new objective to assign to the agriculture of its member countries: the management and development of the rural territory and of the local communities in the name of a multifunctional mission. Agriculture shall take in charge the development and enhancement of landscape and environmental assets, the maintenance of the biodiversity of the species of agricultural interest and, mainly, the improvement and protection of the food quality in the respect of the consumer's health. The future of the Italian agriculture is tied to the ability to set up a quality system of the plant products combined with an efficient commercial system for productive sectors; both systems will resort to the services offered by consortia for the protection and enhancement of quality products (Renna and Pavone, 1998).

Tab. 2. List of the Italian PGI and PDO for plant products

1. Red orange of Sicily	14. Red chicory of Treviso
2. Caper of Pantelleria	15. Variegated chicory of Castelfranco
3. Chestnut of Montella	16. Lentil of Castelluccio di Norcia
4. Mushroom of Borgotaro	17. Clementine of Calabria
5. *Corylus avellana* Piemonte	18. *Corylus avellana* of Giffoni
6. Lamon bean of Belluno valley	19. Ascalonia cepa of Romagna
7. Bean of Sarconi	20. Table grapes of Canicattì
8. *Triticum spelta* of Garfagnana	21. *Corylus avellana* of Belice
9. Pepper of Senise	22. Pear of Mantova
10. Tomato S. Marzano of the Sarnese-Nocerino territory	23. Pear of Emilia Romagna
11. Chestnut (Marron) of Mugello	24. Peach and nectarine of Romagna
12. Chestnut (Marron) of Castel del Rio	25. Olive oil of Tuscany
13. Riso nano Vialone Veronese	
To the above PGI, we shall add 20 PDO olive oils: Aprutino Pescarese- Brisighella- Collina di Brindisi- Canino- Sabina- Riviera Ligure- Bruzio- Cilento- Colline Salernitane- Penisola Sorrentina- Garda- Dauno- Colline Teatine- Umbria- Monti Iblei- Valli Trapanesi- Terra di Bari- Laghi Lombardi- Terra d'Otranto- Lametia.	

Based on these motivations, the regional Government of Apulia worked out a specific provision for the enhancement and promotion of quality regional typical plant products within the Action Plan (POP) 1994/99, cofinanced with the structural funds of the European Union. To back up and complete the above provision, the regional Government of Apulia worked out the regional programme on "Agriculture and Quality" with specific interventions in order to certify the productive processes and the quality of typical plant products. The interventions envisaged by the above-said programmes envision 4 actions:

qualification and enhancement of regional typical agri-food products;

promotion of PDO, PGI, RDO, TGI and collective trademarks which certify the health and quality characteristics of typical quality products;

setting up enogastronomic itineraries (the route of oil and wine);

organization of a commercial system for the typical regional quality products.

Tab. 3. List of the traditional local varieties to exploit (incomplete)

Lentil of Altamura - *Triticum spelta* of Monteleone - Onion of Acquaviva delle Fonti - Bean of the Trasimeno lake - Bean of the Turano lake - Blonde orange of the Gargano - Carrot, onion and potato of Zapponeta - Lemon of the Gargano - Vesuvian Apricot - Artichoke of Montoro, Paestum and Pietrelcina - Artichoke Molese and S. Ferdinando - White artichoke of Polignano and Taranto - Chestnut of Serino - Onion of Montoro - Bean of Controne - Striated bean of Vallo di Daunio - White fig of the Cilento - Lemon of Amalfi and Procida - Chestnut (Marron) of S. Cristina - Apple of the Campania - *Corylus avellana* Mortarella - Walnut of Sorrento - Pear (Spadone) of Salerno - White peach neapolitan - Tomato of Campania, Corbarino and Vesuvian - Tomato of Sorrento - Grapes Catalanesca - Cherry Canfalone - Fig Pasquarell - Plum Gabbaladro - Grapes (Moscato) of Peschici - Turnip-tops of Martina Franca and Fasano - Winter tomato of Corato and Andria - Chicory Puntarella of Galatina - Chicory of Molfetta - Green cucumber of Polignano - Chickpea of Alezio and Poggiorsini - Faba bean of Bari, Castellana, Putignano, Terlizzi, Carovigno, Casarano and Sammichele - Carrot of Polignano and Conversano - Melon of Castellana, Tricase, S. Pietro Vernotico and Gioia del Colle - Yellow melon Brindisino, of Collepasso and S. Vito dei Normanni - Violet faba bean of Policoro, etc.

