GOBIERNO DE CHILE
FUNDACIÓN PARA LA
INNOVACIÓN AGRARIA

PROGRAMA DE FORMACIÓN PARA LA INNOVACIÓN AGRARIA

APOYO A LA PARTICIPACIÓN

INSTRUCTIVO DE INFORME TÉCNICO Y DE DIFUSIÓN

Marzo 2004

GOBIERNO DE CHILE
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CONTENIDO DEL INFORME TÉCNICO Y DE DIFUSIÓN

1. Antecedentes Generales de la Propuesta (no más de 2 páginas)

Nombre. **TERCER SIMPOSIO SOBRE INVESTIGACIÓN EN MEJORAMIENTO GENETICO DE PLANTAS MEDICINALES Y AROMATICAS Y II SIMPOSIO LATINOAMERICA EN PRODUCCION DE PLANTAS MEDICINALES AROMATICAS Y CONDIMENTOS**

Código FIA-FP-L-2004-1-A-047

Postulante: Gustavo E. Zúñiga N

Entidad Patrocinante Universidad de Santiago de Chile

Lugar de Formación (País, Región, Ciudad, Localidad): Campinas- Brasil

Tipo o Modalidad de Formación (curso, pasantía, seminario, entre otros). SIMPOSIO

Fecha de realización (Inicio y término). 4-8 de Julio de 2004

Justificación y Objetivos de la Propuesta.

El simposio esta orientado al mejoramiento de materias primas para el desarrollo de fitomedicamentos y hierbas a traves del uso de la variabilidad genetica y sistemas sustentables de producción. Se pone énfasis en el uso racional de la biodiversidad de especies nativas promisorias. Nuestro grupo apoyado por FIA se ha dedicado en el ultimo tiempo a desarrollar metodologías que permitan utilizar y preservar especies nativas de Chile. Es por esta razon que consideramos que seria de gran ayuda el poder asistir a un evento de esta naturaleza pues permitar conocer las ultimas tendencias en esta tematica.

Objetivo.
Participar en un seminario internacional sobre produccion de plantas medicinales y aromaticas.

Resultados e Impactos Esperados.

- Adquirir una visión actualizada sobre plantas medicinales y aromáticas
- Interactuar con científicos que trabajan con plantas medicinales y aromáticas

- Establecer contactos con científicos de otros países que trabajan con plantas medicinales y aromáticas

2. Breve Resumen de los Resultados: describir si se lograron adquirir los conocimientos, experiencias e impactos esperados a través de la participación del postulante en la actividad programada (no más de 2 páginas).

Durante el desarrollo del Simposio se pudo constar el grado de desarrollo que tiene la investigación en plantas medicinales y aromáticas en países como Brasil, Alemania, Canadá y Estados Unidos. La experiencia obtenida fue transmitida a estudiantes y profesionales chilenos durante dos seminarios dictaos.

De manera especifica la participación en este simposio permitió :

1. **La adquisición de una visión actualizada sobre el manejo de plantas nativas de interés.**
2. **La identificación de materias primas para la industria farmacéutica**
3. **El intercambio de experiencias con otros centros de investigación en plantas nativas productoras de productos naturales de interés.**
4. **El conocimiento de tendencias actuales en el control de calidad de plantas de uso medicinal**
5. **La identificación de estrategias para el uso de productos naturales en salud y medicina.**

A nivel de impacto se logro.

Aumentar la red de contactos con científicos y empresas dedicadas a los productos naturales.

Conocer las últimas tendencias o normas de control de calidad de productos naturales a nivel mundial.

3. Itinerario de Trabajo Realizado: presentación de acuerdo al siguiente cuadro:

Fecha	Actividad	Objetivo	Lugar
5/07/04	Registro en congreso Asistencia a presentaciones entre 11 y 17:30 hrs.	**Asistir al III Internacional Symposium Breeding Research on Medicinal and Aromatic Plants & II Latin American Symposium on the production of Medicinal, Aromatic and Condiment Plants**	Campinas SP-Brasil

6/07/04	Asistencia a presentaciones: Entre 9 a 18 Hrs	**Asistir al III Internacional Symposium Breeding Research on Medicinal and Aromatic Plants & Latin American Symposium on the production of Medicinal, Aromatic and Condiment Plants**	Campinas SP-Brasil
7/07/04	Visitas botánicas a: Estación agrícola Bosque húmedo atlántico	**Asistir al III Internacional Symposium Breeding Research on Medicinal and Aromatic Plants & II Latin American Symposium on the production of Medicinal, Aromatic and Condiment Plants**	Campinas SP-Brasil
8/07/04	Asistencia a presentaciones: Entre 9 a 18 hrs.	**Asistir al III Internacional Symposium Breeding Research on Medicinal and Aromatic Plants &II Latin American Symposium on the production of Medicinal, Aromatic and Condiment Plants**	Campinas SP-Brasil

4. Resultados Obtenidos: descripción detallada de los conocimientos y/o adiestramientos adquiridos. Explicar el grado de cumplimiento de los objetivos propuestos, de acuerdo a los resultados obtenidos. Incorporar en este punto fotografías relevantes que contribuyan a describir las actividades realizadas.

Por tratarse de una actividad bien concreta, los resultados obtenidos se traducen en: el conocimiento de estrategias para el manejo y producción de plantas medicinales y aromáticas. Además, de identificar lo campos de interés y necesidades de desarrollo. De igual modo se establecieron distintos contactos que han permitido el intercambio de información y capacidades.

5. Aplicabilidad: explicar la situación actual del rubro en Chile (región), compararla con la tendencias y perspectivas en el país (región) visitado y explicar la posible incorporación de los conocimientos adquiridos, en el corto, mediano o largo plazo, los procesos de adaptación necesarios, las zonas potenciales y los apoyos tanto técnicos como financieros necesarios para hacer posible su incorporación en nuestro país (región).

La aplicabilidad de esta experiencia puede estar centrada en dos aspectos.

Contribuir al desarrollo de un simposio de características similares

Contribuir al desarrollo de una red dedicada al cultivo de plantas medicinales y aromáticas.

Nuestro país tiene un gran potencial en este campo ya sea como productor de materia prima o como elaborador de extractos. En este sentido las posibilidades que tiene el desarrollo de una industria elaboradora de aceites esenciales de plantas como el orégano, la albahaca y otras especies aromáticas son enormes, pues existe una alta demanda en mercados internacionales.

6. Contactos Establecidos: presentación de los antecedentes de los contactos establecidos durante el desarrollo de la propuesta (profesionales, investigadores, empresas, etc.), de acuerdo al siguiente cuadro:

Institución/Empresa	Rut	Persona de Contacto	Rut	Cargo	Fono/Fax	Dirección	E-mail
Agriculture and agri food Canada		Jim Brandle		Director	519- 4571470		brandleje@agr.gc.ca
ASNAPP-USA		James E Simon		Professor	732-9329711		jesimon@aesop.rutgers.edu
Universidad Nacional de Lujan		Ana Curioni		Investigator			aroma@infovia.com.ar
Institute of Vegetable and Field crops		Efraim Lewinsohn		Investigator	972-4—953-9552		twefraim@agri.gov.il
UFRP		Cicero Deschamps		Investigator	41-3505687		Cicero@ufrp.br

7. Detección de nuevas oportunidades y aspectos que quedan por abordar: señalar aquellas iniciativas detectadas en la actividad de formación, que significan un aporte para el rubro en el marco de los objetivos de la propuesta, como por ejemplo la posibilidad de realizar nuevos cursos, participar en ferias y establecer posibles contactos o convenios. Indicar además, en función de los resultados obtenidos, los aspectos y vacíos tecnológicos que aún quedan por abordar para la modernización del rubro.

En este simposio de pudo detectar los siguientes aspectos:

- Que existe un gran interés y demanda de plantas alimenticias y aromáticas
- Que comparado con países como Brasil o Canadá en nuestro país existe un gran retraso en el desarrollo y producción a nivel masivo de plantas medicinales ya aromáticas.
- Que nuestro país se puede convertir en un productor de plantas medicinales y aromáticas

8. Resultados adicionales: capacidades adquiridas por el participante o entidad patrocinante, como por ejemplo, formación de una organización, incorporación (compra) de alguna maquinaria, desarrollo de un proyecto, firma de un convenio, etc.

Durante el seminario se establecieron contactos con algunos investigadores de gran prestigio en el área. En particular resulta importante destacar la disposición a establecer convenios de colaboración con el Dr. James Simon de la Universidad de Rutgers, New Jersey, El Dr. Simon es el encargado del Programa **New Use Agricultura and Natural Plant Products** .