There are several species of minor fruit crops with traditional local varieties of Southern regions (including Apulia) such as:
Fig - Pomegranate - Persimmon - Medlar of Japan - Prickley Pear - Quince tree - European chestnut - Pistachio - Strawberry tree - Cornel tree - Common medlar - Azerole - Sorb tree - Mulberry - Carob - Jujube - etc.

The organization and implementation of a programme of promotional and information activity in favour of Denominations of Origin, Geographical Indications and Quality Trademarks represent an important factor for the spread of the local plant productions and the quality culture of producers and consumers. Furthermore, the promotional activity shall play the role of nutritional education for the information addressed to consumers on the health safety of plant products, on their organoleptic and nutritional value.

The major promotional actions of typical plant products are:

participation in regional, national and international exhibitions and fairs;

advertisement in papers and journals;

spots and sponsors on TV;

promotional campaigns;

catalogues, brochures, and information material;

publicity material for traditional sales points and for the great distribution, etc.

The high prices that the consumers are willing to pay for quality typical plant products suggest that it is possible to promote a self-sustainable system within which the cultivation of ancient local varieties becomes beneficial for the local farmers for the market demand of quality products. The said system might foster the on farm protection of local varieties and of their genetic variability through the marketing of quality plant products or "typical products". These products are bound to the territory and cultural traditions. The on-farm conservation of the ancient local varieties is an unquestionable necessity that the local political authorities shall tackle and solve jointly with the scientific community and with the farmers who are the stakeholders of the rural environment (Falcinelli and Negri, 1998).

4. On-farm conservation and plant breeding: a paradox?

The work of an on-farm conservation programme shall be geared onto the whole cycle of production of a local crop, thereby including the identification of traditional varieties, breeding, cultivation, genetic erosion control, marketing, storage, determination of production costs and consolidation of the associative structure of farmers and rural communities. It is necessary to initiate a procedure to rescue traditional varieties through the identification, conservation (both *in situ*/on-farm and in a small bank of local germplasm), the evaluation of genetic material, breeding and selection, seed reproduction, release of seeds to farmers. All the steps of the programme are aimed at one objective: the propagation and diffusion of seeds which better fit the climate and the productive conditions of farmers in the microregions where traditional varieties are grown.

Despite the difficulty bound to the high level of genetic heterogeneousness of local seeds, the work of morphological and molecular identification and characterization of old local varieties, the definition of the main reproduction system and the genetic pool of populations are basic activities for the on-farm development of landraces. A strong extension activity is also needed so that farmers avoid contamination with non local seeds and keep on adopting traditional cropping techniques in the seed production.

A crucial strategy to increase the value of local crops is to use them in breeding programmes mainly with the farmers' participation who will

exploit the results. This approach is also referred to as "Participatory Plant Breeding" and is based on a co-operation between farmers and breeders, on the definition of the research objectives and priorities, selection and evaluation of new varieties. Some researchers maintain that the farmers' collaboration should be limited to the first level of participation, to the selection of segregating populations (from F2 to F4); the development of local varieties and populations through procedures such as stratified mass selection (that is to say the choice of the best 20% of plants) can definitely fit marginal environments where conventional breeding has a poor success. Such an approach offers farmers a good alternative to the use of exotic varieties and species; by learning the production techniques of one's own seeds, the farmers get rid of their dependence on seed industries, which release seeds (mainly hybrids) which are not utilizable, at increasingly high prices and with productions that are not higher than those obtained with the native varieties. The said level of breeding is much more useful for conservation purposes in that it makes use of segregating and variable material deriving from materials already used in the local agricultural system.