9. Material Recopilado: junto con el informe técnico se debe entregar un set de todo el material recopilado durante la actividad de formación (escrito y audiovisual) ordenado de acuerdo al cuadro que se presenta a continuación (deben señalarse aquí las fotografías incorporadas en el punto 4):

Tipo de Material	N° Correlativo (si es necesario)	Caracterización (título)
Ej.:		
Artículo	2, 3, 4	
Foto		
Foto		
Libro	1	Libro de resumenes
Diapositiva		Visita Botanica.
CD	3	

1. Aspectos Administrativos

10.1. Organización previa al inicio de la actividad de formación

a. Apoyo de la Entidad Patrocinante

__X__ bueno ____ regular ____ malo

La Universidad de Santiago, fomenta el que sus académicos puedan participar en actividades de investigación y/ formación. Por esta razón, de dan facilidades para poder reprogramar actividades.

b. Información recibida por parte de FIA para realizar la Postulación

__X__ detallada ____ aceptable ____ deficiente

EL formulario de presentación y el llamado a presentar antecedentes contiene todos los aspectos que se deben considerar al momento de postular

c. Sistema de Postulación al Programa de Formación de FIA

_X__ adecuado ____ aceptable ____ deficiente

La postulación es al programa es divulgada con tiempo y a través de diversos medios lo que permite postular

d. Apoyo de FIA en la realización de los trámites de viaje (pasajes, seguros, otros)

__X_ bueno ____ regular ____ malo

La ayuda entregada por FIA en esta actividad consistente en la obtención de pasajes y seguro fue adecuada

e. Recomendaciones (señalar aquellas recomendaciones que puedan aportar a mejorar los aspectos administrativos antes indicados).

Facilitar el formulario de informe de actividades. Es demasiada la información que se debe entregar incluidos los documentos conseguidos en la actividad de formación

10.2. Organización durante la actividad (indicar con cruces)

Ítem	Bueno	Regular	Malo
Recepción en país o región de destino según lo programado	X		
Cumplimiento de reserva en hoteles			
Cumplimiento del programa y horarios según lo establecido por la entidad organizadora	X		
Facilidad en el acceso al transporte			
Estimación de los costos programados para toda la actividad		X	

11.4. Se deberán registrar los antecedentes de todos los asistentes que participaron en todas las actividades de difusión realizadas.

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En la difusión de actividad se realizaron dos presentaciones. La primera de ella dirijida a un grupo de estudio den plantas medicinales coordinado por el FIA, en qle que participaron los miembros de ese grupo y la otra actividad estuvo orientada a alumnos y profesores de la Universidad de Santiago:

	Nombre	Actividad
2.	Luis Villarroel	Académico
3.	Rene Torres	Académico
4.	Lorena Tapia	Bioquímica
5.	Sandra Orellana	Bioquímica
6.	Pablo Zamora	Bioquímica
7.	Fredy	Biólogo, Estudiante de Doctorado
8.	Alejandra Ribera	Ing. Agrónoma
9.	Marcelo Orellana	Est. Bioquímica
10.	Sandra Herrera	Est. Bioquímica
11.	Melissa Torres	Est. Bioquímica
12.	Alberto Obrech	Est. Bioquímica
13.	Cristian Oyarzun	Técnico Agrícola
14.	Cristina Vargas	Técnico
15.	Eduardo Romero	Técnico
16.	Edwin Pret K	Gerente Operaciones Forestal Casino

Ethnomedical Information on Stevia *(Stevia rebaudiana)*

Part / Location	Documented Ethnomedical Uses	Type Extract / Route	Used For	Ref #
Leaf Brazil	Used for diabetes and as a diuretic.	Infusion Oral	Human Adult	ZZ1081
Leaf Brazil	Used to treat diabetes, obesity, dental caries, hypertension, fatigue and depression. Used as a tonic, contraceptive, cardiotonic, to stimulate cerebral function and to regulate arterial pressure in hypertension.	Infusion Oral	Human Adult	ZZ1092
Leaf Brazil	Used as a hypoglycemic, cardiotonic and contraceptive.	Not Stated	Human Adult	ZZ1088
Leaf Brazil	Used for diabetes.	Not Stated	Human Adult	ZZ1013
Leaf Brazil	Used as a hypotensive, antiadrenergic and contraceptive.	Infusion Oral	Human Adult	ZZ1002
Leaf Brazil	Used as a sweetener and for diabetes, hypertension, infections and obesity.	Infusion Oral	Human Adult	ZZ1070
Leaf Brazil	Used for diabetes, sweet cravings, hypertension and infections.	Not Stated	Human Adult	ZZ1016
Leaf + Stem Brazil	Used for gastric defect and wounds.	Infusion Oral	Human Adult	BO1002
Aerial Parts Paraguay	Used as a contraceptive.	Hot H2O Ext Oral	Human Female	T08101
Leaf Paraguay	Used for diabetes.	Hot H2O Ext Oral	Human Adult	A07092
Leaf Paraguay	Used to prevent pregnancy.	Hot H2O Ext Oral	Human Female	T01719
Leaf Paraguay	Described as having sweet properties in 1899.	Leaves Oral	Human Adult	A01574
Leaf Paraguay	Used for its sweetening properties; documentation of use as early as 1845.	Leaves Oral Leaves Oral	Human Adult Human Adult	K08407 T02070
Leaf Paraguay	Used as a sweetening agent.	Leaves Oral	Human Adult	T08101
Leaf Paraguay	Advocated for use in diabetes.	Hot H2O Ext Oral	Human Adult	N15780
Leaf Paraguay	Used occasionally to sweeten mate drink.	Leaves Oral	Human Adult	N15780
Leaf Paraguay	Used for diabetes and as a contraceptive.	Not Stated	Human Adult	ZZ1060
Leaf + Stem Paraguay	Used as a contraceptive.	H2O Ext Oral	Human Female	A04307

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Part / Location	Documented Ethnomedical Uses	Type Extract / Route	Used For	Ref #
Leaf South America	Used as a sweetening agent. Used for obesity, diabetes, hypertension and infections.	Not Stated	Human Adult	ZZ1015
Leaf USA	Used as a sweetener, hypoglycemic and hypotensive for diabetes, hypertension and infections such as *Candida albicans*.	ETOH Ext Oral	Human Adult	ZZ1014
Leaf USA	Used for diabetes. Considered a hypoglycemic, hypotensive, taste improver and vasodilator.	ETOH Ext Oral	Human Adult	BO1001
Leaf Not Stated	Used for hypertension, diabetes and as a contraceptive.	Not Stated	Human Adult	ZZ1102
Not Stated	Used as a contraceptive and sweetener.	Not Stated	Human Adult	ZZ1022

Return to the **Stevia Plant Database File**

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Biological Activities for Extracts of Stevia *(Stevia rebaudiana)*

Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Not Stated	Toxic Effect (general)	Plant	In Ration Rat	10.0 %	Inactive	No growth changes, no change in food intake or food efficiency. No change in size of liver, thyroid or adrenals. Over a 4 week period.	L01448
Leaf Paraguay	Toxic Effect (general)	Not Stated	Oral Rat	Not stated	Active	Paralysis and signs of suffering were produced five minutes following administration: animals died within two hours: no histological abnormality was observed.	T01719
Leaf Paraguay	Toxic Effect (general)	Hot H2O Ext	Oral Human Adult	Not stated	Inactive		N09716
Leaf USA	Toxic Effect (general)	Ext (50% stevioside)	IP Rat	LD50=3.4 g/kg			BO1029
Leaf Japan(cult)	Mutagenic Activity	ETOH(95%)Ext	Agar Plate	2.0 mg	Inactive	*Bacillus subtilis* h-17(rec+) *Bacillus subtilis* m-45(rec-) *Escherichia coli* wp-2 *Salmonella typhimurium* g-46 *Salmonella typhimurium* ta strains	W01182
Leaf Japan(cult)	Mutagenic Activity	Not Stated	Not Stated	Not stated	Inactive		M05678
Leaf Paraguay	Antifertility Effect	Hot H2O Ext	Oral Rat Female	Not stated	Active	Fertility in female rats was reduced to 80%, and termination of treatment returned fertility to normal. No side effects both in mothers and litters were observed.	T01719
Leaf Japan(cult)	Antifertility Effect	MEOH Ext	GI Rat Female	Variable	Equiv.	6/10 pregnancies (8/10 controls were pregnant).	T04639
Leaf + Stem Uruguay	Antifertility Effect	H2O Ext	Oral Rat Female	10.0 ml	Active	57-79% reduction in fertility.	A03469
Not Stated Thailand	Antifertility Effect	Not Stated	Rat	Not Stated	Inactive Inactive Inactive	No effect on male body and testicular weights. No effect on sperm count, morphology and motility. No effect on implantation and the fetus in females mated with plant extract-treated males.	BO1011
Leaf Brazil	Antifertility Effect	Not Stated	Oral Rat Male	Not Stated	Inactive	Seminal vesicle weight fell by 60% but no effect on fertility could be seen.	BO1024

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Paraguay	Antiimplantation Effect	ETOH(95%)Ext	SC Rat Female	Not Stated	Inactive		X01111
Leaf Paraguay	Sperm Count Decrease	H2O Ext	IG Rat Male	1.33 gm	Active		L21116
Leaf Paraguay	Contraceptive and/or Interceptive Effect	Hot H2O Ext	Oral Rat Female	Not Stated	Inactive		T01719
Leaf Paraguay	Fetotoxicity	Hot H2O Ext	Oral Rat Female	Not Stated	Inactive	No effect on pregnancy.	T01719
Leaf Brazil	Hypoglycemic Activity	H2O Ext	Oral Rabbit	Not Stated	Inactive		L01973
Aerial Parts Brazil	Hypoglycemic Activity	Hot H2O Ext	Oral Human Adult	Not Stated	Active	Accentuated hypoglycemic response in the majority of 15 volunteers (19-25 years old) taking tea of stevia in a GTT test.	M11953
Leaf Paraguay	Hypoglycemic Activity	Hot H2O Ext	Oral Human Adult	Not Stated	Active	Mean drop in blood sugar of 35.2% 6-8 hours after ingestion.	A07092
Leaf Not Stated	Hypoglycemic Activity	Not Stated	IG Dog	6.0 ml	Inactive		K17226
Leaf Paraguay	Hypoglycemic Activity	H2O Ext	IG Rat Male	1.33 gm	Inactive		L21116
Leaf Paraguay	Hypoglycemic Activity	Hot H2O Ext	Oral Human Adult	Not Stated	Active	Glucose tolerance test given to 15 normal subjects between ages of 19 + 25. Daily dose of stevia tea administered in 4 divided doses was equivalent to 250 mg per subject of stevioside. There was an accentuated hypoglycemic response.	N09700
Aerial Parts Indonesia	Antihyperglycemic Activity	Not Stated	IG Rabbit	Variable	Active	vs. glucose tolerance test.	K07934
Leaf Not Stated	Antihyperglycemic Activity	Plant	In Ration Rat	10.0 %	Active	Rats on high carbohydrate diet.	L01448
Leaf Brazil	Glucose Tolerance Enhancement	H2O Ext	Oral Human Adult	5 g	Active	5 gms administered to normal volunteers at regular 6 hr intervals for 3 days. Glucose tolerance tests performed before and after extract administration. The extract increased glucose tolerance and decreased plasma glucose levels during the test and after overnight fasting.	BO1025

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Not Stated	Liver Glycogen Decrease	Plant	In Ration Rat	10.0 %	Active	Rats on high carbohydrate diet.	L01448
Aerial Parts Brazil	Hypotensive Activity	Hot H2O Ext	IV Rat	1.0 mg/kg	Active		M12483
Aerial Parts Brazil	Hypotensive Activity	Hot H2O Ext	Oral Human Adult	3.0 gm	Active	Depressed systolic arterial pressure by 9.5% in 10 subjects taking one oral dose of aqueous extract.	M12483
Aerial Parts Brazil	Hypotensive Activity	Hot H2O Ext	Oral Human Adult	Not Stated	Active	Depressed systolic and diastolic arterial pressure by 9.5% in 18 subjects (20-40 yrs old) taking tea of stevia daily for 30 days. Also a discrete prolonation of electric systolic (QTC) in the ECG.	M12483
Leaf Paraguay	Hypotensive Activity	H2O Ext	IG Rat Male	1.3 gm	Active	Results significant at $p < 0.05$ level.	K28973
Leaf Paraguay	Hypotensive Activity	Hot H2O Ext	Oral Human Adult	3.0 gm	Weak Activity	A single oral dose equal to 3.0 gm of leaves was administered to each of 10 normal subjects. Some lowering of systolic pressure(9.5%) but no effect on diastolic pressure. Bradycardia was noted as well as a discrete shortening of the duration of extrasystole.	N09716
Leaf Paraguay	Hypotensive Activity	Hot H2O Ext	Oral Human Adult	Not Stated	Weak Activity	Administration to 18 normal subjects, 20-40 years of age daily for 30 days. Lowering of the systolic and diastolic pressure by about 9.5% and prolongation of electrosystole (QTC) seen.	N09716
Leaf Brazil	Hypotensive Activity	Leaf	Oral Rat Male	2.67 g	Active Active	vs. hypertensive-induced rats. vs. normotensive rats. Mean arterial pressure reduced in both groups.	BO1017
Leaf Brazil	Hypotensive Activity	Infusion	Oral Human Adult	200-220 mg	Active		BO1030
Leaf Brazil	Cardiovascular Activity	Infusion	Oral Human Adult	200-220 mg	Active	Prolonged the duration of the QRS and QTC in ECG.	BO1030
Stem Japan	Vasodilatory Activity	Fermented Ext	Topical Human Adult	½ to 1/5 Conc.	Active		BO1028
Leaf Paraguay	Inotropic Effect Positive	Not Stated	Frog heart	0.015 mg/ml	Active		N09716

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Aerial Parts Brazil(cult)	Bradycardia Activity	Hot H2O Ext Hot H2O Ext	IV Rat Oral Human Adult	1.0 mg/kg 3.0 gm	Active Active		M12483
Leaf Paraguay	Diuretic Activity	H2O Ext	IG Rat Male	1.3 gm	Active	Results significant at $p < 0.05$ level.	K28973
Leaf Paraguay	Natriuretic Activity	H2O Ext	IG Mouse Male	1.3 gm	Active	Glomerular filtration rate constant. Results significant at $p < 0.05$ level.	K28973
Leaf Paraguay	Renal Effects	H2O Ext	IV Rat Male	0.050 mg	Active	Renal water, Na and K excretion. In antidiuresis.	L06736
Leaf Paraguay	Renal Effects	H2O Ext	IV Rat Male	0.050 mg	Active	Increased reabsorption of water by the collecting duct.	L06736
Leaf Paraguay	Renal Effects	H2O Ext	IV Rat Male	0.050 mg	Active	In the diuresis group the extract significantly increased free water clearance.	L06736
Leaf Paraguay	Renal Effects	H2O Ext	IG Mouse Male	1.3 gm	Active	Increase in renal plasma flow seen in rats treated for 60 days.	K28973
Leaf Brazil	Renal Effects	Leaf	Oral Rat Male	2.67 g	Active Active Active Active	Increased glomerular filtration in hypertensive rats on stevia. Increased renal plasma flow in both normo- and hypertensive rats. Increased urinary flow in normo- and hypertensive rats. Increased sodium excretion in both normo- and hypertensive rats.	BO1017
Leaf Japan	Anti-inflammatory Activity	Not Stated	External Mouse	IC50=0.6 mg	Active	vs. 12-o-tetradecanoylphorbol-13-acetate(TPA)-induced ear inflammation.	K11173
Leaf Japan	Anti-inflammatory Activity	MEOH Ext	External Mouse	2.0 mg	Active	Inhibition ratio 89. vs. 12-o-tetradecanoylphorbol-13-acetate(TPA)-induced ear inflammation.	K11173
Leaf Japan	Cytotoxic Activity	MEOH Ext	Cell Culture	50.0 mcg/ml	Weak Activity	Ca-9kb 31% inhibition.	K27314
Leaf Not Stated	Antiandrogenic Effect	Hot H2O Ext	IG Rat Male	10.0 mg/kg	Inactive		T15862
Leaf Paraguay	Testosterone Level Decreased	H2O Ext	IG Rat Male	1.33 gm	Active	Testosterone level decreased, with no alteration in luteinizing hormone level.	L21116

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Brazil	Anticaries Activity	H2O Ext	Broth Culture	1.5%	Active	vs. *Streptococcus mutans* stimulated plaque fermentation. Inhibited the synthesis of insoluble polysaccharides.	M25425
Leaf Not Stated	Biochemical Pathway Inhibition	H2O Ext	Rat mitochondria	Not Stated	Active	Inhibited oxidative phosphorylation, ATPase activity, NADH-oxidase activity, succinate-oxidase activity, succinate dehydrogenase and L-glutamate dehydrogenase. ADP/O ratio was decreased.	BO1026
Stem Japan	Analgesic Activity	Fermented Ext	Topical Human Adult	½ to 1/5 Conc.	Active	Reduced pain from a scald and healed the inflamed part over 5 days.	BO1028
Stem Japan	Antiacne Activity	Fermented Ext	Topical Human Adult	½ to 1/5 Conc.	Active		BO1028
Stem Japan	Antipruritic Activity	Fermented Ext	Topical Human Adult	½ to 1/5 Conc.	Active	Reduced itching in heat rash and allergic irritation.	BO1028
Leaf USA	Antimicrobial Activity	Not Stated	Not Stated	Not Stated	Active	*Pseudomonas aeruginosa* *Proteus vulgaris*	BO1029
Leaf Japan(cult)	Antibacterial Activity	Chromato-graphic Fract	Agar Plate Agar Plate	Not Stated Not Stated	Active Active	*Proteus vulgaris* *Pseudomonas aeruginosa*	N10050
Fermented Leaf Not Stated	Antibacterial Activity	Fermented	Agar Plate	40% 40% 40% 40% 40% 40% 40% 50% 50% 50% 50%	Active Active Active Active Active Active Active Inactive Inactive Inactive Inactive	*Bacillus cereus* *Escherichia coli* *Salmonella enteritidis* *Salmonella typhimurium* *Staphylococcus aureus* *Vibrio parahemolyticus* *Yersinia enterolitica* *Bifidobacterium adolescentis* *Bifidobacterium longum* *Lactobacillus acidophilus* *Lactobacillus casei*	L21358
Leaf + Stem Japan(cult)	Antiviral Activity	Hot H2O Ext	Cell Culture	Variable	Active	*Rotavirus*	L13068