A higher level of breeding is the so-called "Participatory Varietal Selection" envisaging the farmers' participation into the most advanced steps of selection (from F_5 onwards) with a view to creating new productive varieties, resistant to insects and diseases; the result will lead to an accrued genetic variability of the species cultivated in the region, with a greater flexibility in the choice of farmers. Having a higher number of varieties spurs producers to try new crosses in order to obtain more interesting varieties to test locally. Seeds observed in the local tests evaluated with collective discussions with the farmers, are then propagated and introduced in the economy of a region. The protection of the ancient local varieties might be fostered by the introduction of a regional catalogue of local varieties.

5. Biopiracy: the sack of genetic resources and of local knowledge for commercial purposes

Biopiracy is the illegal appropriation (theft) of natural resources (biodiversity) and of the local/traditional knowledge (knowledge systems) available in the south of the world, to patent and exploit them for commercial purposes.

It is the conquest by Christopher Columbus, says Vandana Shiva, the very same colonization project started five centuries ago that continues to be applied through patents and intellectual property rights (IPR), that is to say

the appropriation of the plant genetic resources and of the knowledge of the south of the world by the multinationals of the north through the new international trade agreements set up by the World Trade Organization in 1994 while renewing the GATT. Shiva argues that**"...** the conflicts exacerbated by the GATT treaty, by patents on the life forms, by those who make use of genetic engineering, stem from those processes which may be symbolically considered as the second conquest of Christopher Columbus. Columbus' discovery was geared onto piracy intended as the coloniser's natural right, necessary for the freedom of the colonized. The core of the new GATT treaty and of its norms on patents is the biopiracy meant as the natural right of western undertakings necessary for the development of the Third World community. Patents are the instrument to defend the biopiracy of the richness of non-western populations as a right of western powers... The resistance to biopiracy is a resistance to the colonization of life, of the future of evolution and of non western traditions of knowledge and relationship with nature. It is a struggle to protect the evolution of different species; to conserve the cultural and biological diversity... The problem of patentability of life does not concern only trade; it is an ethical and ecological issue bound to the social injustice of biopiracy. Should the agreement on TRIP be implemented, it might have a tremendous impact on the health of the environment and on the conservation of biodiversity" (Shiva, 1999).

More than 40% of the western drugs that we use contain extracts of plants from developing countries which have had very little or even nothing. The South of the world is much richer in PGR than the North; however, we do have the science, the technology and the legal arms to exploit those resources; poor countries possess a treasure which tempts biopirates.

Biopirates are mainly private firms, but also Universities and governmental organizations which have identified these resources and want to have the private monopoly for 20 years or longer as obtained with a patent. By way of example, in the past there were more than 30,000 local varieties of rice, each of which had been adapted by the farmers' populations to the local pedoclimatic conditions: this is the richness of genetic diversity that the multinationals are claiming and patenting them illegally. A struggle is being combated by the giants of the world economy to locate rare genes in the world and to reclaim them in the form of intellectual property. Let us consider the action of many chemical industries during the industrial revolution, these were chemical multinationals. Over the last years, they have decided to sell or to share their chemical divisions with a view to being focused on genetic research, the science of life, gene technology and gene products. It is very important to understand that it is impossible

(as yet) to create a gene in a laboratory; it must be looked for in the germplasm collections or in the natural conditions. That is why large companies are going round searching for rare genes, micro-organisms, plants, animals and also human beings which may have a commercial value. The genes will be the wealth of the XXI century, the treasure of biopirates (also for the legal ones) as confirmed by the great importance acquired by the so-called gene banks (seed banks, botanical gardens, etc.) which collect and conserve the plant germplasm in the world over.

The collections of gene banks tempt biopirates who take possession of the materials and patent them for their use. The seed bank in the royal botanical gardens of Kew in England is the biggest in the world with a statute not to be involved in actions of biological piracy; seeds are collected following legally binding agreements with the host country and when supplying seeds to other countries, they have to sign similar agreements which protect the rights of both seed donors and breeders. On the contrary, biopirates do not share the profits of their discoveries with the countries which own valuable genetic resources and they usually make their victims sign contracts.

In 1995, two American researchers obtained two licences by the patent office (PTO) for a product with healing ability. The drug was but a *Curcuma longa*-based compound which has long been known in India and even described by the texts of Ayurveda medicine. When the Indian Council of Scientific and Industrial Research discovered it, the American researchers were brought to court and finally on August 13, 1997 the patent was nullified. The dispute on *Curcuma longa* was still on, when the "Basmati" rice case broke out. On 2 September 1997, an American agri-food industry (Texas) obtained from the US PTO a patent on a rice variety, Basmati, known for its aroma and grown from time immemorial, as witnessed by the punjabi poem "Heer Ranjha" written in 1766. That case made a stir in India also for its economic rebound: the patent is supposed to have a heavy impact on the Indian exports of Basmati rice which total 800 million dollars a year. Even worse than that, this patent denies the work of those farmers who have grown and improved Basmati rice over the centuries. A London branch of the Texas company was planning to patent the Thailand's rice "Jasmine" which is grown by 5 million farmers specially in the poorest areas of the country in the North-East; thousand farmers met to protest against the theft of the trademark of their rice before the American embassy. The Thailandese and the Indians want the American company not to use the name "Jasmati" because this rice does not derive from the Indian rice "Basmati" and the Thailandese "Jasmine" but from an Italian rice illegally imported (Report, RAI 3, 2000).

Another serious case of biopiracy regards 4 varieties of subterranean clover patented in Australia and collected in Sardinia (York, Denmark, Eura, Goldium) for which the Italian farmers pay the royalties to a firm based in Olbia. With our clover, the Australians have a turnover of 12,000 billion liras; Australia is one of the worst cases of biopiracy.

So far, 118 cases of biopiracy by private firms, Universities and governmental institutions have been identified. They stole the germplasm from Africa, Asia and even from Italy and patented it for commercial purposes (Pat Mooney RAFI President, Report RAI 3, 2000).

Patents on the people's knowledge of life supporting systems had never faced such an overwhelming ethical obstacle as happened with the Neem. The Neem is a tree which grows in India and in Asia. It has long been used by the rural communities for its pesticidal and bactericidal properties. Neem seeds, and its pesticidal compound "azadirachtin" cannot be patented in any country nor can the knowledge on the pesticidal properties of its seeds. However in the USA, patents were granted on the extracts from the Neem bark (effective in the treatment of some types of cancer), on seed-extracted azadirachtin and on some insecticides which are more stable than the natural compounds. This event caused a public protest in India against the granting of a patent for a technology which belongs to the Indian native culture; with the current systems of IPR, it will be difficult to validate the intellectual innovation of the native population. On the contrary, when some western biopirates take possession of a resource or of a technology of the Third World and waste little time to modify it, this becomes an "invention" useful for mankind and liable of an exclusive patent.

The licence on ayahuasca is part of biopiracy of the plant species and of the ancestral knowledge of the native populations. Last but not least a US researcher obtained a licence on ayahuasca, a ceremonial plant used for centuries by the ethnic groups of the Amazonian basin as a prodigious drink and with procedures which differ according to the people and to the culture. The officer of COICA (Coordinadora de Organizaciones Indigenas de la Cuenca Amazonica) reports that the trial against the biopiracy of ayahuasca has been echoed at international level and a request has been submitted to the US to defend the intellectual property of the original peoples. However, both researchers and natives agree on the fact that national laws shall be issued in order to protect the traditional knowledge in and outside the country since every single plant encompasses millennia of knowledge. If the patent is not suppressed, the natives should stop preparing ayahuasca or they should pay a licence to use the plant for at least 20 years.