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Brazil	Antifungal Activity	ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext	Agar Plate	Not Stated	Active Inactive Inactive Inactive Inactive Inactive Inactive Active Active Active Inactive Inactive Inactive Inactive	*Sclerotinia trifoliorum* *Alternaria tenuissima* *Aspergillus flavus* *Botriodiplodia theobromae* *Diplodia species* *Mucor spinescence* *Phytophthora palmivora* *Diplodia species* *Mucor spinescence* *Sclerotinia trifoliorum* *Alternaria tenuissima* *Aspergillus flavus* *Botriodiplodia theobromae* *Phytophthora palmivora*	T12003
Leaf Brazil	Antiyeast Activity	ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext ETOH(95%)Ext	Agar Plate	Not Stated	Active Active Active Active Active Active Active Inactive Inactive Inactive Inactive	*Candida albicans* *Hansenula polymorpha* *Saccharomyces boulardii* *Saccharomyces cerevisiae* *Saccharomyces rosei* *Saccharomyces species* *Saccharomyces uvarum* *Candida krusei* *Candida lusitaniae* *Candida pseudotropicalis* *Cryptococcus neoformans*	T12003
Leaf Brazil	Antiyeast Activity	H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext H2O Ext	Agar Plate	Not Stated	Active Active Active Active Active Inactive Inactive Inactive Inactive Inactive Inactive	*Saccharomyces boulardii* *Saccharomyces cerevisiae* *Saccharomyces rosei* *Saccharomyces species* *Saccharomyces uvarum* *Candida albicans* *Candida krusei* *Candida lusitaniae* *Candida pseudotropicalis* *Cryptococcus neoformans* *Hansenula polymorpha*	T12003
Aerial Parts Not Stated	Sweetening Effect	Not Stated	Oral Human Adult	Not Stated	Active		N12519
Entire Plant Paraguay	Sweetening Effect	Plant	Oral Human Adult	Not Stated	Active		A03990

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Not Stated	Sweetening Effect	H2O Ext	Oral Human Adult	Not Stated	Active		L01440
Leaf Not Stated	Sweetening Effect	H2O Ext	Oral Human Adult	Not Stated	Active	Mother liquor after stevioside isolation used to improve taste of saccharin.	L01441
Leaf Japan(cult)	Sweetening Effect	H2O Ext	Oral Human Adult	Not Stated	Active		N00921
Leaf Japan(cult)	Sweetening Effect	Not Stated	Oral Human Adult	0.01%	Active		N01720
Leaf Paraguay	Sweetening Effect	Leaves	Oral Human Adult	Not Stated	Active		A00045
Leaf Paraguay	Sweetening Effect	Not Stated	Oral Human Adult	Not Stated	Active	Leaf-derived antacid is marketed commercially in Paraguay with government permission.	T01719
Leaf Not Stated	Sweetening Effect	Not Stated	Oral Human Adult	1:1	Active	A low calorie sweetener, suitable for use in dietetic foods, was prepared by mixing powdered sucrose (1 part) with powdered stevia extract. The prepared sweetener has a sweetness equal to sucrose and the bitterness of the stevia extract is reduced.	N12518
Leaf Not Stated	Sweetening Effect	Not Stated	Oral Human Adult	Not Stated	Active		N12522
Leaf Japan	Sweetening Effect	Not Stated	Oral Human Adult	Not Stated	Active		M26401
Leaf Japan(cult)	Sweetening Effect	ETOH(95%)Ext	Oral Human Adult	Not Stated	Active		N10148
Leaf Japan(cult)	Sweetening Effect	H2O Ext	Oral Human Adult	0.2%	Active	An anticavity sweetener is formulated from palatinose and stevia extract.	M05049
Leaf Japan(cult)	Sweetening Effect	H2O Ext	Oral Human Adult	Not Stated	Active		M05046
Leaf Japan(cult)	Sweetening Effect	H2O Ext	Oral Human Adult	Variable	Active		M05045
Leaf Japan(cult)	Sweetening Effect	H2O Ext	Perlingual Human Adult	Not Stated	Active		K10134

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Japan(cult)	Sweetening Effect	Hot H2O Ext	Oral Human Adult	Variable	Active		M20860
Leaf Japan(cult)	Sweetening Effect	Not Stated	Oral Human Adult	Not Stated	Active		N05696
Leaf Paraguay	Sweetening Effect	Leaves	Oral Human Adult	Undiluted	Active		A08671
Leaf Paraguay	Sweetening Effect	Leaves	Oral Human Adult	Undiluted	Strong Activity		M05164
Leaf Paraguay	Sweetening Effect	Leaves	Oral Human Adult Male	Undiluted	Strong Activity		N15780
Leaf USA(cult)	Taste Aversion(conditioned)	Butanol Ext Ether Ext ETOH(80%)Ext H2O Ext	Drinking Water Gerbil	2.0 mg/ml 5.0 mg/ml 2.0 mg/ml 2.0 mg/ml	Active Inactive Active Active		M23039
Leaf Japan(cult)	Fragrance Use	Glycoside Mixture	Oral Human Adult	Not Stated	Active		M05678
Seed Brazil	Plant Root Growth Stimulant	Not Stated	Not Stated	Not Stated	Active		N12132
Leaf Paraguay	Antimitotic Activity(plant cells)	H2O Ext	*Allium cepa* Bulb Cells	Not Stated	Inactive		J08235
Leaf Paraguay	Antimitotic Activity(plant cells)	Hot H2O Ext		Not Stated	Inactive	vs. *Allium cepa* root tips c-mitotic effect	L00398
Leaf Brazil(cult)	Feeding Deterrent(insect)	Leaves	Insect	Undiluted	Strong Activity	*Epicauta adomaria*	T01665

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Biological Activities for Compounds of Stevia *(Stevia rebaudiana)*

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Stevoside Rebaudiosides A-C Steviolbioside Dulcoside A	Toxic Effect (general)	Oral Mice	2 g/kg 2 g/kg 2 g/kg 2 g/kg	Inactive		BO1029
Steviol	Genotoxic Effect	In vitro	62.5 mcg/ml 125 mcg/ml 250 mcg/ml 500 mcg/ml	Inactive		BO1004
Steviol	Genotoxic Effect	Oral Mice	250 mg/kg 500 mg/kg 1000 mg/kg 2000 mg/kg	Inactive	DNA of the stomach, colon, liver, kidney and testis were not damaged.	BO1004
Steviol	Mutagenic Activity	Cell Culture	Not Stated	Active	*S. typhimurium* TM677 mutation assay.	BO1007
Stevioside	Mutagenic Activity	Cell Culture	50 mg	Inactive	*Salmonella typhimurium* TA98 & TA100 by the in vitro Ames test.	BO1015
Steviol	Mutagenic Activity	Cell Culture	2 mg	Inactive	*Salmonella typhimurium* TA98 & TA100 by the in vitro Ames test.	BO1015
Stevioside	Mutagenic Activity	In vitro Cell Culture In vivo Mouse	Not Stated	Inactive Inactive Inactive		BO1016
Steviol	Mutagenic Activity	Cell Culture	Not Stated	Active Active Active Active	*Salmonella typhimurium* TM677. *S. typhimurium* TA1535/pSK1002. Caused chromosome aberrations in hamster lung fibroblast cells. Gene mutations in hamster lung fibroblast cells.	BO1016
Stevioside	Antireproductive Activity	Oral Hamster Male	0 g/kg 0.5 g/kg 1 g/kg 2.5 g/kg	Inactive	No abnormalities in growth and fertility seen.	BO1022

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Stevioside	Antireproductive Activity	Oral Hamster Female	0 g/kg 0.5 g/kg 1 g/kg 2.5 g/kg	Inactive	No abnormalities in growth and fertility. No effect on pregnancy and no fetal abnormalities seen.	BO1022
Stevioside	Hypoglycemic Activity	Injection Rat	0.025 g/kg	Inactive	Did not induce hypoglycemia.	BO1003
Stevioside	Hypoglycemic Activity	IV Rat	0.2 g/kg	Inactive Active Inactive	Did not alter blood glucose response when administered with glucose in non-diabetic rats. Enhanced insulin levels. No effect on glucagon levels.	BO1009
Stevioside	Antihyperglycemic Activity	IV Rat	0.2 g/kg	Active	Stevioside, administered with glucose, suppressed glucose response (648 stevioside vs 958 control), increased the insulin response and suppressed the glucagon level in a type 2 diabetic rat model.	BO1009
Stevioside	Antihyperglycemic Activity	Oral Rat	0.025 g/kg	Active	In a type 2 diabetic rat model stevioside had an antihyperglycemic effect, enhanced first-phase insulin response and suppressed glucagon levels.	BO1003
Stevioside	Insulin Enhancement	Rat	0.025 g/kg	Active	Augmented insulin content in the beta-cell line INS-1.	BO1003
Stevioside	Insulin Clearance	IV Rat	4 mg/kg 8 mg/kg 12 mg/kg 16 mg/kg	Inactive	No significant change in insulin clearance at all concentrations.	BO1020
Stevioside	Insulinotropic Activity	In vitro - mouse islet cells	1nmol/L	Active	Enhanced insulin secretion in the presence of 16.7 mmol/L glucose. Only potentiated insulin secretion at or above 8.3 mmol/L glucose.	BO1013
Stevioside	Insulinotropic Activity	In vitro - mouse islet cells	1 mmol/L	Active	Enhanced insulin secretion in the presence of 16.7 mmol/L glucose. Only potentiated insulin secretion at or above 8.3 mmol/L glucose.	BO1013
Stevioside	Pancreatic beta-cell stimulation	Cell Culture	1-100 micromol/L	Active	Potentiated insulin secretion from INS-1 cells. Insulin secretion effect deemed to occur via direct action on beta cells.	BO1013
Steviol	Pancreatic beta-cell stimulation	Cell Culture	10 nmol/L to 10 micromol/L	Active	Potentiated insulin secretion from INS-1 cells. Insulin secretion effect deemed to occur via direct action on beta cells.	BO1013

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Stevioside	Antiketogenic Activity	Rat Liver	2.5 mM	Active	Inhibited ketogenesis by 66.3%.	BO1023
Steviol	Glucose Absorption Inhibition	Rat renal tubules	Not Stated	Active	Inhibited glucose production and oxygen uptake in rat renal cortical tubules.	BO1027
Stevioside	Glycogenic Activity	Oral Rat H2O Ext Rat H2O Ext Rat	200 mumol 1 mM 2 mM	Active Active Active	Increased glycogen deposition in the liver, with or without administration of fructose in 24-hr fasting rats. Both concentrations increased hepatic glycogen before fasting.	BO1018
Steviol	Glycogenic Activity	Oral Rat H2O Ext Rat H2O Ext Rat	200 mumol 1 mM 2 mM	Active Inactive Inactive	Increased glycogen deposition in the liver, with or without administration of fructose in 24-hr fasting rats.	BO1018
Stevioside	Hypotensive Activity	Oral Rat	0.025 g/kg	Active	Suppressed both systolic and diastolic blood pressure.	BO1003
Stevioside	Hypotensive Activity	Nasogastric Dog	200 mg/kg	Active	Reduced blood pressure in healthy dogs.	BO1005
Stevioside	Hypotensive Activity	IV Dog IV Dog left vertebral artery	Not Stated Not Stated	Active Inactive	Reduced blood pressure. Lack of activity shows the hypotensive effect is not related to the central nervous system.	BO1005
Stevioside	Hypotensive Activity	Dog	Not Stated	Active	Hypotensive in renal hypertensive dogs.	BO1005
Stevioside	Hypotensive Activity	Cell Culture rat aortic smooth muscle cells	Not stated	Active	Inhibited the stimulatory effects of vasopressin and phenylephrine on intracellular calcium, indicating its hypotensive effect is due to inhibition of calcium influx.	BO1005
Stevioside	Hypotensive Activity	IP Rat	50 mg/kg	Active	vs. normotensive rats, spontaneously hypertensive rats, deoxycorticosterone acetate-salt sensitive hypertensive rats and renal hypertensive rats.	BO1008
Stevioside	Hypotensive Activity	IP Rat	100 mg/kg 200 mg/kg	Active Active	vs. spontaneously hypertensive rats and normotensive rats.	BO1008
Stevioside	Hypotensive Activity	IP Rat	100 mg/kg 200 mg/kg 400 mg/kg	Active Active Active	vs. deoxycorticosterone acetate-salt sensitive hypertensive rats	BO1008

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Stevioside	Hypotensive Activity	IP Rat In vitro rat aorta	25 mg/kg Not Stated	Active Active Inactive Inactive	vs. spontaneously hypertensive rats. vs. vasopressin-induced vasoconstriction. vs. phenylephrine- and KCL-induced vasoconstriction. vs. vasopressin-induced vasoconstriction in Ca(2+)-free medium.	BO1010
Stevioside	Hypotensive Activity	Oral Human Adult	500 mg	Active	In 60 hypertensive patients (vs 46 controls) stevioside reduced systolic and diastolic blood pressure; effect persisted through the year of treatment. No effect seen on lipid and glucose parameters.	BO1012
Stevioside	Hypotensive Activity	IV Rat	50 mg/kg 100 mg/kg 200 mg/kg	Active Active Active	vs. spontaneously hypertensive rats. Reduced both systolic (4.2%) and diastolic (5.6%) blood pressure. Lowering effect lasted for 60 minutes with 200 mg/kg dose. No change in serum catecholamines seen.	BO1014
Stevioside	Hypotensive Activity	Rat	Not Stated	Active	Provoked hypotension, diuresis and natriuresis in normal and hypertensive rats. Normal rats had an increase in renal plasma flow (RPF) with glomerular filtration rate (GFR) constant. Caused an increase in RPF and GFR in hypertensive rats.	BO1019
Stevioside	Vasodilatory Activity	Rat	Not Stated	Active		BO1019
Stevioside	Renal Effects	IV Rat	4 mg/kg 8 mg/kg 12 mg/kg 16 mg/kg	Inactive Active Active Active	At doses above 4 mg/kg stevioside increased sodium excretion, urinary flow and glucose clearance indicating it has diuretic and naturiuretic properties and is able to prevent reabsorption of glucose in renal tubules.	BO1020
Steviol glycosides + stevioside + rebaudiosides + dulcoside A	Anti-inflammatory Activity	Mice	MIC=54.1-291.6 mcg	Active	vs. TPA-induced ear inflammation.	BO1006
Stevioside mixture	Anti-tumor promoting Activity	Mice	1 mg 0.1 mg	Active Active	Inhibited the promoting effect of TPA on skin tumor formation initiated with 7,12-dimethylbenz(a)anthracene.	BO1006
Stevioside	Cariogenic Activity	Oral Rat	0.5%	Inactive		BO1021
Rebaudioside A	Carciogenic Activity	Oral Rat	0.5%	Inactive		BO1021
Flavonoid Fraction	Antibacterial Activity	Agar Plate	Not Stated	Active	*Bacillus subtilis* *Escherichia coli* *Staphylococcus aureus*	K24643

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Flavonoid Fraction	Peroxidase Inhibition	Human Adult	Not Stated	Active		K24643
Flavonoid Fraction	Protease Stimulation	Not Stated	Not Stated	Active	Increased papain activity.	K24643

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Reprinted from: Trends in new crops and new uses. 2002. J. Janick
and A. Whipkey (eds.). ASHS Press, Alexandria, VA.

Antioxidant Activity of Basil

H.R. Juliani and J.E. Simon*

INTRODUCTION

The commercial development of plants as sources of antioxidants to enhance health and food preservation is of current interest (Rice-Evans et al. 1997). Epidemiological studies have suggested positive associations between the consumption of phenolic-rich foods or beverages and the prevention of diseases (Scalbert and Williamson 2000). These effects have been attributed to antioxidant components such as plant phenolics, including flavonoids and phenylpropanoids among others (Rice-Evans et al. 1996).

Basils (*Ocimum* spp., Lamiaceae) contain a wide range of essential oils rich in phenolic compounds (Simon et al. 1990; Phippen and Simon 2000) and a wide array of other natural products including polyphenols such as flavonoids and anthocyanins (Phippen and Simon 1998). The objective of this study was to evaluate the antioxidant activity of basil extracts and essential oils.

METHODOLOGY

Five green basil cultivars and breeding lines including 'Italian Large Leaf' (Johnny's Selected Seeds), 'Sweet' (Rutgers ON92CBT93-19), 'Cinnamon' (*Ocimum basilicum*, Rutgers SPSMEC-98), 'Sweet Dani Lemon' (*O. citriodorum*, Johnny's Selected Seeds), and 'Holy' (*O. sanctum*, Johnny's Selected Seeds), plus four purple basil cultivars, 'Dark Opal' (Richters), 'Osmin Purple', 'Purple Ruffles', and 'Red Rubin' basil (*O. basilicum*, Johnny's Selected Seeds). For comparison purposes, 'Greek' oregano (*Origanum vulgare*) (Rutgers SPS01-01) and green tea (*Camellia sinensis*) (The Vert de Chine Green Tea, Shangai, China) were also assessed as products recognized for their high antioxidant activity.

Sample Preparation

The ethanolic extracts were prepared by grinding two grams of leaf to a fine powder under liquid nitrogen and extracting with 80% ethanol (with 0.1% HCl for purples basils). Essential oils (EO) were extracted by hydrodistillation in a Clevenger-type apparatus (Charles and Simon 1990) of basil leaves that had been dried for 96 hr at 38°C. Yield (in ml) was related to percentages of dry weight samples.

The ethanolic extracts were tested for in vitro antioxidant activity using two screens. In the ABTS screen the antioxidant activity was related to Trolox (a water soluble analogue of vitamin E) and expressed as µmol of Trolox per gram of leaf dry weight (DW) (TEAC, Trolox equivalent antioxidant activity). In the FRAP screen the activity was related to ascorbic acid (vitamin C) and expressed as µmol ascorbic acid per gram of leaf DW (AEAC, ascorbic acid equivalent antioxidant activity). Total phenolics were also measured and expressed as gallic acid equivalents (GAE, mg of gallic acid per gram of leaf DW) (Gao et al. 2000).