Pharmaceutical multinationals are interested in the tropical selva where 30% of the plants are medicinal. It has been recognized by all researchers that the identification of plant species with active elements could double their efficacy should the native knowledge be available. These data can help companies develop new products which are then patented and sold gaining high profits.

It is estimated that the world-wide market of the pharmaceutical industry totalled 130 billion dollars a year in the early 90s and the benefits for southern countries, which provide the genetic material and the knowledge, are about 0.001% of the profits gained through the commercialization of these genetic resources. Indigenous populations have reported the destruction of the forest, the pollution of rivers, the building of hydroelectric plants in their homeland and biopiracy. Five hundred years have been needed for scientists and researchers to understand the importance of the knowledge accumulated by the native populations on a large number of cultivated plants and on the best forms of exploitation of different soils without stressing them. Indigenous populations have shown an excellent command on the agricultural ecosystem where they live and have combined a high number of cultivated plant species in order to preserve the plant diversity. Apart from the knowledge stemming from their age-old experience, these populations have developed several forms of organization which enable a harmonious relationship with the environment in which the accumulation of wealth and richness is not important (Shiva, 1999). In a few years, only 4 or 5 multinationals will control all the seeds of the world and, should they patent them, they will have the control on all the seeds which guarantee the daily survival of the whole mankind. Should we reduce the genetic pool to the intellectual property of private companies or to a political property of governments, we run the risk of genetic wars in the XXI century just like our ancestors who waged wars for silver, gold and copper during the mercantile age and fought for oil, minerals and metals during the industrial age. It is therefore a true war in the name of globalization which requests common regulations on international trade, the promoter being the World Trade Organization (WTO). This is the crossroads of the great profits such as the possession of genetic resources. Some conflicts undermine the development of poor countries in the next century. When the very last gene of the rain forest is patented, the native shall pay someone in London or Washington or Geneva to treat his illnesses with a leaf which grows in his shed; and this is supposed to be globalization and cooperation for development (RAFI, 2000).

6. Intellectual property rights and farmers' rights

Since plant genetic resources are of outstanding importance for the traditional plant breeding and the biotechnology industry, it is fundamental to formulate and issue legal regulations concerning the collection, conservation, evaluation, access, use, property, intellectual property rights (IPR), patents on innovations, rights of natives, farmers and local communities, sharing of benefits.

Conservation (both *ex situ* and *in situ*/on-farm), research, development and use of PGR are all ingredients of a complex system dynamically interacting, based on market-oriented and non market-oriented relations. The stakeholders of the "PGR System" include: indigenous communities, traditional farmers and local communities; collectors and breeders of germplasm collections; research institutions; plant breeders and seed companies, growers/producers.

The recent trend towards the "privatization" of agricultural research and the need for fund raising to back up this research and develop strategic projects have led to an increasing use of the IPR system by both public and private institutions. IPR play a basic role in the breeding/commercial production system of selected seeds; the IPR availability can foster the development of "modern and commercial" varieties, complying with the conditions imposed by the Plant Breeding Rights (PBR) regime.

The intellectual property, generally confers exclusive rights on the use of information in different areas of knowledge. Some types of IPR are relevant for agriculture and include: PBR, patents, market secret, denomination of origin and geographic indication of protection; each of these three types of IPR apply to different subjects of the PGR system. PBRs are a type of IPR which refer to the breeding, propagation and use of selected varieties; they have been adopted by many developed countries, but by a few developing ones. The UPOV Convention (Union for Cultivated Plant Protection) provides an international structure for the protection of plant varieties.