The essential oils were also tested using this two screens but the activity was expressed as µmol (Trolox and ascorbic acid) per ml of oil. The antioxidant activity of the ethanolic extracts was considered as 100% antioxidant activity and the contribution of the essential oil to this percentage was then measured using both assays (ABTS and FRAP).

The oils were analyzed by gas chromatography coupled to a mass and FID detectors. (Agilent GC System 6890 Series, Mass Selective Detector, Agilent 5973 Network, FID detector). Samples were injected with an autosampler (Agilent 7683 Series). The inlet temperature was 180°C, HP5-MS (30 m, 0.25 ID, 0.25 µm) column, programmed temperature, 60°C 1 min, 4°C/min, 200°C 15 min. The helium flow rate was 1 ml/min. Individual compound identifications were made by matching spectra with those from mass spectral library (Wiley 275.L), the identity of each compound was confirmed by its Kovats index (Jennings and Shibamoto 1980). Data were analyzed statistically by analysis of variance (ANOVA) followed by the LSD test, with the level of significance set at 5%.

*We thank the New Jersey Agr. Expt. Station, Cook College and the New Jersey Farm Bureau for their support of this research project and the New Use Agriculture and Natural Plant Products program. We acknowledge financial support from the National Council on Scientific Research and Technology of Argentina for their partial funding of H.R. Juliani.

RESULTS AND DISCUSSION

Ethanolic Extracts

Total phenolics were higher in the purple basils than in the green cultivars (Table 1). 'Dark Opal' basil contained the highest concentration (126.2 mg phenolics/g dry weight), in contrast to the other purple cultivars 'Red Rubin' (95.1 mg) and 'Osmin Purple' (81.7 mg). The green cultivars evaluated yielded significantly lower total phenols, varying from 35.6 mg in 'Cinnamon' to 62.9 mg in 'Italian Large Leaf'.

The antioxidant activity of the purple basils, as measured by TEAC, was higher for 'Dark Opal', 'Red Rubin', and 'Purples Ruffles', than for 'Osmin Purple' (Table 1). Antioxidant activity was much lower in the green basils. Antioxidant activity as measured by the second screen, AEAC, showed the same trends, with 'Dark Opal', 'Purples Ruffles', and 'Red Rubin' exhibiting the highest activity, significantly lower activity in 'Osmin Purple', and the lowest activity observed in the green basils (Table 1).

There was a strong relationship between the total phenolic content and the antioxidant activity expressed as TEAC (R^2=0.93) and FRAP (R^2=0.82). These results suggest that the antioxidant activity in basils is largely due to the presence of phenolic components. The same relationship was also observed between phenolics and antioxidant activity in rosehip extracts (Gao et al. 2000).

Essential Oils

Among the essential oils extracted from the basil cultivars, the highest antioxidant activity was found in the Sweet basil essential oils, with significantly lower activity observed in the essential oils from 'Dark Opal' and 'Osmin purple', and much lower activity in the 'Lemon', 'Purple Ruffles', Italian Large Leaf', 'Cinnamon', and 'Holy Basil' oils (Table 2).

Table 1. Phenolic content and antioxidant activity of basil, oregano, and tea.

Cultivar	Phenolics (GA[z]/g DW)	Antioxidant activity	
		µmol Trolox/g DW	µmol AA/g DW
Basil			
Cinnamon	35.6 g[y]	199 g	282 gh
Dark Opal	126.2 a	547 bc	726 a
Holy	51.1 f	297 fg	420 efg
Italian Large Leaf	62.9 ef	354 ef	459 def
Sweet Dany Lemon	55.8 ef	206 g	254 h
Osmin Purple	81.7 cd	440 de	582 bcd
Purple Ruffles	92.6 bc	497 bcd	694 ab
Red Rubin	95.1 bc	562 b	803 a
Sweet	55.7 ef	296 fg	401 fg
Oregano			
Greek	92.6 bc	670 a	544 cde
Tea			
Green	256.4 h	3028 h	2205 i

[z]Gallic acid.

[y]Values sharing the same letter within a column do not differ statistically according to LSD test (p=0.05).

Table 2. Content and antioxidant activity of basil and oregano essential oils and contribution of essential oils (%) to total antioxidant activity in ABTS and FRAP assays.

		Antioxidant activity			
				Contribution of EO	
Cultivar	Essential oil content (ml EO/100 g DW)	µmol Trolox/ml EO	µmol AA/ml EO	% ABTS	% FRAP
Basil					
Cinnamon	1.4 abcd	171 e	394 de	1.2	2.0
Dark Opal	1.1 bdef	751 c	434 de	1.5	0.7
Holy	1.0 def	127 ef	269 de	0.4	0.7
Italian Large Leaf	1.7 a	59 ef	75 fg	0.3	0.3
Sweet Dany Lemon	1.1 bcde	41 f	52 fg	0.2	1.1
Osmin Purple	0.9 ef	997 b	876 c	1.9	1.0
Purple Ruffles	1.1 cdef	50 ef	22 g	0.1	0.0
Red Rubin	0.6 f	79 ef	78 fg	0.1	0.0
Sweet	1.1 bcde	1105 b	2125 a	4.1	5.9
Oregano					
Greek	1.6ab	1577 a	1447 b	5.0	4.3

[z]Values sharing the same letter within a column do not differ statistically according to LSD test (p=0.05).

The chemical composition showed a close relationship between the relative percentage of eugenol and the antioxidant activity in both assays (Table 3). All basil oils contained less than 18% eugenol. The highest antioxidant activity was observed in oregano essential oil, due to its high levels of carvacrol (70%). The 'Italian Large Leaf', 'Purple Ruffles', 'Cinnamon', and 'Lemon' basil oils showed a very low antioxidant activity, and all contained low concentrations of eugenol.

In all basils, the essential oil contribution to the total antioxidant activity was low, varying from 0.05% in 'Purples Ruffles' to 5.9% in 'Sweet' basil (FRAP) and from 0.1% in 'Purples Ruffles' to 4% (ABTS) in 'Sweet' basil. In 'Greek' oregano, the essential oil contribution to the overall antioxidant activity was also found to be only ca. 5%. These results strongly suggest that the main antioxidant activity from these plants does not arise from their essential oils, but rather from other phenolics such as flavonoids in green basils and anthocyanins in purple basils.

In sweet basil, although the antioxidant activity of the ethanolic extract was low, the activity of the oil itself was the highest, as this oil contained the highest amount of eugenol relative to all other samples. However, the contribution of this oil to the antioxidant activity of the ethanolic extract was around 5%, due to the modest concentration of eugenol (18% relative to total essential oil).

Green tea is extremely rich in polyphenolic compounds which can constitute up to 300 mg/g of material (Robertson 1992). 'Dark Opal' basil contained 126 mg, half of the phenolics of our tea sample (256 mg). The antioxidant activity of purple basils was highest, similar to that of 'Greek' oregano. The phenolic content and antioxidant activity of basils were also similar to red and black raspberry (Wang and Lin 2000) and higher than rosehips (Gao et al. 2000).

Given the high relative antioxidant activity of selected basils, these plants could constitute new sources of antioxidant phenolics in the diet, providing 125 mg of gallic acid equivalents, 85–125 mg of Trolox, or 106–140 mg of ascorbic acid equivalents per gram of dry weight. Using biofractionation, current studies are now elucidating the specific basil compounds that contribute to the antioxidant activity.

Table 3. Chemical composition of basil and Greek oregano essential oils.

Compounds[z]	Retention index	Relative amounts by cultivar (%)									
		Cinnamon basil	Dark Opal basil	Holy basil	Italian Large Leaf basil	Osmin Purple basil	Purple Ruffle basil	Red Rubin basil	Sweet basil	Sweet Dani Lemon basil	Greek oregano
α-Pinene	936	0.10	0.21		0.15[y]	0.18	0.18	0.08	0.10		
Camphene	951		0.11	0.10	tr	tr			0.10		
Sabinene	975		0.27		tr	0.23	0.26	0.14	0.10		0.96
β-Pinene	978	0.50	0.62	tr	0.80	0.53	0.61	0.34	0.10		
Myrcene	991	0.26	0.91		0.50	0.77	0.93	0.46	0.10		
1,8-Cineole	1034	3.60	9.08	0.12	7.70	9.81	7.00	9.60	0.80		0.10
cis Ocimene	1039	0.10							0.10		0.72
β Ocimene	1050	0.60	0.53			0.16			2.60		0.53
γ-Terpinene	1060	0.30	tr			tr	tr				7.66
Terpinolene	1088	0.15	1.17			1.45	0.79	tr	0.20	0.10	0.10
Linalool	1098	13.35	53.42	1.34	21.5	55.3	22.1	63.9	36.00		
Camphor	1146	0.44	1.33	0.04	0.60	0.79			1.10		
Borneol	1166	0.10		3.23					0.70		0.90
Terpineol 4	1179	1.40	0.13	0.09		0.22	0.13	0.14	0.30	1.40	0.26
α-Terpineol	1190	0.60	0.99	0.06		1.20	0.69	0.98	0.10	0.10	0.10
Methylchavicol	1199	13.10		0.65	44.9		52.3	0.13		6.19	
Nerol	1233					tr				4.30	
Neral	1248									25.90	0.10
Trans-Geraniol	1257				0.10	1.40				1.20	
Geranial	1274				0.10					33.16	0.10
Bornylacetate	1286	0.20	0.27		tr	0.33	tr		0.20	0.10	
Thymol	1292										0.50
Carvacrol	1309										70.0
α-Cubebene	1351	0.15	0.10	0.14					0.10	0.18	
Eugenol	1358	0.15	7.29	3.40	0.60	8.24	0.29	0.65	18.20	0.20	
α-Copaene	1375	0.11	0.24	3.40		0.15	0.09	0.19	0.20	0.50	
β-Cubebene	1390			2.10	0.13	0.72	0.57		0.10	0.40	
β-Elemene	1392			2.20				1.36	1.10	0.30	
Methylcinnamate	1394	45.43									
Methyleugenol	1404	0.10	3.93	67.45	0.90	3.39	0.17	0.18	0.70		
β-Caryophyllene	1420	0.10	1.43	0.10		0.95	0.09	0.12	0.17	4.90	1.20
α-Bergamontene	1436	0.10		0.10		0.51				0.90	
α-Guaiene	1440	0.10						7.23			
α-Humulene	1455	0.10	0.09	2.40	0.40	1.02	0.06	0.06	0.40	0.80	
β-Farnesene	1458	0.70	1.11			0.18	0.31	0.40		0.40	
Germacrene D	1482	2.99	2.60	9.90	2.10	2.55	1.49	3.00	5.33	6.80	0.31
β-Selinene	1488									2.40	
α-Selinene	1496									2.26	
Biclogermacrene	1496	1.66			0.80	1.11	0.69	1.07	2.20		
δ-Guaiene	1506	2.30		3.24	0.70	1.38		2.02	2.40	0.18	
β-Bisabolene	1509		1.87							0.10	1.18
γ-Cadinene	1515	1.44			1.15						
α-Amorphene	1516							1.16	3.26		
7 epi-a-Salinene	1518		1.32							0.10	
δ-Cadinene	1525		0.26	0.60	0.26		0.37	0.76	0.50	0.27	0.10

[z]Compounds are listed in order of elution on HP-5MS.

REFERENCES

Charles, D.J. and J.E. Simon. 1990. Comparison of extraction methods for the rapid determination of essential oil content and composition of basil. J. Am. Soc. Hort. Sci. 115:458–462.

Gao, X., L. Bjork, V. Trajkovski, and M. Uggla. 2000. Evaluation of antioxidant activities of rosehip ethanol extracts in different test systems. J. Sci. Food Agr. 80:2021–2027.

Jennings, W. and T. Shibamoto. 1980. Qualitative analysis of flavor and fragrance volatiles by glass capillary gas chromatography. Academic Press, New York.

Phippen, W.B. and J.E. Simon. 1998. Anthocyanins in basil (*Ocimum basilicum* L.). J. Agr. Food Chem. 46:1734–1738.

Phippen, W.B. and J.E. Simon. 2000. Anthocyanin inheritance and instability in purple basil (*Ocimum basilicum* L.). J. Hered. 91:289–296.

Rice-Evans, C.A., N.J. Miller, and G. Paganga. 1996. Structure-antioxidant activity relationships of flavonoids and phenolic acids. Free Radical Biol. Med. 20:933–956.

Rice-Evans, C.A., N.J. Miller, and G. Paganga. 1997. Antioxidant properties of phenolic compounds. Trends Plant Sci. 2:152–159.

Robertson, A. 1991. The chemistry and biochemistry of black tea production—the non volatiles. In: K.C. Willson (ed.) and M.N. Clifford, Tea: Cultivation to consumption. Kluwer Acad. Publ., Dordrecht, The Netherlands.

Scalbert, A. and G. Williamson. 2000. Dietary intake and bioavailability of polyphenols. J. Nutr. 130:2073S–2085S.

Simon, J.E., J. Quinn, and R.G. Murray. 1990. Basil: A source of essential oils. p: 484–489. In: J. Janick and J.E. Simon (eds.), Advances in new crops. Timber Press, Portland, OR.

Wang, S.Y. and H.S. Lin. 2000. Antioxidant activity in fruits and leaves of blackberry, raspberry, and strawberry varies with cultivar and developmental stage. J. Agr. Food Chem. 48:140–146.

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TEMAS TRATADOS

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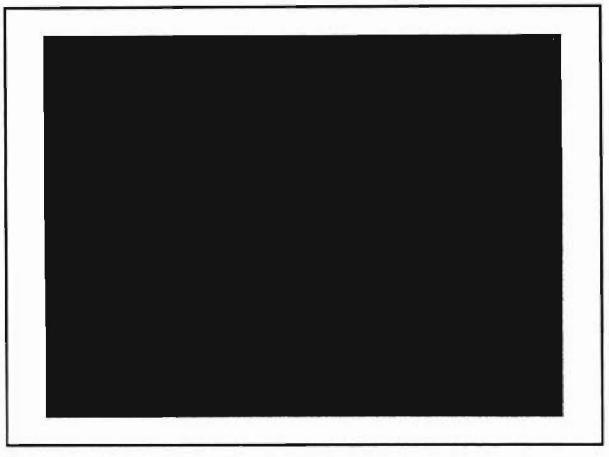
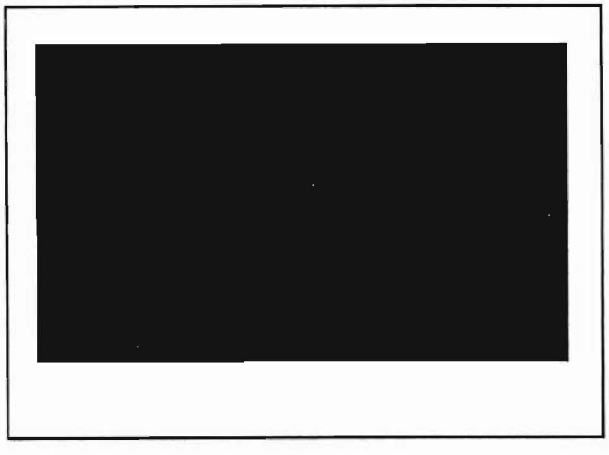
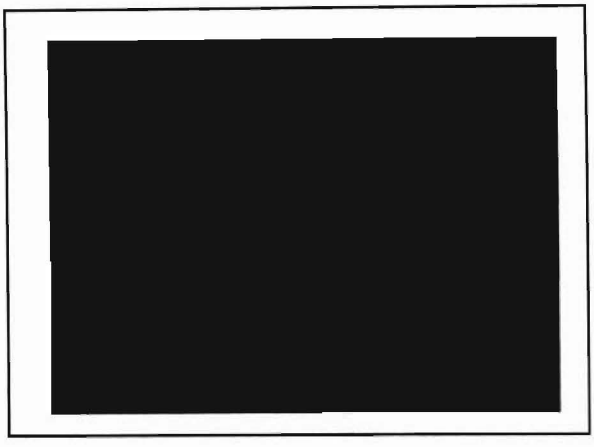
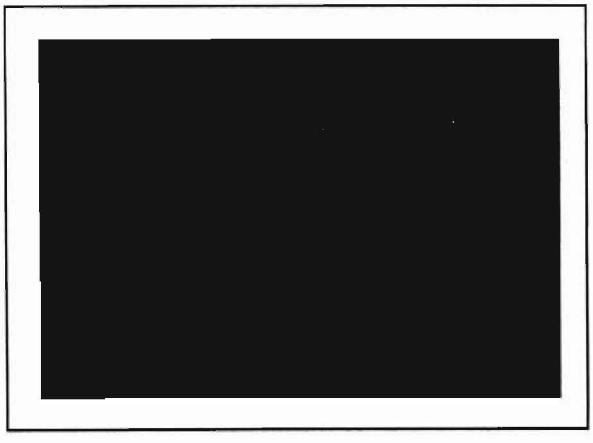
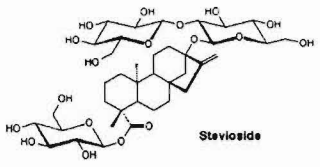
Presentaciones relevantes