The World Trade Organization (WTO) and the agreement on TRIPs (trade aspects of IPR) deal with IPR regimes, including PBRs in all the countries which have subscribed that agreement. A few countries are still outside the WTO and TRIP agreement. Patents are granted in several countries to protect the inventions concerning plants and animals (including genetic material); as regards protection, there exist considerable differences among national laws. The application of patents to plant parts (including cells and genes) has been accepted by several countries; this is still

controversial mainly concerning the possibility of patenting materials already existing in nature which have been isolated and purified or slightly modified to be considered as "inventions". Several countries assign an appropriate value to plant breeders through PBR or patents on bred varieties; however, there is no parallel mechanism to encourage germplasm suppliers to make these resources also available for the future. Within the framework of IPR, knowledge and creativity have been defined in a very restrictive way so as to ignore the creativity of nature and of the knowledge system of farmers and local communities. IPRs as intended in the international agreements such as GATT and the Convention on Biodiversity (CBD), are instrumental to export the patent system all over the world which entails an intellectual and cultural impoverishment since it suppresses the other cognitive tools.

As maintained by Pat Mooney (RAFI President), the idea that the intellectual property might be recognized only if produced in a laboratory is basically a racist view of the scientific development; conversely, the genetic change promoted by farmers over the centuries is much more important than that achieved in the last one hundred years of more systemic scientific efforts. Nonetheless, without an equal and right distribution of benefits also to farmers and national institutions which maintain and develop the landraces (both *ex situ* and *in situ*/on-farm), activities of development and maintenance will not be spurred.

The concept of farmers' rights emerged after a debate started in 1979 within the FAO. If modern breeding produces an economic return through PBR or other legislation on IPRs, no system of compensation or incentives exist for the germplasm suppliers. The debate results in a negotiated compromise: the simultaneous and parallel international recognition of PBRs and farmers' rights. This recognition is included in the FAO Resolutions 4/89, 5/89, and 3/91. These three resolutions have been negotiated by the PGR Commission set up in 1983 (and that became Commission on the Genetic Resources for Food and Agriculture in 1995) and adopted by more than 160 countries, in 1989 and 1991. Since the setting up of the Commission, the member states have been involved in negotiations on this topic; the agreements on the farmers' rights achieved through these negotiations have been included in the International Commitment on PGR, which is the first international agreement on PGRs. The concept is to lay the foundation and set up a formal system of recognition and compensation to encourage, intensify and enhance the role of farmers and rural communities in the conservation and sustainable use of PGRs. FAO Resolution 5/89 (approved on 29/11/1989) defines the farmers' rights as "the right deriving from the past, present and future

contribution to the conservation, improvement, availability of PGRs. These rights are conferred to the international community for the present and future generations of farmers for them to get full benefits and contribute to the general objectives of the "International Compromise".

Resolution 3/91 (approved on 25/11/1991) subscribed the following items:

countries have sovereign rights on PGRs;

breeding lines and the farmers' material shall be available only in compliance with those who have bred them;

the farmers' rights are applied by means of an International Fund which will be of help to conservation and utilization programmes but not for developing countries;

effective conservation and the sustainable use of PGR are a daily and permanent need and the financial resources of the International Fund and of other funding mechanisms must be sufficient, long-lasting and based on principles of equity and transparency;

through the Commission on PGRs, the donors of genetic resources, of funds and technologies, will determine and supervise the policies, programmes and priorities of the Fund along with other funding mechanisms.

Various estimates have been made on the amount of financial resources at global level, necessary to set up the International Fund for the implementation of the "farmers' rights". These amounts are comprised between 300 and 600 million dollars a year. From the financing of the Global Action Plan, through the International Fund or other funding mechanisms, as envisaged in the Resolution 3/91, the international community may contribute to the achievement of the farmers' rights. The Global Action Plan was prepared on the basis of some reports submitted by 156 countries and 11 regional meetings involving 143 countries. The Global Action Plan was signed by the 4th International Technical Conference on PGRs of the FAO that took place in Leipzig (Germany, June 1996). The FAO, on the occasion of the world food summit (Rome, November 1996) declared its support to the Leipzig Action Plan through *ex situ* and *in situ*/on-farm approaches and strategies, a systemic evaluation and a monitoring to enlarge the genetic bases of these resources.