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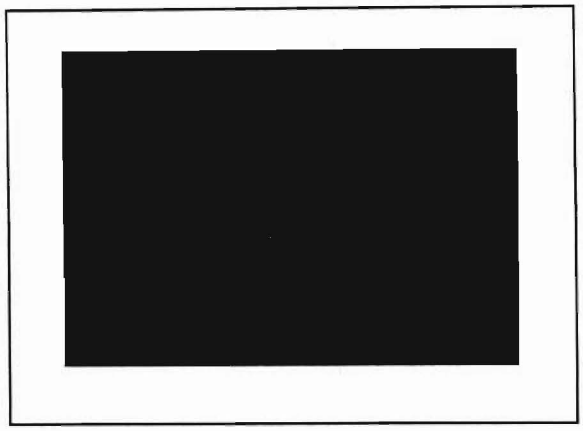
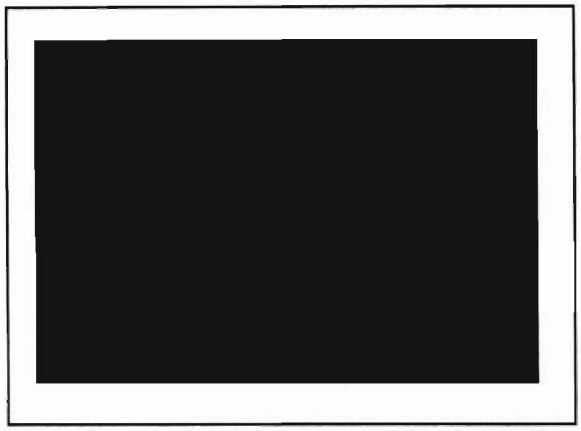
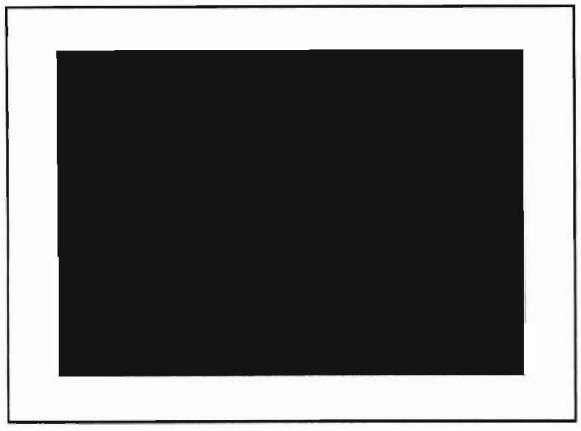
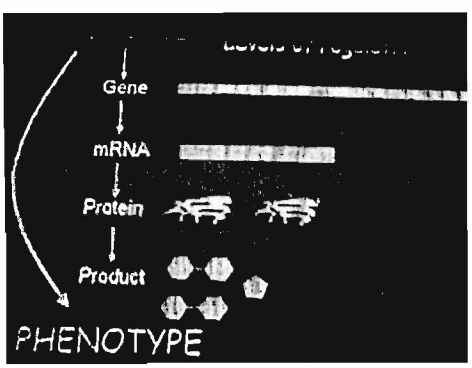







Gene
mRNA
Protein
Product
PHENOTYPE

Genomics: Novel tools and information available

Sequence information (databases)

whole genomes

(human, arabidopsis, yeast, *E. coli*)

7,000,000 EST's (2002)

22,000,000 (2004)

(expressed sequence tags)

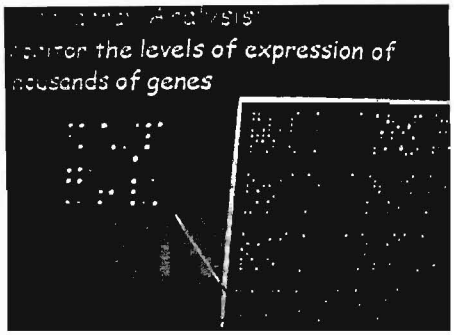
Genomics:

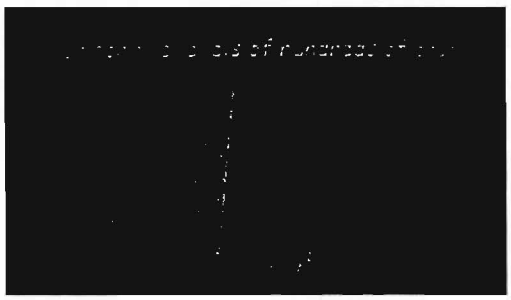
New mental tools (-omics)

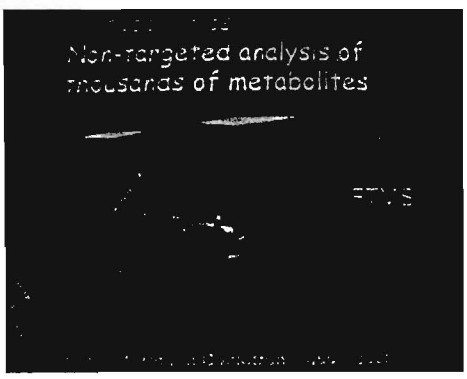
monitor the expression levels of tens of thousands of genes

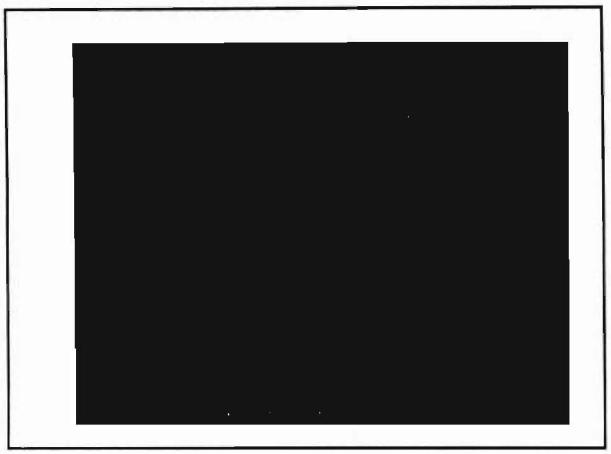
monitor abundance patterns of hundreds of proteins

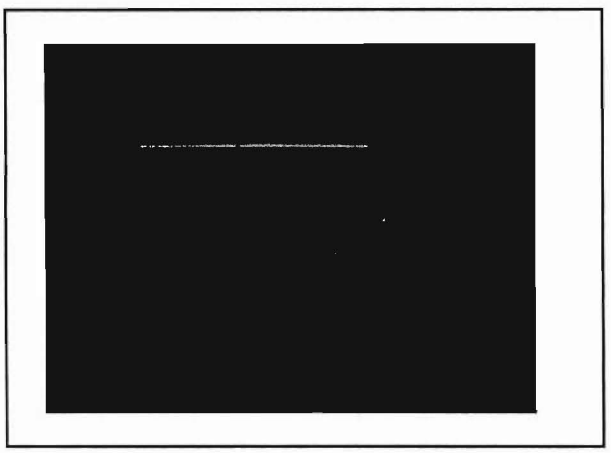
monitor the [illegible]

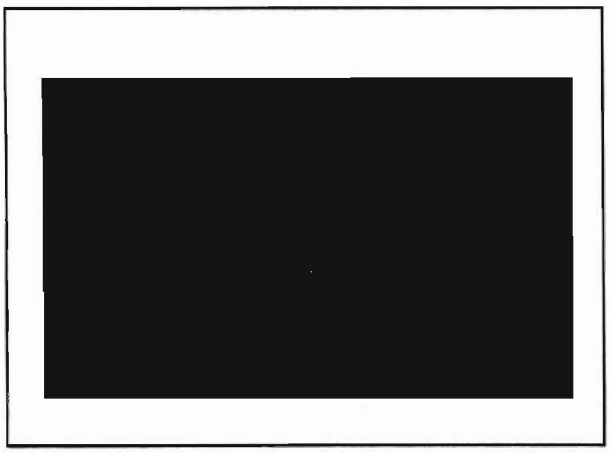

Monitor the levels of expression of
thousands of genes




Non-targeted analysis of
thousands of metabolites







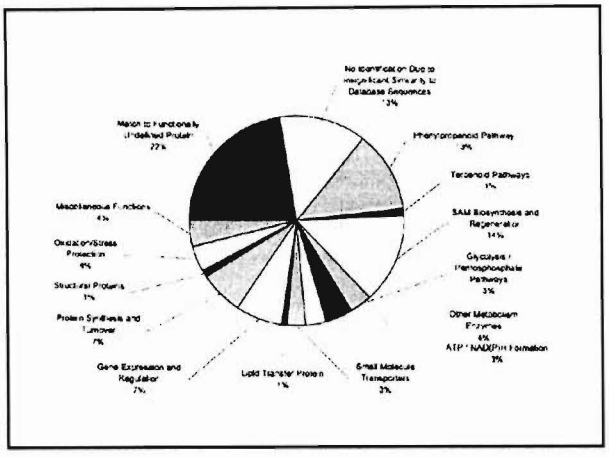


Table II. *The most abundant ESTs in the basil database with strong similarity to proteins with known function*

Putative EST Identification	Total No. of ESTs	Percent of Total ESTs
S-Adenosylmethionine synthetase	62	5.27
S-Adenosylhomocysteine hydrolase	35	2.97
Caffeoyl-CoA-*O*-methyltransferase	28	2.38
Glycine hydroxymethyltransferase	28	2.38
Cobalamine-independent methionine synthase	19	1.61
trans-Cinnamate 4-monooxygenase	18	1.53
Cinnamyl alcohol dehydrogenase	17	1.44
Caffeoyl-CoA *O*-methyltransferase-like	16	1.36
4-Coumarate:coenzyme A ligase	10	0.85
Glycine dehydrogenase (decarboxylating)	9	0.76

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