The same questions were debated during the World Conference on Sciences (UNESCO, Budapest, 1999) which recognized that the extension of the intellectual property rights is inevitable. In this respect, a timely

agreement must be reached as soon as possible by the owners of germplasm in the world with a view to regulating the state and access to PGRs and a mechanism identified for the equal distribution of benefits.

Several countries state that the farmers' rights may be developed through a "*sui generis*" system both at national and international level. As for financing, many countries argue that the Fund for the implementation of the farmers' rights may be refunded by fixed fees regulated by international agreements; it was also stated that the resources of the Fund can derive from both the public and private sector. The implementation of the farmers' rights is one of the most urgent problems to solve for political, environmental, economic and ethical reasons; this should take place within a context of revision of the International Commitment and development of a mechanism for its implementation; the International Commitment might become a protocol of CBD:

Within the revision of the international commitment, 3 articles have been proposed concerning the following points:

to re-affirm the concept of the farmers' rights versus that of PBRs including also the recognition of the "Farmer's Privilege" right;

to link the farmers' rights to the International Fund mechanism which makes the compensation of farmers possible for their work of conservation and development of PGRs and lays the foundation for a right and equal distribution of the benefits stemming from the use of their PGRs as a possible reference of the Global Action Plan;

to establish the rights of farmers and local communities in the national context as guardians of the indigenous knowledge and of their PGRs (in line with article 8(j) of CBD).

The FAO, after the Resolutions 4/89, 5/89, 3/91, adopted Resolution 7/93 for the negotiation concerning the revision of the International Commitment, in harmony with CBD, including the implementation of the farmers' rights. In order to facilitate these negotiations, the Secretariat drew up several papers and analytical studies to submit to the Commission (document CPGR 6/95/ supp. 8; document CPGR 6/95/supp. 8; document CPGR 6/95/9). The Director General has the mandate to organize a Forum for the negotiation by governments on the following aspects:

adaptation of the International Commitment on PGRs in harmony with CBD;

implementation of the farmers' rights;

discussion on the access to PGRs including *ex situ* collections not contemplated by CBD.

The farmers' rights and the intellectual property rights necessitate further definitions, in the name of the sustainable use of biodiversity, scientific research, industry, farmers and welfare of mankind, through agreements which promote an equal distribution of the benefits deriving from the use of PGRs. The UN agencies, mainly FAO, UNESCO, UNEP and UNDP with the technical support of IPGRI and CGIAR, can develop guidelines with a view to harmonizing the measures concerning article 27 (b) of the World Trade Agreement (on IPRs), with the ethical and equity principles of CBD (art. 8 (j) and 15 of CBD). The revision of IPRs will help promoting a symbiosis between the Biological Societies to protect the biodiversity and to eliminate the threat of genetic biopiracy. In this context, it shall be recalled that in the patenting system of innovations, which is commanding for WTO, the protection of plant varieties in the industrialized countries is regulated by the UPOV Convention recognizing and rewarding only plant breeders. In order to recognize and reward farmers and the local communities, just like for plant breeders, a revision of UPOV may be envisioned which might become the "Union for the protection of farmers, local communities and plant breeders".

An urgent action of Governments and international Organizations is needed for the farmers' rights to become legal rights. It is necessary to consider all the elements to increase the mutual support among international boards, mainly: CBD, FAO Commission on the Genetic Resources for Food and Agriculture, trade policies, IPRs of WTO, TRIP agreements (Trade System of Intellectual Properties), UPOP and WIPO (World Organization of Intellectual Property Rights) (Sebastiani, 1992; Onorati, 1994 and 1999; Correa, 1999; Scarascia Mugnozza and Perrino, 2000).

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